

Scope

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K Plant Expands the Horizon of Possibilities in China

Anhui Conch Kawasaki Engineering Co., Ltd. (ACK) and Anhui Conch Kawasaki Energy Conservation Equipment Manufacturing Co., Ltd. (CKM)

In this issue of *Frontline* we continue our coverage of Kawasaki in China with a close-up look at Kawasaki's other operational bases in the country.

China's burgeoning economy has given rise to mounting energy and environmental problems that have been pushed to the top of its national agenda. Against this backdrop, the Kawasaki Group's comprehensive engineering company, Kawasaki Plant Systems, Ltd. (K Plant), has been

expanding its customer base for environmentally friendly, energy-efficient equipment and services.

Our story begins with ACK and CKM, two companies that K Plant launched jointly with the Anhui Conch Group, the parent company of the Chinese cement manufacturing giant Anhui Conch Cement Co., Ltd. The largest cement maker in Asia, Anhui Conch Cement ranks fourth largest in the world.

Workers at CKM making PH boiler pipes.



Established in 2006, ACK designs, procures and sells waste heat recovery power generation (WHRPG) systems for cement plants. CKM, which was launched in 2007, manufactures PH boilers expressly for ACK's systems. Business has been booming at both companies as a steady stream of orders for the systems pour in from cement plants across China. The plants that have installed WHRPG systems now enjoy better energy efficiency and environmental performance. K Plant and the Conch Group recently agreed to further expand the operations of these joint ventures.

Orders Pouring In Anhui Conch Kawasaki Engineering Co., Ltd. (ACK)



ACK office.

stretches back over 2,000 years.

Although ACK was jointly established by K Plant and the Anhui Conch Group in 2006, the partnership between the Conch Group and Kawasaki dates back to 1998, when Kawasaki delivered the first WHRPG system to Ningguo Cement Plant, the Conch Group's subsidiary in Anhui Province. In 2005, K Plant was awarded a package contract by the Conch Group to build WHRPG systems for 11 production lines at its eight cement plants. K Plant has worked with the Group to leverage their technological capabilities in delivering the systems. The strong ties between Kawasaki and Conch provided a secure foundation for the launch of ACK.

● Joint Venture Built on Strong Foundation of Trust

The municipality of Wuhu, with a population of 2.1 million (700,000 in urban areas), is located in southeastern Anhui Province. While Wuhu is the province's second-largest metropolitan area, visitors will be amazed by the beauty of its natural landscape and its rich history, which

● Leveraging Combined Strengths to Boost Sales

Approximately 70 employees work for ACK. The company has administration, sales, design and processing departments whose work covers



All 23 employees in the Processing Dept. respond to the flood of orders.



Some 30 employees work in the Design Dept.

About the Cover

This is a PH boiler, one of the waste-heat recovery boilers that recover the heat contained in the exhaust gas discharged from a cement plant in order to create vapor. This boiler has been installed along the production line in a cement plant of Conch Cement Co., Ltd.

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Scope

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the entire spectrum of design, procurement and sales of WHRPG systems for cement plants. ACK has harnessed the combined strength of K Plant's superior system technologies with the Conch Group's unique knowledge of the local market, its marketing prowess and reputation in the Chinese cement industry, in an effort to drive sales upward. ACK received a total of 39

orders for WHRPG systems for cement plants in 2007. These are expected to result in a reduction of 50 million tons of CO₂ emissions over the next five years, making a significant contribution to energy and environmental conservation in China.

ACK has delivered WHRPG systems for 16 production lines in the Conch Group's nine

cement plants. Just a little over a year after its launch, ACK is doing much better than initially expected.

The company's technological capabilities are so advanced that no one in China can compete against them. ACK aims to capitalize on its strengths to boost its global profile in the industry.

About the Conch Group

The Conch Group, K Plant's joint venture partner, is a Chinese corporate giant whose operations span the fields of cement and construction materials manufacturing as well as trading. Anhui Conch Cement Company, Ltd., one of the many companies operating under its umbrella, engages in the Group's core cement business and has grown exponentially over the past decade.

The Group owns more than 50 cement plants in China, producing some 100 million tons of cement annually (compared with Japan's total annual cement production of 70 million tons). The Group continues to expand each year and plans to double its number of cement plants. While its annual production volume is currently ranked fourth in the world, it is likely to soon top the list.



Wuhu Conch Cement Plant.

WHRPG Systems for Cement Plants

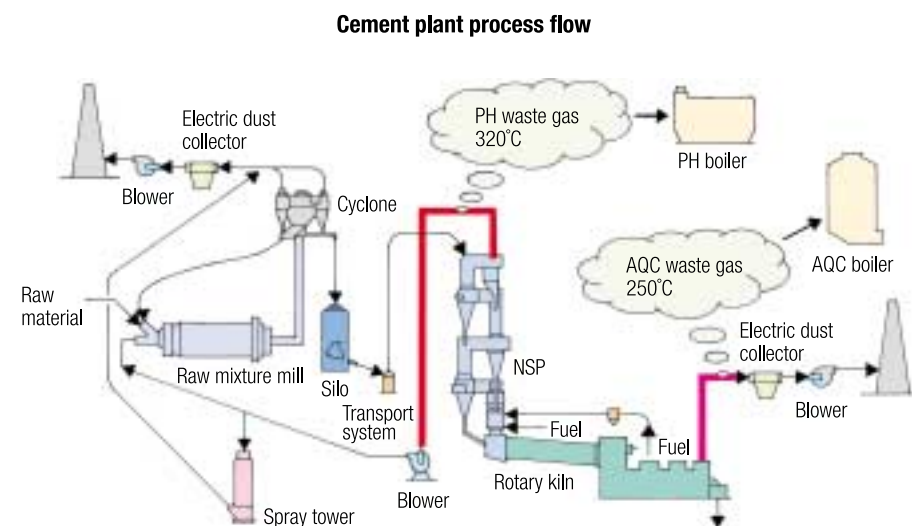
Cement plants generate a lot of heat, since they burn raw materials such as limestone and clay at high temperatures. The cement plant WHRPG system recovers waste heat with boilers and generates electricity using a steam turbine generator.

There are two sources of waste heat: a cyclone preheater (PH) used for precalcination of raw materials and an air quenching cooler (AQC) that rapidly cools hot clinkers (cinder lumps, formed as a result of sintering, which are ground down into cement) by air. The PH, which generates waste heat at a temperature of approximately 320°C, and the AQC (approx. 250°C) are each equipped with heat-recovery boilers.

The WHRPG system generates 18,500 kW of electricity when used in a standard-size cement plant equipped with two rotary kilns (equipment for sintering preheated

raw materials) that produce 5,000 tons of clinkers per day. The generated electricity covers approximately 30% of the total electric consumption of a cement plant in addition to the power used by the power generation

system itself, making it both a huge energy saver and environmentally friendly. Since the system does not require any fuel to operate, it offers a wide window of opportunity for greenhouse gas trading.



CKM office.



Conch Group's headquarters, now under construction.

Second and Third Plants to Go Online Soon

Anhui Conch Kawasaki Energy Conservation Equipment Manufacturing Co., Ltd. (CKM)

● Production in Full Swing at First Boiler Pipe Plant

CKM's office and plant are located in a suburban area of Wuhu on the premises of

Anhui Conch Cement's Bai Ma Shan Cement Plant. Construction of the Conch Group's huge headquarters is now underway at this extensive site. Once completed, the building will become

home to both ACK and CKM.

CKM was launched in July 2007 to produce PH boilers jointly with ACK. About 100 employees are on CKM's payroll and approximately 150 others from its partner companies work on its shop floor. CKM is currently producing steam pipes for PH boilers at its first plant, which has a floor area of 27,000 m² (120 m x 225 m). CKM produced 40 units in 2007 and is going for 50 this year.

● Sustainable Development

In early April 2008, K Plant and the Conch Group signed an agreement to invest in the



Bending pipes.



Welded boiler pipe joints are visually inspected.



CKM's production facilities. From left to right are the third, second and first plants.

expansion of the joint ventures' operational sphere. The two companies have agreed to add highly efficient cement vertical mills and innovative cement plant-based waste treatment systems, as well as environmental products such as wastewater treatment systems, to their current product lines.

CKM's second 18,000 m² (80 m x 225 m) production line went online in August and is

now manufacturing highly efficient vertical mills and AQC boilers. CKM has already received orders for 16 vertical mills. Its third facility, measuring 27,000 m² (120 m x 225 m), for producing waste treatment systems, is scheduled for completion in a few months.



Joint development agreement signing ceremony.

Tongling WHRPG System Up and Running

Tongling Conch Cement is a Conch Group company that was established in 1996. It now boasts four production lines, two with a daily production volume of 5,000 tons and two with a volume of 10,000 tons. The facility, designed to produce 30,000 tons of cement a day (actual production volume: 31,000 tons), is one of the largest cement production plants in the world.

The two production lines, each pumping out a staggering 5,000 tons of cement a day, are equipped with four boilers (two PH and two AQC) and an 18,000 kW steam turbine power generator that went online in January 2007. The other two production lines, each with a daily volume of 10,000 tons, are also equipped with four boilers (two PH and two AQC) and a 33,000 kW steam turbine power generator that went online in October 2007. All of these facilities, which were ordered and delivered via K Plant, have been running without any hitches, saving the plant 100,000 tons of coal and reducing its annual emissions of CO₂ by 200,000 tons and its SO₂ output by 2,000 tons. The amount of electricity generated by the system provides about two-thirds of the plant's total power consumption. WHRPG systems are a win-win business solution that provides an energy-efficient way to save money. Wide-scale implementation of these systems in China is expected to follow on the heels of government policy initiatives aimed at promoting energy conservation and

cutting greenhouse gas emissions.

Tongling Conch Cement plans to implement a K Plant system that uses gas from a municipal refuse gasification furnace as a supplementary fuel for the rotary kiln employed on its 5,000 tons/day production lines. This is a totally new type of environmentally friendly, energy-efficient system, made possible by the fusion of

Conch's cement technology and K Plant's waste incineration technology. The system will be capable of processing all of the approximate 600 tons of municipal waste collected in Tongling City every day. This is the first time such a system has been introduced in China, and it is fueling hopes that it will lead the way to solving the country's soaring environmental and energy problems.



PH boiler.



AQC boiler.



Central control room for two 10,000 t/day production lines.



Two production lines, each with a 10,000 t/day output.

Engineering Dreams



Toshikazu Hayashi

President and CEO, Kawasaki Plant Systems, Ltd.

has made toward assisting the efforts of the Chinese to ameliorate the energy and environmental problems facing them.

Tongling Conch Cement is the first plant in China to plan the installation of our municipal refuse gasification system. It's a revolutionary system that will conserve the cement plant's energy while treating municipal refuse at the same time. I'm looking forward to seeing the benefits it will bring to China. We will begin design and production of this system by the end of this year.

In Shandong Province we will soon start testing a commercial plant (production volume of 1,000 t/day) employing a fluidized bed advanced cement kiln system (FAKS) which we have been working on over the last two decades. The system employs a single vertical kiln for precalcination and calcination of cement materials to enable extremely efficient use of thermal energy. Since the system eliminates the need for a long horizontal rotary kiln, it also makes a smaller footprint. It will be the first such system in the world once it is commercialized.

● In a Class by Itself

As a comprehensive engineering company, K Plant focuses on three major areas: industrial infrastructures, such as cement and chemical plants; energy-related facilities, such as power plants, boiler facilities and nuclear power equipment; and environmental equipment, such as incineration plants, waste and water treatment plants, as well as recycling and industrial waste treatment facilities. K Plant is one of the few companies in the world that engages in such a wide range of business operations. This diverse range provides K Plant with the clear advantage of having an extensive array of technological capabilities as well as multiskilled engineers. In recent years, the boundaries of these three areas have increasingly overlapped, requiring K Plant to incorporate energy-efficient, environmentally friendly technologies in production plants across the board. This has enabled the company to expand the scope of its technological expertise.

● Success in China Fuels Dreams for the Future

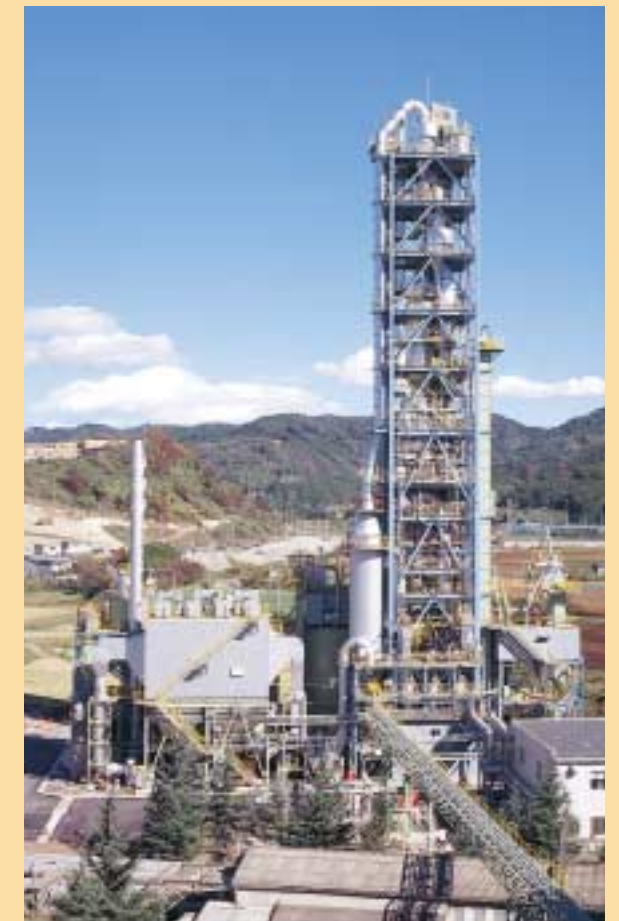
I'm very glad that the joint ventures between K Plant and China's leading cement manufacturer, the Conch Group, are growing steadily and are moving forward to further expand their operations. I am most proud of the groundbreaking contribution that K Plant

● Leading the Way in Japan

Some other new developments we are working on include research in Okinawa to produce bioethanol from agricultural waste such as

sugarcane waste, as well as rice straw and husks. We are now collecting data through a pilot plant with an eye to shifting to test plant operations in the near future. These two research projects in Shandong and Okinawa are leading the way in the development of new technologies that will benefit our entire society. My dream is to make them a real success.

This dream is the driving force behind all our efforts to enhance and expand the operations of the K Plant Group, and propels us to continue exploring the frontiers of technology to make the world a better place to live.



FAKS test plant.

Tunnel Vision: An In-Depth Look at the Shield Machine



An Earth-Munching Mechanical Mole

The machines used in the construction of subway lines and sewage systems employ state-of-the-art shield tunneling technology. These super-size power drills enable safe and speedy underground construction in urban areas without disturbing any of the surface infrastructures.

The cylindrically-shaped steel machine excavates soil as it moves forward, leaving behind collapse-proof tunnel walls. As this unique machine bores through the ground, it lines the tunnel walls with precast steel or ferroconcrete reinforcing segments. This proven construction method has been dubbed "shield tunneling" because of the protective structure, or "shield," that the machine leaves in its wake.

Let's take an in-depth look at shield tunneling and the "mole" at work behind it.

Water pipe

A slurry pump installed outside the tunnel pumps water into the cutter chamber, controlling slurry pressure and preventing the tunnel face or sides from collapsing.

Cutter bits

A shield machine can be outfitted with the exact abrasion-resistant hard metal cutter bit to suit any type of geological condition, from solid soil or sand to hard rock.

Disc-cutter bearings

The shield machine employs highly durable, precision double-row roller bearings that can withstand deep, long-distance excavation.

Disc-cutter drive motor

The drive motor, equipped with a decelerator, directly drives the disc cutter, delivering excellent energy efficiency.

Disc-cutter bearing seal

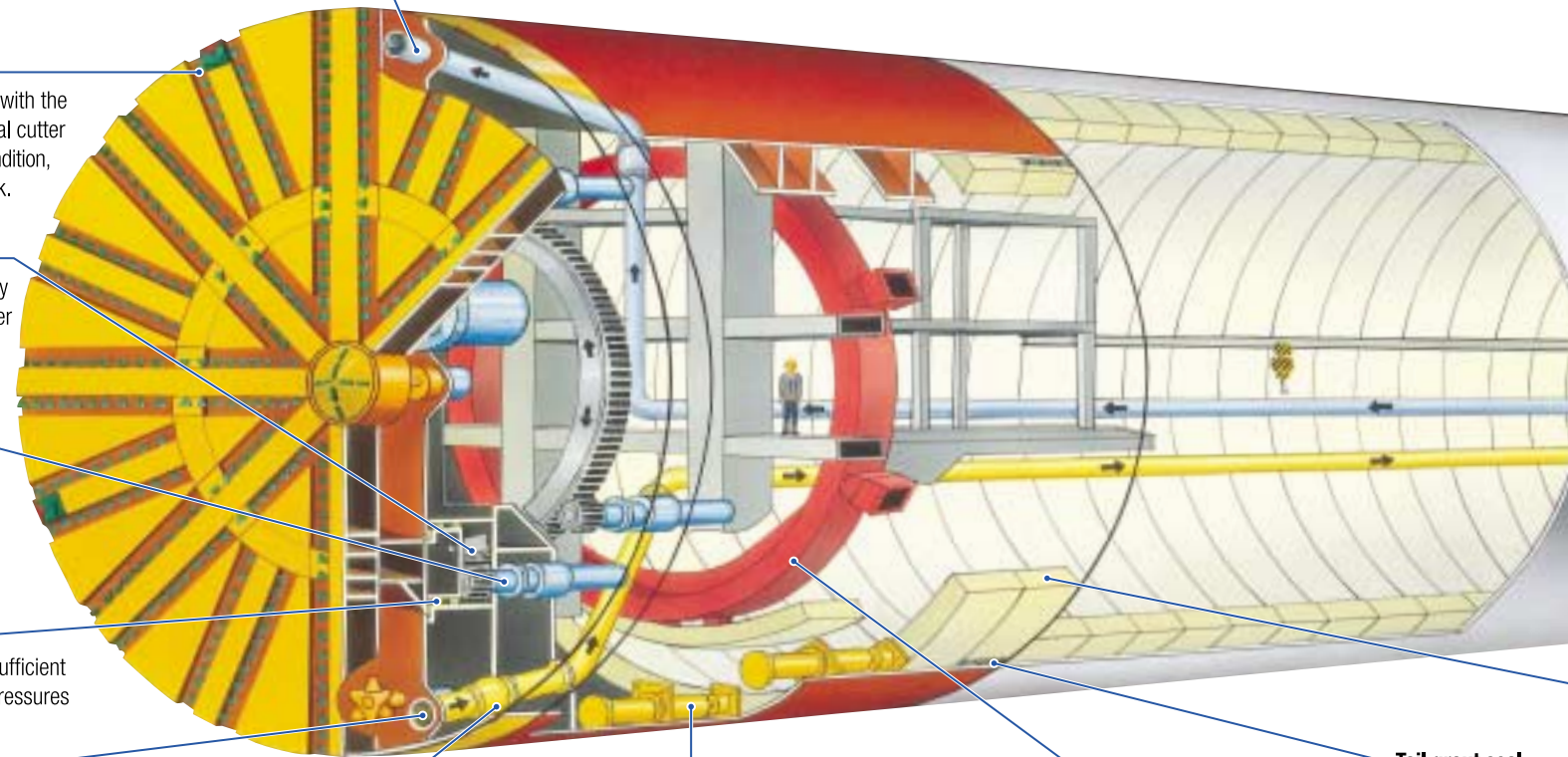
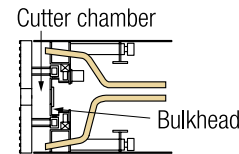
The multistaged lip seal ensures sufficient sealing under high slurry and oil pressures during long-distance excavation.

Agitator

The agitator prevents excavated soil from accumulating in the cutter chamber.

Slurry pipelines

Soil excavated from the tunnel face and muddy water pumped through the water pipe are mixed into slurry inside the chamber behind the disc cutter and carried out of the tunnel.



Shield jack

The shield jacks propel the machine forward by pushing against the precast segments used to line the tunnel walls.

Erector

The erector is a device that assembles a ring of segment blocks that line the tunnel.

Tail grout seal

The tail grout seal prevents underground water or back-fill grout from seeping into the shield machine through the joints between the segment surface and the tail skin plate.



Segments

Made of ferroconcrete or steel, these concrete segments form a permanent structure that supports the tunnel.

* The illustration below is of a slurry shield machine.

Fully Assembled Underground

The shield machine is first assembled in the factory and put through a series of tough quality performance tests. It is then divided into sections and transported to the construction site.

At the site, a vertical shaft is excavated and

the shield machine sections are then lowered into the shaft and fully assembled underground prior to excavation work.

This mechanical mole will then rotate its face and chew up the earth with its front teeth while kicking back the excavated soil with its forepaws.

The mole's front end is called the cutter face and is equipped with numerous cutter bits that work like front teeth to gnaw away at the earth. The machine rotates the cutter face as its cutter bits excavate the soil.

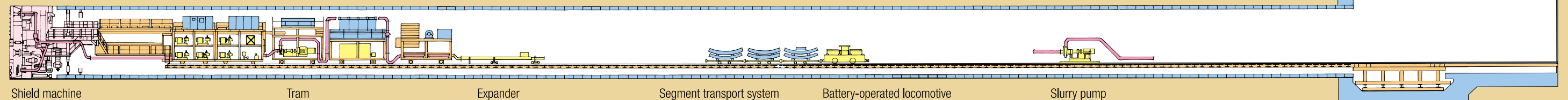
Computer-Controlled Excavation

The excavated soil is carried away via a conveyor belt system or trams, or else pumped out of the tunnel via pipes. As the shield machine excavates a tunnel, it installs ferroconcrete

segments.

The machine's computerized controls ensure that it keeps moving forward safely without veering off course.

Launching shaft (for assembling shield and carrying in construction materials)



First Fixed-Wing Patrol Aircraft for Japanese Defense Ministry Delivered

Kawasaki recently delivered the #1 test XP-1 fixed-wing maritime patrol aircraft to the Ministry of Defense.

The Ministry began development of the XP-1 along with the C-X transport aircraft in 2001 to replace the current P-3C model. In November 2001, Kawasaki earned prime contractor status to develop these airplanes with other aircraft manufacturers and other participating companies.

The XP-1 employs the world's first operational fly-by-light (FBL) system with high electromagnetic interference tolerance,

as well as new acoustic and radar systems with enhanced detection capabilities. It is also equipped with new engines developed with



homegrown technologies. The aircraft boasts a greater flight range capability and superior maximum cruise speed than its predecessors.

Manufactured at Kawasaki's Gifu Works and rolled out in July 2007, the #1 test aircraft completed its first flight in September 2007 after a series of ground testing. This was followed by in-house flight and other scheduled testing before delivery to the Ministry.

Currently, Kawasaki is conducting in-house flight testing for the #2 test XP-1 aircraft, scheduled for delivery to the Ministry by the end of 2008. ::

Automated Cell-Culture Systems for Pharmaceutical R&D Launched

In July, Kawasaki started selling automated cell-culture systems jointly with Kawasaki Plant Systems for use in drug discovery and development.

Kawasaki revealed the first prototype designed for the tissue engineering industry in December 2006 and has conducted evaluation tests at Shinshu University Hospital's Advanced Medical Center. The test findings were incorporated into the development of the new cell-culture system. Work on the system was conducted under a development project commissioned by the

Japan Science and Technology Agency (JST).

The system employs fully automated, clean robotic operations to culture adhesion cells, which are needed for drug discovery and development. Since it can easily culture multiple cell lines, it can be used for cell-based high-content screening.

In preparation for the launch of the system business, Kawasaki verified its performance through a series of tests. The National Institute of Advanced Industrial Science and Technology gave high ratings to the system for being stable enough to

culture high-quality cells as well as for being user friendly. ::



Energy Navigator LNG Carrier Delivered

Kawasaki Shipbuilding Corporation recently delivered the *Energy Navigator* LNG carrier to Tokyo LNG Tanker Co., Ltd. and Mitsui O.S.K. Lines, Ltd.

The carrier is the ninth in a line of internationally acclaimed 147,000 m³ LNG

carriers boasting state-of-the-art facilities developed by Kawasaki Shipbuilding. The vessel has four Moss spherical tanks that hold a total of 147,558 m³ of LNG. It also features excellent thermal insulation performance with the Kawasaki Panel System, which achieves a

boil-off rate of 0.1 percent per day. The cargo tanks are protected against direct damage by double-side shells and a double bottom.

Other features of the 289.53 m long ship include a computer-controlled navigation system integrated into the wheelhouse to improve operability, and a 360° view window that enables single-operator oceangoing navigation.

Monitoring and control of cargo-handling operations is performed from the cargo control room, which is positioned for the best view of the cargo areas. The control room is also equipped with an integrated automation system (IAS), which monitors and controls the cargo system and engine conditions. These superior operability features were adopted at the suggestion of ship operators from the development stage.

The *Energy Navigator* also boasts other features to prevent equipment from malfunctioning in such extreme environments as -25°C air and -2°C water temperatures. ::



First Order for Woody Biomass Gasification System Using CCA-Treated Wood

Kawasaki recently received its first order from Osaka-based Koshii & Co., Ltd. for a unique woody biomass gasification CHP system that can process chromated copper arsenate- (CCA) treated wood. The system employs Kawasaki's proprietary technology for gasifying woody biomass to generate combustible gas, and supplies power and heat via a gas engine. It is the fourth gasifier to be built by Kawasaki and is scheduled for completion by February 2009.

CCA is a chemical wood preservative

containing chromium, copper and arsenic used to protect wood from rotting and damage due to termites. CCA pressure-treated wood was used in residential construction until about 1995 in Japan. Although it is no longer used, it is still found in demolition materials, which has posed a problem for the recycling of such materials. Kawasaki worked jointly with Koshii to develop a safe, adequate and efficient conversion technology that turns CCA-treated wood into energy. The woody biomass gasification CHP system safely

disposes of CCA-treated wood as industrial waste with less of an environmental impact than direct-fired systems.

Kawasaki's proprietary gasification technology employing a fixed-bed downdraft gasifier features a short start-up time of approximately 30 minutes and a low level of tar contained in the generated gas. Once completed, the woody biomass gasification CHP system will be used to provide power and heat to Koshii's Hirabayashi Plant in Osaka. ::

State-of-the-Art Waste Treatment and Recycling Plant Delivered to Clean Association of Tokyo 23

Kawasaki Plant Systems recently delivered a state-of-the-art waste treatment plant to the Clean Association of Tokyo 23.

The plant consists of Kawasaki's proprietary fluidized bed gasification-melting system and plasma ash melting system. These plant components make optimum use of natural resources as well as recycled energy and have been designed to leave a minimum footprint on the environment while offering maximum benefit to the community. The plant meets Japan's strict environmental

standards for dioxins, exhaust gas, effluent emissions, fly ash leachate and slag.

Electricity generated by a steam turbine power generator that utilizes waste heat as well as photovoltaic panels is used to run plant facilities. The plant is the largest gasification-melting system currently operating in Japan for use in municipal waste treatment and the first to be used in a large city. It is the 160th waste-treatment system Kawasaki has delivered, and incorporates the latest technologies that the company has developed. ::



Contract Received to Design Hokkaido PCB Waste Treatment Facility Addition

Kawasaki Plant Systems recently received a contract from the Japan Environmental Safety Corporation (JESCO) to design an addition to JESCO's Hokkaido PCB (polychlorinated biphenyl) Waste Treatment Facility, currently under construction in Muroran. The contract, valued at approximately 2.4 billion yen, is part of a 26.2 billion yen project for the design and construction of the expanded

facility. Kawasaki expects to receive an official order for the remaining portion of the project by the end of March 2009.

Once that order comes through, Kawasaki will employ its proprietary Plasma Enhanced Melter (PEM) technology to design, construct and test the entire PCB treatment system, from receiving/storage, pretreatment/shipping to utilities and ancillary facilities. The overall

construction is scheduled for completion in August 2010.

The PCB treatment system has a number of technical and safety features designed for the safe decomposition of PCB, including complete decomposition and detoxification of waste, exhaust gas purification and monitoring, and an emergency damper system. ::

K Plant Acquires IHI's Cement Plant Business

Kawasaki Plant Systems (K Plant) fully acquired IHI's cement plant business on July 1, making it a world-class cement plant producer. The acquisition includes the design, manufacture, installation, test-run, repair, modification, expansion, after-sales services, supplies and other work for cement plants

and such major components as preheaters, kilns, and mills – virtually all areas related to the cement plant business.

Leveraging the technologies and experience accumulated by the two companies, K Plant will further expand the business in the domestic and overseas markets. The

acquisition is also expected to strengthen its management foundation in the medium to long term.

IHI has withdrawn from the cement plant business, but will continue to be responsible for all the orders it already received in this field. ::



Achieving new heights in technology



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The Kawasaki Heavy Industries (KHI) Group is constantly pioneering the latest advances in technology. With our extensive innovations in transportation, industrial machinery, plants and infrastructure, we are contributing to the future of the earth's environment.

Guided by our vision — *Kawasaki, working as one for the good of the planet* — and supported by our vast array of state-of-the-art technologies, the KHI Group continues to create new value and help realize a sustainable society. Our products are at work on land, at sea, in the air and in space, taking our technological prowess to new heights and depths, and underscoring our environmental commitment to the planet.

 **Kawasaki**