Two Newly Developed LNG Transport Vessels Delivered

In February, Kawasaki delivered the *LNG SAKURA*, a 177,000 m^3 capacity liquefied natural gas (LNG) transport vessel, for use by The Kansai Electric Power Company, Inc. (KEPCO) and Nippon Yusen Kabushiki Kaisha (NYK Line).

The first of Kawasaki's line of 177,000 m^3 capacity LNG carriers to be commissioned, this ship is designed to enable passage through the newly expanded Panama Canal, which opened for full operations in 2016. The *LNG SAKURA* will be used by KEPCO to transport LNG from the Cove Point LNG Project in the U.S. The vessel features standard LNG carrier hull dimensions in order to enable docking at major LNG terminals around the world, while offering larger cargo tanks for increased transport capacity, thus cutting LNG transport costs and facilitating more flexible LNG trade operations by shipowners.

Kawasaki has optimized the hull structure to decrease overall ship weight, enhanced the hull-shape design, and adopted a twin-propulsion motor, twin-screw propulsion system (the first of its kind in a large-size Kawasaki vessel), all of which help achieve the best propulsive performance possible. In addition, the company integrated a DFD electric propulsion system* for the first time in any Moss type LNG carrier worldwide, which increases fuel efficiency at all speeds.

Kawasaki has also delivered the *PACIFIC BREEZE*, a 182,000 m^3 capacity LNG transport vessel for use by Kawasaki Kisen Kaisha, Ltd. ("K" Line), in March. The vessel is scheduled to transport LNG from the Ichthys LNG Project in Australia, which is operated by INPEX CORPORATION.

The *PACIFIC BREEZE* is the world's largest MOSS-type LNG carrier, with a cargo tank capacity of approximately 182,000 m^3, and was based on the 177,000 m^3 LNG carrier, previously the largest MOSS-type LNG carrier on offer from Kawasaki.

* The DFD (Dual Fuel Diesel) engine is capable of burning oil or gas, while a conventional generator engine can only use oil for fuel. The propulsion system is comprised of a number of generator diesel engines, variable speed propulsion motors and other components. Either gas or oil is supplied to the engines to generate electricity, which drives the propulsion motors that power the propeller.

LNG SAKURA

PACIFIC BREEZE

100MW Class Gas Turbine Combined Cycle Power Plant Boasts the World's Highest Electrical Efficiency

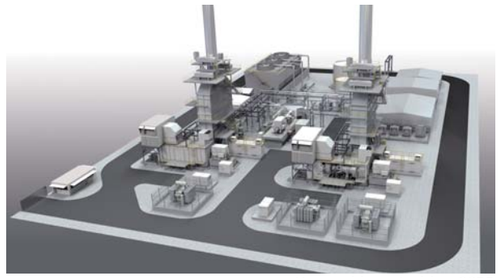
In March, Kawasaki completed development of a combined cycle power plant (CCPP) with the world's highest level of electrical efficiency, and has commenced marketing activities. The CCPP employs the L30A, a 30 MW class made-in-Japan high-efficiency gas turbine featuring the highest output of all Kawasaki gas turbines.

A CCPP consists of two stages of power generation. A gas turbine generator provides the primary power generation, and the gas turbine exhaust is utilized as the heat source for a heat recovery steam generator (HRSG). Steam from the HRSG drives a steam turbine generator to provide secondary power. A CCPP has a shorter startup time than a conventional steam turbine power plant of the same output, and features excellent load response as well as high electrical efficiency, meaning minimal thermal energy is wasted.

The newly developed CCPP is composed of two L30A gas turbines, two HRSGs, and one steam turbine, all produced by Kawasaki. This brings together Kawasaki's product technology and plant engineering capabilities cultivated over many years, to achieve high efficiency in the combined cycle as a whole, in addition to that of the gas turbines alone*. Total Electrical efficiency is 55.2% (reheat type**) in the 100 MW class and 54.4% in the 90 MW class systems, both among the world's highest levels of electrical efficiency.

* Some of the technologies for increasing efficiency and improving load responsiveness of L30A gas turbines were developed by the New Energy and Industrial Technology Development Organization's (NEDO) Program for Strategic Innovative Energy Saving Technology.

** This is a reheat-type CCPP, in which steam is extracted from the middle stage of a steam turbine and reheated in the reheater of an HRSG before being returned to the steam turbine in order to increase power output.



Kawasaki gas turbine CCPP

New AUTO CULTURE Automated Cell Processing System to Aid Regenerative Medicine

Kawasaki recently completed development of its new AUTO CULTURE* automated cell processing system. The system enables consistent-quality, low-cost cell culture operations at various scales, and is expected to help promote the adoption of regenerative medicine. Kawasaki will begin approaching companies seeking the commercialization of regenerative medicine to offer the system as an ideal solution for their business needs.

Kawasaki developed the AUTO CULTURE system by leveraging synergies between relevant technologies in areas such as plant engineering and clean robots for medical and drug discovery applications. This new system maintains the same high quality achieved through manual cell culture operations by experienced technicians, while fully automating all operations from seeding to harvesting. By automating the entire cell culture process, the system achieves safe and consistent cultivation, lowers cell culture costs, enables more flexible response to changes in production volume, improves the work environment for technicians, and achieves other breakthroughs to solve a plethora of problems.

Compared with past Kawasaki systems, the new AUTO CULTURE system attains higher production efficiency through its ability to handle multiple flasks simultaneously. It also includes enhanced measures to prevent problems such as contamination and operator errors, and reduces costs while increasing safety and consistency in cell culture operations. Furthermore, incubator** units and reagent storage cabinets are detachable from the main system unit, allowing for seamless capacity increases from clinical trials to commercial production. The system is capable of handling various flask sizes, and operators can adjust settings for cultivation operations, enabling cultivation of induced pluripotent stem cells (iPS cells), mesenchymal stem cells (MSCs) and a wide range of other cell types.

* "AUTO CULTURE" is a registered trademark of Kawasaki Heavy Industries, Ltd.
** A device used to cultivate cells. Internal environmental conditions are maintained at levels suited to cell proliferation.

Mercedes-Benz GLC F-CELL to use a New High-Pressure Hydrogen Regulator Developed for Daimler

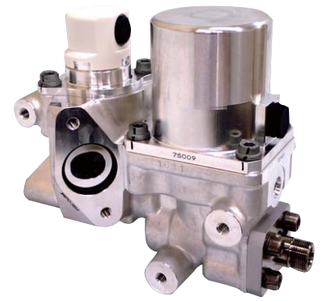
In April, Kawasaki delivered a high-pressure hydrogen regulator to Daimler, a major German automobile manufacturer, to be used in a new model of fuel cell vehicle, the Mercedes-Benz GLC F-CELL.

This high-pressure hydrogen regulator is the fruit of joint development with NuCellSys, a subsidiary of Daimler. Fuel cell vehicles store hydrogen in a tank at extremely high pressure (approx. 700 atmospheres), and the regulator plays the important role of reducing the gas pressure to prepare it for use in the fuel cell stack*.

Exploiting the fluid control technology that Kawasaki has developed through its many years of developing and manufacturing hydraulic devices, together with NuCellSys' expert knowledge in fuel cell systems, we have developed a regulator that takes up less space and contributes to increased range by improving fuel efficiency, while at the same time offering superior reliability, having cleared durability tests that suggest a product life of 20 years. This is all possible through the efficient pressure reduction enabled by high precision gas control technology, and the stable hydrogen gas pressure it delivers during power generation.

* A device that generates power through the chemical reaction of hydrogen and oxygen.

Range: Approx. 500km (NEDC value)
Fuel filling time: 3 minutes
(Photo courtesy of Daimler)



High-Pressure Hydrogen Regulator

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