

CO₂-free Hydrogen Energy Supply-Chain Technology Research Association Commences Operations

In February, Kawasaki, Iwatani Corporation, Shell Japan Limited and Electric Power Development Co., Ltd. (J-POWER) established a CO₂-free Hydrogen Energy Supply-Chain Technology Research Association (HySTRA). The companies transferred their demonstration project to HySTRA, which is now in full-scale operation.

The four companies established HySTRA as an organization to implement a demonstration project for the New Energy and Industrial Technology Development Organization (NEDO). HySTRA's main objective is to establish and demonstrate technologies necessary for the chain from the production of hydrogen from source materials to transportation, storage and use. The long-term goal is to build and commercialize a CO₂-free hydrogen energy supply chain to help save the environment.

In order to implement hydrogen energy in society, CO₂-free hydrogen must be supplied affordably and reliably. In June 2014, the Ministry of Economy, Trade and Industry

released a Strategic Road Map for Hydrogen and Fuel Cells, which called for the establishment of a CO₂-free hydrogen supply chain.

To realize such a hydrogen supply chain, Kawasaki led a collaboration with Iwatani and J-POWER to make a proposal for a demonstration project. In June 2015, the proposal was accepted by NEDO as a Demonstration Project for Establishment of Supply Chain for Mass Marine Transportation of Hydrogen and Gasification of Brown Coal. Now that the three companies, along with Shell Japan, have established HySTRA, the demonstration project previously pursued by the three companies has been transferred to HySTRA.

The intention of HySTRA is to realize a commercial liquefied hydrogen supply chain from overseas in the future. To achieve this, the project is comprised of two parts. One covers technology for gasification of brown coal, and the other covers technology for long-range mass transportation and cargo

handling of liquefied hydrogen. HySTRA aims to conduct technical demonstration and identify issues facing commercialization of each part by fiscal 2020.

J-POWER, which is currently developing an integrated coal gasification combined cycle (IGCC) system, uses the gasification technology they have accumulated to demonstrate technology for gasification of brown coal.

Kawasaki, Iwatani and Shell Japan work together to demonstrate technology for long-range mass transportation and cargo handling of liquefied hydrogen. Kawasaki is a supplier of cryogenic equipment and has built LNG storage tanks and receiving terminals as well as equipment for the rocket launch complex on Tanegashima. Iwatani is Japan's only producer and supplier of liquefied hydrogen. Shell Japan is a subsidiary of Royal Dutch Shell, which has experience with LNG supply chains and carrier operation.

CFRP efWING® Bogies Delivered to JR Shikoku

In May, Kawasaki completed delivery of four efWING*¹ bogies equipped with CFRP*² leaf springs to the Shikoku Railway Company (JR Shikoku).

The newly delivered efWING bogies were installed on a 121-series two-car, electric multiple train, with two trucks to be used on each car. Each efWING's leaf springs and wheel sections feature lime-green coloring, a symbolic color used for Kawasaki motorcycles. This train started revenue service operations as a 7200-series train on JR Shikoku's Yosano Line (running between Takamatsu and Iyo-Saijo Stations) and Dosan Line (between Tadotsu and Kotohira Stations) in June 2016.

These new-generation bogies developed by Kawasaki substitute high-strength, lightweight CFRP components for a portion of the steel frame components found in conventional bogies. Furthermore, the efWING replaces the coil springs found in standard

suspension assemblies with bow-shaped CFRP leaf springs, which combine the functions of the individual, coil-spring-based sections. The end result is greatly reduced unit weight for decreased energy-related costs and more environmentally friendly performance.

The adoption of CFRP springs also enables flexing of the bogie unit as a whole, which stabilizes amounts of force imparted by each wheel on the rails. This provides a smoother ride and cuts the rate of wheel-load reduction*³ by half to reduce derailment risks and thus increase safety.

Moreover, the efWING's comprehensive design approach, which is based on the principles of Kansei Engineering (affective engineering), makes each truck visually appealing and fun to ride upon from the passenger's perspective. Moving forward, Kawasaki intends to leverage the unique advantages offered by the efWING to provide new value to customers.

*1 efWING: registered trademark of Kawasaki Heavy Industries, Ltd.
*2 CFRP: carbon-fiber-reinforced plastic.
*3 Wheel-load reduction: one possible cause of train derailment, in which the vertical load between the wheel and the rail is reduced along curving sections of track, due to a fault or irregularity in the rail, or in other such circumstances.



New Management Team Announced

At the General Meeting of Shareholders held on June 24, board members were elected as shown here. Among them, Managing Executive Officers Makoto Ogawara and Tatsuya Watanabe were newly elected to the Board as directors, and Michio Yoneda as outside director. At the meeting of the Board of Directors that followed, President Shigeru Murayama was appointed chairman, Senior Executive Vice President Yoshinori Kanehana president, and Makoto Ogawara and Tatsuya Watanabe senior vice presidents. Outside Director Hideki Fukuda retired from his post, and Directors Akio Murakami and Eiji Inoue were both appointed advisors.



Shigeru Murayama
Chairman



Yoshinori Kanehana
President



Joji Iki
Executive Senior Vice President



Munenori Ishikawa
Executive Senior Vice President



Kazuo Hida
Senior Vice President
President
Precision Machinery Company



Kenji Tomida
Senior Vice President
President
Motorcycle & Engine Company



Toshiyuki Kuyama
Senior Vice President
President
Gas Turbine & Machinery Company



Kazuo Ota
Senior Vice President
General Manager
Corporate Planning Division



Makoto Ogawara
Senior Vice President
President
Rolling Stock Company



Tatsuya Watanabe
Senior Vice President
President
Plant & Infrastructure Company



Yoshihiko Morita
Outside Director



Michio Yoneda
Outside Director

150 MW Steam Turbine Power Facilities Ordered for Factory in Indonesia

Kawasaki recently received an order from Taiwanese company Formosa Heavy Industries Corp. (FHI) for two 150 MW class steam turbine power generation facilities. The equipment will be used at a factory belonging to PT Asahimas Chemical (ASC), Asahi Glass Co., Ltd. subsidiary in Indonesia.

This steam turbine equipment will be installed at ASC's new high-efficiency, coal-fired power station to be built in their factory in Cilegon City, Banten Province, Indonesia. Kawasaki will provide two sets of steam turbine equipment for

power generation purposes, each with a generation capacity of approximately 150 MW, which is the largest power output achieved by a Kawasaki-made steam turbine. ASC is making efforts to strengthen its factory's production capacity for caustic soda (NaOH), polyvinyl chloride (PVC) and other such products, and by installing these new high-efficiency power generation facilities the company aims to achieve major power-cost reductions while mitigating the environmental impact of

their operations. Kawasaki plans to ship the first set of steam turbine equipment at the end of May 2017 and the second set at the end of September 2017.

Kawasaki manufactured its first industrial steam turbine equipment in 1956 and has completed and delivered more than 370 such facilities to this day. FHI decided to order turbine facilities from Kawasaki based on high overall evaluation of the latter's turbine equipment performance, life-cycle costs, follow-up services and other strengths.