ONE OF THE WORLD'S FIRST 100% HYDROGEN-TO-POWER DEMONSTRATIONS ON INDUSTRIAL SCALE LAUNCHES IN LINGEN, GERMANY

Hydrogen-to-Power Plant in Lingen

Tokyo and Lingen, December 9, 2021 — With the joint-demonstration project "H2GT-Lingen", German energy company RWE Generation SE (RWE) and Japanese comprehensive heavy-industry manufacturer Kawasaki Heavy Industries (Kawasaki) are planning to install a hydrogen-fueled gas turbine based on renewable green hydrogen in Lingen, Germany. The gas turbine generator set "GPB300 / L30A" with an electrical power output of 34 $MW_{el.}$ will be used to reelectrify hydrogen. H2GT-Lingen will be one of the world's first pilots to test 100% hydrogen-to-power conversion on an industrial scale turbine.

In order to become climate-neutral by 2040, RWE is planning to switch its gas-fired power plants from natural gas to hydrogen over time, as one option for decarbonisation. With H2GT-Lingen, RWE is gaining experience in operating a hydrogen-fired turbine.

At the site of its gas-fired power plant in Lingen, RWE intends to generate green hydrogen with electrolysers powered by renewable electricity. The company is planning to build a first 100-MW electrolysis plant in Lingen by 2024, which is to be expanded to 2 GW by the end of the decade.

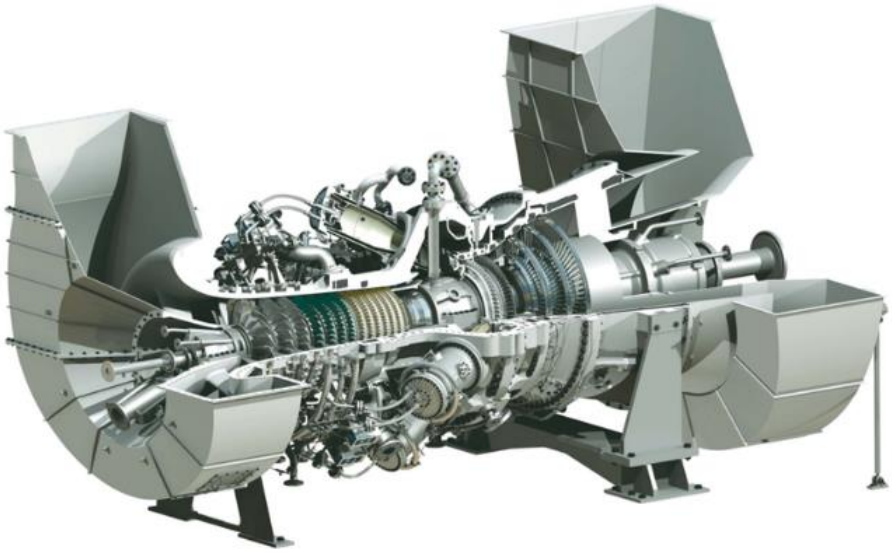
Kawasaki's gas turbine provides the maximum possible fuel flexibility. It can operate with 100% hydrogen, 100% natural gas and with any combination of both. This flexibility will be indispensable, as during the initial phase the amount of hydrogen available for reconversion will fluctuate over time before 100% hydrogen operation will be possible throughout.

Kawasaki has developed two different types of combustion systems to achieve 100% hydrogen operation. One is a diffusion flame, the other a Dry-Low-Emission (DLE) combustor. In the beginning, the diffusion flame combustor will be used for the H2GT-Lingen project. The diffusion flame combustor will use water injection to achieve low emissions. In a subsequent phase, the installed diffusion flame combustor will be replaced by a Micro-Mix DLE combustor (MMX-combustor).

Using hydrogen in conventional DLE combustors increases NOx emissions and heightens the risk of flashbacks. Hence established gas turbine DLE combustion systems cannot be directly used. The development of DLE hydrogen combustion technologies is thus essential for pure hydrogen (100 Vol%) combustion and Kawasaki has therefore developed the innovative and unique MMX-DLE combustor.

The hydrogen combustors that have been developed were successfully tested in 2018 as part of the demonstration power plant project "Hydrogen CGS for Smart Community at Kobe" for the 1 MW gas turbine category in Japan. The "H2GT-Lingen" project aims to scale up these proven technology principles.

The hydrogen-powered gas turbine is scheduled to be operational in mid-2024.



Performance Data @ ISO Conditions *				
Output Power	Electrical Efficiency	Fuel Consumption	Exhaust Gas Mass Flow	Exhaust Gas Temperature
34 380 kW	40.3%	85 300 kW	92.6 kg/s	502°C

*based on natural gas

Kawasaki L30A

The rapid global expansion of renewable energies over the past few decades has led to new challenges for conventional power generation systems. To manage the intermittency of renewable energy, flexible power generation systems and energy storage systems are becoming increasingly important. During the transition period, gas turbine technologies will play a vital role in stabilising power supply. Accordingly, in the course of the H2GT-Lingen project different operational load ranges between 30% and 100% will be tested to increase operation flexibility. This will become very important to compensate for fluctuations in the grid resulting from the volatile availability of renewable energies.

Recently it has become essential to pay full attention to de-carbonisation and sustainability in all industrial sectors. Hydrogen, produced using wind and solar energy, can replace climate-damaging fossil fuels as an alternative for gas turbines, thus enabling low-emission power generation in the future. Both RWE and Kawasaki are thus convinced that hydrogen fuels will be key components of a sustainable de-carbonised society.

The H2GT-Lingen project will demonstrate the suitability and importance of hydrogen fueled gas turbines for the global energy transition.

RWE Generation SE

With its power plants in Germany, the UK and the Netherlands, the approximately 3,000 employees of RWE Generation produce electricity primarily from gas, hydropower and biomass. The company ranks second in Europe with its gas-fired power plants. The RWE Group bundles its hydrogen activities in RWE Generation. RWE is driving forward more than 30 projects in the field of hydrogen with partners from industry and science.

Kawasaki Heavy Industries, Ltd.

Together with about 100 group companies in Japan and overseas, Kawasaki Heavy Industries oversees the formation of a "technology corporate group." Our technological capabilities, polished over a history that exceeds a century, send diverse products forth into wide-ranging fields that go beyond land, sea, and air, extending from the ocean depths to space. We are also active in wide-ranging businesses driven by diverse and high-level engineering technologies, including generators such as gas turbine and gas engine, environmental and recycling plants, industrial plants, precision machinery, industrial robots, and infrastructure equipment. Through the development of unique and broad businesses unmatched elsewhere, we will continue to create new values that solve the issues facing our customers and society.