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Toshiba Energy Systems & Solutions Corporation
Tohoku Electric Power Co., Inc.
Iwatani Corporation

Promoting Advanced System Control Using FH2R for Practical Application of Power-to-Gas

~Extending NEDO Technology Development Project for Practical Use of Hydrogen for
Energy Storage and Utilization~

Toshiba Energy Systems & Solutions Corporation (Head Office: Kawasaki, Kanagawa Prefecture; President and CEO: Tadasu Yotsuyanagi; hereinafter “Toshiba ESS”), Tohoku Electric Power Co., Inc. (Head Office: Sendai, Miyagi Prefecture; President and CEO: Kojiro Higuchi; hereinafter “Tohoku Electric Power”), and Iwatani Corporation (Head Office: Osaka, Osaka Prefecture; President and CEO: Hiroshi Majima; hereinafter “Iwatani”) have announced today that they have signed an agreement with the New Energy and Industrial Technology Development Organization (NEDO) for a “Hydrogen social construction technical development project/Hydrogen energy system technical development/Technical development concerning business model construction and large-scale proof of a hydrogen system for energy reuse*1” (hereinafter “the Project”) to extend the demonstration period until the end of fiscal year 2025. The three companies will work toward further advancement of system control in order to expand and strengthen the Project.

Project Outline

1. Background

As an introduction to renewable energy, such as photovoltaic power and wind power expansion, opportunities for output control to adjust the supply-demand balance in the power system will increase. One way to effectively utilize power from renewable energy sources without output control is to use hydrogen for energy storage and utilization (Power-to-Gas), which enables large-scale and long-term storage of hydrogen. Furthermore, in order to realize Power-to-Gas, it is necessary to establish a system that optimizes the production and supply of hydrogen for fuel cells and fuel cell vehicles based on forecasts of hydrogen supply and demand, as well as demand response functions.

The Fukushima Hydrogen Energy Research Field (FH2R), which opened in March 2020 in Namie Town, Fukushima Prefecture, utilizes one of the world’s leading scales—a 10 MW-class hydrogen production facility—to help adjust the supply-demand balance in the power system through hydrogen production and supply. The FH2R is not equipped with storage

batteries or fuel cells, and has been working to establish clean and low-cost hydrogen production and supply technology by maximizing the use of electricity from renewable energy sources through demand response and system operation based on hydrogen supply and demand forecasts.

Based on project results through FY2022, the companies have developed various control systems (hydrogen energy operation systems, power system-side control systems, and hydrogen demand forecasting systems) and established a basic technology for both Power-to-Gas hydrogen production and supply and demand response. Specifically, they have confirmed that the FH2R facilities can actually adjust the amount of hydrogen production, etc., at the necessary timing, while satisfying hydrogen demand, and can respond in a manner equivalent to products for the Electric Power Reserve Exchange (EPRX) (Frequency Restoration Reserve (FRR) , Replacement Reserve (RR) and Replacement Reserve-for FIT)*2, which are used by general transmission and distribution utilities to procure the power system's adjustment power necessary for power system stabilization.

2. Future activities

Based on demonstrations up to FY2022, issues for the commercialization of Power-to-Gas have become apparent, and in order to make the Power-to-Gas project viable, it became clear that it is necessary to maintain low-cost hydrogen production costs without making any changes to the hydrogen production facilities in the face of changes in the balance of hydrogen supply and demand. Furthermore, it became clear that it is essential to improve the power supply-demand balance adjustment function to the power system in order to stabilize the power system.

To this end, the companies will develop mechanisms and technologies to control the timing and volume of hydrogen supply and demand for external hydrogen consumers, as well as technologies to optimize the operation of hydrogen production facilities to achieve low-cost hydrogen production. Furthermore, in order to contribute to the stabilization of the power system, they aim to develop technologies for upgrading the adjustment function, which can supply adjustment power to the power system even when combined with multiple facilities other than FH2R.

3. Roles and approaches for each company

The roles of each company in the Project, and their approach, are as follows.

Through the Project, Toshiba ESS will contribute to the realization of a CO₂-free hydrogen society by developing hydrogen solutions that enable the efficient use of energy with the production of hydrogen derived from renewable energy to its utilization.

Tohoku Electric Power will verify how to utilize the hydrogen energy system, which is premised on a stable supply of electricity, and aim to expand the introduction of renewable

energy, while continuing to work as a local electric power company to contribute to the reconstruction of Fukushima Prefecture through the Project.

Iwatani believes that the development and demonstration of the Project will contribute to the early establishment of a hydrogen energy society, and will actively work to expand the utilization of hydrogen energy based on its accumulated technologies and knowledge related to hydrogen transportation, storage, and supply.

Company roles

Toshiba ESS	Supervision of the overall project and overall hydrogen energy management system
Tohoku Electric Power	Verification of the utilization of the hydrogen energy system based on a stable electricity supply, and verification of advanced control of the AC system*3
Iwatani	Verification of the hydrogen demand forecasting system, hydrogen supply and demand management system, and hydrogen supply

Overview of FH2R system

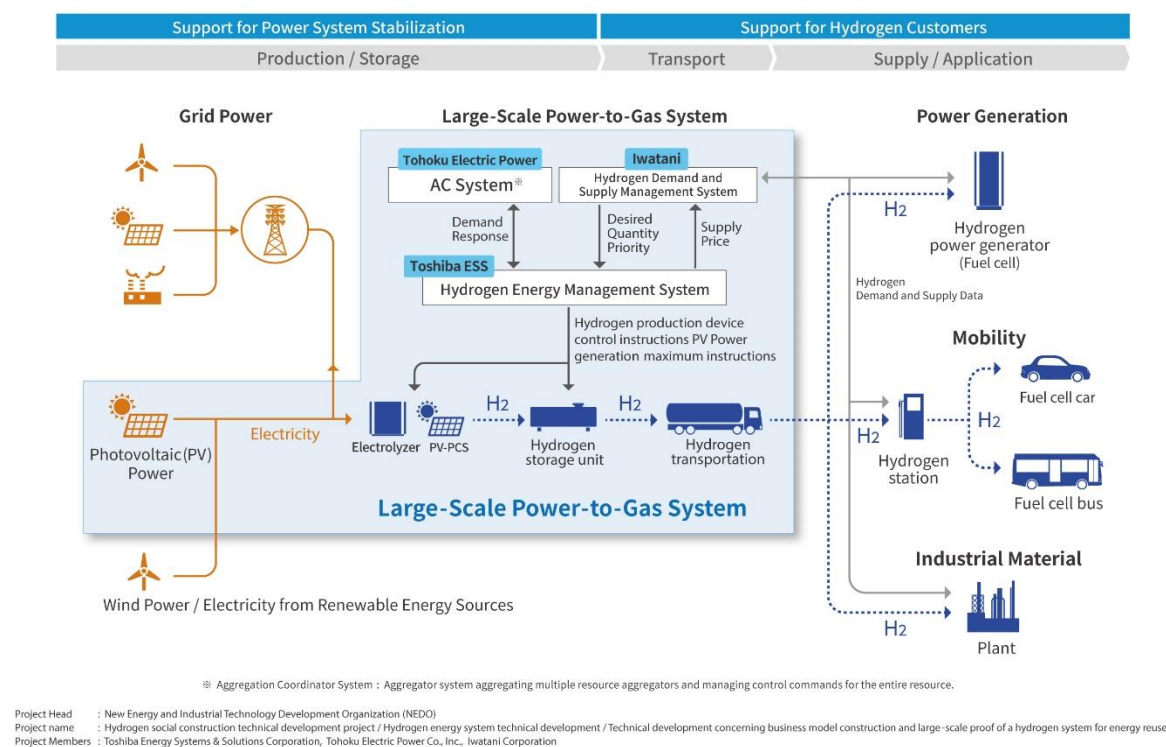


Figure 1. Overall concept of the Project

Through the Project, the three companies will promote technological development to expand the use of hydrogen derived from renewable energy and optimize the operation of hydrogen energy operation systems. They will promote efforts toward the commercialization of a sustainable Power-to-Gas business model after 2030, which is expected to accompany the expansion of the use of renewable energy.

*1:

Project name: Hydrogen social construction technical development project/Hydrogen energy system technical development/Technical development concerning business model construction and large-scale proof of a hydrogen system for energy reuse

Period: Fiscal 2016–2025

(Feasibility study [FS Phase] performed from fiscal 2016 to 2017, system technology development [Demonstration Phase] currently in progress from fiscal 2017 to 2022. System technology development [Demonstration Phase] now extended to fiscal 2025.)

*2:

Frequency Restoration Reserve (FRR): Adjustment power corresponding to load adjustment of frequencies that fluctuate with a cycle of more than a dozen minutes.

Replacement Reserve (RR): Adjustment power to handle the difference between demand and supply caused by errors in demand forecasts and renewable energy output forecasts that occur after the gate closes, or by power supply dropouts due to unexpected problems, etc.

Replacement Reserve-for FIT: Adjustment power to deal with forecast errors of renewable energy using the FIT Special Exception Scheme (1) and FIT Special Exception Scheme (3).

*3:

AC system: Aggregator system that aggregates multiple resource aggregators and manages control commands for the entire resource.