Highlights from the Hydrogen Technologies Virtual Factory Tour Q&A Session
(June 14, 2021)

(Responses were based on information available at the time of the presentation.)

Q. In what ways does MHI's hydrogen gas turbine development outperform or is further along than your competitors? Also, will it be possible to maintain this advantage going forward?

A. MHI's strength lies in having achieved stable combustion at or above 1,600°C before any of the competition. In a Gas Turbine Combined Cycle (GTCC) plant, power generation efficiency improves as the combustion temperature increases. Using an MHI gas turbine rather than a competitor's can decrease generation costs by a few yen/kWh. Also, another important factor that leads customers to choose our equipment over the competition is reliability. Our latest model (J-class) gas turbine boasts the world's highest[1] reliability rating of 99.5%.[2] Our customers' acknowledgement of this achievement helped us win the No. 1 market share[3] (in the Americas and Middle East) in heavy duty gas turbines in CY2020.

Moreover, MHI has 50 years of experience with hydrogen gas turbines. Another unique feature of our hydrogen gas turbine development efforts is that we also develop rocket engines. Our rocket engines utilize hydrogen fuel with combustion temperatures reaching up to 3,000°C. Development of both hydrogen gas turbine and rocket engine technologies is being pursued at the same development facilities with shared equipment, and members of the hydrogen gas turbine R&D team also work on rocket engines.

[1] According to MHI research.

[2] The ratio of unplanned downtime (total downtime minus shutdowns due to regular maintenance etc.) to total cumulative operating hours.

[3] According to McCoy Power Reports.

Q. Around what level of efficiency do you hope to achieve with hydrogen gas turbines?

A. MHI gas turbines achieve the world's highest efficiency[4] of over 64%. Our hydrogen gas turbines will offer this same superior efficiency.

[4] According to MHI research.

Q. Is there any benefit to installing a hydrogen gas turbine in terms of cost?

A. One advantage is that hydrogen can be introduced to the fuel mix starting with small quantities. When a heavy duty gas turbine operates using 100% hydrogen, it consumes a large amount of hydrogen, but depending on the supply available, mixed firing with even a small amount of hydrogen, such as 0.5%, is possible.

Another advantage is that existing facilities can be used as-is. Existing gas-fired power plants have all of the necessary functions other than hydrogen production. By installing hydrogen production equipment at a power plant, surplus electricity from renewable energy sources can be sent to the plant and used to produce and store hydrogen, thereby eliminating hydrogen transportation costs.

MHI believes that utilizing existing gas-fired power plants and gradually expanding the use of hydrogen starting with small amounts will be an effective means of reducing the cost of decarbonization to the overall community.

Q. When installing hydrogen gas turbines, I think that customer requirements will be varied, including the need for different mix ratios. Does MHI have the development capability to fulfill these needs?

A. Yes. In addition to a variety of R&D facilities, MHI also has a demonstration power plant (also known as “T-Point 2”) at our Takasago Works facility, and we have accumulated a vast amount of knowledge including about plant operation. The latest model JAC-class gas turbine installed there has logged more than 4,000 operating hours. Also, the demonstration plant uses parts made with Additive Manufacturing (metal 3D printing) technology and features AI-assisted controls. We believe that the demand for AI-optimized combustion controls will increase as customers begin using hydrogen and other alternative fuels.

Q. What do you think are the challenges to commercializing hydrogen gas turbines? Also, what is MHI doing to solve these issues?

A. The greatest challenge we face is economics, including that of hydrogen production and transportation. In Asia (including Japan), it is difficult to meet 100% of electricity demand using only locally available renewable energy. Therefore, it is necessary to import energy from outside the region, which increases generation costs. In order to make decarbonization economically feasible, we believe it is necessary to hold all-inclusive discussions in the public sphere, including about carbon pricing.

As mentioned previously, in the field of power generation (the hydrogen utilization side), MHI believes that expanding hydrogen utilization starting with small quantities at existing facilities using hydrogen gas turbines can contribute to reducing the cost of decarbonization to the community as a whole. Going forward, we plan to focus our efforts on hydrogen production. By investing in start-ups with promising technologies and participating in cutting-edge projects around the world, we plan to build a knowledge base and increase our presence in the hydrogen production space.

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