

Development of Micro-Tubular Turbine System

Utilizing Applicable Hydropower Resources

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Effective utilization of natural resources, including the reduction of carbon dioxide (CO₂), to facilitate the protection of the environment is one of our business targets. The development of abundant natural resources including water, wind, solar, and geothermal will be both a key element in the future of the electric power business and an important issue to tackle in the production of clean energy.

Hydropower resources can be harnessed not only from rivers but also from developed facilities of our daily lives, such as industrial factories, waterworks and sewage plants. It means that development of hydropower with non-utilized head remaining in human being activities is very effective as an on-site power supply.

Tokyo Electric Power Company, Inc. (TEPCO) and Japan Natural Energy Company, Ltd. (JNE) have researched and developed the micro-tubular turbine system and have studied its effective application scheme utilizing the small but remaining and applicable hydropower resources. This paper describes our developed micro-tubular turbine system and introduces its application cases in recent studies as a new business model in Japan. Our turbines are applicable to the head between 2 and 20[m] and the output covers from 3 to 300[kW] with three different sizes. This system can also be applied to the higher head and/or the larger output with cascade connections or parallel connections of turbines. In addition, a simplified adjustable runner vane mechanism has been developed in order to achieve wider operation range at sites with a larger flow variation.

The first turbine (Head: 5[m], Discharge: 0.93[m³/s], Output: 37[kW]) was installed in a sewage plant in Tokyo owned by the Tokyo Metropolitan Government in 2002, as an achievement of the joint research project of Tokyo bureau of waterworks and TEPCO. The second turbine, which is the first for commercial application, was installed in the waterworks in Kawasaki owned by Kawasaki city in 2004, as a result of the corroborative project of Kawasaki bureau of waterworks and JNE, in which the better hydraulic performance with simple operation and maintenance has been achieved.

At present, JNE is installing micro-tubular turbine systems at some applicable sites in Japan, which will be put into operation in this year. TEPCO and JNE will promote the application of this system further in the future, looking for new business chances in the world.