



## Hydrodynamic design and performance testing of Pelton-type energy recovery turbine for pressure-retarded osmosis systems

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### ABSTRACT

In this paper, we present the hydrodynamic design and performance tests of a Pelton-type energy recovery turbine (ERT) for pressure-retarded osmosis (PRO) systems. We describe the process of selecting the appropriate type of ERT for operating conditions of the PRO system (i.e., 400 ton/day, 30 bar) as well as the design methods for the Pelton-type ERT. Furthermore, we analyse the performance characteristics at design and off-design points and the change in performance with respect to the diameter of the Pelton runner, based on the performance tests of the manufactured Pelton-type ERT. At the design point, the efficiency of the Pelton-type ERT was approximately 85%, and the overall efficiency with the electric generator was approximately 77.2%. The efficiency of the turbine and overall plant was highest when the diameter of the Pelton runner is of the size selected during design. We thus validate the design result through such a performance test. It is expected that this study will be of great assistance to future works involving the selection of ERTs for PRO systems, as well as the design and performance tests of ERTs.

*Keywords:* Pressure-retarded osmosis; Energy recovery device; Hydrodynamic design of Pelton turbine; Performance test; Production of electric power

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