

An Experimental Prototype For Low Head Small Hydro Power Generation Using Hydrum

Abstract:

The global rise in energy demand has resulted to the over exploitation of both renewable and non renewable energy sources. Most feasible hydroelectric power (HEP) plants sites have been exploited and the current focus is on harnessing energy from small HEP plants which have low head and flow velocity rendering them unsuitable for HEP generation. Previous research work focused on improving the turbine shape and efficiency; designing better water intake, improving the generator and development of turbines suitable for low heads. The main aim of this research was to optimize the power generated by low head small hydro plants through the use of hydraulic ram pump (hydrum) to boost the water pressure before it impinges on the turbine. In the current work, a small HEP prototype system was designed fabricated and test runs conducted. The prototype comprised of; a low head water reservoir, a hydraulic ram pump which was used to increase the head of the water emanating from a low head source, a high head reservoir mounted at a the most optimal height based on the hydrum flow rate and pressure considerations and a double cup pelton wheel turbine suitably designed to extract power from the water jet. A drive pipe was used to connect the hydrum pump to the low head reservoir while the delivery pipe connected the pump to the high head reservoir. Water from the high head reservoir was used to turn the pelton turbine which was coupled to a generator. The flow rate in the drive pipe and the delivery pipe as well as the pressure in the hydrum were optimized by adjusting the waste valve stroke length. It was observed that the hydrum was able to pump water to a higher head which then increased the power produced by the turbine.