

**Capacity optimization of an Old Small Scale Hydropower Plant at
Ngombezi Sisal estate along Pangani River.**

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Developing countries experience inadequate electrical power supply. More critical situation is experienced in rural societies due to limited development and diffusion of technologies in the areas. The studies that are done in Tanzania show that there is an existence of a number of untapped small hydropower sites with an approximate overall capacity of about 300MW. In this study, a low head (less than 3m) hydropower plant, situated along the Pangani river at Ngombezi has been studied by the use of stochastic ARMA model for the purpose of optimizing power generation capacity. The stochastic ARMA model was built and fitted from the historical 35 years, monthly river flow data and used for long term synthetic data extension. The flow duration curve was plotted based on cumulative flow rain curve. Based on the net annual energy from the flow duration curve, optimal design discharge was established as $5\text{m}^3/\text{s}$ for Francis, Kaplan, Propeller and Banki turbines. Water wheel and Archimedes screw turbines optional discharge was $6\text{m}^3/\text{s}$. power potential that can be generated was determined as 51kw for propeller, 52 kW for Banki turbine, 56Kw for Francis turbine, 58Kw for waterwheel, 62kW for Kaplan and 65Kw for Archimedes screw turbine. These channel parameters were established based on the Banki turbine or cross flow turbine since it is the simplest turbine types which have been successively manufactured locally. It has been recommended to carry out a study on developing Archimedes screw turbines, which are considered suitable for in-stream technology.