Evaluation of the reservoir yield and hydropower potential of the doma dam, nasarawa state, North Central Nigeria

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Abstrak

Small hydropower has been found to have a positive effect on the quality of life of rural dwellers in numerous ways. It provides a wide range of services, such as improved lighting; energy for small industries, schools, computer and communication service centers, clinics, and entertainment centers; and operations of a range of domestic and light industrial appliances. Nigeria has many dams built for irrigation and water supply, but these may still have the potential for other uses. One such dam is the Doma dam in north central Nigeria. The dam has a live storage of 30 Mm3 and a yearly average inflow of 114 Mm3. This study is a hydrological investigation concerning the possibility of using the dam for power generation. An artificial neural network model, as automated in ALYUDA Forecaster XL, was used to extend the available streamflow record at the dam site. Thereafter, a reservoir yield–capacity analysis was carried out by maximizing the unknown releases subject to storage capacity constraints. The sequent peak algorithm was used to establish the real storage needed to meet the primary demands, including ecological releases and evaporation losses. The results showed that the maximum monthly yield from the reservoir is 6.56 Mm3, while the storage required to satisfy the dam’s primary functions is 12.07 Mm3. This means that there is 16.93 Mm3 of monthly excess stored water, or 6.53 m3/s, which can be used for other purposes, such as electricity generation. Considering 50%, 75%, and 100% usage of the excess stored water with a head of 20 m, the power potentials were found to be 0.51 MW, 0.77 MW, and 1.03 MW, respectively. It is expected that providing 2×500 kW Kaplan turbines to operate for 12 hours a day will deliver between 2.0 and 4.0 GWh of energy yearly to the immediate communities in the Doma local government area.