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## Modeling the Energy Extraction from In-stream Water by Multi Stage Blade System of Cross Flow Micro Hydro Turbine

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### Abstract

This paper aims to present energy extraction behavior of multi stage Micro Hydro Turbine (MHT), particularly when it operates in a low velocity In-Stream water body. Development of a MHT with multi stage blade (runner) for water velocity ranges from 0.5 m/s to 1.0 m/s is the novelty of this research. Findings of literature review on MHT and simulation results of ANSYS CFD software are the basis of designing this research project. The vital parameters involved in designing the turbine were blade area, blade stage, blades position against water flow direction, spacing between blades, blade materials; and other technical factors associated with turbine operations. The study revealed that the turbine had started to extract energy at water velocity 0.3 m/s at 35 RPM turbine speed. At water inlet velocity 1.1 m/s, the velocity drop across blade was 25.6% and the energy extraction efficiency was 48.3%. The findings demonstrated that the energy extraction capacity of turbine blade had been greatly influenced by the blade stages and water velocity. The study concludes that the developed turbine is useful in low velocity In-stream water body for energy extraction and would be able to contribute to achieve energy and environmental sustainability.

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### 1. Introduction and background of research

Various types of Micro Hydro turbine (MHT) are available in the market and generally all are operated on water velocity more than 1 m/s, even energy extraction efficiency of these turbines is less than 50 percent ( $\eta \leq 50\%$ ). The

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