A NOVEL DESIGN WORK IN ENERGY EXTRACTION FROM IN-STREAM WATER BY VARIOUS TYPES OF MICRO HYDRO TURBINES

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ABSTRACT: *Purpose- Micro-hydroelectricity power projects are becoming popular because it is a proven low cost electricity-generating source. This research designed to evaluate energy extraction efficiency of single stage and multistage blade of micro Hydro turbine. Experiments have been conducted with two-laboratory scale turbine at instream water velocity ranges from 0.5m/s to 1 m/s. The finding shows that energy extraction and transfer efficiency of multistage MHT is about 5.5 percent higher compare to single stage MHT. This study concludes that multistage MHT is cost effective as energy extraction efficiency is higher and it could be an energy solution for rural societies. Indeed, the multistage MHT could be a useful electricity generating equipment for supporting rural economy.*

Keywords: Micro Hydro Turbin,; Multi-Stage MHT, energy Efficiency, Energy Performance

1. RESEARCH BACKGROUND

This research aims to assess the most efficient way to generate green energy from instream water by using micro-hydro turbine. This study carried out to support clean and renewable energy application to ensure the environment sustainability. Besides, this study performed to support communities living in the coastal areas by providing information to harvest energy from Instream water by using Micro Hydro Turbine (MHT). Thus, the research on MHT is an approach to contribute to achieve economic and environmental sustainability.

In coastal areas, have the difficulties of getting constant electricity supply due to its remote surrounding where normal power grid is not available. Currently, fossil fuel based generator use to carry out this function for supplying electricity. The problems of using commercial generator are not environmental friendly due greenhouse gas emission and the maintenance cost of engine operations. In this context, renewable energy is the best option. Micro hydropower plant is one of the favoured options among other alternatives such as wind power and solar system.

Hydropower is the most favourable because this source is available constantly. Application of MHT shall be environmental friendly compared to the conventional hydro power plant and mini hydro power plant. The method of energy harvesting of MHT is the same as the conventional hydropower do. The operating procedure of MHT is the water velocity turns the turbine blades and produce mechanical energy; and this energy is transfereg to generator for producing electrical energy.

The known fact is that energy harvesting optimization from instream water would contribute to reduce electricity production cost; and in order to achieve this goal, it is essential to know MHT configuration and installation criteria. Abundance of information on MHT operations and energy extraction procedure are available in the published literature; even the authors of this paper have published a few research papers on MHT operations and energy harvesting. However, in the aspect of energy extraction efficiency difference between multistage MHT and single stage MHT is not available in published literature. In order to fil-up this gap, authors have undertaken this research project.

1.2 Problem Statement

In coastal area, the society living there having difficulty in getting constantly supply of electricity. In absence of supplying electricity from national grid, communities living in these areas, fossil fuel base generators use to produce electricity. In this aspect, micro hydropower plant has the potential to solve the energy issue faced by the coastal area. Thus, micro hydropower plant appears electrical energy supply source for coastal areas. In this aspect, needs to pay attention on for fully utilizing production capacity of MH for increase energy harvesting efficiency.

Therefore, operating properties of MHT is essential to evaluate optimum electric energy production condition. To ensure expected energy harvesting from MHT, this research designed to get answer of the questions about, "**which turbine is energy efficient between single and multistage blade?**

1.3 Objective Of The Study

The objective of this research is to investigate energy extraction performance of MHT by using multi stage blades and single stage blade turbine at lower water velocity ($V \leq 1.0$ m/s). In order to achieve the goal, the broad objectives divide into three specific objectives:

a) Measuring energy extraction performance by using multistage blade micro hydro turbine in In-stream water.
b) Measuring energy extraction performance by using single stage blade micro hydro turbine in In-stream water.
c) To evaluate impact of multistage and single stage blade on turbine performance at low water velocity ($V \leq 1.0$ m/s).

1.4 Scope Of Work

For achieving the research goals, theoretical framework relevant to this research gathered from the published research papers. Laboratory scale of one-multi stage blades and one single stage blade MHT used separately for conducting experiment. The last stage of this research is data analysing for achieving targeted research goals.

1.5 Novelty Of Research Study

This paper focused on the evaluation of energy extraction performance of multistage and single MHT at water velocity ranging of 0.5 m/s to 1 m/see. This type of work is not available in the published literature. In this aspect, the current work is original and novel.