Optimization of Cross Flow Turbine in Micro Hydro Power Plant

[1]Ravi Dhokiya, [2]Ketan Shah
[1]PG Scholar, [2]Asst. professor
[1]Mechanical engineering,
[1]Venus International College Of Technology, Gandhinagar, India

***Abstract* - The objective of this research is to increase the efficiency of micro hydro power plant by changing the blade angles and fixing the head of water in cross flow turbine. The demand of electricity and fresh water is ever increasing due to increase in population and comfort level of human beings. This research investigated micro hydro power plant efficiency with view to improve the power output while keeping the overall project coast within acceptable range. It reviews commonly used cross flow micro turbine which are best for the small plants. Turbine parameters such as blade angle and head of water are deals with the view to increase the efficiency for the micro hydro power plants.**

***Keywords* - Turbine, Cross flow turbine, Micro hydro power plant**

I.INTRODUCTION

It is developed by Anthony Michel in 1903 and is used for low heads. As with a water wheel the water is submitted at the turbine edge. After passing the runner it leaves on the opposite side. the cross flow turbine is a low speed machine that is well suited for location with a low head but high flow. There is no fluctuation in torque in cross flow turbine. It rotates in the same direction, independent of water flow directions.

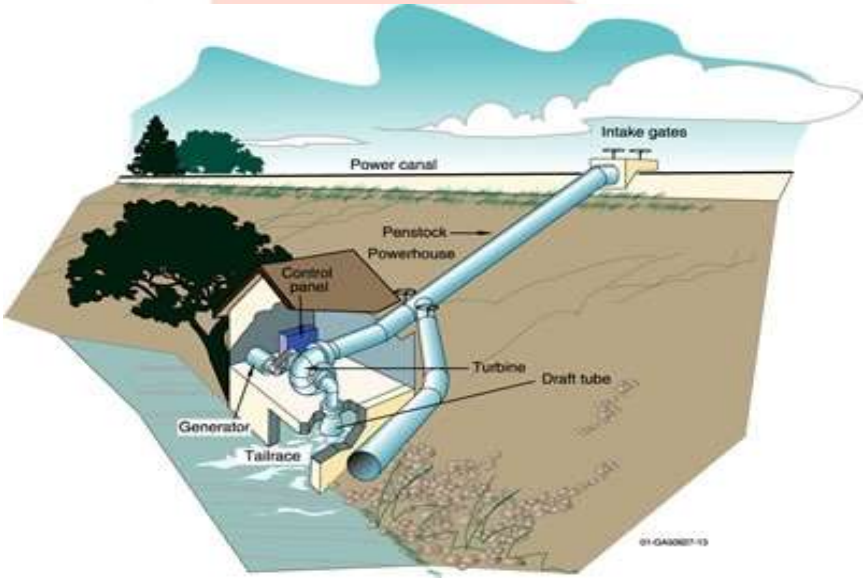

Fig.1 Micro hydro power plant

The cross flow turbine consists of cylindrical water wheel or runner with a horizontal shaft, composed of 18 to 37 blades, arranged radially and tangentially. The blade's edges are sharped to reduce resistence to the flow of water. A blade is made in part circular section[1]. The ends of the blades are welded to discs to form a cage, instead of the bars, the turbine has trough shaped blades.

II.LITERATURE REVIEW

An overview of important of turbine blade angle and blade effects are describely presented. It is mainly focused on studying the different parameters of turbine rotor to improve the efficiency of the cross flow turbine for micro hydro power plant. From the literature review, it is noted that cross flow turbine should have blades between 18 to 37. At various blade angle and no of blades the efficiency is changed for micro hydro power plant. At various height and blade angle the efficiency will be changed. Some of the researcher had done their analysis on turbine rotor. They had changed blade angle, blade material and no of blades at various condition at various site. For cross flow turbine the efficiency found for micro hydro power plant is very low comparatively with other turbines. So by changing the numbers of blades, blade angle & blade spacing of rotor to increase the overall efficiency of micro hydro power plant.

III.METHODOLOGY

The design procedure of the cross-flow turbine involves the following steps:

1. Preparing the site data
   (This involves the calculations and measuring the net head of the hydro-power plant and its water flow rate) (Taking the height of head 6 mtr)
2. Calculation of turbine efficiency (ηt))
3. Calculation of blade spacing (tb))
4. Calculation of the runner blade number (n))
5. Making the 3D model
6. Compare the new design with existing design in ANSYS.

By using this calculation we can try to improve the efficiency of cross flow turbine.

Study the design and performance analysis of the existing rotor. The 3D CAD model of existing rotor's has been made in SolidWorks and carried out through ANSYS to understand the performance of the rotor under the all condition at various blade angle and numbers of blade.
From the analysis of the existing rotor, efficiency optimization were carried out in the existing rotor after identifying the parameters which are needs to change to get the maximum efficiency.
The most feasible optimized design of the rotor and its results discuss in this paper.

IV.RESULT & CONCLUSION

At the fixed head of water the existing turbine is giving the efficiency 37.7% at the 73º blade angle, 36 no. of blades and 30.53 blade spacing. Where the new model is giving the efficiency 43.6% at the 64º blade angle, 27 no. of blades and 41.23 blade spacing. so the new model is more efficient with compare to existing model

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