AN EXPERIMENTAL STUDY ON AXIAL FLOW PUMP OPERATED AS A TURBINE MODEL WITH DRAFT TUBE

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The Philippines has a diverse energy sources for power generation. According to the Accomplishment Report for the year 2000 of the Department of Energy (DoE), coal accounted for 38%; geothermal 25%; oil was drastically reduced from 28.5% in 1999 to 21%; while hydropower was only 16%. Although the country has an abundance of water resources, statistics show that there is a need to fully utilize the indigenous energy reserve and in the process establish the hydropower energy as an important sector in energy planning.

The hydraulic plants or hydro are classified according to its expected generation output. The Philippine National Power Corporation (NAPOCOR) defines small hydro as hydraulic plants with a capacity between 10 and 50 MW. On the other hand, the Department of Energy classifies hydraulic plants with a capacity of 101 kW to 10MW as mini-hydro systems while those with a capacity below 100 kW as micro-hydro systems. The Department of Energy estimates that for a mini-hydro alone, a potential of 1,132.48 MW exists. However, only 89.07 MW has been developed, which represents a mere 7.87% of the identified mini-hydro resource potential. As far as the micro-hydro is concerned, there is an aggregate power potential of about 28 MW. At present, there are 68 units of micro-hydro systems with a total generating capacity of 233 kW which is only 0.832% of the recognized micro-hydro resource potential. There is an assumption that the listing is not complete and that most of those unaccounted micro-hydro systems exist throughout the country.

Due to the abovementioned conditions, small-scale hydro manufacturers as well as researchers from the private sectors and universities alike are encouraged to intensify the hydropower development in order to harness the country's energy reserve particularly for mini and micro-hydro.

Since the development cost of micro-hydro system is cheaper than the mini-hydro, the Department of Mechanical Engineering at the De La Salle University-Manila was able to come up with a design of an axial flow turbine model that is easy to construct and that can

be manufactured locally. The turbine has undergone a series of tests to ensure that it is both efficient and reliable because absence of experimental results will prove that the design is futile since its effectiveness is without any scientific basis.

The preliminary investigation developed and tested a model of an axial flow pump operated as a turbine with a draft tube. The turbine blades and guide vanes configurations are based on the design of axial flow pump by Prof. A.J. Stepanoff. The draft tube however, is a two-dimensional diffuser with a total divergence angle of 15 degrees. In this study, the dimensional analysis is used to derive the functional relationship between discharge coefficient and energy coefficient. The performance of the system was evaluated by using the one-dimensional flow theory. The Reynolds number used in the upstream part of an axial flow turbine model is ranging from 90,000 to 170,000.

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