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# PICO HYDRO POWER FROM PORTABLE IRRIGATION WATER PUMP OF BANGLADESH

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***Abstract-*** *Use of water pump for irrigation is very common in Bangladesh. This irrigation watering is done by various modes. There are some submergible pumps with water dam systems; on the other hand there are some pump and diesel engine arrangement where water is usually extracted from various water bodies. In the later case no arrangements of water dam are there, rather it is placed in the paddy field directly. This type of centrifugal pump and diesel engine arrangement is used where electricity is not available. It is observed that when water is supplied in field a large amount of soil is displaced and nearest crops is also damaged due to impact of high velocity of water from a considerable amount of height. Our theme of this research is using Pico hydro turbine in the outlet of the pump; reduce water velocity up to sustainable level and meanwhile to produce electricity. This idea will help lighting power house, running small house hold items like fan, charging light and specially to recharge a mobile phone. Here we provide alternate path for excess water flow due to turbine periodic maintenance time or if the turbine creates high resistance towards flow. This research project will help to reduce soil erosion and parallel produce Pico hydro power. From this concept Pico hydro power generator will be used. In this power generator we can produce electricity as by-product form irrigation in the field. This hydro power generator utilizes kinetic and potential energy of water coming out of the pump. Here gravitational and centrifugal force of pump will be used to run turbine which in turn rotate generator shaft and thus produce electricity. This generator is portable which facilitates easy and secured source of power.*

**Keywords:** Pico hydro, Water turbine, Irrigation, Erosion, Renewable energy.

## 1. INTRODUCTION

Hydro power is term referring to electricity generation by using the water head. It is widely used as a form of renewable energy. Hydro power generator does not produce any noise or waste in absence of any burning fuel. So, it's a clean source of electricity. The major advantage of this system when compared to other renewable source of energy is that, if enough water is available, it can provide a constant and/or predictable power supply, where as other technologies, especially wind and solar provide intermittent or unpredictable energy. In this project water head is created using discharging water from water pump that is used for the irrigation. Hydro power up to 5 KW is referring as Pico-hydro power.[1]

## 2. OBJECTIVES

The aim and objective of this project is to produce small scale power from portable irrigation watering systems of Bangladesh for use in the pump house and storing the same for the future use. This paper also aims to reduce soil erosion & crop damage from high head water falling directly on the paddy field. It will also help rural people to relief their grief in day to day life.

## 3. METHODS

The aim of this paper is the implementation of a small of power generation system by Pico hydro turbine for electrification of small pump house in remote villages of Bangladesh where utility power cannot be provided due to less population density and commercial non-viability.

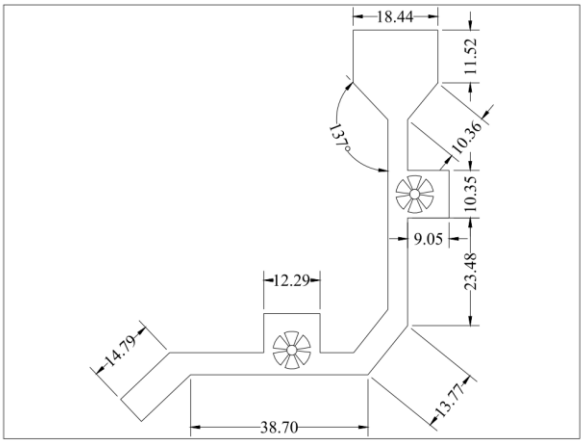


Fig 1: *Schematic diagram of pico hydro turbine*

There are several steps to complete this project. When the water falls upon the water turbine it will rotate which in turn generator shaft. Generator shaft connected with turbine shaft will rotate simultaneously and thus power is produced.

The experiment set up is consists of-

1. Selection of turbine.
2. Design turbine blade.
3. Making a suitable frame for whole arrangement.
4. Reading power output & adjusts for house hold use.

## 4. DESING & SELECTION OF TURBINE

The design of the system for selecting reversed centrifugal pump as turbine was based on Sharma as the following equations of discharge and head [3].

$$Q_t = \frac{Q_{bmp}}{\eta_{max}^{0.8}} \quad (1)$$

Where, $\eta_{max}$ is maximum efficiency of the pump
$Q_t$ is the average flow rate through the pumps
$Q_{bmp}$ is the maximum flow rate through the pumps (cms)

And

$$H_t = \frac{H_{bmp}}{\eta_{max}^{1.2}} \quad (2)$$

Where, $H_t$ is the average head of water above the pump (m)
$H_{bmp}$ is the maximum head of water above the pump (m)

The total pipe loss through the pipe system in (2) was calculated according to Darcy-Weisbachs formula and Moody's diagram [4].

The hydraulic power in a stream can be calculated when the head and flow have been measured. The formula to calculate hydraulic power is as follows:

Power = Net head (m) x flow (liter/s) x 9.81
Net head= 25% x gross head
Power (mechanical) =
net hydraulic power x turbine efficiency
Power (electrical) =
mechanical power x generator efficiency

Generator efficiency is generally 80% and turbine is considered to have 65% efficiency.

## 4. IMPLEMENTATION

This pilot project implemented using locally available raw materials at university lab. A number of items have been used in Pico-hydro turbine set manufacturing. Below some of those:

1. 48"x48" GI pipe
2. 25"x25" sheet metal
3. 2-bearings
4. 25"long and 1.5" of diameter rod
5. Several flat bar.
6. Multimeter
7. Tachometer.

The construction of a conveyance water system from the upstream side of waterfall to the pump and power systems at downstream side of waterfall using PE-pipe type was installed with the inner diameter of 100mm. The electrical controller system to be adapted at normally voltage of 220V was installed by using the parallel

Fig 2: Water turibie

systems and series capacitor set of 8 and 310 microfarads each to be kept as constant voltage without and with workload, respectively[2].

## 5. EXPERIMENTAL DATA

Table No 1: Experimental Data

| Test No. | R.P.M | Voltage (V) | Current (A) |
|---|---|---|---|
| 1 | 200 | 0.56 | 0.31 |
| 2 | 250 | 0.38 | 0.89 |
| 3 | 250 | 0.34 | 0.80 |

## 6. RESULT

In this experiment water reservoir is used as the water source which has a height of 2-3 ft. Here the speed is 200-250 r.p.m., the voltage is 0.38 V and current is 0.8 A Found.

## 7. LIMITATION

In this experiment we use DC motor instead DC generator to generate electricity due costing. With the DC generator I hope the output will be much better. We placed the set up in a water reservoir instead of irrigation pump for insufficient opportunities. But hope to get almost same result if it is placed in irrigation pump.

## 8. DECISSION

With the power this plant generates, mobile battery can be charged; several LED's can be ran and so on. Some improvements can readily be incorporated with this Pico-hydro turbine to increase the efficiency and user

flexibility. It can also be commercially produced as low cost, user friendly Pico-hydro power for uses in remote villages where commercial utility connection is yet to reach.

## 10. CONCLUSION

Water's power is manifested in hydrology. The high force of water coming out of pump gives this power. In this project there is a new process of production electricity and very good idea to utilize water more effectively. From this project the main benefiter will be the farmers who cultivate the land. He can minimize his cost of production, reduce soil erosion and will be able to beautify his life.

## 11. REFERENCES


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