

# Design & Development of Portable Water Turbine

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**Abstract:** In this project a water turbine is designed and fabricated based on the ideals of Tesla's turbine. Frequent power cuts the alternate source of energy for house hold power requirements are very essential. Also, it is important that this source should be portable and easily operated by common man. The purpose of the design and fabricate a portable water turbine using the principle of Tesla turbine. The main objectives of this turbine are to utilize the potential and kinetic energy of a conventional water supply. The goal of this project is to design and build a small/portable hydroelectric power system for use in rural parts of India which do not currently have power, but do have access to streams and small waterfalls.

**Keywords:** Lever Turbine, Energy Conversion Unit, Rotor Blade, Rotor Shaft, Casing, Generator Motor

## I. INTRODUCTION

Renewable energy has been widely adopted for its reusable source of energy that is naturally replenished. Different basic types of renewable energy consist of wind from the air, water from rivers/streams, and solar energy (photovoltaic) from the sun. These natural resources are created by complex chemical reactions of the universe, providing earth with these abundant resources. Renewable energy is clean and effortless, making it the better choice versus nuclear, steam, coal or fuel power plants. Hydro-electric power is the energy that comes from the flow of moving water. Harnessing the power of water has dated to the time of ancient Mesopotamia and Egypt when irrigation systems easily transported water to keep land fertile Imperial Rome used the watermill to effectively grind grain and produce flour as shown in Ancient civilizations understood the importance of harnessing this renewable source of energy to improve the quality and ease of living. In 1831, Michael Faraday devised experiments, using his "induction ring," and rotation, to produce a steady current of electricity. Faraday's experiments led to the development of an electrical generator. By the late 19th century, the electrical generator could be coupled with water to power a house. In the early part of 20th century, the USA approved several major damming projects, including the Hoover and Roosevelt dam. This ushered in the use of a renewable energy. Today, most rivers in the U.S. implement some form of a dam to produce power for distribution in neighbouring areas. The advantage of hydroelectric systems over other renewable energies is that it has longer economic lives

## II. LITERATURE REVIEWS

TITLE: - Floating type water wheel for pico hydro systems in Sri Lanka (L.H.L.T.P.Kumara, 2014)

A theoretical analysis of the water wheel was done based on 6 blades straight type wheel. The performance testing of water wheels in open channel were carry out for three types of blades and two different numbers of blades (6 and 12).Based on the results It shows that 5% deviation between theoretical and experimental values of power and 36% deviation between theoretical and experimental values of R.P.M.

TITLE: - Low head simple reaction water turbine (Abhijit Date, 2009)

In this thesis, two new innovative designs of simple reaction water turbine are presented and the performance characteristics of their prototypes are investigated experimentally and graphically presented. The theoretical analysis of the simple reaction turbine presented in this thesis highlights the potentials and intrinsic characteristics of simple reaction turbine. The theoretical analysis predicts the centrifugal pumping effect that allows additional mass of water to flow through the turbine as it starts to rotate faster

**III. NEEDS**

These are the following needs:-

- Demand for renewable energy is continuously increasing
- Dependence on fossil fuels is for limited years Energy available in running river should be utilized to produce energy
- Existing hydropower plants are costly and are not portable
- Hence there is a need to develop portable, cheap, efficient water turbine

**IV. OBJECTIVES**

1. To design a portable water turbine that will generate power from river, stream, canal
2. To be able to help the people to generate electric power

**V. COMPONENTS**

These are the following components of Portable water turbine:

1. Rotary Turbine wheel
2. Stationary Turbine wheel
3. Shaft
4. Casing
5. Bearing
6. Washer

**Design Calculations**

a) Rotating turbine wheel-

We selected rotating turbine wheel of diameter 148 mm [7]. Shaft is an integral part of rotating turbine wheel. Based on maximum shear strength of Nylon material, we designed shaft of 13 mm outer diameter.

Calculations for shaft design based on maximum shear strength-

$$\tau = \frac{16 T}{\pi d^3}$$

$T = 0.194 \times 9.81 \times 10^6$  Nmm [8]  
 $\tau = 45$  MPa Nylon material

From this equation

$$d = 19.57 \text{ mm (For 25 to 30W power output) [7]}$$

This shaft size is for maximum power conditions and maximum shear stress.

But we cannot generate maximum power based on turbine concept, so we selected 13 mm shaft size which will sustain generated shear stress and load conditions for getting power output of at least 20 W.

$$d = 13 \text{ mm}$$

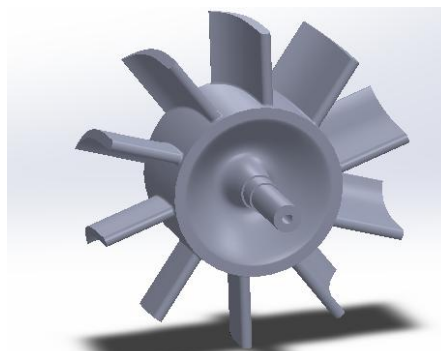
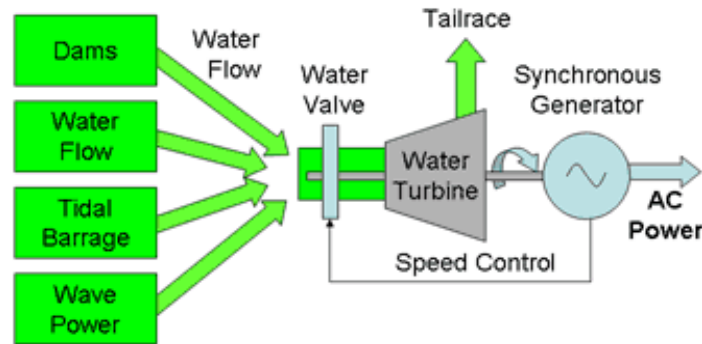


Figure 1- Rotary wheel with shaft [7]

**VI. WORKING**

Turbine consists of rotor blades, rotor shaft, and generator motor. The turbine is immersed in the flowing water where the blades of turbine are impacted by water. This impact on blades makes the turbine shaft to rotate. Turbine shaft is coupled with generator shaft. As the generator shaft rotates, it generates electricity.



**Hydro Electric Power Generation**

Figure 2- Working diagram of Portable water turbine

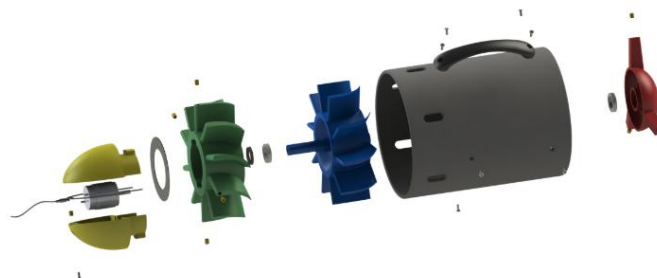


Figure 3 Fully exploded view [7]

Figure 3 shows exploded view of all the components accompanied in portable water turbine.

**VII. CONCLUSION**

- Rotating turbine wheel shaft has been designed successfully.
- It can generate less amount of electricity from energy lost by hydraulic pumps
- It can also be used for energy generation from wind energy as a secondary source by removing outer casing.

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