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DESIGN AND MANUFACTURING OF BUILDING MOUNTED TURBINE FOR COMMERCIAL POWER GENERATION

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Abstract : Almost all of our modern conveniences are electrically powered. Electricity is the most versatile and easily controlled form of energy. At the point of *use* it is practically loss-free and essentially non-polluting. At the point of generation, it can be produced clean with entirely renewable methods, such as wind, water and sunlight. So taking into consideration the importance of electricity generation by renewable methods we will design and manufacture a system that will generate electricity with the help of wheel turbine. For a multi storage building when we supply water for different floors from top of the building. By using the force of water downwards we attach a setup containing pelton wheel turbine and alternator and with the help of this we generate electricity.

Index Terms **-** Pelton Wheel Turbine , Non Renewable Energy Resource,. Hydraulic Pressure, Alternator , Kinetic Energy , Electric Energy , Power Generation.

I. INTRODUCTION

In hydro power plant we use the gravitational force of water to run the Pelton turbine which is coupled with electric generator to produce electricity. There are various types of turbines used for hydro power generation. Among them Pelton turbine is use on medium to high head sites. Energy from flowing water has been exploited from time immemorial to meet some of the energy requirements. The oil embargo of 1972 triggered the search for alternative energy 22 sources. Small scale hydro energy which had hitherto given way to the development of medium and large hydro projects, engaged the attention more than any other renewable source of energy.

Essentially, on the account of the versatility and convenience of the electrical energy on one hand, and the cheapness and renewability of hydro energy on the other, small hydroelectric power plants have a definite role to play in today's energy scene. The concept of generating electricity from water has been around for a long time and there are many large hydro-electric facilities around the world. What is new to most people is the idea that this same concept will work on a smaller – and even individual – scale.

Worldwide there are literally hundreds of thousands of micro-hydropower sites (up to 100 kW) that could be developed to supply environmentally friendly renewable energy.

With the right location, hydro systems can produce many times the power a similarly priced wind or solar system could generate. With special precautions, they can be used virtually year-round, summer or winter. Even a modest output from a hydro system, producing steadily 24 hours a day, will add up to a large cumulative total. Often, peak power use is in the evening when the sun isn't shining and the wind is not necessarily blowing. Batteries can be completely drained by morning with a solar or wind system. With a hydro system located on a year-round creek or river, power is produced steadily around the clock. These are just some of the benefits of hydropower.

1.1 Problem Statement:

Due to increasing needs of luxurious life there emerges a need of electricity generation at a higher rate. Due to low supply of electricity there arises problems of power cut at various places and thus day to day life is affected. Thus, generation of electricity from any source is equally useful due to increasing demands for its use. Electricity can be generated by renewable methods such as water, sunlight, wind.

1.2Objectives

- Use of polyurethane Pelton wheel buckets to reduce the weight of the setup.
- To design, manufacture and fabricate Pelton wheel turbine.
- Production of micro hydro power plant.
- Light Weight and Compact Design.
- To make use of free flow of water due to gravitational force.

II. LITERATURE SURVEY

Literature review

- **(1)Nasr Al Khudhiri et.al** [1] designed and investigated hydro power plant functionally and feasibly for energy generation for a mid-size farm with insufficient water distribution networks that is located in UAE. "Design of Hydro-power Plant for Energy Generation for a Mid-Size Farm with Insufficient Water Distribution Networks" (2018) For rural areas such as a farm, the electricity tariff rate during the on-peak periods is considered as high rate compared to the off-peak periods. So, the idea came to design a hydro-power plant as an alternative energy source that can be used in such farms in to be operated during on-peak periods. From the conceptual general design of the hydro-power plant, a micro Pelton wheel turbine based on the available head and flow rates that will be operated through pumped-storage technique was selected. Then, the turbine section has been designed to have eight turbine buckets that contain the curved reflectors. From the analytical calculations, the functionality of the designed micro-hydropower plant is evaluated, which the results indicate the design is able to deliver the required electrical power to the farm with high overall efficiency. From the feasibility study, it was proven that the project is economically feasible based on the small value of the simple payback period. Applying this project will help to decrease the dependency on conventional energy sources and open the local market and people to the renewable energy sources.

- **Emanuele Quaranta et.al** [2] published a review based on the "Gravity water wheels as a micro hydropower energy source" (2018) Nowadays, due to the need for clean energy and \ sustainable electricity production, hydropower plays a central role in satisfying the energy demand. Particularly, use of low head micro hydropower plants is spreading worldwide, due to their low payback periods and good environmental sustainability. Gravity water wheels are micro hydropower converters typically used in sites with heads less than 6m and discharges of a few cubic meters per second. Although water wheels were scientifically investigated as far back as the eighteenth century, they were largely ignored throughout the twentieth century, and only in the last two decades has there been a renewed interest in their use among the scientific community. In this paper a review on gravity water wheels is presented, distinguishing between undershot, breastshot and overshot water wheels. Water wheels' technology is discussed focusing on geometric and hydraulic design; data and engineering equations found in historic books of the nineteenth century are also presented. Water wheels' performance is described examining experimental results, and modern theoretical models for efficiency estimation are presented. Finally, results achieved through experiments and numerical simulations were discussed with the aim of optimizing the performance of gravity water wheels. The results showed that maximum efficiency of overshot and undershot water wheels was around 85%, while that of breastshot water wheels ranged from 75% to 80%, depending on inflow configuration. Maximum efficiency of modern water wheels can be maintained at such high values over a wider range of flow rates and hydraulic conditions with respect to older installations. Hence well-designed water wheels can be considered as efficient and cost-effective micro hydropower converters.

- **Caiyong Ye et.al** [3] published a paper on "Design and Research of a High-Speed and High-Frequency Pulsed Alternator" (2017) Pulsed alternators have the merits of high energy and power densities, which are applied to a wide range of applications, such as the electromagnetic launch, the pulsed laser, and the pulsed high magnetic field. A new type of high-speed and high-frequency pulsed alternator integrating an alternator and a motor, is proposed in this paper. A solid rotor which is made of high-strength alloy steel with high yield strength is used in the pulsed alternator, so it can work at a high tip speed. This machine consists of two alternators and a motor which share one rotor and one field winding. According to different voltage levels and operation frequencies, the motor and the alternators with different stack lengths and pole-pairs are designed, respectively. Therefore, it has the abilities of being driven by low-frequency current and discharging high-frequency pulses. In this paper, the basic structure and fundamental of the pulsed alternator are introduced, the specific parameters of the prototype are given, and the performances are verified by the simulation. The results show that the machine proposed in this paper is suitable for the applications that require high-frequency pulsed discharge.

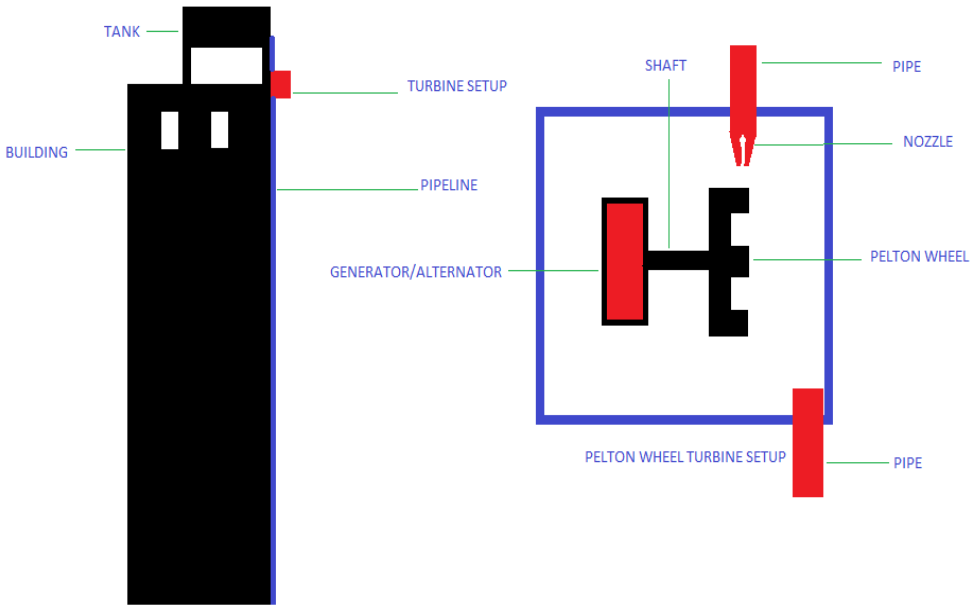
- **Audrius Zidonis et.al** [4] studied "Development of hydro impulse turbines and new opportunities" (2015). Hydro impulse turbines are often referred to as a mature technology having been invented around 100 years ago with many of the old design guide lines producing machines of a high efficiency. However, with recent advances in Computational Fluid Dynamics (CFD) it is now possible to simulate these highly turbulent multiphase flows with good accuracy and in reasonable timescales. This has opened up an avenue for further development and understanding of these machines which has not been possible through traditional analyses and experimental testing. This paper explores some of the more recent developments in the hydraulic design of Pelton and Turgo Impulse turbines and high lights the opportunities for future development.

III. METHODOLOGY

First, we will design the Pelton wheel turbine system suitable to our application. We can use the following methods for generation of electricity.
Analytical: Firstly, we need to analyze Pelton wheel turbine system taking into consideration the applications and operational conditions. Then we will analyze the design in ANSYS for static and dynamic conditions.
Theoretical: Theoretically we will calculate all parameters of Pelton wheel turbine as it is the main component of the system.
Experimentally: In our project we will make an experimental setup for effective generation of electricity.

Principal of Hydro-power Plant

Hydro-power plant can be defined as a plant that convert the kinetic energy that is available in the falling water into mechanical energy of rotational turbine that drives an electric generator to produce electrical energy. Thousands of years ago, people started using hydro-power to produce mechanical work for mainly agriculture purposes. In 1882, first hydro-power plant was built to produce electric energy which consider the hydro-power as the first technology used to produce electricity from renewable source



IV.APPLICATION

1) Pelton wheels are the preferred turbine for hydro-power, when the available water source has relatively high hydraulic head at low flow rates, where the Pelton wheel is most efficient.

2) Thus, more power can be extracted from a water source with high-pressure and low-flow than from a source with low-pressure and high-flow, even when the two flows theoretically contain the same power. Also, a comparable amount of pipe material is required for each of the two sources, one requiring a long thin pipe, and the other a short wide pipe.

3) Pelton wheels are made in all sizes. There exist multi-ton Pelton wheels mounted on vertical oil pad bearings in hydroelectric plants. The largest units can be up to 200 megawatts. The smallest Pelton wheels are only a few inches across, and can be used to tap power from mountain streams having flows of a few gallons per minute. Some of these systems use household plumbing fixtures for water delivery.

4) These small units are recommended for use with thirty meters or more of head, in order to generate significant power levels. Depending on water flow and design, Pelton wheels operate best with heads from 15 meters to 1,800 meters, although there is no theoretical limit.

V. RESULTS AND DISCUSSION

In our setup we conclude that we are getting free electricity by using Inline Pelton wheel turbine. Here we will not provide any extra resource to generate electricity. So, our project is economic and cost effective. Hence, we designed the micro hydro power plant setup for electricity generation. By analytical method we observed that the losses are less and the efficiency is higher

Further to build a more conductive and inclusive ecosystem for small hydro power plant to flourish, government backing into vital. Small hydro sector should in fact be natural allies for governments to partner with as their primary goal is to deliver clean and sustainable energy with minimum to negligible effects on available natural and renewable resources

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