Micro-Hydropower Generation by Waste Water

Mr. G .A .Chougule[1] Anushka Kalolikar[2] Anup Singh[3] Ketan Chougule[4] Viraj Jagtap[5]
[1,2,3,4,5]Department of Civil Engineering
[1,2,3,4,5]Sinhgad Institute of Technology and Science, Nahre, India

Abstract— Electricity is a very important energy in the modern civilization. It helps us to be productive and improves the quality of living. This project aims to make use of renewable resources such as hydro energy and convert it into useful electric energy by installing a micro hydro power plant. Energy requirements for human life today is very high, hydro energy on micro-hydro scale is very attractive to be used as a source of clean energy, sustainable, widely available in the countryside, renewable and prospects its development. Hydro energy is source of regenerative energy and also being clean as well as environment-friendly. This research paper intends to show the emerging concepts hydro-electricity generated from hydro- power plant. Energy demand increases due to rapid urbanization and increase in population growth. And the time is not far away when we will not have sufficient amount of electricity to fulfill our daily need. To avoid the occurrence of such dark future, this paper comprises all the data which will help to analyze how power can be generated with less head, also it reveals all methods which were carried out well enough to ensure that this proposal is extraordinary. The water used for generation of electricity is collected from bathroom and kitchen waste (Sullage water).

Keywords: Micro-Hydropower Generation, Waste Water

I. INTRODUCTION

The current worldwide energy system is based on obtaining energy from fossil fuels, such as oil, coal and gas. The generation of energy from these primary materials is being reconsidered because of several reasons: they are limited to resources which can only be found at specific points on the earth; serious effects about the environment and the health of human are being induced by their use on large- scale; the natural reserves are being depleted compromising the future of the next generations. In the last decade, problems related to energy crisis such as oil crisis, climatic change, electrical demand and restrictions of whole sale markets have risen worldwide. These difficulties are continuously increasing, which suggest the need of technological alternatives to assure their solution. One of these technological alternatives is generating electricity as near as possible of the consumption site, using the renewable energy sources that do not cause environmental pollutions, such as wind, solar, tidal and hydro-electric power plants.

Energy plays a very important role in our day to day life. The concept of generating electricity with continuous recycling of water having minimum water loss to generate electricity at low cost by Micro hydro power plant (MHP) Hydropower is clean, non-polluting, non-renewable source of energy. It will use the water which will reuse for the other purpose. By moving turbine with the help of water, electricity is produced. It is done by converting kinetic energy and potential energy of water into useful form of energy. It is the oldest technology available for power generation.

Now-a-days, conventional power sources are becoming inadequate in availability and there cost is also increasing due shortage in production. The energy demand and generation gap is increasing day by day, resulting in rise in inflation and energy shortage in the grid. This energy crises, has paved way to think about new power generating measures. Alternative and renewable sources of energy have to be developed to achieve future energy demand.

Industries also demand more and better water from all available sources. The rivers receive ever- increasing amounts of sewage and industrial wastes and thus resulting in more attention to sewage treatment, stream pollution and complicated phenomena of self-purification. In many developing countries there is no such treatment plant for sewage water. Rivers receive large amounts of polluted water and result in many diseases. Thus, self- purification and treatment plants play a vital role in sanitation of water. The other benefit is now introducing in the form of generating electricity.

Currently in Pune there are total ten STPs with installed capacity of 567 MLD. Five of them have been funded by PMC while the other five have been funded by JNNURM (Jawaharlal Nehru National Urban Renewal Mission) Phase I. Operation & Maintenance (O&M) of these plants has been outsourced by PMC to various contractors. Treated effluent is being discharged in the rivers Mula, Mutha Rivers. PMC recently admitted in the print media that though the installed capacity of its existing STPs was to treat 567 MLD, only 290 MLD was being treated at present. The balance – almost 50% of the sewage – is going into the river untreated. Pune's Rivers are some of the most polluted in the country.

A. General

Definition of Dynamo- A dynamo is an electrical generator that creates direct current using a commutator. Dynamos were the first electrical generators capable of delivering power for industry, and the foundation upon which many other later electric-power conversion devices were based, including the electric motor, the alternating-current alternator, and the rotary converter.

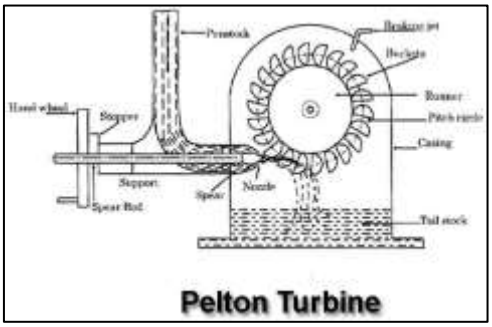
Definition of kinetic energy - It is defined as the work needed to accelerate a body of a given mass from rest to its stated velocity.

Definition of Potential energy- the energy possessed by a body by virtue of its position relative to others, stresses within itself, electric charge, and other factors

Definition Of Turbine -A machine for producing continuous power in which a wheel or rotor, typically fitted with vanes, is made to revolve by a fast-moving flow of water, steam, gas, air, or other fluid.

Pelton Wheel Turbine - The Pelton wheel or Pelton Turbine is an impulse-type water turbine invented by American inventor Lester Allan Pelton in the 1870s.The Pelton wheel extracts energy from the impulse of moving water, as opposed to water's dead weight like the traditional overshot water wheel. Many earlier variations of impulse turbines existed, but they were less efficient than Pelton's

design. Water leaving those wheels typically still had high speed, carrying away much of the dynamic energy brought to the wheels. Pelton's paddle geometry was designed so that when the rim ran at half the speed of the water jet, the water left the wheel with very little speed; thus his design extracted almost all of the water's impulse energy which made for a very efficient turbine.

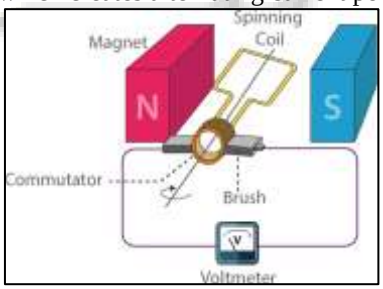


B. Applications of Pelton Wheel Turbine

1) To achieve maximum power and efficiency, the turbine blades are designed in such a way that water jet velocity is twice the velocity of rotating buckets.
2) Pelton turbine, where the water available at the high head is from 150 m to 2000 m in a hydroelectric power plant.
3) It is also used as set up in the labs of Educational Institutions
4) The main advantages are that In this turbine, the whole process of water jet striking and leaving for the runner takes place at atmospheric pressure

1) Applications of Dynamo-

Dynamos and Generators convert mechanical rotation into electric power. Dynamo - a device that makes direct current electric power using electromagnetism. It is also known as a generator, however the term generator normally refers to an "alternator" which creates alternating current power.



C. Problem Statement

Out of 16,662.5 MLD of wastewater generated, only 4037.2 MLD (24 %) is treated before release, the rest (i.e. 12,626.30 MLD) is disposed of untreated. Twenty-seven cities have only primary treatment facilities and only forty- nine have primary and secondary treatment facilities.Globally, 80% of wastewater flows back into the ecosystem without being treated or reused, contributing to a situation where around 1.8 billion people use a source of drinking water contaminated with faces, putting them at risk of contracting cholera, dysentery, typhoid and polio.

The untreated sullage water from residentials are collected and pass through the turbines to generate electricity. This water is used to generate electricity which helps the government to minimise their load in some amount.

D. Advantages and Disadvantages

Advantages:

1) This project will help in assured electric supply in future for street lights.
2) In India there are so many villages where street lights are not installed due to load shedding or other energy crises, this project will help in providing electricity to city as well as remote areas.
3) By making other modifications this project can be used for other electricity consuming things including street lights
4) Government initiative will be the important factor in promoting this project in view of developing nation.
5) India is a developing country this project will encourage India to become developed country.
6) Many of accidents are taken place due no street lights or due to some energy crises by which street lights cannot be provided this project will give assured electric supply to street lights and accidents can be avoided
7) The electricity generated from this concept can be stored and can be used for other purpose.
8) Development of sanitary engineering has contributed to the growth of the city. Without supply of safe water, the great city could not exist and life would be unpleasant and dangerous
9) The population in small areas has made the task of sanitary engineer more complex. The cities, towns and villages are polluted with ground water and surface water.
10) Industries also demand more and better water from all available sources.
11) The rivers receive ever-increasing amount of sewage and industrial wastes and thus resulting more attention to the sewage treatment, stream pollution and complicated phenomena of self-purification.

Disadvantage:

1) Non-Economical for small societies
2) Frequent maintenance is necessary if the sludge water discharge is more

II. LITERATURE REVIEW

Dr. Palakshappa K , Mr. Rudresha N , Dr. Vijay Kumar M[2019] : This project aims to make use of renewable resources such as hydro energy and convert it into useful electric energy by installing a micro hydro power plant at kappadi. As per the research and based on the calculations there is a probability of generation up to 20kw power from a head of 1.5 to 3.34 meters using bulb turbine. . It helps us to be productive and improves the quality of living. Kappadi region of Udupi district in Karnataka India, faces many difficult to get access the electric energy. In the paper , it was found that with the head and discharge available can produce up to 13.79KW of energy which was found to be more than requirement. the complete cost of MHPP is mentioned with its components according to the availability of components with miscellaneous charges the total estimated cost is 7.7 lakhs rupees in Indian currency. The objective of the paper was Conduct the survey to find out the required parameters (distance, head, discharge, and topography) necessary for the installation of the turbine for power generation of a capacity

of 10 to 20kW and Cost estimation for the installation of MHPP.

Bilal Abdullah Nasir[2013]: The design procedure of micro-hydro power plant was implemented by a Matlab Simulink computer program to calculate all the design parameters. The choice of the turbine type depending mainly on the site head and flow rate. The turbine power and speed were directly proportional with the site head, but there were specific points for maximum turbine power and speed with the variation of the site water flow rate. The head losses in the penstock could range from 5 to 10 percent of the gross head, depending on the length of the penstock, quantity of water flow rate and its velocity. The turbine efficiency could range from 80 to 95 percent depending on the turbine type, and the generator efficiency about 90 percent. Micro-hydro power continues to grow around the world, it is important to show the public how feasible micro- hydro systems actually are in a suitable site. The only requirements for micro-hydro power are water sources, turbines, generators, proper design and installation, which not only helps each individual person but also helps the world and environment as a whole. The design study showed that construction of micro-hydroelectric project was feasible in the project site and there were no major problems apparent at the design and implementation stages of the micro-hydro-electric power plant.

III. METHODOLOGY

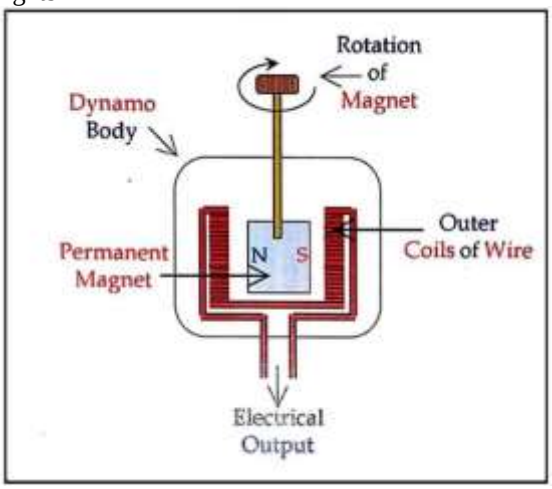
A. *Procedure*

1) Installation of Pelton turbine, with a jet which will rotate from the flow of sullage water when the water is released from the septic tank or from the household works like from the kitchen, W.C, Bath etc.
2) The turbine consists of hollow spoons, ball bearings etc.
3) The sullage water falls on the spoons and with the help of ball bearings the rotation of the turbine will be smooth and efficient.
4) The design of the turbine consists of a central portion of ball bearing socket and a combination of triangular weights which will create centrifugal force.
5) It will allow the turbine to rotate for efficient time just as same concept as a fidget spinner.
6) The location of the turbine will be between the septic tank and the main drainage.
7) The shape of the casing of the turbine will be semi hollow cylindrical and its size will be according to the traffic of the sullage water.
8) If the turbine doesn't reach a suitable speed, then we can provide a Nozzle jet which will give the turbine a suitable speed

Creating electricity from the flow of sullage water is just a vast topic. Considering this system on a small based apartment or society, the sullage water pipeline of all the houses are connected to one, preventing that greywater / sullage water to a septic tank which contains a screening and controlled outlet. The pipeline goes to the septic tank and further goes to the main drainage pipeline of Municipal Corporation. The septic will be made of PVC which is generally used in areas that are not connected to a sewage system, such as rural areas. The size of the tank will be dependent upon the sullage traffic during one day and store the sullage generated throughout the day. The settlement of some semi-solid waste present in the sullage water (1%) i.e., vegetable scraps from kitchens and dishwashers, soap water from bathroom and wash basins will be settled down in the tank during the whole day with the help of sedimentation. During a day an average amount of sullage water is 100 litres per day per capita. However, the size depends upon the sullage density and no of people living in the society. The size of the tank should be considered 20 % more of the actual size for the safety measures and for rain water collected in the rainy season.

B. *Production of Electricity*

1) After the collection of Greywater / sullage water in the tank the water collected throughout the day.
2) Will be discharged towards the turbine which is installed in the compartment underground with a constant and designed flow.
3) As the sullage water will fall on the flaps of the turbine the turbine will start to rotate
4) Because of the ball bearings provided on axle of the turbine the turbine will get a smooth rotation
5) It helps the turbine to rotate for more time.
6) Dynamo attached to turbine will produce electricity.
7) The converted current can be used to charge the batteries and can further light up the street lights and parking lights



An LED street light is an integrated light that uses light emitting diodes (LED) as its light source. These are considered integrated lights because, in most cases, the luminaire and the fixture are not separate parts. In manufacturing, the LED light cluster is sealed on a panel and then assembled to the LED panel with a heat sink to become an integrated lighting fixture. Different designs have been created that incorporate various types of LEDs into a light fixture. Heat sinks for LED street lights are similar in design to heat sinks used to cool other electronics such as computers.

MHPP Model

IV. CONCLUSION

We can produce electricity by the continuous flow of sullage water as it will help in energy saving. It will help the future generation for smart city. By this project we can provide assured electric supply to remote areas. It is highly energy saving and can be used for street lights. It will reduce load on power generation plant if use of this project is increased. The electricity generated from this concept can be stored and can be used for other purpose. By making other modifications this project can be used for other electricity consuming things including street lights. India is a developing country this project will encourage India to become developed country.

REFERENCES

[1] Mohibullah, M. A. R. and MohdIqbal Abdul Hakim: "Basic design aspects of micro-hydro-power plant and its potential development in Malaysia", National Power and Energy Conference (PECon) Proceedings, Kuala Lumpur, Malaysia, 2004.
[2] http://www.microhydropower.net/
[3] http://www.alternative- energy.info/micro-hydro-power-pros- and-cons/
[4] Fatima Hussein ABD ALI "design of waste water treatment plant", 2011.
[5] Ali R. A review on existing and future energy souces for electrical power generation in Malaysia. Renewable and Sustainable Energy Reviews [Internet]. 2015;16(6):4047–55.
[6] Aditya Agrawal1, Aditya Sharma, Harsha Yadav "Hydroelectricity Generation by the Recycling of Water" Journal of Water Resource Engineering and Management, Volume 2, Issue 3

