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Design of Micro Hydro Power Plant for Gorewada Water Treatment Plant

Jayjit Shelke[1], Vaibhav Rajurkar[2], Rahul Itankar[3], Faizan Isani[4], Ajay Rathod[5]

Snehal Lokhande[6], Reshma Pardhi[7], Neha Arokia[8],Rahul Ghanmare[9]

[1, 2, 3, 4, 5, 6, 7] Student of Department of Civil Engineering, DBACER, Nagpur, Maharashtra, Nagpur
[8, 9]Assistant professor, Department of Civil Engineering, DBACER, Nagpur, Maharashtra, Nagpur

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ABSTRACT *:- The most important addition of the modern science is renewable energy to reduce usages of non-renewable energy sources. Hydroelectricity or hydropower is the largest source of renewable power generation. Flowing water creates energy that can be capture and turned into electricity this is called hydropower. The water which is flowing in pipe lines which has some velocity, this velocity can used for generation of electricity by installation of electricity generation system on pipes. This energy has in small scale provides electricity to small community by converting hydro energy in to mechanical energy and then electrical energy.*

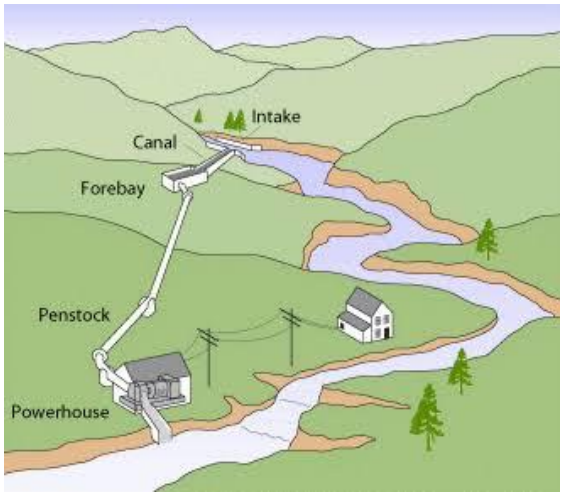
In this project, we are trying to design electricity generation system on water pipes, which are used to transfer water from intake chamber to water treatment plant. Because this pipe line are in working throughout the year.

Keywords:- Easy and simple application and installation, Generator system, Micro-hydro system, Renewable energy.

1. INTRODUCTION

People who live in the cities have full access of electricity through national grid. However, electricity supply in the remote area remains as one of the most challenging issues all over the world. In order to improve the rural people quality of life, decentralized power generation system such as mini hydro or micro hydro power plant plays an important role.

In this project we are trying to generate electricity on pipe lines. Flowing water has some energy or velocity which is hydro energy convert in to mechanical energy and then in electricity. For this generation we are trying generating electricity by theoretical calculation. For this calculation we had arranged a visit to gorewada water treatment plant for data required to further calculation.



2. INFORMATION ABOUT GORE WADA WATER TREATMENT PLANT

Under Pench Phase - II a baby canal from Pench right bank canal to Mahadulla pumping station was constructed to draw additional 136 MLD of water. The raw water is pumped to the existing B.P.T. of capacity 5.70 lakh letters. through 1626mm dia M.S. Rising Main of length 5.60 km from B.P.T. water is conveyed to Gorewada tank through 1500 mm dia P.S.C. 8 Kg.cm2 gravity main of length 400 m. from Gorewada Tank water is taken to conventional water treatment plant of capacity 145 MLD through 1100 mm and 1000 mm dia P.S.C. 4 Kg./Sq.cm. gravity mains of length 650 m and 325 m respectively. Pure water is pumped to Seminary Hills G.S.R. of capacity 20.43 ML through 1321mm dia M.S. Rising Main of length 3760 m. In this scheme two E.S.R.s at Jaripatka and Sharda Rolling Mill each of capacity 22.7 lakhs litres are constructed.

3. INFORMATION ABOUT PROJECT

I n this project we have to use the velocity of water, which is flowing in to the pipe from intake chamber to water treatment Plant.

• In this project we make the prototype of electricity generation on water power.

• Intake chamber take the water from lake river or dam and transfer to the water treatment plant. • Water flows through the pipe line under the gravity, and there is a

headroom which is control the velocity or speed of water.

• The electricity generation unit is placed at a site where we get maximum velocity of water, maximum velocity generate maximum electricity.

• This electricity is used for water treatment plant to run the treatment units.

4. CLASSIFICATION OF HYDRO POWER PLANT

There are 6 types of hydro power plantby electricity generation capacity of plant.

Sr. No.	Classification	Rated power
1.	Large hydro	>100MW
2.	Medium hydro	15-100MW
3.	Small hydro	1-15MW
4.	Mini hydro	100KW-1MW
5.	Micro hydro	5KW-100KW
6.	Pico hydro	<5KW

5. CLASSIFICATION OF HYDRO POWER SYSTEM

In pipe hydro power system can be divided in two main design

1. Internal system:- where the runner is wholly inside the pipe section and only the generator protrudes from the conduit. Internal systems have the advantages of a more compact size that makes them more suitable. Power output ranges from 5-10 watts, sufficient to supply self-powered water metering, to 100 kw for more energy intensive applications.

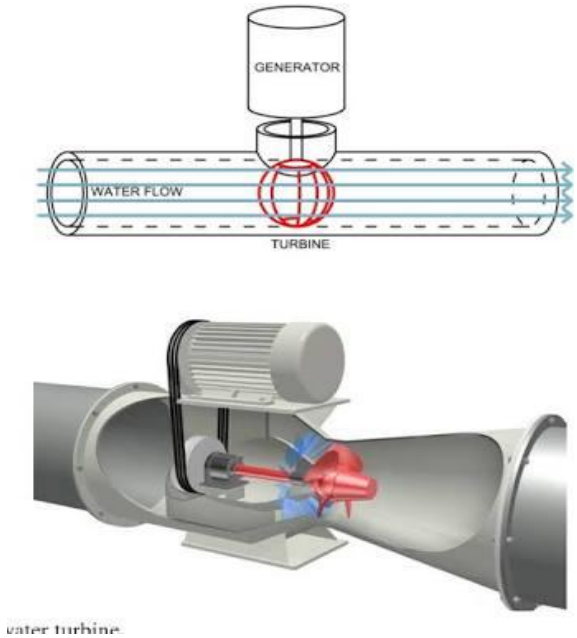


Fig. internal system

2. External system:- where the runner is contained in a secondary conduit that bypasses the main one. Most product available on the market, such as Sustainable energy and Monitoring System or Rentricity flow to wire, employ Francis design turbines with a rated power that goes from 3-10 KW to 5-30KW for smaller applications, whereas large scale application 30-350KW are covered by rentricity flow to wire systems.

5. TYPES OF HYDRO TURBINES

The turbine is the heart of hydro power system, where water power is converted into rotational force that drives the generator [15]. They are generally classified as impulse turbine and reaction turbine.

1. Impulse turbine:- These turbines are more efficient for site with high head and low flow. High head hydro generally provides the most cost effective projects, since the higher the head, the lesser the water required for a given amount of power, so smaller and hence less costly equipment is needed. The most common types of impulse turbines include the Pelton turbine and the Turgo turbine.

2. Reaction turbine:- Reaction turbines, which are highly efficient, depend on pressure rather than velocity to produce energy. They have better performance in sites with low head and high flow. Reaction turbines exploit the oncoming flow of water to generate hydrodynamic lift forces to propel the runner blades, and run fully immersed in water. Typical examples are Francis and Kaplan/propeller turbine.

6. HYDRO GENERATOR

Generators convert the mechanical (rotational) energy produced by the turbine to electrical energy. The principle of generator operation is quite simple: when a coil of wire is moved past a magnetic field, a voltage is induced in the wire.

1. Induction (Asynchronous generator):- Asynchronous generators are simple squirrel-cage induction motors with no possibility of voltage regulation and running at a speed directly related to system frequency. They draw their excitation current from the grid, absorbing reactive energy by their own magnetism. Adding a bank of capacitors can compensate for the absorbed reactive energy.

2. Synchronous generator:- Synchronous generator are equipped with a DC excitation system (rotating or static) associated with a voltage regulator, to provide voltage, frequency and phase angle control before the generator is connected to the grid and supply the reactive energy required by the power system when the generator is tied into the grid.

7. OUTPUT ENERGY

1.power generation of hydroelectric turbine:-
P = h x Q x g x η
Where, P = Power in watt
h = net head in meter
Q = Discharge in lit/sec
g = earths gravitational constant (9.8m/sec^2)
η = efficiency of component
This includes turbine efficiency, but also head loss.
Head loss is reduction in flow due to friction in pipes.
2.power in flowing water:-
P = ½ xρx A x V^2
Where, P = power in watt
A = c/s area
V = velocity in m/sec
ρ = density kg/m^3

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