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Effect of Turbine Materials and Water Impact on Efficiency of Hydro Power Plant

Patel Jainik Alkeshbhai[a],Patel Rushi[b], Patel Ridham [c],Solanki Mihir[d],Patel Soham[e] ,Patel Henish[f] ,Modi Keyur[g], Nikhil[h]

[a] *Patel Jainik Alkeshbhai,LDRP-ITR,Gandhinagar-382015,India*
[b] *Patel Rushi,LDRP-ITR,Gandhinagar-382015,India*
[c] *Patel Ridham,LDRP-ITR,Gandhinagar-382015,India*
[d] *Solanki Mihir,LDRP-ITR,Gandhinagar-382015,India*
[e] *Patel Soham[e],LDRP-ITR,Gandhinagar-382015,India*
[f] *Patel Henish,LDRP-ITR,Gandhinagar-382015,India*
[g] *Modi Keyur,LDRP-ITR,Gandhinagar-382015,India*
[h] *Nikhil,LDRP-ITR,Gandhinagar-382015,India*

A B S T R A C T

Hydro power plant is a natural source of energy from which electricity can be produced by natural way and one can reduce the amount of pollution that is generated by the combustion of coal in thermal power plant. In hydro power plant there are some basic requirements for the generation of electricity and that requirements are larger reservoir, possibility of running of water, storage pump and new technologies that are relevant with the vortex flow and gravitational effect that are concerned with the hydro power plant. Hydro power plant is installed as per the requirement of the local area. It may be large, small and micro power plant. It is observed that for local village with natural mountain area is capable to use the natural source with micro Hydro power plant as a substitution source, as a main source they are provided with conventional source of energy. Due to this idea , total pollution can be reduced and the coal consumption is also decreased up to the extent level.

Keywords: Hydro power plant, Requirement of quantity of water, flow of river water, Stream possibility ; gravitational vortex, turbines material.

1. Introduction.

Now a day's Hydro power plant is a really a best non conventional source of energy that may be useful to reduce the amount of pollution and it is advisable to use for the worldwide. But there are some issues for this type of Hydro power plant. In rural area there is disturbance the voltage, so continuous supply of electricity is not possible. Therefore electrical appliances may be damaged due to interrupted supply. This source of energy is efficient and can be utilised by the lower power consumption areas. As a secondary source of energy conventional power is available that can revert as Hydro power generation is less.

Total power generation from the world contains 25 % power generation from Hydro power plant. It is most efficient than other power plant. But issue is available for the natural wild life especially for the fishes. Number of fishes will change their place due to movement of large amount of water and wild life may get disturbed. But scientists have found one solution and that's the Vortex flow of water.

Hydropower is produced from the extracted energy of water moving from higher to lower locations. Now, it is the time to think alternative energy source. Therefore, renewable energy can be alternative to the fossil fuel. Renewable energy is clean, green, free, pollution less, endless energy source. The hybrid electrification system is the fastest growing electricity generation system in the world. The second fastest growing electricity option is the micro hydro power plant. Solar and water resource assessment clearly documents sustainable and highest resource potentials in the world.

* *Corresponding author*. Tel.: 98258 48387; fax: +0-000-000-0000.
E-mail address: neel_me@ldrp.ac.in

Nomenclature used in the paper

PV Channel	photovoltaic Channel
DC	Direct current
AC	Alternative current (%)
Pw	Measurement of power
He	head in meters m)
Q	flow in litres per second m s)
G	Gravitational force
Eth	Output energy as optimised data.
A =	Solar panel area [m^2]

2. Mechanism of Electricity generation inside Turbine section

In these plant blades of the turbine gets the difference of water head and converts the kinetic energy of water into rotational movement of the shaft. It is observed that the amount of input is not equal to amount of output, it is because of friction available between the different components. There are number of components that are in the rotational movement and they are continuously concern with the frictional forces. So bearings are introduced to reduce the frictional forces existing between the components. But bearing has its own life so sometime components gets in higher frictional forces that will affect the output of the plant. Therefore periodic inspection is required to maintain the efficiency of the plant.

The concept is based on the construction a big reservoir in the form of dam. The long way is used to transmit the power from the dam to the turbine blade is known as penstock. It is also measurable that the friction created in the penstock should be less. As this friction will reduce the power generation in the plant. Because the friction produced it will reduce the kinetic energy of water. So overall efficiency of the plant will be reduced. The shaft of the turbine is connected with the Generator and it will create electrical supply. As one should note that the rotational movement of the shaft is converted into the electrical supply with the help of generator.

On the other hand it should be noted that water flows on the turbine blade should have sufficient kinetic energy then it is possible to convert kinetic energy into rotational movement of the shaft. Pressure drop in the water will result in less power generation. So design of penstock should be in such a way that it does affect the pressure of water.

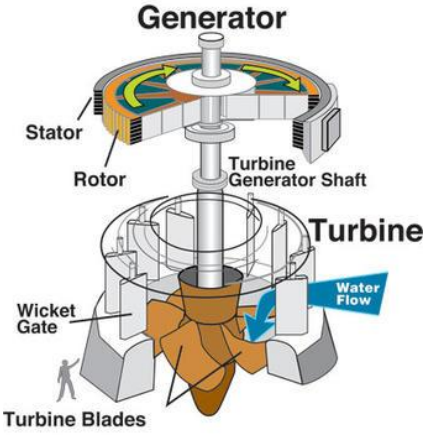

Figure 1 Hydro electric Turbine and Generator

Steel path is made and magnets are promoted to pass around the path so as per laws of Faradays electricity is produced. In that section poles are mounted about the rotor. Total motion is achieved by the flow of water that rotates the shaft and converts kinetic energy to rotational movement of the shaft. When rotors are in rotational movement they promote the conductor to pass through field, this conductor cuts the magnetic field and electricity is produced as per the Faradays law.

2.1 Impulse Turbines

Impulse turbines generally operate best with medium or high head (above 10 m). Penstock of impulse turbine will convert pressurized water into high-speed water jet

This turbine is used when medium or top head is available. Penstock is capable to convert the pressure of water into jet with high speed, so that flow of water with higher impact will strike on turbine blades and rotate that blades. . The pressure drop in the water flow occurs at the nozzle and the runner operates at atmospheric pressure. Examples of impulse turbines are Pelton wheel, Wheel using Turgo etc.

2.2 Reaction Turbines

The flow of water in the turbine is governed by the swirl pattern to create rotation of the shaft. Spiral casing mechanism is used to create the swirl inside the turbine. Reaction turbine is selected while the head is low. It is favourable to use this turbine when water head is under 9 meter. The flow is then redirected by the runner blades. The angular momentum creates the rotational movement and encourage runner to run. So water pressure will take a drop action at the stator portion. Ex, Francis ,propeller, Kaplan etc

3.Run on river Technology

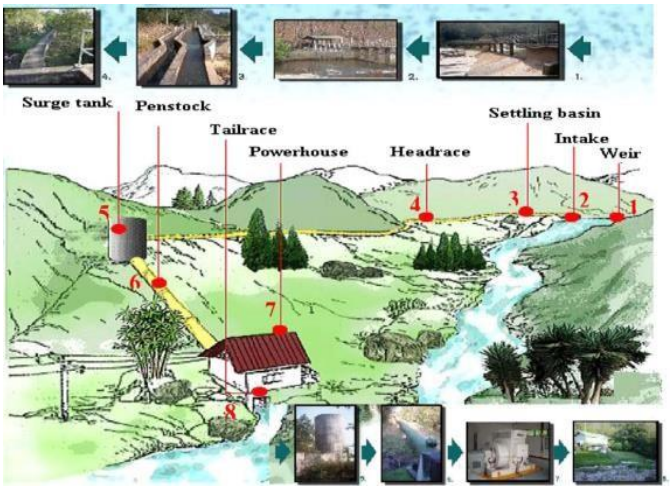

Figure 2 Components of a small run-of-river hydropower project

This type of plant concerns with geological area of the site, amount of water is also depend for the generation of water. Small and local area with less number of person can use this plant. Different parameters are required that are discussed and mentioned in the figure 2. Now a days the area which are near to the river can use this type of plant to generate electricity, because initial cost and time both are less for this power plant. Construction time and labour both can be reduced compared to the other plant. Is a prime time for the government also to promote river side hydroelectric power plant.

One can also refer pumped storage type water reservoir plant. In this plant, water is stored by the excess power generation of electricity and this water is stored at the higher altitude. Water is released as per the requirement of the plant.. At the time of peak load, power consumption is high and the water is released from the penstock to generate more electricity. If one have to pump the water and stores the water for future work, this indicates that this plant is used more amount of power and it is most favourable in that region for the power generation

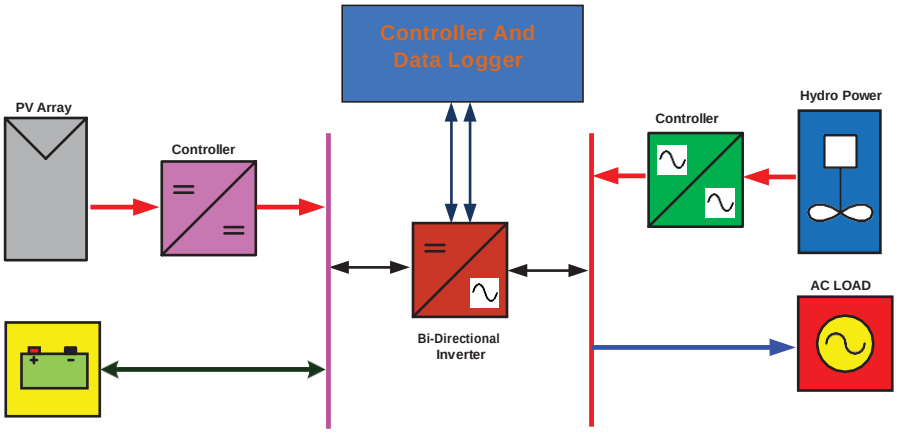

Figure 3 Hybrid system Technology

1. Photo voltaic module is used for conversation of radiation.
2. Control panel processor : It is used to maintain the voltage and current thought the system. It also stable the current and battery operation under high load.
3. Inverter is used to convert DC supply to AC supply.
4. Battery – It stores the current in the form of power and release the power whenever required.
5. Load - is electrical appliances that connected to solar PV system such as lights, radio, TV, computer.
6. Hybrid energy sources are hydro generator and PV system.

4. Conclusion

Steel and Aluminium turbine both are used for power generation in the hydropower plant. One should note that the weight of steel blades is higher compare to the Aluminium blades. After all rotational speed of the turbine depends on the weight of blades. Too bulky blades are not capable to rate the shaft. Therefore overall efficiency of the plant is reduced due to less rotation of the shaft. If developer refers for the too less weight blades then it is possibility to out the blades from the centre and also wear and tear of the blades can be done due to higher pressure of the water. For better efficiency of the plant one should optimise the weight of the blade as per requirement.

Hydro power plant is a golden chance to reduce overall pollution and generate power in natural way. Number of Hydro plants has issue of heat and that can be resolved by applying the reaction turbine. Reaction Turbine can handle the low head of water and gives the better efficiency.

Vortex flow is also new concept that promotes the better rotation of the shaft without disturbing the natural wild life of the river. Till gravitational effect of the vortex flow is analyzed and evaluated in proper way for better result.

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