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Design of Low Head Turbine for Rural Areas

Abhinandan Kumar[1] and O.P. Pandey[2]

[1,2]Birla Institute of Technology, Mesra, Ranchi
E-mail: 1kumarabhi.dtg@gmail.com, 2oppandey28@yahoo.com

Abstract—*Renewable energy is the hot demand of current energy scenario of India due to depletion of all type of fossil or conventional fuel.*
India has the maximum no. of rural areas which life depends on totally agriculture. But there is most harassing problem is low rate of electricity supply.so there should be need of power generation at the place of irrigation place. There is no any power supply at the place of irrigation, if it is available then its cost is too high. So the cost should be reduced by the help of generating power at rural level.
This paper of research based on the fulfillment of power at low at the place of irrigation , which can be able to increase the lifestyle and livelihood of rural peoples by producing abundant amount of electricity at the rural areas, by designing the low head turbine.

Keywords*: - low head, power, flow, energy.*

1. INTRODUCTION

Low head turbine technology has grown over a several long period. Decade per decade human being learnt that how to produce energy, using by water. By the help of considering graphical regions of India, it has lots of small streams where the falls and river are flowing with some heads. Falls and river can be very useful for power generation at rural scale.

This mode of power generation can also be helpful for low cost power generation, by the help of utilizing row Head Rivers and falls, which can be fulfill the demand of energy at small villages and small electric load with proper electricity supply.

Additional advantage of low head turbine are high efficiency with low speed current, less harmful for aquatic life cycle , whereas long blade profile turbine harassed and damage even kill the aquatic life cycle. The advantage is the cost with respect to high head turbine due to reducing component ie. penstock, training wall, etc.

2. MAJOR PARTS REQUIRED

a) Rotor - For fixing the blade into the turbine frame.

b) Shaft - For linking the rotary energy of runner to alternator.

c) Blade - For converting water power to mechanical power.

d) Alternator -Device for converting mechanical energy to electrical energy.

e) Bearing - purpose for easy revolution during movement of shaft.

Major components required and their uses:

- ROTOR: For fixing the blade into shaft.
- Shaft: For linking the rotator energy of runner to alternator.
- Blade: For converting water power mechanical power.
- Alternator: Device for converting mechanical energy into electrical energy.
- Bearing: Purpose for smoothness during rotation of shaft.

3. POWER CALCULATION

Head = (h) in meters

Discharge = Q (m^3/sec)

Speed = N (RPM)

Outer Diameter = $D_{1\ (mm)}$

Diameter of shaft = $D_{s\ (mm)}$

η_t= efficiency of turbine

ρ = Density of water

P = Power calculated which developed by the turbine.

Data assumed for maximum power output.

H = 3 m

Q = 0.08 m^3/sec

N = 80 – 200 RPM

D_1 = 310 mm

η_t = 80%

(a). $\eta_t = P / \rho g q h$

P = 627.2 watt

(b). Spacing between the blades (S_1)

$S_1 = K*D_1$

K = Roughness constant

$S_1 = 26.97$

(c). Blade spacing

$T = S_1 / \sin ß_1$

Taking $\sin ß_1 = 30^0$

T = 53.94 mm

(d) No. of Blades

$N = \pi * D/T$

N=18.

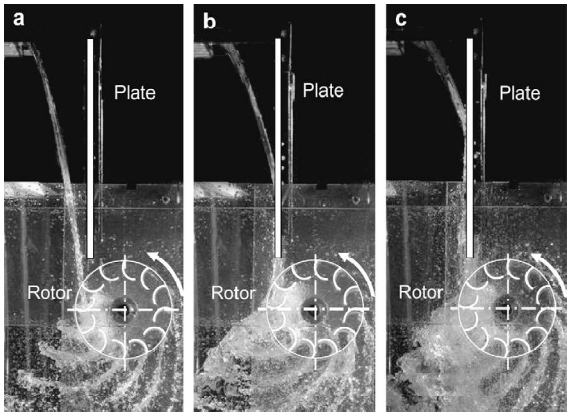

Figure 1 Water flow through runner and turbine

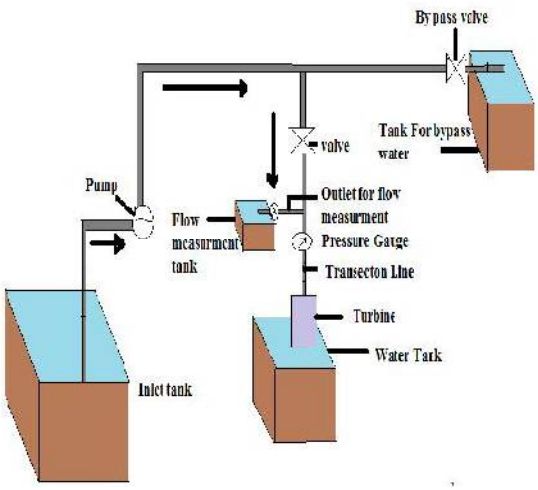

Figure 2 Test set up of low head turbine

4. ADVANTAGES

There are many advantages of low head turbine, for low cost power generation unit. Which are given below :

- No any additional current required to start the set up.
- Low head turbine has capability of better efficiency with long period continuity.
- No high head requirement for this turbine.
- Can be manufactured at local workshop.
- No any high lubrication required.
- It contains less movable parts.
- Low cost maintenance is available.
- Low range of head 1m to 20m and project upto 1MW is suitable.

5. FINDINGS

There is following major result of design of low head turbine:

- The major finding in design of low head turbine is no. of blades, which gives strength for maximum exertion of power from turbine.
- The rate of water flow constantly decrease from high to low, so it cannot be significant beneficed for power extraction.
- The low head flowing water has itself the capacity to develop torque, which helps to get suitable RPM.
- This turbine should be installed at the place where the abundant amount of water available with low head for getting higher values of power.
- This type of low head turbine could be manufactured at local workshop and no any heavy machinery required.
- The values of all parameters could be scaled upto larger as per requirement of energy.

6. CONCLUSION

Current research may be resulted by the statement that, this type of turbine could be implement at the place where, the availability of water is in abundant amount. The dimension of turbine could be varying as per use. These types of small, low head turbine are useful for rural areas, where low cost power generation is basic requirement.

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