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Design of Small Hydro Electric Power Plant at Cheeyappara

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Abstract - *Energy is one of the major inputs for the economic development of any country. The consumption of energy is increasing at a fast pace while available resources remain limited. India is endowed with a vast and viable hydro potential for cleaner power generation. The small hydro power plants have good potential to provide energy in the remote areas away from the grid. The state of Kerala has a large untapped potential for small hydro power generation.*

1. INTRODUCTION

Hydro-electric power is a form of renewable energy resource ,which comes from the following water. To generate electricity, water must be in motion. When the water is falling by the force of gravity, its potential energy converts into kinetic energy. This kinetic energy of the flowing water turns blades or vanes in a hydraulic turbines, the form of energy is changed to mechanical energy. The turbine turns the generator which then converts this mechanical energy into electrical energy and the system is called hydro-electric power station. The proposed project focuses on the development of a small hydro power plant (run-off- river type) at Cheeyappara.

1.1 Objectives

To develop the integration of the power plant in the ecological environment. Then to limit the costs compared to the other sources of energy by developing adapted technology. Improving the living conditions of the village people. Generating new opportunities for over all uplift. Providing light for study and promote education amongst children promising them better future. Creating environmental awareness among the people and help control available destruction of the forest. To open new markets related to marginal hydro potential and improve rehabilitation project. To develop the adequacy of power plant related to the electric power needs and available hydrology.

1.2 Scope

Hydro –electric energy is a renewable resource that is replenished by the environment over a relatively short period of time. Water is neither depleted nor its composition altered during the generation cycle. Small hydro projects(90%)efficient in utilisation of the resource than solar(15-20%), wind (35%) and other renewable energy sources.

2. METHODOLOGY

2.1 Survey and investigation

Reconnaissance survey was first conducted along the course of Chillithodu. This survey revealed that the stream upsteam of the weir site is passing through moderate slope to steep slope terrain. The contribution of a head upto 100m is due to this slope in the stream is the unique advantage for selecting this portion of the stream for hydro power generation.

2.2 Technological feasibility

The proposed small hydro electric project is located on the Chillithodu stream at a location where the catchment area is worked out as 1.065sq.km. Presently discharge data of the project site is not available but the data of near by gauge at Valara for the last 5 years is available. With that data discharge is computed.

2.3 Power potential

With the above discharge data the power that can be generated is found out using the formula is scribbled below by taking head as 92m, and a power energy curve is plotted . it is inferred from the power potential calculations that , 700kw plant can be installed. As per load forecast, 2 units of 350kw is proposed . for the power potential study MS Excel software is used. using the excel the maximum power generated is obtained and power and energy curve are plotted and depicted below.

Power (kW)= 9.81*Q*H

Where

Discharge, Q=0.3329cu.m/s & Head, H =92m

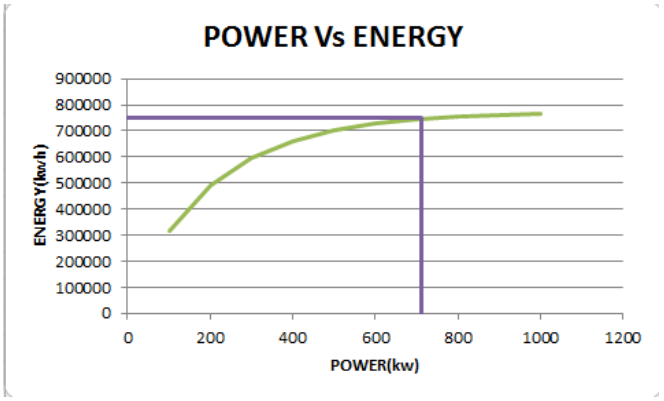

Chart -1: Power-energy curve

The diversion weir of Ogee type is proposed with overflow portion having a length of 4.82m.The maximum flood discharge is 8.81cu.m/sec.

The main components of the structures of the project are

1. Concrete weir of length 10m.The overflow portion is 5m long and non-overflow portion of 1.3m height and of 2.5m length to both banks.

2. A gated intake having 1m*1m is provided at the left bank, through the non-overflow portion.

3. The main water conductor system is a penstock pipe having a length of 100m and having a diameter of size of 50cm is proposed to carry water up to power house.

4. A power house having a size of 15*8*10m is to be provided.

2.4 Selection of Turbine

Considering the head, discharge and specific speed, cross flow turbine with horizontal shaft is suitable for the proposed power plant. The turbine consists of a cylindrical water wheel or runner with a horizontal shaft, composed of numerous blades (up to 37), arranged radially and tangentially. The blades edges are sharpened to reduce resistance to the flow of water. The ends of the blades are welded to disks to form a cage like a hamster cage and are sometimes called "squirrel cage turbines", instead of the bars, the turbine has the trough-shaped steel blades.

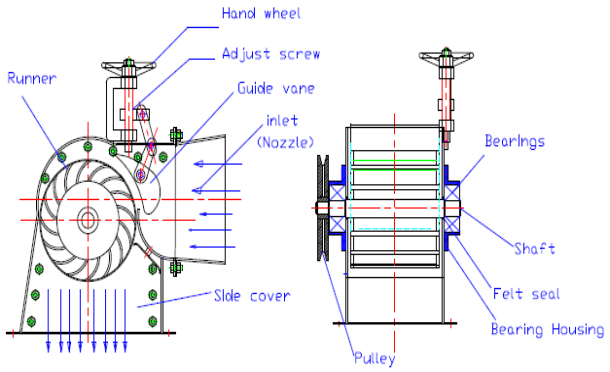

Fig -1: Cross flow turbine.

2.4 Cost Estimation and Financial Analysis

The total estimated cost of the project is 295lakhs and cost per kWh is Rs.5.17/unit and the sale rate is Rs.5.46/unit with a payback period of 10years.This is economically viable and better to implement at the earliest. There is no eviction of land.

3. CONCLUSIONS

Now a days other than hydro power plants, all other plants are over polluting. At the time of this global warming, this type of eco-friendly plants are need to be installed.

In Kerala there is a potential of 6000MW and only 2000MW is using. By implementing these type of small plants at appropriate places more energy can be produced by our own and no need of buying the electricity from other states. Since there is sufficient head and discharge throughout the year ,the project is feasible at the proposed site. After the financial analysis, we concluded that the project is also economically feasible.

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