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Design Planning of Micro-hydro Power Plant in Hink River

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Abstract

Micro-hydro power plant is a type of renewable power plant that is environment friendly, easy to be operated and low operation cost. Hink River is a river in Manokwari, Indonesia. The result of initial survey shows that the river has hydraulic potency about 29.5 kW. According to the result, a micro-hydro power plant has been planned to this location. The power plant will use 25.2 kW of the hydraulic potency based on flow rate 0.3 m^3/s and head height 8.6 m. Turbine for the power plant is cross flow turbine type T-14 D-300 and the turbine will be coupled with a 3 phases synchronous generator to produce electrical energy about 17.32 kW. The energy will be transferred via 3 phase distribution lines to some villages around the power plant in radius of 4 km. According to economic analysis, payback period of this power plant is about 17.32 years at benefit factor 1.94; therefore the power plant has feasibility to be built.

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Keywords: micro-hydro; power plant; Hink river;

1. Introduction

On contrary to electronic technology that is going to nano-technology, the usage of electrical energy starts to giga-watt. This contradiction also happens in Indonesia. The consumption of electrical energy is increasing by the

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time. PLN, as an Indonesian government company that handles electrical energy production, has responsibility to fulfill the essential power of the people in the country.

As an island in Indonesia that has biggest rain forest, Papua Island has many districts and villages separated by cities and forest. This condition gives limitation of accessibility and high investment of power lines. Therefore, not all area in Papua Island can be served by PLN and standalone power plant will be the best solution to solve the problem in Papua.

Hink River is a river in district Hink, Manokwari, Indonesia. Located in between of 1°13' 10.7" S and 133° 56' 05.5" E, the district can be reached from Manokwari local transportation. Hink River has good water supply to be used as micro-hydro power plant. This paper will explain the design planning of a micro-hydro power plant in Hink River and also its power lines distribution.

Nomenclature

PLN	Electrical Company of Indonesian government
S	South Latitude
E	East Longitude
Wh	Watt hour
kWh	Kilowatt hour
MW	Megawatt
km	Kilometre
m	Meter
m/s	Meter per second

2. Micro-hydro System

Hydropower is based on the principle that flowing and falling water has a certain amount of kinetic energy potential associated with it. Hydropower comes from converting the energy in flowing water, by means of a water wheel or a turbine, into useful mechanical energy. This energy can then be converted into electricity through means of an electric generator. The energy from the flowing/falling water can also be used directly by suitable machines to avoid the efficiency loses of the generator. Recently, small-scale hydropower systems receive a great deal of public interest as a promising, renewable source of electrical power for homes, farms, and remote communities. Micro-hydro systems refer specifically to systems generating power on the scale of 5 kW to 100 kW[1].

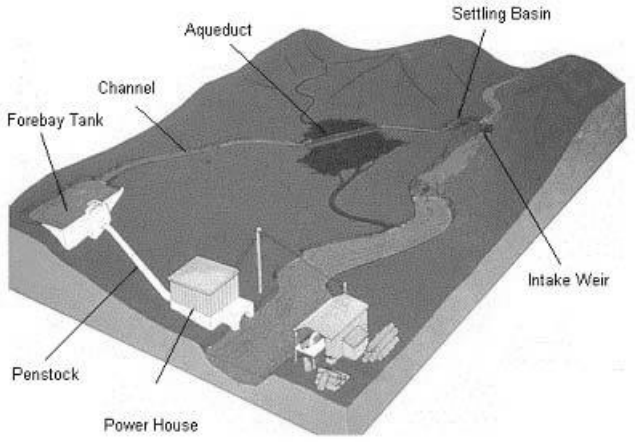

Fig. 1. General components of micro-hydro power plant[1]

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