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Feasibility Study of PLTMH In The Village Mongi'ilo District Bulango Ulu, Bone Bolango

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Abstract-Potential of the water resources in the district Bone Bolango cannot be optimally utilized by local communities particularly in rural areas. This is due to steps that must be done to manage the water power potential to micro hydro power plant (PLTMH) is still lacking, particularly how to Feasibility Study do it right and proper. Feasibility study of PLTMH is important to do step by step accuracy before the development work PLTMH implemented. Feasibility Study of PLTMH was conducted in river flows Bulango Mongi'ilo main village, District Bulango Ulu, Bone Bolango. Methodology that do is find the right location on the river flow Bulango at coordinates E 123008'57,3 "N00039'02,4" with a height of fall (head) 6 m and the potential water power generated by water debits through rational method of 1409.73 kW while the power potential of water by a float method through direct measurement of the flow of the river Bulango of 62.39 kW.

Keywords: Feasibility Study, PLTMH.

Introduction

Feasibility study is a study the identification of potential based on technical quantitative parameters to determine whether the potential locations meet the criteria viable requirements (standards) of technical aspects. Based on the requirements (standard) feasible, the PLTMH development plan to be built can be evaluated so that it can be stated in the technical aspects of the feasibility.

Based on preliminary studies, in Gorontalo Province, especially in the village of Mongi'ilo main, district Bulango Ulu, Bone Bolango, there is a large river that is Bulango river, which flows along the river there are settlements with a number of heads of families 209 KK that inhabit 165 homes. If exploited the potential of water resources for the development of PLTMH in this watershed, it can support the growth of economic development for local communities as well as help the government's policy in meeting national energy needs.

Based on the initial survey, needs to be done feasibility study which is an early stage that must be implemented in every PLTMH implementation. This activity is important to be implemented so that the planners of development, particularly the development of PLTMH and related decision makers can be helped in conducting the initial assessment and evaluate the feasibility of a potential location.

Literature Review

A. Feasibility Study

Feasibility study is a thorough and in-depth study of the technical aspects, socio-economic, environmental and institutional with some justification that the proposed sub-projects in accordance with the goals and objectives expected [1] Objectives to be achieved by the implementation of the feasibility study are:

a. Realization of development projects that meet the technical requirements of the service period in accordance with the technical age, the capacity of services in accordance with the plan;
b. Ensuring the sustainability of development in which technology are applied consider local content, financial capability and institutional managers and human resource capacity available;
c. The project, which will be built to provide a good impact on the surrounding environment, directly or indirectly, and short-term and long-term;
d. The project was built to improve the condition and/or quality of life, including poverty reduction efforts, encouraging local economic growth and the improvement of public services; and
e. The community are able to fund the operation and maintenance of the system are built directly or indirectly (tax from the public is used to build roads, drainage, etc.)

B. Potential Energy of Micro hydro

Basically a micro hydro power plant requires two important data, ie water debit and height of fall (head) to produce useful power. Landscapes occur (width, streams, contours of land and river) will determine the amount of electrical energy potential in that area. Calculations of power potential performed with based on net-head and mainstay debit. Potential of water power is obtained by the equation [1]

Potential of water power, $PG = 9{,}8\ Q\ H_g$ (1)

where: PG = Potential of water power (kW)
H_g = Head gross (m)
Q = the water flow rate (m^3/s)
9.8 = constant of gravitation.

C. Water Debit with Rational Method

Rational method is the old method that still used to determine the run off with a small area coverage. The basic assumption of this method are:

- Rainfall occurs with an intensity that remains within a certain period

- Run off directly reaches a maximum when the duration of the fixed intensity rainfall.
- Run off coefficient is considered fixed for the duration of rain.
- Area watershed does not change during the duration of the rain.

The general formula used to calculate the discharge (Q) with a rational formula [2] are:

$$Q = 0{,}278\ C\ I\ A \quad (2)$$

Where: Q : peak debit (m^2/s)
C : run off coefficient ≈ 0.30
I : intensity of rainfall (mm h)
A : watershed area (km^2) (catchment area)

D. Water Debit with Method Buoy

Debit water with a float method, the speed of water flow (m / s) is obtained by placing a float on water flow and record the time (t) the travel (seconds) and distance (d) (meters) float on the water flow in order to obtain the equation [3,4]:

$$Q = A \times V \quad (3)$$

where: Q = water debit (m^3/s)
A = cross-sectional area of the flow of water (m^2)
V = the water flow rate (m/second)

Research Methodology

This study begins with the initial assessment that provide information and data on river flow Bulango to whether there is to be used as an energy source generating PLTMH. After the determined the appropriate location, the next activity are a field survey to collect data in the form:

1. Information on general description of the topography of the location of PLTMH.
2. Information about the picture of the social life of local communities.
3. Analyze the potential of water resources for the PLTMH generated

Result

Feasibility Study PLTMH begins with determining the location of development and general description of the topography of the PLTMH, the picture of the social life of local communities, analyzing water debit by rational methods, direct measurement of water debit in a field with a float method and then calculated the potential of water resources can be generated by the flow river Bulango

i. Overview of PLTMH Topography

Location of plan of the design of the PLTMH in the village Mongi'ilo main which is the Bulango Ulu district center traversed the river flows Bulango with coordinates E $123^0 08' 57{,}3''$ N $00^0 39' 02{,}4''$ and a height of fall (head) 6 m. The condition of road that connects the district Bulango Ulu with a capital city of Bone Bolango with paved roads and roads stone that can be reached within ± 60 minutes using two-wheeled vehicles, but if it starts to get into districts Bulango Ulu must consider the type of vehicle used and the weather in while traveling due to the condition of the road is still dirt road barely passable by vehicles if it rains with landslides constraints that always occur in road makes sections of this road can not always be traversed by four-wheeled vehicles. Details of construction design survey locations of PLTMH as shown in Figure 1.

Fig 1. The location of the PLTMH in the village of Main Mongi'ilo

ii. Overview of social Life of Local Community

Mongi'ilo village consisting of four hamlets namely: Dusun 1 Loji, Dusun 2 Pangi, Dusun 3 Bongo and Dusun 4 Pohumbuo, where a population of 811 people with a number of heads of families 209 KK and the number of houses as many as 165 houses with houses clustered distribution. In general, people's livelihoods are farmers with an average monthly income are 500.000 rupiahs. A community organization in this village is BPD and farmer groups. Furthermore, the data of village infrastructure such as public facilities: 1 PAUD, 1 kindergarten, 1 primary school, 1 junior high school, 3 mosques, 1 health center, 1 Pustu, 1 village offices and one district office building.

Based on the survey results, the demand for electricity for public facilities is 9.9 kW and 33 kW household, so that the total electrical energy required is 42.9 kW. The purchasing power of the community for the the energy produced by an average community of 30,000 rupiahs / month for the each household.

iii. Potential of Water Resources that can be generated
a.Potential of Water Power based Rational Method

Water debit to the location of river flow Bulango surveyed would happen tendency to increase in size if the rainy season where the widespread use of watersheds through the catchment area (Figure 2) obtained water debit of the river flow Bulango through equation 2. amounted to 23.975 m^3/s.

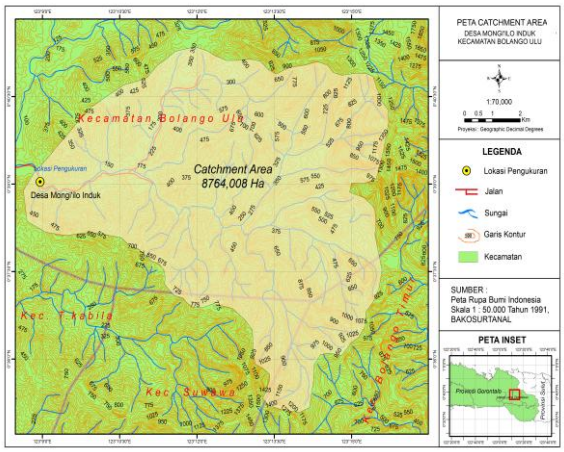

Fig 2. The catchment area of the river flow Bulango

Based on the equation 1 and the data altitude fall (head) were obtained through direct measurements obtained by potential of water power based on water debit with rational method of 1409.73 kW.

b.Potential of Water Power based method Buoy

Direct measurements of water debit was conducted in May 2015 using a float method in which the data obtained include water flow rate of 0.294 m / sec and the flow cross-sectional area of 3.61 m2 in order to obtain water discharge of 1,061 m^3 / s.

Based on the equation 1 in above, the data altitude fall (head) through direct measurement obtained water power potential based on direct measurement of 62.39 kW.

Conclusion

1. Location plan of the design of the PLTMH in the main Mongi'ilo village is located on the watershed Bulango with coordinates E 123008'57,3 "N00039'02,4" with a height of fall (head) 6 m.
2. In general, community livelihoods around the watershed Bulango are farmers with an average monthly income of household heads Rp.500.000, -. If the terms of the characteristics of the electrical load usage by the public, in general, electricity is used for household needs. Besides, it also, electricity used to public facilities for example offices, mosques, schools and health centers. The ability of purchasing power for the the electrical energy generated are 30,000 rupiahs / month.
3. Potential of water power by debit of water through rational methods of 1409.73 kW while the potential of water power by a float method through direct measurement of the flow of the river Bulango at 62.39 kW.

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