Problem identification of micro hydro power plant program in East Java Province

S H Kusuma¹2, B U Aulia¹2, Sardjito¹2 and N Farikha¹2
¹ Department of Urban and Regional Planning
² Institut Teknologi Sepuluh Nopember, Surabaya 60111, Indonesia
Email: surya.uya39@gmail.com

Abstract. The availability of electricity is an important necessity in life to support the economic and social activities of the community such as industry, agriculture, household and trade. Without sufficient access to electricity, the goals of community economic and social development will not be achieved. One of the East Java Provincial Government's efforts to meet its electricity needs is to build renewable energy sources such as micro-hydro power plants (or PLTMH in Indonesian) which are planned to be developed in 21 regencies or cities. However, until now the development of the PLTMH has not been implemented perfectly. Therefore, this research was conducted to determine the extent of the progress of the PLTMH development, factors that caused problems in the development of PLTMH, and recommendations for solving problems such as what could be formulated. The method used in this study is through qualitative descriptive analysis with in-depth interview and using root cause analysis. Based on the results of this study it is known that the main thing that caused problems in the construction of the PLTMH was the existence of constraints in planning and financing. The recommendation for solving the problems obtained from this study is the need for technical planning and budgeting with financing schemes that can be sourced from the government or the private sector.

Keyword: electricity, micro hydro power plant (PLTMH), root cause

1. Introduction
Electrical energy is one of the main needs that can sustain economic and social activities of the community. The electricity needs of the people in Indonesia are increasing every year due to an increase in population and economic activities. As a state-owned enterprise that takes care of all aspects of electricity in Indonesia, the National Electricity Company, or PLN, has not been able to meet 100% of the electricity needs of the community. It is known that there are several regions that cannot be reached by the electricity supply from PLN due to the geographical conditions of the region. One solution in the supply of electrical energy, especially in remote areas, is to utilize the potential of natural resources as a renewable energy source which can be in the form of utilizing water flow as a micro-hydro power plant (or called PLTMH in Indonesian).

PLTMH itself is a system of small-scale power generation that uses hydropower as its driving force such as irrigation canals, rivers or natural waterfalls by utilizing water levels and discharge [1]. PLTMH is often referred to as a small-sized generator capable of producing electricity capacity of up to 100kW, besides that PLTMH is one of the renewable energy sources and is worthy of being called clean energy.
because it is environmentally friendly [2]. The construction of PLTMH continues to grow because it has a simple structure with high usage applications [3]. In East Java Province, there are plans for PLTH development in 21 districts / cities as stipulated in the 2011-2031 Regional Spatial Plan (RTRW) of East Java Province. However, until now the achievement of the PLTMH development has not been 100%, so there are still some regions, especially remote areas, which are not yet covered by electricity. This research was conducted to find out the extent of the achievement of MHP development in East Java Province, inventory problems in its development, and structure alternative solutions to these problems. With the knowledge of the problem of the development of the PLTMH, it is expected that the formulation of a handling strategy can be done more effectively and efficiently.

2. Research methods
The method used in this study is a qualitative method with an inductive approach. This method is used in order to produce a final formulation in a systematic, factual, and accurate manner regarding the characteristics of the object of research that will be used or better known as a decision-making approach from specifically to general [4]. The data analysis techniques used are qualitative descriptive analysis and root cause analysis.

Data collection itself is carried out by secondary surveys and structured interviews for approximately 2 (two) months in September-October 2017 to stakeholders in the energy network system in East Java Province. Data collection activities were carried out with the output of the achievement of the PLTMH development program in East Java Province as well as the problems faced in its development.

Meanwhile, in identifying the problems of PLTMH development in East Java Province, it was carried out using problem tree analysis. This analysis is used to determine the problems that occur in the realization of the program in a structured manner through a causal relationship [5]. It is expected that the use of this analysis technique can be known in detail the root causes of the problem of PLTMH development in East Java so that solutions that are right on target can be concluded.

3. Result
The plans for the development of PLTMH in East Java Province as stated in the spatial plans named Rencana Tata Ruang Wilayah Provinsi Jawa Timur 2011-2031 are spread across 21 regencies and cities including Nganjuk, Bojonegoro, Banyuwangi, Situbondo, Bondowoso, Jember, Lumajang, Malang, Probolinggo, Blitar, Tulungagung, Trenggalek, Pacitan, Madiun, Magetan, Pasuruan, Mojokerto, Ponorogo, Jombang, Gresik, and City of Batu.

Broadly speaking, based on the results of the in-depth interview, the researchers divided the achievement of the PLTMH development program in East Java Province over 3 categories that namely already implemented, process, and not yet implemented with the following explanation:

- A category has been implemented if there has been an implementation of PLTMH development in the district / city area.
- Process category if there are already detailed plans for the construction of PLTMH
- Categories have not been implemented if the planning and development stages have not been implemented

The PLTMH that has been built in East Java Province is only found in 9 regency/cities as seen in the data in Table 1.
### Table 1. PLTMH data in East Java Province in 2017

| Num | Regency/Cities | District | Sub District | Power (KW) | Number of families in the territory | Condition       |
|-----|----------------|----------|--------------|------------|--------------------------------------|-----------------|
| 1   | Lumajang       | Senduro  | Burno        | 16         | 86                                   | Not operating   |
|     |                |          | Tempursari   | 25         | 80                                   | Not operating   |
|     |                |          | Kali Uling   |            |                                      |                 |
| 2   | Pacitan        | Nawangan | Tokawi      | 20         | 90                                   | Not operating   |
|     |                |          |              |            |                                      |                 |
| 3   | Nganjuk        | Sawahan  | Bareng       | 12         | 56                                   | Operate         |
| 4   | Probolinggo    | Krucil   | Kalinan      | 40         | 350                                  | Not operating   |
|     |                |          | Krucil       | 34         | 58                                   | Operate         |
|     |                |          | Watupanjang  |            |                                      |                 |
|     |                |          | Krucil       | 40         | 550                                  | Operate         |
|     |                |          | Andung Biru  | 2,5        | 20                                   | Not operating   |
|     |                |          |              |            |                                      |                 |
| 5   | Madiun         | Kare     | Kare         | 62         | 72                                   | Operate         |
| 6   | Trenggalek     | Munjungan | Besuki      | 22         | 80                                   | Not operating   |
| 7   | Banyuwangi     | Songgon  | Sumber Arum  | 44         | 180                                  | Operate         |
| 8   | Situbondo      | Sumbermalang | Sumberargo | 15         | 170                                  | Operate         |
| 9   | Malang         | Sampit   | Sumber Suko  | 3          | 13                                   | Operate         |

*Source: Dinas Energi dan Sumber Daya Mineral Provinsi Jawa Timur, 2017*

Based on the table above, it is known that from PLTMH that has been built in 9 Regency, there are still PLTMHs that are currently not operating, namely in Lumajang Regency, Pacitan Regency, Probolinggo Regency, and Trenggalek Regency. Apart from the PLTMH that has been built, currently the Blitar Regency Government is proposing the establishment of a PLTMH to the center due to limited district funds. For other districts / cities there has been no development of PLTMH as planned by East Java Province. An illustration of the achievement of the PLTMH development program in East Java Province can be seen in Figure 1.
The next step that was carried out by the researcher was to identify the factors that caused the achievement of the PLTMH development program in East Java Province. Based on the in-depth interview, it is known that there are several obstacles that lead to unsustainable operation and the absence of PLTMH development which includes:

- The flow of electricity from PLN to remote villages in Lumajang Regency has been entered so that the PLTMH that has been built has not been reoperated. People prefer to use electricity from PLN because it is easier, no extra care is needed, and the power produced is stable.
- There is damage to turbines in PLTMH in Pacitan, Probolinggo and Trenggalek Regencies. As is known, PLTMH in this area was built from Provincial grants and private grants. This grant is only in the form of funds for the procurement of PLMTH and there are no funds for maintenance. So that local people are encouraged to take care of this PLMTH with limited knowledge and funds. This is what causes the PLTMH to be abandoned.
- Limited funding for PLTMH planning and construction in other locations.
- In some locations there are obstacles related to land acquisition due to the source of water flow for the PLTMH located in the forest area.
- There are still many PLTMH development plans that have not been accommodated in spatial planning books in each regency/city.

The problem factors presented above will be stated in a root cause analysis as follows:
In order to resolving the problems of PLTMH development, researchers formulated recommendations as follows:

- The need for financing schemes originating from the Provincial Government, Regency / City Government, and funding assistance from private parties in funding PLTMH planning and development in East Java Province
- Funding in the operation and maintenance of PLTMH can be done by conducting electricity sale and purchase transactions from beneficiaries of PLTMH which in this case are the community. This is in accordance with what is stated in the Minister of Energy and Mineral Resources Regulation Number 39 of 2017.
- For PLTMH planning which is located in a forest area, it can use the scheme of forest use loan permit as stated in the Republic of Indonesia Presidential Regulation Number 4 of 2016.
4. Conclusion
The main obstacle in the development of PLTMH in East Java Province lies in the aspect of planning and financing. The recommendation for solving the problems obtained from this study is the need for detailed technical planning and the need for budgeting with financing schemes that can be sourced from government or private.

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