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Identification of Power Plant Operation and Loading Problems at Ngalau Baribuik Micro Hydro, Padang

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A B S T R A C T

Ngalau Baribuik Micro-hydro Power Plant (MHP) is located in Bukit Karang Putih, Lubuk Kilangan, Padang City. This MHP with a capacity of 10 kW belongs to the local community which has been operating since 2012. This MHP was built with the aim of meeting the electricity needs of the people of Nagari Ngalau Baribuik who are not covered by electricity from PLN. Based on the information obtained from the MHP management, until now the operating profile and loading pattern of the MHP which is managed independently by the community has not been identified. To overcome this problem, a community service activity was carried out to minimize the failure of the MHP in meeting the needs of the community and the worst possibility was that there was damage to the generator. The target of this activity is the people of Nagari Ngalau Baribuik who are consumers of the MHP. Through this community service activity, the people who are consumers of the Nagari Ngalau Baribuik MHP have understood the importance of saving energy to maintain the sustainability of the MHP. People also know tips for saving energy that they can apply in their daily lives. Efforts to transfer knowledge to the community have been successfully carried out through this activity.

INTRODUCTION

Indonesia's attention to renewable energy began in the last few decades, especially in the general policy in the energy sector called the General Energy Sector in 1989 and has been reviewed in the National Energy Policy 2003–2020 [1], which focuses on energy efficiency, energy conservation, energy, and environmental diversification. Regarding energy diversification, the government through the Ministry of Energy and Mineral Resources encourages the community to empower environmentally friendly renewable energy. Indonesia's renewable energy target is 23% of the total supply by 2025 [2]. The government has also issued a regulation on the provision of small-scale energy sources in rural or remote areas called the Decree of the Minister of Energy and Mineral Resources concerning Distributed Small-Scale Power Plants. The focus of this regulation is to empower local communities and encourage the development of local energy sources, namely renewable energy [3]. MHP is the best choice of renewable energy technology if a location has hydropower potential [4], [5]. One of the MHP that has been built by the Government is the MHP Ngalau Baribuik.

Ngalau Baribuik Micro-hydro Power Plant (MHP) is located in Bukit Karang Putih, Lubuk Kilangan, Padang City. This MHP with a capacity of 10 kW belongs to the local community which has been operating since 2012 [6]. This MHP was built with the aim of meeting the electricity needs of the people of Nagari Ngalau Baribuik who are not covered by electricity from PLN. Based on the information obtained from the MHP management, until now the operating profile and loading pattern of the MHP which is managed independently by the community has not been identified. In addition, considering that this MHP has been operating for quite a long time and people's energy consumption is increasing every year, it is feared that it will no longer be able to optimally meet the needs of the community.

To overcome this problem, a community service activity was carried out to minimize the failure of the MHP in meeting the needs of the community and the worst possibility was that there was damage to the generator. The target of this activity is the people of Nagari Ngalau Baribuik who are consumers of the MHP. This activity will be carried out by evaluating the MHP system through field measurements, and analyzing the operating profile and loading pattern of MHP. After identifying potential problems and developing a MHP sustainability scheme, counseling was also carried out on the importance of protecting MHP from damage, tips for saving energy and providing assistance in the form of energy-saving lamps. For the sustainability of this activity, identification of the potential for the development of energy utilization that can improve people's lives was carried out using the discussion method.

PARTNER'S DESCRIPTION

The Nagari Ngalau Baribuik Micro-hydro Power Plant (MHP) is approximately 2 kilometers from the PT Semen Padang Mine, Karang Putih, Lubuk Kilangan, Padang City. The trip to the Power House location can only be reached using two-wheeled vehicles. This MHP is managed directly by Mr. Syafril who is also the head of the local RT. Mr. Syafril is in charge of carrying out periodic maintenance of the swimming pool, turbine, generator, and other equipment. In addition, he also manages the finances for the maintenance of the MHP which is a fee from consumers of Rp. 40.000,00 per month.



Figure 1. Ngalau Baribuik MHP Turbine

Ngalau Baribuik MHP serves 24 households located around the MHP. Almost all of the electrical energy produced by the Nagari Ngalau Baribuik MHP is used by the community for household needs such as lighting, cooking, turning on the television, and other electronic equipment needs. There are only a few consumers who use electrical energy for other productive needs such as small-scale chicken farming. This is due to the limited power installed in each house, which is 450 VA per house. This is done with the aim of avoiding damage to the generator due to overload and distribution of power installed on all consumers.

COMMUNITY SERVICE ACTIVITY

To achieve the desired target, the steps or methodologies offered are:

- a) Conducting a field visit to the location of the Ngalau Baribuik MHP. The field visit aims to observe the condition of the MHP directly and conduct discussions with the management. In addition, at this stage, it is hoped that a good relationship will be established with Mr. Syafril and his family.
- b) Initial observation and measurement. From these measurements, data related to the operating profile and loading of the Ngalau SiBaribuik MHP will be obtained. At this stage it can also be observed how the quality of the power generated by the MHP Nagari Ngalau Baribuik can be observed.
- c) Compilation and analysis of the operating and loading profile of the Ngalau SiBaribuik MHP. The purpose of this stage is to map the operating and loading patterns of the Nagari Ngalau Baribuik MHP.
- d) Identification of potential problems and preparation of the Ngalau SiBaribuik MHP sustainability scheme. At this stage, appropriate actions can be formulated for the problems that have been identified.
- e) Energy-saving counseling and delivery of energy-saving equipment to the community and MHP managers. This activity is a real solution that can be accepted directly by the manager and the community who are consumers of the Nagari Ngalau Baribuik MHP.

Community service activity was held on 23 September and 31 October 2021. On day 1, the activity focused on observing the MHP, load measurement, and problem identification through discussion with MHP operator. On day 2, the activity began with sharing about the importance of maintaining the Nagari Ngalau Baribuik MHP as an asset for the local community, then continued with energy-saving counseling. The public is expected to understand the tips for saving energy. In addition, the activity was also filled with discussions about complaints and obstacles faced by the community. In closing the activity, the community service team provided assistance in the form of energy-saving lamps that can be used directly by the community.



Figure 2. Load Measurement of Ngalau Baribuik MHP

RESULTS AND DISCUSSION

In accordance with the planned methodology, this community service activity is carried out in the form of presentations and discussions. This activity began with a presentation and then continued with a discussion with the people who were present. This activity was attended by 22 people. The enthusiasm of the participants in this activity looks quite good, this is shown by the activeness of the participants during the discussion. In addition, from the discussion, it can be seen that almost all of the participants have understood the material presented.

The indicators of the level of success that are expected to be achieved in this activity are:

- i. The community is expected to understand the importance of saving energy so that it can maintain the sustainability of the MHP in the long term
- ii. This presentation and discussion can help raise public awareness of the importance of maintaining the MHP Nagari Ngalau Baribuik as a common asset.
- iii. The provision of assistance in the form of energy-saving lamps can have an impact on the consumption of electrical energy by the community, so that electrical energy that is not consumed can be used for more productive economic activities.

The output of this presentation and discussion is expected that the community can apply energy-saving behavior in their daily lives and have an awareness of the importance of maintaining the MHP Nagari Ngalau Baribuik as a common property. The provision of assistance in the form of energy-saving lamps is also expected to have an impact on the consumption of electrical energy by the community. In addition, with the implementation of energy-saving behavior, people can also utilize existing energy for more productive economic activities to improve their standard of living.



Figure 3. Load Profile of Ngalau Baribuik MHP



Figure 4. Discussion with Community at Ngalau Baribuik



Figure 5. Delivery of Energy Saving Lamp to the Community

CONCLUSIONS

Through this community service activity, the people who are consumers of the Nagari Ngalau Baribuik MHP have understood the importance of saving energy to maintain the sustainability of the MHP. People also know tips for saving energy that they can apply in their daily lives. Efforts to transfer knowledge to the community have been successfully carried out through this activity. In addition, the provision of assistance in the form of energy-saving lamps is also expected to have an impact on the consumption of electrical energy by the community.

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