FEASIBILITY OF 12 W SOLAR POWER PLANT FOR STREET LIGHTING IN RURAL AREA

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ABSTRACT

Solar power plants are a suitable alternative for solving the energy crisis in rural areas in Indonesia because it has abundant solar energy potential. South Sumatra is the second area with the largest solar energy potential in Indonesia, after East Nusa Tenggara. The Dabuk Rejo village is not all area covered by street lighting facilities in South Sumatra. Hence, the solar power plant is suitable for solving the crisis energy problem in Dabuk Rejo because it is cheap, easy to maintain, and easy to operate. Based on the observation field, the solar power plant positively impacts the Dabuk Rejo community because the activity time increases due to lighting.

Keywords: Solar Energy, Solar Power Plant, Rural Area, Electrification, Street Lighting.

1 INTRODUCTION

Until now, Indonesia has many areas categorized as rural areas, where there are 433 villages that do not have access to the national electricity network and 31 thousand villages do not have street lighting [1–3]. Rural areas are districts whose regions and communities are less developed than other regions on a national scale due to a lack of road, electricity, and sanitation facilities (infrastructure) and others, thereby hampering regional growth or development[4].

Electrification effectively improves the quality of life and economic growth of rural communities [5]. The availability of electricity in rural areas can encourage increased economic productivity, education, and health facilities, and it is undeniable that new jobs will be formed [6]. Constraints that are often faced in providing electricity to the regions are the lack of raw materials (fossil energy), losses due to long distribution (grid), and the less than-optimal exploitation of renewable energy due to high investment costs [7].

Independent power plants based on renewable energy are the right solution to overcome the energy crisis in rural areas [8–10]. In line with Presidential Regulation Number 5 of 2006 concerning National Energy Policy (KEN) which is now changed to the General National Energy Plan (RUEN) (2017) which states that in 2025 the composition of national energy required is 23% for new renewable energy, 25% for petroleum, 22% for natural gas and 30% for coal [11].

Based on the results of the study, an effective independent power plant for night lighting in rural areas in Indonesia is solar photovoltaic (PV) [12] because it does not have a complicated construction and can be applied throughout Indonesia [10]. In addition, Indonesia has solar energy potential of 4.8 kWh/m^2 or equivalent to 208 GW, but only 78.5 MW (0.04%) has been utilized [13]. Then, South Sumatra is an area in Indonesia that has the potential for solar energy of 17.2 GW (8.3%), where South Sumatra is the area that has the second highest solar energy potential in Indonesia [14]. Thus, the solar solar independent power plant is a suitable generator to be operated in Indonesia, especially in South Sumatra. Thus, this study aim to investigate the feasibility solar PV as power plant for street lighting in rural areas.

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2 CASE STUDY

The target audience in this activity is the community of Dabuk Rejo village, Lempuing sub-district, Ogan Komering Ilir district. This area was chosen because it has the potential for solar energy. The Dabuk Rejo village has adequate natural resources not only to meet the domestic needs of the village but also to obtain significant economic value from the commodities recommended for cultivation. The plantation and agricultural sectors (oil palm plantations, rubber, and agriculture) are the main commodities of the village. However, it turns out that this area can be said to be in an electric energy crisis because street lighting is only on the village's main road; this causes this area to be less active at night. On average, the people of Dabuk Rejo village have a high school education level with a family of 125 (287 people). After graduating high school, the average teenager will immediately be asked by their parents to continue their business, namely rice farming or agriculture of palm or rubber plantations.

Based on interviews with the pioneers or service partners of the Dabuk Rejo Village Head, who will be the executor of activities in the service area, the Dabuk Rejo community is not too familiar with solar PV; this can be seen even though there are no street lights and have the potential for solar energy, but there is no lighting around the mosque; the mosque is a center for places of worship and village activities (Figure 1). It is hoped that this activity can be a stimulus so that people can exploit the potential of solar energy so that there are no more dark village roads. In addition, it is hoped that this activity will increase public awareness of village facilities, so that night activities are no longer hampered.

3 TROUBLESHOOTING METHOD

The problem-solving framework of this activity is divided into four parts: identification of problems, solutions, proposals, and methods or approaches used in this activity. Problem identification formulates that Dabuk Rejo village is experiencing an electrical energy crisis. According to RUEN (2017), the right alternative is an independent power plant based on new and renewable energy. From the study results, the right solution is PLTS because the Dabuk Rejo area has promising solar potential. For the implemented PLTS to have long sustainability, the Dabuk Rejo village community (groups of farmers and fish breeders, youth organizations, and Irma) are involved in the manufacturing process and its implementation. This community involvement adopts a participatory communication approach for social change (see Method of Service Implementation); for damage or problems to occur, the Dabuk Rejo community can independently repair them. Furthermore, people care for and maintain the turbine for a high lifetime. For clarity, the problem-solving framework can be seen in Figure 1.

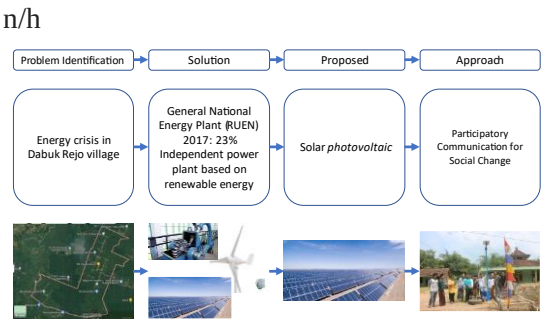

Figure 1 Schematic of problem-solving framework

4 RESULTS AND DISCUSSION

The preparation of activities includes an analysis of the need for tools and materials to manufacture PV mini-grid. Next, after the tools and materials are identified, pile manufacturing begins. After the poles are manufactured, then the poles are planted. Figure 2 shows the poles that are placed at the location to be implemented. After the pole is installed, the next step is the implementation of PLTS.

Based on the test results, the solar power plant light sensor works well where the lights turn on automatically at night and go out in the morning. From the test results, the lamp can illuminate village roads for up to 10 hours with an average power of 12 VA. Figure 3 is documentation of PLTS performance at night conditions.

Based on the RUEN, the relationship between this activity and the central government program can be said to be synchronous, where the exploitation of solar energy is the right solution as a source of electricity either in urban areas or in remote or underdeveloped areas.

Figure 2 Solar power plant pole installation documentation in Dabuk Rejo village

Downstream research on PLTS continues to be carried out in Indonesia as the main energy source of street lighting; this is because many areas are still experiencing an electrical energy crisis. Warjito et al. (2019) [15] recommend off-grid power plants from EBT as the right solution to overcome the electrical energy crisis; this initiates this service activity where there is another impact in the implementation of PLTS in disadvantaged areas, namely making the area a technology education tourism village.

Figure 3 Sensor component testing documentation

5 CONCLUSION

Efforts to alleviate the problem of electrical energy that occurred in the village of Dabuk Rejo, kab. Ogan Komering Ilir combines renewable energy with PLTS and development communication theory. In addition to generating electricity through optimizing solar energy in the area using solar power plants, this community service also has another goal, namely to make Dabuk Rejo village an energy-independent village and a pilot village for villages around Ogan Komering Ilir district through a mass communication approach. In addition, it is also hoped that the community will take better care of the available natural resources so that solar power plant has a high value of sustainability and nature is maintained. Furthermore, the Dabuk Rejo village community can be used as a pilot area for other areas that have abundant natural potential and have not been utilized optimally because this community service conceptualizes renewable energy with educational tours so that the installed turbines also become tourist attractions.

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