


An Application of Photovoltaic Appropriate Technology as Garden Lighting in The Tourist Area of Gangga Murmas Tree House North Lombok District

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Abstract

Park lighting in the Gangga Murmas Tree House Tourism Area, which is more precisely Gangga Hamlet, Genggelang Village, Gangga District, North Lombok Regency, is not sufficient. Without park lighting, tourist locations will resemble a dead zone at night and experience a decline in visitors. Therefore, the Community Service Team of the Madura State Islamic Institute through the 3T area community empowerment service provides a solution to illuminating the Gangga Murmas Tree House Tourism Area by utilizing new renewable energy Photovoltaic monocrystalline type to provide lighting at night. The installation of landscape lighting using polycrystalline technology is determined by the outcomes of location surveys and observations. The implementation carried out in the Gangga Murmas Tree House Tourism Area was carried out in several stages, namely: observation, preparation of garden light design, training and maintenance, performance testing, and tool evaluation. After the project was finished in two months, a solar power plant with a 2800Wh capacity that can power 40 lamps with a combined 120Watt capacity was created. The placement of garden lights to improve the tourism sector also received a positive response from the community and the manager of the Gangga Murmas Tree House Tourism Area.

Keywords: Photovoltaic Appropriate Technology, Garden Lighting

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INTRODUCTION

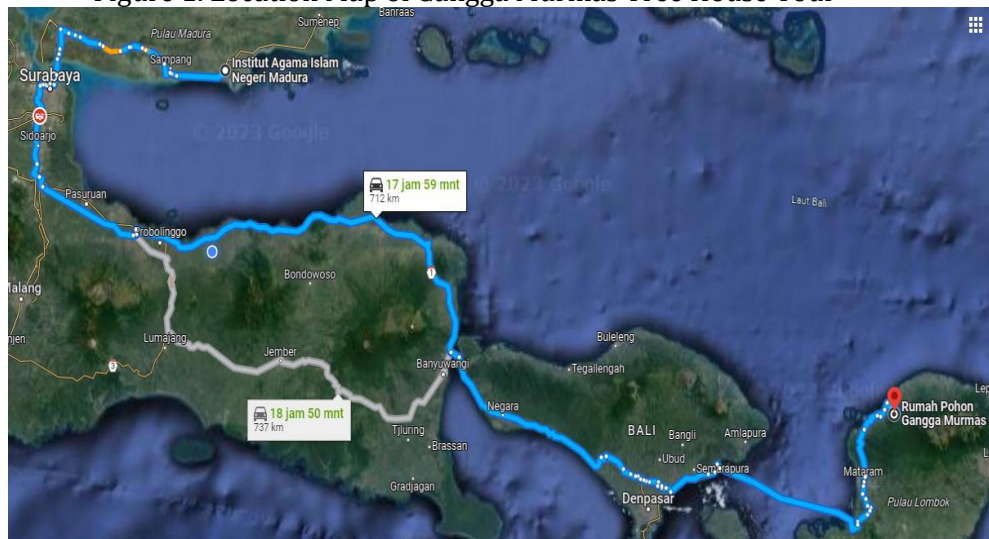
The Gangga Murmas Tree House tourist area located in Gangga Hamlet, Genggelang Village, Gangga District, North Lombok Regency is a strategic location for improving the economy and strengthening the tourism industry, the Gangga Murmas Tree House tourism manager has developed several programs including the construction of garden lights, infrastructure development such as buildings, roads and bridges.

One of the most crucial elements is garden lighting since it contributes to the area's aesthetic appeal and draws visitors. On the other hand, garden lights also function as security and safety for tourists, especially at night (Adhiem, Permana, & Faturahman, 2021; Megantoro, Apsari, Kusuma, & Anggraeni, 2023). The lack of lighting in Gangga Murmas Treehouse Park has an impact on the lack of tourist interest in entering the tour. Lack of lighting also affects the security risk of tourists (Azhari et al., 2023; Saputra, Ramadhan, & Muharom, 2022; Winardi, Nugroho, & Dolphina, 2019) Therefore, the

manager of the Gangga Murmas Tree House tourist spot conveyed the importance of garden lights including:

1. **Tourism:** Greater potential exists in the Gangga Murmas Treehouse tourism region, particularly in the areas of ecological and cultural tourism. The park lights allow the area's tourist attractions to stay open later at night, boosting local revenue and welfare while drawing more visitors (Indriani, Utomo, & Edy, 2020; Sasmito, Laka, & Gunawan, 2020; Wispandono, SE, Nurul Imamah, & Yulistiyono, 2022).
2. **Security:** Garden lights are very important to increase the security of the Gangga Murmas Treehouse tourist area. Park lights will make it easier for visitors who are driving and strolling at night to notice the road, obstructions, and other possible dangers. By doing this, the area's danger of accidents and criminality will be decreased (Hutajulu et al., 2022; Sukma, Azis, & Pebrianti, 2021; Winardi et al., 2019).
3. **Accessibility:** Park lights will also improve accessibility in the Gangga Murmas Tree House tourism area. With the park lights, tourists will feel more comfortable to move at night. This will support regional economic activity and enhance the community's social and cultural life (Falah, Syah, et al., 2023; Iskandar, 2020).

Figure 1. Location Map of Gangga Murmas Tree House Tour



Due to the attraction of tourists, garden lights are crucial in this context to enable movement in the Gangga Murmas Tree House tourist area at night, strengthening the tourism industry, security, accessibility, and improving the economy in the tourism sector (Nasional, 2014). On the other hand, North Lombok Regency is still included in the accelerated development of disadvantaged areas or 3T areas as a strategic plan in the integration of facilities and infrastructure development in 2020-2024 so special attention is needed considering that the Gangga Murmas Tree House is a very important tourism sector because of its function and role in the economy in Indonesia (Hosaini & Samsudi, 2020; Supriyadi & Dewi, 2022). Therefore, partners raised issues related to the construction of garden lights as one of the important needs of the area to improve the tourism sector.

Figure 2. (a), (b), (c) and (d) Gangga Murmas Treehouse Tourism Area Genggelang Village



Figure 2. is the condition of the garden in the Gangga Murmas Tree House tourist area, precisely in Genggelang Village, which still lacks garden lights. A common solution to improve lighting and aesthetics in the area is to install garden lights (Dermawan, Apriaskar, & Djuniadi, 2020; Falah, Handoko, Syah, Azizah, & Gumilar, 2023; Handoko & Handayani, 2023). By using the Participatory Rural Appraisal Methods (PRA) method in this service which is an approach to invite the entire community to participate in the development process, activities are expected to be able to maintain and maintain garden lights. With the use of Solar Power Plants (PLTS) in garden lights, it can be more environmentally friendly (Abdillah, Afandi, Falah, & Firmansah, 2020; Abdillah et al., 2022; Baskoro, Handoko, Agung, Widartono, & Kartini, 2021; Faiz et al., 2023; Sinuhaji, 2019). The hope is that this Solar Power Plant (Photovoltaic) Garden Light will be able to increase the tourism sector of the Gangga Murmas Tree House.

METHOD

The method used in solving the problems that occur is the Participatory Rural Appraisal Method (PRA) which is an approach to invite the whole community to participate in the process of development activities (Hudayana et al., 2019). By using the PRA method, a problem-solving framework and activity methods are made as follows: Gangga Murmas Treehouse Tourism Area, North Lombok Regency.

1. Problem Solving Framework

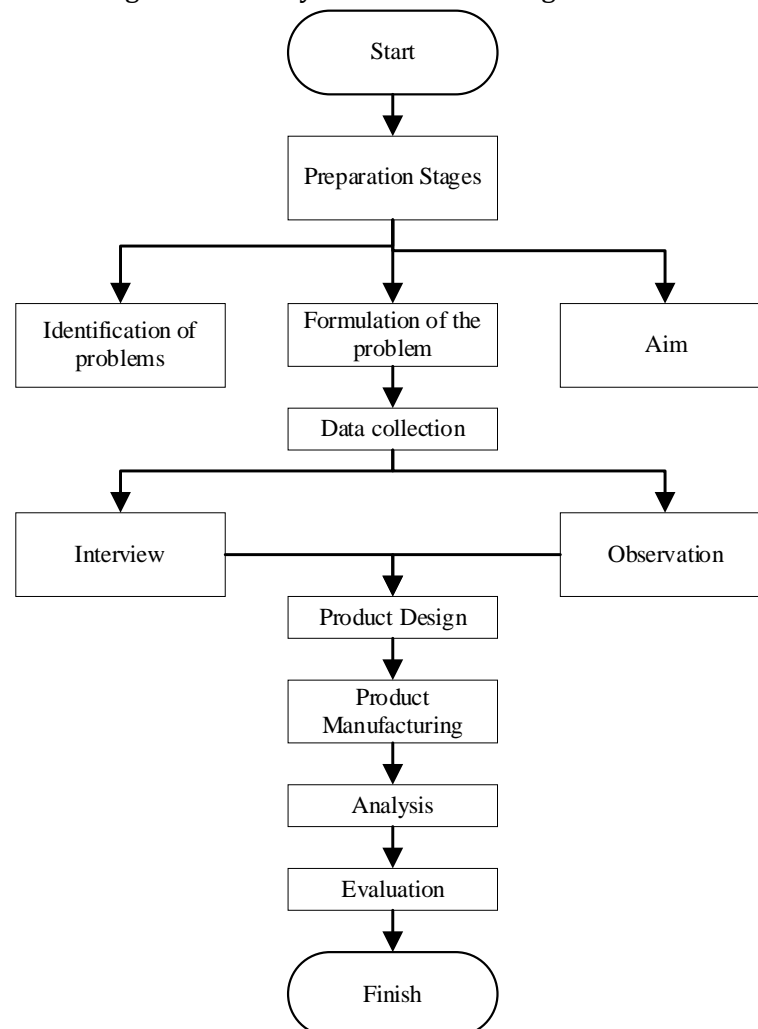
This problem-solving framework was created to address issues and provide solutions to partners of the Gangga Murmas Treehouse Tourism Area in North Lombok Regency:

- a. Designing photovoltaic power plants (PLTS) as an energy source for lighting garden lights.
- b. Testing the lighting of photovoltaic-powered garden lights that have been installed in partners of the Gangga Murmas Tree House Tourism Area, North Lombok Regency. Testing involves measuring the power, voltage, and current produced by solar panels as well as the power produced by garden lights.
- c. Training on installation and maintenance of photovoltaic-based garden lighting.
- d. Evaluation which is carried out in stages within 1 month.

2. Activity Method

The following solution framework is created to address the issues and suggestions made to the Gangga Murmas Treehouse Tourism Area's partners:

Figure 3. Activity Method Block Diagram



The approach that will be used in this activity is creating a framework, which will specify the steps that must be followed. Next, training in the installation and upkeep of solar-powered garden lighting will be provided. Generally speaking, this community duty is carried out as follows::

- a. The purpose of observation is to identify partner needs. To gather information for the observation, the team visited the partner's location, spoke with the partners face-to-face, and took notes (Arisanti & Al Islamiyah, 2020).
- b. During two weeks, the following tasks were completed: establishing agreements with partners, creating activity schedules, and deciding where to locate maintenance training for photovoltaic-based garden lighting systems. Before field implementation, the location and observation data are taken into consideration during the design and computation of the system.
- c. Training and upkeep for landscape lighting powered by solar energy. The following procedures are followed to complete this task on-site:
 1. Instructions on installing yard lighting powered by photovoltaics. Partners will receive instructions on how to operate and maintain landscape lights powered by photovoltaic cells. This system will be used out there in the field.
 2. Looking for locations for the installation of photovoltaic-based garden lighting in the Gangga Murmas tree house tourist area.
 3. Solar power setup. To ensure that the solar panel receives the most sunlight possible, the photovoltaic system will be positioned at the ideal sun angle position.
 4. Installation of charger, SCC, and battery modules.
 5. Installing a charger module with a solar-powered storage cell and battery.
 6. Installing garden lights at predetermined location points.
 7. Final check, including electrical installation and integration of photovoltaic with sunlight.
- d. Testing of performance. To ascertain whether the photovoltaic installation can function effectively, system performance is assessed.
- e. Team representatives transfer the solar-powered garden lights to their partners.
- f. Documentation. A camera or video recorder can be used to capture the entire course of this activity.
- g. Evaluation
- h. Publication

RESULT AND DISCUSSION

The "Application of Photovoltaic Appropriate Technology as Garden Lighting in the Gangga Murmas Tree House Tourism Area, North Lombok Regency" community service initiative yielded noteworthy outcomes with wide-ranging consequences. This program's primary goal is to develop the Gangga Murmas Tree House's tourism industry to boost the local economy and make the area less affected by the 3T area. Additionally, this activity will boost the tourism sector, enhance community welfare, and provide people with a sense of security and comfort when they engage in nighttime activities in the neighborhood. It can also enhance security, boost the economy, promote tourism, and lower crime rates.

The implementation of this community service activity was carried out from November to December 2023 by producing a Solar Power Plant (PLTS) with a capacity of 2800Wh which can be used for garden lights with a total of 40 pieces and a total load capacity of 120Watt. The PLTS and garden lights were assembled and installed by residents and managers of the Gangga Murmas Tree House tourist area Figure 4. shows the process of handing over photovoltaic-based garden lighting equipment to the manager of the Gangga Murmas Tree House tourist area.

Figure 5. is documentation in the field at the time of installation of Photovoltaic-Based Garden Lighting. At that time, training on the use and maintenance of tools was also carried out with the community so that they could have knowledge of operating tools and could develop expertise in the field of renewable energy such as photovoltaic. In terms of

the placement of the installation of Garden Lights, it has been determined by the Gangga Murmas Treehouse Tourism Area Manager through the results of the agreement.

Figure 6. shows the Photovoltaic-Based Garden Lighting tool functioning properly and the installation of a sturdy construction installation. Bright garden lighting is installed at night using photovoltaic technology. Weekly routine monitoring and assessment are also required to assess the effectiveness of photovoltaic-based garden lighting. It has been demonstrated that the tool operates without issue during the full week of observation. By employing energy conversion technology that shifts from photovoltaic to monocrystalline, garden lighting may effectively meet the demands of increased security and comfort while consuming less electricity.

Figure 4. Handover of Tools to the Manager of the Gangga Murmas Treehouse Area



Figure 5. Installation Process and Training on the Use and Maintenance of Photovoltaic-Based Garden Lighting Equipment



Figure 6. Results of Garden Lighting Installation and Test at Night



This activity focuses on developing the tourism industry of the Gangga Murmas Tree House so that it can improve the community's economy and make the 3T alleviated area for Lombok district by applying photovoltaic appropriate technology as garden lighting to improve facilities and infrastructure in the Gangga Murmas Tree House area and provide knowledge to managers and communities related to renewable energy.

There are several related studies on the application of photovoltaic lighting as conducted by (Azhari et al., 2023) photovoltaic is used for Public Street Lighting (PJU) in the Pakuniran agricultural area. Then (Dermawan et al., 2020) designed street lighting in Semarang which focuses on increasing the intensity of public street light. After that (Fadli & Sulistyowati, 2021) carried out activities to design a prototype of public street lighting in Caruban with a 40 watt lamp load that can light up 12 hours at night. The activity carried out (Trisna, Rusdinar, & Ramdhani, 2019) focuses on designing a Solar Charge Controller (SCC) for public street lighting combined with photovoltaic as a generator. Planning for public street lighting with photovoltaic was also carried out by (Sukma et al., 2021) for street lighting Talang Pete Plaju Darat. On the other hand, activities carried out by (Bawano & Tumembow, 2023) include the utilization of photovoltaic energy for street lighting at Politeknik Negeri Manado so that campus lighting can be adequate. The utilization of photovoltaic for lighting was also carried out by (Wati, Muharom, Firmansyah, & Masfufiah, 2023) which was implemented on the Medokan Ayu village road, rungkut sub-district Surabaya, East Java Province which in the implementation process used Rapid Rural Appraisal (RRA) or activities without involving the community. In Buniwangi Village, Surade Sukabumi, there was also an activity to implement photovoltaic in the form of public street lighting which became an alternative to street lighting during light outages and also a source of energy saving (Sembiring, Putra, Ngatoilah, & Mustopa, 2023). The activity carried out by (Nadhiroh, Aji, Kusnadi, & Dwiyaniti, 2022) was to install photovoltaic-based public street lighting for residents of Guha Kulon Klapanunggal, Bogor Regency to overcome the lack of lighting in the area. The activities carried out by (Kango, Hadiyanto, Kusno, Wijaya, & Pongtuluran, 2022) utilized photovoltaics for lighting the bench facilities of green open space parks in Balikpapan city.

Based on several references that have been described, the differentiator of this activity is the application of photovoltaic appropriate technology for lighting garden lights in the Gangga Murmas tree house tourist area which is included in the Disadvantaged, Frontier and Outermost Regions (3T) so that it needs special attention in developing the tourism sector and the economy in the area for the better. In addition, this activity also involves managers and the community to provide knowledge related to how to work, photovoltaic maintenance, and photovoltaic development to improve the skills of managers and the community in developing photovoltaics.

The activity of applying photovoltaic appropriate technology for lighting garden lights in the Gangga Murmas tree house tourist area will certainly have a positive impact on increasing the tourism sector as well as the economy and security for the surrounding area. As for the manager and the community, they get knowledge related to renewable energy such as photovoltaic and how to develop it and the most important thing is that it can alleviate the 3T area.

In this activity, of course, there are still shortcomings so further activities are needed to support this service to be even better, such as utilizing a hybrid inverter that can be done so that it can reserve loads for daytime use and can be used for 24 hours. As well as the application of the Internet of Things (IoT) which is needed in monitoring and controlling photovoltaic and loads used.

CONCLUSION

The Gangga Murmas Tree House Tourism Area, situated in Gangga Hamlet, Genggelang Village, Gangga District, North Lombok Regency, has accomplished its community service obligations with great success. Monocrystalline photovoltaic garden lighting devices have been installed and are operating well. The Gangga Murmas Tree House Tourism Area is dark at night, but all of the installed garden lights may light it up. The beneficial outcomes give people a sense of security and comfort when they are out and about at night, which will boost the tourism sector, enhance community welfare, enhance security, ease the economy, promote tourism, and lower crime rates. Technology's influence is further strengthened by the community's and the Gangga Murmas Tree House's tourism managers' participation in this activity, which encourages teamwork and shared learning. As the village develops, this project offers an intriguing illustration of how well-coordinated use of technology, civic involvement, and sustainable practices may lead to long-lasting beneficial change. It is hoped that this activity will serve as a model for other community service projects in Indonesia and that it will alleviate the 3T area around the popular Gangga Murmas tree house in North Lombok Regency, thereby boosting the local economy.

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