REKA ELKOMIKA: Jurnal Pengabdian kepada Masyarakat
ISSN(p): 2723-3235 | ISSN(e): 2723-3243 | Vol. 4 | No. 3 | Pages 243 - 254
DOI : 10.26760/rekaelkomika.v4i3.243-254 October 2023

Introducing Automated Public Lighting Using Solar Cells in Giri Mekar Village: A Workshop on Equipment Familiarization and Maintenance for the Youth and Karang Taruna

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Received 06 September 2023 **|** Revised 03 October 2023 **|** Accepted 04 October 2023

ABSTRACT

In Giri Mekar Village, the challenge of public street lighting has become a critical issue affecting the daily lives of its residents. Identifying the need for a sustainable solution, an initiative was launched to introduce automatic lighting technology based on solar cells. Through specially designed socialization and training activities, the youth and members of Karang Taruna were engaged to understand, operate, and maintain this lighting system. The training methodology included theoretical sessions on solar cells, equipment demonstrations, and hands-on installation sessions. As a result of these activities, participants demonstrated significant skill enhancement and understanding, as well as a commitment to implementing and maintaining this technology in their village. The overall initiative not only offered an efficient lighting solution but also promoted the concept of community empowerment in village infrastructure development..

Keywords: *Public street lighting, Solar cells, Socialization and training, Youth involvement*

1. INTRODUCTION

Public street lighting is an essential component of urban and rural infrastructure. Not only does it function to enhance visibility at night, but it also plays a role in increasing safety, reducing accident risks, and supporting local economic activities. Moreover, adequate lighting can enhance the aesthetics of an area and provide comfort for road users. However, the reality in Giri Mekar Village shows a different condition. Although the village has seen development in several aspects, public facility lighting remains an unresolved issue. Based on a survey, around

60% of public facilities in Giri Mekar Village lack proper lighting, especially in residential areas and public facilities like sports fields, playgrounds, and community centers.
This condition is of particular concern, especially considering the importance of lighting in supporting community activities at night. The lack of lighting not only impacts comfort but also potentially increases the risk of accidents and criminal activities.

Public street lighting has been a topic of special attention in scientific literature, especially in the context of energy efficiency, safety, and the utilization of the latest technology. Below is a summary of some relevant literature :

1. Energy Efficiency: **Desmira (2022)** highlights the importance of energy efficiency in public street lighting. Her research explores the application of LDR (Light Dependent Resistor) sensors as a solution to enhance energy efficiency in street lights. The results indicate that with the use of this technology, energy consumption can be reduced without compromising lighting quality **(Desmira, 2022).**
2. Solar Power Generation: Rachmanita (2022) and Setiawan et al. (2022) propose solar-powered public street lighting solutions. Both emphasize the significance of harnessing renewable energy sources, such as the sun, to support lighting needs in remote areas or those not yet reached by the electrical grid **(Rachmanita, 2022; Setiawan et al., 2022).**
3. Safety and Comfort: Fahmi Al Gadri et al. (2022) underscore the importance of public street lighting in enhancing the safety and comfort of residents. Their study shows that areas with adequate lighting tend to have lower rates of accidents and criminal activities **(Fahmi Al Gadri et al., 2022).**
4. Smart Public Street Lighting: Hidayatullah et al. (2022) discuss the concept of smart public street lighting controlled by power line carrier technology based on the Internet of Things (IoT). With this system, lighting can be adjusted according to needs, making it more energy-efficient **(Hidayatullah et al., 2022).** The Device used can make it easier to operate to control public street lighting, and can also use three types of settings, namely RTC, LDR, Manual. **(Rahim, A., 2022)**
5. Solar Tracker System: Wibawa et al. (2022) explore the utilization of an Arduino Uno-based solar tracker system to enhance the efficiency of solar panels in public street lighting systems. With this technology, solar panels can follow the sun's direction, optimizing energy absorption **(Wibawa et al., 2022).**
6. Community-based Lighting: Marindra et al. (2022) stress the importance of community involvement in efforts to repair and install public street lighting. Through a participatory approach, the community can have a sense of ownership and responsibility for the lighting infrastructure in their environment **(Marindra et al., 2022).**
   Nadhiroh et al. (2022) Access to public facilities such as places of worship in villages is very poorly lit. Dark, ups and downs and uneven road conditions can pose a risk of accidents and crime. Reflecting these conditions, the need for public street lighting becomes a priority. Considering the economic capacity of the residents of Kampung Guha Kulon, lighting the main street using solar power is more suitable. Solar Public Street Lighting Systems (PJUTS) have advantages compared to PJU systems with electricity sources from PLN, because PJUTS get their energy source directly from the sun**. (Nadhiroh et al., 2022).** This community service program aims to increase public awareness and understanding of EBT and its wise use. The methods used in the service program are survey, observation, outreach, counseling, training, and construction of PLTS for public street lighting as well as monitoring and evaluation**. (Caroko, N., 2022)**

From the literature mentioned above, it can be concluded that public street lighting is not only related to providing illumination but also concerns energy efficiency, safety, and the utilization of the latest technology. Furthermore, the involvement of the community and youth, as seen

in Giri Mekar Village, is key to the success of efforts to improve the quality of public street lighting.

In this context, the role of the youth and "Karang Taruna" (Youth Community Organization) is crucial. As an energetic and innovative younger generation, they have significant potential to contribute to efforts to enhance the quality of village infrastructure, including public street lighting. Empowering the youth and "Karang Taruna" will not only help improve infrastructure quality but also build a sense of ownership and responsibility towards the surrounding environment.

Therefore, through this scientific article, the author aims to delve deeper into the potential and strategies for empowering the youth and "Karang Taruna" in Giri Mekar Village in efforts to enhance the quality of public facility lighting. It is hoped that through this discussion, innovative solutions can be found that can be applied to improve the quality of life for the residents of Giri Mekar Village.

2. METHODS

The primary objective of the methodology applied in this article is to provide a systematic and structured overview of the implementation process of automatic solar-powered street lighting training in Giri Mekar Village. Through this methodology, we aim to ensure that each step of the training, from socialization, tool introduction, to maintenance training, can be clearly understood by readers. Moreover, by detailing the methodology used, we hope that similar training can be replicated or adapted in other locations with comparable conditions. Thus, this methodology not only serves as a guide for readers in understanding the article's content but also as a reference for other parties wishing to implement a similar training concept in the future.

2.1 Design Methods of Community Service

In an effort to enhance the understanding and application of technology among the residents of Giri Mekar Village, we adopted a community service methodology tailored to the village's needs. The primary objective of this approach is to build the capacity of the village residents, especially the youth and members of the Karang Taruna community group, in understanding and implementing automated street lighting technology.

Our approach involved a series of activities designed to provide both theoretical and practical insights into automated street lighting using solar cells. Through these activities, we aimed to raise community awareness about the importance of sustainable technology and how it can be integrated into the village's infrastructure. Furthermore, by engaging the youth and Karang Taruna as the main participants, we sought to ensure that the knowledge and skills acquired would be passed on and applied in the long term for the benefit of the Giri Mekar Village community..

2.2 Site Selection and Participants

The community service program was conducted on August 26, 2023, and was held offline at the Girimekar Village Office Hall, along with several spots designated for the installation of solar cell-based public street lighting. The target participants for this activity were the youth of Girimekar Village, Bandung Regency. The training aimed to accommodate approximately 20 participants.

Giri Mekar Village was chosen as the training location for several crucial reasons. First, Giri Mekar Village holds significant potential for the development of solar cell-based public street

lighting, especially considering its geographical and climatic conditions that favor solar energy utilization. Second, initial observations indicated that the village still has several areas lacking adequate lighting, so this training is expected to provide a solution to enhance the village's lighting quality.

In selecting participants, the criteria used include:

- Active Members of Karang Taruna: Karang Taruna plays a vital role in village development and community empowerment. Thus, involving its active members is anticipated to ensure broader community involvement and information dissemination in this lighting program.
- Village Youth: The youth are change agents in the community. They possess enthusiasm, creativity, and the ability to adapt to new technologies. By involving the village youth, this training is expected to progress beyond mere introduction to further implementation and development stages.
- Other Relevant Parties: Besides the two primary criteria above, other participants with interests or contributions to village infrastructure development were also invited to participate.

Consequently, the selection of Giri Mekar Village and the established participant criteria aim to ensure the success and sustainability of this automatic public street lighting training program.

2.3 Tools and Equipment

During the training in Giri Mekar Village, several essential tools and equipment were introduced to the participants. Below is a list and description of these tools and equipment:

- Solar Panel (as shown in figure 1):
  Technical Specifications: Monocrystalline panel with a capacity of 100W, conversion efficiency of around 25%.
  Function: Converts solar energy into electrical energy, which is then stored in a battery.

Figure 1. Photovoltaic Cells

- Lithium Battery (as shown in figure 2):
  Technical Specifications: Lithium-ion battery with a capacity of 6V 60Ah.
  Function: Stores the electrical energy generated by the solar panel for use when the sun is not shining.

Figure 2. Lithium Battery

- LED Lamp (as shown in figure 3):
  Technical Specifications: 10W LED light with a luminance of approximately 1000 lumens.
  Function: Serves as an energy-efficient lighting source with a long lifespan.

Figure 3. LED lamp

- Light Dependent Resistor Sensor (as shown in figure 4):
  Technical Specifications: A resistor whose resistance varies based on the intensity of light it receives.
  Function: Automatically activates or deactivates the light based on surrounding light conditions.

Figure 4. LDR Sensor

- Solar Charge Controller (as shown in figure 5):
  Technical Specifications: Controller with a maximum capacity of 20A.
  Function: Manages the battery charging process from the solar panel and prevents overcharging.

Figure 5. Solar Charge Controller

2.4 Socialization and training procedures

The training on automatic solar-powered street lighting in Giri Mekar Village was designed to provide comprehensive understanding to participants, especially the youth and members of Karang Taruna. Below are the steps taken during the training process as illustrated in Figure 6.

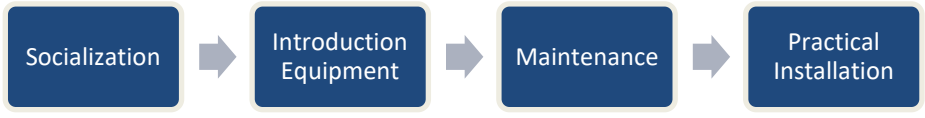

Figure 6. Flow of Community Service Implementation

2.4.1 Socialization:

- Invitation Delivery: The training organizers coordinated with the village authorities to deliver an official invitation regarding the upcoming training. After obtaining approval

from the village officials, the invitation was forwarded to the youth and members of Karang Taruna as the primary targets of this training.

- Attendance Confirmation: To ensure participants' attendance, the organizing committee conducted a follow-up confirmation with the youth and Karang Taruna members who had received the invitation.

2.4.2 Introduction Equipment:

- Presentation by the Instructor: A presentation session was conducted where the instructor provided detailed explanations about the tools required for solar cell-based public street lighting. From the solar panels, batteries, LED lights, to the charge controller, all components were introduced clearly.
- Question and Answer Session: After the presentation, a Q&A session was opened to give participants the opportunity to clarify any questions or confusions they had regarding the tools and equipment introduced.

2.4.3 Practical Maintenance:

- Maintenance Guide: The instructor presented a step-by-step guide on how to maintain the lighting system, including cleaning the solar panels, checking the batteries, and replacing lights if necessary.
- Demonstration: The instructor conducted practical maintenance demonstrations, such as how to properly clean the panels or replace damaged components..

2.4.4 Practical Installation:

- Location Identification: Before the installation practice, the training team, along with the participants, identified several points in Giri Mekar Village that required lighting.
- Direct Installation: Under the guidance of the instructor, participants were given the opportunity to directly install the lighting system at the identified points. This provided hands-on experience to the participants and ensured they understood each step of the installation process..

2.5 Duration of Training and Socialization

This activity is carried out in the span of one day in full with the details of the event as shows in table 1.

Table 1. Even Rundown Community Service

Time	Even
08:30 - 08:30	Registration and Opening
08:30 - 09:00	Introduction and official opening of the training.
09:00 - 10:30	Introduction to the tools and equipment for solar-based lighting systems
10:30 - 10:45	Coffee Break
10:45 - 12:00	Q&A session and discussion about the introduced tools and equipment.
12:00 - 13:00	Lunch Break
13:00 - 14:30	Training on the maintenance of the lighting system.
14:30 - 15:45	Hands-on practice of installing the lighting system at selected points
15:45 - 16:00	Closing and evaluation of the training.

2.6 Evaluation

In every training activity, evaluation is a crucial component to measure the success and effectiveness of the conducted activities. This evaluation aims to understand the extent of participants' comprehension of the presented material and to gather feedback for future improvements. In this community service activity, the effectiveness measurement was conducted using:

- Questionnaire: After the socialization session concluded, participants were given a questionnaire to complete. This questionnaire was designed to gauge the extent of participants' understanding of the information conveyed during the socialization. Questions in the questionnaire covered aspects such as the completeness of information, the method of delivery, and the relevance of the information to participants' needs. The results from this questionnaire were then analyzed to get a general overview of the socialization's effectiveness.
- Interviews: In addition to the questionnaire, several participants were randomly selected for interviews. These interviews aimed to gather more in-depth and specific feedback regarding the socialization activity. Through the interviews, organizers could identify specific aspects that might not be covered in the questionnaire, such as suggestions for improvement or feedback on certain aspects of the socialization. The results of these interviews were then compiled and analyzed alongside the questionnaire results to provide a comprehensive view of the socialization's effectiveness

3. RESULT AND DISCUSSION

This section will explain the results of the community service that has been conducted, Figure 7 shows a banner designed for community service activities

Figure 7. Banner Designed for Community Services

3.1 Result of Training and Socialization Implementation

The socialization and training event in Desa Giri Mekar was a significant step towards introducing the community to the benefits of automatic public lighting using solar cells. This chapter presents a detailed overview of the event's outcomes, supplemented with photographs capturing key moments from the beginning to the end.

- Opening Ceremony
  The event commenced with a formal opening ceremony as shown in figure 8. Distinguished guests, community leaders, and participants gathered to mark the beginning of this transformative initiative.

Figure 8. Opening Ceremony of Community Service

- Socialization Section
  After the opening, the first session was dedicated to socializing the concept of automatic public lighting as shown in figure 9. Participants were introduced to the importance and benefits of using solar cells for general lighting. followed by an introduction to the equipment. The instructor gave a comprehensive presentation, showing the tools and materials needed for the installation of the lighting system. In addition, participants were also taught how to carry out maintenance where participants were taught how to care for the installed lighting system. This session is very important to ensure the longevity and efficiency of the lamp.

Figure 9. Socialization Section

- Practical Instalation
  One of the event's highlights was the practical installation session as shown in figure 10. Participants, under the guidance of the instructor, installed public lighting systems at selected points around Desa Giri Mekar. This session provided them with practical experience and confidence.

Figure 10. Practical Instalation

- Closing Ceremony
  The event concluded with a closing ceremony as shown in figure 11. Feedback was collected, and certificates were distributed to the participants. The community leaders expressed their gratitude and emphasized the importance of implementing the knowledge gained.

Figure 11. Closing Ceremony

3.2 Feedback from the Questionaire

One of the evaluation methods we used was distributing opinion and satisfaction questionnaires to the participants. These questionnaires were designed to gather feedback from participants about various aspects of the training, ranging from the quality of materials and teaching methods used to their overall satisfaction with the training. The data generated from these questionnaires was then processed and analyzed to provide an objective overview of the effectiveness and impact of the training.

Table 2 below shows the results of the satisfaction and opinion questionnaire, where we presented 7 questions regarding the training and assessed them using a Likert scale, where a score of 1 represents strongly disagree, a score of 2 represents disagree, a score of 3 represents neutral, a score of 4 represents agree, and a score of 5 represents strongly agree.

Table 2 Results of The Satisfaction And Opinion Questionnaire

No	Question	Scale	Mean
1	Was the information presented during the socialization comprehensive and covering all essential aspects related to automatic public lighting using solar cells?	1-5	4.4
2	Was the method of delivering information during the socialization easy to understand and engaging?	1-5	4.2
3	Was the information presented relevant to your needs and expectations as a participant?	1-5	4.5
4	Was the instructor responsive to questions and provided adequate clarifications during the Q&A session?	1-5	4.3
5	After attending the socialization, do you feel you have a good understanding of automatic public lighting using solar cells?	1-5	4.2
6	Was the presentation material of good quality and systematically arranged?	1-5	4.3
7	Overall, how would you rate your experience during the socialization activity?	1-5	3.8

Based on the results of the questionnaire presented in Table 2, participants generally expressed satisfaction with the conducted socialization, with average scores ranging between 3.8 and 4.5 on a scale of 1-5. Participants felt that the information provided was comprehensive, relevant, and the method of delivery was easily understood. However, the average score of 3.8 for the overall experience indicates that there are specific aspects that need improvement to enhance participant satisfaction, such as the duration of the event or the quality of facilities. This feedback is crucial for the organization of future socialization events to ensure they are more effective and meet participants' expectations.

This evaluation stage is important as it allows us to measure the success of the training and identify areas for improvement. By conducting systematic and comprehensive evaluations, we can ensure that our training program continues to evolve and adapt to the needs and expectations of participants, while providing maximum benefit to them.

3.3 Discussion

The high participation rate and positive feedback from the questionnaire indicate the success of the socialization event. The community's evident interest in sustainable and automated public lighting solutions was addressed, and the training provided them with the necessary knowledge and skills. However, it's crucial to highlight that this success isn't solely measured by the number of participants or positive feedback but also by how the community can implement and maintain this lighting system in the long run.

The hands-on installation session allowed participants to immediately apply their newfound knowledge, reinforcing their understanding and boosting their confidence. However, even though the majority felt confident in maintaining the system, it's essential to conduct regular monitoring and refresher training sessions. This will ensure the durability of the installed systems and empower the community to handle any issues independently.

Furthermore, the questionnaire data suggests a need for advanced training, especially concerning maintenance and repairs. Therefore, a sound follow-up plan would be to organize advanced training sessions and periodic maintenance workshops.

In conclusion, the socialization and training event in Giri Mekar Village was a success. However, to ensure the sustainability and optimal utilization of this lighting system, continuous efforts and commitment from the entire community are required.

4. CONCLUSION

Socialization and training activities in Giri Mekar Village have succeeded in providing understanding to the community about the importance of automatic public lighting using solar cells. From the opening ceremony to the closing ceremony, the enthusiasm and involvement of the participants demonstrated how important this initiative is for the community.

Automated public lighting not only provides a more efficient and sustainable lighting solution, but also promotes community independence in managing and maintaining their own infrastructure. The training provided to the youth and Karang Taruna of Giri Mekar Village has empowered them with the skills and knowledge needed to lead this transformation.

In addition, this activity also emphasizes the importance of collaboration between youth, Karang Taruna, and other stakeholders in realizing the vision of better public information. With the support and active participation of the entire community, Giri Mekar Village can become an example for other villages in adopting sustainable technology.

ACKNOWLEDGEMENT

Thank you to all parties who have actively participated in this community service activity starting from the PKM team, participants, and other support teams. So that the implementation of community service activities is good and smooth without any problems during its activities.

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