Solar Panel Based Field Lighting at Madinathul Ilmi School in Muara Gembong District

Aris Sunawar[1], Nur Hanifah Y[2], Imam Nursyahied[3], Naura[4]
Program Studi Pendidikan Teknik Elektro, Fakultas Teknik, Universitas Negeri Jakarta
Email : arissunawar@unj.ac.id

Abstract

Field lighting in schools is one of the important elements that support educational activities, especially at night. This study aims to evaluate the implementation of a solar panel-based lighting system at Madinathul Ilmi School located in Muara Gembong District. By utilizing renewable energy sources, namely solar energy, this system is designed to overcome the problem of limited access to electricity in remote areas and reduce dependence on fossil energy sources. The research methodology includes the planning, installation, and performance evaluation stages of the lighting system used. Analysis was carried out on energy efficiency, operational costs, and the resulting environmental impacts. The results of the study indicate that the solar panel-based lighting system is able to provide adequate lighting with lower operational costs compared to conventional systems. In addition, the use of solar panels also contributes positively to reducing carbon emission.

Keywords: *Field Lighting, Solar panels, Renewable energi, muara gembong*

INTRODUCTION

Field lighting in schools is very important in supporting student activities, especially at night. In remote areas such as Muara Gembong District, limited access to electricity is the main challenge in providing adequate lighting. Therefore, the use of renewable energy, especially solar panels, is a potential solution.

Madinathul Ilmi School, located in Muara Gembong District, is facing these challenges. In order to improve school facilities and support teaching and learning activities that take place at night, the school took the initiative to implement a solar panel-based lighting system.

IMPLEMENTATION METHOD

Most solar panel research focuses on street lighting, whereas this research was conducted in school fields, so the method used was a descriptive approach with a case study method in the implementation of a solar panel-based lighting system at the Madinathul Ilmi School. (Fatkhurrozi et al., 2019; Putri et al., 2019)

The research stages include:

1. Location Survey: Identifying lighting needs in the field and local environmental conditions or points that require lighting. (MAKKULAU et al., 2021; Ramadhani et al., 2023)
2. System Design: Determine the type and number of solar panels and other components needed based on the location and type of panel. (Setiawan et al., 2022)
3. nstallation and Implementation: The process of installing solar panels, batteries and lighting at the specified location. (Pujianto et al., 2022)
4. Testing and Evaluation: Measuring the system's performance in providing sufficient lighting and the resulting energy efficiency.

RESULTS AND DISCUSSION

The results of this research show that The solar panel-based lighting system installed at Madinathul Ilmi School is able to operate efficiently. Some of the key findings include:

Energy Efficiency: This system is capable of producing enough energy to light the school grounds for 6-8 hours every night.

Operational Costs: The use of solar panels significantly reduces operational costs compared to the use of diesel generators. (Shomad & Nurisna, 2021)

Environmental Impact: By reducing use fossil fuels, this system helps in reducing carbon emissions and preserving the environment.

Figure 1. Exposure to material regarding solar panels
(Source: Personal Documents)

With a structured delivery method to increase community competence, especially in the use of solar panel technology. The following are the specific adjustments to the steps taken:

PreTest (Initial Level of Understanding):

Before initiating the program, the community's initial understanding regarding solar panel technology and its dangers, such as lightning or external factors that could damage the system, was carried out.

This survey can be based on direct interviews, field observations, or questionnaires as is also applied in research using observation methods

Solar Panel System Practices:

Provides a hands-on demonstration of solar panel components, how they work, and how the system can convert solar energy into electricity.

Educational designs such as training for the Girikerto Village community are relevant for this step, where solar panel technology is introduced in detail to the community. (Setiawan et al., 2022)

Practices for Installing Solar Panel Systems According to Standards in the Field:

The public is invited directly to assemble and install solar panels so that the lighting system functions according to standards.

This stage includes the installation of solar panels, power storage batteries, as well as electrical output trials as described in the installation process in Sidakangen Village and Sukarame Village. (Putri et al., 2019; Ramadhani et al., 2023)

PostTest (Analysis of Increase in Understanding):

After all steps have been implemented, a post-activity evaluation is carried out to measure the increase in the level of public understanding of solar panel technology based on the training that has been provided.

This approach is also in accordance with the evaluation of community behavior and competence in the PJU TS-based Community Empowerment project. (Dhion Khairul Nugraha et al., 2023)

Figure 2. Installation of solar panels on portable poles
(Source: Personal Documents)

Figure 3. Results of installing solar panels for the field
(Source: Personal Documents)

Comparative Analysis of Participants' Pre-test and Post-test Results Before and After Solar Panel-Based Lighting at Madinathul Ilmi School, Muara Gembong District

As part of the evaluation of community service in Muara Gembong District, the level of community understanding was measured through pre-test

and post-test. This assessment aims to assess the effectiveness of providing materials and practices regarding solar panel-based lighting. Following are the results and analysis:

a. Pre-test Results

Before being given material and practice, all participants (10 people) had an inadequate initial understanding, with the highest score being 60 and the lowest score being 30. The class average was 49, indicating that the majority of participants did not understand solar panel lighting technology well. The distribution of scores on the pre-test can be seen in Table 1 below:

Table 1. Distribution of pretest results

No	Mark	Frequency (F)	Percentage (%)
1.	30	2	20
2.	40	1	10
3.	50	3	30
4.	60	4	40

From the data above, 100% of participants scored <70, which shows that their level of understanding is still very low regarding solar panel technology and lighting.

b. Post-test results

After delivery of the material, practice, and installation of solar panels, the post-test results showed a significant increase in participants' understanding. The highest score increased to 80 (obtained by 1 person), while the lowest score increased to 40 (2 people). The class average increased to 58, with the following distribution of scores in Table 2:

Table 2. Distribution of posttest results

No	Mark	Frequency (F)	Percentage (%)
1.	40	2	20
2.	50	2	30
3.	60	3	30
4.	70	2	20
5.	80	1	10

After training, only 70% of participants (7 people) remained below 70, while the remaining 30% (3 people) managed to achieve a score >70.

Comparison of Frequency Values Before and After: Analysis of Pre-test and Post-test Results of Solar Panel Application

After analyzing the pre-test and post-test results, there were striking differences in the frequency distribution of participants' scores. This change can be used as a significant indicator of increasing public understanding regarding solar panels after being provided with materials and training. The following is an analysis of the frequency distribution of scores before and after training:

1. Frequency of Values Before Training (Pre-test)

Distribution of Scores: In the pre-test, the majority of scores were distributed in the low score range (30–60). No participant managed to get a score >70.

Lowest score: 30 (2 participants or 20%).

Highest score: 60 (4 participants or 40%).

Class average: 49.

Distribution Analysis: Most participants converged on a score of 60, indicating that although there is potential for understanding, they are still at a basic level.

The lowest score (30) achieved by two participants indicates that there are individuals who have a very poor understanding of solar panel technology.

The percentage of 100% of participants is below 70, so it can be concluded that the community's initial understanding was still very low before the training.

2. Frequency of Values After Training (Post-test)

Score Distribution: In the post-test, participants' scores were seen to increase, both in terms of the highest score and the average score of all participants.

Lowest score: 40 (2 participants or 20%), an increase from the pre-test.

Highest score: 80 (1 participant or 10%).

Class average: 58 (up around 18% compared to pre-test).

Distribution Analysis: Participants with a score of 60 remain dominant, but the number has dropped to 3 participants, from the original 4 participants.

There were 3 participants (30%) who succeeded in achieving a score above 70, which was not previously available in the pre-test results.

The number of participants with the lowest score (40) shows that although there has been improvement, some people still need more assistance to understand this topic better.

3. Comparison Before and After Training

Significant changes can be seen from the shift in the frequency distribution of values which reflects an increase in understanding as follows:

Table 3. Analysis of changes

Category	Pretest	Posttest	Analysis of changes
<70	100%	70%	The number of participants with scores below standard (<70) was reduced by 30%.
>70	0%	30%	Three participants managed to increase their scores beyond 70, which was previously non-existent.
Lowest Value	30 (20%)	40 (20%)	The lowest score increased by 10 points, indicating a better level of basic understanding.
The highest score	60 (40%)	80 (10%)	The highest score increased by 20 points, indicating an increase in participants who understood the concept well.

4. Improved Interpretation

An increase in the frequency of this value indicates the effectiveness of the training carried out:

Practical and interactive training methods (such as practicing installing solar panels)

help participants apply theory directly, so it is easier to understand than just theory.

The increase in scores ranging from 10 to 20 points for the majority of participants reflects the success of the modules and materials in increasing their understanding of solar energy-based technology.

Reducing the percentage of participants with scores below the average (<70) from 100% to 70% is a good initial indicator in strengthening community competence.

Even though there was a significant increase, there were still 70% of participants who scored <70. To drive better results in the future, the following steps need to be considered:

Periodic Assistance: Re-evaluation of participants with low scores through small group discussions or question and answer sessions.

Material Enrichment: Emphasis on subjects that are most difficult for participants to understand, such as installation of solar panel components.

Repeated Practice: Provides more opportunities for direct practice, because this method is proven to have a positive impact on participants.

CONCLUSION

Comparison of the pre-test and post-test results shows a significant increase in participants' understanding regarding solar panel lighting. The decrease in the number of participants with a score of <70 and an increase in the >70 category confirms the effectiveness of this training. However, follow-up is still needed to improve the abilities of groups with low scores and ensure community competence as a whole.

The implementation of a solar panel-based lighting system at Madinathul Ilmi School in Muara Gembong District has proven effective in providing adequate and sustainable lighting. This system not only provides economic benefits but also contributes to environmental conservation. Further research can be carried out to examine the potential for developing this system in other schools in remote areas.

ACKNOWLEDGEMEN

Special thanks go to Jakarta State University for funding this community service activity. Thanks were also expressed to the parties who helped carry out community service in Muara Gembong District.

BIBLIOGRAPHY

Dhion Khairul Nugraha, Herman Budi Harja, Haris Setiawan, Dini Hadiani, & Muhamad Fathurohman. (2023). *Pemasangan Penerangan Jalan Umum Tenaga Surya (PJU-TS) di Desa Sukamandi, Sagalaherang, Subang*.

Fatkhurrozi, B., Nawawi, I., Jaya Saputra, T., & Tidar Jl Kapten Suparman, U. (2019). *Pemasangan Lampu Penerangan Jalan Berbasi Pembangkit Listrik Tenaga Surya (Plts Di Dusun Gentan Desa Purwosari Kecamatan Tegalrejo Kabupaten Magelang*.

MAKKULAU, A., Mauriraya, K. T., Afrianda, R., & Pasra, N. (2021). Pengembangan Lampu Jalan Umum Dengan Listrik Tenaga Surya Di Desa Cilatak Kecamatan Ciomas Kabupaten Serang Banten. *TERANG*, *3*(2), 171–176. https://doi.org/10.33322/terang.v3i2.1025

Pujianto, Asepta Surya Wardhana, & Astrie Kusuma Dewi. (2022). *Pelatihan Dan Pembuatan Pembangkit Listrik Tenaga Surya (PLTS) Untuk Penerangan Jalan di Masyarakat*.

Putri, T. W. O., Senen, A., & Simamora, Y. (2019). Pemanfaatan Energi Surya untuk Penerangan Jalan & Fasilitas Umum di Desa Sukarame Kab. Lebak Banten. *TERANG*, *1*(2), 128–136. https://doi.org/10.33322/terang.v1i2.369

Ramadhani, Y., Supriyanti, R., & Aliim, M. S. (2023). PPM Penerangan Tenaga Surya Untuk Fasilitas Umum Bagi Warga Desa Blater Dan Desa Sidakangen Kalimanah Purbalingga. *RENATA: Jurnal Pengabdian Masyarakat Kita Semua*, *1*(2). https://doi.org/10.61124/1.renata.8

Setiawan, A., Lilbilad, W. M., Nurmanwala, E., Safitri, S. D., Syahra, N. A., Hidayah, D.

Q., & Artikel, R. (2022). *Tenaga Surya sebagai Solusi Penerangan Jalan Umum Di Desa Girikerto Kecamatan Turi Kabupaten Sleman*. https://ejournal.unib.ac.id/index.php/icomes/index

Shomad, M. A., & Nurisna, Z. (2021). Pemanfaatan Listrik Tenaga Surya Sebagai Penerangan Di Jalan Desa Pedukuhan Plumbon Banguntapan. *Prosiding Seminar Nasional Program Pengabdian Masyarakat*. https://doi.org/10.18196/ppm.32.182