Village Street Lighting with Solar Cells and Counseling on Electricity & EBT for the Cikembang Caringin Community, Sukabumi Regency

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ABSTRACT

Street lighting is an important aspect in the lives of rural communities. However, the Cikembang Caringin area in Sukabumi Regency still faces challenges in providing efficient and sustainable street lighting. To overcome this problem, this study was carried out with the aim of implementing solar cells as an alternative source of street lighting and providing education about electricity to the local community. The results of this study show that the implementation of solar cells as a source of street lighting in Cikembang Caringin provides positive results. Street lighting produced from a solar cell system is able to provide sufficient light for the community at night, thereby providing a sense of security and comfort for local residents.The education about electricity, namely the dangers of short circuits and also about Renewable Energy provided by Pak Anang and Pak Tyo, had a positive impact in increasing public awareness of the wise and sustainable use of energy. It is hoped that the findings from this research can be an inspiration for the development of renewable energy-based street lighting in other rural areas.

KEYWORDS
Cikembang;
Electricity Education;
EBT;
Sukabumi;
Nusaputra

1. Introduction

Street lighting is a crucial aspect in people's lives, especially in rural areas such as Cikembang Caringin, which is located in Sukabumi Regency. Adequate lighting on village streets not only provides security for residents, but also facilitates social and economic activities at night. However, adequate street lighting is often a challenge in remote areas such as Cikembang Caringin, due to limited or no access to electricity. Efforts to improve street lighting in rural areas have become a concern for many researchers and local governments. Renewable energy sources, especially solar energy, have been identified as an attractive alternative to meet lighting needs in remote areas. Solar cells offer various advantages, including ease of installation, low operational costs, and minimal environmental impact.

Solar cells have been widely studied by previous researchers for reference in applications in community service. Improving the efficiency and stability of CsPbBr3 perovskite solar cells via a modified multi-step coating method was researched by Che [1]. A Surface Cover Layer Prepared from Large Tetradodecylammonium Bromide as an Efficient Perovskite Passivation Layer for High Performance Perovskite Solar Cells was researched by Abate [2]. Exciton–Phonon Coupling and Low Energy Emission in 2D and Quasi-2D BA 2 MA n –1 Pb n I 3 n +1 Thin Films with Better Phase Purity were investigated by Shen [3].

The synthesis of chitosan-based perylene dyes for photovoltaic solar cell applications was researched by Kumar [4]. Synthesis of Conjugated Bis-Schiff Bases and Their Complexes as Dye-Sensitizers for Dye Sensitized Solar Cell (DSSC) Applications was researched by NURSYAFIRA [5]. Machine Learning-Aided Development of Organic Solar Cell Materials: Problems, Analysis, and Insights researched by Miyake [6].

The synergistic effect of additives inducing increased resistance to bending and self-healing properties for efficient flexible perovskite solar cells was investigated by Lei [7]. The effect of reducing agents on the coprecipitation synthesis of reduced titanium dioxide/graphene oxide composite materials

to improve the performance of dye-sensitive solar cells was investigated by Van Cuong [8]. High Efficiency Sb 2 Se 3 Solar Cells Modified by Potassium Hydroxide were researched by Guo [9].

Mesoporous Ti-substituted NiO nanosheets as an efficient electrocatalyst for triiodide reduction in dye-sensitive solar cells were investigated by Gunasekaran [10]. Suppression of PbI2 decomposition with the Lewis base semicarbazide hydrochloride for stable and efficient perovskite solar cells was investigated by H. Wang [11]. Grain Orientation Mapping in 2D Perovskite Thin Films using Low Frequency Polarized Raman Microspectroscopy was studied by Toda [12].

The influence of benzene-based dyes on the optothermal properties of the active layer of ternary organic solar cells was investigated by Lewinska [13]. The alloys In 2 Se 3 , In 2 Te 3 , and In 2 (Se,Te) 3 as Photovoltaic Materials were researched by Li [14]. Introduction of 4-hydroxybenzaldehyde as interface modifier with multidimensional defects passivation effect for high-performance perovskite solar cells was researched by Wu [15].

How do carbon dots with terminal amines help perovskite solar cells work better? researched by Luo [16]. The Evolution of Structure and Optoelectronic Properties During Vapor Deposition of Halide Perovskites was investigated by Held [17]. The electronic structure and surface stability of (0 0 1) double halide perovskite Cs2AgBiBr6 were investigated by Zhou [18].

Nose-to-brain translocation and nervous system injury in response to indium tin oxide nanoparticles from long-term low dose exposure were studied by Pang [19]. Reducing the Voltage Loss of Organic Solar Cells to Energy Modification by Thermal Stress was researched by L.-H. Wang [20]. Optoelectronically Augmented Phosphorus Nanoribbons for Enhanced Hole Extraction was researched by Macdonald [21].

Reducing energy disturbances by stabilizing the octahedral lattice with thiocyanate for an efficient and stable Sn-Pb mixed perovskite solar cell was researched by Hu [22]. Conformal 1D Imidazolium Perovskite Cover Layer Stable 3D Perovskite Film for Efficient Solar Modules was researched by Chen [23]. Emerging Hetero-anionic Materials: Perovskite Oxychalcogenide was researched by AHN [24].

Formamidine formate as a multifunctional modulator at buried interfaces for efficient FAPbI3 perovskite solar cells was investigated by Wang [25]. Pure 2D Perovskite Formation with Interface Engineering Generating High Open Circuit Voltages in excess of 1.28 V for 1.77-eV Wide-Bandgap Perovskite Solar Cells was investigated by He [26]. Emerging Hetero-anionic Materials: Perovskite Oxychalcogenide was researched by Penezko [27].

Experimental and theoretical studies of electrodeposited CuInS2 thin films for solar cell applications were investigated by Boulkaddat [28]. Low power consumption PV electrolysis with CoFeP nanowires for hydrazine-assisted hydrogen production was investigated by Roh [29]. High-performance carbon-based CsPbI2Br perovskite solar cells via small molecule modification were researched by Han [30].

The aim of this service is to implement a solar cell-based village street lighting system in Cikembang Caringin, Sukabumi Regency, as an efficient and sustainable solution. In this context, we also aim to provide education about electricity to local communities, so that they can understand the benefits of using electrical energy wisely and sustainably.

Education about electricity is considered very important because apart from helping people adopt solar cell technology, it also aims to increase awareness of the importance of using renewable energy sources to reduce the negative impacts of climate change due to fossil fuels. By increasing people's understanding of electricity, it is hoped that behavioral patterns will emerge that are more oriented towards efficient and environmentally friendly energy use.

In this service, we will involve the active participation of the Cikembang Caringin community as partners in the process of implementing and evaluating a solar cell-based street lighting system. Community participation will be the key to the success of this project, because through collaboration, solutions can be found that suit local needs and conditions.

It is hoped that the results of this service will provide guidance and recommendations for local governments and other stakeholders in adopting solar cell technology for street lighting in rural areas.

Apart from that, it is hoped that it can also be an inspiration for the development of similar initiatives in other areas, in order to create a more sustainable and environmentally friendly environment.

2. Method

2.1. Preliminary Study

A preliminary study was carried out to collect data and information about the existing condition of street lighting in Cikembang Caringin, including the needs and obstacles faced by the community. Field surveys, interviews with residents and local stakeholders, as well as literature reviews about solar cell technology are the methods used in this stage.

2.2. Design of a Solar Cell Based Street Lighting System

Based on the results of a preliminary study, a solar cell-based street lighting system is designed to meet lighting needs in the Cikembang Caringin area. Determining the installation points and technical specifications of the solar cells, batteries and LED lights is part of this design process.

2.3. Implementation of a Street Lighting System

The process of implementing a solar cell-based street lighting system is carried out after the design has been approved. Installation of solar cells, batteries and LED lights is carried out at strategic points that have been determined together with the active participation of the local community. The technical team will carry out the installation by involving local residents to increase their understanding and involvement in this project.

2.4. Monitoring and Evaluation

After the solar cell-based street lighting system is operational, a monitoring process is carried out to monitor the system's performance periodically. Data on solar cell productivity, battery capacity and lighting quality will be taken and evaluated to assess the efficiency and performance of the system as a whole, all carried out periodically by students, coincidentally there are students whose homes are close to the location so they can monitor.

2.5. Electrical Education

The implementation of education about electricity is carried out through social activities involving the Cikembang Caringin community. The counseling will include an explanation of the benefits of solar energy, how solar cells work, and the principles of using electrical energy efficiently and the dangers of short circuits delivered by lecturers in electrical engineering at Nusa Putra University, namely Mr. Anang Suryana and Mr. Muchtar Setyo Ali Yudono. In addition, the importance of awareness about Environmental preservation by adopting environmentally friendly technology will also be conveyed.

2.6. Data Collection and Results Analysis

Data collected from various implementation stages, including preliminary studies, system implementation, and outreach, will be processed and analyzed. This analysis will provide a comprehensive picture of the success and impact of implementing a solar cell-based street lighting system and electricity education.

2.7. Preparation of Reports and Dissemination of Results

The results of this research will be summarized in the form of a final report which includes findings, recommendations and conclusions from the research. This report will be distributed to local governments, related institutions and the public to increase awareness about the importance of street lighting based on renewable energy and efficient electricity.

By implementing a solar cell-based village street lighting system and providing education about electricity to the Cikembang Caringin community, it is hoped that sustainable, energy-saving street lighting will be achieved, as well as increasing public awareness of the importance of using energy wisely and sustainably.

3. Results and Discussion

The community service event carried out by electrical engineering students and lecturers at Nusa Putra University on 19-21 May 2023 is 7 km from campus, similar community service has been carried out twice in a row in different places, around campus by Electrical Engineering students Nusa Putra Sukabumi first semester which is a community service activity in accordance with expertise held in the last 3 years. Solar Cell Based Street Lighting System Design: Based on the results of the preliminary study, the team designed a solar cell based street lighting system consisting of solar panels, long-lasting batteries and energy-saving LED lights. In compact form, there are 2 pieces, namely with a power of 150 watts, installed on a 6 meter high pole. The installation point is chosen based on community needs and local environmental characteristics, shown in Figure 1. The picture shows that the land is being excavated for installing the solar panels.

Fig. 1. Installation of solar panels

Preparation of Outreach Materials: The research team carried out by electrical engineering lecturers at Nusa Putra University prepared outreach materials which included information about solar energy, how solar cells work, their benefits in street lighting, and the importance of using electrical energy efficiently and regarding the dangers of short circuits as shown in Figure 2. The picture shows that before doing the counseling they took a photo together. The material also includes education about sustainable energy (EBT) and ways to utilize renewable energy sources.

Fig. 2. Some new students are carrying out community service activities

Extension Activities: The extension team held social activities in Cikembang Caringin village, involving the community in discussions and question and answer sessions about electricity and sustainable energy. In this activity, participants were given an in-depth understanding of the importance of adopting renewable energy and how solar cell technology can be a solution for street lighting.

Assistance and Knowledge Diffusion: After the outreach activities, the team continues to communicate and interact with the community to provide assistance and answers to questions that may arise after the outreach activities, for example how to maintain village road lighting with solar panels and what if you want to install other village road lighting. Apart from that, the diffusion of knowledge about electricity and NRE is carried out through educational materials which are distributed widely in the village environment.

Results of Solar Cell Lighting and Education on Electricity and Sustainable Energy:

Village Street Lighting with Solar Cells: The implementation of a solar cell-based street lighting system in Cikembang Caringin has succeeded in providing adequate lighting at night as shown in Figure 3. The image shows that solar cells help produce enough electrical energy for energy-saving LED lights, thereby providing efficient and sustainable lighting for society.

Fig. 3. Village street lighting with solar panels at night

Increasing Public Awareness: Electricity and sustainable energy outreach activities have succeeded in increasing public awareness about the application of sustainable technology. People are becoming more

aware of the benefits of solar energy and the importance of using energy wisely to reduce negative impacts on the environment.

Positive Impact on the Environment: Using solar energy as a source of street lighting reduces greenhouse gas emissions and other negative impacts from the use of fossil fuels and according to one village official, it also makes it easier because if you use cables from electricity poles due to the long distance, you can save 100 m of cable. . Therefore, this research contributes to environmental conservation efforts in Cikembang Caringin and its surroundings.

Development of Other Models: The successful implementation of solar cell-based street lighting and electricity education in Cikembang Caringin can be a model for other villages in Sukabumi Regency or other areas dealing with similar problems.

4. Conclusion

With the implementation of solar cell lighting and education on electricity and sustainable energy, it is hoped that the people of Cikembang Caringin can enjoy sustainable, energy-saving street lighting, as well as increase their awareness and participation in adopting sustainable technology for the sake of environmental preservation and sustainable development.

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Author Contribution

A preliminary study was carried out to collect data and information about the existing condition of street lighting in Cikembang Caringin, including the needs and obstacles faced by the community.

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Conflict of Interest

The authors declare no conflict of interest.

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