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Implementation of a Polycrystalline PV-Based PJU System to Support Mobility and Psychological Environmental Safety in Gondosuli Village

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Abstract

Public street lighting (PJU) is critical because it affects the safety and security of road users, particularly at night when appropriate lighting is required. Inadequate street illumination can be harmful to society, increasing the likelihood of accidents and street crime. Mr. Muhammad, the Head of Gondosuli Village in the Pakuniran district, underlines the need for public street lighting. In this context, public street lighting is particularly required for activities in the region at night, so that it can encourage tourism, security, accessibility, and increase community welfare because the existing street lighting in Gondosuli is very inadequate. As a result, these partners considered the development of public street lighting (PJU) as a critical necessity in the region. Polycrystalline photovoltaics (PV) are a form of solar cell that generates electricity from sunlight. Polycrystalline PV is made from a semiconductor material like silicon that has been manufactured into tiny wafers with crystals aligned in diverse directions. Solar Photovoltaic Power Generation (PLTS) systems utilize polycrystalline photovoltaics (polycrystalline PV).

Keywords: PLTS Photovoltaic Polycrystalline, Psychological Environmental Safety

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INTRODUCTION

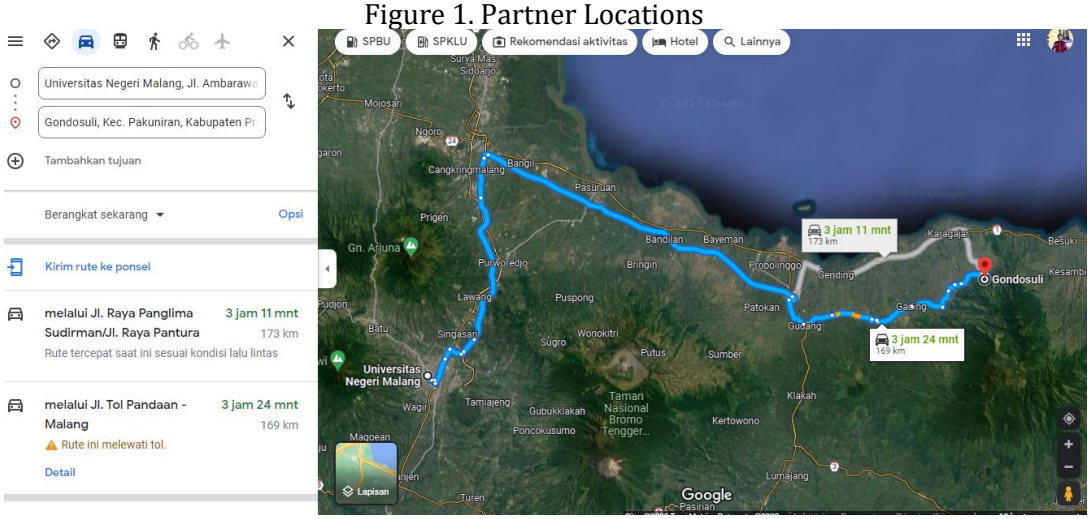
Gondosuli Village is located in the Pakuniran District of Probolinggo Regency, East Java Province, Indonesia. It is located in the highlands and has a land area of around 542.67 hectares. Gondosuli Village borders Batu Gajah Village to the north, Pakis Village to the east, Ranon Village to the south, and Bima Village to the west. It acts as a strategic connector connecting settlements. To boost the economy and strengthen the tourism industry, the Gondosuli Village Government has initiated many development programs, including providing street lights, developing tourist towns, and building supporting infrastructure such as roads and bridges.

Public street lighting is vital because it is related to the safety and security of road users, especially at night, when good lighting is required. (Abdillah dkk., 2022a; Azhari dkk., 2023; Falah, Handoko, & Kurniawan, 2023; Hartono dkk., 2021; Puriza dkk., 2021). Lack of lighting on the road can have harmful repercussions on society, including raising the likelihood of traffic accidents and the crime rate on the road. (Falah, Handoko, Syah, dkk., 2023; Handoko & Handayani, 2023; Novendra, 2021; Pulungan dkk., 2021).

Therefore, Mr. Muhammad, the chief of Gondosuli village, communicated the importance of PJU, which included:

1. Security: Public street lighting (PJU) plays a significant role in increasing security in Gondosuli Village. PJUs make it easier for cars and pedestrians to negotiate roads, obstacles, and potential hazards at night, lowering the likelihood of accidents and criminal activity in the region.

Figure 1. Partner Locations



2. Accessibility: PJU will also improve access to Gondosuli Village. With roadway and public area lighting, village people would feel more comfortable participating in outdoor activities at night, especially as Gondosuli serves as a crucial link connecting numerous communities in Pakuniran District. This will promote local economic activity while also strengthening social and cultural life in the region.
3. Tourism: Gondosuli Village has significant tourism potential, particularly natural and cultural tourism. PJU allows tourist attractions in the area to stay open later into the evening, enhancing people's income and welfare and drawing additional visitors to the area.
4. Development: PJU will also aid development in Gondosuli Village. Lighting important highways and public places will improve access to public infrastructure and services including schools, clinics, and retail malls. This will speed up economic growth in the area.

In this context, PJU is very important to be able to carry out activities in the area at night, so that it will promote the tourism sector, security, accessibility, and increase community welfare where there is limited street lighting in Gondosuli (Arrasyid, 2017; Falah, Handoko, Sujito, dkk., 2023; Handoko dkk., 2024; Hayat dkk., 2022; Lutfiah & Suyandi, 2021; Pawitra dkk., 2020; Windarta dkk., 2019). As a result, partners transmit challenges associated with PJU construction as one of the region's critical priorities (Abdillah dkk., 2022b; Ferza & Pranasari, 2020; Nadhiroh dkk., 2022; Sembiring dkk., 2023; Ullah & Oktaviandra, 2020). Figure 2 depicts a road in the Pakuniran area, namely Gondosuli village, where there is still limited public street lighting (PJU). The general option to improve lighting in this region is the installation of Public Street Lighting (PJU) supported by Polycrystalline Photovoltaic (PLTS) to make it more environmentally friendly (ADHIEM dkk., 2021; Bawano & Tumembow, 2023; Ciptayani dkk., 2020; Dermawan dkk., 2020; Falah, Syah, Handoko, dkk., 2023; Sukma dkk., 2021; Wati dkk., 2023). The PJU PLTS Polycrystalline Photovoltaic system is expected to improve illumination quality in many Pakuniran regions in Gondosuli Village.

Figure 2. Gondosuli Village Mitra Village Area

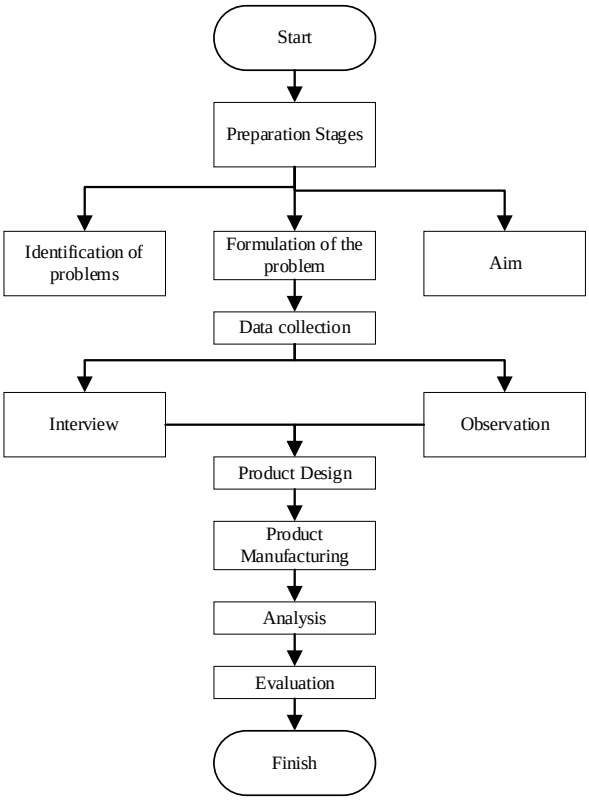
METHOD

A problem-solving framework has been established to provide solutions to Gondosuli Village, a Partner Village of Malang State University:

1. Designing PLTS power plants as PJU energy sources.
2. Testing of solar-powered PJUs installed by partners in Gondosuli Village, Pakuniran District, Probolinggo Regency. measuring includes measuring the voltage, current, and power generated by the solar panels, as well as the power produced by the lights.
3. Training for installing and maintaining PJU PLTS.
4. Evaluation is completed in stages within one month.

A solution framework was created to address the issues and solutions proposed by Gondosuli Village partners:

Figure 3. Activity Method Flow

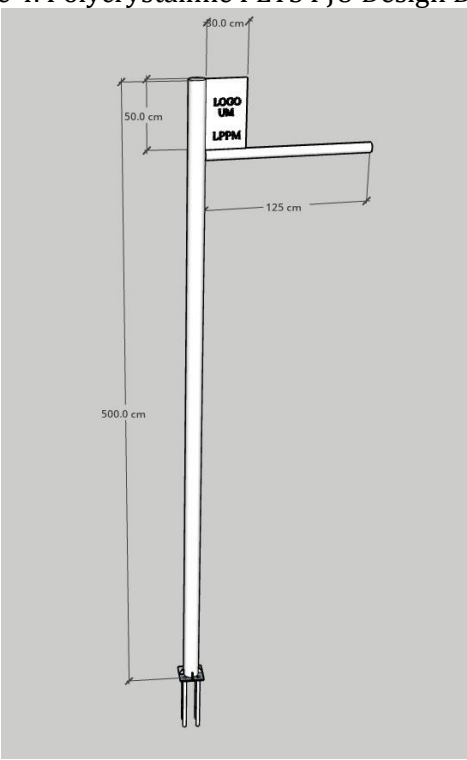


The method utilized in this service is to first create a framework. The framework will explain the implementation sequence, which will be followed by PJU PLTS installation

and maintenance training. The general implementation of this community service is as follows:

1. Observation, this activity tries to uncover partner needs. To collect the findings of the observation, the team goes directly to the partner location, conducts interviews directly with partners, and documents.
2. Preparation and design of the PJU PLTS system took two weeks and included agreements with partners, activity schedule preparation, and establishing where PJU PLTS maintenance training should be held. Design planning and system design calculations before implementation in the field, taking into account the location and observation data collected.

Figure 4. Polycrystalline PLTS PJU Design Design



3. Training and maintenance for PJU PLTS. This activity is performed immediately on location, with the following steps:
   a) PJU Energy provides training on how to install solar panels. Partners will be trained to use and maintain PJU PLTS. This mechanism will be implemented immediately in the field.
   b) Looking for a spot to install the PJU solar panels.
   c) Solar panel installation. Solar panels will need to be supported with iron during this action. The solar panels will be mounted with an iron frame. Before we begin building the frame to support the solar panels, we must determine the optimal sun angle so that the solar panels receive maximum sunlight.
   d) Installation of charger, SCC, and battery modules.
   e) Installing a charger module with SCC and battery to store electricity from solar panels.
   f) Install lights and poles at the designated sites.
   g) Final inspection, including electrical installations and pipe leaks.

4. The final examination includes electrical installation and performance testing. The system performance is examined to determine whether the solar panel installation can function well with pipe leaks.
5. Team representatives and partners handed out the PJU PLTS.
6. Documentation. This task can be completed from start to finish utilizing a camera or video.
7. Evaluation.
8. Publication.

RESULT AND DISCUSSION

In the community service program entitled "Implementation of a Polycrystalline PV-based PJU System to Support Mobility and Environmental Psychological Safety in Gondosuli Village" Significant gains were achieved in establishing a sense of security and comfort during nocturnal activities in Gondosuli Village, Pakuniran District, Probolinggo Regency. This service initiative will undoubtedly promote the tourism industry and improve community welfare. Aside from that, it can boost security, calm the economy, and lower crime rates.

This community service project will be carried out from June to July 2024, creating 9 Public Street Lighting (PJU) light poles. The PJU poles will be constructed and placed alongside locals before being dispersed to regions where they are needed to boost security and lower crime rates. Figure 5 depicts the procedure of passing over the PJU to the Gondosuli Village Head.

Figure 5. Transfer of PJU Equipment to the Head of Gondosuli Village

Figure 6. Installation Process, Training on Use and Maintenance of PJU

Figure 7. Results of PJU Installation and Testing at Night

Figure 6 depicts the activities of installing public street lighting (PJU) at certain places. At the time, the community was also trained on how to utilize and maintain PJU equipment. The places for PJU installation were chosen based on the outcomes of community discussions with the Gondosuli Village. Figure 7 shows that the PJU tool works properly and has a solid installation construction. All PJU units that have been deployed in designated areas are brightly lit at night. Every week, routine monitoring and evaluation are required to assess the performance of the installed PJU. It was demonstrated that there were no issues during the tool's one-month monitoring and evaluation period. Using energy conversion technology from polycrystalline photovoltaic (PV), it will undoubtedly become ecologically friendly energy. On the other hand, PJU's electricity use is fairly manageable. However, many public roads still lack lighting, so in the future, it is important to build more PJU units to promote mobility and environmental and psychological safety, especially for Gondosuli Village, Pakuniran District, Probolinggo Regency.

CONCLUSION

Community service activities in Gondusuli Village, Pakuniran District, Probolinggo Regency, were carried out successfully. Polycrystalline photovoltaic (PV)--based public street lighting (PJU) equipment has been installed and is performing well. All placed PJU points can brighten dark roadways, providing a sense of security and comfort when carrying out nighttime activities. The establishment of PJU may undoubtedly boost mobility and environmental psychological safety, which will have a good impact on the tourist, economy, and agriculture sectors, enhancing community welfare, and reducing crime rates. Community participation in this activity develops a sense of collaboration and expands technological knowledge that can be utilized. As the village progresses, it becomes an amazing example of combining technology, community interaction, and sustainable village development techniques to achieve positive change for the future.

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