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Implementation of Appropriate Technology Polycrystalline Photovoltaic as New Renewable Alternative Energy in Public Street Lighting (PJU) at Pakuniran Probolinggo Area

Muhammad Holqi Rizki Azhari[1*], Wahyu Tri Handoko[1], Moh. Zainul Falah[3], Milzam Rahmat Busono[1], Ghasa Faraasyatul 'Alam[1], Sucipto[1], Khotibul Umam[2]
[1]*Universitas Negeri Malang, Indonesia*
[2]*Institut Agama Islam Negeri Madura, Indonesia*

muhammad.holqi.2101328@students.um.ac.id

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Abstract

Public road lighting (PJU) in the Pakuniran area, Probolinggo, East Java, more precisely in Gondosuli Village, is not sufficient. An environment without street lighting will be like a dead zone and can occur in many cases of crime, and traffic accidents and will hurt social life at night. Therefore, the community service team at the State University of Malang (UM) through student service provided a solution to reaching the road by utilizing new, renewable energy from polycrystalline solar panels to turn on the lights at night. The results of observations and site surveys show that several points require PJU installation with polycrystalline technology. The implementation carried out in Gondosuli Village was carried out in several stages, namely: observation, preparation of PJU designs, training and maintenance, performance testing, and evaluation tools. This activity, which was completed within 2 months, resulted in 5 PJUs being placed at several points with minimal lighting conditions and received a positive response from the community.

Keywords: Public Street Lighting, Polycrystalline Photovoltaic, Gondosuli Village

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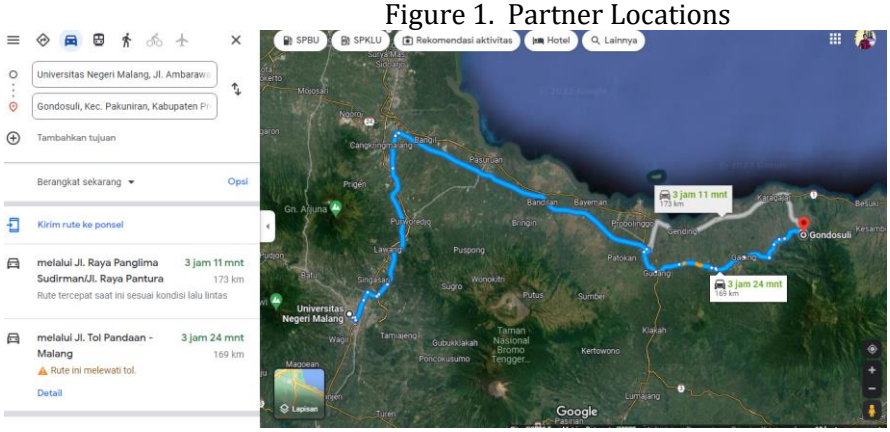
INTRODUCTION

Street lighting is designed to make life easier and help people see objects on the street at night or in dark environments. An environment without street lighting will become like a dead zone and can result in many cases of crime (Ullah & Oktaviandra, 2020), traffic accidents (Nadhiroh, Aji, Kusnadi, & Dwiyaniti, 2022) and will hurt social life at night (Hutajulu dkk., 2022). An area with good public lighting will be a better and more beautiful face of the environment. It also has a better impact on public social life. One of the regional infrastructure developments is the construction and installation of public lighting (Ferza & Pranasari, 2020). The implementation of public street lighting construction requires good planning, as well as the installation of street light lighting which has high performance and strong power, is quite light, and has low operating costs (Sukma, Azis, & Pebrianti, 2021).

Figure 1. Partner Locations



Gondosuli Village is a village located in Pakuniran District, Probolinggo Regency, East Java Province, Indonesia. This village is in the highlands and has an area of around 542.67 hectares (Sya'roni, Mulyati, & Hidayat, 2021). 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 (Sari, 2021). Gondosuli village is a strategic location to connect villages. To improve the economy and strengthen the tourism industry, the Gondosuli village government has developed several development programs, including building PJUs, developing tourist villages, and building supporting infrastructure such as roads and bridges (Abdillah, Afandi, Falah, & Firmansah, 2020; Abdillah dkk., 2022; Habibi dkk., 2022).

Village Public street lighting is one the important things because it is related to the safety and security of road users, especially at night which requires good lighting (Faiz dkk., 2023; Hartono, Prabowo, Sudarmaji, & Hariyadi, 2021; Pulungan, Hamdani, Yuhendra, & Islami, 2021). Lack of lighting on the road can have dangerous impacts on society, one of which is increasing the risk of road accidents and increasing the crime rate on the road (Lutfiah & Suyandi, 2021; Novendra, 2021). Therefore, Mr. Muhammad as the head of Gondosuli village conveyed the importance of PJU, among other things :

1. Security: PJU is very important to improve security in Gondosuli Village. With PJUs, vehicle drivers and pedestrians will more easily see the road, obstacles, and other potential dangers at night. This will help reduce the risk of accidents and criminal acts in the area (Manggalou, Nafi'ah, & Uang, 2023).
2. Accessibility: PJU will also improve accessibility in Gondosuli Village. With lights on the main roads and public areas, village residents will feel more comfortable doing activities outside the house at night because Gondosuli is a strategic area that connects several areas in the district, Pakuniran. This will facilitate local economic activities and strengthen social and cultural life in the region.
3. Tourism: Gondosuli Village has great tourism potential, especially in the fields of natural and cultural tourism. With PJU, tourist attractions in the area can remain open longer at night, thereby increasing people's income and welfare and attracting more tourists to visit.
4. Development: PJU will also support development in Gondosuli Village. Having lights on main roads and public areas will facilitate access to public infrastructure and services such as schools, clinics, and shopping centers. This will accelerate economic growth in the region.

In this context, PJU is very important to be able to carry out activities in the area at night, so that it will strengthen the tourism industry (Lestariningsih, Triono, Hidayatullah, & Wicaksono, 2023), security, accessibility and improve community welfare where there

is minimal street (Handoko & Handayani, 2023) lighting in Gondosuli. Therefore, partners convey problems related to PJU construction as one of the important needs of the region.

Figure 2. Pakuniran area of Gondosuli Village

Figure 2 is a road in the Pakuniran area, precisely in Gondosuli village, which still lacks public street lighting (PJU). Based on the results of interviews conducted with partners, several problems were found, including the need for public street lighting (PJU) (Rosalina dkk., 2023), the need for environmentally friendly equipment by implementing an environmentally friendly PLTS independent electricity source (Baskoro, Handoko, Agung, Widyartono, & Kartini, 2021; Falah, Syah, dkk., 2023), then the need for training in the use, maintenance, and repair of the technology offered (Falah, Handoko, Syah, Azizah, & Gumilar, 2023).

After seeing and considering the problems faced by partners, the service team has a solution, namely a technology or Public Street Lighting (PJU) system to provide a sense of security and comfort when carrying out activities in the area at night, so that it will strengthen the tourism industry and improve community welfare. and can improve security, facilitate the economy, encourage tourism, and reduce crime rates. Public Street Lighting (PJU) is assisted by Polycrystalline Photovoltaic PLTS to make it more

environmentally friendly (Harahap, Adam, & Oktrialdi, 2022; Pawitra, Kumara, & Ariastina, 2020; Windarta, Sinuraya, Abidin, Setyawan, & Kusuma, 2019). The hope is that the PJU PLTS Polycrystalline Photovoltaic will be able to improve the quality of lighting in several Pakuniran areas in Gondosuli Village.

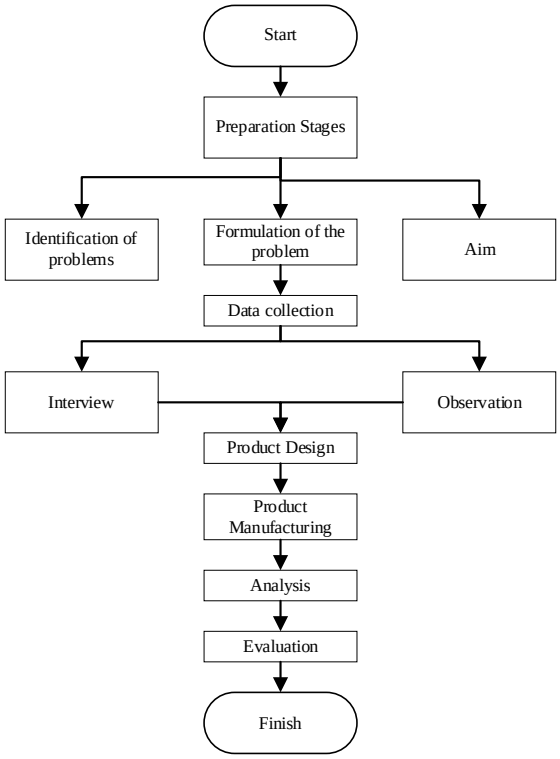
METHOD

Based on the results of discussions and literature studies with partners, the problem-solving and solutions offered together with partners are prepared with the following problem-solving framework :

1. Design of PLTS power plants as PJU energy sources. and benefits for teachers.
2. Testing of solar-powered PJUs that have been installed in Gondosuli District partners. Pakuniran, Probolinggo Regency. Testing includes testing the voltage, current, and power produced by the solar panels, and the power produced by the lights. Time available.
3. Training on installation and maintenance of PJU PLTS.
4. Evaluation is carried out in stages within 1 month.

To solve problems and solutions offered to partners in Gondosuli Village one of the areas in the Pakuniran area, an activity method was prepared as in Figure 3.

Figure 3. Activity Method Flow



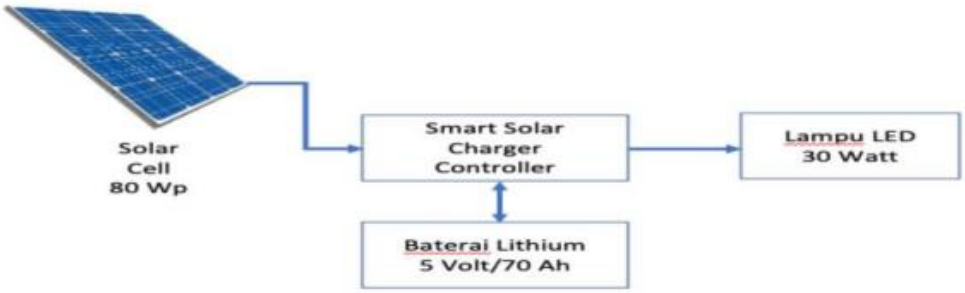
The method used in this service is, first, by creating a framework. The framework will explain the sequence that will be implemented, followed by training on the installation and maintenance of PJU PLTS. In general, the implementation of this community service is as follows:

1. Observation, this activity aims to find the partner's needs, to get the results of the observation the team goes directly to the partner's location, conducts interviews directly with the partner, and carries out documentation (Arisanti & Al Islamiyah, 2020).
2. Preparation and design of the PJU PLTS system, this activity was carried out for 2 weeks including, agreements with partners, preparation of activity schedules, and determining placement of PJU PLTS maintenance training. Design planning and

system design calculations before implementation in the field by considering the location and observation results that have been obtained.

Figure 4. Polycrystalline PLTS PJU Design Design

Figure 5. Polycristaline PLTS PJU installation



3. Training and maintenance of PJU PLTS. This activity is carried out directly on location, with the following steps:
   a) Training on installing solar panels as PJU energy. Partners will be guided to be able to use and maintain PJU PLTS. This mechanism will be carried out directly in the field.
   b) Looking for a location to install PJU solar panels.
   c) Solar panel installation. In this activity, solar panels require iron support. The solar panels will be installed using an iron frame. Before starting to make the frame to support the solar panels, we must find the optimum sun angle so that the solar panels receive maximum sunlight.
   d) Installation of charger, SCC, and battery modules.
   e) Installation of a charger module with SCC and battery for power storage from solar panels.
   f) Install lights and poles at location points.
   g) Final check, including electrical installation and pipe leaks.
4. Performance testing. The system performance is tested to find out whether the solar panel installation can work properly.
5. The handover of the PJU PLTS was carried out by team representatives and partners.
6. Documentation: This activity can be carried out from start to finish using a camera or video.

7. Evaluation.
8. Publication

RESULT AND DISCUSSION

The community service program entitled "Implementation of Appropriate Technology Polycrystalline Photovoltaic As New Renewable Alternative Energy in Public Street Lighting (PJU) in Pakuniran Probolinggo Area" produced significant results with broad implications. The main aim of this program is to provide a sense of security and comfort when carrying out activities in the area at night so that it will strengthen the tourism industry and improve community welfare as well as increase security, facilitating the economy, encouraging tourism, and reducing crime rates.

This community service activity will be carried out from May to June 2023 by producing 5 Public Street Lighting (PJU) light poles. The PJU poles will be assembled and installed with residents and will later be distributed to areas that are needed or are dark but are often passed by people during their activities. Figure 6 shows the process of handing over PJU equipment to the Gondosuli village head who represents the Pakuniran area.

Figure 6. Handover of Tools to the Head of Gondosuli Village

Figure 7. Installation Process and Training on Use and Maintenance of PJU Equipment

Figure 8. Results of PJU Installation and PJU Testing at Night

Figure 7 is documentation in the field during the installation of Public Street Lighting (PJU). At that time, training was also carried out on the use and maintenance of equipment with the community so that they would know about operating the equipment. In terms of placement of PJU installations, it has been determined by the community through the results of an agreement.

Figure 8 shows that the PJU equipment is functioning properly and the construction installation is sturdy. All PJU units installed are brightly lit at night. Routine monitoring and evaluation are also needed every week to see the performance of PJU. It was proven that during the 2 months of monitoring the tool, there were no problems. By utilizing energy conversion technology from polycrystalline solar panels, the electrical power consumption at PJU can be met very well. However, there are still many public road areas that do not have lighting. So in the future, it is necessary to add several other PJU units to meet the need to increase the feeling of safety and comfort.

CONCLUSION

Community service activities carried out in Gondosuli Village, Pakuniran District, Pobolinggo Regency have been completed very well. Public Street Lighting Equipment (PJU) using polycrystalline-type solar panels has been installed with good performance. All PJU points that have been installed can light up dark roads. The positive results provide a sense of security and comfort in carrying out activities in the area at night it will strengthen the tourism industry and improve community welfare and can increase security, facilitate the economy, encourage tourism, and reduce crime rates. Community involvement in this activity also fosters a sense of collaboration and shared learning, thus further strengthening the impact of technology. As the village progresses this initiative becomes an exciting example of how the harmonious integration of technology, community involvement, and sustainable agricultural practices can produce lasting positive change.

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