

***ELECTRIC BIKES FOR GREEN MOBILITY IMPROVEMENT IN GILI IYANG,
MADURA***

**SEPEDA LISTRIK UNTUK PENINGKATAN MOBILITAS HIJAU DI GILI
IYANG, MADURA**

Yoga Uta Nugraha¹, M. Syahril Mubarak¹, Retna Apsari*¹

*¹ Fakultas Teknologi Maju dan Multidisiplin, Universitas Airlangga

*e-mail: yoga.uta.n@ftmm.unair.ac.id

Abstract

This community service program is implemented in an island region that has limited access to electricity and fuel. This program is implemented on Gili Iyang Island, Sumenep, Madura. On the island, the only mode of transportation available is motorbikes and three-wheeled motorbikes due to limited and narrow roads. The price of gasoline reaches two to four times the normal price. Based on these conditions, the issue raised in this community service program is the use of electric bicycles for mobility, with the hope that it can also be a means of supporting the main tourist attraction of the island known as "Oxygen Island". This program is training for the community on how to assemble and maintain electric bicycles. The electric bicycles used in this program are designed with compact and flexible advantages, equipped with lithium batteries with a range of up to 30 km. In addition, there is a pedal assist feature to make it easier to pedal when needed, such as when going uphill or crossing sandy roads. For recharging electric bicycles, a solar shelter is provided, which helps save transportation costs. Training is provided through theoretical and practical materials. Participants can directly implement the theory that has been conveyed when practicing assembling bicycles. Based on the results of the pre and post tests, in general, there was an increase of 17-50% in the knowledge and skills of participants related to the assembly and maintenance of electric bicycles. This is a very strong belief that the Gili Iyang community has been able to use and maintain electric bicycles.

Keywords: *Electric Bike; Renewable Energy Sources; Gili Iyang.*

Abstrak

Program pengabdian masyarakat ini dilaksanakan di wilayah kepulauan yang memiliki keterbatasan akses listrik dan bahan bakar. Program ini dilaksanakan di Pulau Gili Iyang, Sumenep, Madura. Di pulau tersebut, satu-satunya moda transportasi yang tersedia adalah sepeda motor dan sepeda motor roda tiga karena keterbatasan dan sempitnya jalan. Harga bensin mencapai dua hingga empat kali lipat dari harga normal. Berdasarkan kondisi tersebut, isu yang diangkat dalam program pengabdian masyarakat ini adalah pemanfaatan sepeda listrik untuk mobilitas, dengan harapan dapat juga menjadi sarana pendukung daya tarik wisata utama pulau yang dikenal sebagai "Pulau Oksigen". Program ini adalah pelatihan bagi masyarakat tentang cara merakit dan perawatan sepeda listrik. Sepeda listrik yang digunakan dalam program ini didesain dengan keunggulan kompak dan fleksibel, dilengkapi dengan baterai lithium dengan jangkauan hingga 30 km. Selain itu, terdapat fitur pedal assist untuk memudahkan mengayuh saat dibutuhkan, seperti saat menanjak atau melintasi jalan berpasir. Untuk pengisian ulang daya sepeda listrik, disediakan solar shelter, yang membantu

Received 29 October 2024; Received in revised form 5 May 2025; Accepted 29 May 2025; Available online 19 June 2025.

 [10.20473/jlm.v9i2.2025.215-222](https://doi.org/10.20473/jlm.v9i2.2025.215-222)



Copyright: © by the author(s) Open access under CC BY-SA license
[Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/)

menghemat biaya transportasi. Pelatihan diberikan melalui materi teori dan praktek. Peserta dapat secara langsung mengimplementasikan teori yang telah disampaikan saat praktek merakit sepeda. Berdasarkan hasil pre dan post test, secara umum, terdapat peningkatan 17-50% terhadap pengetahuan dan kemampuan peserta terkait dengan perakitan dan perawatan sepeda listrik. Hal tersebut menjadi keyakinan yang sangat besar bahwa masyarakat Gili Iyang telah mampu menggunakan dan merawat sepeda listrik.

Kata kunci: Sepeda Listrik; Energi Tak Terbarukan; Gili Iyang.

INTRODUCTION

Gili Iyang Island as one of the best tourist destinations in Sumenep Regency offers tourism with the concept of going around several tourist spots in one day. The island is famous for its high oxygen air content. In addition, overnight packages are also offered for tourists who want to enjoy the sensation of the "oxygen" island at night and in the morning through tracking or cycling activities (Megantoro, Kusuma, et al., 2024; Wirawan et al., 2023). The potential for new renewable energy sources is also promising, especially wind and solar. These sources are abundant and well-suited to Indonesia's geographic and climatic conditions, particularly in island regions like Gili Iyang that receive high solar irradiation and steady coastal winds. Investing in solar and wind energy can reduce dependency on fossil fuels, lower greenhouse gas emissions, and improve energy resilience for remote communities (Megantoro, Syahbani, et al., 2024). Tourism with electric bicycles, or often called "e-bike tourism," is a tourism concept that combines the use of electric bicycles to explore tourist destinations (Ahmad & Harun, 2023). An electric bicycle is a conventional bicycle equipped with an electric motor, which allows the rider to pedal the bicycle with the help of an electric motor. Electric bikes are generally more environmentally friendly than conventional motor vehicles (Plazier et al., 2023). They produce lower carbon emissions and help reduce air pollution. With the help of an electric motor, E-bikes make traveling easier and allow people who may not have high physical fitness to explore tourist destinations more comfortably (Bardi et al., 2019).

Fuel costs in Gili Iyang can reach up to 2 times, which is certainly burdensome for residents. On the other hand, the price of electricity in Gili Iyang is no different from other places, so this is a potential for motorcycle electrification in Gili Iyang because the cost of transportation energy is more affordable (ZAIFUDDIN, 2017). Based on the benefits above, electric bicycles are very important to support tourism in Gili Iyang, Madura. In addition, to support the sustainability of electric bicycles "E-bike" on Gili Iyang Island, therefore in this program one of the agendas that is an important concern is the maintenance of Solar Shelter, as a means of charging stations for electric bicycles or charging telecommunications devices has been installed in the Batu Canggih tourist area, Banraas Village, Gili Iyang (Wisata Gili Iyang, n.d.). So that it can support the tourism program with free charging from the solar shelter electricity source. The solar shelter unit has been installed and operating for almost 8 months so that a monitoring and checking process needs to be carried out to determine the performance conditions related to solar panels, batteries and DC and AC charging systems (Rumbayan et al., 2025). To support the facilities and infrastructure that have been mentioned, efforts are needed to educate local residents through electric bicycle assembly and maintenance workshops so that local residents can maintain and extend the sustainability of these facilities and infrastructure (Prastio et al., 2023). This activity was carried out by directly involving young people in Gili Iyang to be able to participate in assembling electric bicycles so that with direct

practice it is hoped that they can better recognize the components of electric bicycles and of course understand the parts that will require regular maintenance so that if there are electric bicycles for tourism, young people can carry out regular maintenance to maintain tourism services and the condition of electric bicycles in the best condition (Putri et al., 2024).

COMMUNITY SERVICE METHOD

Several solutions have been obtained by FTMM Unair, including the Gili Iyang Tourism Awareness Group (Pokdarwis) which can make electric bicycles one of the new tourism services based on health and zero emissions (Ach. Aslim et al., n.d.). The current condition is that tourists in Gili Iyang use conventional 3-wheeled motorbike transportation that uses fuel so that it is hoped that the use of electric bicycles can maintain the quality of oxygen in Gili Iyang (Musleh, 2023). Of course, an evaluation needs to be carried out regarding the selection of routes, duration of the tour and the number of electric bicycles, but at least it can be a new attraction for tourists in Gili Iyang (Shyrida & Tamara, n.d.). The addition of facilities will accompany the increase in the number of visitors to Gili Iyang. In addition, through the electric bicycle workshop, young people in Gili Iyang are able to become agents of change for the maintenance and repair of both electric bicycles and electric motorbikes (Lijo et al., 2023). This is due to the increasing number of electric motorbike users in Gili Iyang which must be followed by the community's ability regarding maintenance and assembly. This program was implemented in March 2023 on Gili Iyang Island. The workshop was carried out with theoretical and practical materials. The theoretical presentation material was carried out for 60 minutes covering the types, functions and troubleshooting of each component on an electric bicycle, In the method of application section, clearly and concisely describe the method used to achieve the goals set in the community service activities. The results of this service must be measurable and the authors were asked to explain the measuring instruments used both descriptively and qualitatively. Explain how to measure the level of achievement of the success of community service activities. The level of achievement can be seen from the attitude, socio-cultural and economic changes of the target community (Putri et al., 2024).



Figure 1. Sharing session about electric bike.

Then, practical material with participants directly assembling electric bicycles with the guidance of trainers from the FTMM Unair team. Assembly begins by installing the dynamo on the rear wheel and installing the front wheel. The battery system wiring and display are installed on the bicycle chassis and bicycle handlebar area. The contribution of the surrounding community by attending and preparing assembly equipment can be realized as an in-kind from the community to support the electric bicycle workshop activities to be realized and completed with the target of related bicycles and can be used directly.



Figure 2. Final assembly process.

The image shows a group of people gathered outdoors at night, working together on repairing or assembling a bicycle. Several individuals, including young men and possibly students, appear to be intently focused on the task, while one person holds a flashlight to illuminate the area. The setting includes a simple building and trees in the background, giving the scene a community-oriented, hands-on learning atmosphere. Some of the participants are wearing traditional attire, indicating a cultural or local community gathering where practical skills are shared and taught collaboratively. The availability of Pokdarwis to offer electric bicycle tour packages is also a media for future evaluation regarding the performance and reliability of the design plan to obtain an electric bicycle design that is in accordance with road conditions and the needs of the community in Gili Iyang.

RESULTS AND DISCUSSIONS

Pre-test and post-test materials were provided to evaluate the understanding of workshop participants covering theoretical and practical materials on assembling electric bicycles (Damayanti et al., 2023). These materials served as tools to measure the effectiveness of the training program in enhancing participants' knowledge and skills. The theoretical section included topics such as electric drive systems, battery configuration, and safety protocols, while the practical section focused on hands-on activities like component

installation and wiring. Based on the evaluation results, there was a significant increase in participants' comprehension, with score improvements ranging from 17% to 50%. This positive outcome indicates that the workshop succeeded in transferring knowledge and building technical competencies among the attendees. The overall trend of improvement is illustrated clearly in the graph below, demonstrating the impact of structured and interactive learning methods.

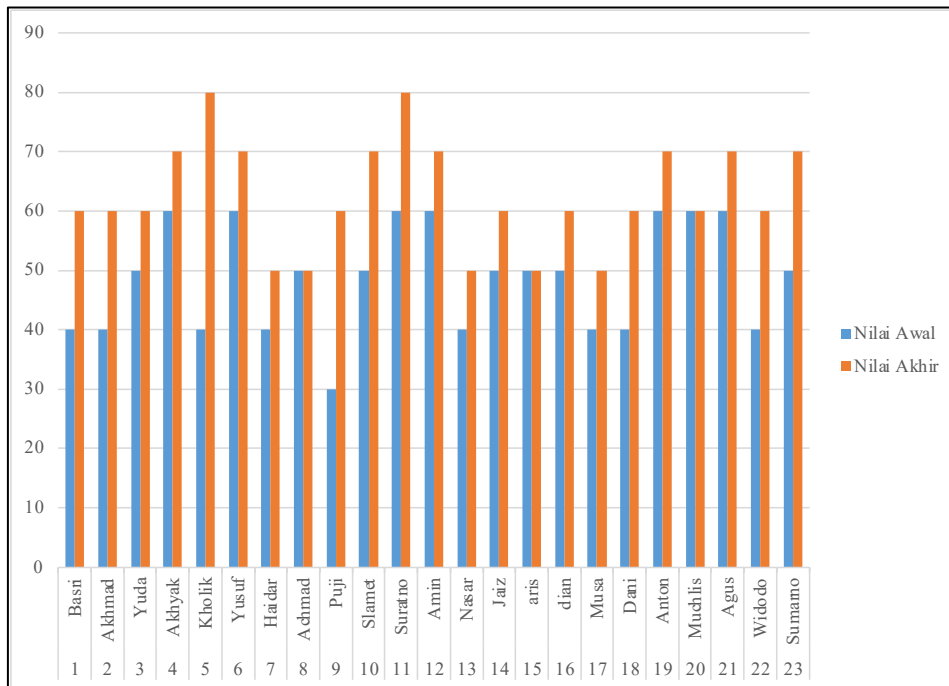


Figure 3. Chart result performance.

Based on the comparison graph of the initial and final scores of the electric bicycle assembly training participants, there is a significant increase in almost all participants. This graph reflects the results of the pre-test and post-test conducted as part of the evaluation of understanding of theoretical and practical materials during the training. The initial score (blue) shows the participants' knowledge before the training, while the final score (orange) describes the results after the training session is completed. Most participants experienced an increase in scores ranging from 17% to 50%, depending on the initial level of understanding of each individual. For example, participants such as Suranto and Kholik showed a sharp increase, from an initial score of around 50 to a final score approaching 80. This increase shows the effectiveness of the training method used, both in delivering theoretical material and direct practice in the field.

This average increase shows that the training has succeeded in providing a better understanding related to the technical aspects of electric bicycle assembly. In addition, these results can also be the basis for training organizers to conduct further evaluations and develop a more targeted curriculum according to the needs of the participants. Thus, this training has made a real contribution to increasing the capacity of human resources in the field of electric vehicle technology. The majority of participants were able to get an increase in value at the end of the workshop session so it can be concluded that the ability to understand the theoretical and practical materials was well received. The challenge faced was using technical terms that usually use English must be adjusted to

Indonesian and even use regional languages (Madura). Then the reliability of the electricity network and the availability of electricity affect the quality of the internet connection which is a challenge for the surrounding community to get information through online media.

CLOSING

Simpulan. FTMM Unair which has been implemented on Gili Iyang Island with a series of activities including routine maintenance of Solar Shelter and electric bicycle workshop for the youth community in Gili Iyang. Solar Shelter is still functioning well and normally can help the community and tourists in Batu Canggih when running out of electricity for mobile phones and cameras. The workshop activity was carried out with 30 participants from the youth community in Gili Iyang which took place with the presentation of theoretical material then continued with direct practice of assembling electric bicycles. Based on the results of the post-test, there was an increase in the knowledge of workshop participants in recognizing electric bicycle components so that they could independently carry out maintenance for electric bicycles in Gili Iyang. The output achievements of this program make Gili Iyang a fostered village that requires support from various parties to be able to provide real solutions from various fields. Economic potential is formed by being able to open a workshop to repair electric bicycles independently in Gili Iyang so that it can generate additional income.

Saran. The Gili Iyang community needs to be more open and contribute to every community service activity so that a sustainable process occurs.

ACKNOWLEDGEMENT

The author would like to thank Pengabdian Masyarakat 2022 Airlangga University who have provided financial support for the service that has been carried out.

REFERENCES

- Ahmad, N., & Harun, A. (2023). Reasons for tourist intention to use e-bike sharing services; an application behavioral reasoning theory (BRT). *Tourism Review*. <https://doi.org/10.1108/TR-03-2023-0165>.
- Bardi, A., Mantecchini, L., Grasso, D., Paganelli, F., & Malandri, C. (2019). Flexible Mobile Hub for E-Bike Sharing and Cruise Tourism: A Case Study. *Sustainability* 2019, Vol. 11, Page 5462, 11(19), 5462. <https://doi.org/10.3390/SU11195462>.
- Damayanti, R., Lutfiya, I., Wahyu Kusuma Wardani, R., Studi Keselamatan dan Kesehatan Kerja, P., Vokasi, F., & Airlangga, U. (2023). EFFORTS TO INCREASING WORKER'S KNOWLEDGE ABOUT OBESITY IN THE MANUFACTURING SECTOR. *Jurnal Layanan Masyarakat (Journal of Public Services)*, 7(3), 361–368. <https://doi.org/10.20473/JLM.V7I3.2023.361-368>.
- ZAIFUDDIN. (2017). *PENENTUAN POLA OPERASI BERDASARKAN ANALISIS BEBAN KERJA PEMBANGKIT LISTRIK TENAGA DIESEL DI PULAU GILI*

IYANG.

- Lijo, R., Quevedo, E., & Castro, J. J. (2023). Qualitative Assessment of the Educational Use of an Electrical Engineering YouTube Channel. *EDUNINE 2023 - 7th IEEE World Engineering Education Conference: Reimagining Engineering - Toward the Next Generation of Engineering Education, Merging Technologies in a Connected World, Proceedings*. <https://doi.org/10.1109/EDUNINE57531.2023.10102890>.
- Megantoro, P., Kusuma, H. F. A., Perkasa, S. D., Syahbani, M. A., Salmahuda, M. K., Rachmadani, B. F., Apsari, R., Nugraha, Y. U., Ghani, M., & Prastio, R. P. (2024). Analysis distribution of oxygen and carbon dioxide concentration as air quality indicators in Gili Iyang Island, Madura, Indonesia. *AIP Conference Proceedings*, 3047(1). <https://doi.org/10.1063/5.0194116/3179807>.
- Megantoro, P., Syahbani, M. A., Perkasa, S. D., Kusuma, H. F. A., Salmahuda, M. K., Rachmadhani, B. F., Apsari, R., Nugraha, Y. U., Ghani, M., & Prastio, R. P. (2024). Analysis of wind and solar energy potential of coastal island in East Madura (Case study: Gili Iyang island). *AIP Conference Proceedings*, 3047(1). <https://doi.org/10.1063/5.0194117/3179811>.
- Musleh, M. (2023). Tata Kelola Wisata Pulau Gili Iyang: Perspektif Community Based Tourism. *Journal of Contemporary Public Administration (JCPA)*, 3(1), 42–50. <https://doi.org/10.22225/jcpa.3.1.6853.42-50>.
- Ach. Aslim, Mukhlishi, & Suluh Mardika Alam. (2021). *OPTIMALISASI PENGELOLAAN WISATA KESEHATAN DALAM MENINGKATKAN KESEJAHTERAAN MASYARAKAT DI DESA BANCAMARA GILI IYANG DUNGKEK SUMENEP.*
- Plazier, P., Weitkamp, G., & van den Berg, A. (2023). E-bikes in rural areas: current and potential users in the Netherlands. *Transportation*, 50(4), 1449–1470. <https://doi.org/10.1007/S11116-022-10283-Y/TABLES/4>.
- Prastio, R. P., Megantoro, P., Galih Satrio, J., Nurkhotib, I., Atthama, N., Sukmawan, I. H., Rachman, R. N., & Mutiarso, I. R. (2023). CAPACITY EXPANSION AND INSTALLATION OF SURGE PROTECTION DEVICE IN SOLAR POWER PLANT SYSTEM FOR HYDROPONICS FARMER. *Jurnal Layanan Masyarakat (Journal of Public Services)*, 7(1), 151–160. <https://doi.org/10.20473/JLM.V7I1.2023.151-160>.
- Putri, B., Pratiwi, P., Kartina, A., Hady, F., Alya, G., Tasya, I., Irham, M., Putri, N., Izzuddin, N., Khalilah, N., Jawda, R., Psikologi, F., & Airlangga, U. (2024). COMMUNITY EMPOWERMENT AND SUSTAINABLE TOURISM: THE IMPLEMENTATION OF COMMUNITY-BASED TOURISM PROGRAMME IN SONGKHLA CITY. *Jurnal Layanan Masyarakat (Journal of Public Services)*, 8(3), 451–459. <https://doi.org/10.20473/JLM.V8I3.2024.451-459>.
- Rumbayan, M., Kindangen, J., Sambul, A., Sompie, S., & Cross, J. (2025). Solar energy implementation in rural communities and its contributions to SDGs: A systematic

literature review. *Unconventional Resources*, 6, 100180.
<https://doi.org/10.1016/J.UNCRE.2025.100180>.

Shyrida, O. :, & Tamara, O. (n.d.). *Prosiding Seminar Nasional PENINGKATAN AKSESIBILITAS(TRANSPORTASI DALAM MENDUKUNG STRATEGI PEMBANGUNAN PARIWISATA BERKELANJUTAN DI KABUPATEN SUMENEP INCREASING ACCESSIBILITY (TRANSPORTATION) IN SUPPORTING SUSTAINABLE TOURISM DEVELOPMENT STRATEGIES IN SUMENEP REGENCY.*

Wirawan, R., Utama, S. J., & Arieffiani, D. (2023). Analisis Community Based Tourism dalam Pengembangan Wisata Pulau Gili Iyang di Kecamatan Dungkek Kabupaten Sumenep. *Policy and Maritime Review*, 32(1), 32–44.
<https://doi.org/10.30649/PMR.V2I1.45>.

Wisata Gili Iyang. (n.d.).