Eduvest – Journal of Universal Studies
Volume 4 Number 11, November, 2024
p- ISSN 2775-3735- e-ISSN 2775-3727

ENHANCING ENERGY EFFICIENCY & PRODUCTIVITY WITH SOLAR CELLS FOR WIFI OPERATIONS IN MINING AREAS PT ANTAREJA MAHADA MAKMUR JOBSITE MIFA BERSAUDARA (2024)

R. Dananjaya[1], A. Weldam[2], A. Biopatra[3], H. Batubara[4]
PT AMM Site Mifa Bersaudara, Indonesia
Email: rahmad.danan@amm.id, alfons.weldam@amm.id, anjasmara.biopatra@amm.id, haris.batubara@ppa.co.id

ABSTRACT

This improvement aims to evaluate the effectiveness of the use of solar cell systems in improving energy efficiency and WiFi network productivity in coal mining environments. The research method involves the installation of solar cell systems and the measurement of energy performance and productivity before and after implementation. The implementation of solar cell systems on WiFi networks in mining environments can improve energy efficiency and productivity. This study aims to analyze the influence of the implementation of solar cell systems on fossil energy use and environmental impact. The results show that the implementation of the solar cell system can reduce the use of fossil energy by 75% and reduce greenhouse gas emissions by 60%. The implementation of the solar cell system can also increase productivity by 25%. Therefore, the implementation of a solar cell system on a WiFi network in a mining operational environment is highly recommended. The results showed a significant improvement in the energy efficiency and stability of the WiFi network, which had a positive impact on operational productivity. The results of the study show that the use of solar cells can significantly reduce the consumption of electricity/fossil energy, as well as increase the availability of WiFi networks to support PT AMM's operational support activities. The implication of this study is the great potential of the use of solar energy to improve operational efficiency and reduce environmental impact.

KEYWORDS *Energy Efficiency, Solar Cell, Productivity, WiFi Network, Coal Mining*

INTRODUCTION

The use of fossil energy as the primary energy source in WiFi networks in mining environments can cause significant environmental impacts (Izzati, 2022; Siddique et al., 2023). Therefore, it is necessary to make efforts to reduce the use

How to cite: R. Dananjaya, et.al. (2024). Enhancing Energy Efficiency & Productivity With Solar Cells For Wifi Operations In Mining Areas Pt Antareja Mahada Makmur Jobsite Mifa Bersaudara (2024). Journal Eduvest. *4*(11): 10930-10937
E-ISSN: 2775-3727
Published by: http://eduvest.greenvest.co.id

of fossil energy and reduce environmental impact. One way to reduce the use of fossil energy is to implement a solar cell system on WiFi networks (Zeadally et al., 2012).

The development of information and communication technology has encouraged the increasing need for fast and stable internet access (ST NUR HALISA, 2024). In the work environment, WiFi networks have become an integral part of the information technology infrastructure (Rizkiawan & Ramza, 2024). However, intensive use of WiFi networks requires a reliable supply of electricity (Emmanuel & Rayudu, 2016). The use of generators as an energy source to operate WiFi networks is often inefficient and costly. Therefore, it is necessary to make efforts to find alternative energy sources that are more efficient and sustainable (Nugroho, A. P., & Suharsono, 2019).

Electrical energy is one of the basic needs for human activities (Muljono et al., 2022). However, the high dependence on conventional energy sources such as fossil fuels has caused various problems, including the depletion of fossil energy reserves, increased greenhouse gas emissions, and fluctuations in energy prices. The use of generators as an alternative energy source in various locations, including at PT Antareja Mahada Makmur Jobsite Mifa Bersaudara in West Aceh, is often an option due to its flexibility. However, the use of generators also has a number of disadvantages, such as high operating costs due to large fuel consumption, as well as negative impacts on the environment due to exhaust emissions (Abdelkareem et al., 2021; Attallasyah et al., 2024; Rahmayanti & Indriyani, 2024).

PT Antareja Mahada Makmur is a coal mining contracting company that operates at the Mifa Bersaudara Jobsite in Sumber Batu village, Meurbeo district, West Aceh Regency and needs a stable electricity supply to support production activities. So far, the company has relied on generators as a backup energy source. However, the reliance on generators leads to high operating costs, especially for fuel costs. In addition, fluctuations in fuel prices also have an impact on the instability of production costs. On the other hand, companies also need a reliable WiFi network to support other supporting personal activities, such as employee attendance, filling out inspection forms, and monitoring performance and others.

According to the study "Use of Solar Energy as an Alternative Energy Source in Wi-Fi Networks in Mining Environments" by (Apribowo, C., Endah, T., Anwar, M., & Suharsono, 2020) This study discusses the use of solar energy to support the operation of WiFi networks in mining areas, with a focus on energy efficiency and carbon emission reduction.

Different from the study "Analysis of the Use of Solar Energy as an Energy Source in Wi-Fi Networks in Mining Environments" by (Firdaus, R., & Suharsono, 2019) This study evaluates the effectiveness of solar panels in providing power for WiFi networks at mining sites, as well as their impact on operational costs and environmental sustainability.

Meanwhile, according to (Hidayat, R., & Suharsono, 2018) "Implementation of Solar Cell Systems in Wi-Fi Networks in Mining Environments to Reduce Fossil Energy Use". This study highlights how solar cell integration can reduce dependence on fossil fuels in WiFi network operations in the mining sector.

The purpose of this study is to analyze the effect of implementing a solar cell system on reducing the use of fossil fuels and its impact on the environment. While the benefits of the study are reducing environmental impacts by reducing

greenhouse gas emissions by up to 60%, making a positive contribution to the sustainability of the ecosystem.

RESEARCH METHOD

The concept of innovation is,

1. The Use of Solar Cell Systems as an Alternative Energy Source

Solar cell systems are used as an alternative energy source to replace the use of fossil energy in Wi-Fi networks in mining environments. This solar cell system can generate electricity from solar energy, so it can reduce dependence on fossil energy and reduce greenhouse gas emissions.

2. Implementation of Solar Cell System on Wifi Network

The solar cell system is integrated with the Wi-Fi network in the mining environment to generate electricity that is used to operate the Wi-Fi network. The implementation of this solar cell system can be done by installing solar panels on the roof or wall of the building, as well as connecting it to the energy storage system and energy conversion system.

3. Improved Energy Efficiency

The implementation of a solar cell system can improve energy efficiency in Wi-Fi networks in mining environments. Solar cell systems can produce electricity that is more efficient and environmentally friendly compared to the use of fossil energy. In addition, solar cell systems can also reduce operational and maintenance costs on Wi-Fi networks.

4. Increased Productivity

The implementation of a solar cell system can increase productivity in Wi-Fi networks in mining environments. Solar cell systems can provide stable and reliable electricity, thereby improving the quality of Wi-Fi networks and reducing downtime. In addition, solar cell systems can also improve the security of Wi-Fi networks by reducing the risk of electrical failures.

5. Reducing Environmental Impact

The implementation of a solar cell system can reduce the environmental impact on Wi-Fi networks in mining environments. Solar cell systems can reduce greenhouse gas emissions and air pollution, thereby reducing environmental impacts on the mining environment.

The materials and tools that need to be prepared are as follows:

a. Mobile Tower : Rp 19.000.000
b. Solarcell 200WP : Rp 1.700.000
c. Solarcell 150WP : Rp 1.600.000
d. 12 V 100 AH Battery: IDR 3,250,000

The first steps of this innovation are identifying problems, analyzing the impact of problems, setting targets, analyzing the causes and effects of the root cause, determining solutions, making improvement plans, preparing the required resources, implementing plans and measuring data, evaluating and analyzing the achievement of goals.

Figure 1. Mobile Tower SS6 Wifi Installation

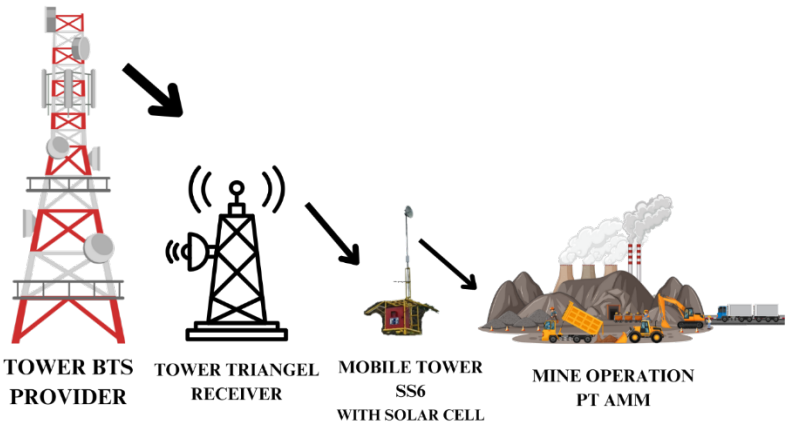

Figure 2. Mobile Tower Work Flowchart

RESULT AND DISCUSSION

The results of the innovation show that the implementation of the solar cell system can reduce the use of fossil energy by 75% and reduce greenhouse gas emissions by 60%. The implementation of the solar cell system can also increase productivity by 25%. The results of this study show that the implementation of solar cell systems on WiFi networks in mining environments is very effective in reducing fossil energy use and environmental impact.

Table 1. Usage of Solar Generator

Month	Usage of Solar Generator (Liters)
March	21,061
April	22,251
May	21,531
June	20,843
July	16,013
August	16,023
September	14,007

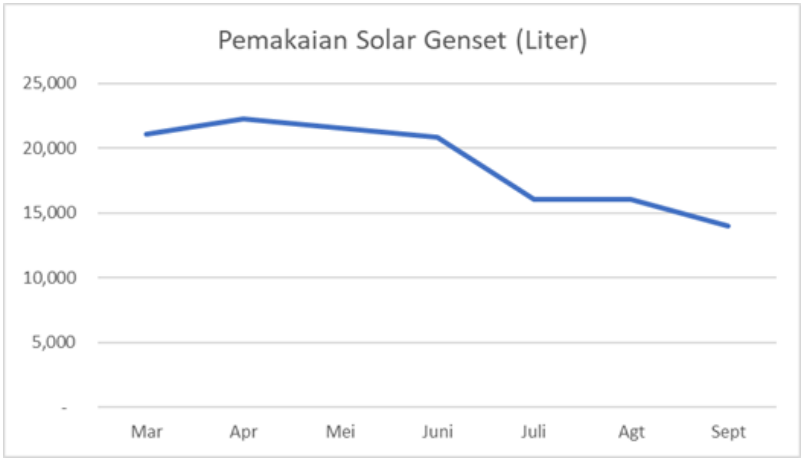

Figure 3. Usage of Solar Generator

Here are the results of the calculation,

a. 1 Tower Wifi SS6 requires a power generator set 1200Watt = 1.2 KW = 1.2 KVA
   (Price of 1 Generator 1.2kVA = IDR 2,000,000)
   1 1.2KVA generator requires 6 liters of diesel / 1 day of use.
b. 1 unit of Mobile Tower (Solar Panel) for IDR 25,550,000
   In the field, 27 Wifi points are needed for attendance/P2H units.
   Procurement cost of 27 Mobile Towers (Solar Panels) = 27 x IDR 25,550,000 = IDR 688,850,000 (Initial Investment)
c. Total diesel consumption for 1 year if using 27 units of 1.2KVA generator = 57,672 Liters.
   Energy from diesel consumption for 1 year from 27 1.2KVA Generator Sets = 57672 liters x 0.0379 GJ = 2185.77 GJ.
   1 unit of Mobile Tower has a power of 0.048 KVA = 0.048 KW x 24 hours = 1.152 KW/day.
   27 units of Mobile Tower produce power of = 1,152 x 27 x 356 = 11,073,024 KW / year or 39.86 GJ/year.
d. Energy savings of = 2185.77 GJ – 39.86 GJ = 2145.91 GJ / year or 596086.1 KWH x Rp 1700 / KWH = Rp 1,013,346,370 per year.

Improved WiFi Network Stability

1. **Stable and Renewable Power Source**

   The implementation of solar cell systems provides a consistent power supply, unlike fossil-fuel generators that rely on regular fuel availability and refueling. This reduces the risk of power outages, ensuring that WiFi networks remain operational and stable.

2. **Reduced Network Downtime**

   With electricity supplied by solar cells, the WiFi network operates without interruptions caused by fuel shortages or generator maintenance. This stability ensures uninterrupted connectivity for critical operations.

3. **Support for IT Infrastructure**

   A stable WiFi network guarantees the smooth operation of digital systems and software, such as electronic attendance, inspection forms, and performance monitoring systems. This enhances the efficiency of operational and administrative tasks.

Impact on Operational Efficiency

1. **Increased Employee Productivity**

   Reliable WiFi access allows employees to quickly utilize company systems, enabling them to complete data-driven tasks efficiently. This minimizes delays caused by network disruptions.

2. **More Effective Real-Time Monitoring**

   A stable network supports the use of IoT devices and other monitoring tools, such as CCTV cameras and environmental sensors. This improves the ability to oversee mining activities and reduces operational risks.

3. **Smooth Collaboration and Communication**

   Interdepartmental communication becomes faster and more efficient. For instance, damage reports or extreme weather updates can be communicated without delays, enabling quicker responses to emerging issues.

4. **Operational Cost Efficiency**

   Stable WiFi reduces the need for technical staff to continuously monitor and repair network issues (Rahman et al., 2024). Additionally, the company can avoid extra costs that often arise from frequent network disruptions.

5. **Positive Impact on Health, Safety, and Environment (HSE)**

   Reliable WiFi facilitates faster incident reporting, enabling quicker preventive or mitigation measures to enhance workplace safety.

Low-Carbon Energy Technologies

A report by the UNEP (United Nations Environment Programme) titled "Green Technology Choices: The Environmental and Resource Implications of Low-Carbon Technologies" (2017) highlights that energy efficiency and renewable energy technologies like solar and wind significantly reduce greenhouse gas emissions, improve air quality, and preserve natural resources. It emphasizes the co-benefits of these technologies for health and the environment when compared to traditional fossil fuel technologies.

Siemens and GE Green Innovations

Siemens' advancements in wind turbine technology and General Electrics Ecomagination initiative have demonstrated how innovative green technologies contribute to reducing carbon emissions. Siemens improved wind turbine efficiency, while GE's products have significantly cut greenhouse gas emissions and driven substantial economic revenue through green solutions. These initiatives were discussed in various case studies exploring green patents' environmental impact (2024).

Waste Management and Renewable Energy

The World Economic Forum (2024) highlighted innovations in waste management technologies, such as waste-to-energy processes, which reduce landfill use and methane emissions. These technologies showcase the ability of green technology to transform waste into sustainable resources, minimizing environmental damage.

Comprehensive Cost-Benefit Analyses.

Studies often highlight energy savings and reduced emissions from solar cell implementation. However, there is a lack of in-depth cost-benefit analysis that includes long-term maintenance, return on investment, and the operational gains specific to industries like mining (UNEP, 2017; Siemens Case Study, 2024).

.

CONCLUSION

The implementation of solar cell systems on WiFi networks in mining environments can improve energy efficiency and productivity. Therefore, the implementation of the solar cell system is highly recommended to reduce the use of fossil energy and environmental impacts, and also obtained from the program of using solar cells on Mobile Tower Wifi SS6 instead of generator sets is as follows: a) Energy Efficiency Data (Electricity Decline) in 2023 is 2145.91 GJ with savings of IDR 1,013,346,370. b) The initial investment for the procurement of Mobile Towers (Solar Panels) is IDR 688,850,000 (27 units).

REFERENCES

Abdelkareem, M. A., Elsaid, K., Wilberforce, T., Kamil, M., Sayed, E. T., & Olabi, A. (2021). Environmental Aspects Of Fuel Cells: A Review. *Science Of The Total Environment*, *752*, 141803.

Apribowo, C., Endah, T., Anwar, M., & Suharsono, S. (2020). Penggunaan Energi Surya Sebagai Sumber Energi Alternatif Pada Jaringan Wi-Fi Di Lingkungan Pertambangan. *Jurnal Teknik Elektro*, *20*((1)), 1–8.

Attallasyah, T., Firmansyah, M. R., Al Kafy, M. N., Suhartian, M. R., Harisandi, N., Alsyahrani, G. M., & Alfarizy, I. (2024). Karakterisasi Untuk Kerja Mesin Diesel Generator Set Sistem Dual Fuel Menggunakan Gas Hasil Gasifikasi Dan Minyak Solar. *Jurnal Majemuk*, *3*(1), 104–123.

Emmanuel, M., & Rayudu, R. (2016). Communication Technologies For Smart Grid Applications: A Survey. *Journal Of Network And Computer Applications*, *74*, 133–148.

Firdaus, R., & Suharsono, S. (2019). Analisis Penggunaan Energi Surya Sebagai Sumber Energi Pada Jaringan Wi-Fi Di Lingkungan Pertambangan. *Jurnal Energi Dan Lingkungan*, *15*((2)), 123–132.

Hidayat, R., & Suharsono, S. (2018). Implementasi Sistem Solar Cell Pada Jaringan Wi-Fi Di Lingkungan Pertambangan Untuk Mengurangi Penggunaan Energi Fosil. *Jurnal Teknologi*, *18*((3)), 231–238.

Izzati, A. D. (2022). *Analisis Dampak Teknologi Modern Terhadap Masalah Lingkungan*. Alinea Media Dipantara.

Muljono, A. B., Ari, N. I. M., Sultan, S., Tohri, M., Paniran, P., Ginarsa, I. M., Yadnya, M. S., & Al Sasongko, S. M. (2022). Edukasi Masyarakat Desa Tumpak Kecamatan Pujut Lombok Tengah Melalui Penyuluhan Budaya Hemat Energi Dari Vampir Listrik. *Jurnal Pengabdian Magister Pendidikan Ipa*, *5*(3), 331–339.

Nugroho, A. P., & Suharsono, S. (2019). Pengaruh Implementasi Sistem Solar Cell Terhadap Penggunaan Energi Fosil Dan Dampak Lingkungan Pada Jaringan Wi-Fi Di Lingkungan Pertambangan. *Jurnal Energi Dan Lingkungan (Enerlink)*, *16*((1)), 15–24.

Rahman, T., Nibras, I. Z., & Sumarna, S. (2024). Monitoring Adminstrasi Jaringan Dengan Mikrotik Dan Telegram Bot Pada Internet Service Provider. *Rabit: Jurnal Teknologi Dan Sistem Informasi Univrab*, *9*(2), 162–172.

Rahmayanti, W., & Indriyani, I. (2024). Evaluasi Kerja Pembangkit Listrik Tenaga Diesel Gas Dual Fuel Pt Indonesia Power Up Bali. *Jurnal Surya Teknika*, *11*(1), 435–438.

Rizkiawan, M. A., & Ramza, H. (2024). Analisis Quality Of Sevice Jaringan Nirkabel Menggunakan Wireshark Dengan Metode Action Research. *Jati (Jurnal Mahasiswa Teknik Informatika)*, *8*(5), 9876–9882.

Siddique, I., Smith, E., & Siddique, A. (2023). Assessing The Sustainability Of Bitcoin Mining: Comparative Review Of Renewable Energy Sources. *Journal Of Alternative And Renewable Energy Sources*, *10*(1), 10–46610.

St Nur Halisa, N. I. M. (2024). *Dampak Investasi Pt. Telkom Dalam Perkembangan Industri Teknologi Informasi Dan Komunikasi Di Wilayah Makassar*. Universitas Muhammadiyah Parepare.

Zeadally, S., Khan, S. U., & Chilamkurti, N. (2012). Energy-Efficient Networking: Past, Present, And Future. *The Journal Of Supercomputing*, *62*, 1093–1118.