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Simplified Analysis of CD-ROM as an Emergency Solar Panel Alternative

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Anggoro Nur Setiawan [1*], Lalu Saefullah [2]

1. Prodi Otomotif Kendaraan Tempur, Politeknik Angkatan Darat, Pendem, Kec. Junrejo, Kota Batu, Jawa Timur 65324 Indonesia.
2. Department of Physics, Faculty of Mathematics and Natural Sciences, Universitas Brawijaya, Jl. Veteran No.10-11, Ketawanggede, Kec. Lowokwaru, Kota Malang, Jawa Timur 65145, Indonesia.

***E-mail:** anggoro68@gmail.com

Abstract
This research aims to analyze the capabilities of CD-ROM discs as solar panels, taking into consideration energy conversion efficiency and temperature effects. The research results indicate that the conversion efficiency of CD-ROM discs is relatively low, averaging around 1.9%, which is still far below conventional solar panels. This efficiency tends to be higher under high sunlight intensity and decreases at higher temperatures. The production cost of CD-ROM discs as solar panels is relatively low compared to conventional solar panels. The environmental impact of using CD-ROM discs as solar panels is also discussed. However, the use of used CD-ROM discs has the potential to reduce electronic waste. Research recommendations include efforts to improve the efficiency of CD-ROM discs, the development of cooling technologies, and a comprehensive evaluation of the environmental impacts throughout the life cycle of CD-ROM discs as solar panels. This research provides a deeper understanding of the potential use of CD-ROM discs as an alternative solar panel and the challenges that need to be addressed for its effective implementation.

Keywords: Solar Panels, CD-ROM, Platters, Renewable Energy.

1. Introduction

The use of solar panel technology in generating renewable electrical energy has become a very important topic in an effort to overcome the problem of energy crisis and the impact of global climate change [1], [2]. Solar panels are devices designed to convert solar energy into electrical energy [3]. One of the alternative materials in solar panels is used CD-ROM discs, which have interesting potential to be used as the main component in making simple solar panels. CD-ROM discs have characteristics as light refraction that produces a photo lithic effect. The utilization of CD-ROM discs as solar panels can reduce industrial waste [4], [5], [6].

CD-ROM discs are typically used for digital data storage and have a reflective surface made of plastic material that is resistant to environmental conditions. In recent years, researchers and scientists have begun to explore the potential of CD-ROM discs as an alternative material for cost-effective solar panels. This effort is a step towards sustainability and reuse of obsolete materials [6]. An analysis of the capabilities of CD-ROM discs as solar panels includes several key aspects, such as the efficiency of converting solar energy into electricity, durability against extreme weather, and production and environmental costs [7]. This research will investigate several important elements in understanding the potential of CD-ROM discs as efficient and sustainable solar panel components to reduce industrial waste.

This research explores various important aspects related to the use of CD-ROM discs in solar panels, including their energy conversion process, efficiency, and potential positive impact on the environment. In addition, it will discuss the challenges that may be faced in implementing this technology widely, especially in unelectrified areas. An in-depth analysis of the capabilities of CD-ROM discs as solar panels is expected to help develop renewable energy solutions that are more cost-effective, environmentally friendly, and sustainable. That way, it can support global efforts in reducing

our dependence on diminishing fossil energy sources and reducing our carbon footprint for a better future [8]. The purpose of this research is to analyze the ability of CD-ROM discs as solar panels by considering energy conversion efficiency and temperature effects.

2. Method

The components used in this study are CD-ROM discs and 2.3 KΩ zener diodes, as shown in Figure 1. The field study was conducted at Poltekad Kodiklatad Malang. This field research was conducted with various materials, namely, used CD-ROMs in good condition, cables, 2.3 KΩ zener diodes. This research will be carried out in several stages, namely the preparation of CD-ROM plates, testing voltage, current, and power against temperature.

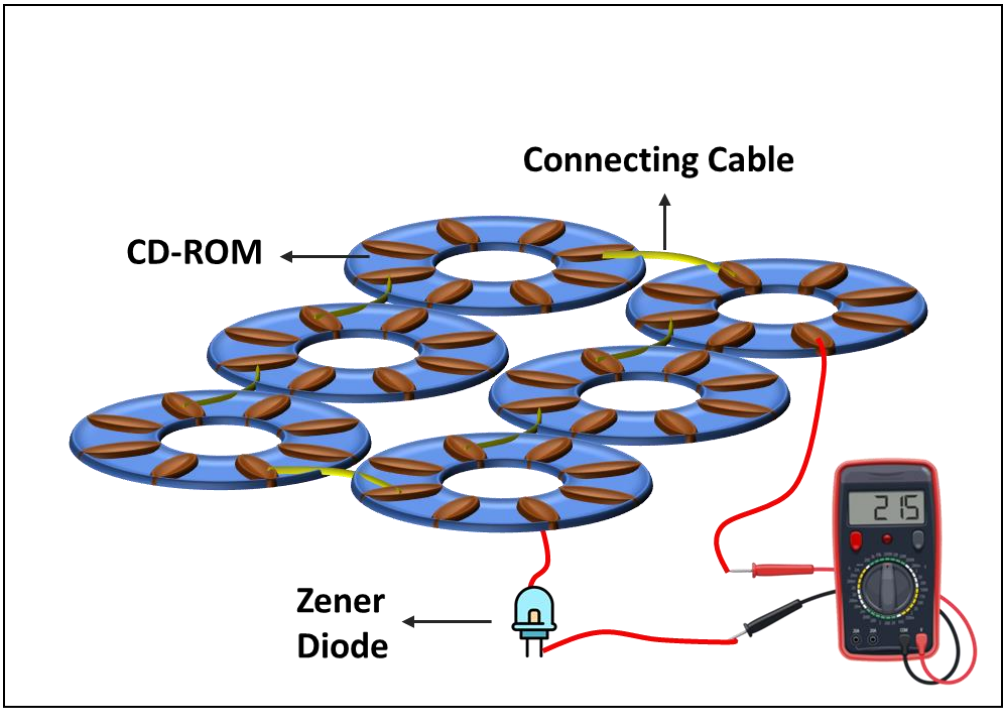

Figure 1. Solar Panel Design Using a CD-ROM Disc

Furthermore, similar tests were carried out but compared to time for several hours. Data was collected between 12:00 pm and 4:00 pm, taking into account weather conditions and sunlight. The data needed in this research comes from previous research and relevant theories. This data is used to analyze the results of the research to be carried out. After the research data is collected, the next step is to process and analyze the data using ohm's law and visualize its changes over time and temperature. Selection of CD-ROM chips under the same conditions. The experimental parameters are the intensity of sunlight per square meter of time and the dimensions and number of CD-ROM plates. Measurement of performance parameters such as current, voltage, output power and conversion efficiency. Analysis of experimental data to determine the extent to which CD-ROM discs are capable of generating electrical energy from sunlight.

3. Result and Discussion

First, the voltage, current and power were analyzed against temperature using an AVO meter. The analysis results are presented in Figure 2. Furthermore, the current voltage and power of the CD-ROM disk were measured against time. The results of temperature measurements on the performance of CD-ROM discs as solar panels are shown in Figure 2. In this study, the efficiency of converting solar energy into electrical energy by used CD-ROM discs is one of the main focuses. Experimental results using the efficiency equation (Equation 1 [12]) show that the average conversion efficiency of CD-ROM discs is about 1.9%.

This figure is much lower than that of conventional solar panels, which usually have efficiencies above 15%.

$$\%Efficiency = \frac{P2\ (Power\ CD - ROM)}{P1\ (Power\ of\ Sun)} \quad (1)$$

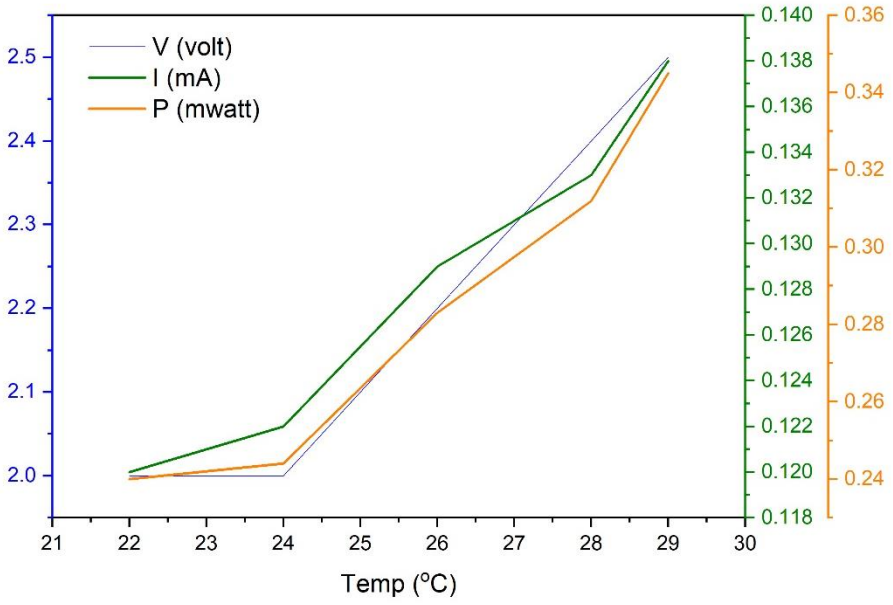

Figure 2. Analysis of CD-ROM Discs against Temperature VS Voltage, Current, and Power

The data showing an increase in voltage, current, and power on the CD-ROM disk as the temperature increases is a finding that can be explained by the concept of photonic energy conversion in solar panels (Figure 1). Solar panels, or in this case CD-ROM discs, function by converting photonic energy from sunlight into electrical energy. When sunlight hits the semiconductor material in the solar panel, the photons of light cause the electrons in the semiconductor material to move, creating an electric current [9], [10]. However, it should be noted that temperature plays a crucial role in this process.

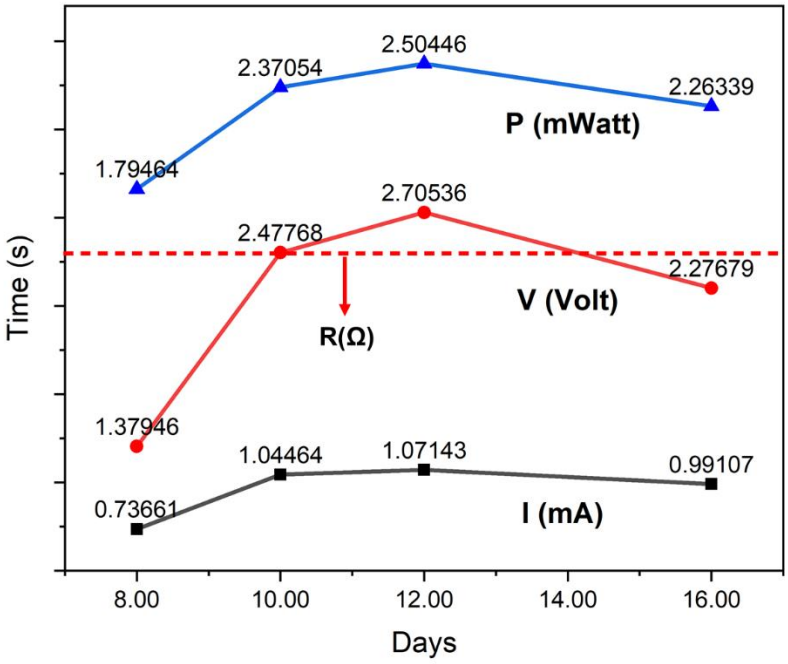

Figure 3. Graph of Measurement Results at Specific Times

As the temperature rises, the thermal activity in the semiconductor material increases, which in turn can increase the conductivity and current generated by the solar panel. However, an increase in temperature can also lead to a decrease in the open voltage of the solar panel, reducing its efficiency [11]. Therefore, optimization of the operating temperature of solar panels is an important element in the effort to maximize the efficiency of converting photonic energy into electrical energy under various temperature conditions, which may occur in daily use. Thus, from the three graphs above, the data obtained is that the higher the temperature, the more the voltage, current and power of the CD-ROM disk increase.

Figure 3 shows an increase in voltage from 08:00-12:00 which indicates that the level of intensity obtained by the CD-ROM is increasing. However, it starts to drop significantly after 12:00. Likewise, the current and power obtained, the peak is located at 12:00 where the sun is right above and has the highest energy level. The power also drops as the intensity of the sun tends to dim. It is important to note that the conversion efficiency of the CD-ROM disc tends to increase with higher sunlight intensity, but decreases significantly at lower intensities. This suggests that CD-ROM discs have better potential for use in areas with strong sunlight, such as the tropics. However, the low efficiency at low light intensities indicates the limited use of these CD-ROM discs in areas with less sunny weather.

The voltage arising from the CD-ROM disk became the basis of the next measurement by adding more CD-ROM disks. These results are presented in Figure 4.

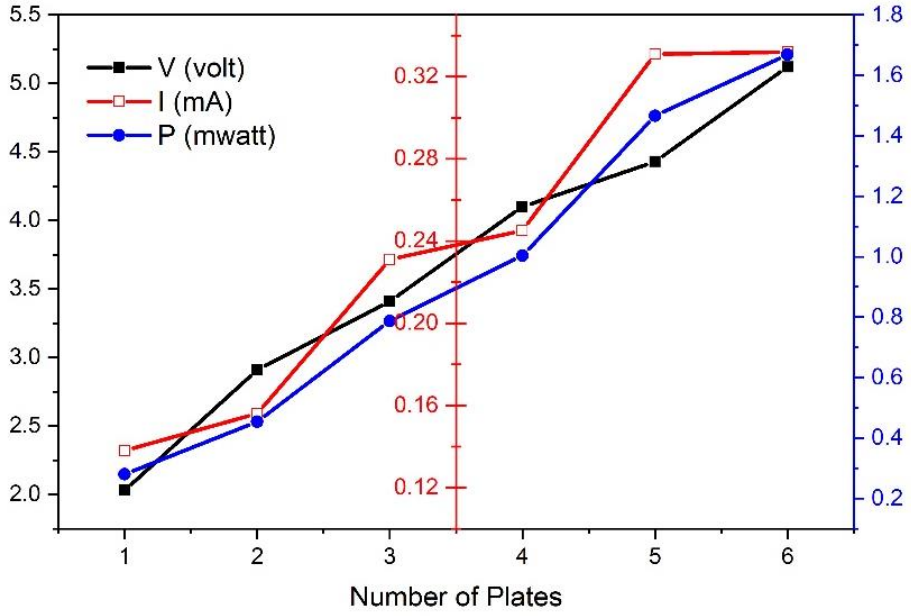

Figure 4. Graph of Measurement Results on the Number of Plates

The results above show that as the number of disks increases, the voltage, current and power increase. This is due to the number of panels that can absorb heat energy thus increasing the temperature of the CD-ROM which results in an increase in these parameters. The highest current level generated from the number of disks 6 is 0.332 mA. This result is equivalent to a solar panel with a size of 10 cm. Likewise, the power obtained is 1.6 mwatt with the number of 6 CD-ROM plates. To clarify the results obtained, the following researchers attach an illustration of the CD-ROM mechanism in absorbing and transmitting energy presented in Figure 5. Figure 5 is an interesting illustration in the context of solar photon energy and how it affects CD-ROM discs. The photoelectric effect is a physical phenomenon that explains how electrons in a material can be ejected or "punched" by sunlight hitting the surface of the material. When photons from the sun hit a CD-ROM disc, they have enough energy to move electrons in the semiconductor layer of the disc.

The photoelectric effect is an important concept that explains that electrons subjected to sunlight will receive energy from the photons, and if the energy is large enough, the electrons will become "free" and can move in the semiconductor material. This is what happens to a CD-ROM disk when sunlight falls on its surface. What is interesting is how these released electrons interact with each other. When many electrons are released simultaneously, there is interaction between them. This effect is called the

Compton effect, which describes how moving electrons can cause "vibrations" in the crystal structure of semiconductor materials [13]. These vibrations increase the temperature of the semiconductor material. In other words, the kinetic energy of the free electrons permeates the material in the form of vibrations, which in turn increases the temperature.

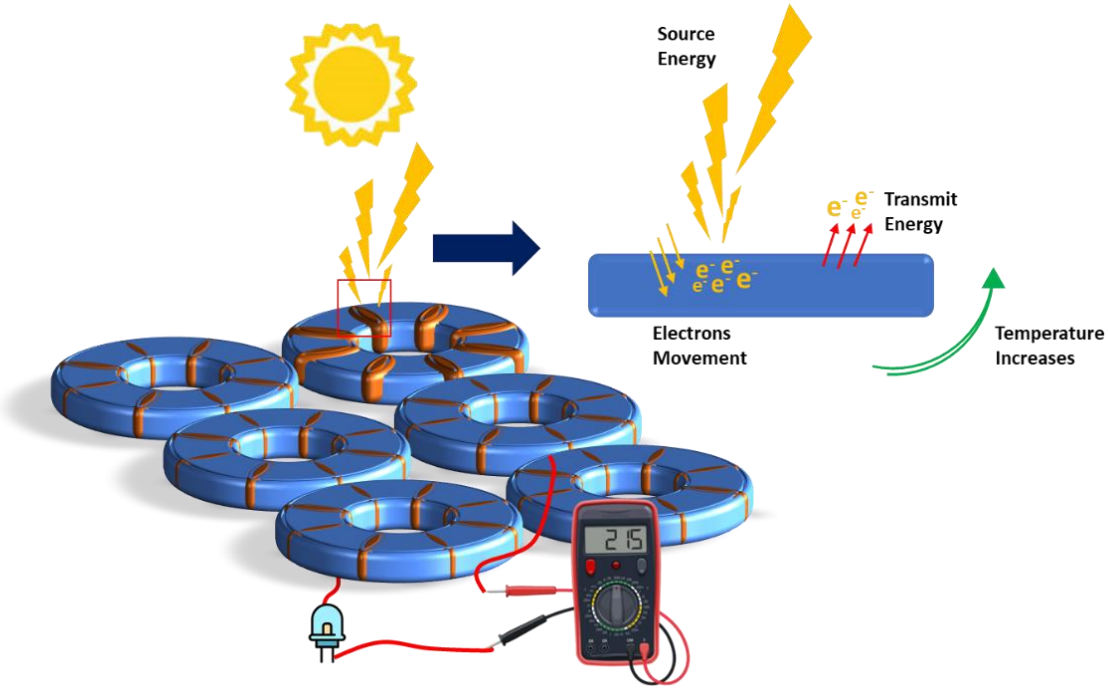

Figure 5. Schematic of CD-ROM Disc in Absorbing Energy

The increase in temperature that occurs in the semiconductor material of a CD-ROM disk is evidence of an increase in energy from solar photon energy. The more photons received by the semiconductor material and the more electrons released, the greater the Compton effect that occurs, and the temperature of the semiconductor increases [14]. In the context of solar panels, this temperature rise can actually be a challenge as high temperatures can reduce the efficiency of solar panels. Related to the issue of low energy generation capability, it is necessary to understand that most of the energy that goes into the plant is lost when it comes out. This is due to various losses, mainly in the form of mechanical losses and wasted electrical energy. While the technical capability of the plant may be low, there is the benefit of experience or length of operation, which can provide advantages even if it requires proper adjustments.

Therefore, in order to achieve the main goal, careful planning is needed in the use of steam power plants with turbine drives. Research has shown that by applying the plant on a larger scale, it can improve the ability and efficiency in generating electricity [15], [16]. Although the initial technical capability may be low, with good planning measures and adjustments when used on a wider scale, better results can be obtained, in line with the previous discussion. This study also noted the effect of temperature on the performance of CD-ROM discs as solar panels. The conversion efficiency of the CD-ROM disc decreased as the temperature of the CD-ROM disc rose above the ambient temperature. This is in line with previous studies which show that high temperatures can reduce the efficiency of solar panels [17]. Therefore, it is necessary to consider the cooling factor in the use of CD-ROM discs as solar panels.

4. Conclusion

Based on the results of this study, it can be concluded that used CD-ROM discs have potential as alternative solar panels, especially in areas with strong sunlight. However, the low efficiency is a major challenge. Therefore, further research is needed to improve the conversion efficiency of CD-ROM discs.

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