# Viability of Reflector to Improve Solar Panels Productions & Viability of Indoors Solar Panels with Artificial Light For Future Applications.

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## ABSTRACT

The good voltage and current values in a solar panel, but they are not negligible for practical applications. use of renewable energies has gradually been incorporated into society to counteract the damaging effects caused by the current electrical energy systems, which require fossil fuels for their operation. Photovoltaic systems have become popular among the variety of renewable energy systems due to their great practicality. However, these have two major disadvantages: (1) PV Systems only produce at their maximum capacity when sunlight is perpendicular to them and (2) they do not have the ability to produce electricity at night. For this reason, this research took two aspects of experimentation: (1) The feasibility of reflective materials (Mirrors and Aluminum) was investigated to improve the energy production of solar panels when the sunlight is not optimal. (2) Investigate which type of artificial light works best with solar panels to use in indoor applications when there is no sunlight. For the first part of the investigation, the data showed that using reflectors greatly helps the solar panel's operating parameters, but its usefulness is impractical in the long term. For the second part of the investigation, the data revealed that artificial light from a burning light bulb can cause

## INTRODUCTION

Renewable energy has become the promise of future electric generation. Organizations such as the Center for Climate and Energy Solutions (C2ES, 2020) project that generation with renewable energy technologies will increase from 11% (in 2017) to 48% by 2050 in the world. This is an indication that renewable energy is the new north for generating electricity residentially, commercially and industrially. Although renewable energy technologies have gradually improved over the years, there is still a lot to work and improve to guarantee the stability of these systems that cover our daily lives. For this reason, it is important to make these systems as reliable as traditional generation systems (which use fossil energy). A limitation of solar panels, however, even with high efficiencies, is that they produce at their maximum capacity as long as photons of light hit the panel perpendicularly. On the other hand, it is also important to find a way to implement renewable energy technologies in our homes in order to achieve efficient energy consumption. With such an aspect in mind, it is imperative to be able to find more efficient ways for solar panels to transform solar energy to electrical energy.

## OBJECTIVES

This research took two aspects of experimentation, (1) Study the feasibility of using reflectors as a way to deflect the incidence of solar light, so that it remains constantly perpendicular to the solar panel and therefore, improve the production of solar panels. In this particular case, the utility of aluminum and mirrors as a constant reflector was studied. (2) Investigate the feasibility of using flexible solar panels indoors with different colors of artificial lights. It was intended to study the behavior of the solar panel when the light from residences is used as an alternative source to the sun. Also, the principle of retro-feed for a 12V battery was studied to analyze future energy efficiency applications using the indoor solar panel with such artificial light.

## METHODOLOGY

Part I of Research:

- Acquire materials
- Determine the hours in the morning and in the afternoon where the solar panel does not produce at its maximum capacity.
- Find the most effective position for the reflective material in such a way that the reflection of light covers the entire solar panel.
- Collect parameters such as voltage and current produced by the board before and after using reflective materials.
- Carry out the aforementioned steps with mirrors and with aluminum.
- Compare and contrast the data obtained.
- Determine viability in the short, medium and long term.
- Develop a conclusion and recommendations based on the data obtained

Part II of Research:

- Acquire materials.
- Connect the lamp to the 12V battery. The voltage and current consumed by each used bulb will be measured with the multimeter.
- Placed the flexible solar panel inside the lamp cover. The operating parameters of the solar panel that are produced using each bulb were measured with the multimeter.
- Connect the flexible solar panel in parallel with the battery and determined how much current can be supplied back to the battery to decrease the its drain rate.
- Study the viability of the aforementioned process for future residential applications.
- Develop a conclusion and recommendations based on the data obtained.
- Final report development

## DATA

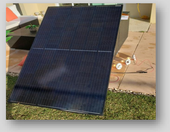
By fully reflecting the solar panel it increases energy production significantly.

Experiment #3.1 Set up. Solar Panel was positioned also at 43 degrees

Solar Panel was placed inside the cover of the lamp, perpendicular to the light bulb.

By fully reflecting the solar panel, an interesting increase in luminosity from the incandescent bulbs were observed.

Experimental Results for Aluminum as a reflector for sunrise periods.



Measuring Battery Voltage

Experimental results experiment 1.1. Significant increase in operating voltage values can be observed as the reflector size increases.

| | Time | Voc | Isc | Operating Voltage | Operating Current |
|---|---|---|---|---|---|
| No Reflection | 7:39 am | 36.38 V | 0.409 A | 18.66 V | 0.440 A |
| Medium Reflector | 7:47 am | 36.55 V | 0.543 A | 24.10 V | 0.480 A |
| Large Reflector | 7:55 am | 37.06 V | 0.750 A | 30.00 V | 0.580 A |

Experimental Results for Aluminum as Reflector for Sunrise Hours

| | Time | Voc | Isc | Operating Voltage | Operating Current |
|---|---|---|---|---|---|
| No Reflection | 7:53 am | 36.62 V | 0.485 A | 18.73 V | 0.477 A |
| Aluminum Reflector | 8:00 am | 36.70 V | 0.635 A | 26.95 V | 0.557 A |

Experimental results using the incandescent lightbulb.

| | Battery | Solar Panel |
|---|---|---|
| Voltage | 11.87 V | 12.41 V |
| Current | 87.40 mA | 3.25 mA |

## CONCLUSION AND RECOMENDATIONS

In the case of the first part of the investigation, the data collected reveals that the reflection effect of light produces significant energy increases in solar panels. It was observed that, for there to be a significant increase in the energy production of the solar panel, the reflector must be equal to or larger than the solar panel and also be at the same inclination as the solar panel. The two main materials used as reflectors in this part were the mirror and aluminum. Due to the high reflective capacity of the mirror, higher production values were produced on the panel. However, due to its weight, it was more difficult to handle. However, because the position of the sun is changing during the day, the use of reflectors can be impractical in most applications. Yet, it is understood that reflectors can have practical applications in events where shadow events affect the production of the solar panel.

For the second part of the research, the use of artificial light for the use of solar panels indoors was experimented with. The data revealed that the incandescent light bulb, being the one that best simulates sunlight, produces good production values in the solar panel. However, being a high consumption light bulb, the feedback effect is not viable due to the little current supplied back to the source. Surprisingly, although the 2,700K bulb had lower output values on the solar panel, the current supplied back to the source was more viable than the incandescent bulb. The definitive conclusion for this part of the research is that more experimentation is needed to achieve more practical applications at the residential level. However, the use of solar panels indoors can be used in other fields such as electronics or electric vehicles for the preservation of batteries in the short term.

**Recommendations**:

In order to make the solar panels more efficient.

- Study new structures and chemical compositions for solar cells.
- Promote the use of PV Systems.

**Future Work:**

For future work on this research.

- Combine the reflection techniques studied in this research with sun tracking systems
- Study the retro-feed effect with panels of greater capacity and interconnect them to the electrical system.

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