# OPTIMIZING SOLAR PANEL EFFICIENCY: ANGLE VARIATIONS AND OUTPUT VOLTAGE ANALYSIS

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## ABSTRACT:

This report presents the findings of a study aimed at investigating the impact of solar panel angle variations on voltage output under different time intervals. A solar panel with dimensions 6x6 cm, capable of producing a maximum voltage of 4-5 V and current of 100 mA, was utilized for the experiment. Data was collected at 1-hour intervals over the course of [insert duration] with the solar panel positioned at angles of 30, 45, and 60 degrees relative to the sun's rays. A total of 10 readings were taken at each angle setting using a multi-meter. The results indicate significant variations in voltage output based on the angle of the solar panel, with higher angles generally resulting in increased voltage output. Additionally, the data collected at different time intervals revealed dynamic fluctuations in voltage output throughout the day. These findings contribute to our understanding of how solar panel orientation influences voltage output and have implications for optimizing solar panel efficiency in real-world applications.

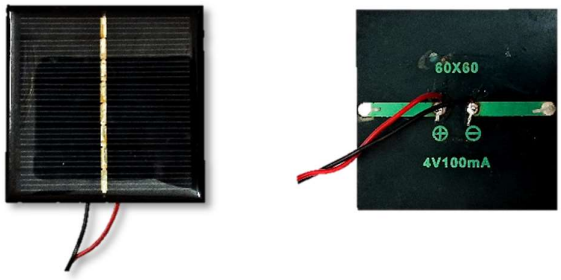

## INTRODUCTION:

Solar panels play a crucial role in the transition to renewable energy sources, offering a sustainable solution for generating electricity from sunlight. The efficiency of solar panels is influenced by various factors, including their orientation relative to the sun's rays. Optimizing the angle at which solar panels are positioned can significantly impact their performance and overall energy output. The objective of this study was to investigate the relationship between solar panel angle variations and voltage output under different time intervals.

By systematically adjusting the angle of a solar panel and recording voltage output at regular intervals, we aimed to assess how changes in orientation affect its efficiency throughout the day.

## EQUIPMENTS:

- The solar panel has dimensions of 6cm x 6cm and is capable of producing a voltage between 4-5 V and a current of 100 mA.
- Digital multi-meter.




*Front and back view of solar panel used here*

## METHODOLOGY:

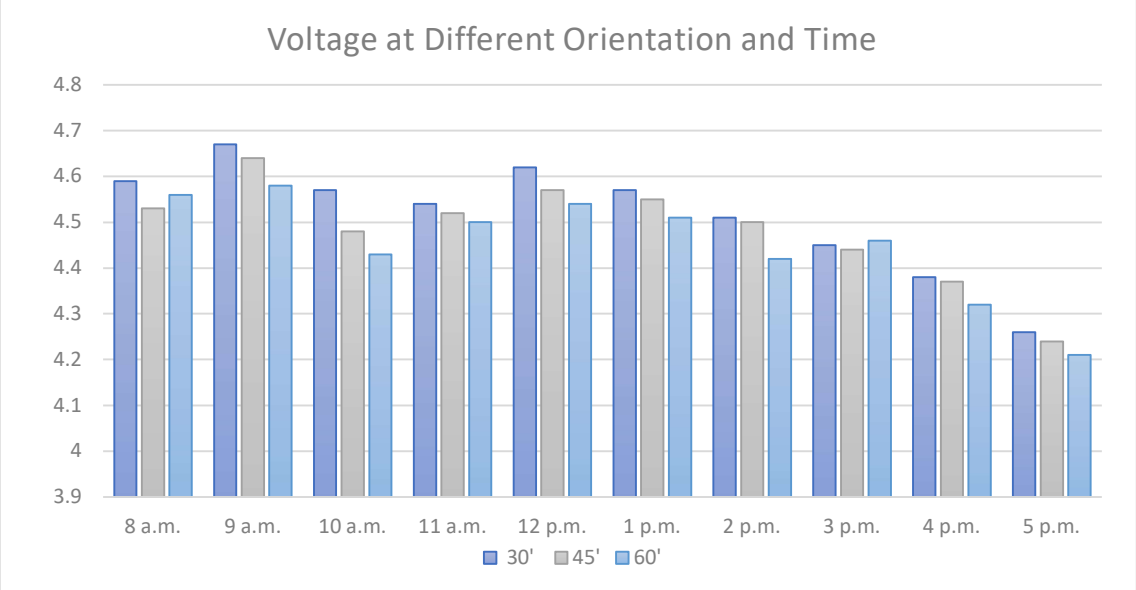
For this data collection, a solar panel with dimensions 6x6 cm was utilized. The solar panel is capable of producing a maximum voltage of 4-5 V and a current of 100 mA under optimal conditions. The data collection process involved taking readings at 1-hour intervals throughout the day to observe variations in voltage output. A total of 10 readings were taken at each time interval, with the solar panel positioned at different angles of *30, 45,* and *60 degrees* relative to the sun's rays. A multi-meter was used to measure the voltage output of the solar panel at each angle. The angle adjustments were made manually, ensuring accurate positioning for each reading. The experiment was conducted over a specified duration, with data recorded systematically at each time interval and angle setting. The solar panel is constantly fixed facing south for maximum sun exposure. This methodology allowed for the systematic collection of data to

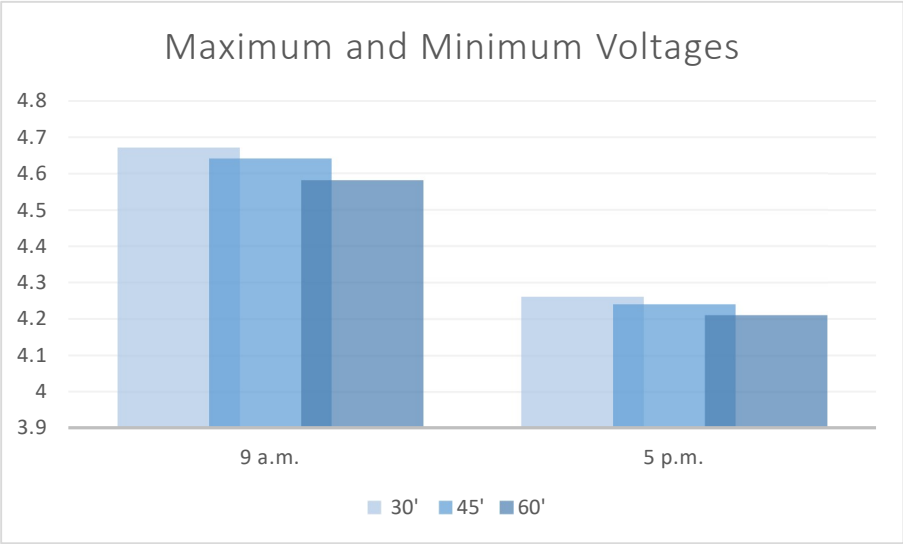
analyse the impact of angle variations on the voltage output of the solar panel over time.

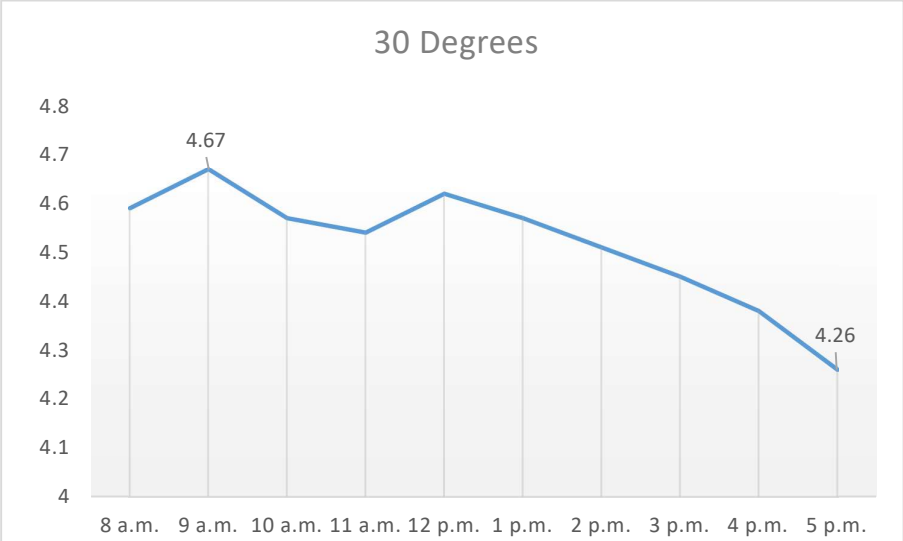
## RESULTS:

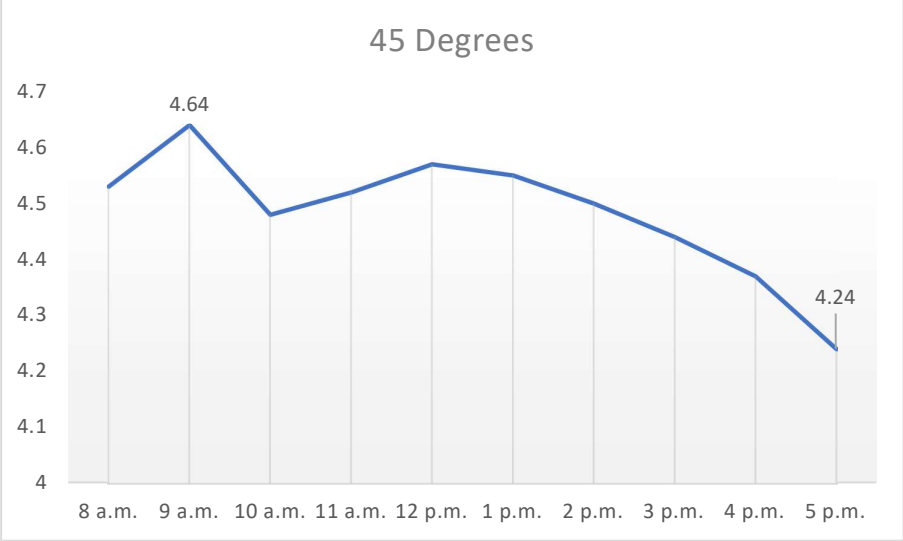
The data collected from the experiment revealed notable variations in voltage output based on the angle of the solar panel relative to the sun's rays.

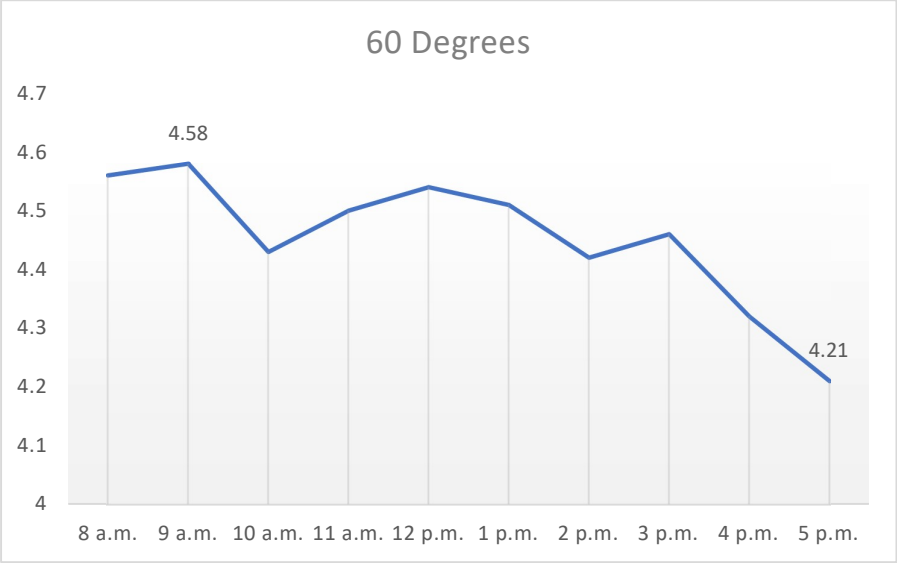
| Time vs Angle | 30' | 45' | 60' |
|---|---|---|---|
| **8 a.m.** | 4.59 | 4.53 | 4.56 |
| **9 a.m.** | 4.67 | 4.64 | 4.58 |
| **10 a.m.** | 4.57 | 4.48 | 4.43 |
| **11 a.m.** | 4.54 | 4.52 | 4.5 |
| **12 p.m.** | 4.62 | 4.57 | 4.54 |
| **1 p.m.** | 4.57 | 4.55 | 4.51 |
| **2 p.m.** | 4.51 | 4.5 | 4.42 |
| **3 p.m.** | 4.45 | 4.44 | 4.46 |
| **4 p.m.** | 4.38 | 4.37 | 4.32 |
| **5 p.m.** | 4.26 | 4.24 | 4.21 |
| **Average (Voltage)** | **4.516** | **4.484** | **4.453** |
| **Maximum (Voltage)** | 4.67 at 9 a.m. | 4.64 at 9 a.m. | 4.58 at 9 a.m. |
| **Minimum (Voltage)** | 4.26 at 5 p.m. | 4.24 at 5 p.m. | 4.21 at 5 p.m. |




Maximum and Minimum Voltages
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4
3.9
9 a.m.
5 p.m.
30'
45'
60'


30 Degrees
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4
4.67
4.26
8 a.m.
9 a.m.
10 a.m.
11 a.m.
12 p.m.
1 p.m.
2 p.m.
3 p.m.
4 p.m.
5 p.m.


45 Degrees
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4
4.64
4.24
8 a.m.
9 a.m.
10 a.m.
11 a.m.
12 p.m.
1 p.m.
2 p.m.
3 p.m.
4 p.m.
5 p.m.




The maximum recorded voltage value was 4.67 V at 30 degrees at 9 a.m., while the minimum recorded voltage value was 4.21 V at 60 degrees at 5 p.m.

## CONCLUSION:

From the collected data, it is observed that the maximum voltage output was obtained at 9 a.m. for all three angles. Conversely, the minimum voltage output was recorded at 5 p.m. for all three angles. The ideal orientation for the solar panel was found to be at 30 degrees, with an average voltage of 4.51 V. The maximum and minimum values recorded were 4.67 V and 4.26 V, respectively.