Solar Maintenance Efficiency Analyzer

# 1. Project Purpose

The aim of this project is to analyze the effect of preventive maintenance procedures performed on solar panels on energy production. Research has been conducted to determine whether regular maintenance increases production efficiency.

# 2. Data Set Used

The data used in the analysis consists of columns such as date, production amount (kWh), maintenance status (done/not done), ambient temperature (°C), panel voltage, and solar radiation (W/m²) belonging to the solar power plant.

# 3. Average Energy Production Based on Maintenance Status

Average production on days when maintenance was performed: 498.07 kWh

Average production on days when maintenance was not performed: 494.40 kWh

As a result, the panels that underwent maintenance produced 0.74% more energy.

# 4. Time Series Analysis

The energy production time series graph visualizes the change in production on days when maintenance was performed and days when it was not. The graph shows that there were slight increases in production after maintenance.

# 5. Regression Analysis (Minitab)

Dependent variable: energy\_output\_kWh

Independent variables: ambient\_temp\_C, panel\_voltage, irradiance\_W/m2

Minitab results:

- Constant: 362 (p=0.031)

- ambient\_temp\_C: 0.86 (p=0.413)

- panel\_voltage: 0.289 (p=0.226)

- irradiance\_W/m2: -0.074 (p=0.463)

Based on these results, none of the selected variables were statistically significant (p>0.05). However, the model generally shows that temperature and voltage have a positive effect at low production values.

# 6. Conclusions and Recommendations

The analysis showed that regular maintenance has a small but positive effect on energy production. More robust results can be obtained with a more comprehensive data set and analysis of different stations. In the future, more accurate prediction models can be developed by controlling the effects of variables such as temperature, sunshine, and voltage separately.