

Solar Panel Energy Prediction Study-Commercial

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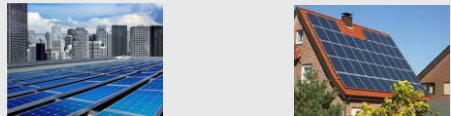
PURPOSE

Study the return on using solar panels to replace traditional electricity on commercial buildings, which will benefit both solar panel consumers and the local environment.

INTRODUCTION

Solar energy is a clean source of energy. The solar prices fell significantly from 2008 to 2020, and there was still a 4% decline in the last two quarters of 2020. However, solar panels are not widely used and the government is promoting them.

commercial VS residential



- Commercial solar panels are more efficient than residential solar panels by roughly 2 percent.
- Commercial solar panels are larger than residential solar panels.
- Commercial roofs are usually flat, allowing for an easier installation process.

METHODOLOGY

- Developing machine learning algorithms to predict energy generation with the weather.
- Applying time series analysis models to predict the energy generation and electricity price with time.
- Applying investment return analysis to evaluate this investment.
- Comparing solar panel investment on commercial and residential buildings.

PRODUCT & RESULT

Task 1. Data Collection & Processing

- Solar energy generation of a system.
- Weather.
- Price of a solar panel system.
- Prices of traditional electricity.

Build a data environment, including data preparation, cleaning, metadata, and extract transform load. We focus on data from Euless, Texas from 2016 to 2020.

Task 2. Energy Prediction Model

The photovoltaic power potential is closely related to weather. Based on the Random Forest algorithm, the fine weather condition is the most important weather factor. To predict solar energy generation from the weather, Neural Network performs better, with the r^2 score of 0.864, than Support Vector Machine and Multiple Linear Regression.

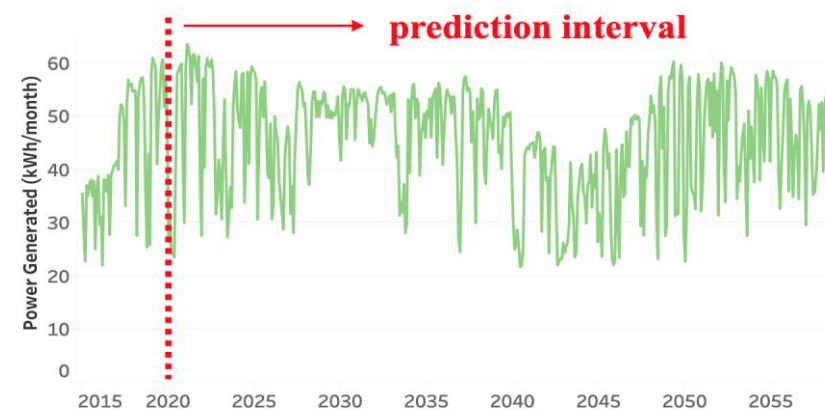


Figure2:Power Generated from 2016-2060

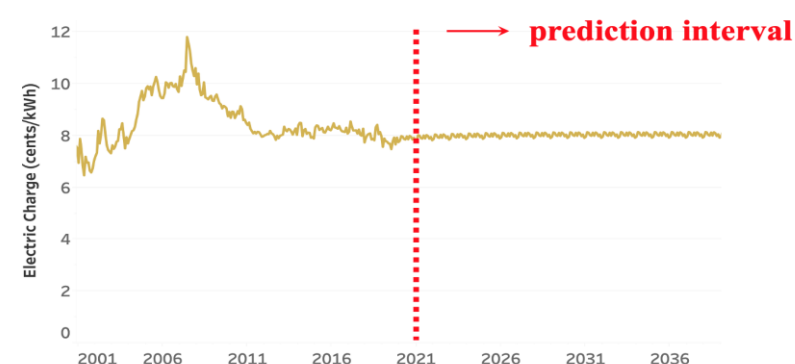


Figure3:Electric Charge from 2016-2040

Table1: Daily power and weather features

Date	Power	Temp	Dew_Point	Wind_Speed	Pressure	PPT
2020/1/1	7.5	49.5	32.4	13.2	29.2	0.0
2020/1/2	51.0	54.0	46.9	11.1	28.9	0.0
2020/1/3	40.0	49.5	40.0	11.4	29.2	0.0
2020/1/4	51.2	46.5	29.5	5.8	29.6	0.0
2020/1/5	64.6	52.5	32.4	8.6	29.5	0.0

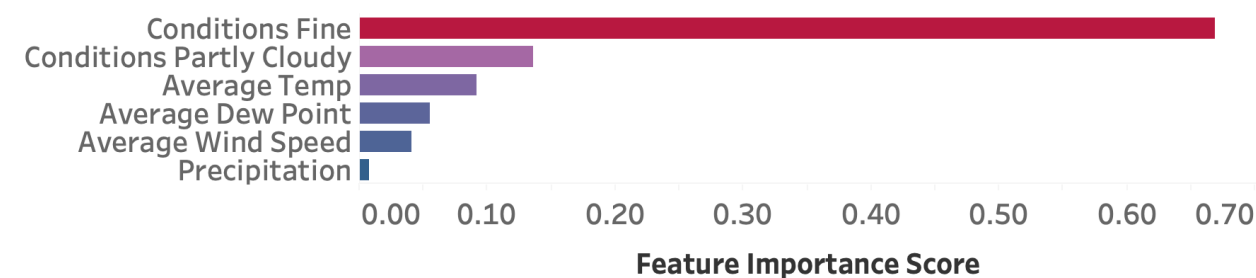


Figure1: Importance of weather features

Task 3. Time Series Analysis Model

Both solar energy generation of a single system and electricity prices have periodic changes in recent years, thus we apply the SARIMA model for data fitting and prediction.

With the prediction of energy generation and electricity price, we can conduct investment analysis and give suggestions for solar usage.

Task 4. Return on Investment Analysis

The address of the solar panels that generated the data we use is Euless, Texas. The solar panel is 11.76kW. We assume that the price of the solar panel is 30,000 US dollars and the installation cost is 2,000 US dollars.

By predicting the electricity generation and traditional electricity in the next 40 years Expenses, the payback period is calculated to be 25 years. We did not take into account other costs such as equipment damage and repairs.

CONCLUSION

- The payback period for an investment of installing an 11.76 kW commercial solar system in Euless, Texas in 2021 is 25 years.
- In contrast, the payback period of 10.5kW residential solar panels in Texas is 16 years, which is much shorter than that of commercial solar panels.
- This shows that taking into account the ROI rate and other uncertainties during the payback period, the current commercial solar panels are less likely to be accepted like residential panels.

FUTURE

- Collect more precise and regionally segmented weather data.
- Predict solar generation in different types of buildings with advanced models.
- Accurately predict conversion efficiency, equipment life, and cost changes.

REFENERCE

- <https://www.solarreviews.com/solar-panel-cost>
- <https://pvoutput.org/display.jsp?sid=42980>
- <https://www.wunderground.com/history/monthly/us/tx/euless/KTXEULES5/date/2019-10>
- <https://www.eia.gov/electricity/data/browser/#/topic/7?agg=0>