Day-Ahead Solar Panel Energy Forecasting

Jocelyn Lau

Introduction

Benefits of day-ahead solar panel electricity output forecasting for utility companies:

Optimize different sources for the day's energy demand

Plan maintenance on low-output days

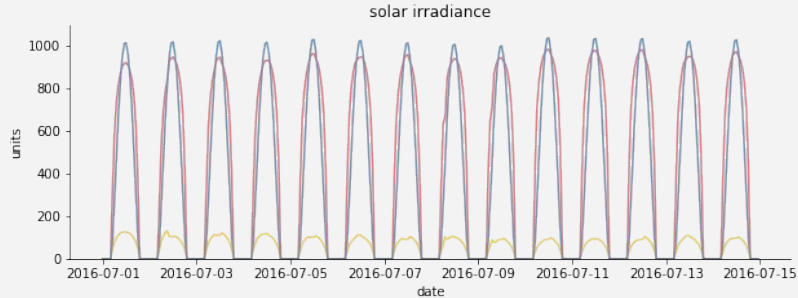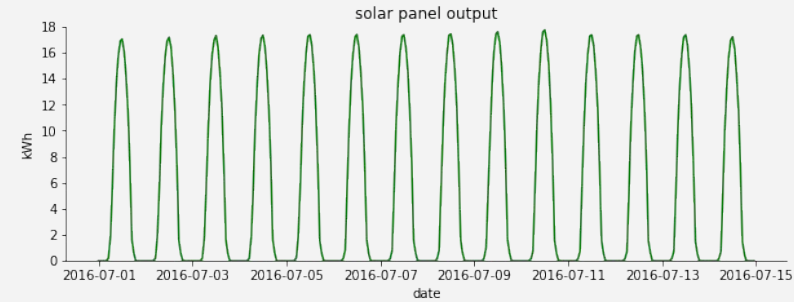Determine if solar panels are working properly

Solar Panel Data

- California Solar Initiative (CSI) hourly PV output for 2011-2016 from a grid in Fresno, CA

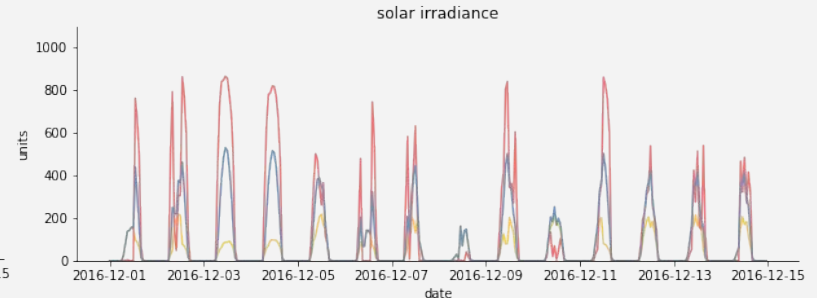- Solar irradiance data from the National Renewable Energy Laboratory (NREL)
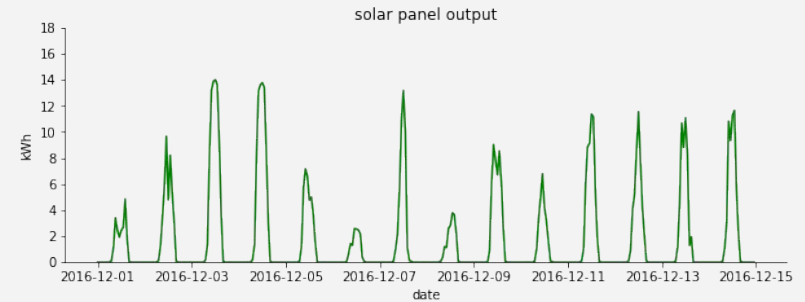
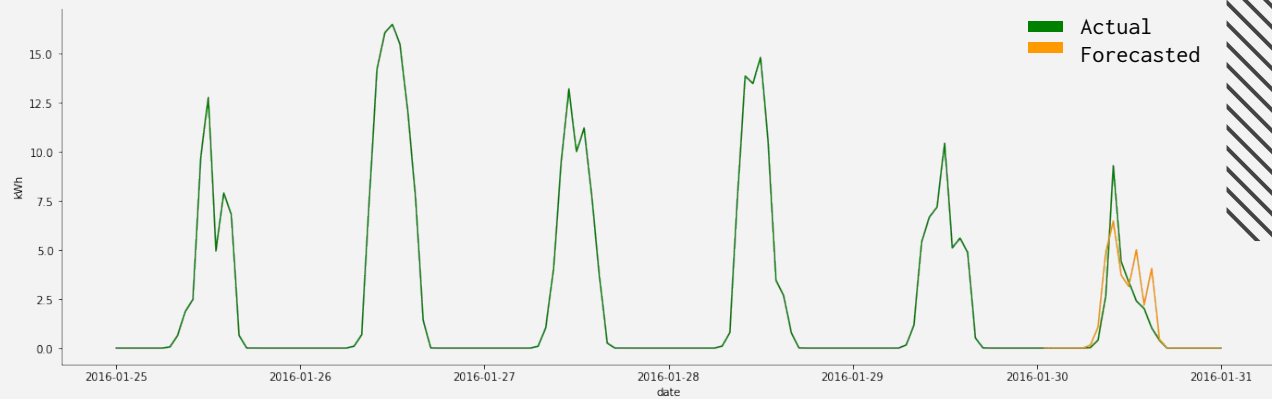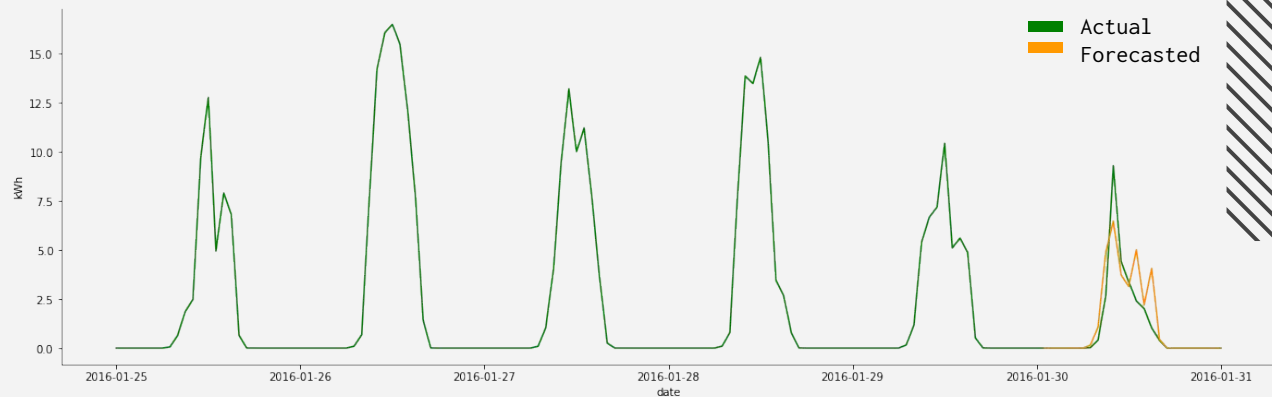# Energy output is higher and more consistent in sunnier seasons

Rolling Day-Ahead Hourly Forecasting with SARIMAX
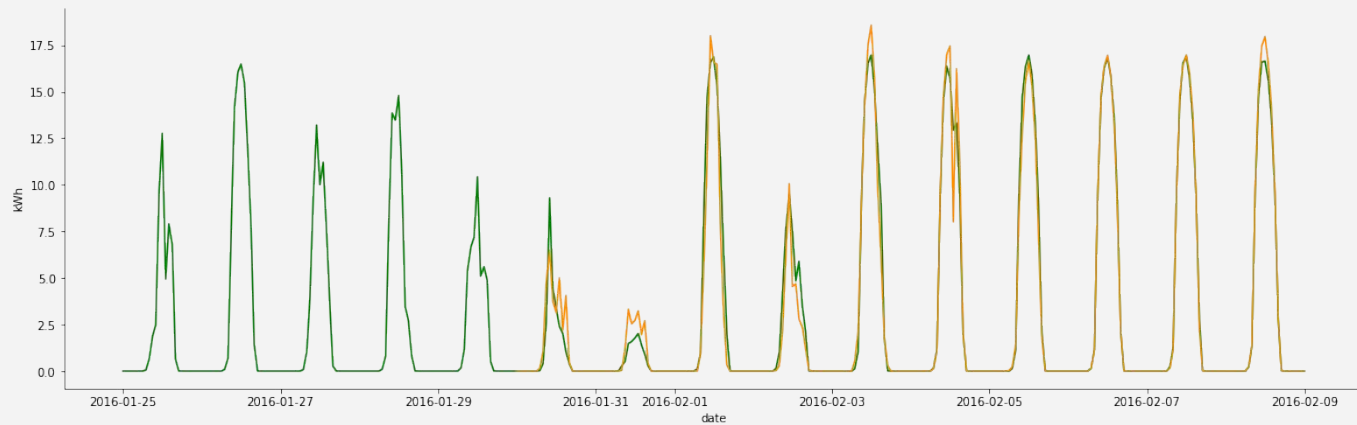
Forecasted:
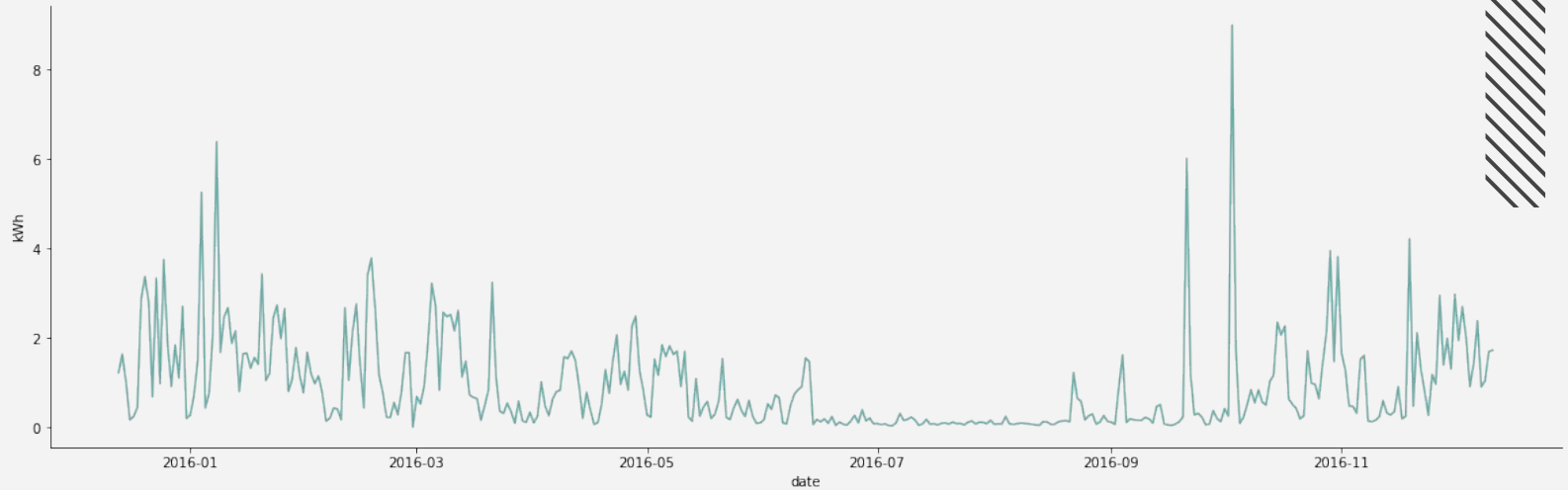1/30/2016

Rolling Day-Ahead Hourly Forecasting

Forecasted:
1/30/2016

Forecasted:
1/30/2016
through
2/8/2016

Model performs better in the summer than winter

daily mean absolute error

Total MAE (12/13/2015 – 12/11/2016):
0.87 kWh
Average Hourly Output: **7.72 kWh**

Dashboard Demo

Output Forecasting - PGE-CSI-00114 in Fresno, CA   ✏ Edit Details

ews | Jocelyn Lau

ead solar panel output forecasting and historical results and forecasting performance

Detail

Last Saved:	Dec 10, 2019
Workbook Details:	7 Sheets
Original Author:	You (Jocelyn Lau)

Metadata: Day-Ahead Forecast
Historical
Day-Ahead Forecast for 12/11/2016
Solar Irradiance Forecast
Historical Forecasted and Actual Output (kWh)
Historical Solar Irradiance
Historical Forecast Performance (Daily Mean Absolute Er

Conclusion

- Model can forecast hourly energy output for any day of the year

- Dashboard can show predictions and deep-dives into past experience/performance

- Dashboard and model can be scaled up to:

  - use data from different locations

  - use forecasted solar irradiance data

- Ultimate goal is to improve renewable energy efficiency and reduce reliance on fossil fuels

Thank You

Appendix

Creating a Day-Ahead Forecasting Model

Solar Panel Data

- California Solar Initiative (CSI) hourly PV output for 2011-2016 from a grid in Fresno, CA
- Solar irradiance data from the National Renewable Energy Laboratory (NREL)
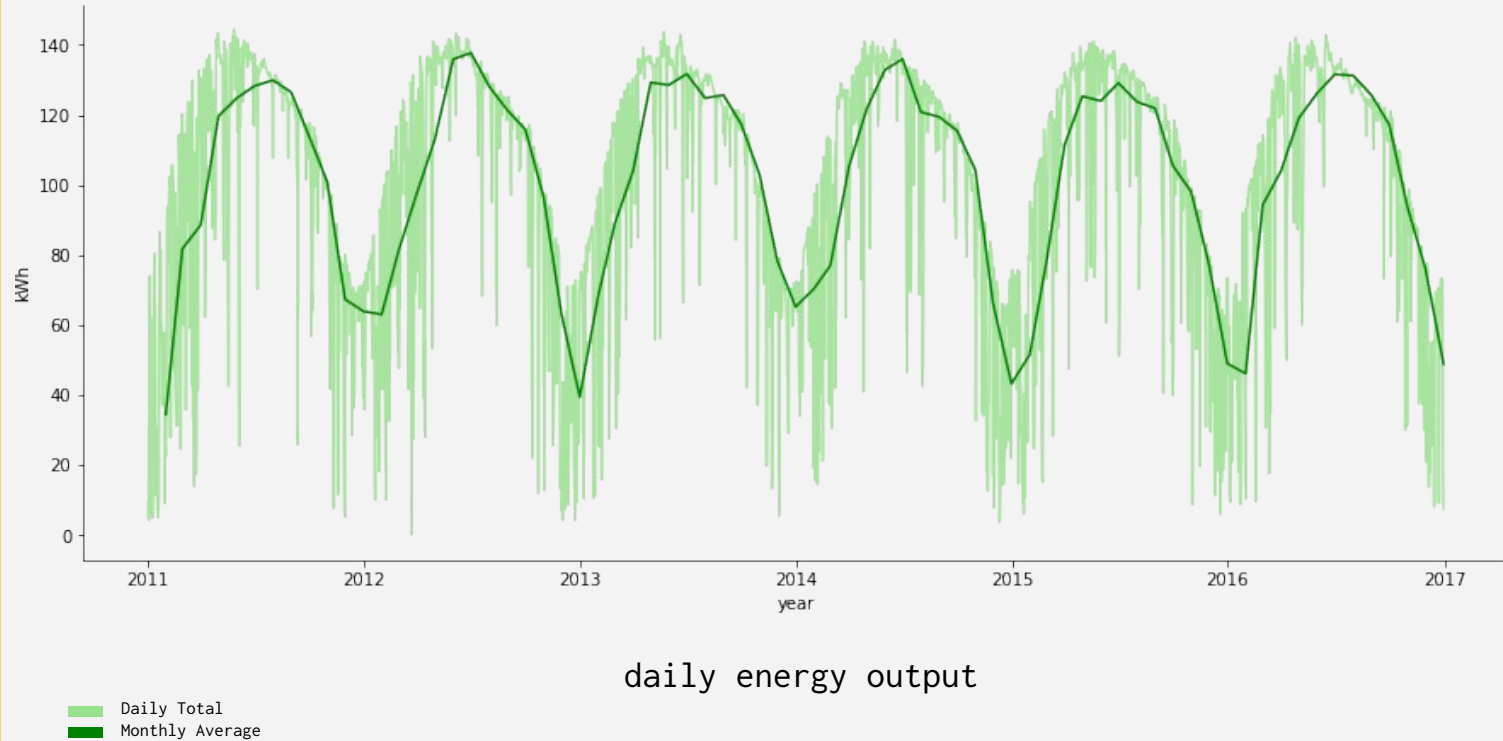
Forecasting

SARIMAX
- with exogenous variables (solar irradiance)

- daily seasonality

Dashboard

- Day-ahead forecasts
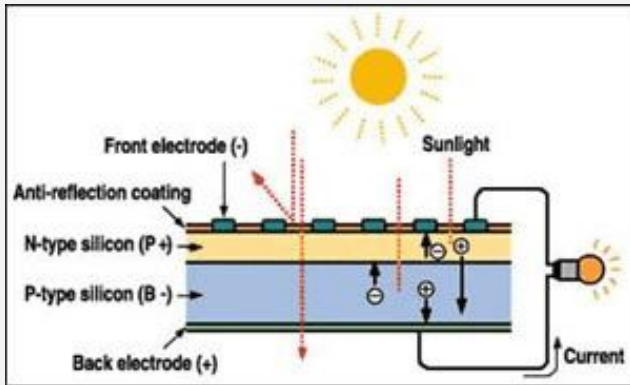- Historical trends

Energy output is higher and more consistent in sunnier seasons

daily energy output

Introduction

- Solar panel energy output varies day to day

- Benefits of day-ahead solar output forecasting for utility companies:

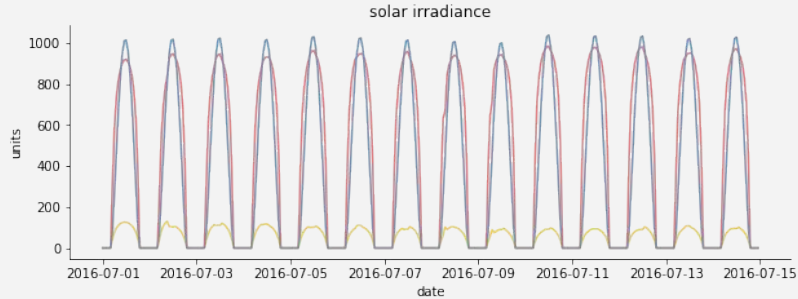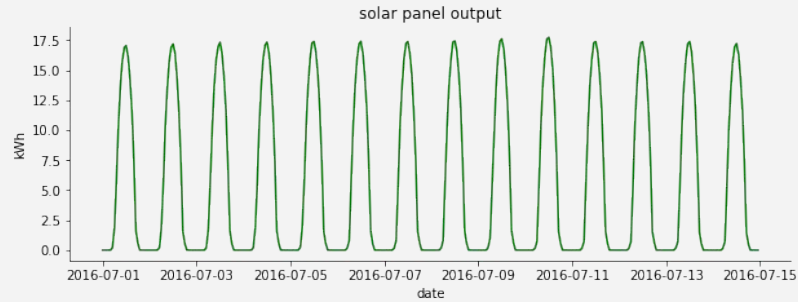Optimize energy sources for the day's energy demand

Plan maintenance on low-output days

Determine if solar panels are working properly

Energy output is higher and more consistent in sunnier seasons

July 1-14, 2016

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