GA Tech 2023 CAISO Solar Prediction Project

Overview

Increasingly, Solar Generation Forecasting is becoming a component of managing in Electric Grid oriented businesses. Uses of these forecasts are many and include:

- Energy Traders making bets on renewable generation and its contribution to meeting energy demand.
- Day Ahead Planners in utilities preparing for or short-term planning horizons
- Calculating vital metrics such as Net Demand. I
- Initializing Power Flow simulation models

While the Power & Renewables industry has a lot of experience with Demand Forecasting; there is less experience with Solar forecasting. With the rise of Solar Generation capability over the last decade, and its current growth, new approaches are an active area of investigation by Utilities, Academic Researchers, and Businesses and Consumers interested in Solar Power.

Data

Forecast Inputs

Use the open source PVLib library:

pvlib python — pvlib python 0.9.5 documentation

Forecast Target

Use the Actuals data in the attached Excel file

CAISO Total So… ls.xlsx
17 May 2023, 06:20 PM

Expectations

- You will work with your team to build a model(s) for CAISO Total Solar.
- You can build a single model, aggregate model (sub areas) or ensemble model (combining different kinds of model forecasts) as you see fit.
- At minimum, use GHI as an input variable; use whatever additional input variables you identify as adding value to the forecast.

- You will at minimum calculate and display Residuals to evaluate your model. Additional Evaluation statistics, visuals and processes are up to you (the team).
- You will leverage any open source library you feel appropriate and reference in your code. If you decide to use a custom forecasting algorithm of your own design; please supply the algorithm .
- Where you use any ideas or algorithms from the published literature, you will cite them.
- The resulting output should be a **7-day, hourly forecast** of CAISO solar power generation.
- Good Data Science Practice, but make sure to do a train and test set and evaluate performance on the test set.

Things To Think About

- What is the contribution of each input variable you choose to the forecast?
- Are your input variables bringing in “new information” into the model, or are they correlated?
- How does Solar forecast fit into the overall energy system, are there factors there that could influence it?
- Test Model Philosophies before testing model types? Does it make sense to break up the model into sub-regions ? Or in other formats and then bringing it together? What type of model to chose.
- High emphasis on Exploratory Data Analysis - Make sure you formulate a robust hypothesis on the variables selected that go beyond “X variable is a good predictor because it adds to the accuracy score“.

Judging Criteria

- We will judge models on two criteria: (a) model accuracy as evidenced via Residuals and (b) model explainability as evidenced by your summary report/presentation. Highest rank is “best”. Lowest rank is “worst”.
- We will rank order across teams on the two judgeing criteria.
- We will allow ties if two teams have same rank.

We will calculate final rank via the formula:

Final_Rank = (0.8 * Accuracy_Rank) + (0.2 * Explainability_Rank)

Resources

PViz Forecast Example

Forecasting — pvlib python 0.9.0+0.g518cc35.dirty documentation

CAISO Website

http://oasis.caiso.com/mrioasis/logon.do?reason=application.baseAction.noSession

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ll technical specifications and artifacts for OASIS are available on the ISO Developer site. **Self-registration is required to access the site.**
o download data without using the OASIS interface, see How to use report URLs to download OASIS data on the **ISO Developer site.**
ccess non-technical OASIS reference documents on www.caiso.com

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- CAISO Demand Forecast
- CAISO Peak Demand Forecast
- Wind and Solar Forecast
- Advisory CAISO Demand Forecast
- Sufficiency Evaluation Demand Forecast
- Load Adjustments

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site. On OASIS you will find real-time data related to
and its Market, such as system demand forecasts, tra
status, market prices and market result data.

Standards Information
North American Energy Standards Board (NAESB)

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Wind and Solar Forecast

Opr Date	Market	Trading Hub	Renewable Type	Opr Interval	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24	HE25
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- ACTUAL
- DAM
- HASP
- RTD
- RTPD

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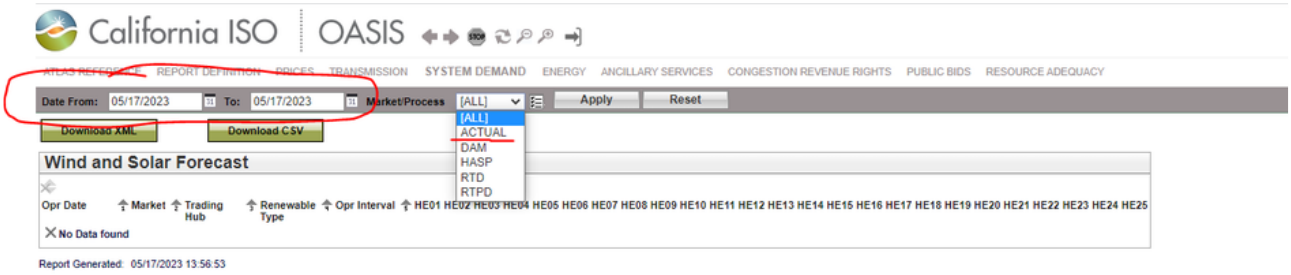

GHI

Global Horizontal Irradiance (GHI)

PV Performance Modeling Collaborative | Global Horizontal Irradiance

Residuals & Metrics

Numeracy, Maths and Statistics - Academic Skills Kit

Interpreting Residual Plots to Improve Your Regression

https://towardsdatascience.com/time-series-forecast-error-metrics-you-should-know-cc88b8c67f27