



Energy Forecasting

REQUEST FOR PROPOSAL
RFP #: EF – F2.P

TITLE: Energy Forecasting
CLOSING DATE AND TIME: OCTOBER 27, 2023 @ 5:00 PM

Hydro-electricity Forecast: EF – F2.P

Background and Purpose

By responding to this Request for Proposal (RFP), the Proposer agrees that s/he has read and understood all documents within this RFP package.

Submission Details

Responders to this RFP should supply the following 3 files (uploaded to Moodle) by October 27, 2023 @ 5:00 PM:

1. A business report up to 5 pages (not including cover page or table of contents), including any supporting plots and tables.
2. The commented code (in a separate file) used to produce the results.
3. A CSV file with the forecasted, hourly energy usage for all hours between October 27, 2023 through November 2, 2023.

The report should address **all points described in the “Objective” section** below.

Background

More states are starting to move towards a deregulation of energy companies which allows consumers the ability to choose their own energy supplier. But what does this mean? There are 3 parts of your electric service:

1. Generation – the production of electricity
2. Transmission – the movement of electricity from where it is generated to the point of distribution
3. Distribution – the delivery of electricity to your home or business

When you shop for an electric supplier, you are choosing the company that generates your electricity. Generation supply costs make up most of an average electric bill, so savings may be significant. For most electric customers who select a new supplier, the transmission costs will typically be included in the new charges received from the new supplier. The electric utility that distributes your electricity will remain the same.

Your team is tasked with forecasting the electric load for American Electric Power Co. (AEP), one of the major electricity suppliers in mid-Atlantic. Specifically, you will be forecasting hourly energy load for the Appalachian Power Territory of AEP. Electricity load by a power supplier need forecasts to better meet the needs of customers and prepare for operational expenses.

You are to forecast hourly energy usage for October 27, 2023 – November 2, 2023. Every week you will be sent the updated data with the latest week’s energy data through October 26, 2023.

The project will be broken down into 3 phases:

- Phase 1 – Exponential smoothing and seasonal ARIMA models
- Phase 2 – Prophet and neural network models
- Final Phase – Additional model as well as overall comparison of all modeling approaches used.

Objective

The scope of services includes the following:

- (Phase 1) The data contains monthly information with an annual seasonal component:
 - Evaluate the best approach to accounting for the seasonality.
 - Explain which approach you use and why.
- (Phase 1) Build an appropriate Exponential Smoothing Model.
 - Forecast this model for your validation set only.
 - Calculate the MAE and MAPE for the validation set.
- (Phase 1) Build a seasonal ARIMA model.
 - Describe the approach you used to select the lags of the model.
 - Forecast this model for your validation set only.
 - Calculate the MAE and MAPE for the validation set.
- (Phase 2) Build a Prophet model.
 - Forecast this model for your validation set only.
 - Calculate the MAE and MAPE for the validation set.
- (Phase 2) Build a neural network model.
 - Describe the approach you used to select the lags of the model.
 - Forecast this model for your validation set only.
 - Calculate the MAE and MAPE for the validation set.
- (Final Phase) Build an additional model of your choice.
 - Feel free to bring in extra data for this model. Some examples of useful data might be temperature or precipitation. (HINT: This is regional energy usage so you will have to find regional averages for any variables you choose to use.)
 - Feel free to combine techniques or bring in a new technique that is not covered in the above 4 techniques.
 - Forecast this model for your validation set only.
 - Calculate the MAE and MAPE for the validation set.
- (Final Phase) Compare the 5 models based on their MAE and MAPE for the validation set.
 - Select the model you want to use based on their validation set metrics.
 - Explain your choice.
- (Final Phase) Forecast your final chosen model for the test data set.
 - Calculate the MAE and MAPE for the test data set.

Data Provided

- The data is provided in a csv format. The variables contained within this data set are:

Datetime_beginning_ept – Date of the observation (in hourly format)

Nerc_region, mkt_region, zone, load_area – unused variables for defining region

Mw – megawatt hour energy usage for the given hour