

ENERGY MARKET FORECASTING

Laura Fedoruk - P.Eng., M.Sc., LEED AP BD+C

The background of the slide features a series of high-voltage electrical transmission towers, also known as pylons, silhouetted against a vibrant sunset sky. The sky transitions from a deep orange near the horizon to a darker blue at the top. The towers are interconnected by a network of power lines that stretch across the frame. A semi-transparent white rectangular box is centered in the upper half of the image, containing the main title and subtitle.

HOW CAN WE BALANCE THE ELECTRICAL GRID?

Time shifting of supply or demand requires predictive insight

Variable
Supply

Variable
Demand

BETTER DISTRIBUTED ENERGY RESOURCE DEPLOYMENT

Resilience



Sustainability



Cost

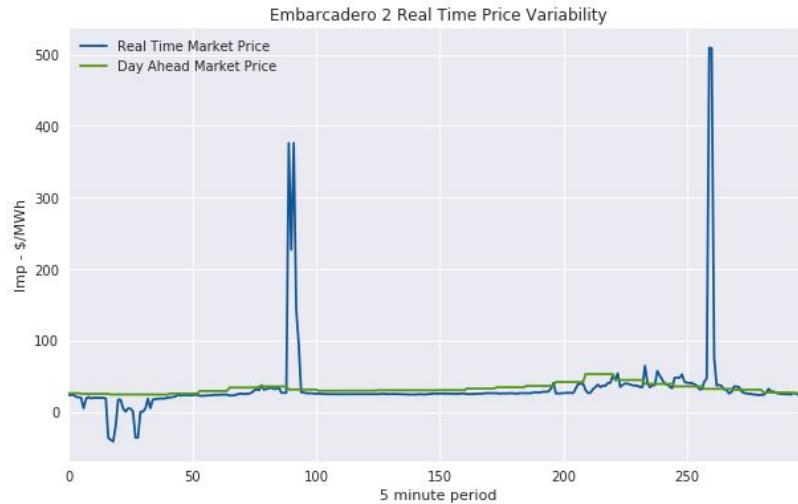


PREDICTIONS OF: LOCATIONAL MARGINAL PRICE

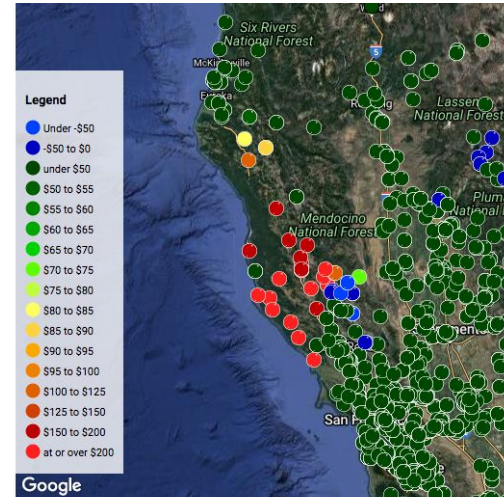
The cost of adding one unit of energy to the grid at a particular node.

WHOLESALE ENERGY MARKET PRICING

HIGHLY VARIABLE



LOCATION DEPENDENT



MODELING PROCESS

Data Gathering/Cleaning

- Weather data near nodes
 - Wind Speed
 - Irradiance
 - Dew Point
 - Temperature
 - Pressure, ...
- Pricing at other nodes
- Statewide demand
- Statewide net Import/Export

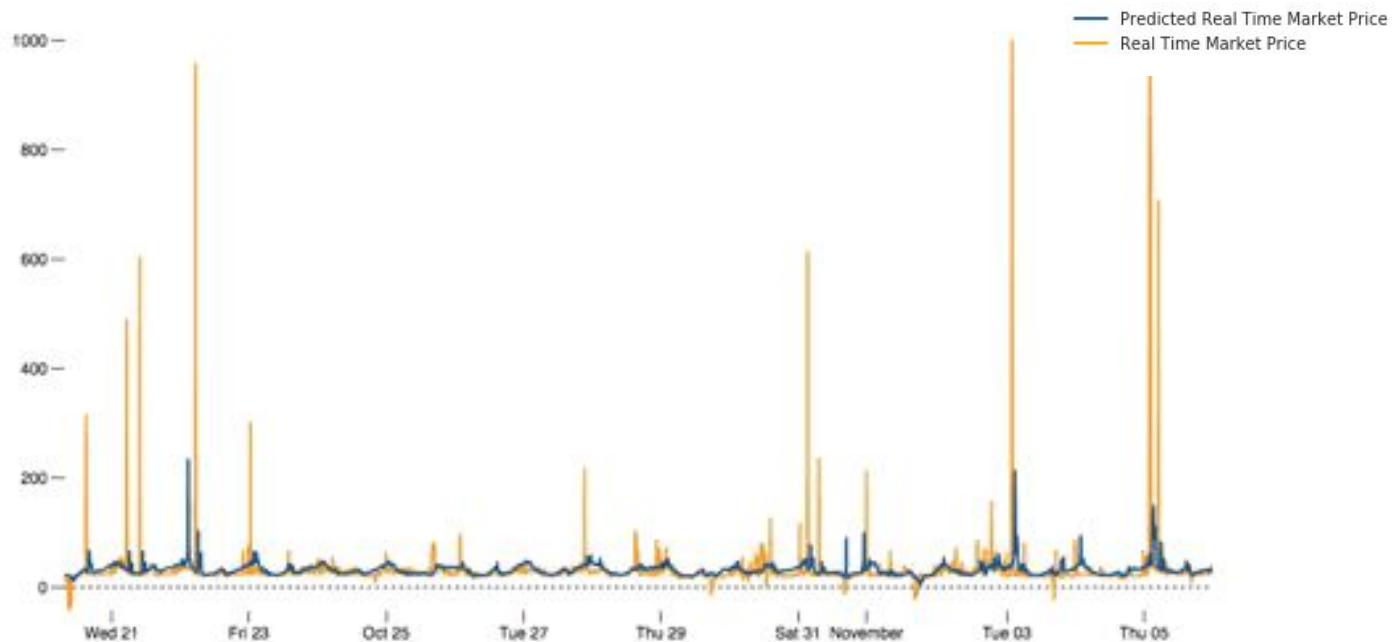
Time Series Decomposition and Feature Engineering

- Data resampling
- Seasonal components
- Short term memory of previous values
- Rolling averages
- Rate of change of values
- On and off 'peak' hours

Ensemble predictions for 60 min ahead of real time market

- Custom feature engineered auto-regressive moving average ensemble model:
 - Lasso
 - Random Forest Regressor

LMP TIME SERIES PREDICTIONS FOR EMBARCADERO SF



What features are predictive?

Historical Features related to:
Location Price and Weather
Generation
Demand



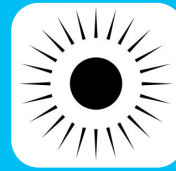
Other
Prices



California
Demand



Grid
mix



Solar
Irradiance



Wind
Speed



Nearby
rolling averages

ENERGY STORAGE DEPLOYMENT BASED ON TIME SERIES PREDICTIONS





74%

value capture vs. perfect foresight

THANK YOU!



Laura Fedoruk

Professional Engineer (APEGBC)

The University of British Columbia

M.Sc., B.A.Sc.



in/laura-fedoruk



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