Guest Editorial
Special Section on Analytics for Energy Forecasting with Applications to Smart Grid

WIDE RANGE deployment of smart grid technologies enables utilities to gather electricity consumption data on a much more granular level than ever before. While the utilities can potentially better understand the customers, design the demand response programs, forecast and control the loads, and plan the systems, they are facing analytic issues with making sense and taking advantage of the "big data."

This special section aims to bring together the state-of-the-art analytics, technologies and best practices in the smart grid era. Through a careful peer review process, 15 papers representing diverse topics on analysis and forecasting of load, price, wind power, demand response and electric vehicles are included in this special section. Based on the various aspects of contributions, these papers are categorized into five groups:

Global Energy Forecasting Competition (GEFCom2012): GEFCom2012 is the largest energy forecasting competition known to date. The competition includes two tracks, hierarchical load forecasting and wind power forecasting. The two papers below are from two of the winning teams.

- Local Short and Middle Term Electricity Load Forecasting with Semi-Parametric Additive Models
- Short-term Wind Power Ensemble Prediction based on Gaussian Processes and Neural Networks

Load Forecasting and analysis with High Granular Data: Modern technologies bring high resolution data to the utility industry. The following four papers apply novel methodologies to take advantage of the high granular load and weather data in load forecasting and analysis.

- Clustering-based Improvement of Nonparametric Functional Time Series Forecasting: Application to Intra-day Household-Level Load Curves
- Household Energy Consumption Lifestyle Segmentation using Hourly Data
- The Impact of Smart Grid Prosumer Grouping on Forecasting Accuracy and its Benefits for Local Electricity Market Trading
- Hierarchical Load Hindcasting Using Reanalysis Weather

Probabilistic Energy Forecasting: Forecasting is a stochastic problem by nature. While most research efforts in energy forecasting have been devoted to point forecasts, more and more decision making processes today are relying on the probabilistic forecasts. The four papers below present probabilistic forecasting methods for load, wind power and electricity price.

- Long Term Probabilistic Load Forecasting and Normalization with Hourly Information
- Probabilistic Forecasts of Wind Power Generation Accounting for Geographically Dispersed Information
- Future Wind Power Scenario Synthesis through Power Spectral Density Analysis
- A Hybrid Approach for Probabilistic Forecasting of Electricity Price

Forecasting and Analysis of Emerging Subjects: Energy forecasting, in a broader sense, covers more than just electric load. The following three papers discuss forecasting of emerging subjects, such as effect of demand response activities, reserve and regulation prices and sales and load profile of plug-in electric vehicles:

- Analysis of Conservation Voltage Reduction Effect Based on Multistage SVR and Stochastic Process
- Descriptive Models for Reserve and Regulation Prices in Competitive Electricity Markets
- Forecasting Plug-in Electric Vehicles Sales and the Diurnal Recharging Load Curve

Novel Methods for Wind Power Forecasting: Forecasting accuracy is crucial to renewable integration. The two papers below proposed novel methodologies to very short and short term wind power forecasting.

- Hybrid Forecasting Model for Very-short Term Wind Power Forecasting Based on Grey Relational Analysis and Wind Speed Distribution Features
- Short-term Spatio-temporal Wind Power Forecast in Robust Look-ahead Power System Dispatch

The papers included in this special section are written by the authors from utilities, academia, and vendors. Many of these papers can be highlighted in multiple groups listed above. We hope to offer the readers a comprehensive outlook of the industry needs and research trend in the area of energy forecasting.

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