

Scope of Work for Independent Consultant on PJM Load Forecasting Methodology 04/6/10

Purpose for Proposal

On March 8, 2010 a group of stakeholders requested, by letter, that the PJM Interconnection (PJM), “retain an independent consultant to review its peak load forecasting methodology and make recommendations.” The stated goal of the stakeholders is to “ensure that the load forecast is as accurate as possible and is adapted as necessary for changing circumstances.”

Background:

PJM developed an internal load forecasting function beginning in 2004, and released its first independent load forecast in 2006. The PJM load forecast model is an econometric model that produces estimates of non-coincident and coincident peaks loads and net energy for load, for each PJM zone, locational deliverability area (LDA) and the RTO. It uses local economic activity, weather, and day-type variables as explanatory variables/drivers. Weather data and economic data and forecasts are procured from outside vendors. The model features a Monte Carlo simulation of historical weather patterns and regional diversities to develop a distribution of forecasts which are then used to produce monthly and seasonal forecasts across a range of weather conditions.

Internal uses of the load forecast are: the Regional Transmission Expansion Plan (RTEP), which identifies needed system upgrades; the Reliability Pricing Model (RPM), the forward capacity market; emergency import capability (CETO/CETL) studies, which measure transmission constraints in PJM; and the installed reserve margin study, which determines the reserves required to maintain 1-in-10 reliability. Additionally, PJM supplies its load forecasts to the North American Electric Reliability Corporation (NERC), SERC Reliability Corporation (SERC) and ReliabilityFirst Corporation (RFC), for use in regional reliability assessments.

Subsequent to the release of the first load forecast in 2006, PJM experienced an unrestricted all-time peak load of 145,951 MW on August 2, 2006, exceeding the forecasted peak load by over 12,000 MW. PJM retained independent consultant The Brattle Group (TBG) to assess the load forecast model and make recommendations. TBG concluded that, “the model is doing a good job of forecasting peak demand and the main source of error is weather.” TBG also made recommendations for enhancements to the model. A number of TBG’s recommendations have been implemented (along with others that have been vetted through PJM’s Load Analysis Subcommittee).

As PJM developed the 2009 load forecast in fall 2008, the U.S. economy was in recession and the economic forecasts that drive the load forecasts were being revised downward significantly. Some PJM stakeholders expressed concern that the PJM model

was too dependent on the economic forecast of one vendor whose forecast could be erroneous, that the model was unable to respond to slowing load growth, and that there are industry developments that will impact load growth that are not reflected in the PJM model. This led PJM to conduct a special stakeholder process throughout 2009, which included sessions on the details of the model and review of all stakeholder concerns. Ultimately, the process resulted in one proposed revision: to supplement the existing forecast based on GMP data from a single vendor with an alternative forecast based on consensus US GDP data from the Blue Chip Economic Indicators publication. The proposal was rejected by a vote of the PJM Planning Committee on September 16, 2009.

Scope of Work:

PJM solicits analysis to address the following issues. All recommendations must be reasonably achievable, cost effective and compatible with PJM's planning policies. To the extent possible, all recommendations should be backed up with demonstrated benefits:

- **Maximizing Forecast Accuracy:**
 - The Brattle Group report (and PJM analysis) has verified that, given accurate inputs for weather and economics, the PJM load forecast model predicts unrestricted peak load accurately. The remaining challenge is to handle the two major sources of uncertainty:
 - **Weather:** uncertainty is currently handled through the Monte Carlo simulation which provides load estimates over a wide range of weather conditions. **Is there a more appropriate way to treat weather uncertainty or to determine 50/50 and 90/10 load levels?**
 - **Economics/Price:** PJM currently uses point estimates of economic variables from one provider (Gross Metropolitan Product from Moody's Economy.com). This puts significant weight on that one input (economics is the only true growth driver). The quality of the load forecast is directly tied to the quality of the economic forecast. The model does not include a price term for either peak load or net energy for load. **Is there a more appropriate way to incorporate economic activity into the model?** Consideration should be given to:
 - Economic variables in place of or in addition to Gross Metropolitan Product;
 - A method to select the most accurate economic forecaster;
 - Producing separate load forecasts using economic inputs from multiple providers (with a method to select a final forecast);
 - A method to produce a blended economic forecast from multiple providers;
 - A method to produce a true consensus economic forecast;

- A method to adjust the economic forecasts by the average error of the forecaster.

Can the load forecast model be improved by the addition of a price variable? Consideration should be given to:

- Address this issue separately for peak load and net energy for load;
- A method to acquire historical price data;
- A method to forecast forward prices.

- In addition to the unrestricted peak forecasts, PJM uses adjustments to the load forecasts to derive the final peak loads that are used in system planning studies and RPM. These adjustments capture the impact on future load growth of Demand Response, Energy Efficiency and Price Responsive Demand:

- PJM currently uses the amounts of DR, EE and PRD cleared in RPM auctions. PJM believes, at this time, that using only impacts of resources committed through the auction process is appropriate. **Is there a more appropriate way to incorporate future demand side response activity into the model? How should state mandates to reduce future load be addressed?** Consideration should be given to:
 - The ability to model demand side response as opposed to separately developing adjustments to the forecast;
 - The possibility of double-counting of energy efficiency gains already embedded in the load data;
 - The possibility that mandated load reductions may not materialize or be fleeting.

- **Minimizing the Impact of Forecast Error:**

- Even with any recommended revisions, there will always be forecast error. **Is there an opportunity to revise other PJM processes to minimize the impact of any load forecast error on market participants?** Consideration should be given to:

- RTEP:
 - Sensitivity studies
 - Revisions to the bright line test
- RPM:
 - Revisit the 97.5% procurement of resources through the Base Residual Auction;
 - Revisit the rules for incremental auctions to allow for non-procurement/sale of excess capacity.