PJM Interconnection
Load Analysis Subcommittee
Minutes of the 293rd Meeting
Conference Call
November 10, 2011

<u>**Members Present**</u>:

Randy Holliday	AEP Appalachian Transmission Company, Inc.
Kemm Farney	Atlantic City Electric Company
John Citrolo	Calpine Corporation
Dennis Kelter	Commonwealth Edison Company
Bill Schofield	Customized Energy Solutions
Dale Flaherty	Duquesne Light Company
William Moll	FirstEnergy Solutions Corp.
Michael Stansky	FirstEnergy Solutions Corp.
Stuart McMenamin	Itron
Frank Monforte	Itron
Andy Sukenik	Itron
Mike Krauthammer	Maryland PSC
David Hamilton	Old Dominion Electric Cooperative
James Wright	Old Dominion Electric Cooperative
Dave Mabry	PJM Industrials
Susan Mushock	PPL Electric Utilities Corporation d/b/a PPL Utilities
Bryan Mills	PSEG Energy Resources and Trade LLC
James Jablonski	Public Power Authority of New Jersey
Stephen Wreschnig	Public Service Electric & Gas Company
Ayana Wood	UGI Utilities, Inc.
Jeff Burke	Virginia Electric & Power Company
Abhijit Rajan	Virginia Electric & Power Company
Karim Siamer	Virginia Electric & Power Company
Debbie Kanner	West Penn Power Company d/b/a Allegheny Power
James Wilson	Wilson Energy Economics

<u>**PJM Staff Present**</u>:

John Reynolds, Chairman	PJM Interconnection, L.L.C.
John Slivka	PJM Interconnection, L.L.C.
Jennifer Warner-Freeman	PJM Interconnection, L.L.C.
Andrew Gledhill, Secretary	PJM Interconnection, L.L.C.

1. ADMINISTRATIVE

PJM took attendance and asked for any additional agenda items.

2. MINUTES

Minutes from the July 25, 2011 meeting were reviewed. The minutes were approved and final minutes will be posted to the LAS webpage.

3. REVIEW OF PJM ANALYSIS OF FORECAST ACCURACY AND STABILITY

Ms. Warner-Freeman provided a detailed summary of analysis on forecast accuracy and stability that was presented to, and endorsed by, Itron. This analysis was initiated in response to members' concern of PJM's choice to use Moody's Analytics as its sole economic vendor. An earlier recommendation from Itron had indicated that blending with Global Insight forecasts may provide more accurate and stable load forecast results.

PJM's approach was to utilize archived economic forecasts from Moody's Analytics and Global Insight from 2005 through 2011 to produce peak load forecasts had PJM been using a particular vendor or forecast method at that time. December economic forecasts were used to produce the load forecast and the following June economic forecasts were used to produce the weather-normalized peak load values. These months were chosen due to availability.

Prior to analyzing the accuracy of load forecast results, PJM examined the accuracy of the economic data in isolation. PJM's findings showed that Global Insight was slightly better at forecasting Gross Domestic Product (GDP); Moody's Analytics had more accurate results with Gross Metropolitan Product (GMP); the two economic vendors were similarly accurate at forecasting nonmanufacturing employment and population.

Mr. Wilson posed a question as to whether PJM had investigated which economic vendor was more accurate in forecasting the economic indices, as Itron had recommended. Ms. Warner-Freeman responded that this analysis was not conducted as the economic indices used are PJM creations and thus there is no benchmark by which to gauge their accuracy.

Ms. Warner-Freeman moved on to explaining the analysis of the load forecast accuracy results. Results were analyzed by comparing:

> 1) Forecasted peak load values to weather-normalized peaks and
> 2) Actual peaks to values produced by using actual economics and actual weather conditions (or "actual to actual").

Models were developed using GMP, GDP, Index 1, Index 2 as well as Index 1 and Index 2 with GDP replacing GMP and real personal income. The models used Moody's Analytics, Global Insight and an average of the two economic vendors' forecasts.

PJM's efforts of evaluating forecasts relative to w/n peaks were summarized. This included looking at the absolute percent error and how the various model combinations stacked up against one another. The primary analytical tool chosen was a method that measured the magnitude of performance improvement. This involved looking at each zone and selecting a model that was the most accurate in each forecast period and then comparing all other models' accuracy to this most accurate model to obtain the percent from the best model. This analysis showed Moody's Index 1 as the best performer in terms of accuracy.

Zonal weights were then constructed by calculating each zone's average contribution to the RTO CP from 2006 to 2011. Combining these weights with the aforementioned accuracy measure still showed Moody's Index 1 as the top performer, followed by Moody's Index 2.

Analysis involving the "actual to actual" approach was then discussed. Gauging the methods by magnitude of performance improvement showed the index approaches as the best. Results were fairly similar across indexed forecast types, with Global Insight Index 2 showing a slight edge.

Ms. Warner-Freeman laid out PJM's approach to quantifying stability based on an Itron recommended metric, the coefficient of variation. Load forecasts were generated and then compared to see how much variation there was within a given year for each vendor and method combination. Moody's Index 1 and Moody's Index 2 were found to be the most stable the most often. Similar to the accuracy approach, PJM constructed a tool to measure the magnitude of stability improvement. This still showed Moody's Index 1 and Moody's Index 2 as the most stable. This finding was unchanged after incorporating the previously discussed zonal weighting scheme.

Due to PJM's interest in both accuracy and stability, analysis was presented that combined both into a singular measure. A 50/50 weighting was chosen on accuracy and stability to reflect that PJM is equally interested in both qualities for a forecasting method. These findings pointed to Moody's Index 1 or Moody's Index 2 as being the preferable options for forecasting considering current information.

4.   REVIEW OF UPDATED ITRON RECOMMENDATIONS

Itron presented its latest "Update on PJM Models Forecast Performance and Recommendations" report recommending the use of Index 2 with Moody's Analytics. Dr. McMenamin summarized their prior recommendations 1, 3 and 4 and their rationale. These recommendations were for:

- (1) Adopting an index-based forecasting approach
- (3) Using a weighted average of the economic forecasts from Moody's Analytics and Global Insight
- (4) Tracking each provider's performance to adjust vendor weighting in future forecasts.

Dr. McMenamin explained that recommendations (3) and (4) were based on survey responses that had showed that Moody's and Global Insight were the forecast providers predominantly used. This suggested that without additional information on vendor performance, equally weighting each vendor and tracking their forecast errors for weighting adjustment were sound recommendations.

Dr. McMenamin discussed their review of PJM's results and stated that they concluded that looking at zonal-weighted calculations was the appropriate way to examine the findings. Observing accuracy and stability in tandem show, based on PJM's analysis, Moody's Index 1 and Moody's Index 2 to be the preferred forecasting approaches. This confirmed their prior judgment that an index-based forecasting method is favored.

Itron's latest recommendation is to adopt Moody's Index 2 and continue to observe Global Insight forecasts for potential future blending of the two vendors. Index 2 is chosen over the moderately better performing Index 1 as Index 2 makes more sense conceptually due to its different weighting of customer segments, its injection of regional flavor, and its greater potential for refinement in the future.

Mr. Wilson posed a question as to whether Moody's or Global Insight was consulted on PJM's findings. Ms. Warner-Freeman responded that they had not, to which Mr. Wilson stated that Global Insight had concerns about the PJM analysis. Mr. Wilson asked if PJM would be willing to submit their analysis to Global Insight for review and PJM agreed.

Mr. Wilson asked for clarification on how PJM constructed weather-normalized values, as to whether they were constructed using Moody's only. Ms. Warner-Freeman responded that weather-normalized values were calculated using each economic vendor and forecasting method combination.

Mr. Wilson raised several issues in regard to PJM's analytical approach. Among other criticisms, he pointed out that under PJM's approach, the ranking of the various forecast approaches depended upon which other approaches were included in the analysis (there were a total of 18 approaches). Mr. Wilson suggested that analysis should have been performed with only results related to the index-based methods that were under consideration. Ms. Warner-Freeman stated that the goal of the analysis was to evaluate all possible combinations of forecast method and economic vendor. Mr. Farney interjected that perhaps arithmetic should also be done on an individual basis if there is interest in verifying PJM results. Mr. Farney continued to state that he has come to similar findings and economic vendor choice likely does not matter.

Mr. Wilson noted that under PJM's analysis, Global Insight had performed more accurately in the comparison of actual peaks to values produced using actual economics and actual weather. Dr. McMenamin explained that this is not a true forecast test and thus not the optimal way to gauge forecast accuracy. Itron views the appropriate test as comparing weather-normalized peaks to forecasted peaks, which shows Moody's as the more accurate performer.

Mr. Wilson questioned whether Itron remained concerned over the vendors' ability to forecast GMP. Dr. McMenamin explained that he had some lingering concerns over long-term forecasts, but reiterated Itron's choice to use Moody's forecasts exclusively for now and to continue to evaluate the decision over blending.

Mr. Wilson asked for clarification on the conclusion that Moody's was more accurate and why the decision was made not to blend. Dr. McMenamin stated that he is inclined to prefer the blended approach, but pointed out the better performance by Moody's in the weather-normalized accuracy analysis. For this reason, Dr. McMenamin stated that at this point it was not advisable to switch to a method that performs less accurately.

Mr. Wilson asked if greater forecast stability is always an advantage, noting that during a period of instability as is seen in a recession that stability is not necessarily favorable. Dr. McMenamin responded that this is only the case if it is stable and less accurate, reiterating that Moody's results were more accurate and had less variation. Mr. Farney stated his support for PJM's method of evaluating forecasts going forward and that stakeholders may be able to make contributions in the future through knowledge sharing. Mr. Reynolds reiterated that PJM plans to follow the roadmap Itron has laid out.

Mr. Rajan asked if Itron had done any analysis on estimation period residuals to see if they are correlated. Dr. McMenamin responded that he had not looked at the residuals and the focus has been on forecast accuracy. Mr. Rajan stated that he had found residuals in PJM's existing Dominion Zone model to be correlated. Dr. Menamin agreed that introducing an autoregressive term may alter coefficients of other variables present in the model and potentially impact the forecast.

5.   PJM PLAN FOR LOAD FORECAST MODEL REVISIONS

Mr. Reynolds stated that PJM plans to proceed with the 2012 load forecast using Index 2 which was endorsed by the Planning Committee and will be asked for approval by the Markets and Reliability Committee at their November 16th meeting. Manual language is not specific on vendor choice and PJM will use Moody's forecasts for now and will evaluate this choice in the future using Itron's roadmap for vendor pooling.

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