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Review of PJM Models

Model Accuracy and Forecast Stability

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PJM Model Accuracy and Forecast Stability

This memo provides analysis of forecast results provided by PJM to Itron. PJM generated a series of estimated models and forecasts based on data that would have been available at five points in time. The timing of the forecasts is summarized as follows:

- Final2007 – Models are estimated using data through Oct 31, 2006. Forecasts are based on June 2006 economics (history and forecast).
- Final2008 – Models are estimated using data through Aug 31, 2007. Forecasts are based on September 2007 economics (history and forecast).
- Final2009 – Models are estimated using data through Aug 31, 2008. Forecasts are based on Dec 2008 economics (history and forecast).
- Final2010 – Models are estimated using data through Aug 31, 2009. Forecasts are based on Nov 2009 economics (history and forecast)
- Final2011 – Models are estimated using data through Aug 31, 2010. Forecasts are based on Dec 2010 economics (history and forecast)

All forecasts are based on economic data from Moody's. To generate the results it was necessary to gather the Moody's historical and forecast data values in place at each point in time for all of the economic factors used in construction of the Index variables. These factors are: Population, Households, Real Personal Income, Non Manufacturing Employment, Real Gross Metropolitan Product and Real Gross Domestic Product.

For each forecast vintage, three sets of models were estimated and used to generate daily coincident and non-coincident peak forecasts. The first model uses the standard PJM specification, based on GMP as the single driver. The second model uses the Index1 approach, which uses common weighting factors for all zones. The third model uses the Index2 approach, which uses different weightings based on revenue class sales for each zone.

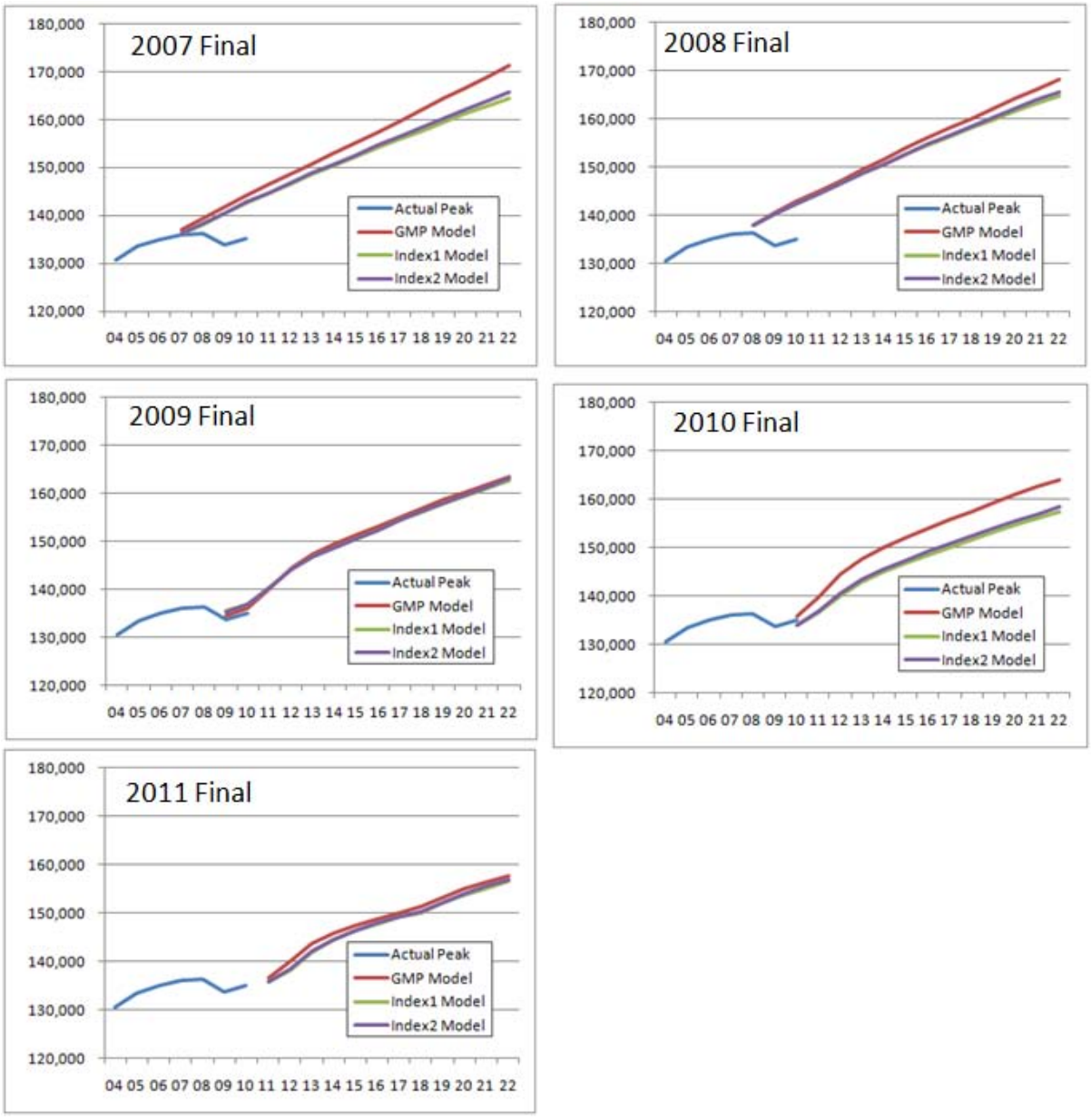
Results for the annual summer peaks were provided for the PJM zones as well as the RTO total values. The annual peak forecasts at the RTO level are summarized in Figure 1. In this figure, each graph represents one forecast vintage. Each graph shows the three sets of forecast methods and also the actual weather normalized peak values through 2010.

Visual inspection of the forecasts shows the following:

- In the first forecast (Final2007), the GMP approach generated a higher overall forecast than the Index approaches. The difference was about 1,000 MW one year out, increasing to 5,000 MW in the later years.

- In the second forecast (Final2008), the differences narrowed. All approaches gave a very similar short-term forecast. The GMP approach again gave a higher forecast in the later years, but the difference fell to about 3,000 MW.

Figure 1: Forecasts of PJM Summer Peak



- In the third set of forecasts (Final2009), the approaches converged to give similar short-term and long term forecasts.

- In the fourth set of forecasts (Final 2010), forecasts using the GMP method accelerated slightly while the Index model forecasts dropped significantly. The resulting gap is about 2,000 MW in the near term, increasing to 6,000 MW in the long term.

- In the most recent set of forecasts (Final2011), the index approaches remained relatively stable and forecasts from the GMP method declined significantly. The GMP method still shows slightly stronger growth in the short term, but the long-term values are within 1,000 MW of the index-based forecasts.

These results are used to calculate statistics that summarize the accuracy of each forecast approach as well as the stability of forecasts generated by each approach.

Forecast Accuracy

To judge forecast accuracy, the forecast results were compared to weather normalized actual peak values for 2008, 2009, and 2010. The results using the GMP method are shown in Figure 2. This figure shows the five sets of forecasts and accuracy statistics (1, 2, and 3 year ahead percentage errors).

Comparable statistics are provided for the Index1 method and the Index2 method in Figures 3 and 4, respectively.

Figure 2: Accuracy Statistics for PJM Peak using GMP Method

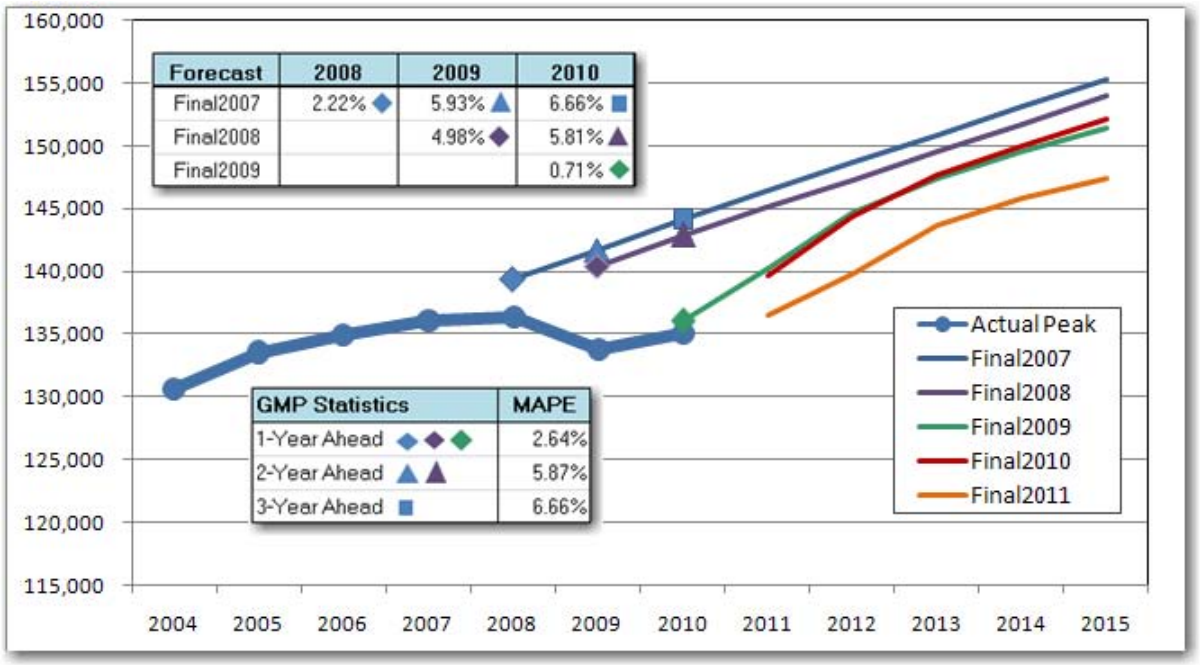


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Figure 3: Accuracy Statistics for PJM Peak using Index1 Method

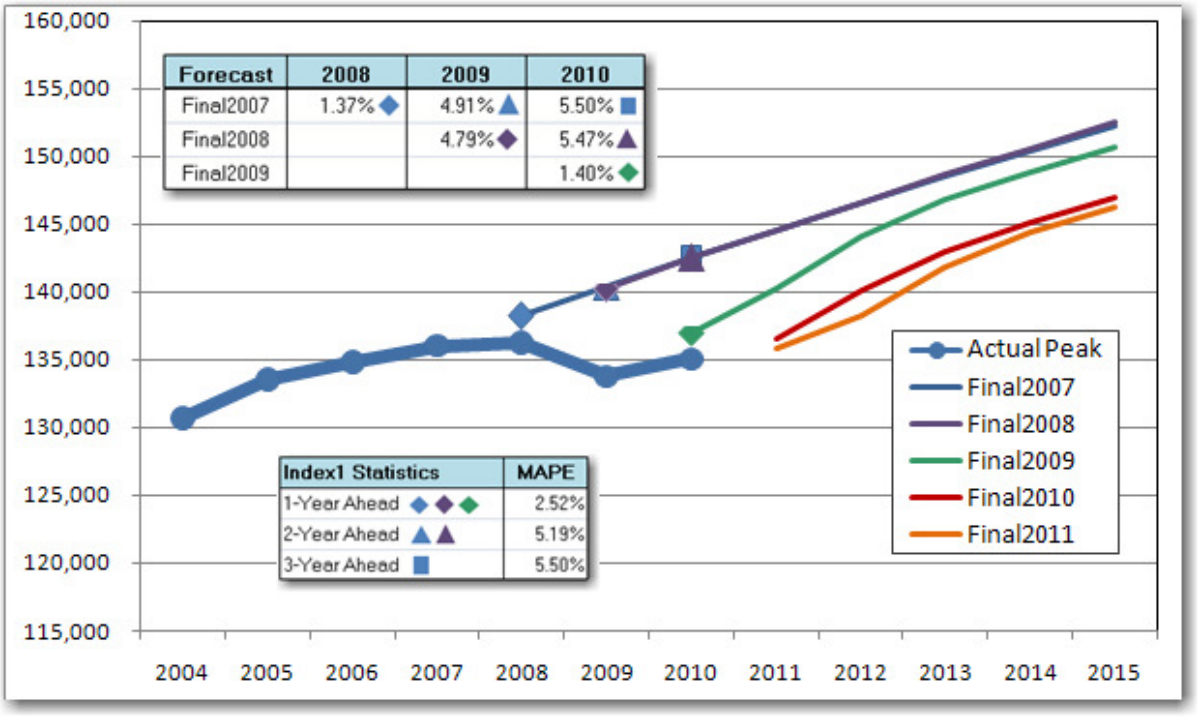
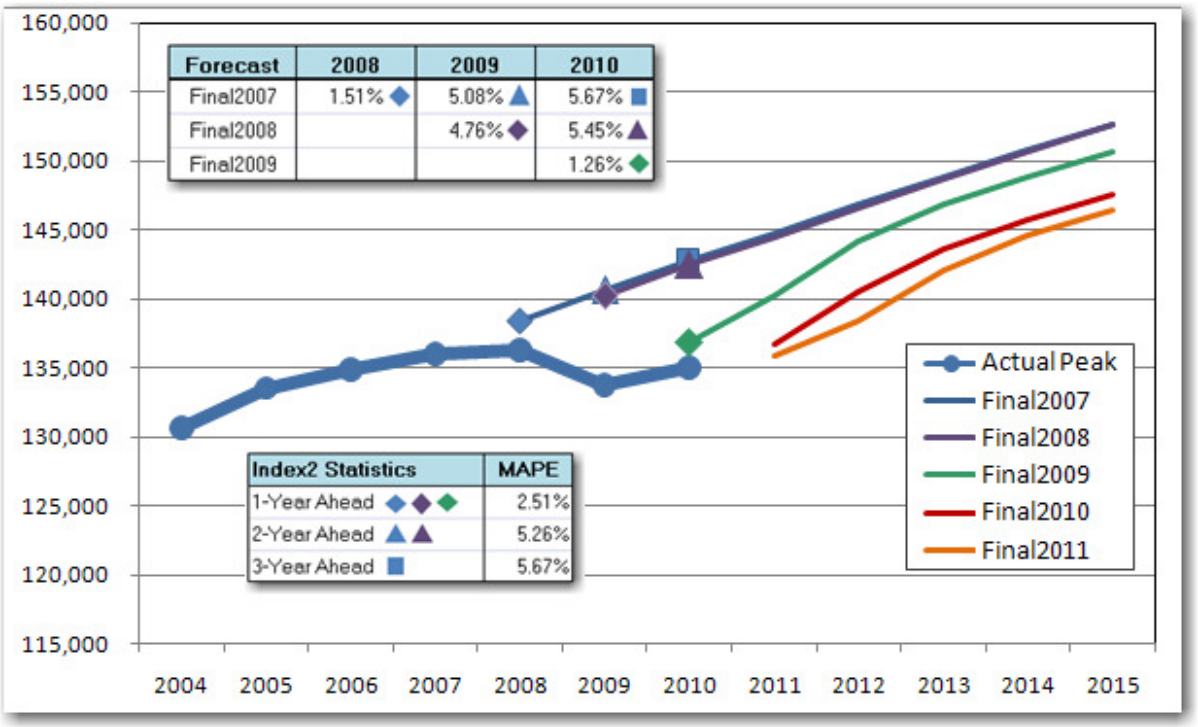


Figure 4: Accuracy Statistics for PJM Peak using Index2 Method



To compute 1-year ahead errors, three forecast values are used: the Final2007 forecast for 2008, the Final2008 forecast for 2009, and the Final2009 forecast for 2010. These

forecasts are represented by diamond shape symbols on each forecast line. To compute 2-year ahead errors, two forecast values are used: the Final2007 forecast for 2009 and the Final2008 forecast for 2010. These forecasts are represented by triangular symbols on each forecast line.

To compute the 3-year ahead errors, a single forecast is used: the Final2007 forecast for 2010. This forecast is represented by the square shaped symbol on the 2007 forecast line.

In all cases, the error is computed from the difference between the symbols on each forecast line and the corresponding weather normalized actual value. The residuals are computed as Predicted-Actual, so a positive value indicates an overprediction.

The Year ahead statistics are compared in Figure 5, which shows the mean absolute error statistics for all three methods. As shown, Index 2 has a slight accuracy edge for the 1-Year ahead forecasts, but Index1 performs better in the 2-Year ahead and 3-Year ahead time frames.

Figure 5: Comparison of Accuracy Statistics

Years Ahead	GMP	Index1	Index2
1-Year Ahead	2.64%	2.52%	2.51%
2-Year Ahead	5.87%	5.19%	5.26%
3-Year Ahead	6.66%	5.50%	5.67%

These statistics are repeated for each of the zones for the 1-Year statistics in Figure 6, for the 2-Year statistics in Figure 7, and for the 3-Year Statistics in Figure 8. These figures show coincident peak (CP) statistics on the left and non coincident zone peaks (NCP) on the right. In these figures, the cell highlighted in Green on each row has the best accuracy of the three methods for the zone and forecast time frame.

The conclusions are the same whether the CP or NCP statistics are used.

- For the 1-Year statistics, Index2 has a slight edge over the other methods, based on the average of the zone statistics. It has the best accuracy for 9 of the 18 zones for CP and 11 of the 18 zones for NCP.

- For the 2-Year statistics, Index1 and Index2 are comparable. Index1 has the best accuracy for 8 of 18 zones for both CP and NCP. Index2 has the best accuracy for 8 of 18 zones for both CP and 7 of 18 zones for NCP. The GMP method has the best accuracy for only 2 zones (Penelec and Dayton).

- For the 3-Year statistics, Index1 and Index2 are both about 1% more accurate than the GMP method. Index1 has a slight edge, and has the best accuracy for 10 of 18 cases for CP and 8 of 18 cases for NCP.

Figure 6: 1-Year Ahead Accuracy Statistics by Zone

	CP Forecast MAPES 1 Year Ahead		
Zone	GMP	Index1	Index2
AE	5.67%	4.09%	3.89%
AEP	2.45%	2.72%	2.96%
APS	3.06%	3.02%	3.13%
BGE	2.07%	1.36%	1.20%
COMED	4.24%	4.24%	4.20%
DAYTON	5.30%	5.81%	5.87%
DPL	4.69%	3.73%	3.64%
DQE	2.53%	1.45%	1.60%
JCPL	3.36%	1.76%	1.54%
METED	2.42%	2.43%	2.51%
PECO	1.96%	1.37%	1.38%
PENLC	2.05%	3.39%	2.99%
PEPCO	2.29%	1.70%	1.58%
PL	2.53%	2.80%	2.84%
PS	2.74%	1.72%	1.55%
RECO	2.35%	2.01%	1.89%
UGI	3.61%	3.80%	3.65%
VEPCO	2.76%	2.61%	2.57%
Zone Avg	**3.12%**	**2.78%**	**2.72%**
Most Accurate	**33.3%**	**16.7%**	**50.0%**
PJM_RTO	**2.64%**	**2.52%**	**2.51%**

	NCP Forecast MAPES 1 Year Ahead		
Zone	GMP	Index1	Index2
AE	5.26%	3.58%	3.41%
AEP	2.46%	2.45%	2.67%
APS	2.87%	2.66%	2.78%
BGE	1.90%	0.99%	0.86%
COMED	4.18%	3.93%	3.90%
DAYTON	5.19%	5.58%	5.55%
DPL	4.38%	3.31%	3.23%
DQE	2.21%	1.15%	1.29%
JCPL	3.09%	1.31%	1.21%
METED	2.16%	1.90%	2.00%
PECO	1.75%	1.34%	1.34%
PENLC	1.91%	3.02%	2.63%
PEPCO	2.07%	1.48%	1.36%
PL	2.35%	2.40%	2.45%
PS	2.56%	1.39%	1.25%
RECO	2.86%	2.66%	2.55%
UGI	2.20%	2.26%	2.12%
VEPCO	2.64%	2.47%	2.42%
Zone Avg	**2.89%**	**2.44%**	**2.39%**
Most Accurate	**16.7%**	**22.2%**	**61.1%**
Zone Wgt Avg[1]	**2.51%**	**2.18%**	**2.18%**

Figure 7: 2-Year Ahead Accuracy Statistics by Zone

	CP Forecast MAPES 2 Years Ahead		
Zone	GMP	Index1	Index2
AE	11.19%	8.72%	8.53%
AEP	5.84%	5.28%	5.67%
APS	3.92%	3.75%	4.04%
BGE	3.30%	2.82%	2.64%
COMED	9.70%	8.45%	8.63%
DAYTON	7.73%	10.25%	9.75%
DPL	7.93%	6.64%	6.66%
DQE	4.16%	3.51%	3.60%
JCPL	6.22%	4.72%	4.40%
METED	5.26%	4.54%	4.77%
PECO	4.38%	3.16%	3.91%
PENLC	5.46%	7.11%	6.43%
PEPCO	4.25%	3.44%	3.04%
PL	5.93%	5.28%	5.49%
PS	4.96%	3.89%	3.69%
RECO	3.20%	2.64%	2.73%
UGI	7.64%	7.08%	6.88%
VEPCO	3.93%	3.76%	3.63%
Zone Avg	**5.83%**	**5.28%**	**5.25%**
Most Accurate	**11.1%**	**44.4%**	**44.4%**
PJM_RTO	**5.87%**	**5.19%**	**5.26%**

	NCP Forecast MAPES 2 Years Ahead		
Zone	GMP	Index1	Index2
AE	10.36%	8.12%	7.94%
AEP	5.90%	5.11%	5.49%
APS	3.63%	3.36%	3.67%
BGE	3.17%	2.54%	2.36%
COMED	9.58%	8.04%	8.20%
DAYTON	7.51%	10.03%	9.52%
DPL	7.56%	6.11%	6.15%
DQE	3.94%	3.22%	3.31%
JCPL	6.10%	4.42%	4.11%
METED	4.90%	3.96%	4.20%
PECO	4.07%	2.85%	3.56%
PENLC	5.08%	6.58%	5.93%
PEPCO	3.87%	3.07%	2.68%
PL	5.56%	4.83%	5.03%
PS	4.72%	3.60%	3.41%
RECO	3.39%	3.89%	3.95%
UGI	5.88%	5.38%	5.18%
VEPCO	3.74%	3.41%	3.29%
Zone Avg	**5.50%**	**4.92%**	**4.89%**
Most Accurate	**16.7%**	**44.4%**	**38.9%**
Zone Wgt Avg[1]	**5.67%**	**4.86%**	**4.92%**

[1] The Zone Wgt Avg represents the NCP model accuracy for the PJM RTO. It is intended to provide a comparison of overall NCP model accuracy by weighting each of the contributing zones with respect to their peak load.

Figure 8: 3-Year Ahead Accuracy Statistics by Zone

Zone	CP Forecast MAPES 3 Years Ahead		
	GMP	Index1	Index2
AE	12.24%	9.49%	9.27%
AEP	7.93%	6.85%	7.44%
APS	4.10%	3.60%	4.18%
BGE	4.36%	3.40%	3.24%
COMED	10.39%	8.11%	8.51%
DAYTON	5.46%	7.56%	7.07%
DPL	7.41%	5.68%	5.80%
DQE	4.90%	3.60%	3.87%
JCPL	7.05%	5.19%	4.85%
METED	6.80%	6.07%	6.37%
PECO	4.74%	3.40%	4.23%
PENLC	8.29%	10.06%	9.13%
PEPCO	5.47%	4.11%	3.66%
PL	7.72%	6.65%	6.94%
PS	5.78%	4.35%	4.19%
RECO	2.24%	0.15%	0.49%
UGI	9.21%	8.10%	7.92%
VEPCO	3.54%	2.96%	2.87%
Zone Avg	**6.54%**	**5.52%**	**5.56%**
Most Accurate	**11.1%**	**55.6%**	**33.3%**
PJM_RTO	**6.66%**	**5.50%**	**5.67%**

Zone	NCP Forecast MAPES 3 Years Ahead		
	GMP	Index1	Index2
AE	10.98%	8.62%	8.40%
AEP	7.88%	6.67%	7.24%
APS	3.68%	3.25%	3.81%
BGE	4.15%	3.14%	3.00%
COMED	10.34%	7.96%	8.35%
DAYTON	5.13%	7.52%	6.99%
DPL	7.26%	5.31%	5.43%
DQE	4.72%	3.49%	3.73%
JCPL	6.60%	4.71%	4.40%
METED	6.20%	5.38%	5.68%
PECO	4.22%	3.06%	3.84%
PENLC	7.61%	9.33%	8.46%
PEPCO	5.02%	3.74%	3.30%
PL	7.19%	6.12%	6.38%
PS	5.43%	4.10%	3.94%
RECO	2.66%	1.28%	0.59%
UGI	7.04%	6.21%	6.05%
VEPCO	3.29%	2.59%	2.50%
Zone Avg	**6.08%**	**5.14%**	**5.12%**
Most Accurate	**11.1%**	**44.4%**	**44.4%**
Zone Wgt Avg[1]	**6.38%**	**5.19%**	**5.36%**

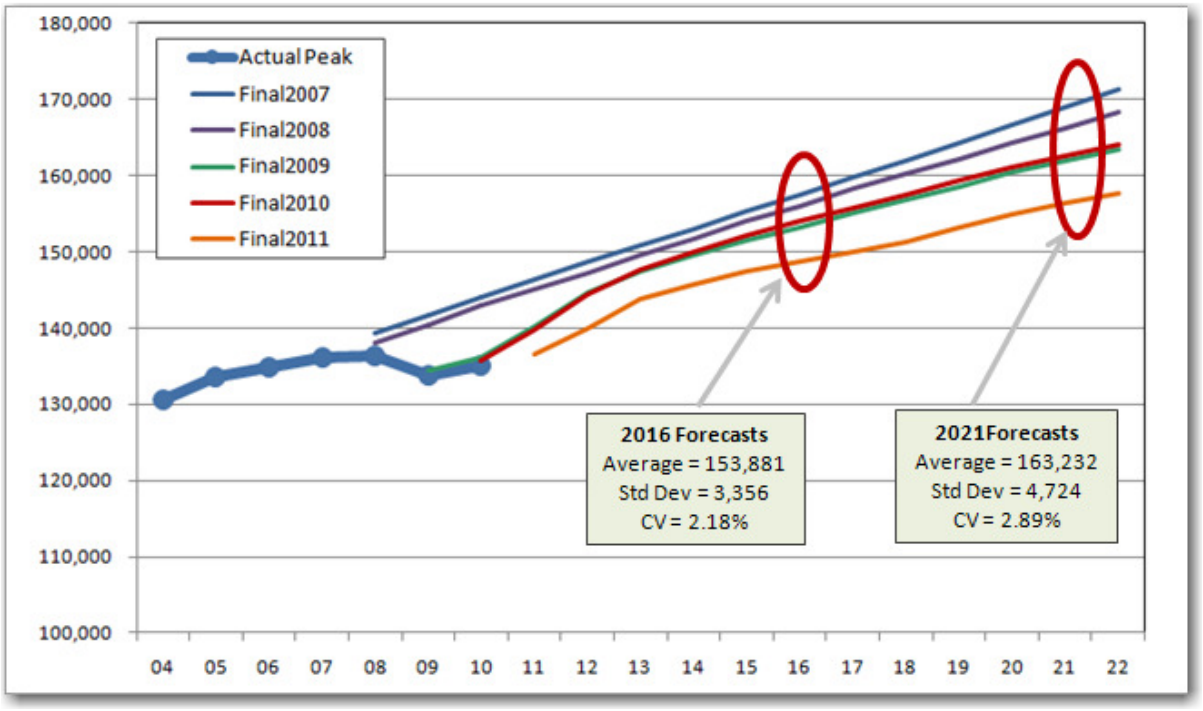
Forecast Stability.

The second set of statistics concern forecast stability. The stability of a forecasting method reflects the stability of the explanatory variable forecasts and the elasticity of the forecast with respect to these variables. For economic data that are subject to significant revision, forecast changes can result from changes to the historical data as well as changes in the forecast growth rates.

To measure stability, two points in time were selected, 2016 and 2021. These represent points about 5 years from today and 10 years from today. The statistics for a method are computed by taking the 5 forecast versions and computing a simple standard deviation of the forecasts values for each target year.

This idea is depicted in Figure 9. This shows the five forecasts for the PJM RTO annual summer peak. The forecast values for 2016 and 2021 are circled in red. The statistics are the Average value of the forecasts, the Standard Deviation of the forecast values and the Coefficient of Variation (ratio of the Standard Deviation to the Average).

Figure 9: Depiction of Stability Statistics – PJM Peaks, GMP Method



Stability results are summarized in Figures 10 and 11 for the CP results by zone. Figures 12 and 13 summarize the NCP results.

At the RTO level, the Index methods (CV values of 2.10% and 2.07%) show slightly less variation at the 5-year level than the GMP method, with a CV of 2.18%. At the 10-year level, this difference becomes more pronounced, with CV values of 2.89% for GMP versus 2.40% (Index1) and 2.46% (Index2) for the Index methods.

The stability advantage of the Index methods is more pronounced at the zone level. Focusing on the NCP statistics in Figures 12 and13:

- The Index methods have better stability statistics (smaller CV values) in 16 of the 18 cases at the 5-year horizon and in 15 of the 18 cases at the 10-year horizon.

- At the 5-year horizon, the average CV value across zones is slightly lower for Index2 (2.16%) than it is for Index1 (2.21%). Both are more stable than the GMP method, which has an average CV value of 2.86%.

- At the 10-year horizon, the average CV value across zones remains slightly lower for Index2 (2.77%) than it is for Index1 (2.79%). Both are significantly more stable than the GMP method, which has an average CV value of 4.17%.

Figure 10: Stability Statistics – CP Forecasts for 2016

Zone	CP Forecast Standard Deviations -- 2016		
	GMP	Index1	Index2
AE	233	130	133
AEP	529	823	805
APS	166	154	155
BGE	188	150	146
COMED	921	676	672
DAYTON	74	92	71
DPL	239	141	146
DQE	44	33	29
JCPL	253	233	218
METED	44	26	27
PECO	222	56	98
PENLC	54	46	30
PEPCO	226	210	194
PL	202	94	109
PS	340	300	277
RECO	13	16	17
UGI	7	4	4
VEPCO	489	315	309
Zone Avg	**236**	**194**	**191**
Most Stable	**11.1%**	**33.3%**	**55.6%**
PJM_RTO	**3,356**	**3,182**	**3,139**

Zone	CP Forecast Coefficient of Variation -- 2016		
	GMP	Index1	Index2
AE	7.30%	4.35%	4.47%
AEP	2.10%	3.33%	3.23%
APS	1.83%	1.69%	1.70%
BGE	2.39%	1.93%	1.89%
COMED	3.58%	2.71%	2.68%
DAYTON	2.01%	2.38%	1.86%
DPL	5.36%	3.18%	3.28%
DQE	1.44%	1.08%	0.95%
JCPL	3.57%	3.41%	3.21%
METED	1.39%	0.83%	0.86%
PECO	2.41%	0.61%	1.06%
PENLC	1.76%	1.46%	0.95%
PEPCO	3.05%	2.85%	2.65%
PL	2.61%	1.23%	1.41%
PS	2.93%	2.66%	2.46%
RECO	2.94%	3.68%	3.90%
UGI	3.45%	1.99%	1.88%
VEPCO	2.25%	1.47%	1.44%
Zone Avg	**2.91%**	**2.27%**	**2.22%**
Most Stable	**11.1%**	**33.3%**	**55.6%**
PJM_RTO	**2.18%**	**2.10%**	**2.07%**

Figure 11: Stability Statistics – CP Forecasts for 2021

Zone	CP Forecast Standard Deviations -- 2021		
	GMP	Index1	Index2
AE	283	158	162
AEP	828	929	934
APS	215	222	234
BGE	316	186	183
COMED	1,326	813	842
DAYTON	140	134	104
DPL	345	188	198
DQE	56	45	39
JCPL	431	318	304
METED	98	35	37
PECO	387	86	159
PENLC	100	88	53
PEPCO	312	281	269
PL	380	116	151
PS	534	400	385
RECO	17	22	23
UGI	13	6	6
VEPCO	683	365	359
Zone Avg	**359**	**244**	**247**
Most Stable	**16.7%**	**38.9%**	**44.4%**
PJM_RTO	**4,724**	**3,836**	**3,943**

Zone	CP Forecast Coefficient of Variation -- 2021		
	GMP	Index1	Index2
AE	8.28%	5.02%	5.18%
AEP	3.17%	3.61%	3.59%
APS	2.27%	2.33%	2.43%
BGE	3.77%	2.27%	2.25%
COMED	4.84%	3.09%	3.17%
DAYTON	3.67%	3.30%	2.59%
DPL	7.14%	3.96%	4.17%
DQE	1.75%	1.41%	1.24%
JCPL	5.69%	4.40%	4.24%
METED	2.91%	1.05%	1.11%
PECO	4.00%	0.90%	1.64%
PENLC	3.05%	2.59%	1.58%
PEPCO	3.99%	3.63%	3.51%
PL	4.70%	1.44%	1.87%
PS	4.37%	3.41%	3.27%
RECO	3.58%	4.78%	5.16%
UGI	6.09%	2.62%	2.63%
VEPCO	2.87%	1.57%	1.55%
Zone Avg	**4.23%**	**2.86%**	**2.84%**
Most Stable	**16.7%**	**38.9%**	**44.4%**
PJM_RTO	**2.89%**	**2.40%**	**2.46%**

Figure 12: Stability Statistics – NCP Forecasts for 2016

	NCP Forecast Standard Deviations -- 2016		
Zone	GMP	Index1	Index2
AE	233.7	132.4	135.5
AEP	568.8	855.4	836.9
APS	172.3	156.6	157.7
BGE	196.2	149.5	144.9
COMED	982.1	693.3	688.6
DAYTON	77.9	99.2	77.8
DPL	243.8	142.4	146.7
DQE	43.2	34.6	30.0
JCPL	267.8	244.6	229.4
METED	43.5	22.2	23.2
PECO	215.1	51.8	96.4
PENLC	50.2	44.3	25.8
PEPCO	224.0	208.6	191.5
PL	198.5	86.3	102.5
PS	341.9	303.6	280.0
RECO	15.9	16.9	18.0
UGI	6.5	3.7	3.4
VEPCO	494.8	313.4	308.5
Zone Avg	**243.1**	**197.7**	**194.3**
Most Stable %	**11.1%**	**33.3%**	**55.6%**
Zone Wgt Avg[2]	**3,457.4**	**3,204.8**	**3,160.5**

	NCP Forecast Coef of Variation -- 2016		
Zone	GMP	Index1	Index2
AE	7.08%	4.29%	4.40%
AEP	2.17%	3.32%	3.23%
APS	1.84%	1.67%	1.67%
BGE	2.41%	1.87%	1.82%
COMED	3.67%	2.67%	2.64%
DAYTON	2.01%	2.45%	1.94%
DPL	5.28%	3.10%	3.20%
DQE	1.36%	1.09%	0.95%
JCPL	3.64%	3.46%	3.25%
METED	1.32%	0.69%	0.71%
PECO	2.25%	0.55%	1.01%
PENLC	1.58%	1.35%	0.80%
PEPCO	2.92%	2.75%	2.54%
PL	2.48%	1.09%	1.29%
PS	2.84%	2.60%	2.40%
RECO	3.40%	3.70%	3.96%
UGI	3.08%	1.75%	1.63%
VEPCO	2.19%	1.41%	1.39%
Zone Avg	**2.86%**	**2.21%**	**2.16%**
Most Stable %	**11.1%**	**33.3%**	**55.6%**
Zone Wgt Avg[2]	**2.16%**	**2.04%**	**2.01%**

[2] The Zone Wgt Avg represents stability statistics for the PJM RTO. It provides an overall measure of NCP model stability by weighting the contributing zones with respect to their peak load.

Figure 13: Stability Statistics – NCP Forecasts for 2021

	NCP Forecast Standard Deviations -- 2021		
Zone	GMP	Index1	Index2
AE	282.3	160.5	164.6
AEP	883.2	956.9	960.6
APS	231.8	234.9	248.0
BGE	339.0	186.8	182.7
COMED	1,390.9	813.7	845.6
DAYTON	146.3	142.1	111.3
DPL	347.4	189.4	199.1
DQE	55.1	45.5	39.7
JCPL	450.0	329.4	315.1
METED	97.2	31.4	33.6
PECO	381.2	80.5	155.1
PENLC	99.0	91.2	53.2
PEPCO	305.7	280.9	268.1
PL	378.0	105.5	142.7
PS	532.4	402.6	386.0
RECO	20.4	22.8	24.4
UGI	12.1	5.1	5.1
VEPCO	712.8	371.3	360.1
Zone Avg	**370.3**	**247.3**	**249.7**
Most Stable %	**16.7%**	**33.3%**	**50.0%**
Zone Wgt Avg²	**4,831.6**	**3,831.8**	**3,930.8**

	NCP Forecast Coef of Variation -- 2021		
Zone	GMP	Index1	Index2
AE	8.01%	4.94%	5.07%
AEP	3.24%	3.57%	3.55%
APS	2.36%	2.38%	2.49%
BGE	3.91%	2.21%	2.17%
COMED	4.87%	2.98%	3.06%
DAYTON	3.65%	3.35%	2.64%
DPL	6.96%	3.86%	4.05%
DQE	1.65%	1.38%	1.20%
JCPL	5.73%	4.41%	4.24%
METED	2.80%	0.91%	0.97%
PECO	3.81%	0.81%	1.54%
PENLC	2.91%	2.57%	1.53%
PEPCO	3.78%	3.51%	3.38%
PL	4.52%	1.27%	1.70%
PS	4.21%	3.31%	3.18%
RECO	4.18%	4.84%	5.23%
UGI	5.55%	2.34%	2.34%
VEPCO	2.89%	1.55%	1.50%
Zone Avg	**4.17%**	**2.79%**	**2.77%**
Most Stable %	**16.7%**	**33.3%**	**50.0%**
Zone Wgt Avg²	**2.85%**	**2.31%**	**2.36%**

Conclusions Related to Accuracy and Stability

In the Phase I report, Recommendation #1 was to implement the Index1 approach. This approach combines economic variables using a set of weights based on the industry survey. This recommendation was based on the following logic:

- On a conceptual level, the index approaches are preferred to a method with a single driver such as GMP. The underlying economic theory and end-use modeling frameworks suggest different drivers for different customer segments. As indicated by the industry survey, utility modelers typically drive their sales and peak models with corresponding sector-oriented variables.

- In the three test cases that were examined, the Index-based forecasts were more consistent with historical peak growth rates.

- Reflecting the results of the industry survey, we concluded that the index approaches will provide zone forecasts that are more consistent with forecasts developed by the utilities.

- In the three test cases, the two index approaches had about the same historical fit. The simpler approach (Index1) actually performed slightly better in all three cases than the sector -weighted approach (Index2).

Following this recommendation there was significant discussion about the need to test the forecast accuracy of the Index methods relative to the GMP method. In these discussions Itron stressed the need to use true forecast test statistics, rather than statistics based on withheld sample points or backcasts where the true X variable values are known. Based on our observations about the GMP data and forecasts for the three test regions that were examined, we expected that use of an Index approach would provide better forecast accuracy and reduced forecast volatility.

The analysis presented above confirms these expectations. The index methods are consistently more accurate and give more stable forecasts than the GMP based method. The results do not indicate a strong advantage for one index approach over the other. Index1 appears to have a slight edge in terms of accuracy at the PJM level. Index2 appears to have a slight advantage in terms of stability.