Suggested Additions to
PJM Load Forecast Report

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Topics

1. Suggested additions to Load Forecast Reports: economic index values, elasticities of peak load to economic index
2. Value of backcasting based on identified elasticities; examples
3. Elasticities based on alternate historical periods: examples
PJM Load Forecasting Methodology

- Zone-specific forecasted six-part economic index drives the load forecast: households, population, real personal income, non-manufacturing employees, US GDP, metro GMP, weighted by res/comm/ind (Manual 19 p. 17)

- Econometric analysis used to determine the relationship between historical loads and the economic index values for each zone

- The relationship is then used to project zonal loads forward based on forecasted economic index values

- Lots more going on, of course; hour, weekday/weekend, month, holidays, weather, etc.
Elasticity of Peak Load to Economic Index

- Focusing on the peak load forecast values (the median of the distribution):
  - the relationship between peak load and the economic index can be summarized as an elasticity: percent change in peak load per percent change in index
  - The elasticity values are very stable over the forecast period

- Example: PECO zone: The 2013 forecast reflects a 0.787 percent increase in peak load for each percent increase in economic index
Zonal Peak Load Forecast Economic Index

- Peak Forecast (Jan. 2013 PJM Load Forecast)
- Peaks based on solved elasticity, intensity
- Economic Index, 2012 = 1.00 (right axis)

Zone: PECO
Elasticity Match Range: 2012 - 2022
Elasticity: 0.787
Intensity (%/year): (Off)
Root Mean Sq. Error (MW): 2
Elasticity of Peak Load to Economic Index: A Single Value that Summarizes Each Zonal Forecast

● The elasticity of peak load to the economic index is easily calculated based on the resulting forecast and economic index values
● This elasticity is a single number that summarizes the zonal forecast
● Recommendation:
  – Include a table in the Load Forecast Report showing elasticity of peak load to economic index for each zone
  – Also include the same elasticities from recent load forecasts in the table
  – Include a separate table with the economic index values, or a summary of them
  – Or, post this information separate from the report (not preferred)
● Benefits:
  – Single number summarizes each forecast, can compare across zones, years
  – Furthers understanding, transparency of the forecast and methodology
2. Backcasting Based on Elasticity

- The elasticity can also be used to backcast peak loads based on historical economic index values; the resulting backcast peaks can be compared to historical weather-normalized peaks
  - Shows how well zonal w/n peaks tracked the corresponding economic index
  - Indicates extent to which zonal peaks behave according to the underlying premise of the methodology – that peaks grow with the economic index
  - Suggests zones where there appears to be something else going on

- Such graphs would also be a valuable addition to the report (or posted separately)

*Caveat: the w/n peaks depend upon the forecasting model and database, each annual update would result in somewhat different historical w/n values... I used values provided by PJM and from Load Forecast Reports*
Zonal Peak Load Forecast, History (w/n), and Economic Index

- Historical Weather-Normalized Peaks (to 2012)
- Peak Forecast (Jan. 2013 PJM Load Forecast)
- Peaks based on solved elasticity, intensity
- Economic Index, 2012 = 1.00 (right axis)

Economic Index

Zone: AE
Elasticity Match Range: 2012 - 2022
Elasticity: 0.853
Intensity (%/year): (Off)
Root Mean Sq. Error (MW): 2
Zonal Peak Load Forecast, History (w/n), and Economic Index

- Historical Weather-Normalized Peaks (to 2012)
- Peak Forecast (Jan. 2013 PJM Load Forecast)
- Peaks based on solved elasticity, intensity
- Economic Index, 2012 = 1.00 (right axis)

Zone: DPL
Elasticity Match Range: 2012 - 2022
Elasticity: 0.654
Intensity (%/year): (Off)
Root Mean Sq. Error (MW): 2
Zonal Peak Load Forecast, History (w/n), and Economic Index

- Historical Weather-Normalized Peaks (to 2012)
- Peak Forecast (Jan. 2013 PJM Load Forecast)
- Peaks based on solved elasticity, intensity
- Economic Index, 2012 = 1.00 (right axis)

**Zone:**
- Elasticity Match Range: PEPCO 2012 - 2022
- Elasticity: 0.462
- Intensity (%/year): (Off)
- Root Mean Sq. Error (MW): 8

MW

Zonal Peak Load Forecast, History (w/n), and Economic Index

Historical Weather-Normalized Peaks (to 2012)
Peak Forecast (Jan. 2013 PJM Load Forecast)
Peaks based on solved elasticity, intensity
Economic Index, 2012 = 1.00 (right axis)

Zone: PS
Elasticity Match Range: 2012 - 2022
Elasticity: 0.563
Intensity (%/year): (Off)
Root Mean Sq. Error (MW): 8
3. Taking It Another Step: Determining Elasticities Based on Historical Periods

● The preceding graphs all used the elasticities as reflected in the forecasts from the PJM 2013 Load Forecast Report

● Elasticities can also be calculated based on historical periods
  – Find elasticity that provides best fit between changes in economic index values and changes in historical w/n peaks over a chosen historical period
  – Can be considered a very simplified version of what the load forecasting methodology does

● Allows seeing how different historical periods suggest different elasticities, forecasts
Zonal Peak Load Forecast, History (w/n), and Economic Index

- Historical Weather-Normalized Peaks (to 2012)
- Peak Forecast (Jan. 2013 PJM Load Forecast)
- Peaks based on solved elasticity, intensity
- Economic Index, 2012 = 1.00 (right axis)

**Zone:** BGE
- Elasticity Match Range: 2005 - 2012
- Elasticity: 0.222
- Intensity (%/year): Off
- Root Mean Sq. Error (MW): 35
Summary

- The peak load forecasts can be summarized with a single number for each zone: elasticity of peak to economic index

- Backcasting illustrates how well a zone’s peaks have moved with the index – the underlying premise of the methodology
  - Suggests zones where there appear to be other driving factors

- Proposed additions to the Load Forecast Report or posted data
  - Elasticities by zone, current and recent
  - Economic index values
  - Backcasts based on forecast elasticities