Weather Normalization of Peak Load

Load Analysis Subcommittee

September 2, 2015

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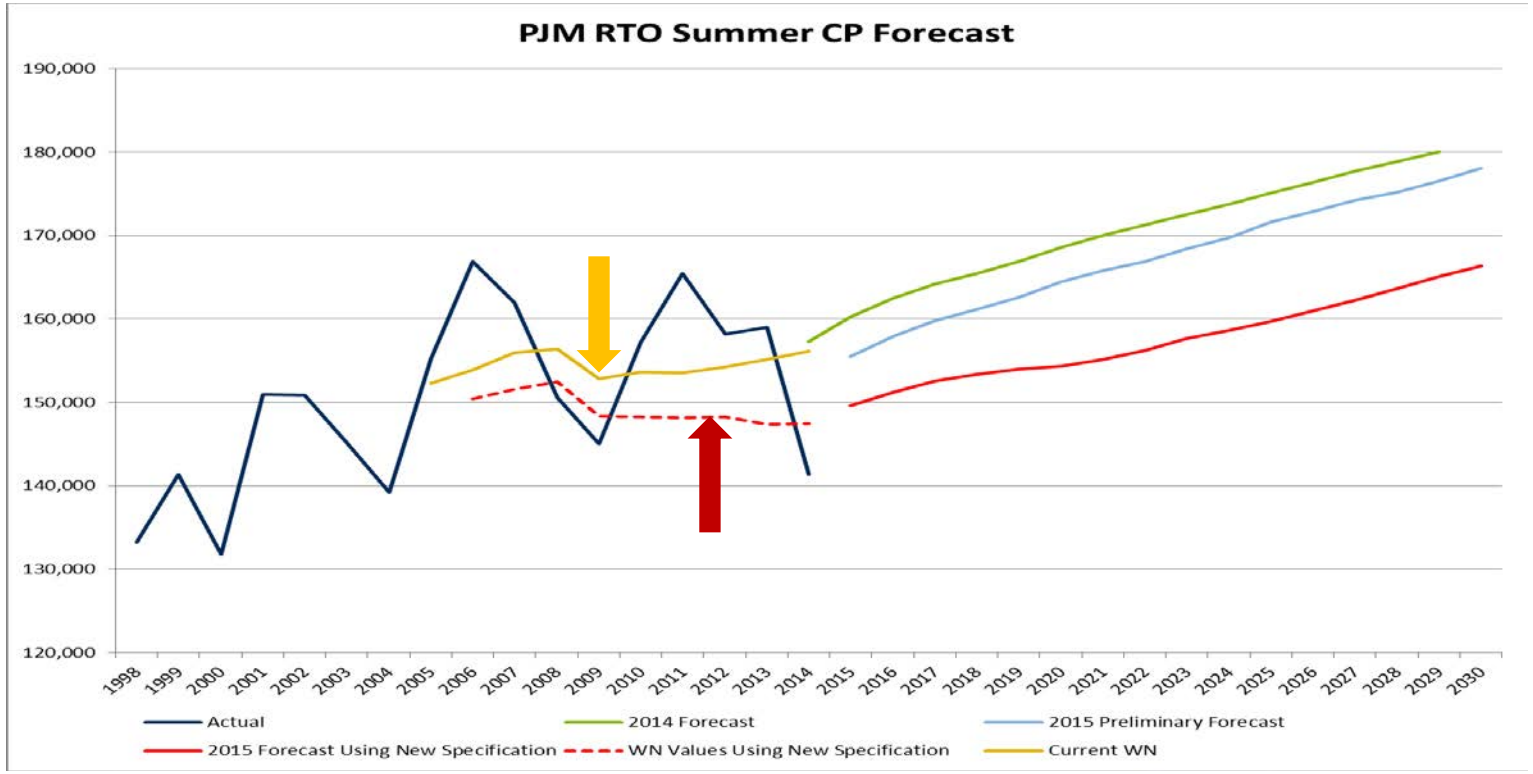
Issue

- PJM's current method of weather normalizing peak loads involves updating the peak load forecast model
- Revising the peak load model results in a significantly different weather-normalized history:



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Issue

- Stakeholders expressed concern that the multiple weather normalized series complicate understanding and evaluating the load forecast.

- PJM has investigated multiple weather normalization methods with the intent to adopt one that best indicates:
    1. The long-term trend of each zone's seasonal non-coincident peak loads
    2. A reasonable portrayal of the anticipated growth in each zone's first year forecast.

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Weather Normalization Investigation

- PJM used two sources to help guide the investigation:
  1. The former bottom-up weather normalization procedure developed by the Load Analysis Subcommittee and used until 2007.
  2. A survey of weather normalization practices of 135 North American companies conducted in 2013.

- Approach: Regress daily peak load on non-holiday weekdays against weather and evaluate the equation at a weather standard. Include only days in the heating/cooling range (summer > 74 WTHI, winter < 45 WWP)

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Weather Normalization Elements Investigated

- Exception - Weather measurement: two-day weighted (4-today,1-yesterday) temperature humidity index (summer); wind-adjusted temperature (winter)
- Number of historical years included in analysis
- Weather standard definition:
  - Number of years included
  - Seasonal extreme or coincident with peak day
  - Rolling or static
  - Average or median

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Number of Years Included in Analysis

- PJM tested using only one year of historical data to estimate the relationship between daily load and weather as well as pooling data over three years:
  - One year will focus on the load/weather relationship for each study year and may pick up sudden shifts in load growth
  - Three years improves the chances of having a wide range of weather to evaluate and may prevent anomalous results in extreme weather years (adjustments are made to allow for load shifts in each of the three years).

  - Choice: 3 years, since the results are close but 3 years smooths the series, reducing year-to-year jumps but preserving trends.

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Number of Years Included in Analysis: 1 vs 3

Average Difference: 8 MW (0.1%)
Average Absolute Difference: 1.2 %

Largest Difference: 250 MW (2013)

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Weather: Number of Years Used in Standard

- Tested using years 1998 through 2014 (17 years) as a proxy for using data consistent with model estimation and years 1994 through 2014 as a proxy for what will be used in model simulation.

- Choice: Use a period that begins in 1994 up to the most recent year available to be consistent with model simulation.

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Weather: Peak Day or Seasonal Extreme

- Using peak day weather will result in a lower weather standard for summer (higher for winter) but accounts for the approximately 30 percent likelihood that the most extreme weather will occur on a low load day (weekends, holidays).
- Using the seasonal extreme reflects weather conditions that may occur and might better reflect load for planning purposes but not be appropriate for how weather –normalized values will be used.
- Another option is to use the weather that occurred on non-holiday weekdays, balancing possible and probable weather.

- Choice: Use the seasonal extreme from all non-holiday weekdays.

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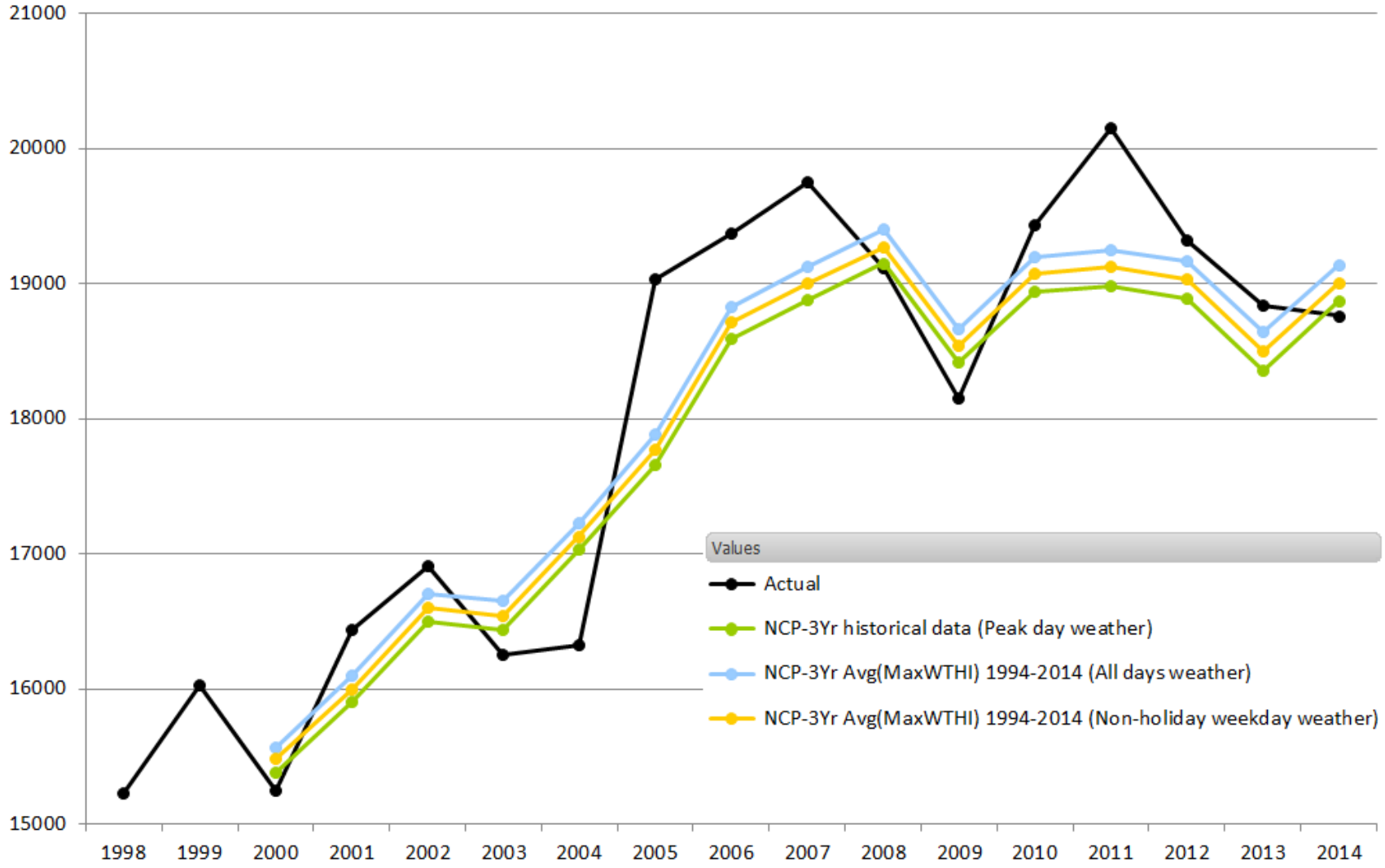
Weather: Peak Day or Seasonal Extreme

Average Difference Low-High: 1.3 %
Average Difference Med-High: 0.5 %



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Weather: Rolling or Static

- Rolling weather over years will pick up trends in weather but will use different weather standard each year. Weather-normalized values will not change as new years are analyzed.
- Static weather standard will result in normalized loads that only reflect load changes, but presents the issue of how often the standard is refreshed and if previous normalized loads will be restated.

- Choice: Static. Each year the weather standard will be applied to each year of history. Note: the tail will wag the dog, as previous normalized values will be restated.

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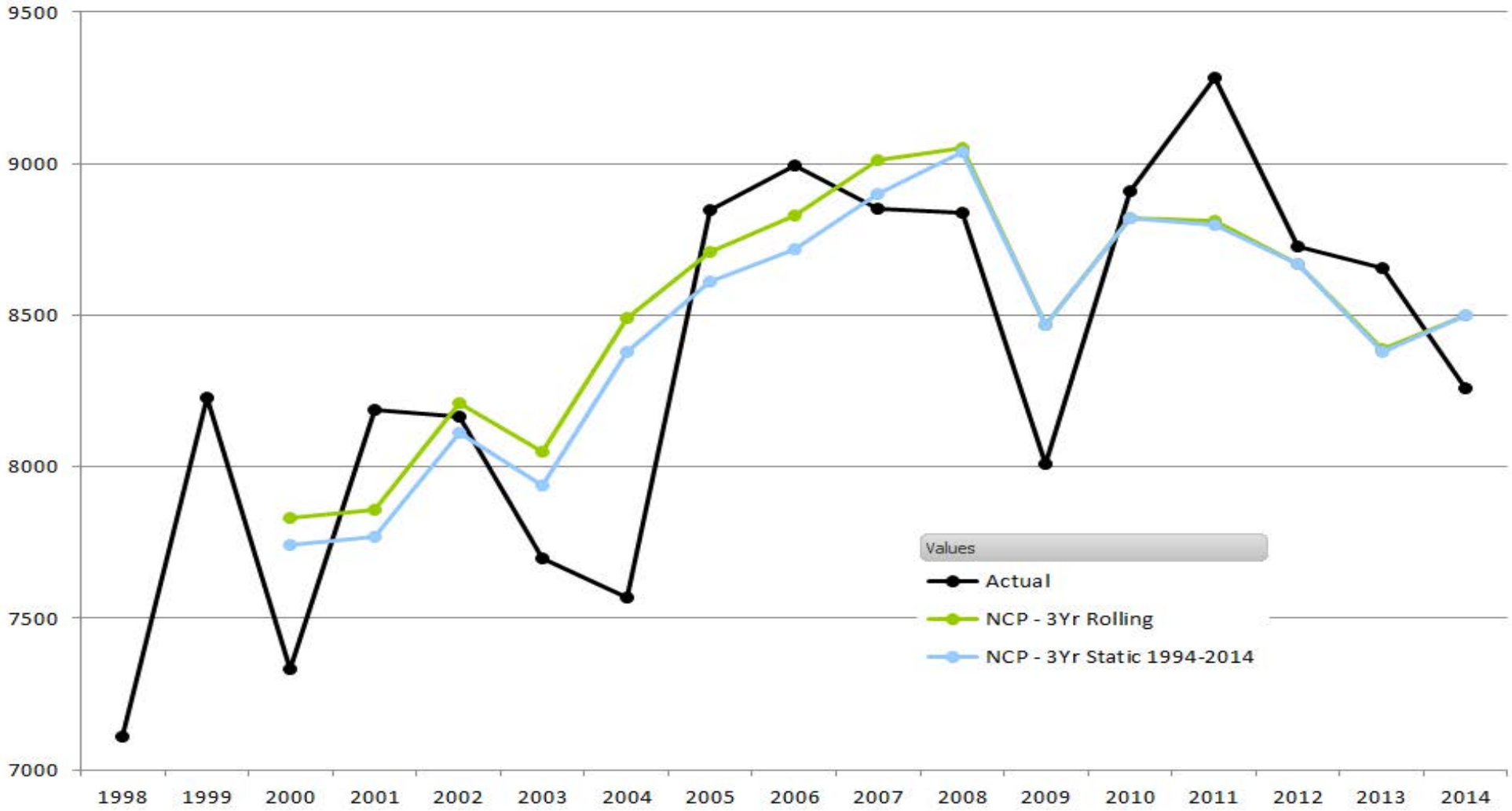
Weather: Rolling or Static



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Weather: Average or Median

- Both average and median values reflect central tendency and will differ significantly only if weather is not distributed normally.

- Choice: Average, as there are no significant or systematic differences and average is the industry standard.

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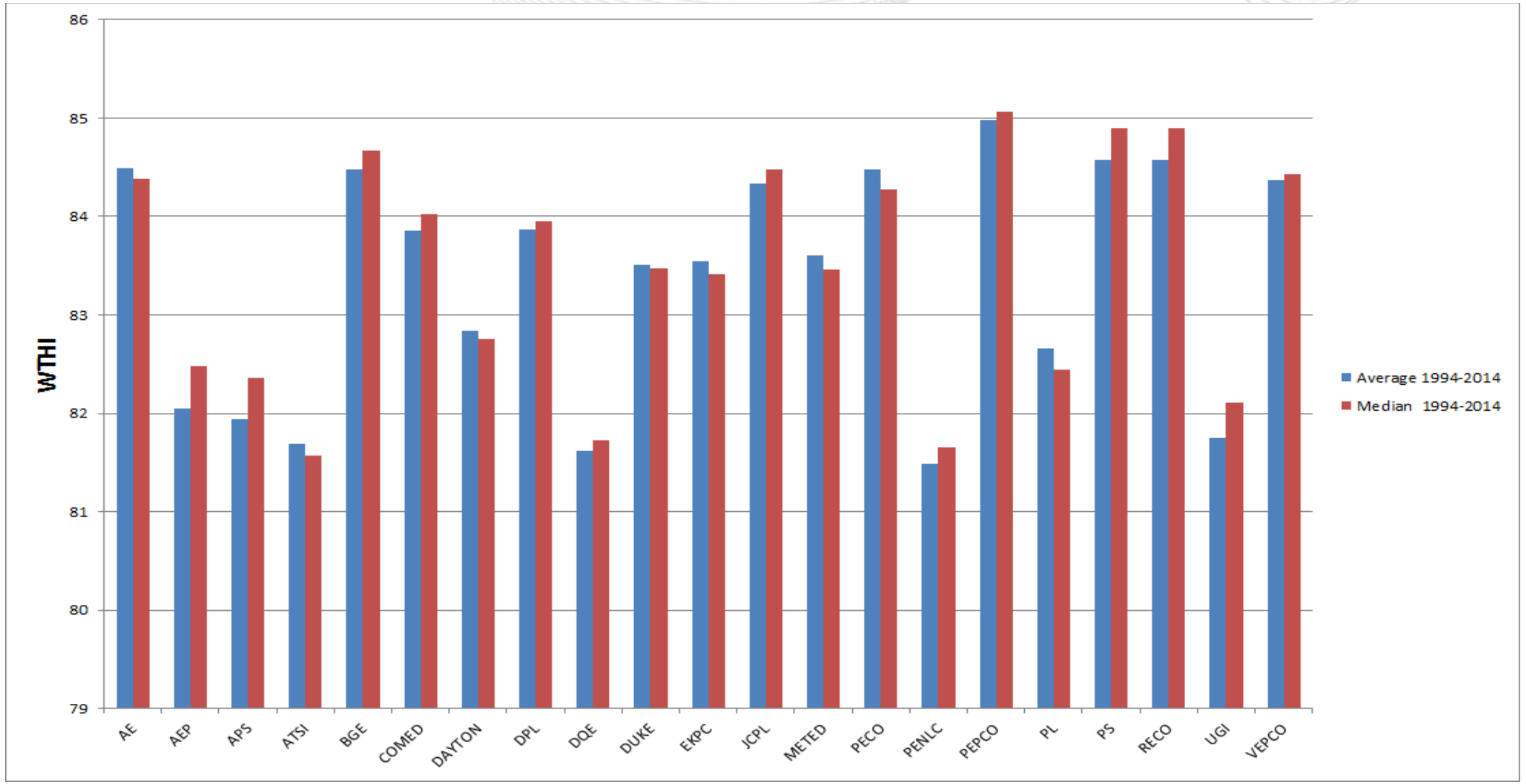
Weather: Average or Median



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Summary

- Weather measurement: temperature humidity index for summer; wind-adjusted temperature for winter
- For each year analyzed, three years of history will be used, pooling across years for the load/weather relationship but allowing for constant adjustment for each year.
- The weather standard will be calculated using:
  - Weather data back to 1994
  - The seasonal extremes from all non-holiday weekdays
  - Static average (applied to all historical years)

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Disclaimer

- Changes outlined here apply only to zonal non-coincident peaks.
- Development of weather-normalized coincident peaks has not been addressed yet. That effort would likely involve more thorough stakeholder review if weather-normalized coincident peaks continue to be used to allocate costs in PJM's capacity market.
- Weather-normalized coincident peaks will not be needed if capacity market cost allocation is revamped.

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Questions/Comments?

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