

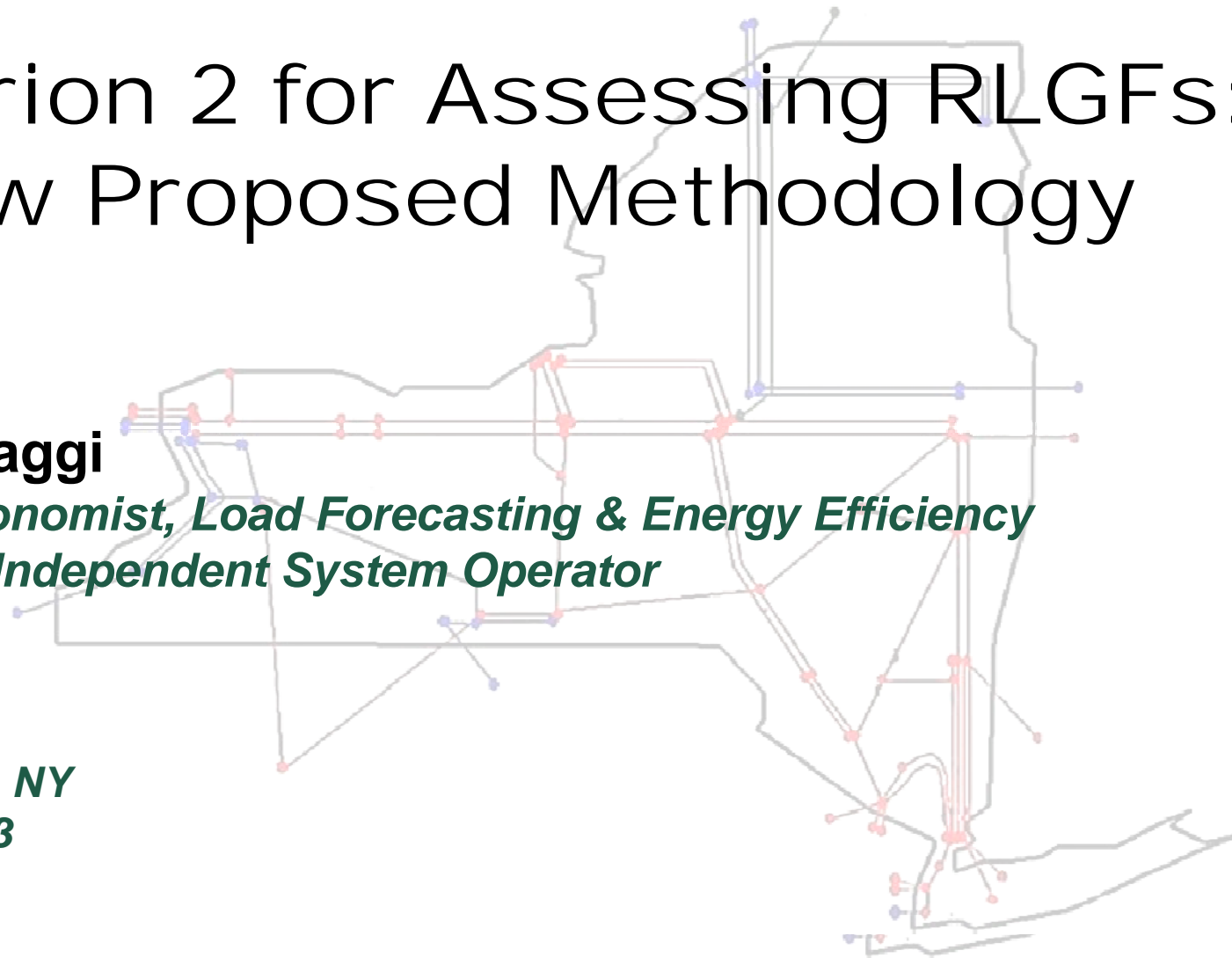
Criterion 2 for Assessing RLGFs: A New Proposed Methodology

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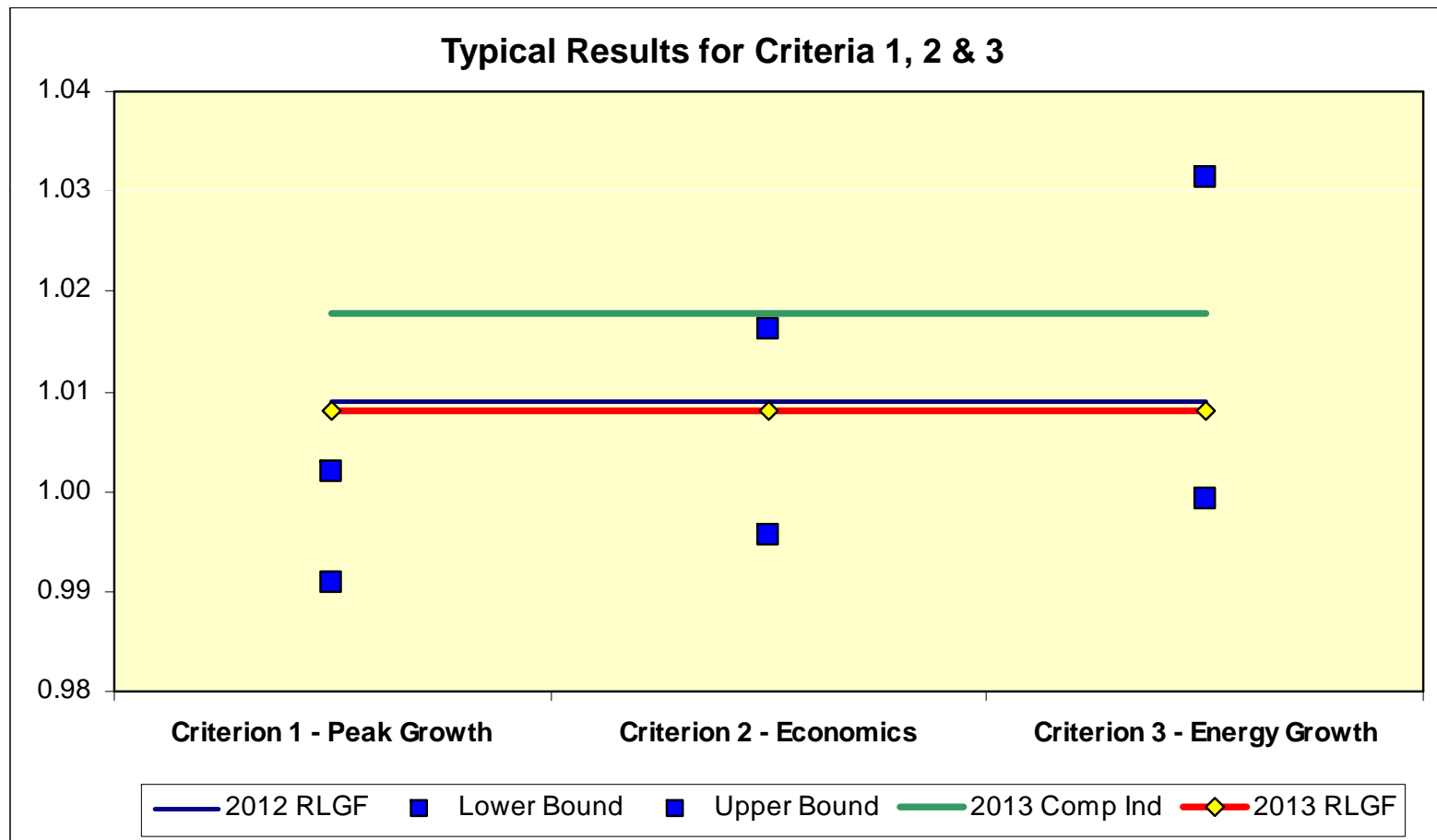
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Three Criteria for Evaluation of Peak Demand Growth



Overview of Assessment of Regional Load Growth Factors

Current Methodology for Criterion 2

Based on ratios of economic growth to peak demand growth:

1. Annual composite economic indicators for five historic years and the forecast year.
2. Weather Normalized Peaks over a five year historic period.
3. Correlations between annual weather normalized peaks and annual historic composite economic indicators, to select which ratios of peak to economic growth are the most significant.
4. Upper and lower bounds of peak demand growth in the forecast year are obtained by applying the 2nd highest and 4th highest ratios to the value of the composite indicator in the forecast year.

Overview of Assessment of Regional Load Growth Factors (cont.)

Deficiencies in Current Methodology

1. **Correlation coefficients between growth of some macroeconomic indicators and Peak Load Growth have become negative**
 - **Causes**
 - ✓ **Structural changes in the economy**
 - ✓ **Impact of Energy Efficiency measures**
 - **Impact**
 - ✓ **Since recession, low correlations between growth in economic indicators and in peak demand growth**
2. **The use of the 2nd and 4th ranked ratios from the 5-year period**
 - **Arbitrary approach; may not assure equal probability bandwidths from one year to the next**
 - **Allows for values from anomalous years to be included in the assessment (e.g. the recent recession led to a very volatile period with respect to the growth factors.)**
3. **Non-uniform methods for normalizing peaks for the several TDs**

Example of Current Methodology

- 1. Examine the ratios of historical Regional Load Growth Factors (RLGFs) to Macroeconomic Growth Factors over the previous 5 years. Select the economic indicators with the highest correlations to peak demand growth**
- 2. Calculate ratios of peak demand growth to economic growth for five historic years.**
- 3. Select the 2nd and 4th highest ratios as basis for upper and lower bounds.**
- 4. Apply 2nd and 4th ratios to find upper & lower bounds in year of forecast.**

Step 1: Calculation of Composite Indicator Growth Indices & Correlations to Peak Demand Growth, Showing Selection of Best Indicator

Economic Data from Economy.Com								
Indicator	2006	2007	2008	2009	2010	2011	2012	2013
Employment_RGE	546	548.02	533.87	534	541	550	551	558
GDP_RGE	55,201	53,810	52,263	54,498	56,788	58,157	59,417	60,987
Households_RGE	436	439	443	446	446	445	445	444
Income_RGE	38,908	40,077	38,891	39,672	40,100	40,923	41,767	43,276
Population_RGE	1,107	1,110	1,113	1,115	1,115	1,116	1,117	1,118
Correlation of Economic Indicator to Peak Load								
Indicator	Rho	Rank	Weight	Wgt Rho				
Employment_RGE	-0.1780	2	0	0.0000				
GDP_RGE	-0.2935	4	1	-0.2935				
Households_RGE	-0.6286	5	0	0.0000				
Income_RGE	-0.0716	1	0	0.0000				
Population_RGE	-0.2638	3	0	0.0000				
Annual Growth Index of Economic Indicators								
Indicator	2006	2007	2008	2009	2010	2011	2012	2013
Employment_RGE			0.9742	1.0011	1.0121	1.0170	1.0025	1.0127
GDP_RGE			0.9713	1.0428	1.0420	1.0241	1.0217	1.0264
Households_RGE			1.0074	1.0070	1.0005	0.9984	0.9989	0.9992
Income_RGE			0.9704	1.0201	1.0108	1.0205	1.0206	1.0361
Population_RGE			1.0025	1.0020	1.0004	1.0003	1.0009	1.0014
Composite Indicator			0.9713	1.0428	1.0420	1.0241	1.0217	1.0264

Step 1, continued: Weather Normalized Peak Growth Indices

Peak Load Data								
	2006	2007	2008	2009	2010	2011	2012	2013
W/N Peak MW	1,613	1,623	1,642	1,626	1,555	1,581	1,644	
Peak Growth Index			1.0117	0.9903	0.9563	1.0167	1.0397	

Steps 2 and 3: Calculate Ratios of Peak Load Growth to Composite Indicator Growth & Select 2nd & 4th Highest

Ratio of Peak Load Growth to Composite Economic Indicator								
	2006	2007	2008	2009	2010	2011	2012	2013
Rank			1	4	5	3	2	
Ratio			1.0416	0.9497	0.9178	0.9928	1.0177	

The 2nd & 4th ranked ratios serve as the basis for the Upper and Lower Bounds, respectively

Step 4: Calculate Upper & Lower Bounds for RLG in Forecast Year

Upper Bound =

**2nd Ranked Ratio of Peak Load Growth to Composite Growth x
Forecasted Composite Growth**

i.e. $1.0177 \times 1.0264 = 1.0446$

Lower Bound =

**4th Ranked Ratio of Peak Load Growth to Composite Growth x
Forecasted Composite Growth**

i.e. $0.9497 \times 1.0264 = 0.9748$

Proposed New Approach for Criterion 2

Salient Details

- ◆ ***Analysis of 10 years of annual data instead of 5 years***
- ◆ ***Uniform annual peak normalization method: Use daily data (Jun – Aug) and 20-year normal weather conditions for each Transmission District***
- ◆ ***Use of the most significant economic driver for producing peak forecast.***
- ◆ ***Includes ability to adjust for EE impacts, ex post.***
- ◆ ***Statistically based Upper and Lower Bounds (suggested +/- 25%)***

Proposed Method for Criterion 2 Bounds

Step 1: Estimate Weather Normalized Peaks for, say, 2003-2012

- **Daily Peak and CTHI data from Jun. 1 through Aug. 31**
- **Design condition based on 20 years of seasonal-high CTHIs**
- **3rd Order polynomial models**
- **Separate models for each year**

Step 2: Regress 10 years of Annual Weather Normalized Peaks from Step 1 on Macroeconomic Variable, e.g. GDP

Step 3: Calculate the 50% confidence interval (+/- 25%) for the 2013 forecasted Peak Load based on Standard Error of the regression to obtain the Upper and Lower bounds for the RLGf. (Note: The 50% interval is a suggestion. A wider interval will widen the gap between the bounds)

Step 4: Energy Efficiency Impacts should be accounted by subtracting impacts from expected peak and the upper and lower bandwidths.

Proposed Method: Example 1 (Con Ed)

Design CTHI (1 in 3 value based on data from 1993-2012) = 89.27

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
WN Peaks	12,059	12,224	12,937	13,040	13,047	12,902	13,195	13,395	13,538	13,308

Results based on regression of WN Peaks on GDP

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
WN Peaks - Actual	12,059	12,224	12,937	13,040	13,047	12,902	13,195	13,395	13,538	13,308	
WN Peaks - Predicted	12,203	12,359	12,697	12,992	13,100	13,118	12,923	13,243	13,426	13,583	13,781

R- Squared = 0.839

No. of Observations = 10

Degrees of Freedom = 8

Standard Error of Regression = 204.46

t- statistic for 2-tailed 50% interval = 0.7064

Upper Bound for 2013 Peak = 13,781 + (0.7064 x 204.46) = 13,925

Lower Bound for 2013 Peak = 13,781 – (0.7064 x 204.46) = 13,637

Hence, Upper Bound for RLGF = 13,925/13,583 = 1.0104
Lower Bound for RLGF = 13,637/13,583 = 0.9895

Proposed Method: Example 2 (Nat. Grid)

Design CTHI (Average based on data from 1993-2012) = 84.39

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
WN Peaks	6,929	6,806	6,963	7,201	7,160	7,226	7,222	7,250	7,226	7,256

Results based on regression of WN Peaks on GDP

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
WN Peaks - Actual	6,929	6,806	6,963	7,201	7,160	7,226	7,222	7,250	7,226	7,256	
WN Peaks - Predicted	6,887	6,962	7,042	7,118	7,162	7,155	7,105	7,195	7,270	7,342	7,395

R- Squared = 0.702

No. of Observations = 10

Degrees of Freedom = 8

Standard Error of Regression = 93.77

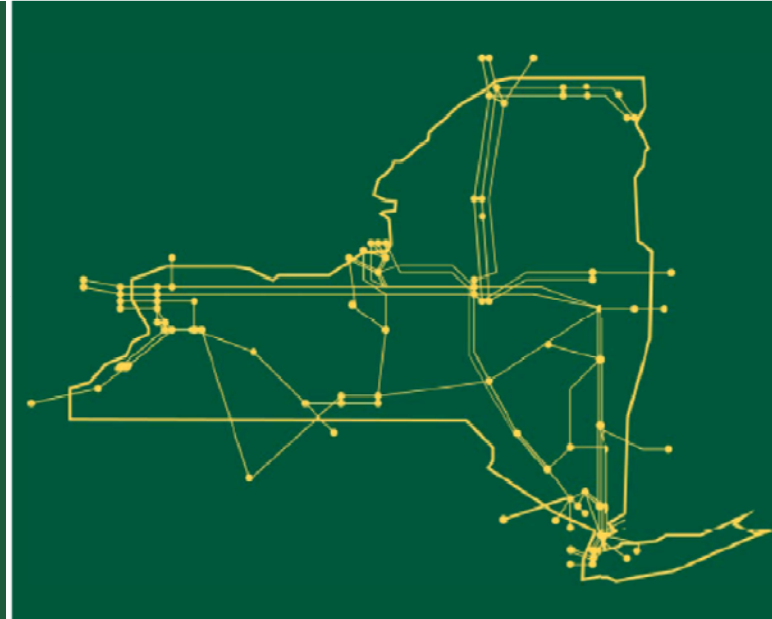
t- statistic for 2-tailed 50% interval = 0.7064

Upper Bound for 2013 Peak = 7,395 + (0.7064 x 93.77) = 7,461

Lower Bound for 2013 Peak = 7,395 – (0.7064 x 93.77) = 7,329

Hence, Upper Bound for RLGf = 7,461/7,342 = 1.0162
Lower Bound for RLGf = 7,329/7,342 = 0.9982

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