



The Public Utilities
Commission of Ohio

Ohio's One-Stop Utility Resource

An Essential Attribute: Facilitating A Transition to Efficient Markets

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Public Utilities Commission of Ohio**

PJM Long Term Capacity Issues Symposium
January 26, 2010



Capacity Market Origins & Issues

- What should be the forward capacity obligation for consumers in markets with variable prices?
 - Not a meaningful question in normal efficient market
 - Capacity Obligations were a response to “Missing Money Problem” – Resulting from Assumption Demand would Not Respond to Prices¹
- Tipping Point: Expansion of Demand Response, Investments in Smart Grid & AMI, & Development of Dynamic Retail Pricing
 - Key Question: Will current capacity markets support this transition to more efficient markets?

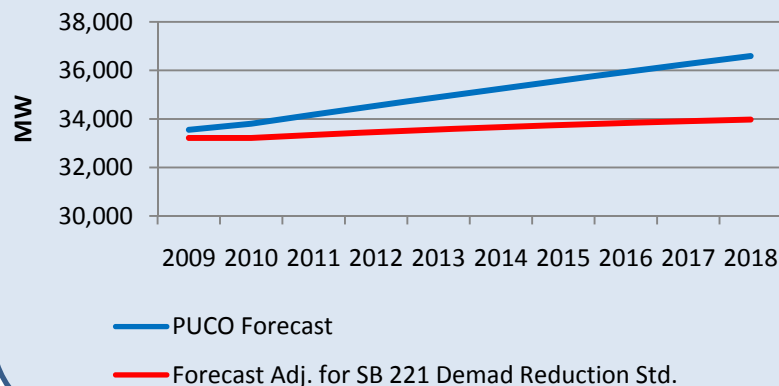
“Capacity markets should diminish in importance to the extent energy markets in the future prove capable, standing alone, of offering adequate assurance of reliability.”
- PJM Interconnection, LLC, 115 FERC ¶(2006) at P. 170-71.



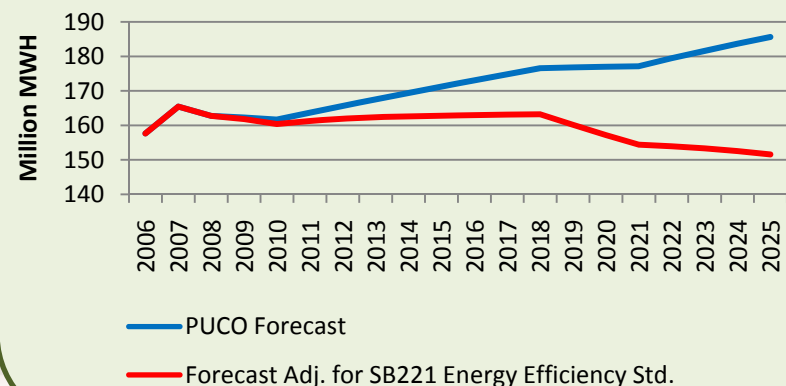
Ohio's Electricity Statute

- State Policy to Encourage AMI & Time Differentiated Pricing
- Single Issue & Incentive Ratemaking for Grid Modernization
- Ohio Peak Demand Reduction Standard: 7.75% by 2018
- Ohio Electric Efficiency Standard: 22%+ Reduction by 2025

Ohio Demand Forecast: Impact of Peak Demand Standard



Ohio Energy Forecast: Impact of Energy Efficiency Standard





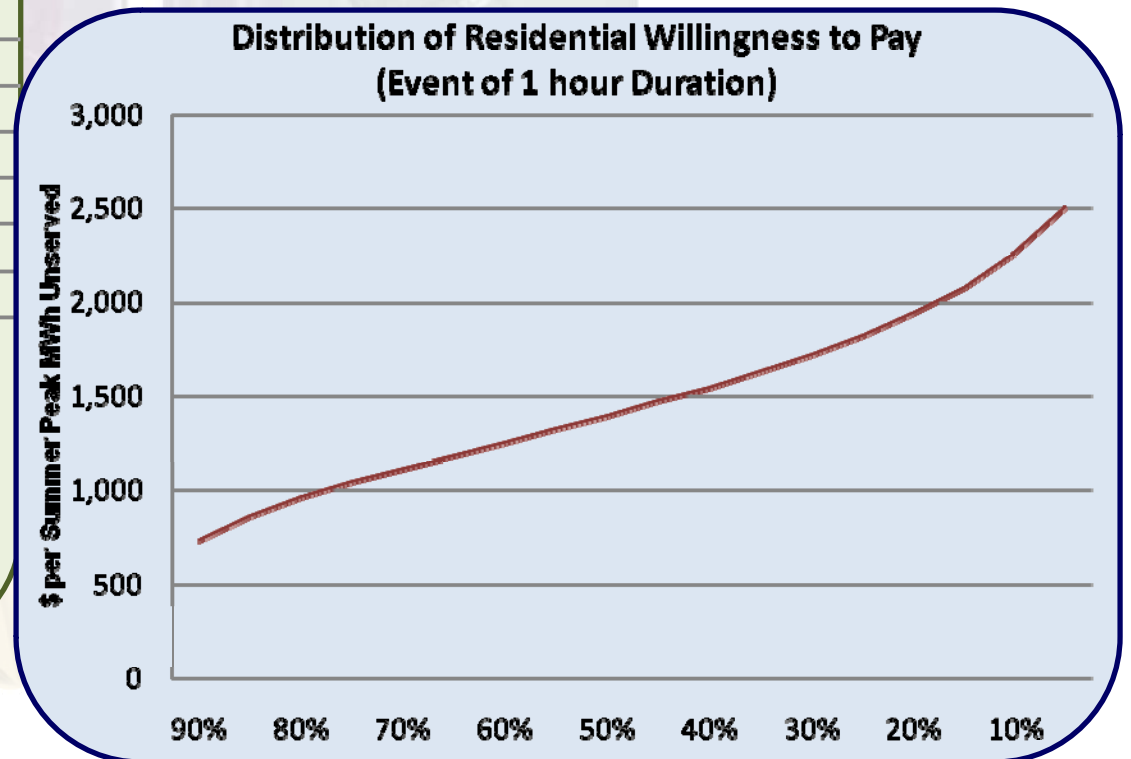
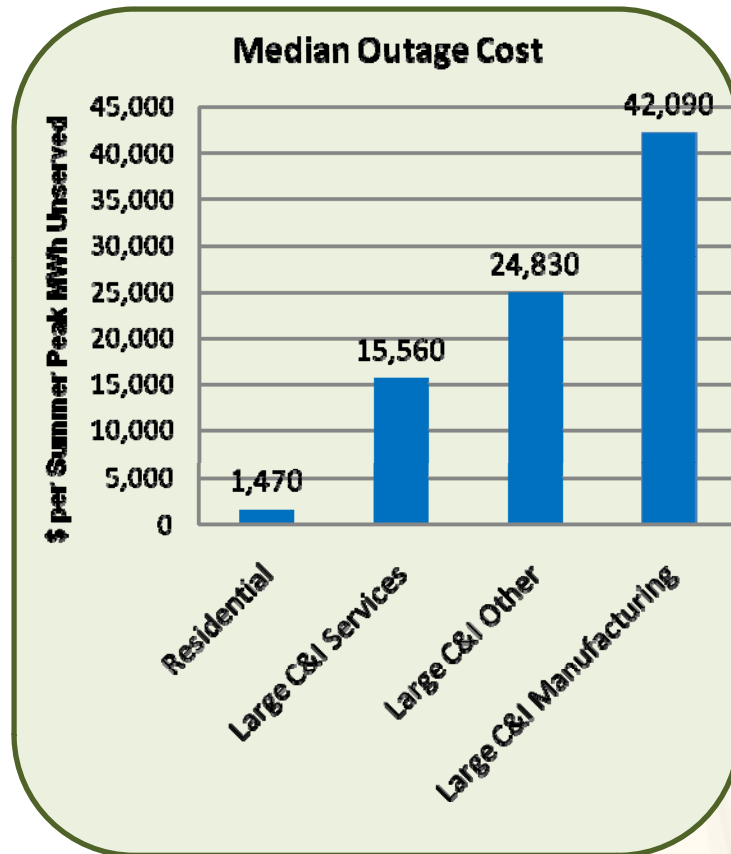
Implied Value of Capacity²

- Optimal Investment: Marginal Cost = Value of Lost Load
= Net CONE (\$/MW Year) / LOLE / Duration of Avoided Interruption
(Hours /Year) = VOLL
- Implied Value Of Lost Load in RPM
= RTO Net CONE: \$94,283 / LOLE of 0.1 / 5 hours Interruption =
\$188,566/MWh
- Impact of Resource Adequacy Requirement on SAIDI (System Average Interruption Duration Index)
= LOLE * Event Duration (Hours /Year) * Individual Customers Impacted
(% per Hour) * Minutes / Hour = SAIDI Reduction
- Implied SAIDI for 1-in-10 Year LOLE
= LOLE: 0.1 * 5 hours * 4% * 60 minutes = **1.2 Minutes per Year**



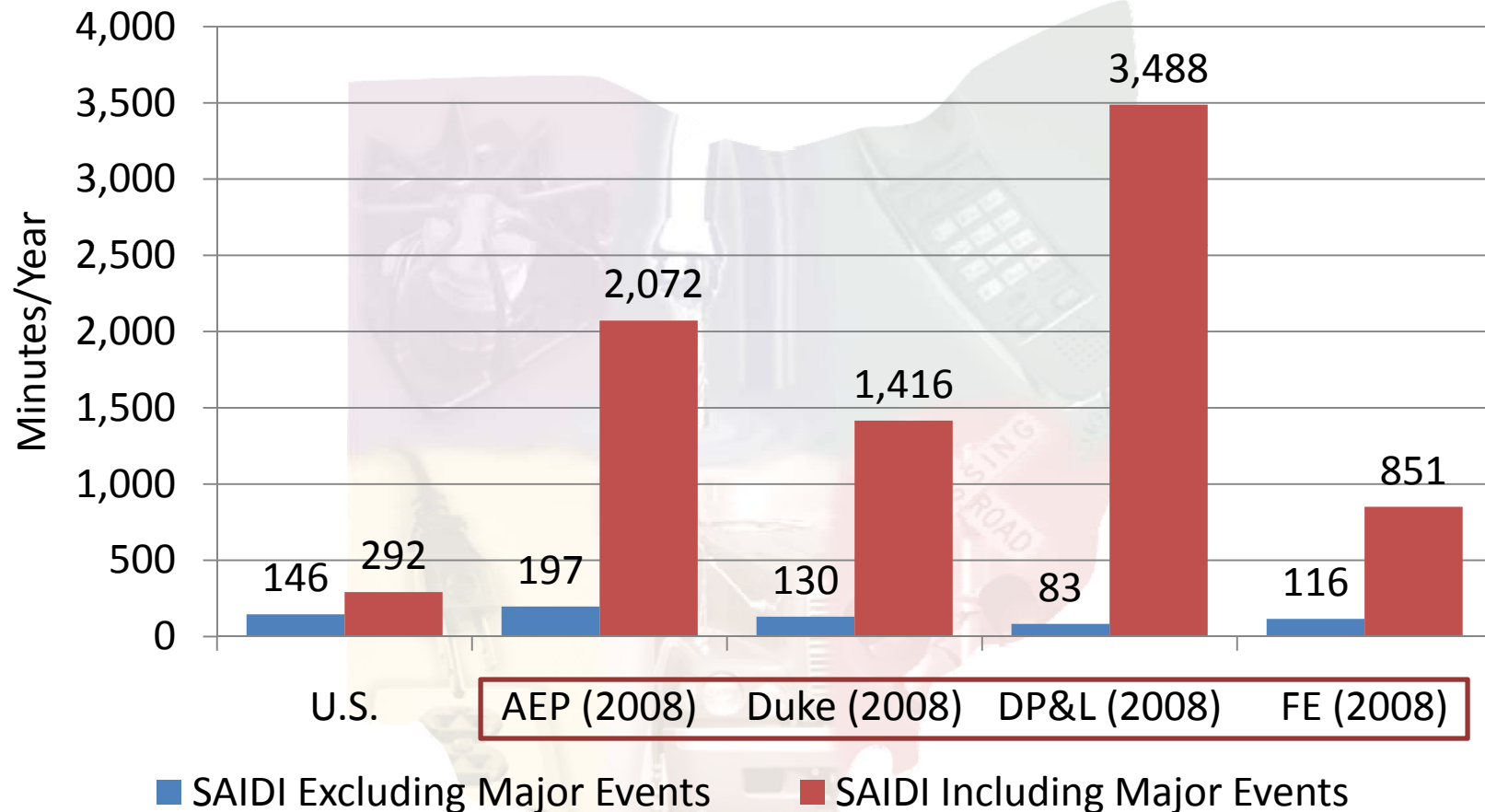
Value of Lost Load ³

- Midwest ISO VOLL Estimates
- Consistent with 70+ N. America & UK Estimates





Customer Level Reliability: SAIDI ⁴



* Major Events include impacts of Hurricane Ike on Ohio EDUs .



Current Capacity Model: Barriers to Development of an Efficient Market

- Lack of Peak Price Transparency subsidizes Uneconomic & increasingly Unaffordable Investment
- Uncertainty impacts Long-term Contracting for New Capacity
 - Capacity revenues are sensitive to administratively determined, forecast inputs to capacity market structure & requirements
- Failing to Effectively Price Scarcity & Capping the ability of Demand to set Prices Mutes Time- & Location-specific Efficiency Incentives
- Historically Based Forecasts force LSEs to Carry Capacity for Demand that Not present at Higher Energy & AS Prices
 - Undermines Business Case for AMI & Threatens Smart Grid Investments
- One-size Fits All Capacity Obligation Precludes Individual Consumer Choice & the Opportunity to Reveal Consumer Preferences



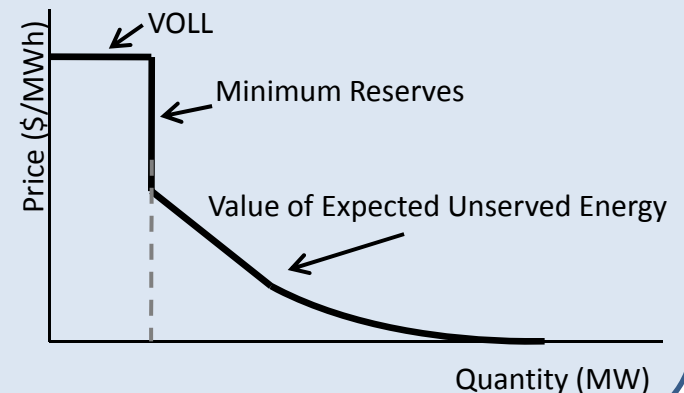
Transitioning to an Efficient Market

- Dynamic Retail Pricing Makes Resource Adequacy a Private Good⁵
 - Under old Common Pool Resource model, question was: What is the right amount of capacity?
 - Private Good question is: What price hedges are appropriate for risk profile of specific consumers?

Essential PJM Market Reforms⁶

- Forecasts: Demand Response Curves based on Statistical Relationship Between Price & Demand
- Scarcity Pricing: Operating Reserve Demand Curve based on Value of Reserves to Consumers
 - Minimum reserve price should be sufficiently high to elicit voluntary reductions
- Synchronizing Capacity and Scarcity Pricing
 - Generation Committed pursuant to its Capacity Obligation Should Not Also Benefit from Scarcity Price
 - To the extent Load has Paid for Capacity, it is Hedged & Should Not also Pay Scarcity Prices
 - Load should have Option to Hold Capacity in Excess of any Obligation for Residual Firm Demand
- Emergency Procedures: Non-discriminatory Curtailment based on relative Capacity Deficiency

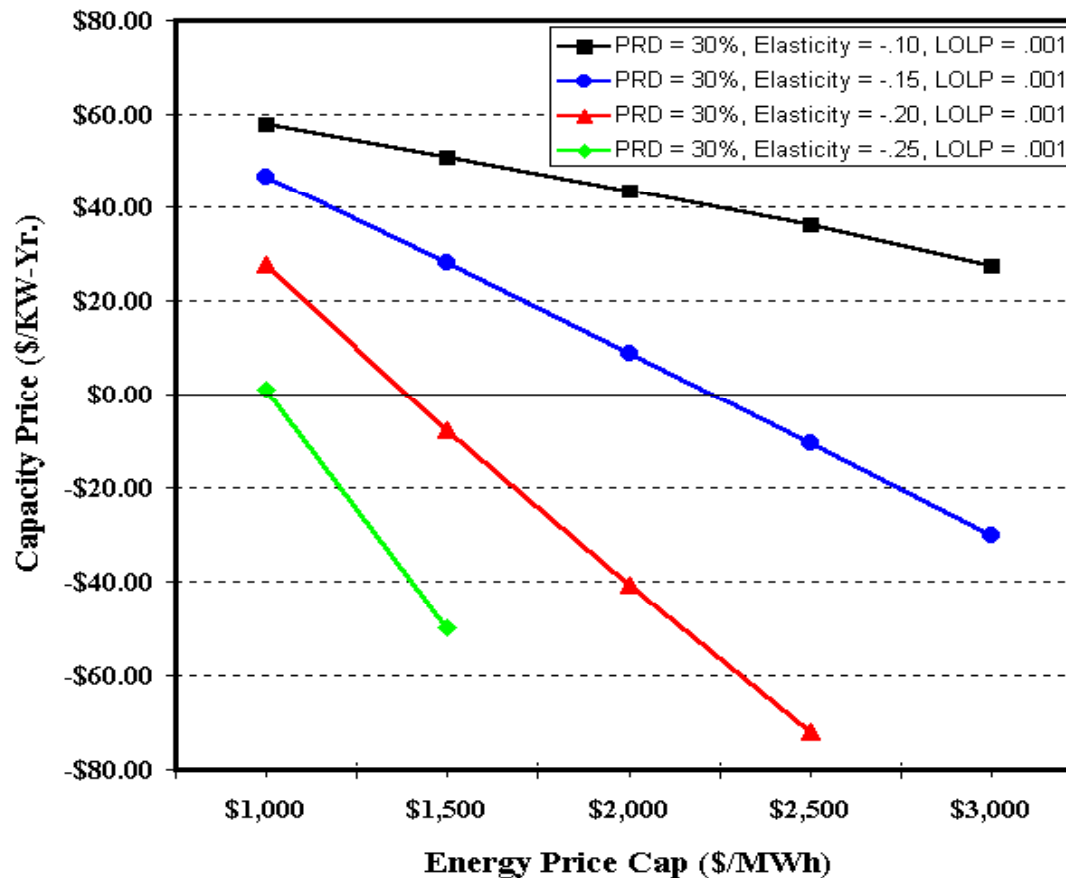
Operating Reserve Demand Curve





Illustrative Transition to Efficient Market⁷

Capacity Prices Required To Attract New CTs





References

1. See : Cramton, Peter and Steven Stoft, *The Convergence of Market Designs for Adequate Generating Capacity* (April 25, 2006), at 23. They describe the “missing money problem,” but recognize that eliminating the lack of metering and real-time billing would “allow the investment problem to be solved” and that, “In a normal market, price keeps supply and demand equal and the markets are much less fragile. ... The right level of capacity is the level that makes the marginal value of product to consumers equal the long-run marginal cost of production. No economics text will explain how a market sets capacity to the adequate level for reliability, because normal markets cannot do that and do not need to.”
2. For a detailed discussion, see: Wilson, James F., *One Day in Ten years? Resource Adequacy for the Smart Grid* (November 2009), <http://www.wilsonenec.com/RecentWork.php>. See also: Telson, Michael. "The Economics of Alternative Levels of Reliability for Electric Power Generation Systems." *The Bell Journal of Economics* 6 (1975): 679-694; Keane, Dennis M., & Woo, Chi-Keung. "Using customer outage costs to plan generation reliability." *Energy*. 17, No. 9, (1992): 823-827; and Hogan, William W., *Regulation and Electricity Markets: Smart Pricing for Smart Grids*, presentation to the Energy Bar Association Electricity Committee Meeting, October 16, 2009. The RTO Net Cone value is from: PJM, *RPM CONE and E&AS Values for 2012/2013 Base Residual Auction* (April 8, 2009).
3. Midwest ISO,. *Final Report On Value of Lost Load* (2006). See also: Lawton, L., M. Sullivan, K. Van Lier, A. Katz, and J. Eto. "A Framework and Review of Customer Outage Costs: Integration and Analysis of Electric Utility Outage Cost Surveys," LBNL-54365. Berkeley, CA: Ernest Orlando Lawrence Berkeley National Laboratory (2003); and Bushnell, James. "Electricity Resource Adequacy: Matching Policies and Goals," CSEM WP 146 (August 2005).
4. U.S. Data: Eto, Joseph H. and Kristina Hamachi LaCommare, *Tracking the Reliability of the U.S. Electric Power System: An Assessment of Publicly Available Information Reported to State Public Utility Commissions*, Lawrence Berkeley National Laboratory (October 2008), p. 15 Table 4. Ohio Utility Data: Utility Annual Reports filed pursuant to O.A.C § 4901:1-10-10. Ohio data for Major Events includes impacts of Hurricane Ike.
5. For a detailed discussion, see: L. Lynne Kiesling, *Deregulation, Innovation and Market Liberalization: Electricity regulation in a continually evolving environment*, (London, U.K.: Routledge, 2009).
6. P. Centolella & A. Ott, *The Integration of Price Responsive Demand into PJM Wholesale Power Markets and System Operations* (March 2009).
7. Borlick, R. 2003. "Mandatory Reserve Margins Good Idea or Not?" 26th IAAE International Conference (June 4-7, 2003).