



Creating a 21st Century Grid: Distribution & Demand Response

**Commissioner Paul A. Centolella
Public Utilities Commission of Ohio**

Aspen Institute Energy Policy Forum

July 11, 2009

The views expressed herein are my own and should not be regarded as an opinion regarding the merits of any pending case.



Key Challenges

- Globalization
- Power Demands of Digital Applications & Electric Vehicles
- Significant Reductions in Greenhouse Gas Emissions

How can we Affordably Meet a Growing Demand for Energy Services and Sharply Reduce Carbon Emissions?

Near Term Objectives:

- **Engage Consumers**
- **Efficiently Use Existing Assets**
- **Foster Innovation**



Energy Efficiency

- Large, Unrealized Cost-effective Efficiency Potential indicates Markets have Not Produced the Economically Efficient Result
 - Efficiency is Incidental to Consumer Decisions Impacting Energy Use
- Ohio Electric Efficiency Standard: 22%+ Reduction by 2025
 - Aggressive: Could Reduce Annual Use 13.8 million MWh below 2007
 - Rules Authorize Banking of Early Reductions
 - Flexible: After Exhausting all Options, Utility may Apply to Amend a Benchmark that it Cannot Meet due to Factors Beyond its Control
 - Part of a Broader Policy: Excess savings can be applied to Ohio's Advanced Energy Standard, but not our Renewable Energy Standard

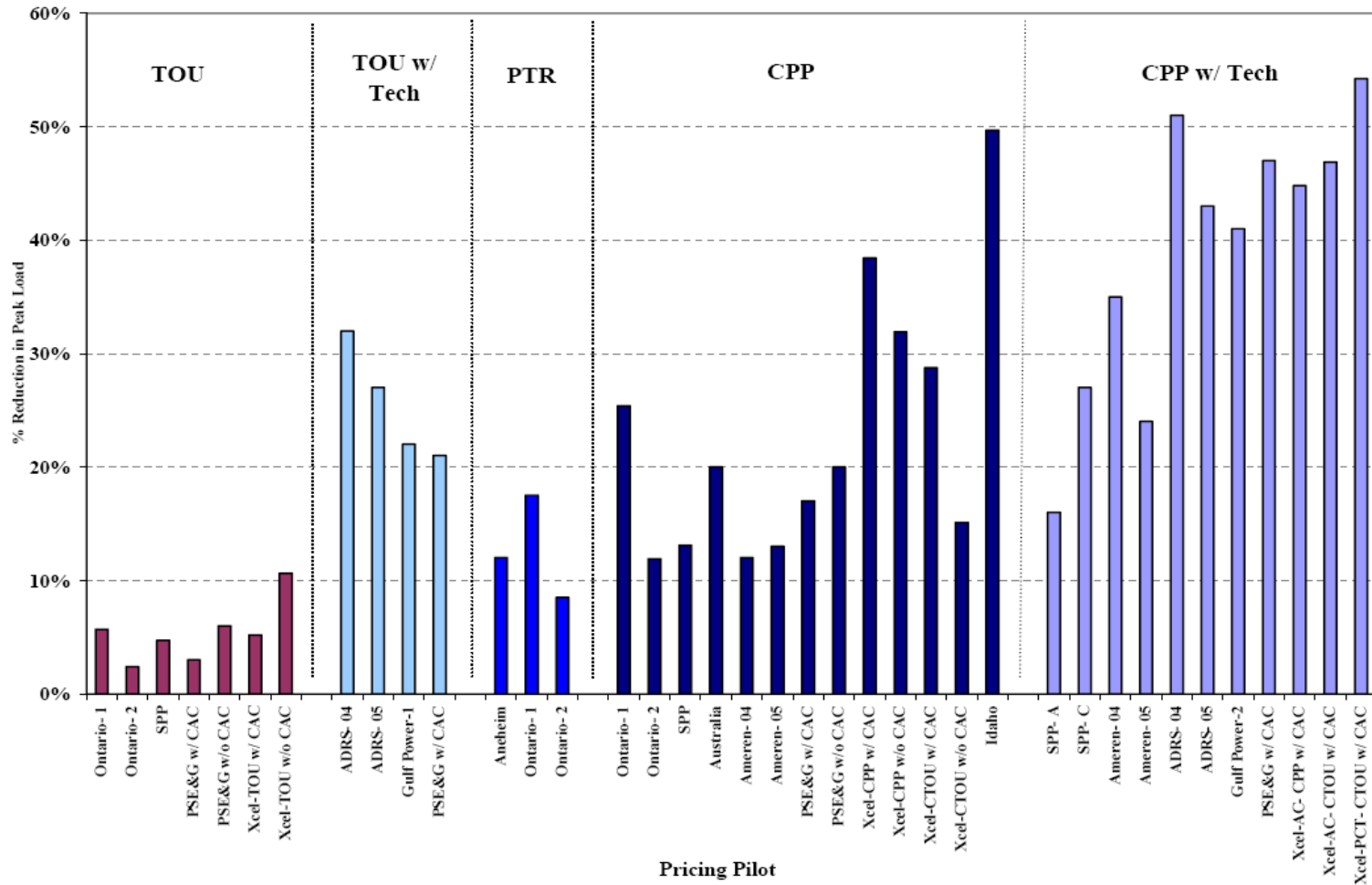


Price Responsive Demand

- The Predictable Response to Changes in Wholesale Prices by Consumers on Dynamic or Time-Differentiated Retail Pricing
 - Third Generation Demand Response
 - Examples: Critical Peak Price, Critical Peak Rebate, & Real-Time Pricing
- Expansion Depends on Sending Prices to Devices & AMI
 - Smart Devices could Significantly Reduce Costs & Improve Results
- Price Responsive Demand is Not Offered & Dispatched as a Resource



Estimated Household Demand Response



Source: A. Faruqi & S. Sergici, *Household Response to Dynamic Pricing of Electricity A Survey of Seventeen Pricing Experiments* (2008)



Transitioning to Smart Rates

- Generation Prices Have Two Components
 - Actual Real-Time Price: Cost of Providing Incremental Energy at Specific Time & Place
 - Hedge against Volatility in Real-Time Price: Increases the Price in Return for Reduced Risk
- Two Part Pricing is Key to Reducing Consumer Resistance to Dynamic Rates
 - Examples: Critical Peak Rebate or Two Part Real-time Pricing
 - Hedge Volatility of Total Bill + Dynamic Pricing of Changes from Agreed Baseline
- Introduced to Rates with Dynamic Components & Limited Risk, Consumers can Migrate to Rates that Better Reflect Cost & Risk Preferences



Smart Grid

- A smart grid is the integration of the power system with an open architecture, advanced communications infrastructure
 - A smart grid is the information and communications architecture that supports new applications and enables them to interact with one another and with established power system functions
 - The platform for integrating a potentially broad range of sensing, measurement, transactional, control, and other applications that may include AMI, dynamic retail pricing, advanced distribution automation, distributed resource management, electric vehicle integration, etc.



Smart Grid Deployment

- Ohio S.B. 221 (Effective July 2008):
 - Electric Security Plan: Single Issue & Incentive Ratemaking for Grid Modernization
 - State Policy Supporting Distribution Quality of Service Standards
 - State Policy to Encourage AMI & Time-Differentiated Pricing
- PUCO Approved Smart Grid Deployment Plans, including AMI
 - Duke Energy: 50,000 Advanced Meters in 2009, Complete Rollout over 5 years
 - AEP: 110,000 Advanced Meters in Phase 1, Complete Rollout over 7 years
- Over 40 U.S. Electric Utilities in 37 States Have Announced AMI Plans
 - If fully implemented, Deploy More Than 42 Million AMI Meters
 - Recovery Act “will result in more than ... 40 million ‘Smart Meters’ in American homes.” *White House Benchmarks Report* (Jan. 24, 2009)



Benefits May Include:

- Defer Generation Investment Decisions
- Empower Consumers to Control their Energy Bills
 - Timely Feedback on Energy Costs
- Reduce Often Regressive Cross-Subsidies in Flat Rates
- Mitigate Potential Market Power
- Enhance System Reliability: Price Responsive Demand Creates Beneficial Feedback as Price Increases Cause an Offsetting Demand Reduction
 - Improves Predictability of Demand & Power Flows for Operations
- Improve Distribution System Reliability
 - Reduced Outage Time & Condition Based Maintenance
- Reduce Emissions through Lower Energy Requirements and:
 - Substituting Demand Response for Generators providing Ancillary Services
 - Reduced Losses
- Create a Platform for Innovation



Next Steps: Engaging Consumers

- Integrate Meters with the Rollout of Dynamic Pricing, Enabling Technology, Feedback Tools, Efficiency Programs, & Consumer Education
 - Understand Best Practices
 - Support Hypothesis Testing & Ongoing Learning
 - Encourage Cooperation among Utilities and Stakeholders



Next Steps: Removing RTO Barriers to Price Responsive Demand

- Current Planning Models Require Carrying Capacity & Planning Reserves for Demand that Would Not Exist at Higher Energy Prices
 - Eliminates Opportunity to Achieve Capacity Savings
 - Added Capacity Keeps Spot Prices Too Low to Evoke Demand Response
- Operations & Planning Not Optimized for Price Responsive Demand
 - Systems Built on Assumptions of Inelastic Demand & Generation Sets Prices
- Coordination of Wholesale & Retail Markets
 - Transparent Forecast Demand Response Curve Replaces Demand Forecasts
 - Scarcity Pricing Reform: Operating Reserve Demand Curve
 - Non-Discriminatory Curtailment in any Capacity Emergency

See: P. Centolella & A. Ott, *The Integration of Price Responsive Demand into PJM Wholesale Power Markets and System Operations* (March 2009).



Next Steps: Smart Grid Standards

- Standards Require a State / Federal Partnership
 - NIST Coordinating Standards Development
 - FERC May Adopt Standards for “interstate transmission of bulk electric power” & “organized regional and wholesale electric markets”
 - Many Standards Address Distribution & Consumer Applications
- High Level Interoperability Requirements:
 - Accommodate transactional control: millions of devices & consumers responding to price signals, without dispatch by system operator
 - Create an architecture that is open for third party innovation
 - Facilitate the development of distributed intelligence in the power grid



Potential Implications:

- Transition to Decentralized Coordination
 - Distributed Devices & Actors Control Parts of the System
 - In Aggregate their Interactions Create More Efficient, Reliable Result
- A Smart, Adaptive Grid
 - Optimizes Asset Utilization
 - Reflects Uncertainty
 - Creates Broadly Defined Economic Value for Consumers