Ohio | Public Utilities Commission

"Smart Technology vs. Smart Policy"

37th Annual PURC Conference

Gainesville, Florida

"Rate Implications of Changing Technologies"

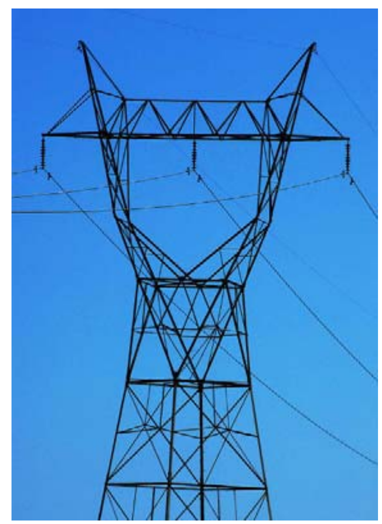
February 4, 2010

9:00AM – 10:30AM

Valerie A. Lemmie, Commissioner

Using Smart Grid to Establish Smart Rates

- History of U.S. Electric Industry
- Environmental & Economic Policies Require New Regulatory Rate Designs
- Smart Grid: Making Revolution Possible
- From Smart Grid to Smart Rates and Dynamic Pricing
- Energy Services Business Model
- Cost to Consumers



History of US Electric Industry: Early Breakthroughs, Innovation and New Technologies[1]

We learned in Elementary School about Benjamin Franklin using a kite to prove lightning was electricity in 1752.

Just like Franklin's breakthrough, the history of electric power generation in the U.S. can be traced to a series of key scientific, engineering and business management breakthroughs that made electric power widely available as a safe, reliable, dependable and affordable energy resource.

Beginning with Alesandro Volta who proved electricity could travel over wires (1800), through the formation of the first electric utility (1816), and the formation of the first commercial arc lighting system in Cleveland (1879).

Then, the Menlo Park demonstration of incandescent lamp (1879), the opening of Thomas Edison's Pearl Street Station using direct current (1882), enabling of long distance transmission of high voltages over long distances (1880's), development of transformers that could step-down high voltage electrical power at point of use (1886).

The opening of the first AC power transmission plant in Great Barrington (1886), municipal ownership of small electric stations (1900's), through the establishment of the Federal Power Commission (1920), the first U.S. plant to burn only pulverized coal (1920), and the electrification of rural America under Roosevelt's Rural Electric Administration (1935).

[1]: Wikipedia History of Electricity

From Ben Franklin to Market Restructuring

- Modern Electric Power System evolved from early breakthroughs demonstrating electricity was safe, controllable, reliable, available and could be:
  - Generated using relatively cheap fuel sources indigenous to America
  - Centrally dispatched
  - Efficiently distributed
  - Affordably priced
  - Effortless to end user
- By 1930's, electric services regulated by states as "Natural Monopoly."
- As "Natural Monopoly" utilities operated under single utility ownership providing electric generation, transmission and distribution services.
- As a regulated commodity, utility business model was based on growth in user demand and managerial efficiency.
- Regulatory approved rates based on constant rate tariff (fixed price) determined by formula that insured recovery of a utility's prudently incurred costs and a reasonable return on equity.
- Rising prices in the 1970's foreshadowed concerns with traditional view of the efficiency of utility companies as "Natural Monopoly".
- PURPA encouraged new utility business models along with restructuring of "Natural Monopolies" to incent competition as means of keeping electric energy prices low and economy strong.

The Revolution Is Coming!

- By the 21st Century, global warming caused by burning of carbon-based fuels energized U.S. Policy makers at the federal level to take notice and at state level to take action to reduce carbon emissions from coal fired electric generating plants.
- Most states now have:
  - Renewable Portfolio Standards (RPS) requiring incumbent utilities to diversify generation fleet to incorporate renewable and alternative energy resources;
  - Requirements to reduce energy demand for all classes of customers through Energy Efficiency (EE) and Peak Demand Reduction (PDR) programs; and
  - Policies that allow customers to sell-back excess energy back to the utility (Distributed Generation).

The Revolution Is Coming!

- The convergence of energy, economic and environmental policies has resulted in utility companies being required by state regulators to promote reductions in energy usage under business model predicated upon energy growth.
- Traditional fixed rate tariff design model based on average historic costs, not profitable to utilities as lower (or static) energy demand reduces their return on equity, access to cheap capital and ability to recover prudently incurred expenses.
- Challenge exacerbated by demands for new investments in Smart Grid, AMI and Smart Meters. Even with rate decoupling, no mechanism under traditional rate design to recover new capital costs—only capital investments already made.
- As long as pricing of electricity not based on how much or when electricity is used, limited incentives for customers to reduce usage, especially during peak demand.

New Regulatory Rate Design Needed To:

- Incentivize investments in environmentally friendly energy resources;
- Price power to reduce energy demand and need for new fossil-fuel based electric generation resources; and
- Transition utilities to business model based upon energy savings, not growth.

Smart Grid: Making The Revolution Possible

- Advancements in information technology and telecommunications provides means to upgrade power transmission system network to a **"Smarter Grid."** This Smart Grid can connect assets in energy infrastructure to business and homes, making it possible to measure and achieve renewable and alternative energy generation resources, peak energy demand reductions and greater energy efficiency to reduce our carbon footprint.[2]
- Coupling Smart Grid with an advanced metering infrastructure, including smart meters, utility companies can send price signals to customers informing them of cost of energy to facilitate their management of energy resources to reduce energy consumption.

[2] Cisco systems

Other Benefits Of The Smart Grid

- More efficient and reliable energy transmission and distribution through improved demand forecasts and predictability of power flows.
- More timely responses to outages through faster problem identification and resolution.
- Manage increasing number of plug-in hybrid vehicles. Stimulate an array of new business models in energy sector.
- Remote monitoring of the electric distribution system, allowing for reductions in line losses and faster restoration of outages and enable condition based maintenance.
- Better integration of intermittent renewable resources like wind and solar as Smart Grid can better compensate for days when wind isn't blowing or sun shining and electric vehicles.
- Time of use pricing based on consumption rates—higher during peak demand and lower during non-peak periods should reduce peak demand.
- Utility control (with customer approval) of home appliances based on pricing/demand. Integration of more distributed generation and demand resources.
- In-home energy management services to residential and small commercial customers. Enhanced power quality and higher capacity utilization.

From Smart Grid To Smart Rates

"The challenges of climate change and the continued growth of electricity demand are putting increasing stress on the world's electricity network infrastructure. The prevailing design philosophy for the existing electricity network is a legacy from a period when energy was relatively cheap and plentiful and meeting rising demand was the dominant driver. The world is now at the point of transition to a new era where clean energy will be at a premium, networks will need to be flexible to the incorporation of new low-carbon technologies and customers will demand greater insight and control over their own consumption." ~World Economic Forum

- While Smart Grid enables customers to receive price signals that allow them to curtail or sell-back energy when the price of electricity is high, or to shift their demand to times when energy costs are lower, smart rates provide incentive for customers to change energy consumption patterns.
- With increasing investments in the deployment of Smart Grid, Advanced Metering Infrastructure (AMI) and Smart Meters utilities will be seeking cost recovery from State Commissions.
- Combining the technological ability of the Smart Grid and Smart Meters to send price signals to customers and smart appliances that can respond automatically to these signals will increase energy efficiency and reduce demand at peak periods.
- Dynamic rates based on time of use pricing models give state regulators tools to facilitate reduced carbon emissions from electric generation.

Smart Rates Require Dynamic Pricing Rate Design

- **A Dynamic Rate is when price of electricity is time-varied by day or season.**
- Dynamic pricing rate designs can provide State Regulators tools to meet economic, environmental, energy and social policy goals if designed to ensure:[3]
  - Revenues in aggregate recover total costs.
  - Costs fairly allocated by and within customer classes.
  - Prices encourage efficient energy consumption.
  - Prices equitable, fair and transparent.
  - Price/revenue stability.
  - Customers given information and education to align energy usage to non-peak hours and sell-back electricity to Grid to lower energy costs.

[3] Fundamentals of Dynamic Pricing by Theresa Flaim, PhD, pg 18

Issues to Consider When Establishing Dynamic Rates[4]

- Types of Products Designing
  - Rates for Basic Commodity Service
    - Default or POLR Service
    - Traditional Service
  - Overlay/Optional Products
- Rate Classes
  - Residential/Commercial/Industrial
  - All Classes
  - Based on MW
- Desired Resource Goals
  - PDR (7.75% by 2018 – Ohio)
  - EE (22% by 2025 – Ohio)
  - RPS (20% by 2025 – Ohio)
- Setting Customer Baseline Loads
  - Day Ahead or Hourly Forecast
  - Real Time Energy Prices
  - Seasonal/Time of Use
- Reflecting Short Term "Capacity" Costs in Energy Rate (PJM)
- Setting Customer Baseline Loads
  - Average Historic Usage
  - Customer Baseline Load
- Designing price protection products for customers who may want more or less exposure to the marketplace.
- Measure Sources of Value
  - Reliability (Capacity)
  - Economics (Energy)

[4] Fundamentals of Dynamic Pricing by Theresa Flaim, PhD

Issues to Consider When Establishing Dynamic Rates[5]

- Product dimensions that affect value
  - Interruptions (Notice, Duration, Frequency)
  - Length of Contract
- Measuring Load Reduction
  - Real Time Response
  - Assuring Load Reduction is Firm
  - Load Level Relative to a Baseline
- Assuring Compliance
  - Penalties for Non-Compliance of Firm Demand Reduction Resource
- Number of Overlay Tariffs Mix of Rebates and Credits that make most economic sense and incent customer behavior to reduce critical peak demand
- Engaging and informing stakeholders about costs and benefits of dynamic pricing models before implemented by a utility company

[5] Fundamentals of Dynamic Pricing by Theresa Flaim, PhD

Examples of Dynamic Pricing Tariffs

- Critical Peak Pricing – Customer can manage electricity costs by shifting load from higher price periods to lower price periods or by curtailing load during critical peak hours.
- Time of Use Pricing – Enables customers with qualifying meter to take advantage of time differentiated rates by modifying daily electrical usage patterns to lower energy costs.
- Peak time rebates or interruptible/curtailment rates – rebate given for load shedding during critical peak demand events, the latter usually within defined parameters.
- Real Time Pricing – Customers can shift or add load during lower price periods in response to the hourly wholesale market price for electricity.
- Peak Load Management – Management of electric usage during critical peak demand times.

Energy Services Business Model

- Smart Grid and Dynamic Pricing are two legs of the smart policies stool. The third leg is a business model for pricing electric power.
- To achieve low-carbon based energy production and capital investments in Smart Grid, AMI, Smart Meters and Home Energy Management Programs, state regulators must send proper market signals using pricing models that incent EE and PDR over energy growth.
- For utilities lower energy demand means declining sales and lower rates of return. Coupled with infrastructure demands estimated at $1.3 Trillion through 2030 to decarbonize electric sector [6], business model based upon growth in energy sales is not viable.
- Peter Fox-Penner describes energy services as model enabled by Smart Grid allowing utilities to sell units of delivered energy services rather than energy commodities, making utilities a hybrid between wireless network providers and regulated public works. [7]
- Changes in industry economics and technology provide rationale for an energy services model that blends two services with different cost trends – electric power and end-use hardware – to produce a value proposition customers will accept; not being charged more for using less energy. [8]

[6] Return of the Energy Services Model: How Energy Efficiency, Climate Change and Smart Grid Will Transform American Utilities, 2009, The Brattle Group Pg 1

[7] Return of the Energy Services Model, Pg 2

[8] IBID Pg 10

Would Consumers Pay More For Smarter Grid?

National Survey by Parks Associates found[9]:

- Over 80% of consumers are very interested in cutting energy costs, but fewer than 50% surveyed want to learn more about Smart Grid.
- 80%-85% of households willing to pay $80-$100 for cost-savings equipment with guaranteed savings of 10%-30% off monthly electric bill.
- 15%-20% of customers are interested in Time-of-Use or Demand Response programs.
- 35% do not want utilities controlling their in-home energy management systems.

[9] SmartGridNews.Com article, "Bringing the Smart Grid to the Smart House: It's Not Only About the Meter"

What Does it Cost?

- $461 million world-wide Smart Grid investment in 2008. (World Economic Forum)
- $3.4 billion from the Department of Energy in stimulus funding, matched by $4.7 billion in private sector dollars to support investment and deployment of Smart Grid technology, including 18 million smart meters in October 2009. Goal is deployment of 40 million smart meters over next few years. (CNNMoney.com)
- Over $250 million in stimulus funding for Smart Grid projects received by Ohio utilities and communities.
  - $75 million to AEP-Ohio for demonstrating secure, interoperable and integrated Smart Grid/Smart Meters affecting 100,000 customers.
  - $200 million for Duke Energy's grid modernization. PUCO already approved 50,000 Smart Meter rollout.
  - $57.4 million to FirstEnergy to modernize it's electrical grid and deploy Smart Meter network to reduce peak demand.
  - $9.7 million for 15,500 Smart Meters for two municipally-owned utilities.

What Does it Cost?

Residential Bills

Duke Energy of Ohio

Smart Grid Rate Caps:

2009:	$0.50
2010:	$1.50
2011:	$3.25
2012:	$5.25
2013:	$5.50

Dayton Power & Light

Smart Grid Rider:

2010: $0.64 plus $0.0004722 per kWh ($1.11 per month for average residential customer)

FirstEnergy

Smart Grid Rider :

2010: $0.27

Columbus Southern Power

Smart Grid Rider:

2010: $0.75

- Avoided Cost of Not Having to Build New Generation
  - $20 billion over next decade [10]

[10] Time Magazine 12/14/09, Get Smart article.

The Ohio Experience

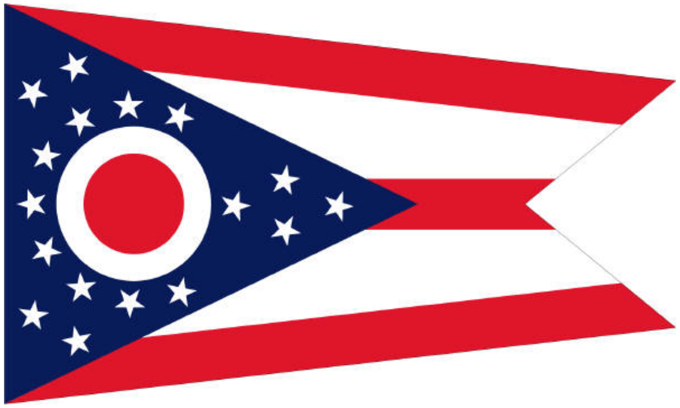
- Ohio has regulated services and customer choice
- Generation prices have two components
  - Actual Real-Time Price: Cost of Providing Incremental Energy at Specific Time and Place
  - Hedge against Volatility in Real-Time Price: Increases the Price in Return for Reduced Risk
- Two Part Pricing is Key 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
- Introducing Rates with Dynamic Components and Limited Risk as Customers Can Migrate to Rates that Better Reflect Costs and Risk Preferences [11]
  - CPP (Experimental)
  - TOD
  - RTP (Based on LMP)

[11] Critical Peak Pricing, Time-of-Day Pricing, and Real Time Pricing

State of Ohio 2009 Electric Rates

OH 2009 Average Retail Rates [12]

- Residential 10.20 cents/kWh
- Commercial 9.25 cents/kWh
- Industrial 6.24 cents/kWh
- Total OH Average 8.47 cents/kWh



[12] Edison Electric Institute: The above rates are all-in rates that include generation, transmission, and distribution charges plus any applicable riders.

Engaging Consumers

- Integrate rollout of Dynamic Pricing with installation of Smart Meters and Home Energy Programs with consumer education
  - Incent accelerated development of Smart Appliances
  - Maintain “Best Practice” inventory
  - Incorporate continuous learning approach as end use technology becomes more efficient
  - Promote cooperation among utilities, stakeholders and consumers
  - Help consumers understand benefits and cost of Smart Grid, AMI and Smart Meters

Conclusion

“It is cheaper not to emit carbon in the first place. A Smarter Grid allows us to more efficiently integrate alternative energy resources into the electric grid, while concomitantly ensuring system reliability and security; to better manage our personal energy usage in ways that reduce consumption and level demand; both saving the need for new generation resources and reducing our carbon footprint. Smart policies, smart rates and a utility business model that encourages energy services delivery over commodity growth, in tandem help align price signals to incentivize behavior and investment in infrastructure that makes Smart Grid possible”

????Questions????

Disclaimer: The views expressed herein are my own and do not reflect the position of the PUCO, except where expressly stated or any other party nor should they be regarded as an opinion about the merits of any pending cases. ~Valerie Lemmie