Dynamic Pricing for Retail Electric Utility Service

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Topics

- Types of Dynamic Pricing
- Objectives/Purposes for Dynamic Pricing
- Historical Experience and Current Status
- Considerations for Northwest Utilities
- Business Case Analysis of Cost-Effectiveness
- Systems Approach
- Conclusions

Types of Dynamic Pricing

Real-Time Pricing

- Rate variations are not known in advance
  - Any time (may be subject to limits)
  - Any duration "
  - Any level "
- Most complex to implement
  - Infrastructure (metering, communications, billing)
  - Pricing basis (e.g., market index, utility marginal cost)
  - Customer education and relations

Time of Use Rates

- Rate variations are known in advance
  - Predetermined timing (e.g., on-peak, shoulder, off-peak)
  - Predetermined durations
  - Predetermined levels
- Somewhat complex to implement
  - Infrastructure (metering, communications, billing)
  - Pricing basis (e.g., forecasted variation in utility costs)
  - Customer education and relations

Critical Peak Pricing

- Rate variations are occasional
  - Event-driven timing (e.g., cold winter weather)
  - Limited duration
  - Pricing level may be predetermined or event-specific
- Less complex to implement
  - Infrastructure (metering, communications, billing)
  - Pricing basis (e.g., forecasted variation in utility costs)
  - Customer education and relations

Other Forms of Dynamic Pricing

- Seasonal Rates
- Interruptible Rates
- Peak Time Rebates

- Customer demand response
  - Not dynamic pricing per se, but may be similar
  - Can be managed by the utility (e.g., direct load control)
  - Tends to be oriented more toward system reliability

Objectives/Purposes for Dynamic Pricing

Theoretical Objective

- According to neoclassical microeconomic theory, setting prices at marginal costs sends a signal that promotes efficient choices
  - Consumers' purchases and use
  - Producers' investments and operations
- But the underlying theory assumes 'atomistic' competition, including:
  - Numerous competing providers, few barriers to market entry/exit
  - Product substitutability
  - Price transparency
  - Price = MC for everything else

Practical Purposes

- Inform consumers about variations in the cost of providing retail electric service and enable them to adjust their consumption in response
- Encourage consumer investments in energy efficiency
- Reduce frequency and severity of power supply constraints, thereby limiting spikes in market prices and utility costs of service
- Assist in reliable operation of the bulk power system and local distribution systems
- Reduce overall emissions and other negative environmental impacts

Examples

- Temperature-driven increases in loads (e.g., cold winter weather, hot summer weather)
- Variability in hydroelectric generation
- Intermittent generation from renewable resources (e.g., wind power)
- Vehicle electrification (e.g., timing for battery charging, use of batteries to provide system support)
- Exercise Smart Grid capabilities, justify Smart Grid costs

Historical Experience and Current Status

Historical Experience

- Dynamic pricing has been in existence for three decades
- Numerous pilot programs have been conducted in over half of U.S. states, as well as a small number of more permanent programs
- The results to date have been mixed at best
  - Many programs did not perform as expected and were abandoned
  - Prominent example of ongoing success is Georgia Power's real-time pricing program started in 1992

Current Status

- Development of the Smart Grid has significantly increased interest in dynamic pricing
  - Smart Grid capabilities as an enabler for dynamic pricing
  - Dynamic pricing as a justification for Smart Grid costs
- Other recent developments
  - Overall increased focus on energy issues
  - Growing customer interest in managing their consumption
  - Imminent arrival of vehicle electrification and broad support for low electric rates to recharge vehicle batteries
  - Development of new service offerings in states with RTOs/ISOs and consumer ability to choose power supplier

Pacific Northwest Examples

- Puget Sound Energy offered then discontinued time of use rates for 300,000 residential and small commercial customers (2001-2002)
- Portland General Electric offers optional time of use rates to residential and small business customers
- City of Port Angeles offers optional time of use rates to all customer classes
- Klickitat PUD offers time of use rates for irrigation
- Clark PUD offers optional off-peak demand rates that provide a discount to large commercial and industrial customers who shift their peak demand to off-peak hours

Examples of Lessons Learned

- Does the form of dynamic pricing chosen represent the best match for the situation?
- Is the rate design effective (e.g., do the prices reflect actual utility costs and can they vary enough to elicit changes in consumption)?
- Are time and costs to implement realistically estimated?
- Will the technology actually perform as promised/expected?
- Will there be sufficient customer education and service?

Considerations for Northwest Utilities

Considerations - Traditional

- Hydro-based system (historically energy-constrained)
- Regional loads peak during the winter
- Spot market prices for wholesale power tend to peak in the summer (timing mismatch)
- Rolled-in wholesale power rates for Bonneville Power Administration's publicly-owned utility customers
- Long-standing public service obligation for utilities to plan, acquire and manage electric resources

Considerations - Current

- Increasing reliance on natural gas-fired generation
- Growth in summer peak loads
- Large and expanding quantity of wind power (system integration and balancing challenges)
- Not an ‘organized market’ (golly, no LMPs)
- BPA implementing tiered wholesale power rates October 2011
- Utilities retain public service obligation to plan, acquire and manage electric resources

Business Case Analysis of Cost-Effectiveness

Business Case Analysis

- No one form of dynamic pricing is ‘best’ for all utilities
- Benefits, costs and cost-effectiveness are also specific to each utility
- Therefore, it is essential for each utility to prepare a rigorous and robust business case analysis *before* committing to dynamic pricing
  - Evaluate alternative forms of dynamic pricing
  - Develop realistic estimates of benefits & costs to implement
  - Use business case results as basis for regulatory approval, to monitor implementation and evaluate results

Types of Benefits to Include

- Reductions and shifts in consumption of electricity by retail customers, and resulting impacts on overall power supply costs
- Impacts on and benefits from:
  - Integrating intermittent renewable generation
  - Vehicle electrification (battery recharging and system support)
  - Emissions reductions
  - System reliability (bulk power system, local distribution)
  - Customer investments in energy efficiency

Types of Costs to Include

- While a large share of benefits can come from electric resources, the majority of costs are in delivery and customer service
- Components to include and estimate costs for:
  - Advanced metering
  - Two-way communications
  - Data storage and management systems
  - Customer billing systems
  - Market research
  - Customer education and service

Systems Approach

Interconnectedness & Complexity

- Dynamic pricing affects and is affected by a broad range of topics and issues, including:
  - Overall economic efficiency
  - Electric resource portfolio planning and management
  - Integration of intermittent generation
  - Vehicle electrification
  - Smart Grid
  - Customer energy efficiency
  - Environmental impacts

Systems Approach

- Dynamic pricing is not a single-issue topic
  - Dealing with it on a stand-alone basis hasn't been successful
  - Increasing interconnectedness and complexity are making it even more important to consider related topics
- A more effective approach: address dynamic pricing from a broader, systems-based perspective
  - Explicitly recognize linkages and interactions
  - Identify and focus on key drivers, not symptoms
  - Develop integrated approaches that maximize overall system benefits

Conclusions

Conclusions

- Various forms of dynamic pricing have been attempted for over 30 years, with mixed results
- Needs and capabilities to implement dynamic pricing appear to be growing
- Ingredients for success:
  - Clear, realistic purpose
  - Design that matches the situation
  - Capable execution (technical and customer engagement)

Conclusions

- Business case analysis
  - Evaluate alternative forms of dynamic pricing and identify the one that best fits the situation (i.e., result not an input)
  - Address all significant benefits, including impacts on the utility's resource portfolio
  - Develop realistic estimates of requirements, costs and risks
  - Assess benefits and costs on an integrated basis
- Using the business case analysis results
  - Basis for regulatory review and approval
  - Tool for monitoring implementation, evaluating results

Conclusions

- Systems approach can help to avoid pitfalls
  - Recognize increasing interconnectedness and complexity
  - Address dynamic pricing as part of a broader system, including linkages with related topics