Foundations of Retail Electricity Rates

ESIG Task Force on Aligning Retail Rates and Grid Needs

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Why and How Do We Regulate Utilities?

• Public policy goals
  • Efficient competition and control of monopoly behavior
  • Safe, adequate, and reliable service
  • Societal equity (e.g., universal access and affordability)
  • Environmental and public health requirements

• Principles for setting utility prices
  • Effective recovery of revenue requirement
  • Customer understanding, acceptance, and bill stability
  • Equitable allocation of costs
  • Efficient forward-looking price signals
The Regulatory Prerequisite: Data

- FERC Uniform System of Accounts
  - Important industry standard but not specific enough for some purposes
- Overall system load and generation data
- Location-specific T&D data have become more sophisticated
- Customer-specific data
  - Load sampling is no longer necessary with AMI
Simplified rate-making process

1. Determine revenue requirement
   - Net rate base: Plant in service – depreciation reserve
2. Add:
   - Rate of return
   - Depreciation expense: Plant in service x depreciation rate
   - Operating expense: Fuel + purchased power + labor + labor overheads + supplies + services + income taxes
3. Add:
   - Other taxes
   - $ millions

Allocate costs among customer classes

Design retail rates
Determining Customer Classes

Types:
- Residential
  - Single-Family
  - Multi-Family
  - Solar?
  - Heating?
- Commercial
- Industrial
- Agriculture
- Street Lighting
Changing Purpose of Customer Class Distinctions

- In principle, a perfect set of time- and location-varying prices would eliminate the need for customer classes and even cost allocation in the traditional sense
- Customer class distinctions can be used to push the envelope on pricing sophistication
  - Segment residential class into “basic” and “advanced”
Traditional Embedded Cost of Service Study (ECOSS) Process
Cost Causation for Electric System

• System serves joint needs of all customers across all hours of the year
• Each function has distinct cost drivers
  • Energy supply costs are time-differentiated
  • Transmission lines serve multiple purposes
  • Distribution is built only where there is load to support it
  • Basic meters are for billing, but the costs of AMI are incurred for a broad array of purposes
• Administrative and general costs scale with size of the business
• Public policy programs reflect a mix of motivations
  • Electric system benefits
  • Broader societal goals
Example: Fixed v. Variable

• Multiple ways to serve an increase in peak demand
  • Peaker – mix of fixed and variable costs
  • Utility-owned battery storage – almost entirely fixed costs
  • Demand response – primarily variable costs
Demand-Related Costs at Off-Peak Times

• D.J. Bolton in 1951:
  
  “Another reason why the half-hour of absolute annual peak is not the sole criterion of plant cost lies in the necessity of overhaul…. Peak responsibility must then have regard not only to the absolute system capacity but to the capacity temporarily available… As an example, during 1948, load on the grid had to be shed on 38 occasions between April and October, although the load was far below the winter peak. There was therefore a definite indication of demand-related expenses on account of generating plant even in the summer.”

• Same logic applies to other reliability costs!
The Demand Classification is Splintering

1950

2020

Peak demand related
Capacity related
Reliability related
Modern embedded cost of service study flowchart

Functionalization

- Generation
- Transmission
- Distribution
- Billing, customer service, and A&G costs

Allocation

- Peak hours
- Intermediate hours
- All hours, including off-peak

Time Assignment

- Site infrastructure, billing and collection
- Residential
- Commercial
- Industrial
- Street lighting
Traditional MCOSS Process

• Created in the 1970s
  • Adopted in a handful of states

• The basics
  • Functionalize, like ECOSS
  • Estimate marginal unit costs for each function
  • Compute sum of marginal costs by class
  • Reconcile to total revenue requirement

• Theory that efficient pricing should be better linked to marginal costs at all points in the process
  • In principle, this is the societal marginal cost
Different Flavors of Restructuring and Wholesale Market Design

• Full divestment of generation and transmission
  • LSEs charged appropriately for generation based on wholesale markets
  • Distribution service territories or LSEs are charged ISO rates for transmission
• State-jurisdictional utilities retain ownership of transmission assets
• State-jurisdictional utilities retain ownership of generation assets
Retail Generation Supply in Wholesale Market Jurisdictions

- Customer rates driven by both:
  - Wholesale market structures and ISO pricing
  - Retail supply rules and procurement structures
- States have more control over the second than the first
  - Less direct control than traditional regulation of vertically integrated utilities
Rate Design Influences Investments and Operation

Algorithm for Socially Efficient Price Signals

1. Start with short-run marginal costs where you can
2. Layer in long-run marginal costs
3. Add any unpriced externalities
4. End by allocating and pricing “residual” costs that must be recovered through rates
Residual or “Unallocable” Costs

- Marginal cost frameworks explicitly wrestle with concept of what to do with residual costs
- Embedded cost frameworks force you to put every single cost into one of three buckets
  - Administrative and general costs?
  - Distribution system backbone or “minimum system” costs?
Ratemaking in the Future

- Increasing importance of short-run marginal cost pricing
  - Particularly if you are relying on demand-side for generation resource adequacy or other grid needs
- The problem of residual costs gets harder
  - As grid cleans up, marginal emissions rate likely goes down
  - With high penetrations of DER, traditional billing determinants stagnate, and price elasticity will likely increase across multiple dimensions
- As pricing becomes more granular, the class load profile is less relevant
  - Instead of accounting for cost differences at the cost allocation stage you are doing it automatically in the rate design stage!
- Technology-neutral time-varying rates of increasing complexity
  - Assigning costs to time periods for rate design is similar to the traditional cost allocation challenge
Options for SRMC Pricing

• Wholesale market options
  • Directly pass-through wholesale energy market costs
  • Directly pass-through capacity market signals

• State level options
  • TOU rates
  • Variable peak pricing
  • Critical peak pricing
  • Peak-time rebates
  • Create new granular pricing scheme
Customer Understanding

- Customers must be able to understand their rates and manage their bills
  - Basic explanations and educational materials
  - Data provision, online tools and energy management technology help
- Gradual transitions can diffuse knowledge and help acceptance
  - Start with opt-in and move to opt-out or mandatory
  - Shadow billing and hold harmless protection
  - Segmenting customer classes allows for different default rate designs
- Companion programs are important
  - Cost-effective energy management technology programs to enable customer response and minimize risk of negative bill impacts
  - Special low-income programs can be as simple as timers for electric water heaters offered for free
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