Incentive for the Adoption of Load Management Solutions in the Electric Energy Industry

IREC Presentation
March 29, 2024
The Electric Energy Industry

Single Incentive to Promote Supply and Demand Actions

- Energy Supply Actions
- Demand for Energy

Incentive Provided by Market Clearing Prices!
Follow up on “Zingers”

- The industry objective - customers and value. Infrastructure aligns with this key objective.
- Product is "ENERGY" - other items are ancillary
- Market Pricing of Electric Energy
- Environmental Objectives and how incorporated (or not)
- Supply chain and relation to location of Energy Prices
- Uniqueness of Electric Energy and Complexities
- Hurdles and obstacles to overcome in transition
  - Regulated paradigm
  - Market Clearing Prices in Mature Market
  - Assuring Operational Stability
  - Transmitting and Establishing Pricing
Industry Objective –
Serving Customer Value

• **Customer** - the *reason for existence* of industry

• **Multitude of Customers** achieve values for many *diverse* uses for energy. Each customer achieves value for each application.

• Customer achieves *value* corresponding to *price level when indifferent to consumption and price paid*

• Measure of *greatest economic efficiency* - achieved with greatest *summation of customer values*

• Investment in *infrastructure* (supply and demand) occurs when *positive investment cash flow* occurs corresponding to *Market Clearing Prices*
The product to customers is “ENERGY”

- **Energy** commodity – provides light, heat, motive force and energy for electronics. Other related commodities are ancillary corresponding to Energy.
- Capacity value – corresponds to time period of energy delivery. Capacity value occurs when all costs recovered (investment and operations) corresponding to time actuated, hence Capacity corresponds to Market Clearing Prices
- Storage - positive value when differential in market clearing prices is sufficient to recover investment costs and corresponding losses. These include:
  - Battery storage
  - Pumped Hydro
  - Thermal storage – hot water
- Many related derivatives
  - Options and hedges (buyers and sellers insurance)
  - Pricing structures including average pricing, contracted prices, forward prices.
- **Others?**
Market pricing of Electric Energy

• Extreme volatility to changes in both supply and demand
  – Supply variability largely a function of non-dispatchable resources (such as wind and solar)
  – Currently demand largely un-responsive of RTP due to pricing set by tariffs

• Market prices variants
  – Equilibrium Price (Supply/Demand)
    • Established at a specific point in time
    • Location corresponding to supply chain costs
    • Response time (day ahead, 4 hour, hourly 15 minute, voltage stability etc.,)

• Complexity of Pricing Energy Commodity
  – Operational sensitivity to maintaining balance of Supply/Demand
  – Unintended occurrences and consequences
Environmental – Internalized in price  
**OR**  a Separate Objective

- Problem of competing objectives without consensus  
  - Competing objectives do not allow a single objective (balance tenuous)  
  - Division of perspectives, often puts decisions into hands of activists

- Internalization of Environmental Costs

  How:  
  - Specified and constraints on **resource operation**  
  - Guidelines for the **development of new supply** options  
  - **Subsidy** for non-carbon emitting resources (tax credits, production credits etc)  
  - **Internalization** of emission costs  
    - **Carbon tax** (cost levied on carbon emitting resource - $/ton)  
    - **Carbon trading** – costs/benefits shared among suppliers to reduce emissions  
    - **Carbon sequestration** – replenish carbon
Supply Chain of Energy Prices

- Market Clearing Price are inclusive of supply chain costs specific the location of the consumer

- **Components** of supply chain costs
  - Supply/Demand equilibrium (Incremental cost of energy supply)
  - Transmission or grid costs (network of transmission, inclusive of distance between source and use (less distribution) influenced by congestion and market maturity (airline example) and energy losses
  - Distribution costs – market at infancy of maturity (currently priced by utilities as fixed cost of service) May take on pricing as established in airline industry or package delivery service or combination
  - Equilibrium price inclusive of customer demand elasticity and demand side resources
    - When not grid connected - lesser of supply cost or self generation cost
    - Grid connected – system supply, self generation achieves opportunity cost
Uniqueness of the Commodity of Electric Energy

- Speed of light – energy produced is consumed nearly instantaneously
- System Stability **Oversight** – assuring the balance required for interconnected loads and resources including voltage level and frequency response
- Equilibrium price (market clearing price) is both variable and volatile to changing conditions. Established by prevailing conditions affecting both supply and demand. Prices are established in dynamic conditions of change; prices increasing variability.
- Supply chain costs which can be uniquely established to facilitate market pricing considerations in a competitive market
Hurdles and Obstacles – Transition of Regulated Paradigm

• **Regulated paradigm** far afield from competitive open transparent market
  – Tariffs little relation with Open Transparent Market
    • Investment recovery of “prudent expenditures based upon scheduled recovery of return of and on investment
    • Inclusive of other “fixed” investment costs including taxes, fixed O&M
    • Power (Energy) costs including Energy purchases for interconnected supply and variable cost of dispatching owned facilities) recovered from prior periods with some adjustment for variances.

• **Investment risk** and equity return requirements shift from an industry having regulatory oversight to a condition of the dynamics market competition

• **Some regulatory oversight** will likely continue to be needed to **assure system stability** (operations and investment)
Hurdles and Obstacles – Implementation of Market Clearing Prices

• Market Clearing Prices (MCP) in Mature Market
  – Equilibrium price occurs when the increment of increased supply provides anticipated recovery of variable costs and slight margin for contribution towards investment costs.
  – Long-term, provides cost recovery of return “of” and “on” investment – resulting from necessary cash flows to incent investment with MCP, limiting investment not economically justified resulting in lower prices with oversupply.
  – Resources having commitment over extended periods (gas turbines from 4 to 12 hours and coal plants 6 days and nuclear committed for weeks to months) establish operations based upon optimizing position
  – Demand response and load management investments have parallel considerations and optimize individual values
Hurdles and Obstacles – Assurance of Operation Stability

• Assuring Operational Stability
  – Utility dispatch operations provide grid stability,
    • Making adjustments to interconnected supply to fulfill demand requirements
    • Inclusive of bulk energy and balancing to assure stability in voltage levels and frequency

• Establishing a pathway forward requires careful considerations to assure system stability
Hurdles and Obstacles – Dissemination of Market Clearing Prices

• Transmitting and Establishing Pricing (?)
  – Currently considered within utility in dispatch operations at the bulk power level (grid operations)
  – Currently only “crudely” shared in wholesale markets to allow for the bidding of energy suppliers

• How Accomplished (?)
  – Will transition over time
    • Refinement corresponding to Utility economic dispatch and establishing wholesale market prices
    • TE of other platforms that allow market constructs
      • Placeholders for distribution costs, determined on market forces
  – How communicated (internet, radio waves, .....)

The “Takeaways”

- **Greatest value** achieved with incentives based upon “Market Clearing Prices”, aligned with open access, competitive markets

- Electric Industry **highly complex** and corresponding to other commodities and market pricing is not easily achieved

- Many **obstacles to transition** from regulated to market pricing

- The **pathway** forward is to 1) **identify the end game** as to what is conceptually achievable and 2) **construct the right steps forward** to constructively move forward to satisfy customer values and avoid misdirected actions

- We are **at the infancy** of a transition to market concepts in the electric energy market and the **dynamics of market transitions** will immerge
David LeVee
Dave.pwrcast@gmail.com
503 970-1073