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

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