Prices to Devices: A Business Case

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Investment Challenge

- Majority of our electric infrastructure is at or approaching the end of its expected useful life
- American Society of Civil Engineers: Maintaining electric infrastructure requires $673 billion in new investment by 2020
- Challenging investment environment:
  - Costs have increased with global competition for resources
  - Most electric utilities have credit ratings of BBB or lower, compared to 1 in 5 in 1992
  - Sales growth declined & could be further eroded by falling cost of distributed resources
Investment Challenge

• American Society of Civil Engineers on the consequences of failing to close the investment gap:
  • “As costs to households and businesses associated with service interruptions rise, GDP will fall by a total of $496 billion by 2020. The U.S. economy will end up with an average of 529,000 fewer jobs than it would otherwise have by 2020. … In addition, personal income in the U.S. will fall by a total of $656 billion from expected levels by 2020.”

• Current levels of asset utilization are highly inefficient
  • Capacity factor for U.S. generation: 45%
  • Average Capacity Utilization in Other Capital Intensive Industries: >75%

• Financing the next investment cycle will be difficult without improving load factors and asset utilization
Beyond Demand Response: Facilitating Demand Optimization

- Demand Response Programs are Significant, but:
  - Focus is on peak reduction, not on responding to changing market conditions
  - Participation largely limited to larger C&I customers
  - Compensate some demand variations that would have occurred in any event and fail to fully compensate other reductions from desired usage levels
  - Baselines create complexity & opportunities for gaming
- Dynamically Responding Devices Could Provide Much Greater Value

Midwest ISO LMPs – July 21, 2011
(Red = $200+/MWh, Blue = <$30/MWh)
Demand Optimization Strategy

• Energy’s “Holy Grail” – Storage Capabilities of End Use Devices
  • Most energy uses that have thermal inertia (heating, cooling, water heating, & refrigeration) and/or flexibility in timing of power draws (pumping loads, industrial batch processes, pool pumps, dishwashers, clothes driers, & charging of vehicles and battery powered devices)
  • Capabilities exist in many end use devices that are already intelligent, but unaware of electricity prices or grid conditions

• Optimizing the Timing of Electricity Demand
  • Not limited to demand response for peak demand reduction
  • Take advantage of capability of devices to dynamically determine when to use power based on efficient market price or marginal cost signals, consistent with the value of energy services to the consumer and device-specific constraints

• Creates a More Agile Infrastructure:
  • Improves resilience through beneficial feedback
  • Enables integration of renewables & electric vehicles at scale
  • Provides foundation for greater reliability through balanced clusters of distributed resources & local intelligent control
SGIP Objective: Identify a Standard Data Model for Communicating Price Signals to Devices

- If standards exist, there will be multiple paths to encourage mass deployment of grid aware intelligent devices

- Bypass the Chicken & Egg Problem: Don’t wait for dynamic retail pricing to create price responsive devices: Rate reform requires action by many commissions & utilities

- Identify any standards gaps that prevent appliances and other intelligent devices from obtaining & automatically responding to dynamic price or comparable signals

- Start with standardized approach for describing ISO / RTO pricing information, while allowing distribution utilities to add local information

- Identify a standard data packet that could be used to directly communicate price information to intelligent end use devices

- Communicate current and indicative forward interval prices, enabling end use devices to use relative price differences to decide to pre-cool, pre-heat, or otherwise adjust the timing of power draws
Prices to Devices: Communicating with End Use Devices

• There are many potential means to engage end use devices in homes and businesses – Goal should be to accelerate that engagement

• Inexpensive one-way broadcast approaches, e.g. FM Radio Sidebands
  • Given an appropriate business model equipment manufacturers could build inexpensive receiver chips into devices
    • Consumer demand could be driven by Energy Star recognition or utility purchase incentives
  • Utility will see, and increasingly will be able to predict, responses to broadcast signals at the meter and substation
  • Presence of devices with a built in capability to automatically respond will be an important foundation for efficient dynamic retail pricing
  • Broadcast approaches do not preclude obtaining device information from other backhaul channels

• Two-way communication, important in some approaches, also will require a standard approach to communicating prices
BnP DEWG: System & Device Integration Subgroup

- Brings together ISOs/RTOs, regulators, utilities, appliance manufacturers, and consumer electronics companies

- Cataloged price information currently available from ISOs/RTOs
  - Types of Pricing Data Available: Day Ahead, Real-time, Other
  - Time Granularity
  - Latency
  - Locational: Nodal vs. Zonal
  - Availability of Look Ahead Pricing

- Identified a parallel between demand optimization and operational day commitment of generation with a lead time to full availability

- Focus on ability of end use devices to use available information to compare current to indicative forward prices to make more intelligent operational decisions
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