Maximum Market Value and Maximum Customer Choice: Nar the Twain May Meet?

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Outline of Presentation

- *Nar the Twain May Meet?*
- Market value v. customer choice – will these converge?
- Customer prices and values
- Market values – are they transparent?
- Customer value of service (VOS) -- characteristics of outage costs
- Comparison of TX/ERCOT prices & VOS
- *****Approach to customer value assessment

Nar the Twain May Meet?

- Twain: an archaic term for the number two
  - "…never the twain shall meet…the two things are too different to exist alongside each other." New Oxford American Dictionary
- Point: "What is a cynic?" "A [person] that knows the price of everything and the value of nothing." The Critic as Artist
- Compare market prices & customer value of service – have others done this before?

Market Value v. Customer Choice

Question: Are these book-ends that reflect diverging values, or will these values converge as customers have more market access through the smart-grid?
Conclusion: these values will converge

- Data sources: ERCOT/ICE data & reports, and LBL/Freeman Sullivan Group report, at http://certs.lbl.gov/pdf/lbnl-2132e.pdf

Marginal Customer Prices & Values

- Marginal-cost-of-service (MCOS) = electricity consumption X marginal cost for generation + transmission + distribution
- Marginal customer value of service (MVOS) = outage cost/damage function:
  - *Willingness to pay & value-of-lost-load*
  - Costs per annual KWh – rough average proxy
  - Discretionary vs. non-discretionary loads
- Optimal system expansion: MCOS=MVOS

Market Value: Marginal Cost of Service (MCOS) – Transparent?

- Marginal energy costs
  - Zonal energy or locational marginal prices
  - Instructed energy – highest priced energy
  - Reg-up/Reg-down – highest price freq control
- Marginal capacity costs
  - Local resource adequacy
  - Combustion-turbine proxy
  - Spinning/Non-spinning reserves
  - Capacity market costs (PJM, ISONE)

ERCOT/Texas Market Prices

- ERCOT wholesale (G) energy prices:
  - West Hub 4 August 2011 around $.47/kWh
  - Houston Hub around $.44/kWh;
  - North Hub around $.44/kWh
  - ERCOT South Hub around $.41/kWh
- ERCOT 2011 peak price was $3.00/kWh
- Texas 2010 average annual residential retail (G+T+D) prices around $.13/kWh (maybe $.09/.10/kWh for wholesale G)

Customer Value-of-Service (VOS)

- Outage Characteristics: duration, onset, time, season, day of week
- Customer Characteristics: Usage (kWh), income, demographics, presence of backup generation, building type, outages
- Customer Damage Function: Estimate outage costs (by duration, season, onset time, day of week = $/event, $/annual kWh and $/interrupted kWh)

Average Electricity Customer Outage Cost, Summer PM -- US

Outage Cost	Outage Duration				
	Momentary	30 minutes	1 hour	4 hours	8 hours
Medium-Large Ind. Cost Per Event	$11,756	$15,709	$20,360	$59,188	$93,890
Cost Per Average kW	$14.40	$19.30	$25.00	$72.60	$115.20
Cost Per Un-served kWh	$173.10	$38.50	$25.00	$18.20	$14.40
Cost Per Annual kWh	$1.65	$2.20	$2.85	$8.29	$1.31
Small Com Cost Per Event	$439	$610	$818	$2,696	$4,768
Cost Per Average kW	$200.10	$278.10	$373.10	$1,229.20	$2,173.80
Cost Per Un-served kWh	$2,401.00	$556.30	$373.10	$307.30	$271.70
Cost Per Annual kWh	$2.28	$3.18	$4.26	$0.14	$0.25
Res Cost Per Event	$2.70	$3.30	$3.90	$7.80	$10.70
Cost Per Average kW	$1.80	$2.20	$2.60	$5.10	$7.10
Cost Per Un-served kWh	$21.60	$4.40	$2.60	$1.30	$0.90
Cost Per Annual kWh	$2.06	$2.48	$2.94	$5.81	$8.05

Max Market Value (hour) & Max Customer Choice?

- Res. outage cost $2.94/kWh vs. peak 2011 wholesale energy market cost $3.00/kWh & $.44/kWh (Aug 2011) + ancillary services (at least a 10% adder)
- Small Comm. outage cost $4.26/kWh, vs. $3.00/kWh & $.44/kWh for energy + …
- Medium/Large Comm. outage cost $2.85/kWh vs. $3.00/kWh & $.44/kWh + …

Differentiate Discretionary & Non-discretionary Loads

- Discretionary residential loads (e.g., with HAN) -- refrigerator, dishwasher, cloths washer (e.g., outage cost = $.50/kWh)
- Non-discretionary residential load
  - Air conditioning in August, working at home (e.g., outage cost = $2.50/kWh)
- Non-discretionary small commercial load
  - Retail space air conditioning load (e.g., outage cost = $3.25/kWh)

Tradeoffs: Market Value & Customer Choice

- Define customer reactions to MCOS vs. MVOS/outage cost?
  - When is MCOS > MVOS for each major load?
  - Rational behavior is to act if MCOS > MVOS => reduce/curtail specific loads
  - Need to know MVOS for each major load
  - Discretionary loads reduced => gain value
  - Non-discretionary loads “stay on” at high prices (until MCOS>MVOS)
  - Market transparency will reinforce behavior

Approach to Customer Value Assessment

- Provide value concepts to customers and interrogate through interface/interviews
  - Customer value of service -- first differentiate discretionary from nondiscretionary loads
  - Estimate customer VOS & customer response, use the “MVOS/MCOS book-ends”
  - Define expected value benefits from smart grid response

Customer Market Potential

- Define the customer value of service (hierarchy) by customer and load type
- Define discretionary/non-discretionary loads for targeted customers
- Calibrate & target customer incentives based on customer value of service
  - Examine customer participant test B/C
  - Examine utility Total Resource Cost B/C
- Provide a more concrete basis for smart grid related customer services!

Caveat with use of $/kWh cost per annual outage

“This estimate was derived by dividing the interruption cost per event by [(annual kWh/8760) times the interruption duration]. While we recognize this calculation oversimplifies the estimation of un-served kWh, the data available concerning the distribution of customer loads and energy use across time is quite limited (i.e., annual kWh and in some cases annual maximum demand).” pg. xxi. LBL Report