Four Years and 11,000 Customers – Hourly Residential Electric Pricing in Ameren Illinois

July 14, 2011

National Town Meeting on Demand Response and Smart Grid, Washington, D.C.

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PROGRAM BACKGROUND

- Program called “Power Smart Pricing”.
- Largest hourly pricing program in the U.S. in 2010; highest participation rate in the U.S. for residential hourly pricing in 2011.
- Legislative experiment to determine broader benefits of residential hourly pricing programs.
  - If responsiveness (elasticity) was observed, would it provide “net benefits” to other residential customers, even those not served under hourly pricing?
  - Program costs paid by all electric residential customers.

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PROGRAM BACKGROUND (cont'd)

- Started in 2007, with evaluation period concluding in December 2010. (2007 mostly lost due to uncertainty about transition from rate freeze period.)

- Marketing and customer service provided by CNT Energy from Chicago.
  - Restrictions on Illinois IOU's marketing electric supply choices.

- Program evaluation conducted by Navigant Consulting.

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PROGRAM BACKGROUND (cont'd)

- Ameren Illinois is a "wires only" electric company.
  - All power purchased in the MISO market.
  - All power purchase costs passed along without mark-up to customers – Ameren Illinois is held whole.

- Day-ahead hourly prices used for billing purposes.
  - Prices available at 5 pm the preceding day; posted on web-site and available through toll-free number.

- High Price Alerts sent when prices exceed thresholds.
  - Alerts sent via medium of customer's choice (e-mail, phone call, etc.) the night before high prices occur.

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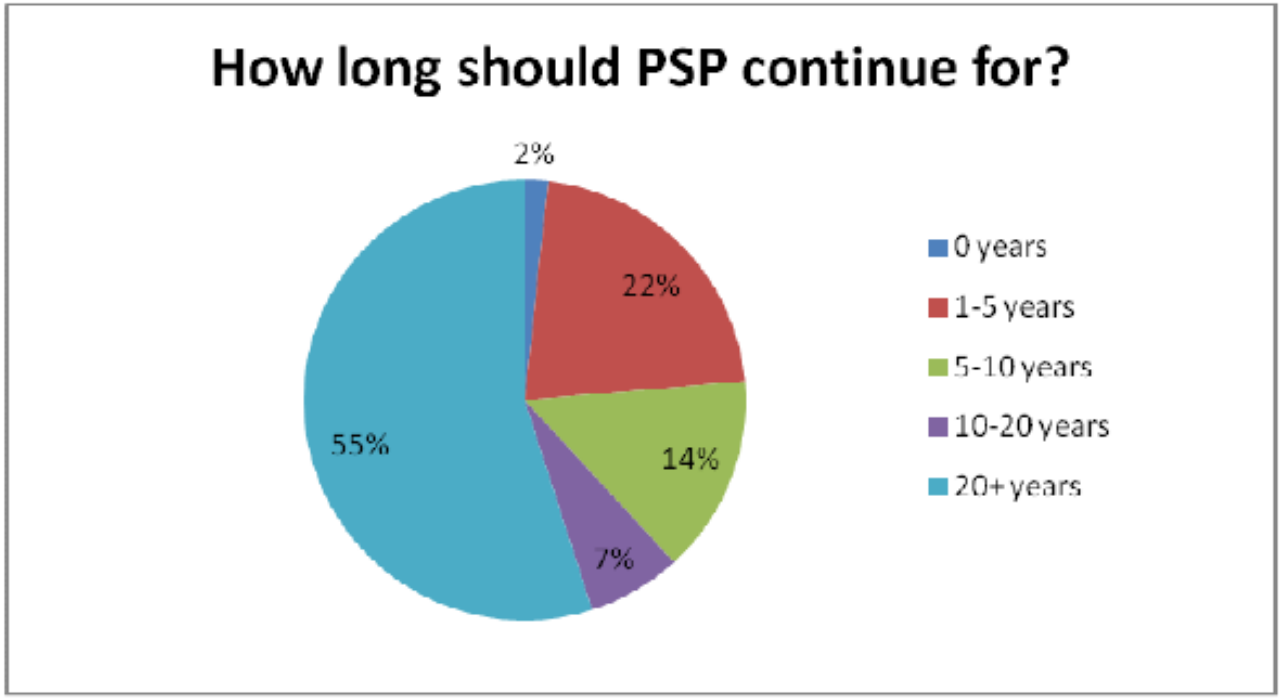
LEARNINGS

- So, what did we learn?
  - Day-ahead hourly pricing is very well received by customers.
  - Significant elasticity … but elasticity isn't constant.
  - Ameren Illinois residential customers received net benefits from PSP … but then, so did all electric customers in MISO.
  - Good energy efficiency tool … for ¾ of the year.

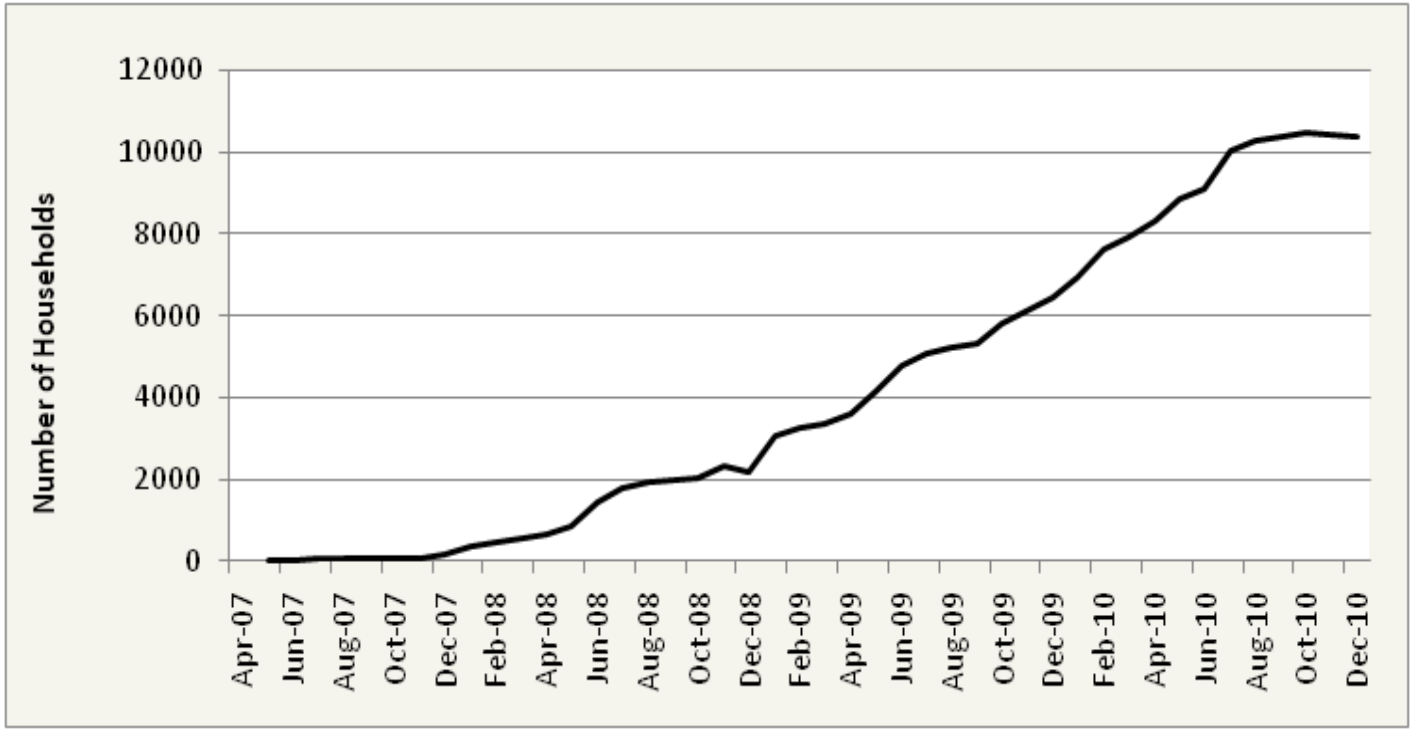
LEARNINGS – CUSTOMER EMBRACE OF HOURLY PRICING

- From the 2010 survey of PSP customers:



LEARNINGS – CUSTOMER EMBRACE OF HOURLY PRICING (cont'd.)

Growth in PSP Participation Over Time



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LEARNINGS – PRICE ELASTICITY OF DEMAND

- Price response to real-time pricing at several time scales:
  - "Medium Run Elasticity" – broad behavior shifts, such as consistently running the dishwasher at night since prices are typically lower in the evening.
    - Reflects the response to differences in ***average*** price across hours.
    - Ranged from a low of -0.04 on weekday nighttime hours to a high of -0.29 during late afternoon weekday hours.
  - "Short Run Elasticity" – hour by hour price response.
    - Reflects the response to ***deviations*** in price from the average hourly price.
    - Analysis examines responses during 28 High Price Alert days when price deviation is substantial and cost of information is low.
    - Short run elasticity ranged from -0.21 in the hour of 3 pm to 4pm to -0.89 in the hours of noon to 2 pm.

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LEARNINGS – ELASTICITY (cont'd.)

- "Usage Block" concept developed.
  - Electricity is a different good or service depending on the time of day.
  - Within blocks of time during the day, electricity is a homogenous good.
    - Electric usage during overnight hours provides a similar function in each overnight hour, and electric usage during afternoon hours on hot days provides a similar function in each afternoon hour, but electricity serves a much different role during the overnight than it does during the afternoon.

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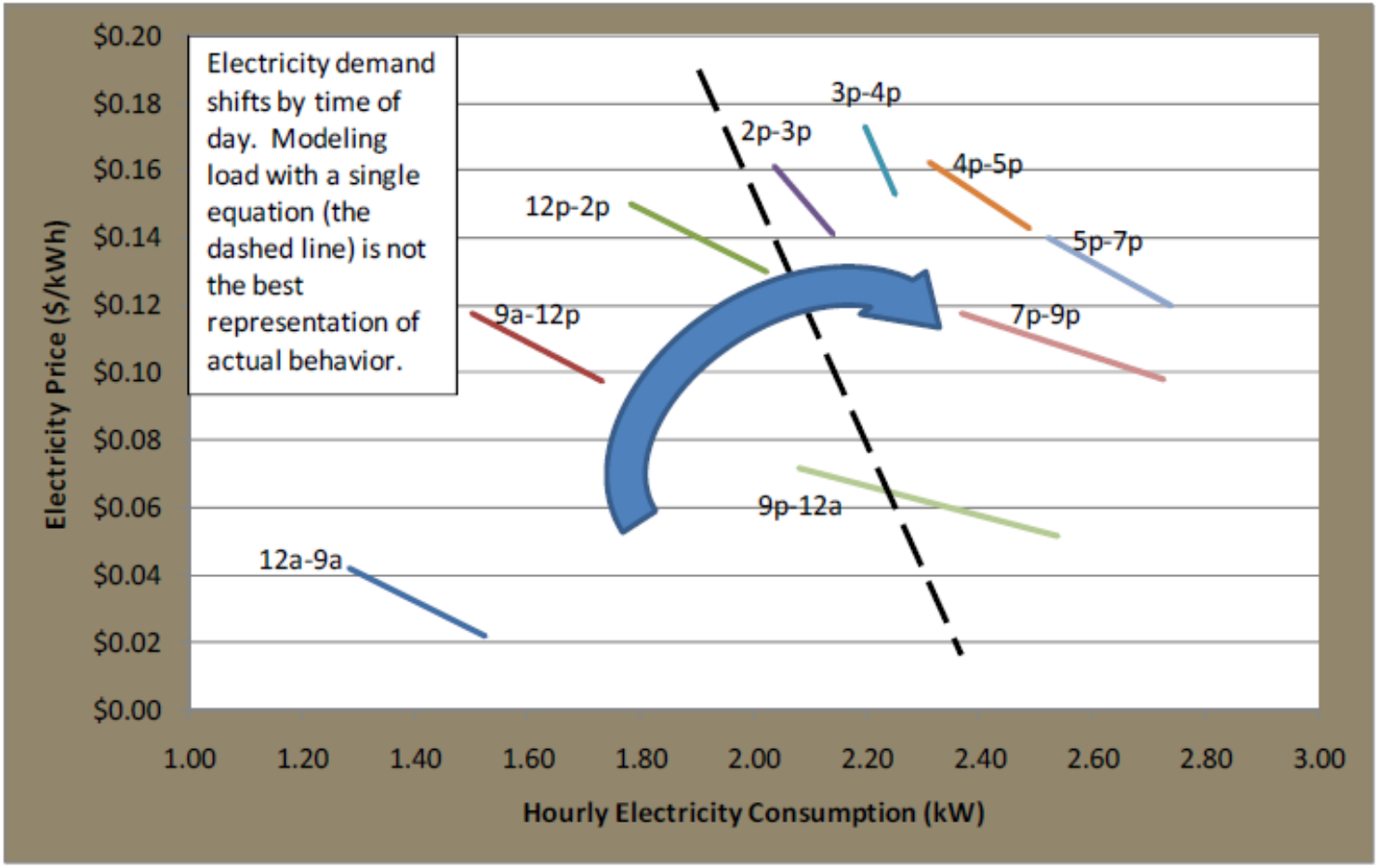
LEARNINGS – ELASTICITY (cont'd.)

Figure 7. Electricity Demand Shifts by Time of Day



Source: Navigant analysis

Block 1: midnight – 9 am

Block 2: 9 am – noon

Block 3: noon – 2 pm

Block 4: 2 pm – 3 pm

Block 5: 3 pm – 4 pm

Block 6: 4 pm – 5 pm

Block 7: 5 pm – 7 pm

Block 8: 7 pm – 9 pm

Block 9: 9 pm – midnight

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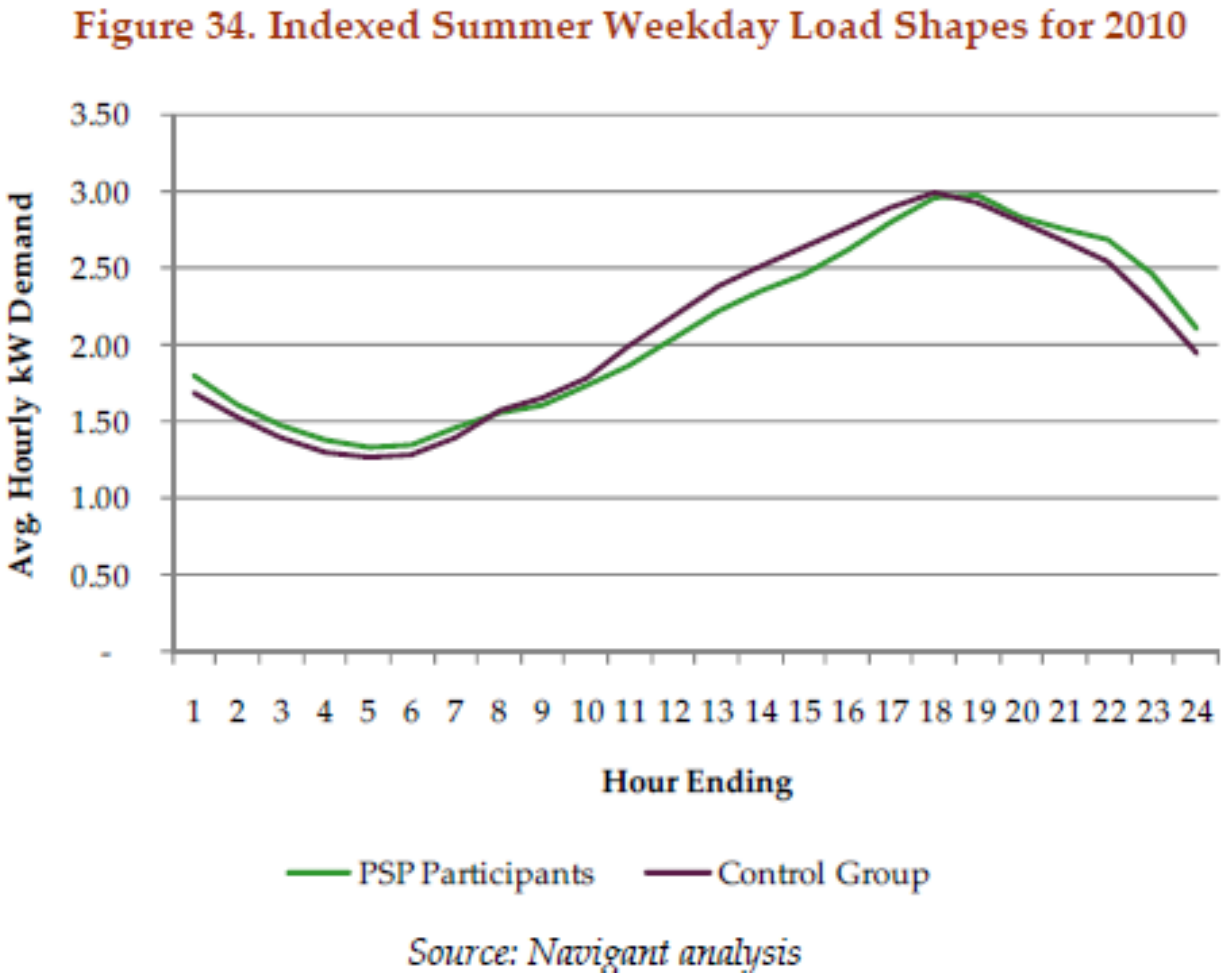
LEARNINGS – LOAD CHANGES IN RESPONSE TO PRICES



Price response implied by elasticities generate load shifts in summer.

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LEARNINGS – LOAD CHANGES IN RESPONSE TO PRICES (cont'd.)

- Average demand reduction on Summer weekdays from 12pm – 5 pm:
  - 2008: -0.21 KW
  - 2009: -0.13 KW
  - 2010: -0.15 KW

- Average demand reduction on High Price Alert days in 2008:
  - -0.26 KW
  - Weather-normalized demand reduction projected at -0.45 KW (2008 was cooler than usual.)

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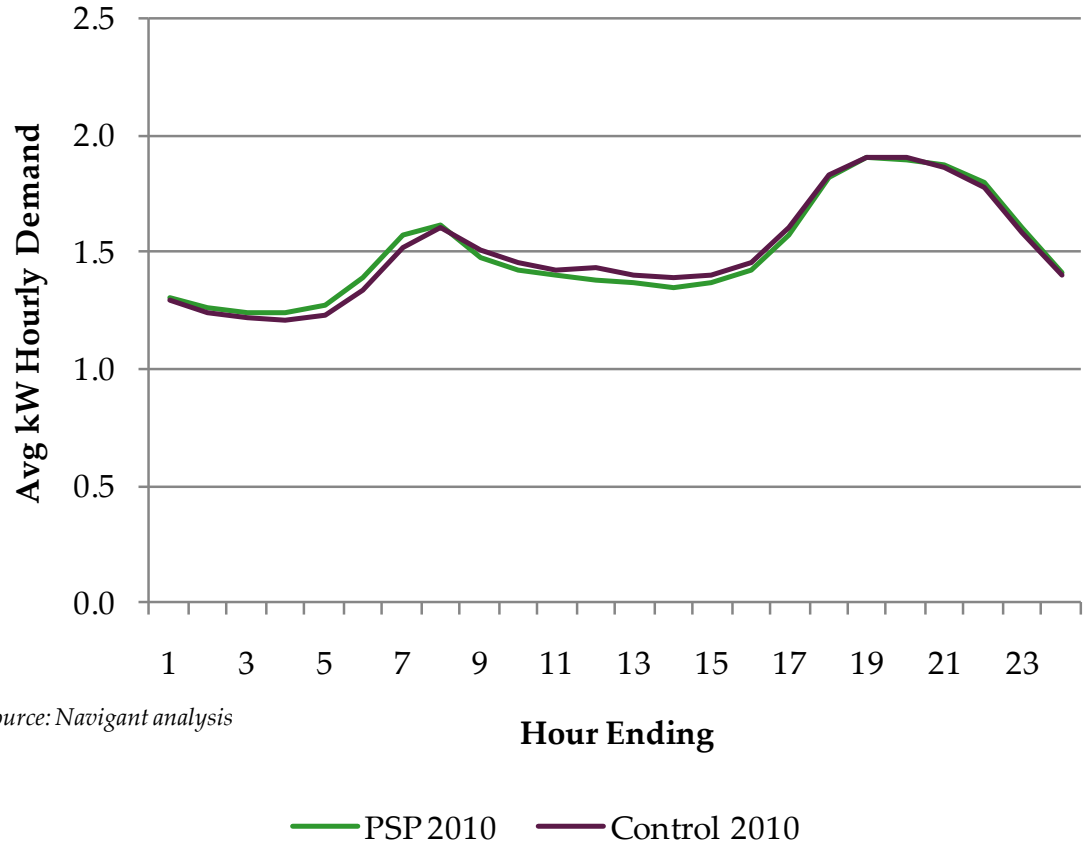
LEARNINGS – LOAD CHANGES IN RESPONSE TO PRICES (cont'd.)

Figure 13. Winter 2010 Weekday Load Curve, Controlling for Electric Space Heating

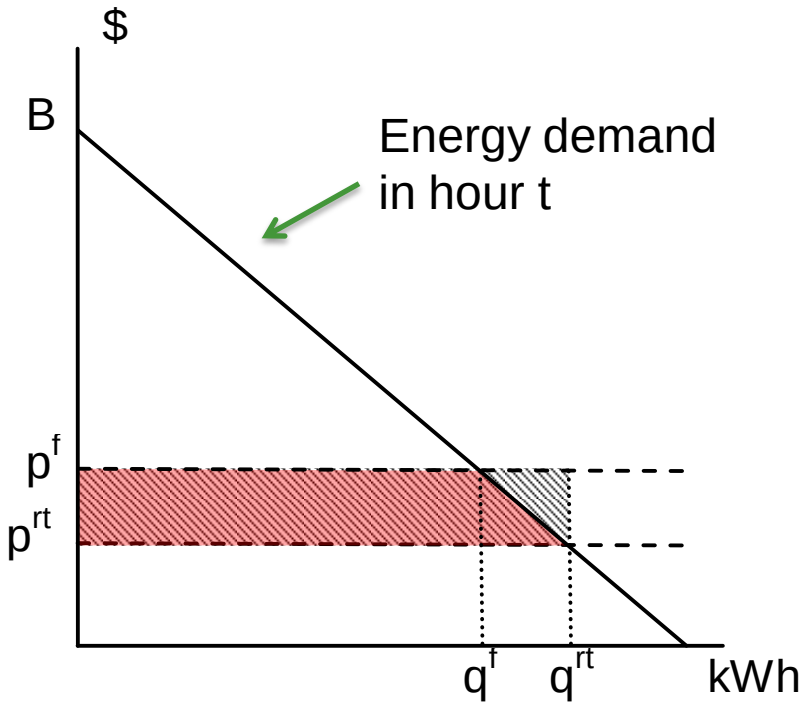


Source: Navigant analysis

Price response implied by elasticities generate load shifts in summer…but unexpected behavior in winter.

LEARNINGS – NET BENEFITS TO PARTICIPANTS

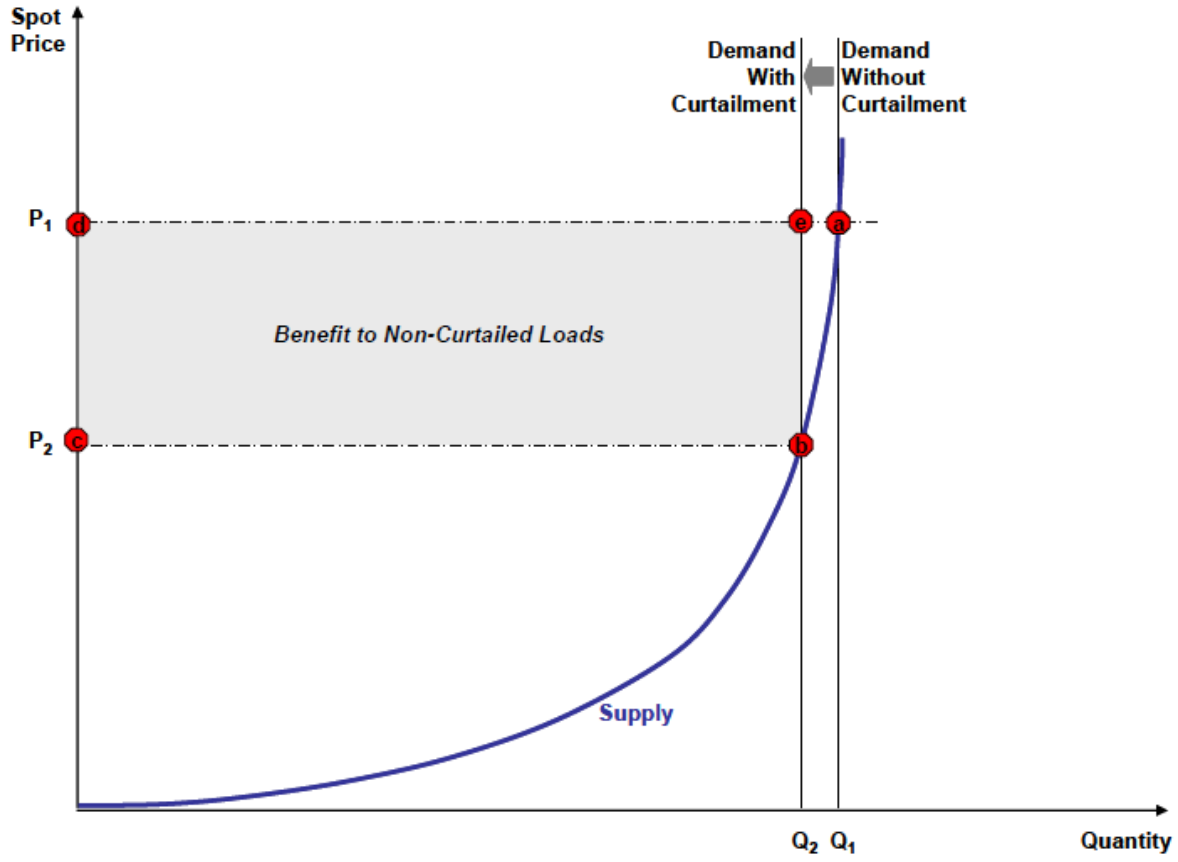
Consumption changes implied by load shifts map into bill changes, which are then adjusted to reflect the economic measure of consumer benefits from price changes: consumer surplus.



The case where $p^{rt} < p^f$

LEARNINGS –NET BENEFITS TO NON-PARTICIPANTS

Figure 23. Conceptual Diagram of Direct Energy Benefits to Non-Curtailed Loads



Source: "Quantifying Demand Response Benefits in PJM," prepared for PJM Interconnection, LLC, and the Mid-Atlantic Distributed Resources Initiative by The Brattle Group, January 29, 2007, page 20.

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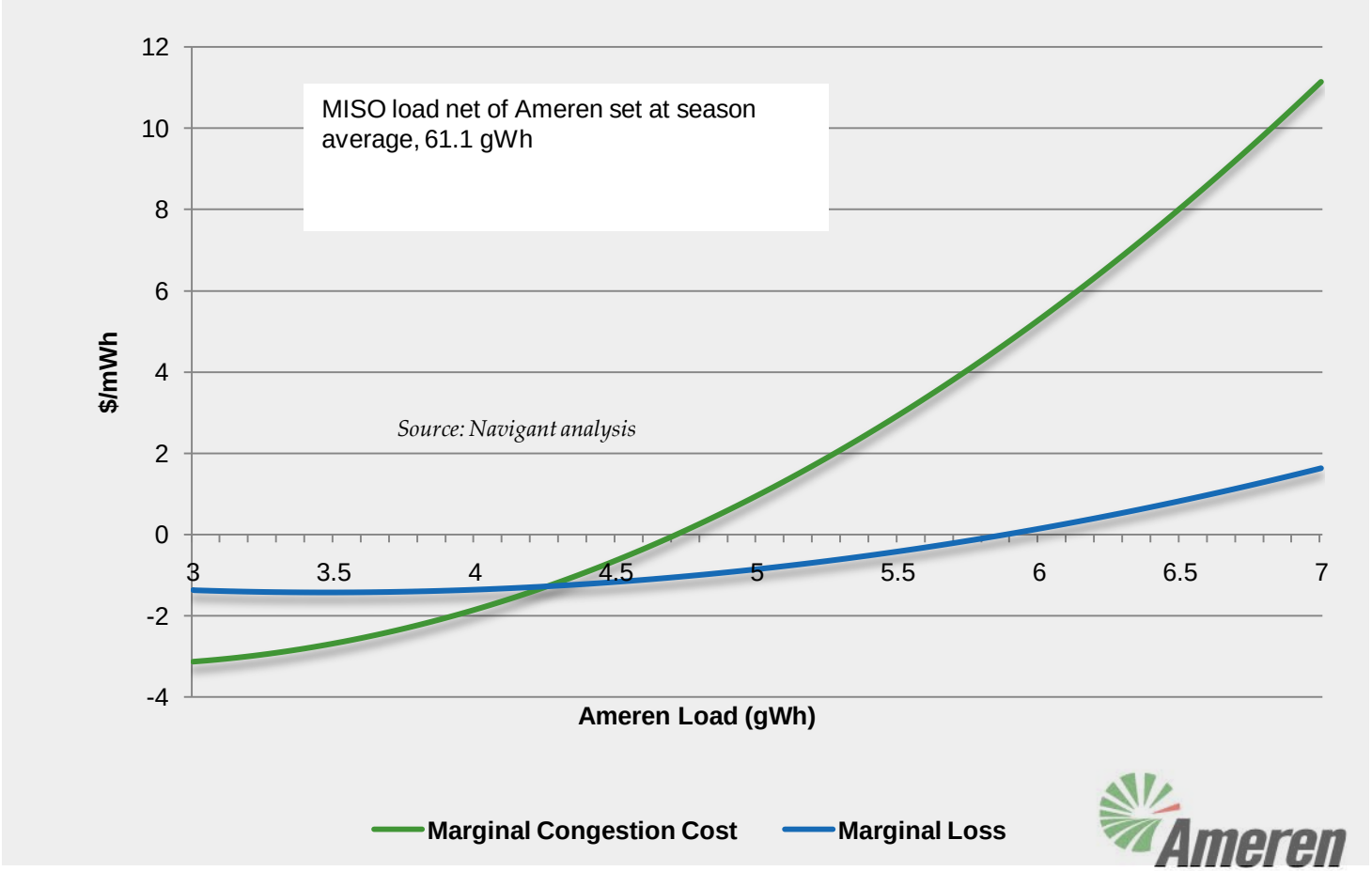
Figure 26. Estimated Ameren Illinois Marginal Cost Curves, Transmission Congestion and Loss, 2008–2010

LEARNINGS –NET BENEFITS TO NON-PARTICIPANTS (cont'd.)

Derivation of benefits to non-participants depends on elasticity of supply (marginal cost) curves for the three LMP components: energy, congestion , and loss.



LEARNINGS –NET BENEFITS TO NON-PARTICIPANTS (cont'd.)

Example of Energy Price Effect: June 6, 2008, 12 PM

Change in load due to PSP program (gWh)	0.0015
Price difference ($/MW):	$0.0104
Savings for one hour, MISO:	$910.26
Savings for one hour, Ameren residential customers (42% of Ameren load):	**$25.95**

LEARNINGS – OVERALL NET BENEFITS

Table 1. Historical Benefits and Costs for PSP Program 2007-2010

	2007	2008	2009	2010
Participant Benefits: Avoided Capacity Costs	$0	$7,200	$9,800	$14,000
Participant Benefits: Consumer Surplus	$0	$170,800	$1,666,000	$1,872,000
Non-Participant Benefits: Residential Customers	$0	$5,200	$2,100	$14,800
TOTAL BENEFITS	$0	$183,200	$1,677,900	$1,900,800
TOTAL COSTS	$1,040,000	$577,400	$933,700	$1,159,000
NET BENEFITS	-$1,040,000	-$394,200	$744,200	$741,800

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LEARNINGS – OVERALL NET BENEFITS (cont'd.)

Table 2. Net Present Value of Benefits and Costs for Program Inception Through 2020

	MISO View	Ameren Illinois View	Ameren Illinois Residential Customer View
Participant Benefits: Avoided Capacity Costs	$3,452,000	$3,452,000	$3,452,000
Participant Benefits: Consumer Surplus	$10,097,000	$10,097,000	$10,097,000
Non-Participant Benefits: Market Effects	$5,844,000	$411,000	$201,000
TOTAL BENEFITS	$19,393,000	$13,960,000	$13,750,000
TOTAL COSTS	$13,480,000	$13,480,000	$13,480,000
NET BENEFITS	$5,913,000	$480,000	$270,000

- Ameren Illinois sources all of its electric power and energy from the MISO market.

LEARNINGS – ENERGY CONSERVATION

Table 53. Annual Change in kWh Consumption for PSP Participants

Season	Annual kWh Change	Percentage Change
Spring	-47	-1.8%
Summer	-139	-3.2%
Fall	-94	-3.4%
Winter	309	9.2%
Total Year	29	0.2%

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FOR MORE INFORMATION

- Full Net Benefits evaluation available on ICC website at:

www.icc.illinois.gov/docket/files.aspx?no=06-0693&docId=165814

- Power Smart Pricing web site: www.powersmartpricing.org
- Peter Millburg – pmillburg@ameren.com 217.535.5054
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