

Merging Customer Behavior, Smart Metering and Pricing

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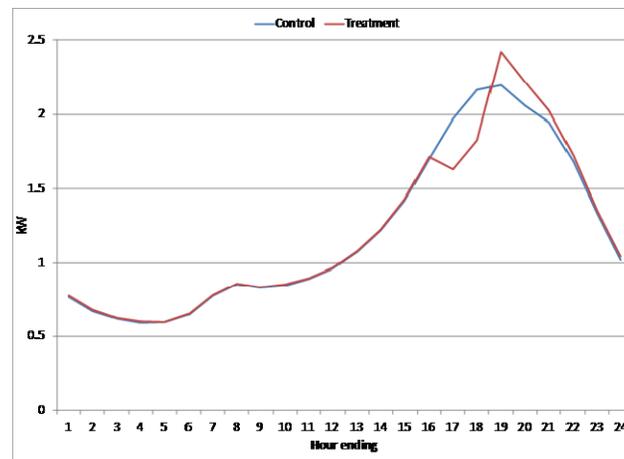
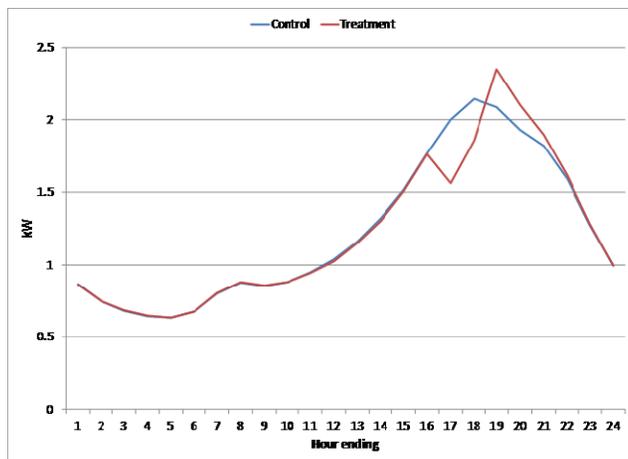
What's the big deal?

- Smart Meters can enable:
 - Dynamic pricing (CPP, PTR, RTP)
 - Information feedback through stand alone devices (i.e., IHD, home computer, SMS)
 - Control (remote through home computer or SMS)
 - Data (relatively immediate information about customer response to prices and information)

Measuring Impacts

- Change in observed energy consumption is the only acceptable standard for judging the effectiveness of dynamic pricing, load control and behavior based programs – really it ought to be the standard for evaluating all programs.
- Critical issue – defining and measuring the counterfactual condition
- Smart meter infrastructure greatly enhances our ability to measure changes in energy use
 - Subtle effects require relatively large sample sizes
 - Experimental design is a critical consideration
 - RCT (random assignment to treatments)
 - RED (random assignment of encouragement)
 - Within subjects design (panel regression)
 - Non-equivalent control groups
- Rapid feedback (results of tests available within days)

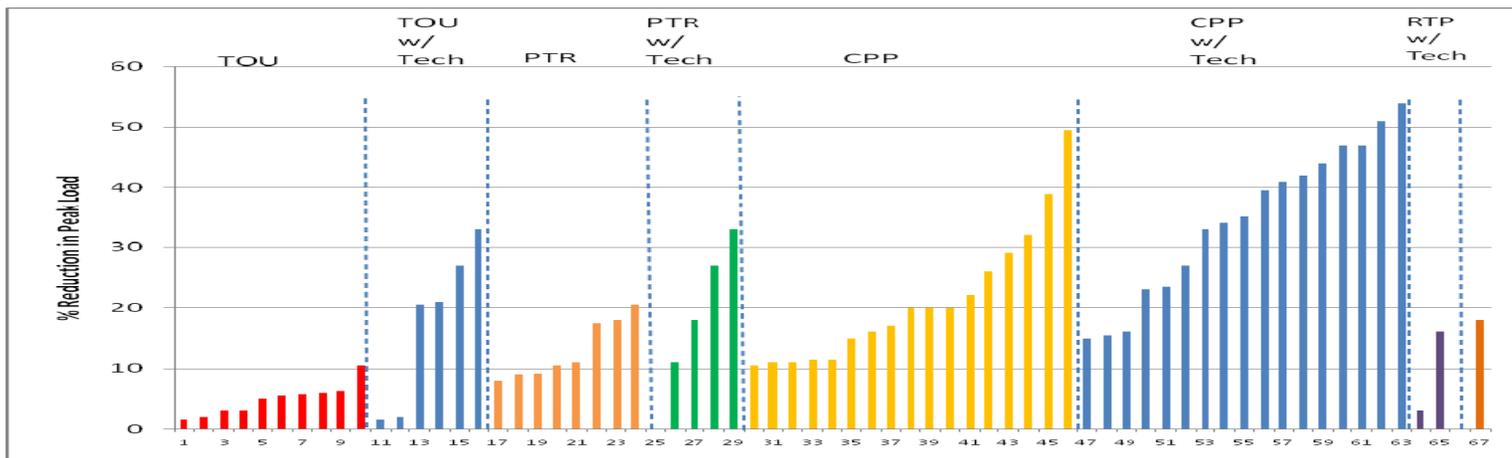
RCT Load Control Experiment



- Large scale experimental operations treatment group 15,000 – control group 120,000
- Two hour load control operations over 3 day period
- Results of experiment obtained in 3 days
- Contrast this design with what is possible without Smart meters

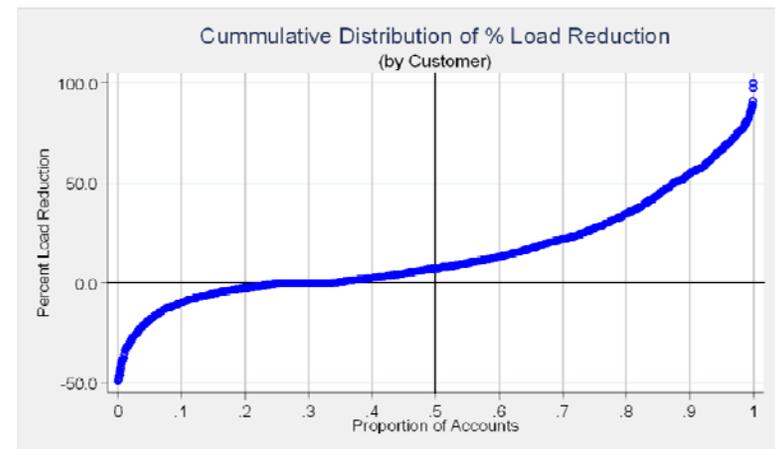
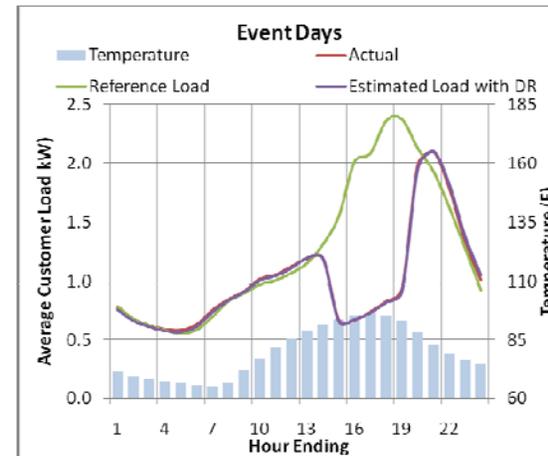
Dynamic Pricing

- There is no doubt that prices can be used to shape the timing of electricity consumption
- Pricing structure and enabling technology matter
- From *Rethinking Prices* Faruqui et. al. Public Utilities Fortnightly, January 2010



Dynamic Pricing

- Example of pricing impact – PG&E SmartRate™
- Three critical issues:
 - Inducing customers to volunteer
 - Inducing response
 - Impacts on customers



Up and Coming Pricing Studies

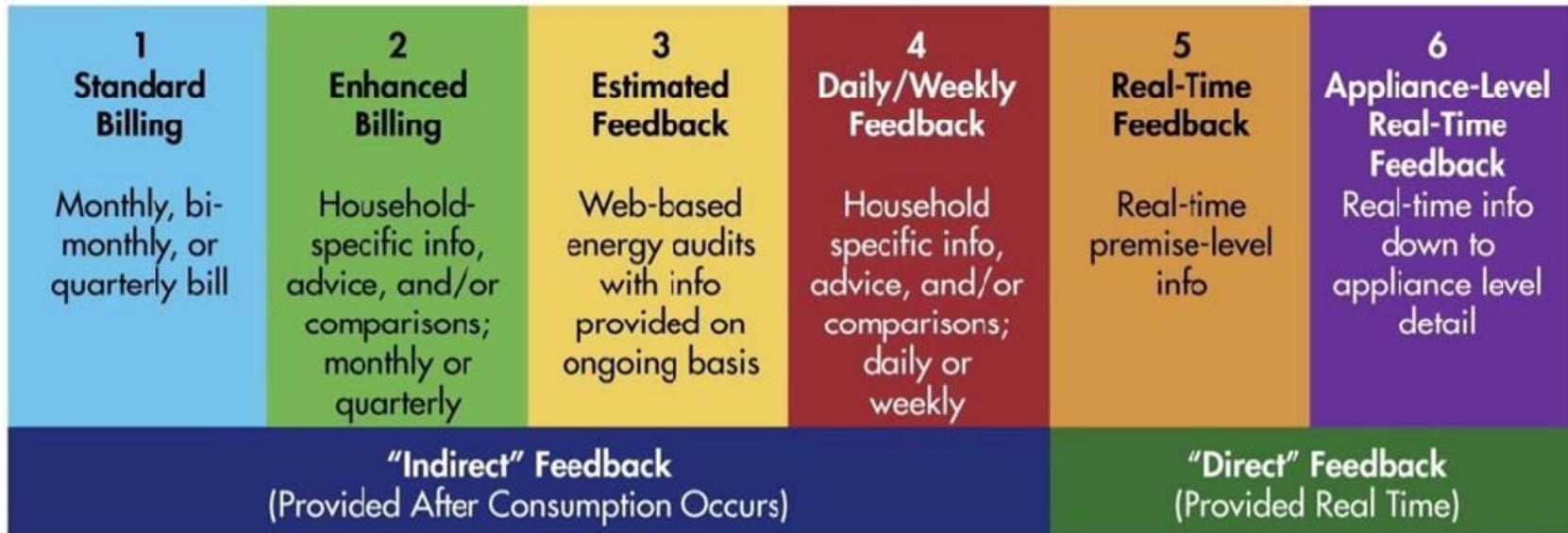
Load Impacts

- SGIG CBS Studies
 - experiments under way in 9 different utilities – design assistance from LBNL TAG Team
 - rate designs, education, recruiting strategies and enabling technologies
 - Results will be released 2013-2014
- Com ED Pilot
 - Large scale experiment started in 2010
 - 2 EPRI reports published regarding study results so far
 - Additional reports will be made in the next two years
 - Interesting findings so far

Marketing

- PECO Dynamic Pricing Pilot
 - Primarily focused on testing marketing strategies for selling TOU and CPP in combination with enabling technology
 - Studying customer response to marketing initiatives and load impacts for volunteers
 - First results available in 2013

Information Feedback



Customer reports

Normative comparisons

Web portal without daily usage

Web portal with daily usage

IHD
PC
SMS

HAN

Feedback

- Technology is emerging more quickly than we can get pilots on the ground to test it
 - Customer Reports (ala OPOWER)
 - Numerous robust RCTs indicate 1.8% to 3% reduction in energy use);
 - High energy users produce more savings;
 - So far, effects appear to be persistent (i.e., after 18-24 months);
 - Mechanisms not well understood; and
 - Impacts of interval data unknown.
 - Web Portal with daily usage (emerging technology ranging from plain vanilla usage reports and graphs to all kinds of “secret sauce”
 - Wide range of impacts (0% to 9%);
 - Experimental evidence is very limited;
 - Impacts are very difficult to quantify given commission policies; and
 - Robust studies involving RCTs and RED designs have begun only recently.

Feedback

- Technology is emerging more quickly than we can get pilots on the ground to test it
 - In Home Displays – numerous technologies – some requiring smart meters others not – potentially obsolete before they ever get to market:
 - Information security and privacy concerns are a very significant barrier to market evolution;
 - Numerous small scale pilots going back 20 years;
 - Most studies indicate real time feedback reduces energy consumption;
 - Range of impacts from 0 to 18%;
 - Robust studies only beginning – no reliable evidence yet;
 - Critical issues
 - Obsolescence (conventional IHD may be replaced by smart phone applications)
 - Adoption
 - Impacts

Feedback

- Technology is emerging more quickly than we can get pilots on the ground to test it
 - Home Area Networks – significant technological change stimulating dramatic cost reductions in HAN technology
 - Broadband market penetration very high in most markets – WiFi increasing
 - Measurement and control of key appliances is available at low cost now
 - GE Nucleus (Nucleus plus Brillion thermostat) ~\$300 + installation
 - Tendril Transport (Transport plus Setpoint) ~\$300 + installation
 - Honeywell UtiliPro
 - Impacts unknown at this point, but very promising

Up and Coming Feedback Studies

Customer Reports

- Large number (35+) experiments under way at present in a wide variety of utilities some using OPOWER and others doing their own designs

Web Portal with interval data

- California IOUs ordered to document savings due to interval data from smart meters – reporting annually
- Avista – RCT with 6,500 treatment and 6,500 controls
- CMP --

IHD

- SGIG consumer behavior studies at various utilities – RCT and RED designs with large sample sizes across 7 utilities
- Com Ed – opt-out distribution testing customer acceptance and energy savings – approximately 2,400 treatment
- CenterPoint Energy – opt-in distribution, RCT with 800 treatment and 800 controls

HAN -- ??

Concluding Remarks

- Energy consumption changes induced by information feedback and pricing appear to be real – though serious questions remain about their magnitude.
- Technology and market very much in flux:
 - Many display and control products entering the market
 - Well established enterprises like GE and Honeywell are entering the market with inexpensive solutions
 - Products are evolving quickly to compensate for the addition of new players
- Some important market barriers to success are becoming evident:
 - Ownership of smart meter data (customer or utility)
 - Security of communications link between smart meter and household devices
 - Privacy issues
- While opportunities for achieving significant energy conservation and improvement in the efficiency appear real, the evidence for most of the conservation impacts of information feedback technologies is still quite weak.
- The industry is at least 18-24 months away from having robust evidence of impacts of emerging technologies.
- The holy grail (consumer control of energy loads) remains a mystery.

Save the Date



22nd National Conference & Expo

February 6-10, 2012
Hilton San Diego Bayfront

