EB-2007-0031
Update Report on Time of Use (ToU) Pricing Pilots

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Scope of Update Report (1)

- This report-back represents business arising from the December 12, 2007 meeting
  - Stakeholders requested additional information with respect to ToU pricing pilots including the two pilot projects briefly discussed at the last meeting (Puget Sound Energy and California's Statewide Pricing Pilot [SPP])
  - Additional information sought included details concerning program sample design and objectives, pricing information (e.g., absolute prices, peak/off-peak price ratios, identification of number of ToU pricing periods), impact analysis, conclusions, etc.

Scope of Update Report (2)

- Besides California's experiment, we are aware of several other dynamic pricing pilots that are currently underway or have been recently completed in North America:
  - Ameren, Missouri (Critical peak pricing (CPP), ToU)
  - Anaheim, California (Peak-time rebate (PTR))
  - Commonwealth Edison (Real time pricing (RTP))
  - Hydro Ottawa (CPP, PTR)
  - Idaho Power, Idaho (CPP, ToU)
  - PSEG, New Jersey (CPP)
  - SMUD, California (CPP)

Scope of Update Report (3)

- In addition, pilots are planned for the District of Columbia, Hawaii and Maryland
  - As an example, PEPCO will start up this month a smart meter pilot program that was recently approved by the District of Columbia PSC. The program is limited to 2,250 randomly selected homes spread throughout all four quadrants of the nation's capital - with smart thermostats offered to about half the participants. Ratepayers will be billed under one of three pricing options -- hourly pricing, CPP or CPR
  - PEPCO also has a similar proposal pending before the Regulator in Maryland. A decision is expected in early 2008

Scope of Update Report (4)

- At this time particulars with respect to two completed ToU pricing pilots and one in-progress ToU meter program have been obtained and are the subject matter of this update:
  - Puget Sound Energy ToU pricing pilot (completed)
  - EnergyAustralia ToU meter program (well underway)
  - California's SPP (completed)

Puget Sound Energy ToU Pricing Pilot (1)

- Overview:
  - Service territory - Seattle and Bellevue, Washington State (rural-15%, metropolitan-20%, suburban-65%)
  - 973,489 Total Electric Customers
  - 908,949 are AMR Capable Meters
  - 271,556 Electric Customers on Time of Use Rates (29%)
  - 168,933 Electric Customers on ToU Info (17%)
  - 64,540 Total Electric Non-AMR Meters

Puget Sound Energy ToU Pricing Pilot (2)

- Pilot
  - 14-month large-scale pilot project (May 2001- June 2002) that involved 300,000 residential customers and 20,000 small commercial customers
    - Successfully rolled out smart meters to mass market customers
    - Integrated technology investments in place (web based real time usage data and real time pricing data)
      - Customers on the pilot get personal online reports of energy usage
      - Other customers also get information

Puget Sound Energy ToU Pricing Pilot (3)

- Rollout:
  - Phase I: November 2000
    - Franchise-wide information campaign
    - 400,000+ target customer program
    - Four-period time-of-use framework
  - Phase II: May 2001
    - 300,000+ customers receive ToU rate differentials
    - Customers may opt off by calling Puget Sound Energy [PSE]
  - Phase III: September 2001
    - Added 20,000 C/I customers
    - Extended Pilot through winter to June 2002

Puget Sound Energy ToU Pricing Pilot (4)

- Customer Insight:
  - Unaware of:
    - how and why the cost to provide electricity varies during the day, or from time to time
    - how to best change energy usage patterns
  - Interested in:
    - protecting the environment
    - 'fair' rates for all, including dynamic pricing
  - Open to dynamic pricing, **if**:
    - the impact on them, personally, is clear and simple
    - the community benefits

Puget Sound Energy ToU Pricing Pilot (5)

- ToU Rates:
  - Bundled rates (included charges for transmission, distribution and generation)
  - Featured three prices and four price blocks
    - Peak: 6.25¢ per kWh
      (Mon-Sat: morning and evening, 6am-10am and 5pm-9pm)
    - Mid-Peak: 5.36¢ per kWh
      (Mon-Sat: mid-day, 10am-5pm)
    - Off-Peak: 4.70¢ per kWh
      (Mon-Sat: 9pm-6am, all day Sun & Holidays)

Puget Sound Energy ToU Pricing Pilot (6)

- Compares to summer fixed rate of 5.36¢ per kWh
  - Variable cost of producing electricity 25% higher than fixed rate during peak periods, 4% lower during mid-day, and 13% lower during off-peak
- ToU rates were set (designed) to be revenue neutral for the average customer based upon the average load shape curve
  - There was no decoupling or true up for either customers or the Company (the customers either paid more or less than they would have under the flat rate; the Company did not request any recovery of lost revenues)

Puget Sound Energy ToU Pricing Pilot (7)

- Fairly mild ToU rates
  - Peak period prices for electricity were 1.3 times the off-peak period price and the mid-peak period price 1.2 times the off-peak period price
  - PSE had originally proposed higher pricing differentials and more pricing periods. Final rates - approved by regulator - reflected WUTC's desire for simplicity

Puget Sound Energy ToU Pricing Pilot (8)

- Summary of Results:
  - Shift Savings
    - 5%-6% shift out of peak
  - Conservation Savings
    - 1%
  - Peak Capacity Savings
    - 30-40 MW
  - Corresponding own-price elasticities are higher (absolute terms) during the winter (see table on next page)

Puget Sound Energy ToU Pricing Pilot (9)

- Analysis by Charles River Associates

Own-Price Elasticity (Absolute Terms)				
	Morning Peak	Mid-(day) Peak	Evening Peak	Off-Peak
Summer	-0.2	-0.2	-0.2	-0.15
Fall/Spring	-0.23	-0.2	-0.2	-0.15
Winter	-0.3	-0.3	-0.25	-0.15

Puget Sound Energy ToU Pricing Pilot (10)

- General Residential Customer Reaction
  - Overall satisfaction with TOD Pricing Program - 85% (9%-totally dissatisfied)
    - 67% - ToU is a good idea
    - 66% - reduces need for power plants
    - 64% - ToU pricing is fair
    - 72% - concept is easy to understand
    - 37% - should pay the same price no matter what time of day they use it

Source: Puget Sound Energy

EnergyAustralia ToU Meter Program (1)

- Background information on the electricity industry in New South Wales (NSW), Australia:
  - EnergyAustralia (EA) is one of four electricity distribution networks (DNSPs) operating within a defined area of NSW
  - EA operates one of the largest electricity distribution networks in Australia – around 22,275 square kilometres – distributing electricity to approximately 1.6 million residents and businesses in the Sydney, Central Coast and Hunter regions
  - In the NEM, competitive electricity retailers are responsible for billing customers under retailer-consolidated billing

EnergyAustralia ToU Meter (2)

- The electricity industry in Australia has undergone significant reform over the last decade
  - In the early 1990s, each state and territory operated vertically integrated utilities with little interconnection between electricity grids in different jurisdictions
  - Core to creating a fully competitive National Electricity Market (NEM) was the establishment of a wholesale electricity market and interconnected electricity grid
  - In order to facilitate the creation of a NEM, state authorities were separated into specialized entities (with competitive functions separated from monopoly functions) and corporatized
  - EA, as a combined distributor and retailer, was corporatized in 1997
  - Governments also implemented a system of third party access to distribution and transmission

EnergyAustralia ToU Meter Program (3)

- Goal of program
  - Defer locational growth capital expenditure
    - By offering incentives to customers to reduce or shift their peak load
    - Through the pervasive use of ToU tariffs, that create a financial pay off to customers for shifting or reducing load during peak times

EnergyAustralia ToU (4)

- EA currently has approximately 250,000 customers (of customer base of 1.6 million) on standard ToU tariffs
- EA did not run a smart meter pilot first
  - for standard ToU, EA prepared and filed a business case (absent the benefit of a pilot) which was accepted by the state regulator, the Independent Pricing and Regulatory Tribunal (IPART)
  - The business case indicated that it was viable to apply ToU down to 15 MWh customers, below which the amount of demand response was not enough to outweigh the meter install cost
  - The business case analysis assumed elasticities of -0.12 rising to -0.37 after five years (distribution only business case, excluded consideration of retail benefits)

EnergyAustralia ToU (5)

- EA started using manually read interval meters in July 2003, but the roll out of interval meters commenced in July 2004 and should finish by December 2009
  - As of July 2007, EA had rolled out 240,000+ interval meters as follows: 0 - 15 MWh customers, 11% out of a total of 1.4 million; 15 - 40 MWh customers, 38% out of a total of 124.2 thousand; 40 - 160 MWh customers, 91% out of a total of 31.9 thousand; and above 160 MWh customers, 100% or 13.3 thousand
  - With respect to full AMI deployment, EA is still awaiting national direction before installing AMI to below 15 MWh customer sites (as well, will likely have to replace existing ToU meters for above 15 MWh customer sites at a later date (with communications capable metering))

EnergyAustralia ToU (6)

- Pricing
  - Regulated retail tariffs are "bundled" (generation, transmission, distribution, market and meter charges)
    - applies to system customers with annual electricity consumption of less than 160 megawatt hours
    - The individual rates under the "bundled" tariffs set out in the Res and Bus Price Lists cover both:
      - retail charges – being the amount EA charges end users for the electricity they consume and for the provision of retailing services (e.g., billing, call centre, etc.) and
      - network charges – being the amount EA charges end users for availability and use of the electrical network

EnergyAustralia ToU Meter Program (7)

- Pricing (cont.)
  - The majority of the current tariffs are made up of a charge based on consumption (this may be a single rate or time of use rates) and a fixed daily charge (consistent with the requirements of IPART's June 2007 pricing determination)

EnergyAustralia ToU (8)

- ToU Rates
  - For low voltage residential and business customers (with an annual consumption below 40 megawatt hours) with ToU meters, the current (effective July 1, 2007) ToU tariff features three pricing periods and these rates apply all year round
    - Peak: 25.1¢ per kWh (Mon-Fri: 2pm-8pm)
    - Shoulder: 8.9¢ per kWh (Mon-Fri: 7am-2pm and 8pm-10pm, Weekends Holidays: 7am-10pm)
    - Off-Peak: 5.1¢ per kWh (All other times)
    - Peak period prices are 4.9 times the off-peak period price and the mid-peak period price is 1.8 times the off-peak period price

EnergyAustralia ToU (9)

- For low voltage business customers (with an annual consumption above 40 megawatt hours) with ToU meters, the current (effective July 1, 2007) ToU tariff features three pricing periods, the same time bands as for low voltage residential and business customers (with an annual consumption below 40 megawatt hours) and a monthly Capacity Charge that applies for consumption during peak periods under this tariff
  - Peak: 21.2¢ per kWh
  - Shoulder: 11.2¢ per kWh
  - Off-Peak: 6.1¢ per kWh
  - Capacity Charge: $3.1791 per kW per month
  - Peak period prices are 3.5 times the off-peak period price and the mid-peak period price is 1.8 times the off-peak period price

EnergyAustralia ToU Meter Program (10)

- ToU Rates (cont.)
  - For all ToU tariffs, a fixed daily charge, which recovers the fixed costs of providing retail and network services to the customer, also applies (expressed in cents per day per meter)

EnergyAustralia ToU Meter Program (11)

- Standard Rates
  - In comparison, the current standard (flat) two-part energy rate (inverted rate structure) for all low voltage residential and business system customers with a conventional meter, is as follows:
    - Residential - 11.7¢ per kWh for the first 1,750 kWh per quarter; and 16.3¢ per kWh for remaining usage per quarter
    - Business - 11.5¢ per kWh for the first 2,500 kWh per quarter; and 16.6¢ per kWh for remaining usage per quarter

EnergyAustralia ToU Meter Program (12)

- Standard Rates (cont'd)
  - Not unlike all the ToU tariffs, a Service Availability Charge, which recovers the fixed costs of providing retail and network services to the customer, also applies under the standard tariff (expressed in cents/day/connection point)

EnergyAustralia ToU Meter Program (13)

- Tariff Developments
  - Some of the tariffs on the Price Lists are described as "obsolete" (including the standard [flat rate] tariff for low voltage residential and business customers)
    - This means that the tariff applies only to customers under existing supply arrangements
    - EA may choose to abolish any tariff listed as "obsolete" on July anniversary dates
    - If this occurs, affected customers would be changed from the "obsolete" tariff to a current residential or business tariff as applicable (in accordance with the "Determination No 1, 2007 - NSW Electricity Regulated Retail Tariffs and Charges, 2007 to 2010"

EnergyAustralia ToU (14)

- Tariff Developments (cont.)
  - It should also be noted that single consumption tariffs will not be applied to premises with the capability to support ToU billing
  - TheToU rate tariff is now EA's "business as usual" tariff, with all new and upgraded meter installations going on to ToU rates, including the ToU meter roll out to 15-40 MWh customers
  - The 15-40 MWh customers are being mandated away from a flat tariff (affecting about 120,000 customers, out of a customer base of 1.6 million)
  - ToU is now EA's standard default tariff
  - EA is thinking about introducing voluntary CPP tariffs in the future

EnergyAustralia ToU Meter Program (15)

- Customer Perceptions of ToU
  - 71% - think this method of charging people for electricity consumption is fairer than a flat rate
  - 65% - don't think enough has been done to educate people about a pricing system where customers are charged according to when they use
  - 48% - have no idea how much energy different appliances in their household consume
  - 28% - weren't aware that they could reduce their electricity bill by changing the times of day they use different electrical appliances

EnergyAustralia ToU (16)

Results

- Preliminary reductions in
  - Business 40-160 MWh of 3% on peak period energy (but not statistically significant)
  - Domestic 15-40 MWh of 2-3% on peak energy (2pm to 8pm) but on peak summer half hour only 1.1%
- EA concludes
  - It will be some time off before it has any meaningful CAPEX impact, but early results are promising
  - Pervasive deployment is key
  - Need long run view of end user appliance purchases
  - Proposition needs to be marketed well, but that is in the hands of Retailers
- EA questions whether external retailers will pass through the tariff?

EnergyAustralia ToU Meter Program (17)

- Other Pricing Developments
  - Concurrent with the ToU meter roll out program, EA is undertaking a Dynamic [Critical] Peak Pricing (DPP) pilot
    - Two-year pilot project that is scheduled to end in April 2008 (may be extended another eight months to capture another summer period)
    - Involves a sample of 1,300 customers (target population: low voltage residential and business customers below 40 MWh per annum and low voltage business customers 40-160 MWh per annum)

EnergyAustralia ToU Meter Program (18)

- testing two dynamic tariffs (DPP High and DPP Medium), seasonal ToU, as well as an information only group that gets dynamic signals but remains on a flat tariff
- The pricing trial is key to EA's assessment of the capital deferral value of such tariffs for incorporation into the business

California Pricing Pilot (1)

- In response to California's energy crisis in 2000/2001, the California Public Utilities Commission (CPUC), initiated a proceeding under Order Instituting Rulemaking on policies and practices for advanced metering, demand response and dynamic pricing, OIR 02-06-001, designed to introduce demand response in California's power market
  - This represented a joint (cooperative) California state agency proceeding involving the CPUC, the California Energy Commission (CEC), the California Consumer Power and Conservation Financing Authority (CPA, and other involved or interested state agencies
  - Began in June 2002 when the CPUC instituted Rulemaking (R.) 02-06-001 to provide the forum to formulate comprehensive policies regarding demand response and advanced metering

California Statewide Pricing Pilot (2)

- Background (cont.)
  - The Commission's rulemaking effort targeted the investor owned utility (IOU) service territories of respondents Pacific Gas & Electric (PG&E), San Diego Gas & Electric (SDG&E), and Southern California Edison Company (SCE), who participated in the cooperative joint venture pilot

California Statewide Pricing Pilot (3)

- Background (cont.)
  - Three working groups were charged with developing specific tariff proposals to achieve increased demand response in the state. The mission of the third working group (WG3) was to develop a dynamic tariff (or set of tariffs) for residential and small commercial customers with demands less than 200 kW. WG3 includes representatives from the state's three investor-owned utilities, commissions, equipment vendors, The Utility Reform Network (TURN) and other interested parties

California Statewide Pricing Pilot (4)

- Background (cont.)
  - As part of the WG3 deliberations, Charles River Associates (CRA) conducted a preliminary analysis of the potential benefits of ToU and dynamic pricing for Pacific Gas & Electric Company
  - The analysis showed a wide range of potential benefits from the implementation of dynamic pricing
  - Analysis also indicated that conducting an experiment with a few thousand customers could significantly reduce the uncertainty in the net benefit estimates

California Pricing Pilot (5)

- Background (cont.)
  - Based in part on this preliminary analysis, WG3 recommended on December 10, 2002 that the state conduct a carefully designed social experiment with different pricing options prior to making a decision on full-scale deployment of the automated metering infrastructure required to support such rates
  - The CPUC approved the experiment, now called the Statewide Pricing Pilot (SPP), on March 14, 2003
  - The SPP was originally estimated to cost about $10 million (later revised upwards), including metering, project planning, management, evaluation, and concurrent market research on non-pilot participants focused on customer preferences for rate options

California Pricing Pilot (6)

- Background (cont.)
  - The SPP broke new ground in four areas
    - First, it tested time-varying rates against a backdrop of an inverted five-tier rate structure that was created in response to the energy crisis of 2000/01
    - Second, it used an integrated sample design across three utility service areas, permitting efficiency gains in sample size that had not been realized in prior work
    - Third, it used similar rates across the three utilities
    - And fourth, it represented the first experiment to estimate price elasticities for dynamic tariffs

California Pricing Pilot (7)

- OIR 02-06-001 - Major decisions
  - Adopted demand response programs for large customers (>200 kW)
  - Established demand response as a preferred option, with renewals and energy efficiency, over new power plant construction
  - Set goal for 2007 of demand response to meet 5% of peak demand
  - Adopted business case methodology for utility AMI deployments and ordered utilities to file deployment plans (due 12/15/2004)
  - Ordered Statewide Pricing Pilot to test Critical Peak Pricing for small commercial and residential customers (CPUC Decision 03-03-036)

California Statewide Pricing Pilot (8)

- SPP Goals
  - Measure peak demand reductions
  - Measure total consumption reductions
  - Assess customer preferences via market surveys

California Statewide Pricing Pilot (9)

- SPP Objectives
  - Estimate demand curves for electricity consumption by time-of-use period for dynamic tariffs and derive the associated price elasticities of demand
  - Gather information on customer acceptance of dynamic tariffs, control technologies and information treatments
  - Forecast the impact of a full-scale roll out of dynamic tariffs
  - Provide input into a cost-benefit analysis of universal deployment of advanced metering infrastructure

California Pricing Pilot (10)

Three rates tested

- The SPP includes a traditional time-of-use (ToU) rate and two types of critical peak pricing (CPP) rates that feature a substantially higher peak price (about 50 to 75 cents/kWh) for 15 days of the year
  - ToU with fixed peak and off-peak time bands
  - One type of CPP rate, Critical Peak Pricing-Fixed (CPP-F), features a fixed peak period identical to the one in the ToU rate, and day-ahead customer notification (ToU plus dispatched "Super Peaks")
  - The other type of CPP rate, Critical Peak Pricing-Variable (CPP-V), features a variable-length peak period, which may be called on the day-of an "emergency" (same as CPP-F, except length and advance notice period for Super Peaks varies)

California Pricing Pilot (11)

- Since the primary objective of the SPP was to obtain econometrically sound estimates of own-price and cross-price elasticities of demand and the associated elasticities of substitution, the SPP included two rate levels for each rate type in addition to a third, non-time-varying rate that was offered to the control group

California Statewide Pricing Pilot (12)

SPP Design Features

- 2,500 participating customers
  - Gross sample across six segments with mix of PG&E, SCE and SDG&E customers
  - Gross sample includes mix of residential customers and small commercial customers (3:1 ratio)
    - Four residential segments capture the variation in customer price response across the state's climate zones
    - Two small commercial and industrial segments capture the variation by size (0-20 kW, 20-200 kW)

California Statewide Pricing Pilot (13)

- SPP Design Features (cont'd)
  - Approximately one-third of gross sample of customers to be placed in control groups - with the largest number to be placed on the CPP-F rate (with another number of customers to be placed on the CPP-F rate in conjunction with a community-based information treatment), the next largest number to be placed on the CPP-V rate, and the balance to be placed on ToU rates
  - Since customers would be allowed to opt-out of the pilot, some attrition was expected to occur

California Pricing Pilot (14)

SPP Design Features (cont.)

- Another unique feature of the SPP experimental design is that it encompasses three tracks, reflecting the diverse interests of the members of WG3
  - Track A includes 75% of gross sample selected through a stratified random sample
    - This track was designed to provide both statewide and climate-zone specific price elasticity estimates for ToU and CPP rates
  - Track B includes 10% of gross sample located in lower-income neighborhoods that are directly affected by power plant emissions on peak days
    - This track was intended to measure the effects of increased awareness of local environmental and reliability issues on price elasticities for the CPP-F tariff

California Pricing Pilot (15)

SPP Design Features (cont.)

- Track C covered the balance of the gross sample (15%), involving the transfer of the small group of then existing (residential and small commercial) customers of SCE and SDG&E who originally volunteered to participate in the pilot program featuring smart thermostats at the time (experimental incentive program where participants were paid an incentive to allow the utility to send a signal to a smart thermostat and change the temperature setting by a designated amount). These customers were to be placed on the CPP-V rate
- Complex experimental design –statistically representative
- Revenue neutral rate designs

California Statewide Pricing Pilot (16)

SPP Design Features (cont.)

- Rate treatments: (1) ToU, (2) CPP-F, (3) CPP-V.
- Technology and information treatments
  - CPP With Automated Response
    - Technology provided to all CPP-V customers to help them automate a change in energy use (customers to be offered a choice of air conditioner, water heater and pool pump controls)
    - Outbound paging signal to thermostat
    - Thermostat automatically adjusted up 4 degrees during critical peak hours

California Statewide Pricing Pilot (17)

SPP Design Features (cont.)

- A number of residential PG&E customers to be given information on how electricity costs vary by time-of-use and to be notified when critical peak days are encountered (but they stay on standard rates, enabling an assessment of the impact of pure information treatment)

California Statewide Pricing Pilot (18)

- SPP Timeline
  - Project authorized – March 2003
  - Rate pilot start – July 2003
  - Preliminary results – September 2003
  - Final summer 2003 results – September 2004
  - Start replenishment – March 2004
  - Rate pilot complete – October 2004
  - Final summer 2004 results – March 2005

California Statewide Pricing Pilot (19)

- SPP Structure
  - 2,500 customers state-wide
    - Random sample with participants and controls
    - Stratified sample
      - Residential and commercial
      - Dwelling type (single family/multi-family/<20kW/>20kW)
      - Climate zone

California Statewide Pricing Pilot (20)

- SPP Structure (cont'd)
  - Four residential rates and six commercial rates
    - Vary by type (ToU vs. CPP-F vs. CPP-V)
    - Vary within type to test price response ("elasticity")
      - Price ratios vary from 2.0:1 (peak to off-peak) to 2.5:1
      - CPP prices range from 50 cents/kWh to $1/kWh

California Statewide Pricing Pilot (21)

- Static versus Dynamic Tariffs
  - As noted, CA's SPP was designed to test a variety of pricing options, including ToU rates and CPP rates
  - In California, standard residential tariffs involve an inverted-tier design in which the price of power rises with electricity usage
    - The typical residential customer pays an average price of about 13 cents per kWh (average summer price of 13.36 ¢/kWh)

California Pricing Pilot (22)

- Static versus Dynamic Tariffs (cont.)
  - Within the SPP, customers on ToU and CPP rates pay a higher price during the five-hour peak period that lasts from 2pm to 7pm on weekdays and a lower price during the off-peak period, which applies during all other hours
  - Each ToU and CPP rate involves two sets of peak/off-peak prices, to allow for precise estimation of the elasticities of demand
  - On average, customers on ToU rates are given a discount of 23 percent during the off-peak hours and are charged a price of around 10 cents
  - They are charged around 22 cents during the peak hours, which is 69 percent higher than their standard rate of 13 cents per kWh

California Pricing Pilot (23)

- Static versus Dynamic Tariffs (cont.)
  - With ToU rates, customers are given a strong incentive to curtail peak usage and to shift usage to off-peak periods
  - The incentive is much greater on selected days for customers on CPP rates, who are charged, on average, a price of 64 cents during the peak hours on 12 summer days, making prices nearly five times higher than the standard rate of 13 cents
    - On the peak hours of other days and the off-peak hours of all days they face prices that are slightly lower than the prices faced by ToU customers during these periods

California Statewide Pricing Pilot (24)

- Static versus Dynamic Tariffs (cont.)
  - Analysis of data from the first summer of the California experiment indicates that CPP-rate customers face what are called rifle-shot price signals that can be very effective at reducing peak demand, thus damping wholesale prices and obviating the need for building costly power plants that would run for only a few hundred hours a year

California Pricing Pilot (26)

- Illustration of SPP Pricing (cont.)
  - Experimental Residential ToU Service (PG&E Schedule E-2, Bundled Rate)
    - Summer On-Peak - 25.5¢/kWh
    - Summer Off-Peak - 9.8¢/kWh
    - Winter On-Peak - 19.3¢/kWh
    - Winter Off-Peak - 12.8¢/kWh

  (Winter: Nov.-April, Summer: May-Oct.; On-Peak: 2pm-7pm weekdays, Off-Peak: all other weekday hours plus weekends and holidays)

California Statewide Pricing Pilot (27)

- Illustration of SPP Pricing (cont.)
  - Standard ToU
    - Night - 6¢/kWh (Weekdays: 10 pm-6 am plus Weekends and Holidays)
    - Shoulder - 11¢/kWh (Weekdays: 6 am-2 pm, 7 pm-10 pm)
    - Peak - 23¢/kWh (Weekdays: 2 pm-7 pm)

California Pricing Pilot (28)

- Illustration of SPP Pricing (cont.)
  - CPP
    - 50 hours per year
    - 2-5 hours per event
    - CPP two major functions
      - Economic - CPP Price Signal 10x per year (CPP prices goes to $0.50 - $1.00 per KWh with 24 hour notice and customer decides on how to respond to price
      - Grid Protection or Reliability - Extraordinary Curtailment Signal, < once per year, local or system-wide problem, no advance notice

California Statewide Pricing Pilot (29)

- Elasticities From the California Experiment
  - Charles River Associates (CRA) evaluated the impact of the experimental prices to construct electricity demand models that could be used by utilities and regulatory agencies to estimate the impact of similar prices that were not explicitly tested during the experiment
  - To accomplish this objective, CRA estimated an econometric model called the constant elasticity of substitution (CES) demand model

California Statewide Pricing Pilot (30)

- Elasticities From the California Experiment
  - The CES can be summarized by two elasticity measures, that of elasticity substitution (ES) and the daily price elasticity
    - The ES measures the change in the ratio of peak to off-peak electricity within a day that is induced by changes in the ratio of peak to off-peak prices
    - The daily price elasticity measures the change in daily usage that is induced by changes in the daily price, which varies across different day types

California Pricing Pilot (31)

- Elasticities From the California Experiment (cont.)
  - CRA estimated the CES model using experimental data from the summers of 2003 and 2004 and the winter of 2003/2004
  - Statewide, the estimated average reduction in summer peak-period energy use on critical days was 13.1 percent
    - Impacts varied across climate zones, from a low of -7.6 percent in the relatively mild climate of zone 1 to a high of -15.8 percent in the hot climate of zone 4
    - The average impact on normal weekdays was -4.7 percent, with a range across climate zones from -2.2 percent to -6.5 percent

California Statewide Pricing Pilot (32)

- Elasticities From the California Experiment (cont.)
  - Other key findings for the CPP rate include:
    - Differences in peak-period reductions on critical days across the two summers, 2003 and 2004, were not statistically significant
    - Differences in effects across critical days when two or three critical days are called in a row (as might occur during a heat wave) were not statistically significant
    - Average effects on critical days were greater during the hot summer months of July through September (the inner summer) than during the milder months of May, June and October (the outer summer)

California Pricing Pilot (32)

- Elasticities From the California Experiment (cont.)
  - Households with central air conditioning were more price responsive and produced greater absolute and percentage reductions in peak-period energy use than did households without air conditioning
  - Demand response effects were lower in the winter than in the summer, and lower during the milder winter months of November, March and April (the outer winter) than during the colder months of December, January and February (the inner winter)
  - There was essentially no change in total energy use across the entire year based on average SPP prices (i.e., the reduction in energy use during high-price periods was almost exactly offset by increases in energy use during off-peak periods

California Statewide Pricing Pilot (33)

- Elasticities From the California Experiment (cont.)
  - The model specification indicates that price responsiveness varies with climate and with the saturation of central air conditioning (CAC)
    - Based on average statewide weather conditions during the entire summer period and statewide CAC saturation estimates, the estimated ES has a value of -0.076
      - As a result, if the price ratio between peak and off-peak prices were raised by 100 percent, the corresponding ratio between peak and off-peak electric usage would fall by 7.6 percent

California Pricing Pilot (34)

- Elasticities From the California Experiment (cont.)
  - For a customer with no CAC, the ES falls to -0.045, while for a customer with CAC, it rises to -0.116
  - This analysis also produced estimates that vary across four climate zones that differ with respect to average weather conditions and CAC saturations
    - For example, in the mild climate of Zone 1 - which lies mostly along the northern coastline and includes the city of San Francisco - customers have an ES of -0.039, while in the hot climate of Zone 4 - which includes the deserts and outer areas of the Central Valley - customers have an ES of -0.113

California Pricing Pilot (35)

- Elasticities From the California Experiment (cont.)
  - CRA has also estimated a daily price elasticity of -0.041 for the average customer in the state on a typical weather day
    - On that basis, if the daily price were to be raised by 100 percent, usage would drop by 4.1 percent
    - The daily price also varies with the presence or absence of CAC and with weather conditions
      - Low value is -0.031; high value is -0.051
  - It is important to note that the demand effects reported in this section are specific to the average prices that were used in the SPP

California Statewide Pricing Pilot (36)

- SPP Management and Data Requirements
  - Recruitment
    - All participants must be recruited and agree in writing to be part of the program
    - Sample design necessitates recruitment order and little opportunity for deviation (designated slot and rank)
    - Record all customer contact, including reasons for reject or refusal
    - Coordinated mailing of enrollment materials, follow up communication, program information packet and customer surveys

California Statewide Pricing Pilot (37)

- SPP Requirements (cont.)
  - Meter installation
    - Install interval meter with daily data collection upon enrollment
    - Begin data collection as soon as meter is installed and validate reads within 1 week
    - Begin billing on new rate by next billing cycle
  - CPP notification
    - Positive notification (via phone) is required for each CPP event
    - Notification by groups
    - Alternate notification by cell, email, pager

California Statewide Pricing Pilot (38)

- SPP Requirements (cont.)
  - Meter data collection (15 minute interval data)
  - Customer Communication
    - Track all customer contacts
    - Shadow bills (within 2 weeks of meter install and after 12 months)
    - Graphical bill summary with monthly bill
    - Welcome packet
    - Website
    - Surveys
    - Incentive payments

California Pricing Pilot (39)

- Achievements
  - Reached critical mass on July 1, 2003
    - Close to complete enrollment by August 15, 2003
    - Duplicates in some slots
    - Average 3.5 attempts per enrollment
  - First CPP notification on July 17, 2003
    - Notification success between 96 and 98%
  - 20% customer opt-out and moves
    - Replenishment and new research cells accommodated
  - Data supplied to research and analysis sufficient in quantity and quality to enable demand response conclusions

California Statewide Pricing Pilot (40)

- Summary
  - Customers in all rate groups reduced peak demand during peak and critical peak periods
  - Usage increased during lower priced-off peak periods
  - Total usage declined (peak reductions exceeded off peak increases)
  - At the pilot's end, 71% of participants chose to stay on the new rates rather than return to their old rates
  - By an 8 to 1 margin, participants think the rates should be offered to other customers

California Pricing Pilot (41)

SPP Conclusions

- System - Residential CPP rates can, within five years of deployment reduce California's peak load by 1,500 to over 3,000 MW
- Conservation and Peak Load Impacts - Dynamic rates encourage greater conservation and peak demand impacts than conventional inverted tier or ToU rates
- Customer Acceptance - Residential and small to medium commercial and industrial customers understand and strongly prefer dynamic rates to inverted tier rates

Source: California Energy Commission Website (http://www.energy.ca.gov/demandresponse/documents/index.html#group3)