Snapshot of Smart Grid Activities in U.S. for Mass Market

Regulation 101 Panel

Smart Grid: Today's Regulation and Tomorrow's Technology
Citizens' Utility Board of Oregon Policy Center

Presented by Lisa Schwartz

Oct. 21, 2011

US Federal Support for Smart Grid

Funding (millions)

Smart Grid Investment Grants - $3,400

Smart Grid Regional Demonstrations - $615

Standards/Interoperability* Framework - $10

Subset of funding for state regulators ($50) and state planning ($55)

*The ability of systems or products to work with other systems or products without special effort by the customer

Smart Grid Systems and Equipment Funded	Number of Units
Networked Phasor Measurement Units	877
Smart Transformers	205,983
Automated Substations	671
Load Control Devices	176,814
Smart Thermostats	170,218
Smart Meters	18,179,912
In-Home Display Units	1,183,265
Electric Vehicle Charging Stations	100

This slide reflects only federal funding, not other public and private investment.

Why Are We Investing in Smart Grid?

- Reduced labor costs
  - Meter reading, outage management
- Enhanced reliability
- Peak load management
  - Reduced energy, capacity, and transmission & distribution costs
- Ability to control ("dispatch") large new loads
  - Including electric vehicles
- Reduced energy consumption
  - Automation and behavioral changes
- Interconnect, balance and deliver renewable resources
- Reduced emissions

NREL

What Can Regulators Do to Achieve This Vision?

1. Scale up smart policies ahead of smart grids, such as:
   - Aligning utility incentives with consumer interests to optimize deployment of smart grid and customer-side resources
   - Integrating rate design (incentives for customers) with smart grid technologies to optimize consumer behavior and system operations
2. Plan for the transition (review utility plans periodically)
3. Address information access and privacy issues
   - Give consumers easy access to their interval data in a useful format
   - Enable an open market for products and services – allow third parties authorized by the consumer to receive the consumer's data
4. Facilitate price-responsive loads
   - Customer-owned programmable communicating thermostats that allow consumers to "set it and forget it," set per customer preferences
5. Update reliability objectives, criteria, service quality measures and reporting requirements

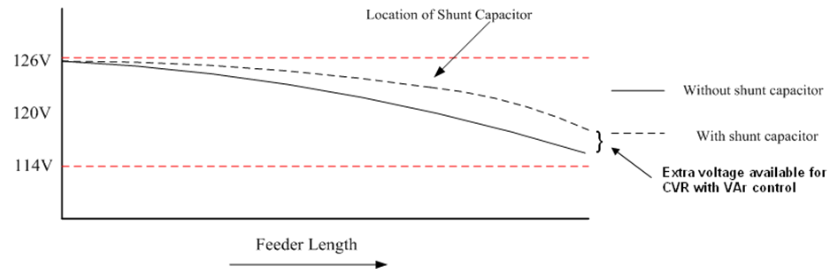
Partial list from presentation to OPUC, 9/9/09

What We've Learned So Far Toward a Clean Energy Vision of Smart Grid

Information-Driven Savings

- Home energy reports: ~3%
  - Delivered via mail or Web
  - No smart grid needed, but improves usage breakdown to identify how to reduce peak use
- In-home displays (Brattle): 7%
- Among all feedback modes
  - ACEEE: 4% to 12%
  - EPRI: *negative* to 18%
- Influential variables: feedback as soon after consumption behavior as possible and specificity (usage by appliance)
- Persistence of savings unknown

Conservation Voltage Reduction



- 1-3% reduction in energy use
- 1-4% peak load reduction
- Most energy savings due to *end-use* equipment operating at lower voltage
- Cost is low (2/3 of potential savings in NW <$30/MWh)
- *Incremental* impact of smart grid estimated at 2% (EPRI); more studies needed to confirm

Dynamic Pricing

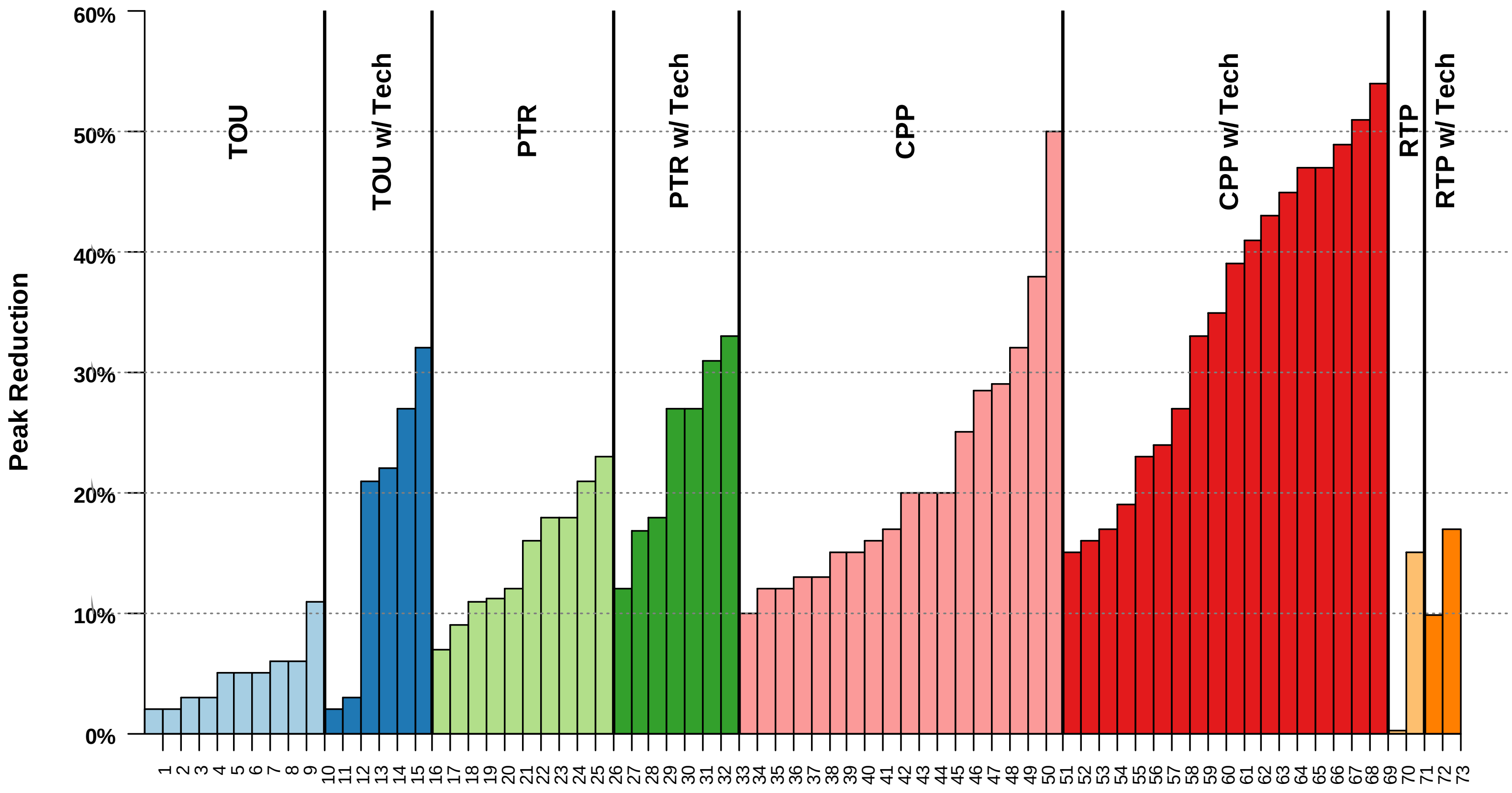
- Residential customers respond to price
  - Some a little, some a lot
  - Large users yield larger reductions
- Response to pricing > participation payments
- Most residential customers on dynamic pricing like it
- Opt-out yields far higher participation than opt-in

Demand Response to Integrate Renewables

- Largest variability and uncertainty in wind and solar output over 1 to 12 hours – in sync with most DR programs
- Real-time pricing with automation is the pricing option with most potential to manage integration
- Incentive-based programs (e.g., water heating control) also have high potential
  - If customers are willing to participate in programs with frequent but short DR events

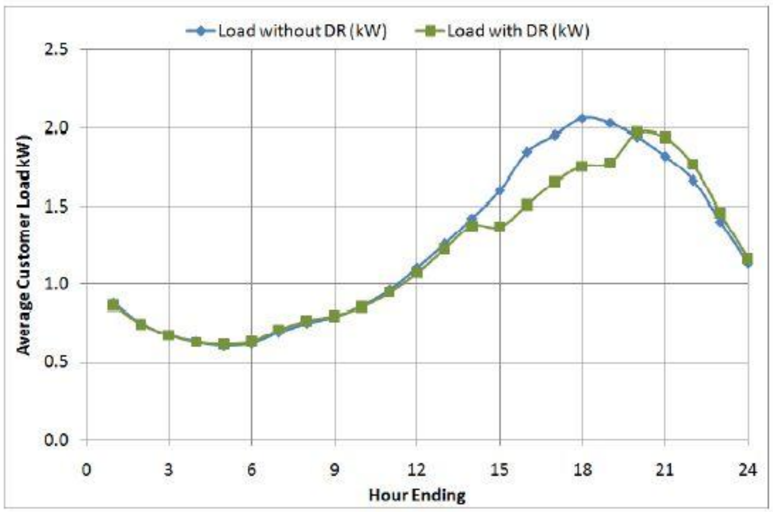
Adapted from LBNL, October 2011

Residential Pricing Pilots in U.S.



Results from 18 residential pricing pilots testing >70 combinations of rates and technologies. *Source:* Brattle Group

PG&E SmartRate™

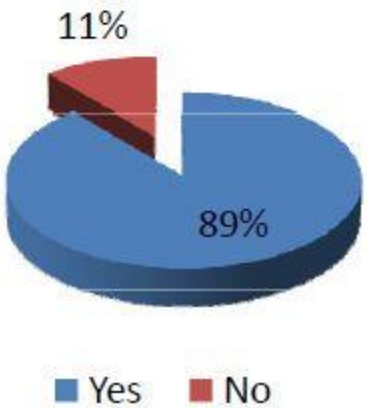


- 25,500 customers
- Voluntary and most stick with it
- Load reductions persist
- Critical peak pricing overlay
  - ≤15 summer days, May 1-Oct. 1
    - 60¢/kWh adder from 2 p.m. to 7 p.m.
    - Remaining summer hours priced lower than standard rates
    - Notification by 3 p.m. preceding day
- Average demand reduction for participants who opt to have utility control central AC ~23% higher than other participants with AC
- Bill protection for 1st full summer – reduces response about ~25%
- Average reduction in 2010: 14.1% (0.26 kW); similar to 2009 (15%)
  - Range: 5.7% (0.11 kW) for 1st event to 22.8% (0.47 kW)
- Vast majority of participants (88%) saved money: avr. $53 (8.2%)
  - Range: loss of $10 to gain of $180 for 90% of participants

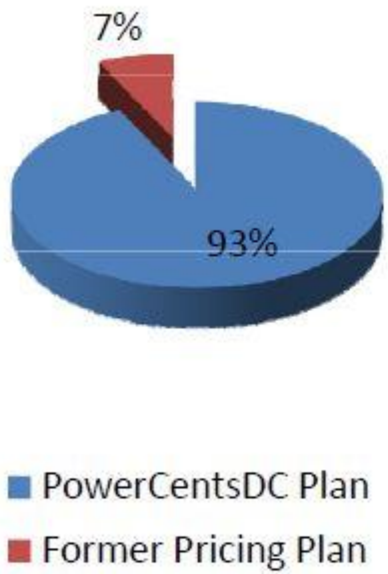
Stephen George, *et al., Freeman Sullivan & Co.*

Customer Acceptance: PEPCO PowerCents DC

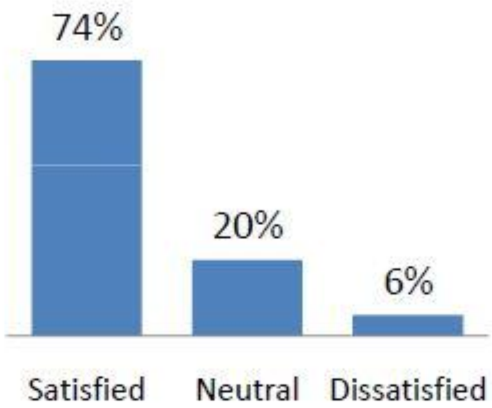
Would you recommend PowerCentsDC electricity pricing to your friends and family?



Which price plan did you prefer?



Overall, were you satisfied, neutral, or dissatisfied with the PowerCentsDC program?



Moving Ahead

What's Needed for Smart Grid to Support Demand Response

- Advanced metering infrastructure deployment
- Stakeholder acceptance of time-based rates
  - Willingness of regulators to allow utilities to offer time-based retail rates as well as degree of customer acceptance
- Customer acceptance of automation
  - Willingness of customers to accept automation/control technologies based on alleviation of privacy concerns and development of value proposition

Adapted from LBNL, October 2011

What's Needed for Smart Grid to Support Wind and Solar Integration

- Regulatory and stakeholder support for dynamic rates with the greatest potential to address variable generation integration issues
- Establishment of price and event response strategies at the customer level that rely on automation technology
- Ratepayer acceptance of frequent end-use control
- Regulatory/market framework
  - Bundled utility offering
  - Utility incentives + price/event signals with competitive market for control technology and demand response services
- Addressing market restrictions/designs and reliability rules

Adapted from LBNL, October 2011

Electric Vehicles

Example: California PUC Decision - July 14, 2011

- Existing residential EV rates OK for now – and voluntary*
  - Customer can 1) remain on standard tariff or 2) choose a time-of-use rate on a separate EV meter (customer pays for it) or a whole-house meter
  - Same rates for quick charging
  - All rates are seasonally differentiated
  - Tiered rates may discourage EVs – no tiers for separate EV meter rates
- Nonresidential customer EV charging – use standard tariffs (TOU for customers >500 kW)
- No special EV meter functionality or demand response capability required
- Shared costs for residential distribution system upgrades for EV charging ≥ 6/30/13
- Utilities to propose process for notification of EV purchases
- Utilities can't own EV service equipment except for own fleets

**CPUC may not authorize mandatory or default TOU rates for residential customers prior to 1/1/13*

New Research: USDOE Consumer Behavior Studies

USDOE Smart Grid Investment Grant Recipients With Approved Consumer Behavior Study Plans

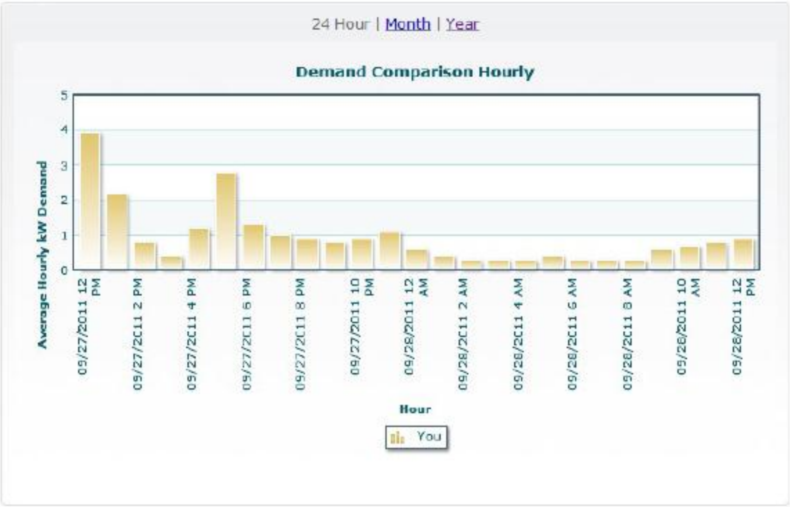
	Sierra Pacific	Nevada Power	OG&E	MMLD	CVPS	VEC	MN Power*	CEIC	SMUD	DECo	Lake land	**Total**
Rate Treatments												
TOU	●	●							●		●	**3**
CPP	●	●	●	●	●		●		●	●		**8**
CPR					●			●				**2**
VPP			●			●						**2**
Non-Rate Treatments												
Education	●	●								●		**3**
Cust. Service						●						**1**
IHD	●	●	●		●	●	●	●	●	●		**9**
PCT	●	●	●					●		●		**5**
DLC								●				**1**
Features												
Bill Protection	●	●	●	●							●	**4**
Recruitment Method												
Opt In	●	●	●	●	●	●	●		●	●	●	**9**
Opt Out								●	●	●	●	**3**
Number of Participants												
	9,509	6,853	3,196	500	3,735	6,440	4,025	5,000	97,480	5,400	3,000	**145,138**

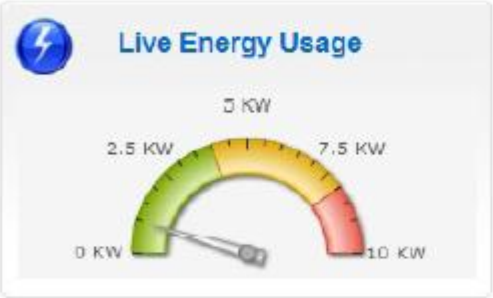
●—● Sierra Pacific and Nevada Power are testing the effect of a technology package, including an IHD and a PCT

* MN Power is also testing the difference between hourly energy feedback and daily energy feedback

Some Concepts Being Tested in DOE Pilots

- Acceptance and retention
- Opt-in vs. opt-out enrollment
- Variable peak pricing
  - Hybrid of TOU and RTP
  - Fixed on-/off-peak periods
  - On-peak rate varies *every day*
- Peak time rebates as a transition tool
- Technology acceptance/impact
- Effect of customer demographics
- First-year bill protection
- Enhanced education





For More Information

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- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

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