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Experience with Dynamic Pricing Deployment

May 2011

Global perspective: eMeter software clients

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Direct customer experience

- **Anaheim Public Utilities** - Turn-key Spare the Power Days critical peak rebate program
- **PG&E** - Smart meters for PG&E's customers above 200 kW representing $3B annual revenue
- **California Large IOUs** - Data management for the California Statewide Pricing Pilot
- **PowerCentsDC™** – Project design, implementation and operation for Washington D.C. smart meter/thermostat pilot
- **Ontario Smart Price Pilot** – Project design, implementation, and operation for time-of-use and critical peak pricing pilot

Case study: PowerCentsDC

Smart Grid pilot

- About 1,000 residential customers throughout District of Columbia

Integrated “Smart” approach

- Dynamic prices based on interval usage data
- Energy information feedback: with bills, in home, online
- Smart appliances: automated control via smart thermostats

Consumers had ability to manage their energy costs

- By shifting use from peak to other times
- By reducing total electricity use

PowerCentsDC design

Goals:

- How much do consumers reduce peak demand?
- How do consumers feel about the program and features?

Methodology:

- Test plan by Frank Wolak, Professor of Economics at Stanford
- Classic experimental analysis by comparing control vs. treatment
- Participants selected randomly

Customer groups:

- Critical Peak Pricing
- Critical Peak Rebate
- Hourly Pricing

PowerCentsDC prices

Standard rate

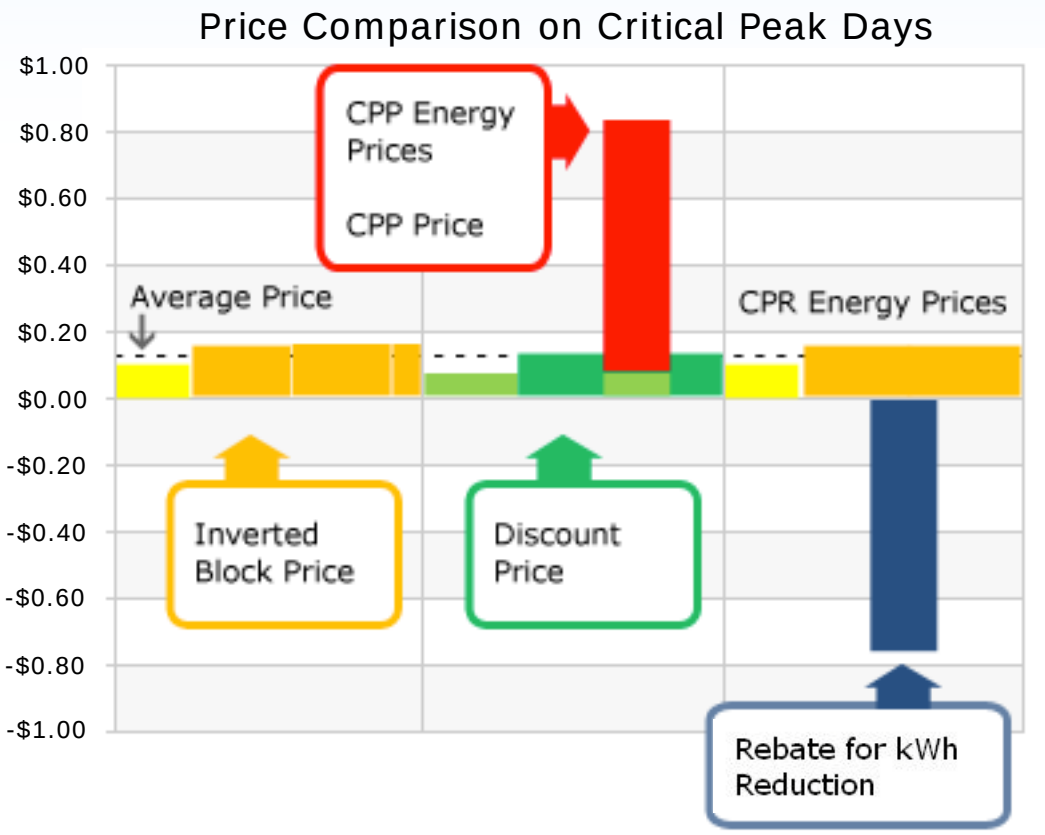
- Two tiers
- Higher price for more usage

Critical peak price/peak day pricing

- Slight discount during most hours
- Much higher price during 60 critical peak hours per year
- 15 events, 4 hours each
- Day-ahead notification

Peak time rebate/critical peak rebate

- Stay on standard rate
- Rebate for reductions during critical peak hours



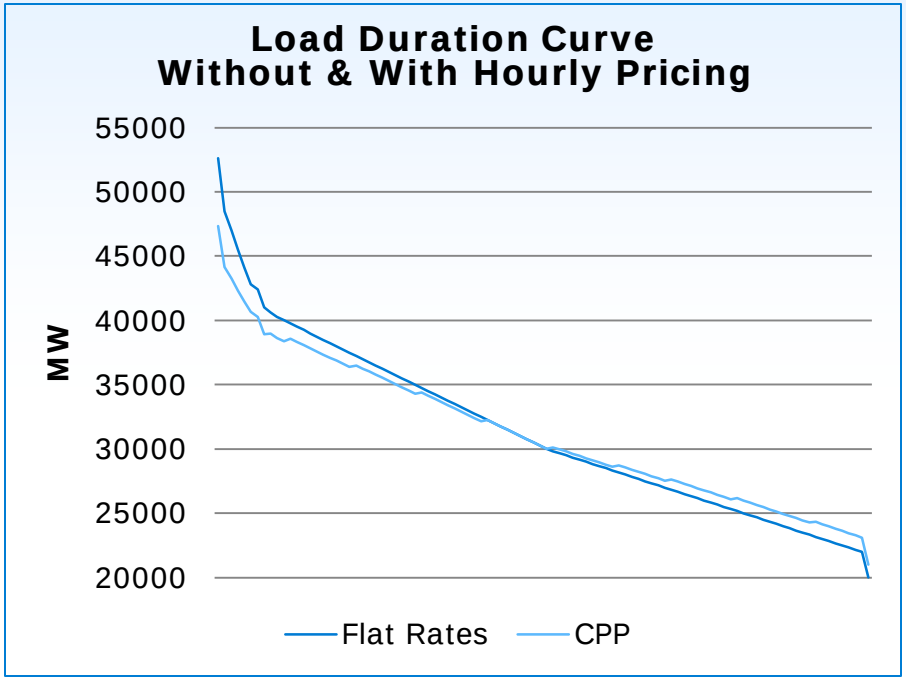
Hourly pricing

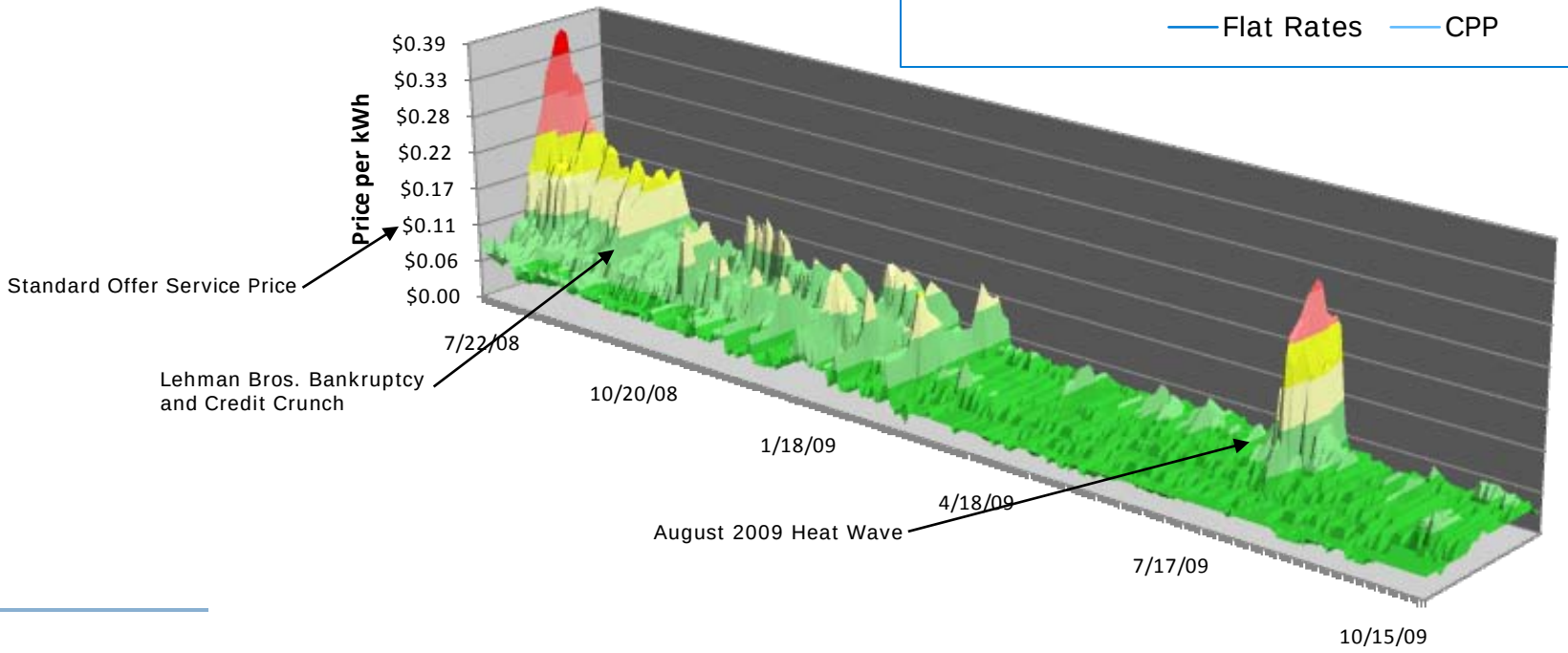
Price varies hourly

- Day ahead
- PJM in 2008-9 from $0.37 per kWh to $0.00

Attributes

- Greatest savings opportunity
- Potentially highest risk
- Incentive to shift from high- to low-cost periods throughout year
- Good for intermittent renewables & EVs





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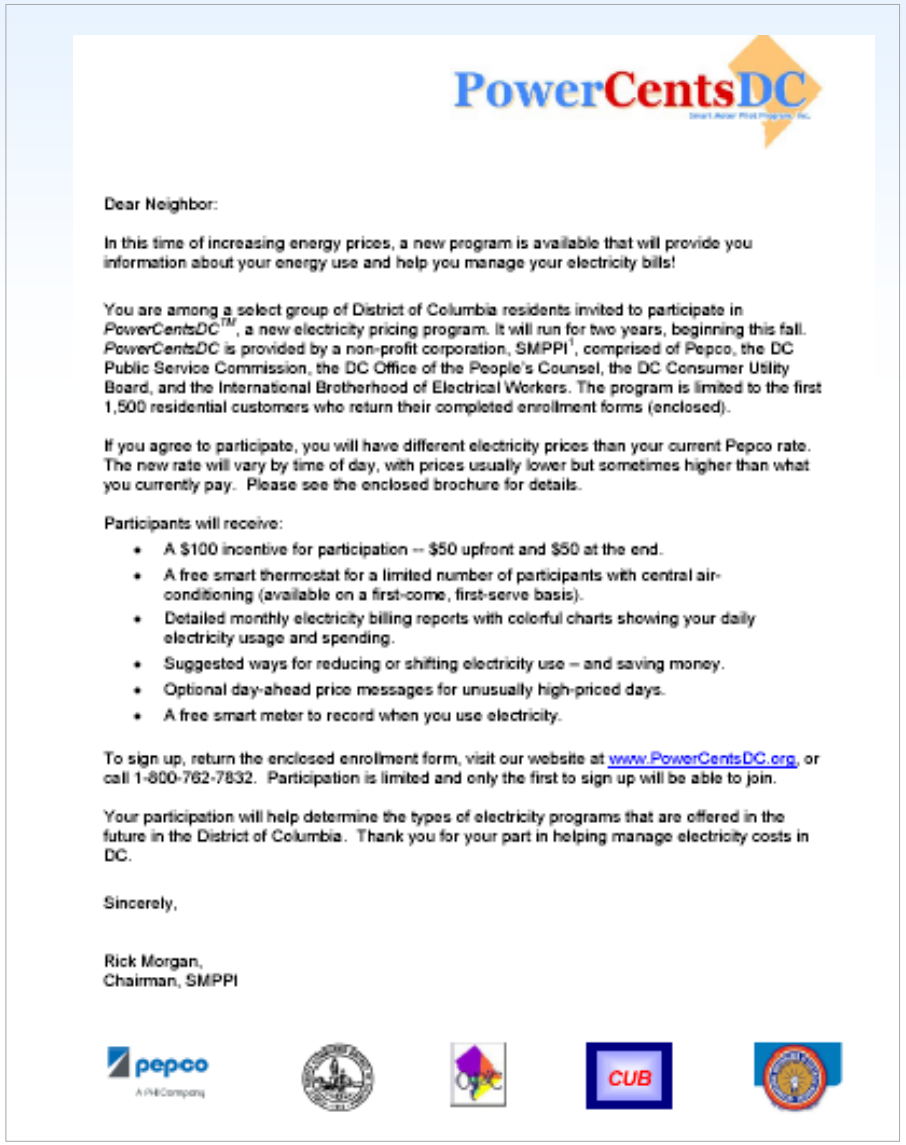
Recruitment

Random selection
Single letter
CPR most popular

Customer Group	Recruitment Response
Standard Customers	6.2%
All-Electric Customers	7.2%
Standard RAD Customers	8.0%
All-Electric RAD Customers	6.4%
Weighted Average	**6.6%**

Pricing Option	Recruitment Response
Critical Peak Pricing	6.5%
Critical Peak Rebate	7.4%
Hourly Pricing	5.5%
Weighted Average	**6.6%**



PowerCentsDC

Dear Neighbor:

In this time of increasing energy prices, a new program is available that will provide you information about your energy use and help you manage your electricity bills!

You are among a select group of District of Columbia residents invited to participate in *PowerCentsDC*™, a new electricity pricing program. It will run for two years, beginning this fall. *PowerCentsDC* is provided by a non-profit corporation, SMPPI[1], comprised of Pepco, the DC Public Service Commission, the DC Office of the People's Counsel, the DC Consumer Utility Board, and the International Brotherhood of Electrical Workers. The program is limited to the first 1,500 residential customers who return their completed enrollment forms (enclosed).

If you agree to participate, you will have different electricity prices than your current Pepco rate. The new rate will vary by time of day, with prices usually lower but sometimes higher than what you currently pay. Please see the enclosed brochure for details.

Participants will receive:

- A $100 incentive for participation -- $50 upfront and $50 at the end.
- A free smart thermostat for a limited number of participants with central air-conditioning (available on a first-come, first-serve basis).
- Detailed monthly electricity billing reports with colorful charts showing your daily electricity usage and spending.
- Suggested ways for reducing or shifting electricity use – and saving money.
- Optional day-ahead price messages for unusually high-priced days.
- A free smart meter to record when you use electricity.

To sign up, return the enclosed enrollment form, visit our website at www.PowerCentsDC.org, or call 1-800-762-7832. Participation is limited and only the first to sign up will be able to join.

Your participation will help determine the types of electricity programs that are offered in the future in the District of Columbia. Thank you for your part in helping manage electricity costs in DC.

Sincerely,

Rick Morgan,
Chairman, SMPPI

pepco

CUB

Recruitment brochure

CPR sample

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Sample distribution

Random sample

Entire city

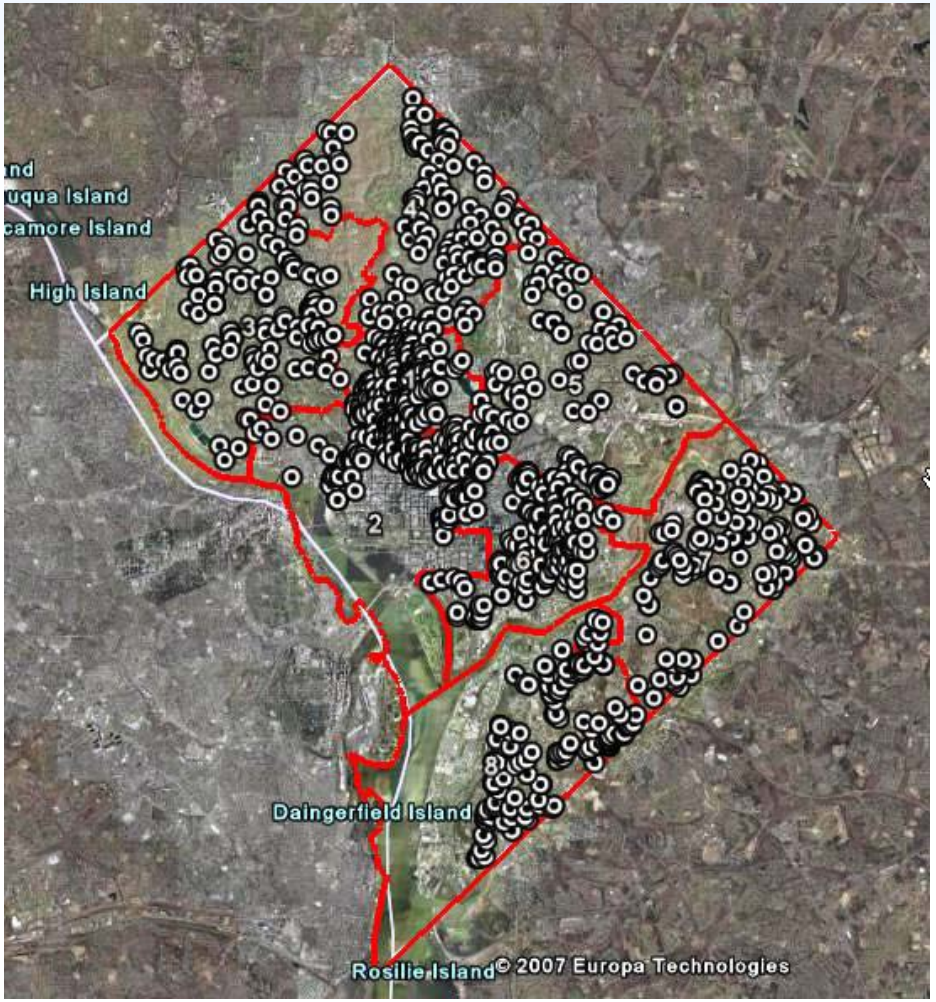
- All eight wards

All housing types

- Single family
- Multi-tenant

All demographics

- Income
- Education



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Participant education

Prior to going on the “smart prices”, participants received a Welcome Kit

- “Smart price” reminder description
- Refrigerator magnet

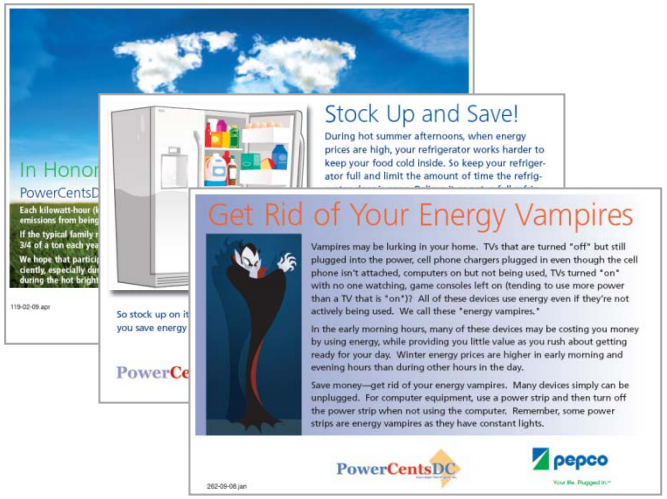
Three informational meetings

- One for each pricing group

During the course of the pilot

- Electric Usage Reports
- Monthly energy savings tips
- Consumer engagement website
- Smart thermostat in home display

Blog



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Electric usage report

Comes each month with bill

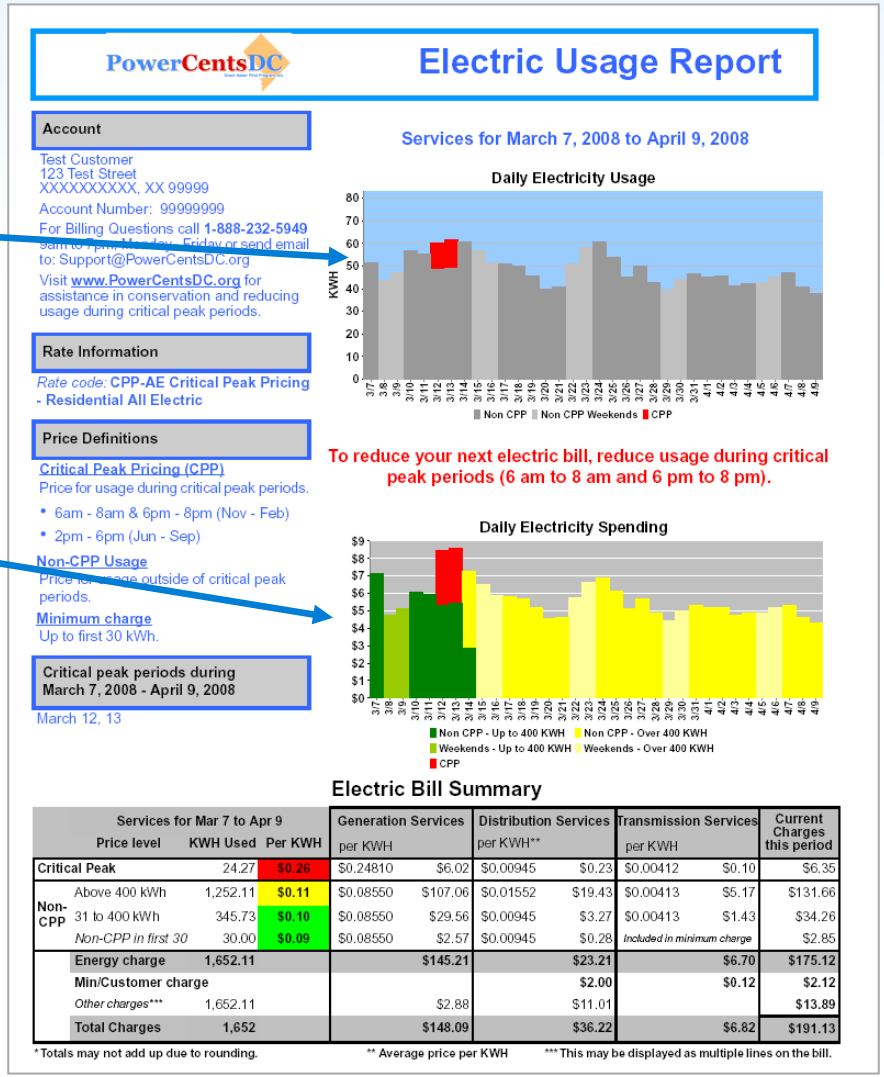
Shows detail on usage

- By day
- During critical periods

Shows detail on spending

- In parallel with usage
- Tier 1 and Tier 2 costs

Colorful graphs for quick reference



PowerCentsDC

Electric Usage Report

Account

Test Customer
123 Test Street
XXXXXXXXX, XX 99999
Account Number: 99999999
For Billing Questions call **1-888-232-5949** 8am to 4pm, Monday - Friday or send email to: Support@PowerCentsDC.org
Visit **www.PowerCentsDC.org** for assistance in conservation and reducing usage during critical peak periods.

Rate Information

Rate code: **CPP-AE Critical Peak Pricing - Residential All Electric**

Price Definitions

Critical Peak Pricing (CPP)
Price for usage during critical peak periods.
- 6am - 8am & 6pm - 8pm (Nov - Feb)
- 2pm - 6pm (Jun - Sep)

Non-CPP Usage
Price for usage outside of critical peak periods.

Minimum charge
Up to first 30 kWh.

Critical peak periods during March 7, 2008 - April 9, 2008

March 12, 13

Services for March 7, 2008 to April 9, 2008

Daily Electricity Usage

To reduce your next electric bill, reduce usage during critical peak periods (6 am to 8 am and 6 pm to 8 pm).

Daily Electricity Spending

Electric Bill Summary

Services for Mar 7 to Apr 9	Price level	KWH Used	Per KWH	Generation Services per KWH		Distribution Services per KWH**		Transmission Services per KWH		Current Charges this period
Critical Peak		24.27	$0.26	$0.24810	$6.02	$0.00945	$0.23	$0.00412	$0.10	$6.35
Non-CPP	Above 400 kWh	1,252.11	$0.11	$0.08550	$107.06	$0.01552	$19.43	$0.00413	$5.17	$131.66
	31 to 400 kWh	345.73	$0.10	$0.08550	$29.56	$0.00945	$3.27	$0.00413	$1.43	$34.26
	Non-CPP in first 30	30.00	$0.09	$0.08550	$2.57	$0.00945	$0.28	*Included in minimum charge*		$2.85
	Energy charge	**1,652.11**			**$145.21**		**$23.21**		**$6.70**	**$175.12**
	Min/Customer charge						**$2.00**		**$0.12**	**$2.12**
	*Other charges****	1,652.11			$2.88		$11.01			**$13.89**
	Total Charges	**1,652**			**$148.09**		**$36.22**		**$6.82**	**$191.13**

*Totals may not add up due to rounding. ** Average price per KWH *** This may be displayed as multiple lines on the bill.

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Consumer engagement software

Web 2.0 dashboard

- Minimal charts
- Large headings
- Not too much text

Usage

- Month to date
- Compared to last month

Pushed data

- Alerts
- Usage reports

Context

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Price response results from PowerCentsDC

- Higher price differentials led to greater peak demand reductions

Price Plan	Summer Peak Reduction	Winter Peak Reduction
CPP	34%	13%
CPR	13%	5%
HP	4%	2%

- Participants at all income levels responded to the price signals

CPR Participants by Income Level	Summer Peak Reduction
Residential	13%
Residential with Limited Income	11%

Automation and weather

Smart thermostats caused larger reductions

Rate Group	No Smart Thermostat	With Smart Thermostat
R-CPP	29%	49%
R-CPR	11%	17%
AE-CPP	22%	51%
AE-CPR	6%	24%

Higher temperatures caused larger reductions

Rate Group	Peak Reduction At 85°F	At 97°F
CPP	26%	43%
CPR	8%	20%
HP	3%	3%

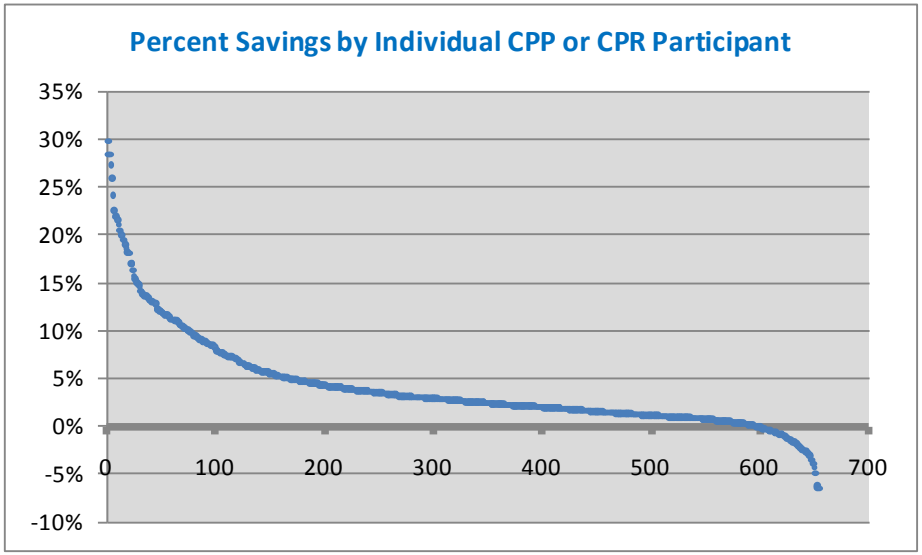
Bill savings

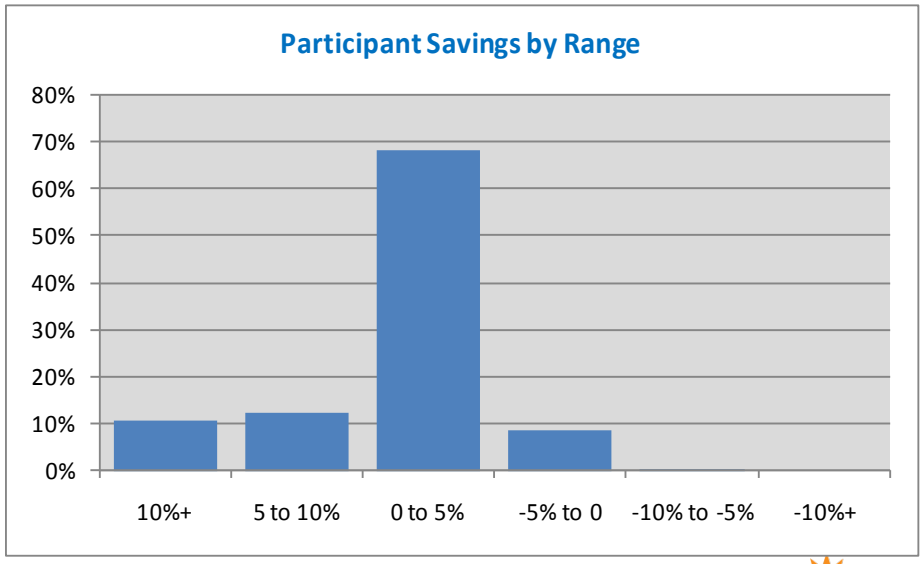
Prices designed to be revenue neutral

- Average customer pays same bill if no peak load reduction
- Strategy failed for HP prices due to rapidly declining PJM prices

Analysis for CPP and CPR only

- **91% of participants saved money**
- Average 12-month savings was $43.83 (4%)
- Average 12-month bill increase for the other 9% was $17.43 (2%)





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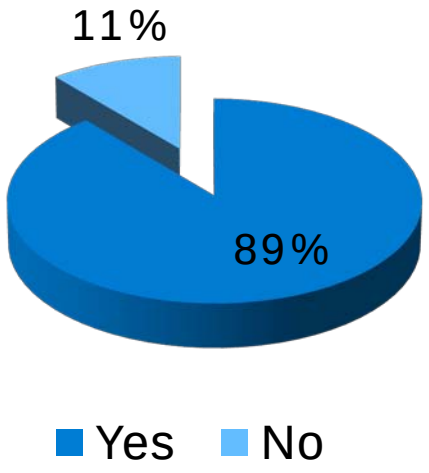
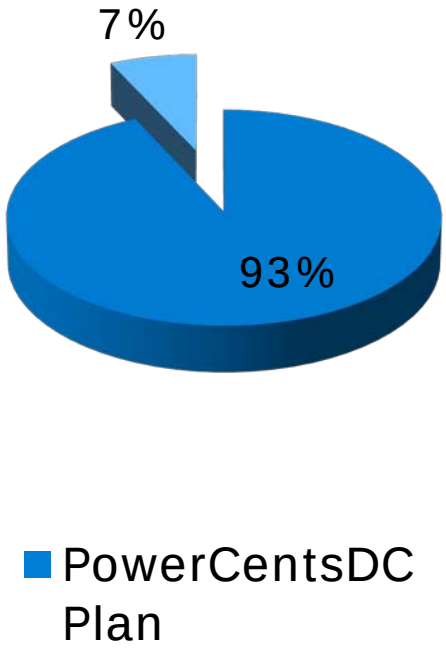
Participant satisfaction

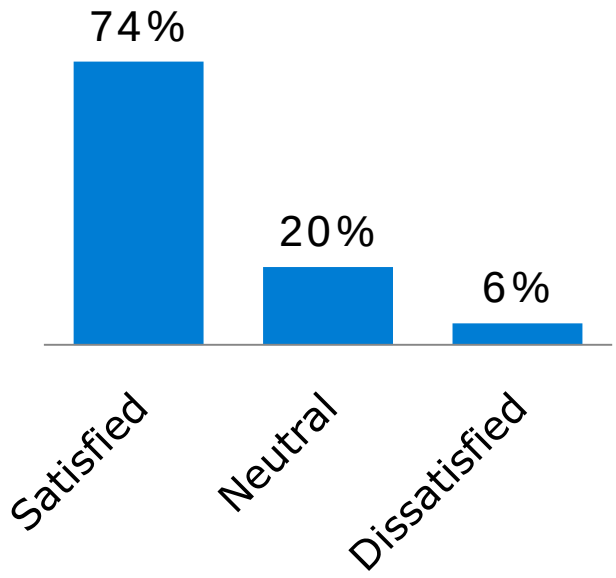
Would you recommend PowerCentsDC electricity pricing to your friends and family?



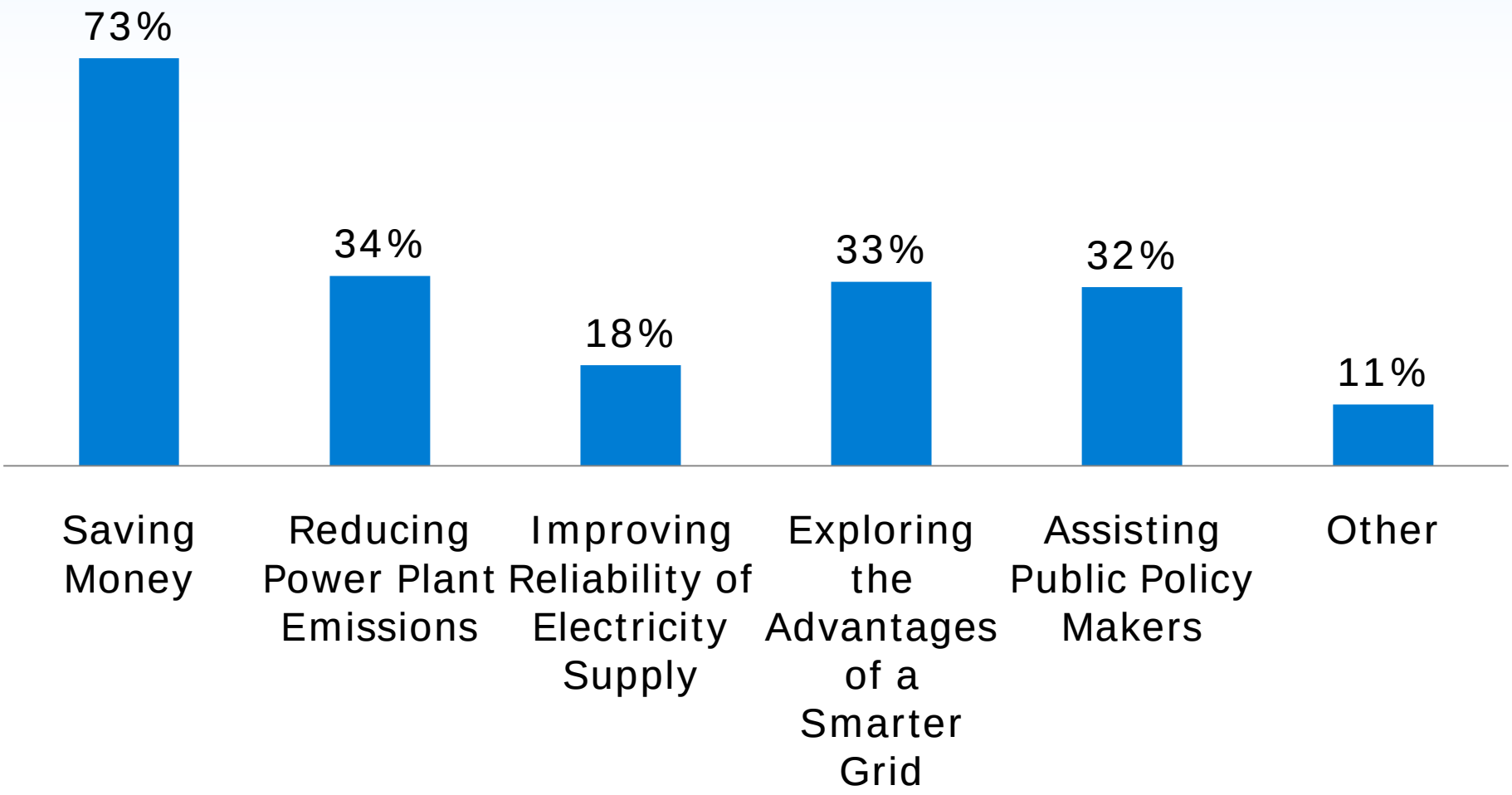
Which price plan did you prefer?



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

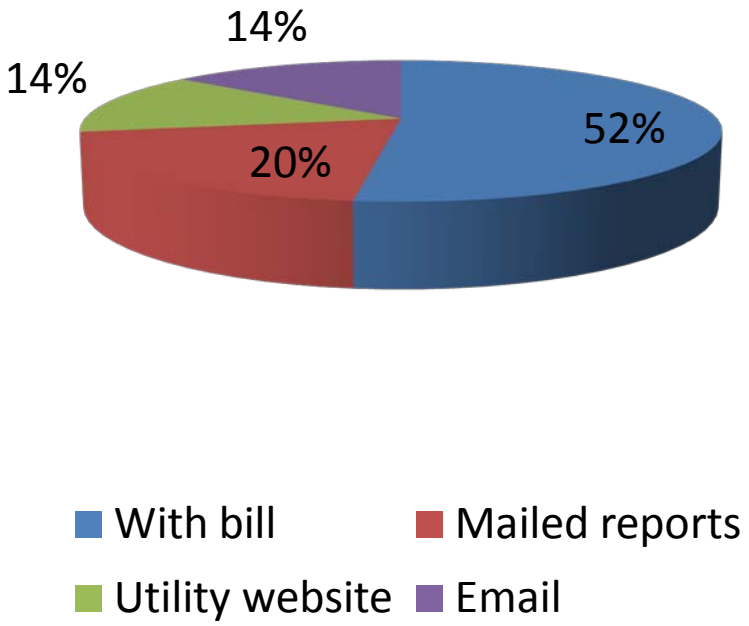


What motivated you to participate in the pilot program?

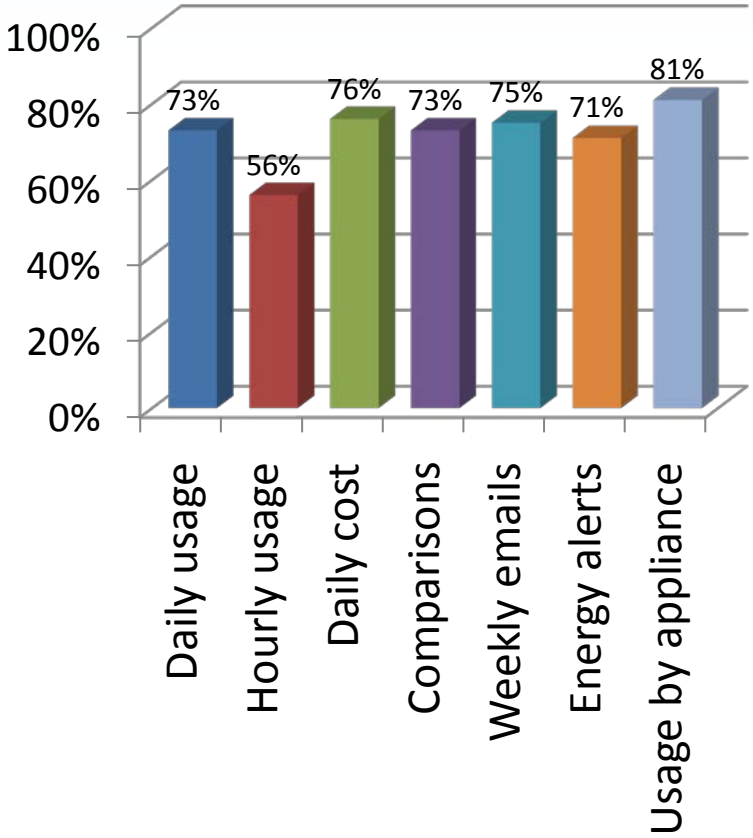


PowerCentsDC Smart Grid pilot survey

Consumers Want Data Pushed to Them



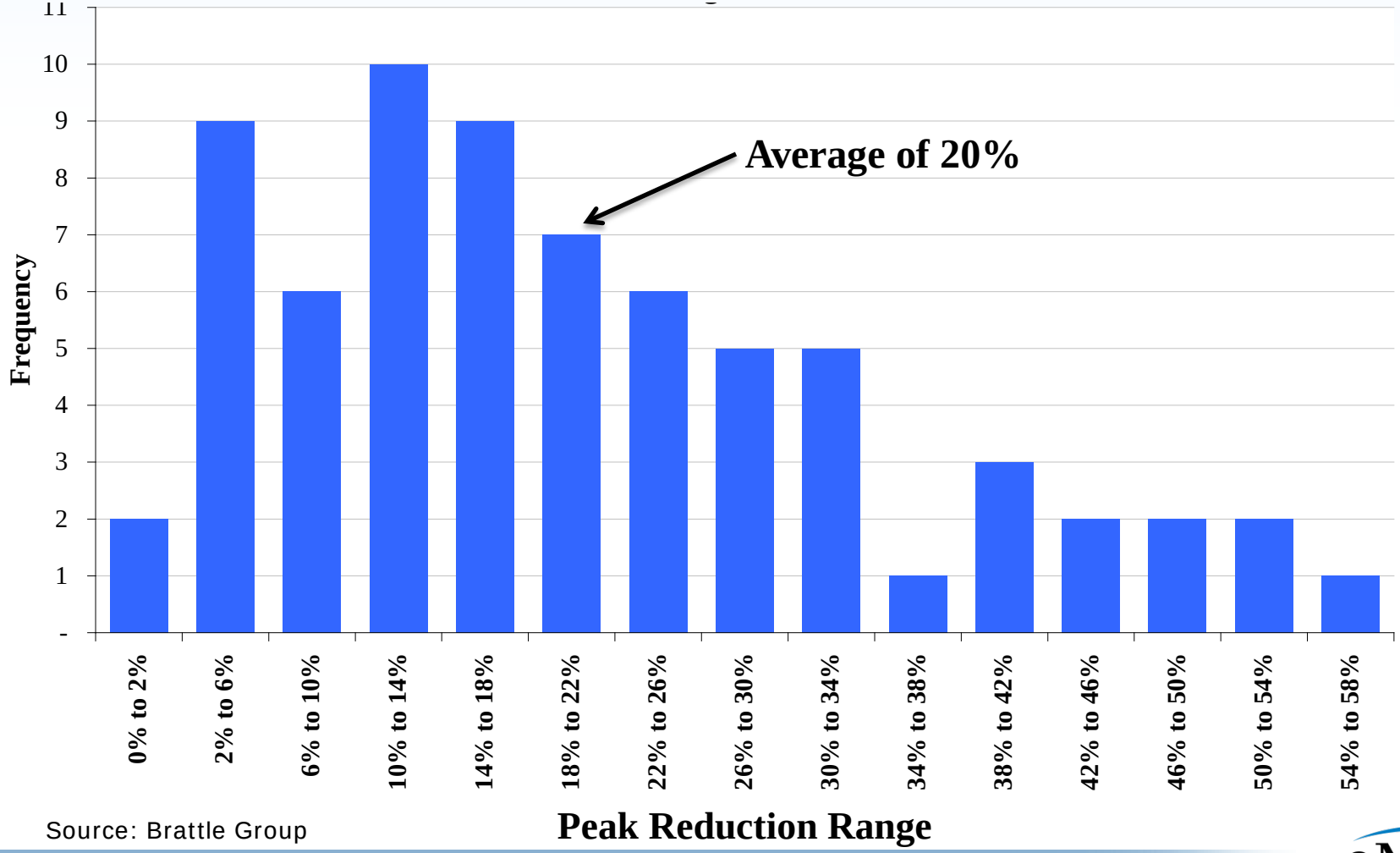
Highest Interest is Usage by Appliance



Source: Smart Meter Pilot Program, Inc.

Other program results

Peak load reductions in 70 dynamic pricing experiments



Source: Brattle Group

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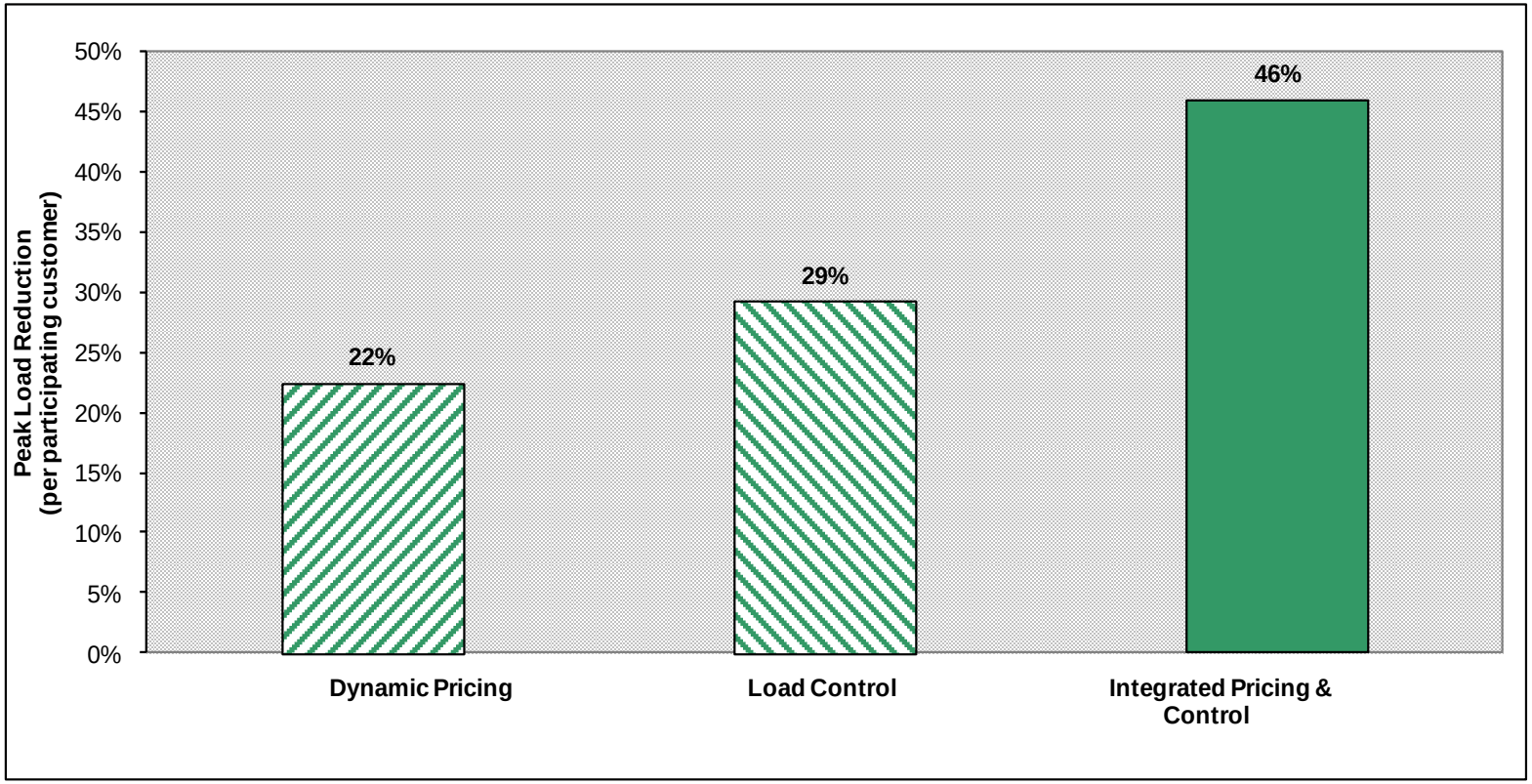
Combining automation and dynamic prices

Meta-study of 24 utility pilot and large-scale programs



Source: eMeter Strategic Consulting

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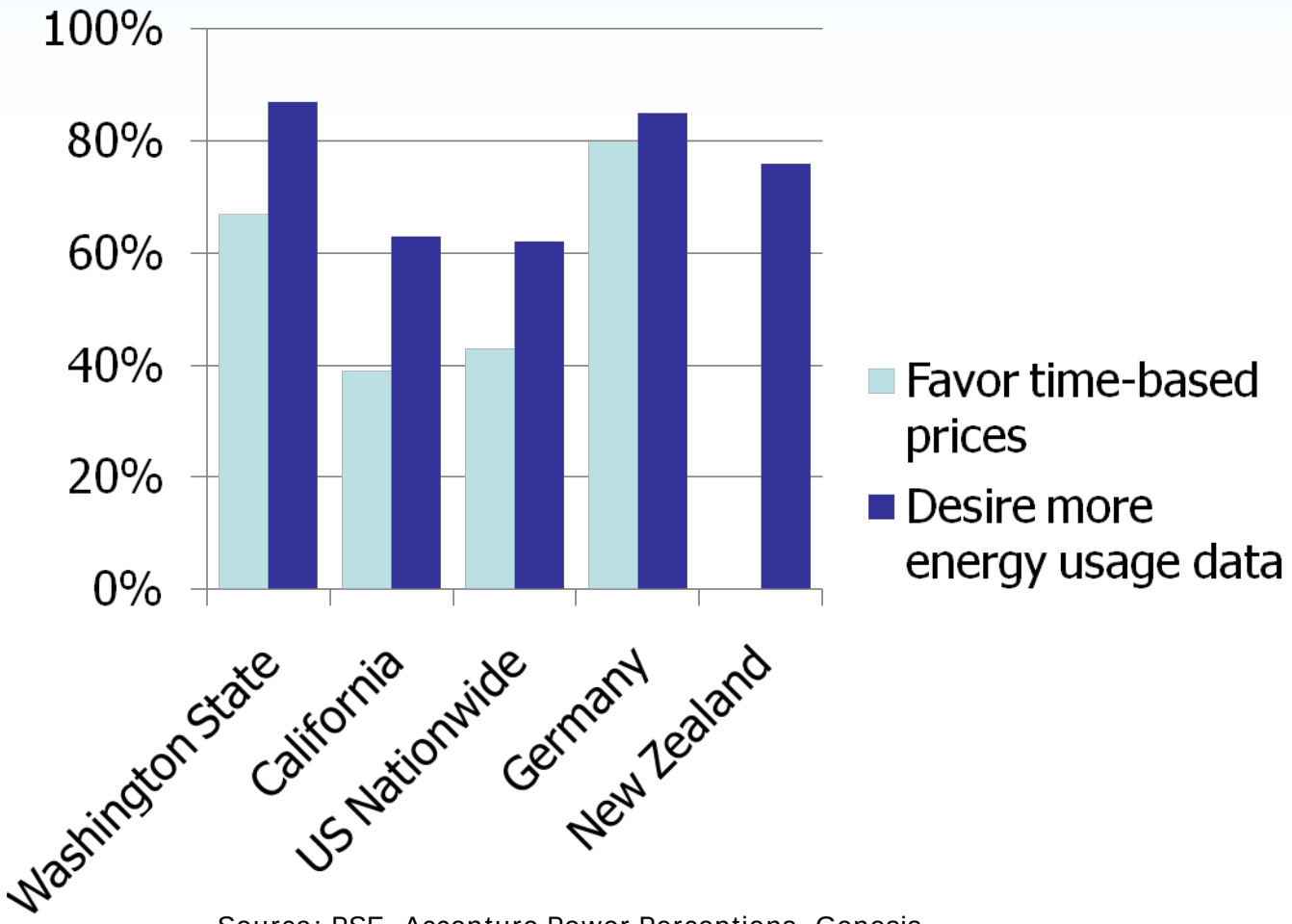
Do consumers generally want pricing choices – and what about information?

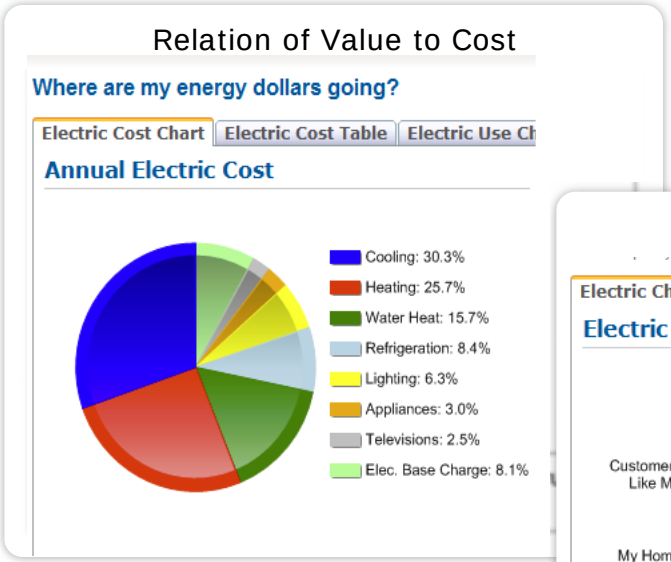


Source: PSE, Accenture Power Perceptions, Genesis

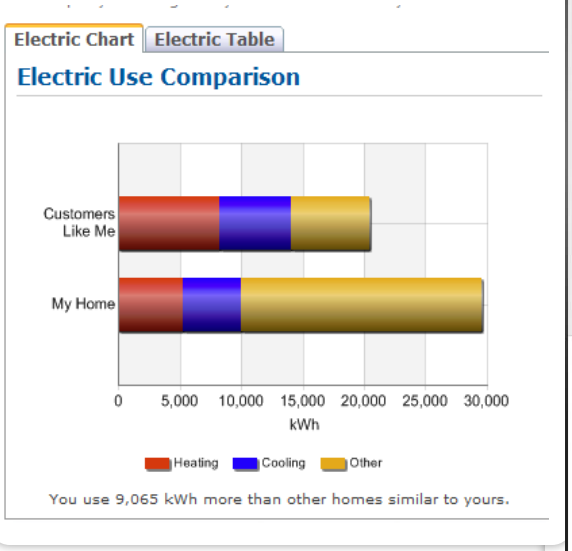
Information empowers consumers

Enhanced information has been shown to help customers manage energy with knowledge of the cost implications of their choices.

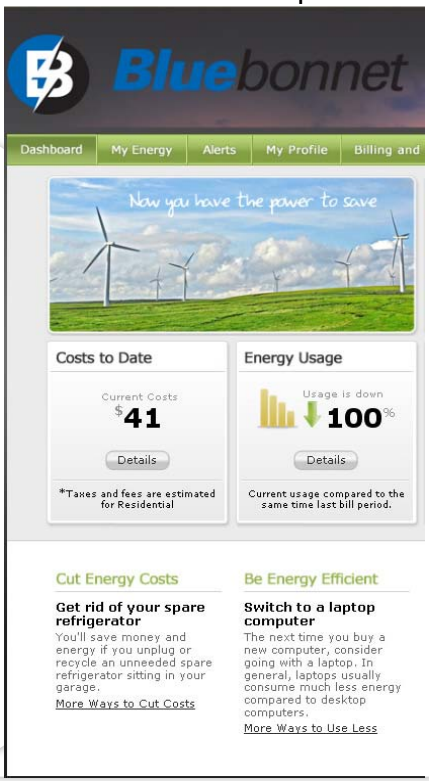
Relation of Value to Cost



Benchmarks



Contextual Tips



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Information feedback effect

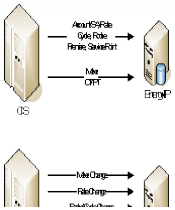
Results from 42 programs of different mechanisms, including in-home displays, websites, bill inserts, and mailed reports.

Direct Feedback Programs	Indirect Feedback Programs	Total Programs	Savings
3		3	20%
	1	1	20% of peak, weekdays
2	1	3	15-19%, Mon-Sat
8	6	14	10-14%
11	3	14	5-9%
4	3	7	0-4%
Weighted average savings			**9.4%**

Source: eMeter Strategic Consulting

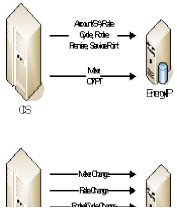
PowerCentsDC Data Architecture

Interval data

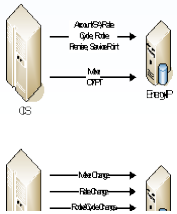


Smart meter head end

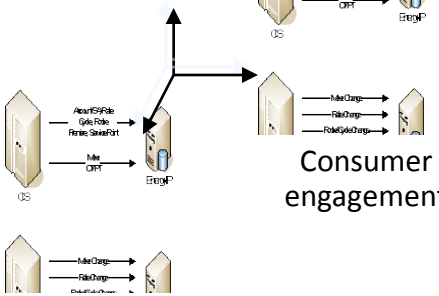
Prices, usage & bill MTD, events, control commands



Load control head end



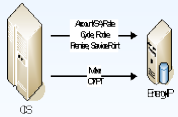
MDM



Consumer engagement

Billing/CIS

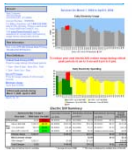
Integrated system



Monthly bill

Pepco Billing

Recruitment, monthly energy report



U.S. Mail

Web

email

Mobile SMS

Voicemail

Cost, usage, carbon data; event notifications; consumer engagement

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Roadmapping the future

Consumer Engagement

Awareness **Influence** **Persistent Behavior Change**

Core Elements

Energy Info & Analytics	Consumer Analytics & Content	Push Services	Demand Response	Intelligent Energy Sourcing
• Usage • Cost • CO_2	• Comparisons • Facts & Tips • What If's • Community	• Alerts • Notifications	• Pricing plans • Load control	• Real-time, best price sourcing

Consumer Access Points

Web

Email

Mobile SMS

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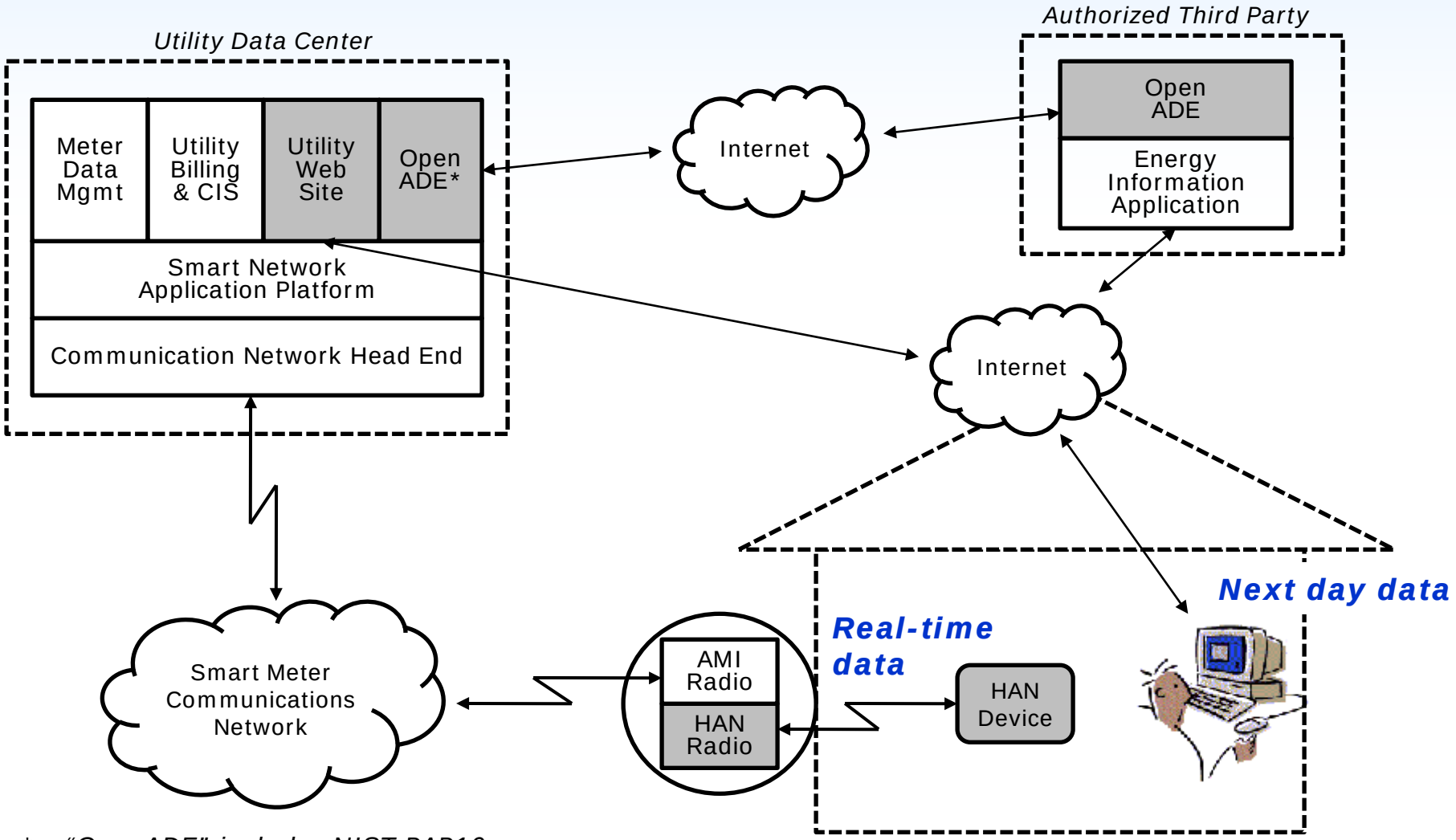
Information standards



** - "OpenADE" includes NIST PAP10 and NAESB ESPI, plus privacy*

Privacy and data access

Draft decision issued by CPUC last Friday

Information access

- Utility: daily update of usage, bill to date, and projected bill; rate comparison; prices; and notifications
- Third parties: with customer authorization, both via OpenADE (voluntary standard) and OpenHAN

Privacy and security

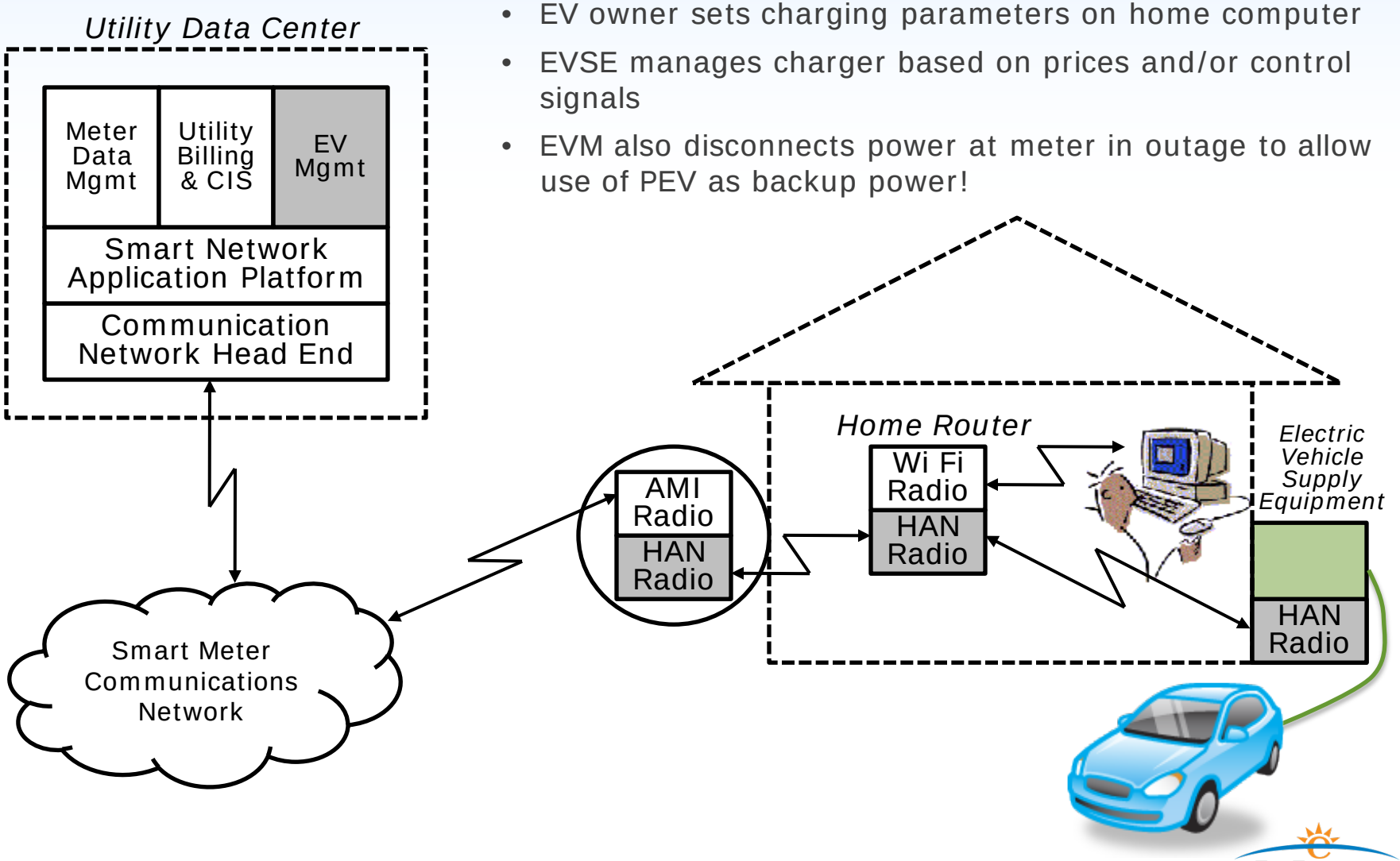
- Third parties must agree to follow CPUC rules

HAN interface

- Utilities must pilot turning on the interface

Combining pricing and control

- Price and/or control signals sent from EVM application
- EV owner sets charging parameters on home computer
- EVSE manages charger based on prices and/or control signals
- EVM also disconnects power at meter in outage to allow use of PEV as backup power!



The consumer's perspective

"All the pieces are needed to make the smart grid work"

Segmentation

- Savers
- Sustainers
- Technophiles
- Ignorers

Applications

- Energy information
- Pricing choices
- Convenience of automation

Technologies

- Smart meters and communications
- Smart thermostats, lighting, appliances, equipment
- Software