



## CEC Load Management Workshop

# The Evolution of Demand Response Technologies

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**Levy Associates**



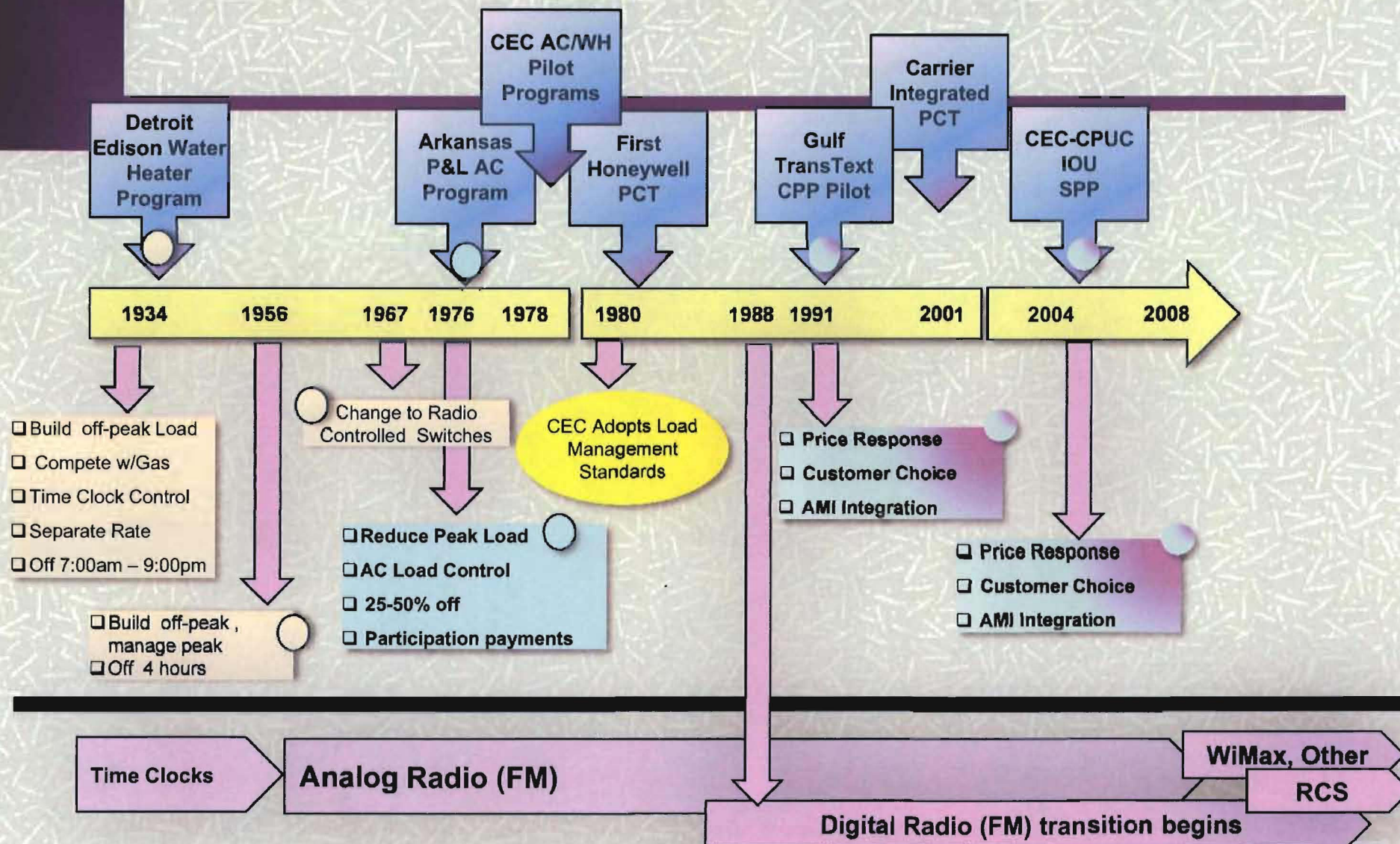
# What do customers want ?

- 1 **Reliable Service**
- 2 **Low Cost**
- 3 **No Blackouts**
- 4 **Customer Choice & Simplicity**





# Evolution of DR – Technology and Programs





# The Vision

## Efficiency and DR Integrated

1

- Efficiency and demand response fully integrated under a unified default tariff / incentive structure.
- Demand Response, like Efficiency a condition of service.
- All customers, all load participates.

2

- Major appliances come “DR Ready” from the factory.
- All buildings are “DR Enabled” .








3

- Rates that are easily understood, that create a cause and effect relationship between customer actions and customer costs
- Prices that are actionable under consumer preferences





# Today – DR is A Limited Resource

	Evaluation Criteria	Direct Control	Price Response
1	Customer Choice		
2	Economic Response		
3	Reliability Response		
4	Sustainable		
5	Cost		



Top rated performance, proven, sustainable effectiveness



Moderate performance, limited but acceptable effectiveness



Limited performance, variable, uncertain effectiveness





# Demand Response - What's Different ?

## DR Today

- Separate programs
- Separate incentives
- Pushed into market
- Focused on generation
- Designed for the utility not the customer

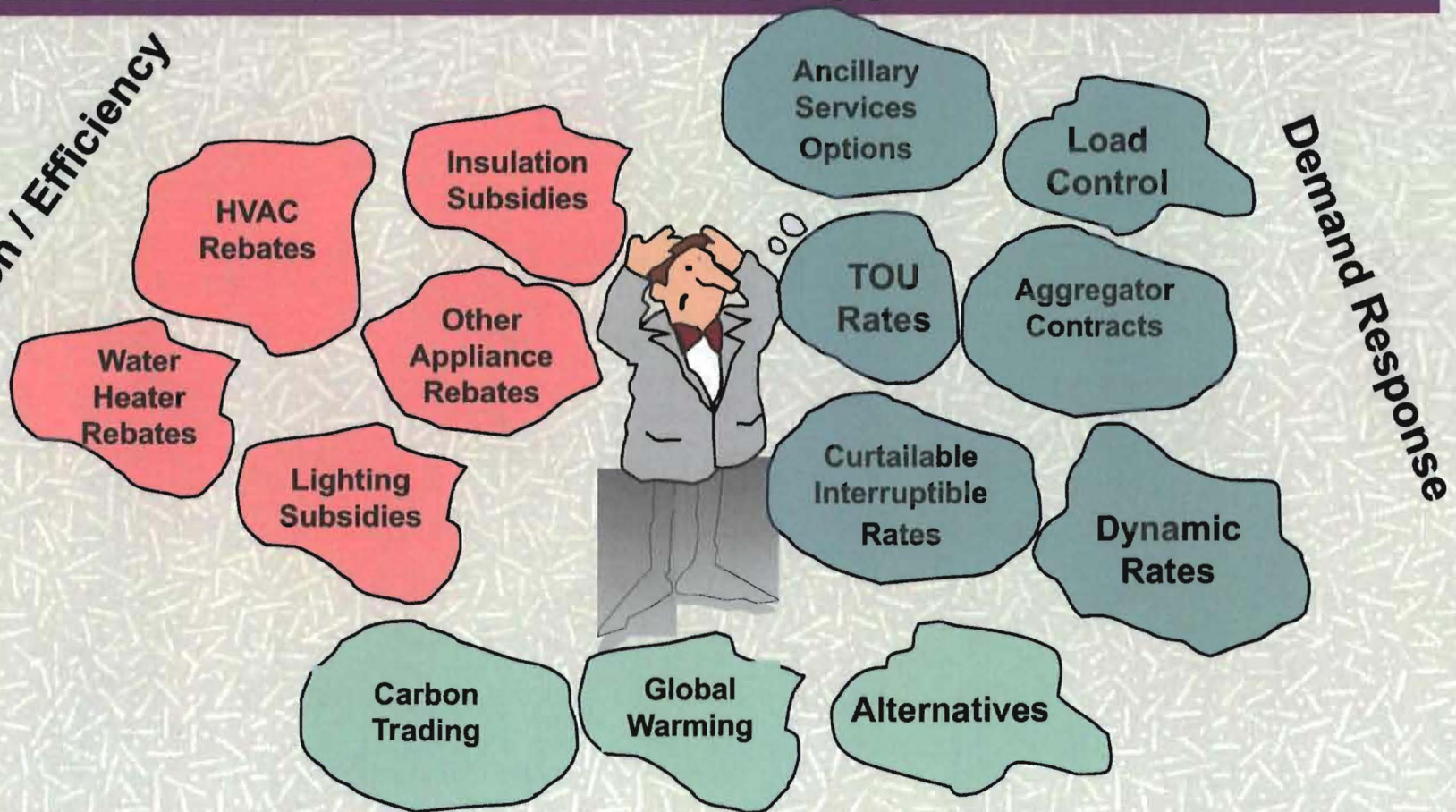
## A Better Vision

- DR as a system wide, integrated resource
- Market driven
- Wholesale-Retail integration
- DR for generation and distribution management
- DR for economic & reliability
- Designed for the customer not the utility



# What to Do ?

Conservation / Efficiency



Global Warming



# The Market Model for Load Management

The Benchmark  
Customer Model  
Efficiency



	Utility Model Direct Control	Customer Model Price Response	
Participation	Targeted	All Customers	All Customers
Value of DR	Utility Value	Customer Value	Customer Value
Ownership	Utility	Customers	Customers
Equipment	Few Suppliers	Many Suppliers	Many Suppliers
Customization	Little - None	No Limits	No Limits
Incentives	Participation	Performance	Purchase & Performance
Key Problems	Equity, Sustainability	Rate Design	Performance



# How do you get there... and why?

## “ Three Things “

- 1 Advanced Metering
- 2 Dynamic Rates
- 3 Automation





# **“Thing #1” - Advanced Metering**

## **What**

- **System wide**
- **Communications**
- **Interval Recording**

## **Why**

- **Information and customer education**
- **Support Rates – feedback and performance based incentives**
- **System operations**





## **“Thing #2” – Dynamic Rates**

<b>What</b>	<b>Why</b>
<ul style="list-style-type: none"><li>• <b>Reflect system costs</b></li></ul>	<ul style="list-style-type: none"><li>• <b>Establish a customer value function</b></li><li>• <b>Price signals for economic response</b></li><li>• <b>Reliability signals for emergency response</b></li><li>• <b><u>Customer Choice</u></b></li></ul>

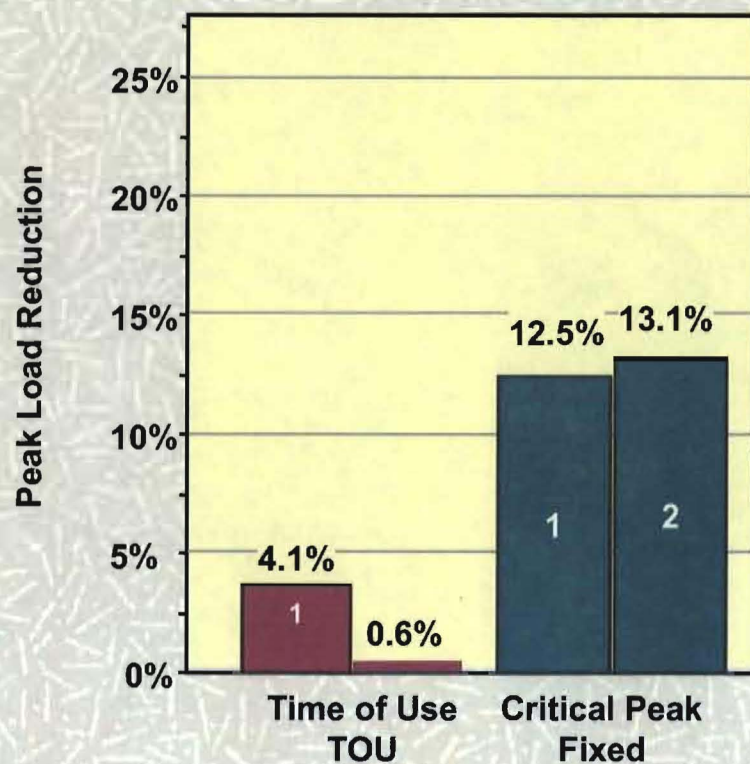




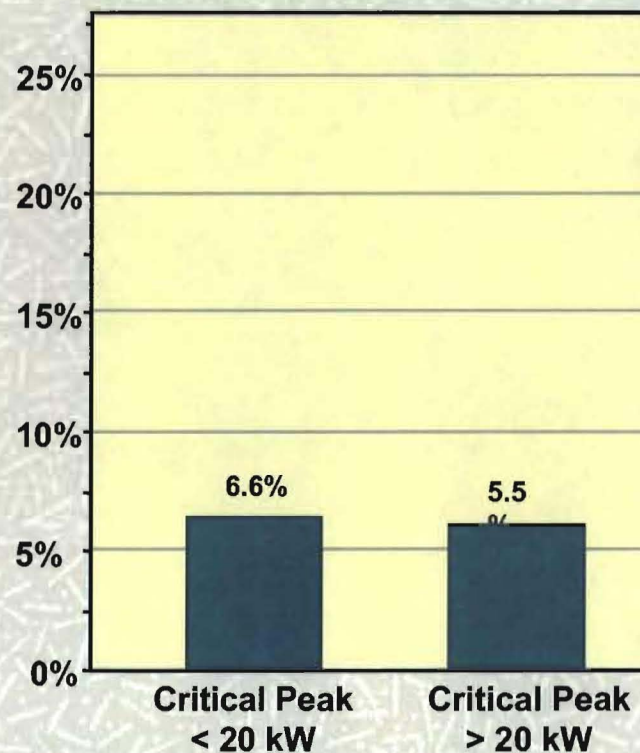
# Customer Response to Price

## Statewide Pricing Pilot

Residential Critical Peak  
Impacts (Years 1 & 2)



Small Commercial  
Critical Peak Impacts

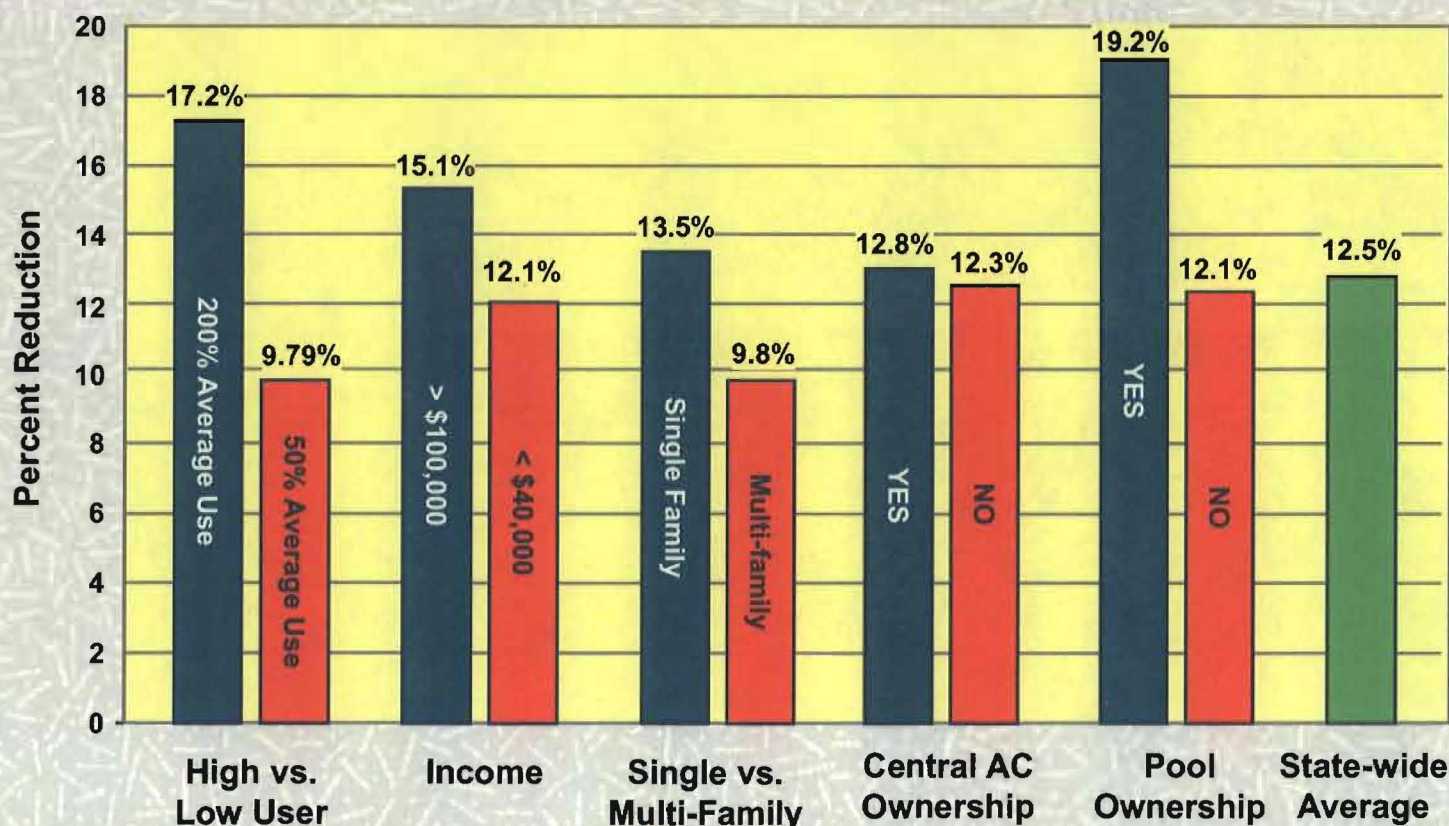




# Customer Response to Price – Residential

## Statewide Pricing Pilot

### All Residential Customers Reduce Peak Load



Source: Statewide Pricing Pilot, Summer 2003 Impact Analysis, CRA, August 9, 2004, Table 5-9, p.90





## **“Thing #3” – Automation**

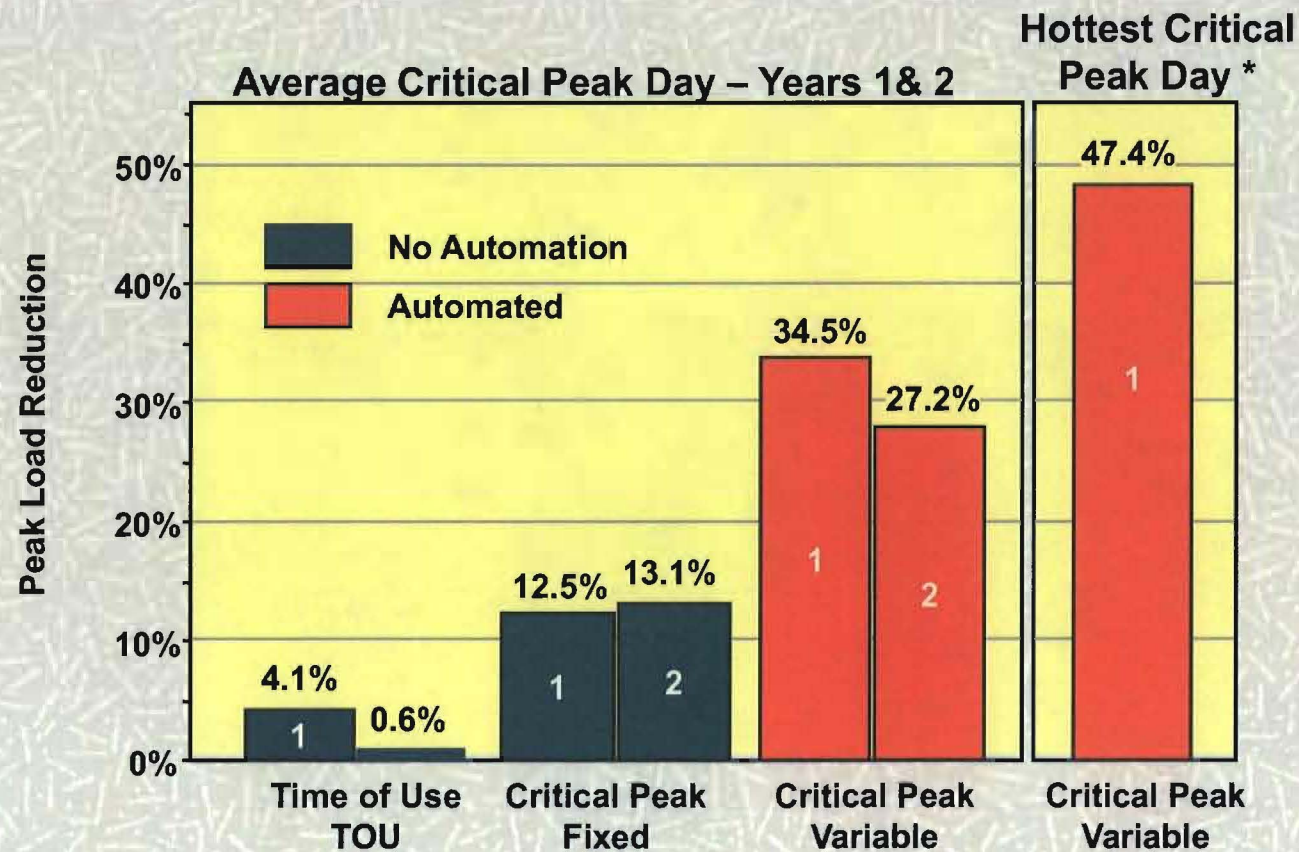
<b>What</b>	<b>Why</b>
<ul style="list-style-type: none"><li>• <b>Enable and simplify customer choice</b></li><li>• <b>Enable <u>price</u> and <u>reliability</u> response</b></li><li>• <b><u>Integrate</u> with system operations</b></li></ul>	<ul style="list-style-type: none"><li>• <b>Customer acceptance</b></li><li>• <b>Expand system potential</b></li><li>• <b>System protection</b></li></ul>





# Customer Response to Price - Residential

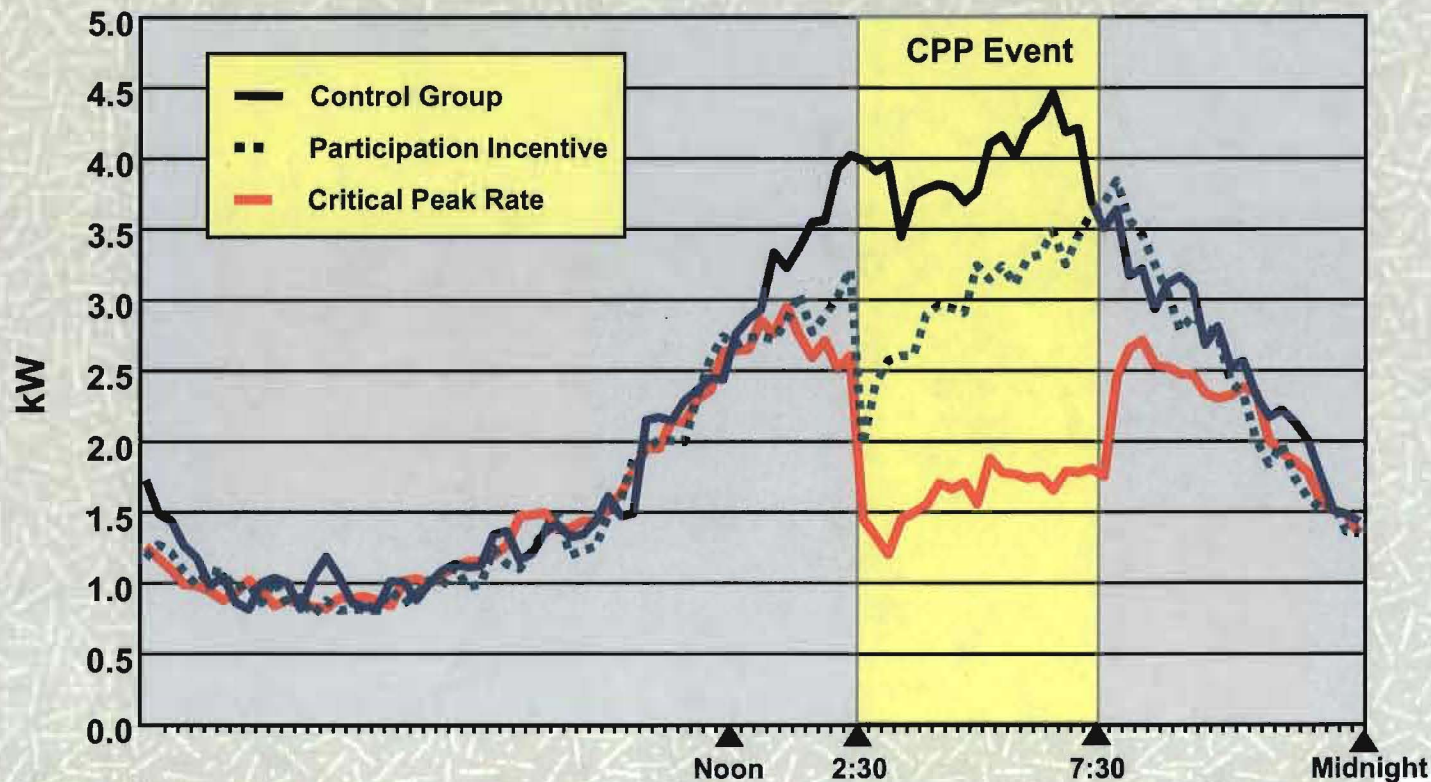
## Residential Critical Peak Impacts





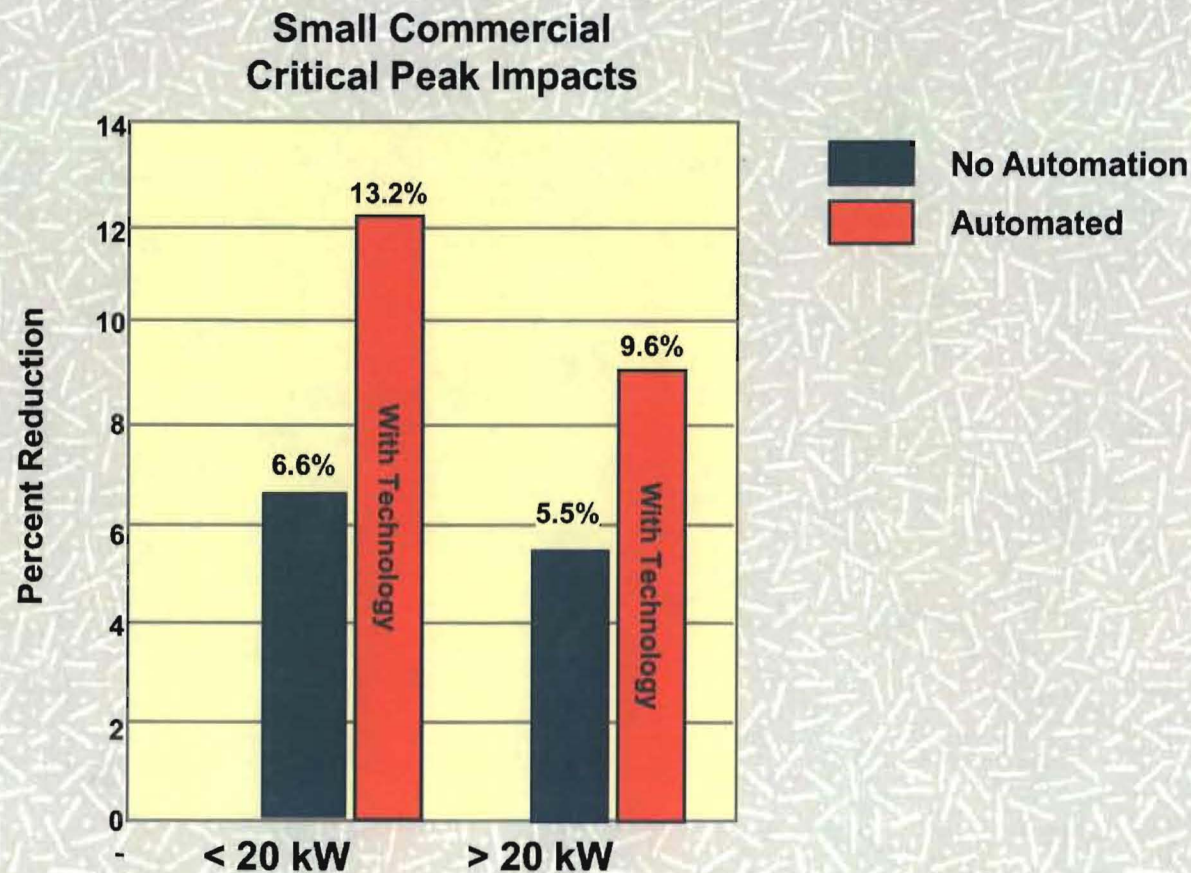
# Customer Response to Price - Residential

## Residential Summer Peak Load Controllable Thermostat and Participation Incentive





# Customer Response to Price – Small C/I

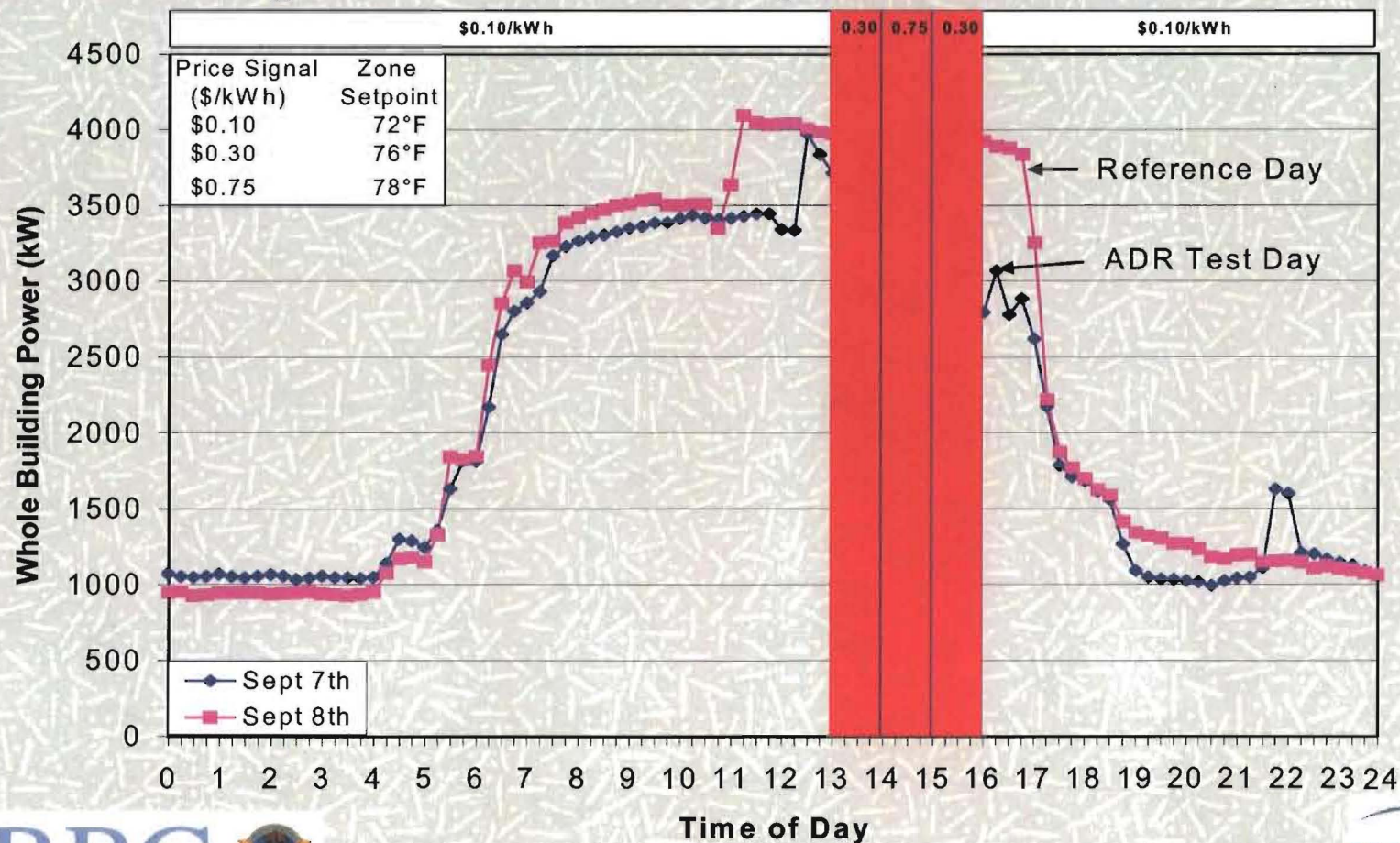




# Customer Response to Price – Large C/I

## AutoDR Results

### Large Commercial Building (Summer 2004, 90 F Day)





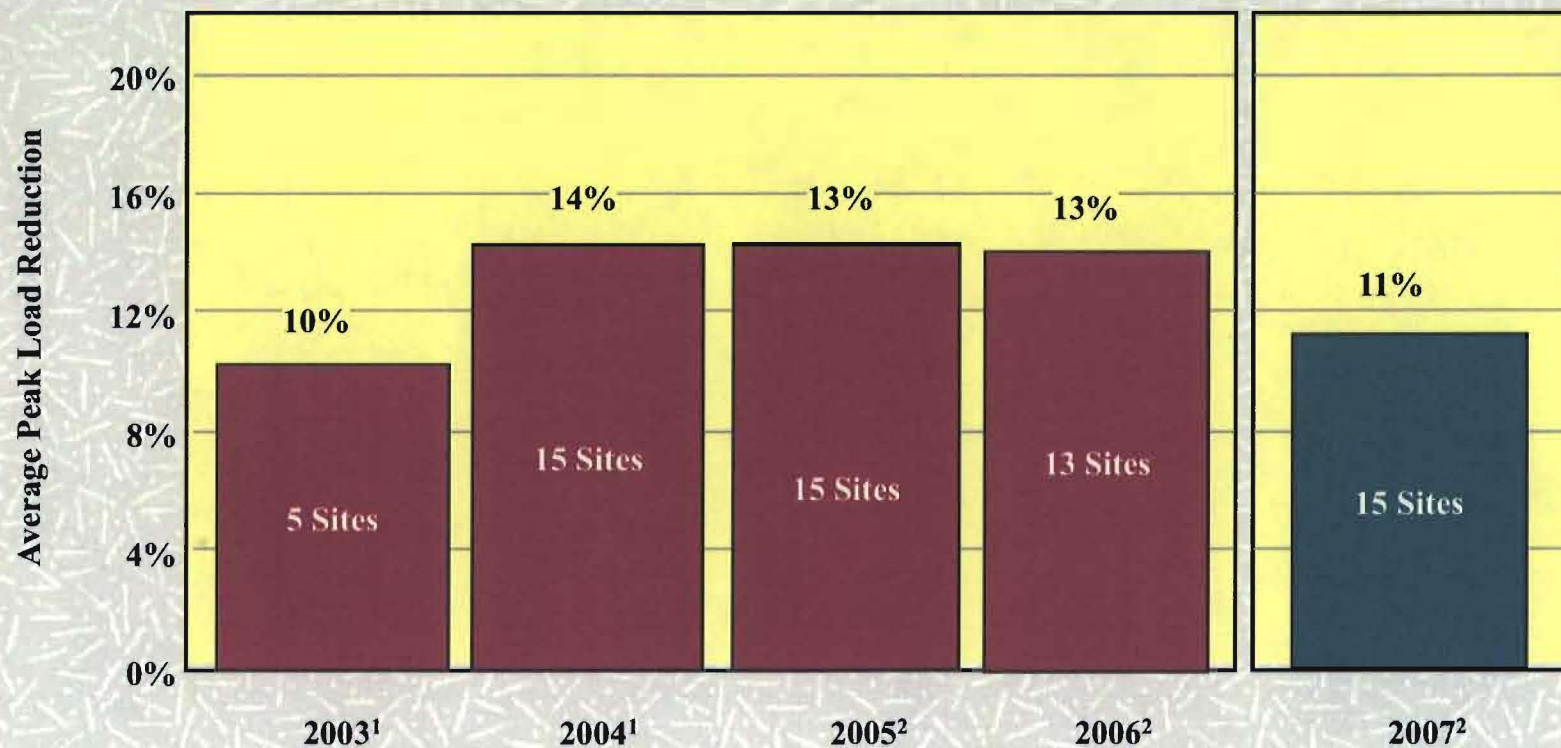
# AutoDR Summary Results - 2007

CPUC ACR Objectives	2006	2007 Installed	2007 In-Process	2007 Total
<b>1. <u>Accelerate Implementation</u></b> <ul style="list-style-type: none"> <li>▪ Commercial participants</li> <li>▪ Industrial participants</li> <li>▪ Peak Load Reduction</li> </ul>	13 0 1 MW	125 3 18 MW	16 8 7 MW	152 25MW
<b>2. <u>Expand AutoDR beyond CPP</u> to other DR options</b>	CPP only	CPP, DBP, CBP		
<b>3. <u>Expand the role of Technical Providers</u></b>	none	8 industry participants		
<b>4. Improve DR performance (Peak Reduction)</b> <ul style="list-style-type: none"> <li>▪ Commercial</li> <li>▪ Industrial</li> <li>▪ Aggregate All Participants</li> </ul>	13% -- --	23% 46% 31%	12% 66% 37%	21% 52% 34%



# Continuity / Reliability of Customer Response

Average Peak Reduction for AutoDR Customers Continuing in 2007



1 - Customer response to test signals

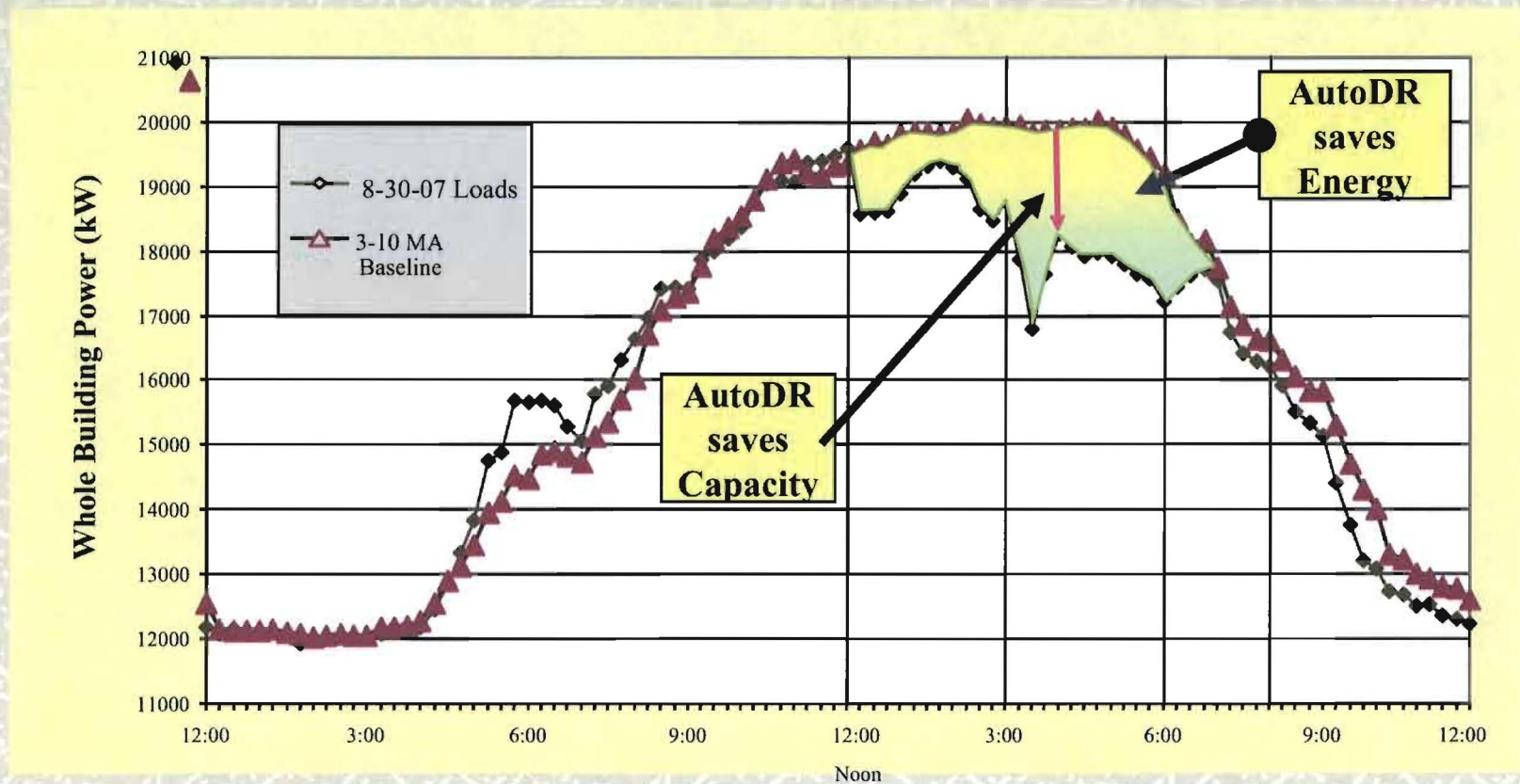
2 - Customer response to CPP rate price signals.





# Auto-DR Load Impact – 8/30 Non-Industrial

PG&E AutoDR Test Day – Non-Industrial AutoDR Participants





# Auto-Demand Bid Performance

Date of DBP Event	Number of Participating Sites	Estimated Load Shed (kW)	Actual Load Shed (kW)		Actual as Percent of DBP Baseline
			DBP Baseline		
			Max 2 Hour	2pm-6pm Avg	
8/30/07	11	10,850	10,674	10,416	98%





## C/I Customers on CPP With and Without AutoDR





# Customer Response to Price – Large C/I

## AutoDR Results

Company	Avg. kW Reduction (3 hr. shed)	Bldg. Load Percent Reduction	Non-Coincident Max kW Reduction	Events (2003-4/2005)	One-time Setup Cost
ACWD	52	20%	84	4 (0)	\$12,824
B of A	111	2%	227	3 (4)	\$1,614
Chabot	18	5%	46	3 (1)	\$4,510
50 Douglas	61	21%	85	4 (4)	\$2,000
2530 Arnold	61	16%	92	1 (3)	\$2,000
Echelon	78	25%	110	4 (3)	\$3,620
Gilead	71	10%	208	4 (1)	\$7,500
IKEA	219	12%	272	2 (0)	\$5,050
Oracle	45	10%	65	1 (0)	\$375
Target	33	10%	56	4 (1)	\$3,312
USPS	202	15%	265	0 (2)	\$12,000
<b>Summary</b>	<b>951</b>	<b>13.4%</b>		<b>49</b>	<b>\$57.62 / kW</b>



# How – New Technology Options

Commercially Available

Programmable  
Communicating  
Thermostat



\$300

CEC PCT Cost  
Effectiveness Benchmark

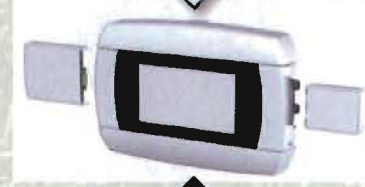
Programmable  
Communicating  
Thermostat



\$200

CEC PCT First Release  
Commercially Available

Programmable  
Communicating  
Thermostat

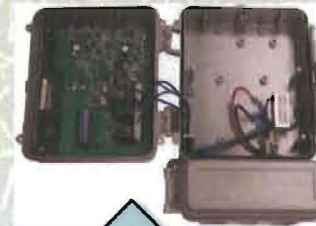


\$100

\$0

## Demand Response Equipment Evolution

- ☐ Switches to thermostats
- ☐ Thermostats to embedded controls
- ☐ Utility to customer control



Conventional Air  
Conditioner Control  
Switch

Commercially Available

PCT  
Embedded  
Controls

Projected





# Contact Information

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