



# **Demand Response Research Center Accomplishments and Future Directions**

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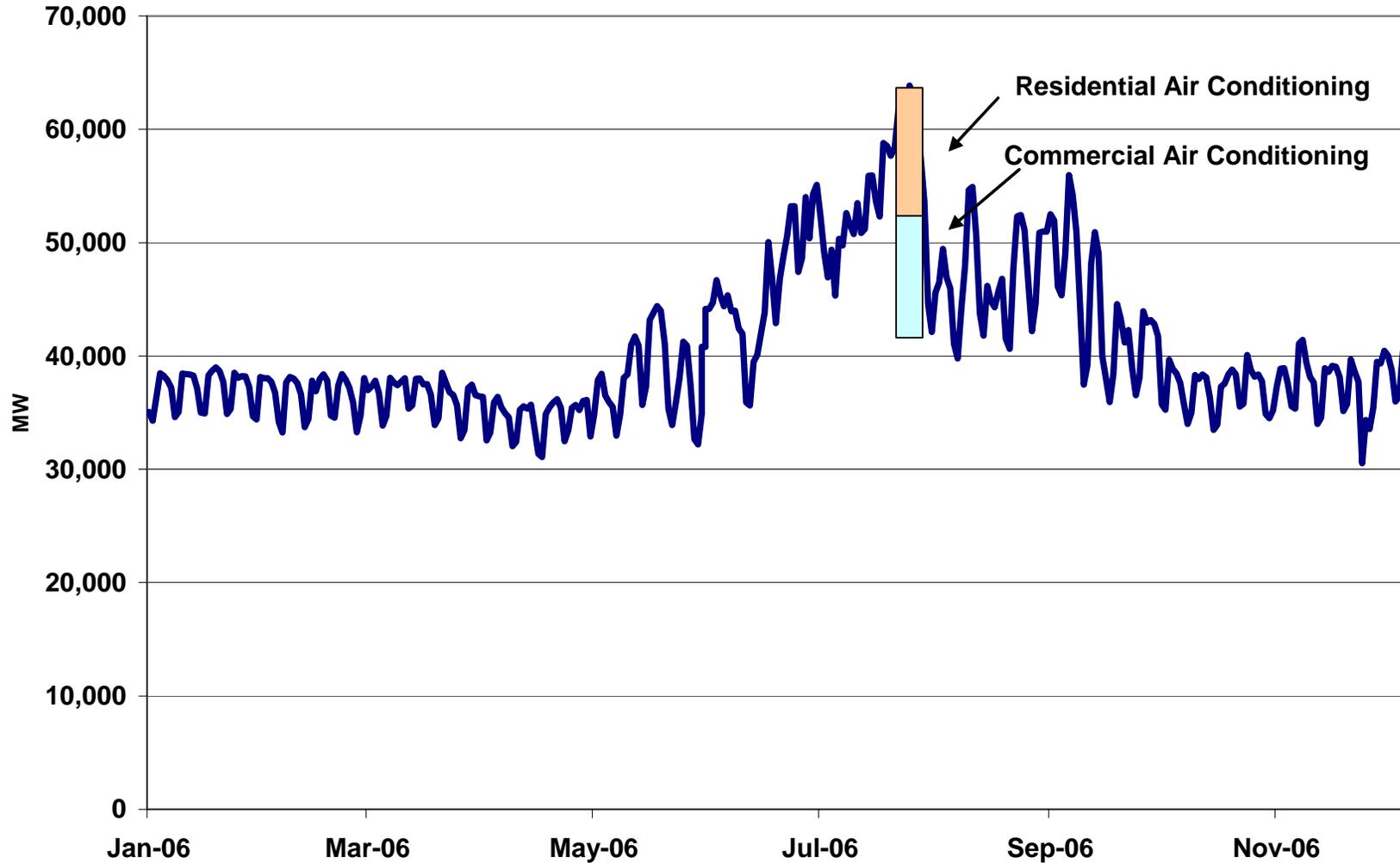
**Research Director - Demand Response Research Center**

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# California is Summer Peaking

California Daily Peak Loads -- 2006





# Demand Response Research Center

[drrc.lbl.gov](http://drrc.lbl.gov)

## Objective

To develop, prioritize, conduct, and disseminate multi-institutional research to facilitate DR

## Scope

Technologies, policies, programs, strategies and practices, emphasizing a market connection

## Method

Partners Planning Committee, Annual R&D Plan

## Stakeholders

- State Policy Makers
- Researchers
- Information and Metering System Developers
- Aggregators
- Program Implementers
- Utilities
- Industry Trade Associations
- Building Owners / Operators
- Building Equipment Manufacturers
- End-Use customers





# What Are We Trying to Achieve?

- Joint proceeding – CEC and CPUC (R.02-06-001)
  - Early goal for price sensitive DR: 5% of peak by 2007
- Residential Default CPP
- Small Commercial (< 200 kW) Default CPP
- Medium Commercial (< 999 kW) Default CPP
- Large C&I (> 1 MW) 2-part RTP
- IOU business plans for Automated Meter Infrastructure
- Long term success → DR as business as usual
- Research needs
  - DR value, potential, technologies, programs, policies
  - How much DR do we need? Relation between price response and reliability?



# Key Activities

## Recent and Ongoing Projects

**Project 1**

**Evaluation of RTP  
for Large Users**

**Project 2**

**Demand Shifting  
with Thermal Mass**

**Project 3**

**Automated DR in  
Commercial Buildings**

## New Projects

**Project 4**

**Industrial Strategies  
and DR Automation**

**Project 5**

**Rates Design for DR**

**Project 6**

**DR Behavior– Residential  
and Small Commercial**



# AutoDR Project Background

- **AutoDR Goals**

- Develop a low-cost, fully automated infrastructure to improve DR capability in California
- Evaluate “readiness” facilities to receive common signals
- Evaluate capability of control shed strategies and measurement of sheds to improve future buildings

- **Motivation for Automation**

- Improve repeatability and reliability of DR resource
- Reduce manual DR labor costs
- Harden strategies in software

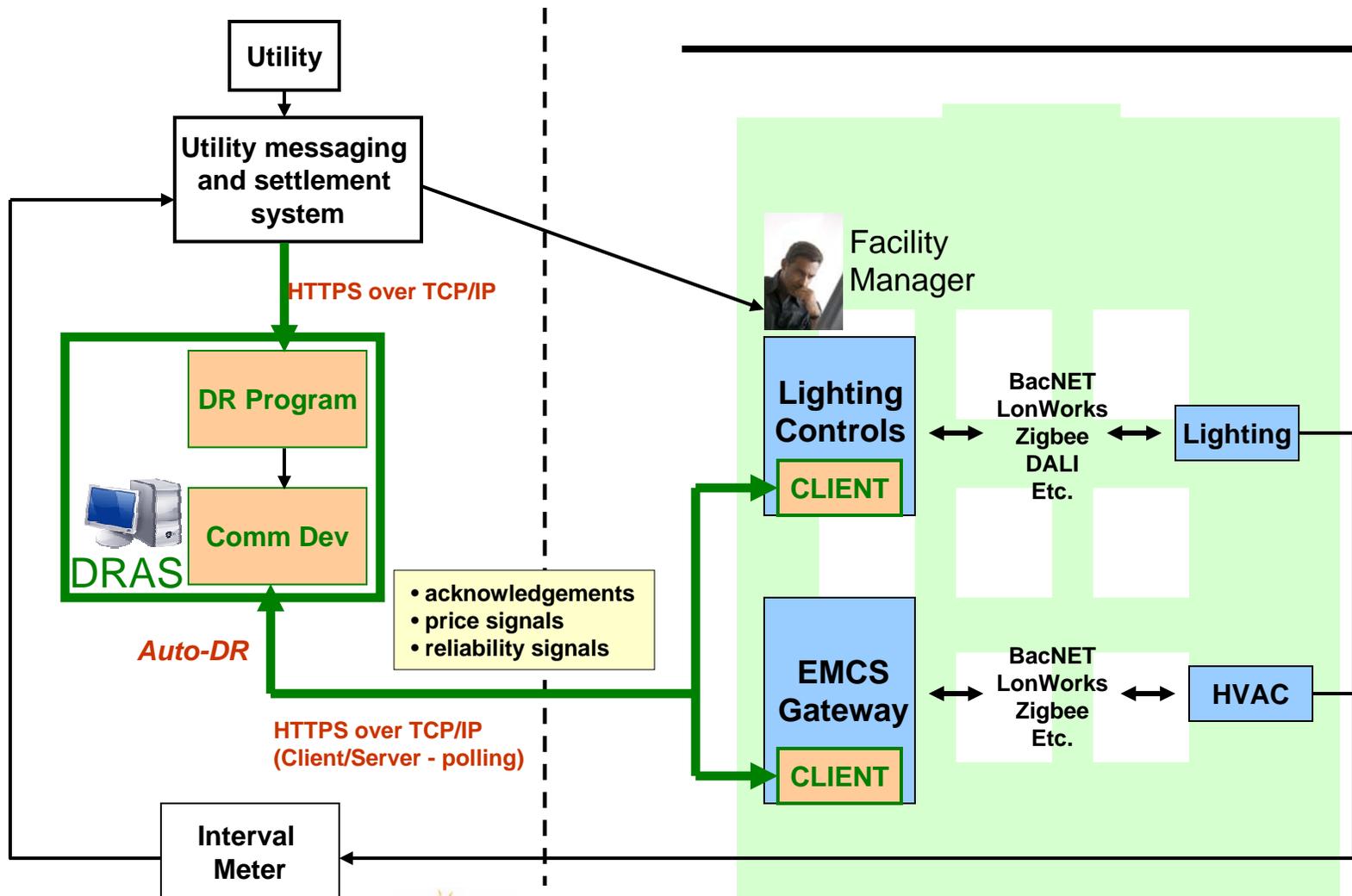




# Automated DR Server and Software Client

Utility Owned

Consumer Owned





# Automated Demand Response Accomplishments

- ❑ Developed and Refined Demand Response Automation Systems
- ❑ Developed connection to Energy Management Control Systems (EMCS)
- ❑ Field Tests – 2 to 12 events per summer

**2003 – 5 sites – Internet link to Energy Information Systems (EIS)**

**2004 – 18 sites – Linked to EIS and EMCS**

**2005 – 12 sites – PG&E Critical Peak Pricing Collaboration**

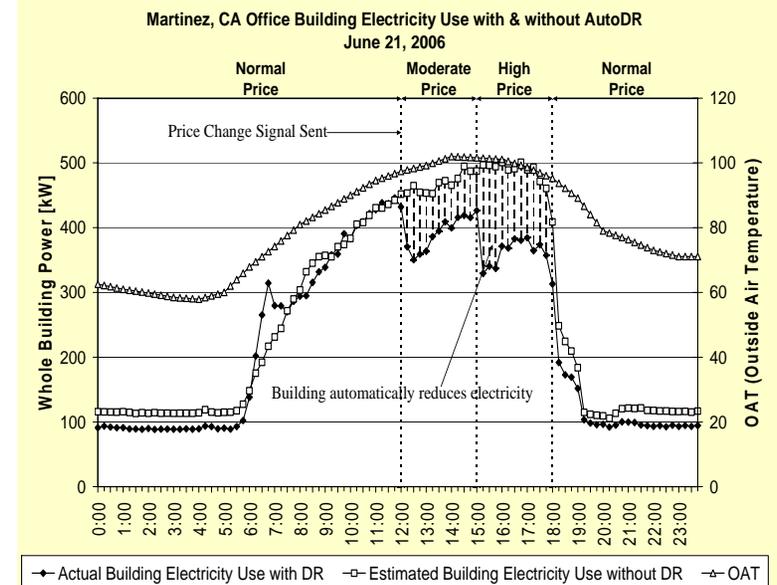
**2006 – 25 sites – PG&E, SDG&E, Planning with SCE**

**2007 – PG&E goal of 200 sites (15 MW)**

– SCE 10-12 sites, mostly industrial

– SDG&E Aggregator Collaboration

- ❑ Worked with over 50 sites
- ❑ 1 GW potential with current technology





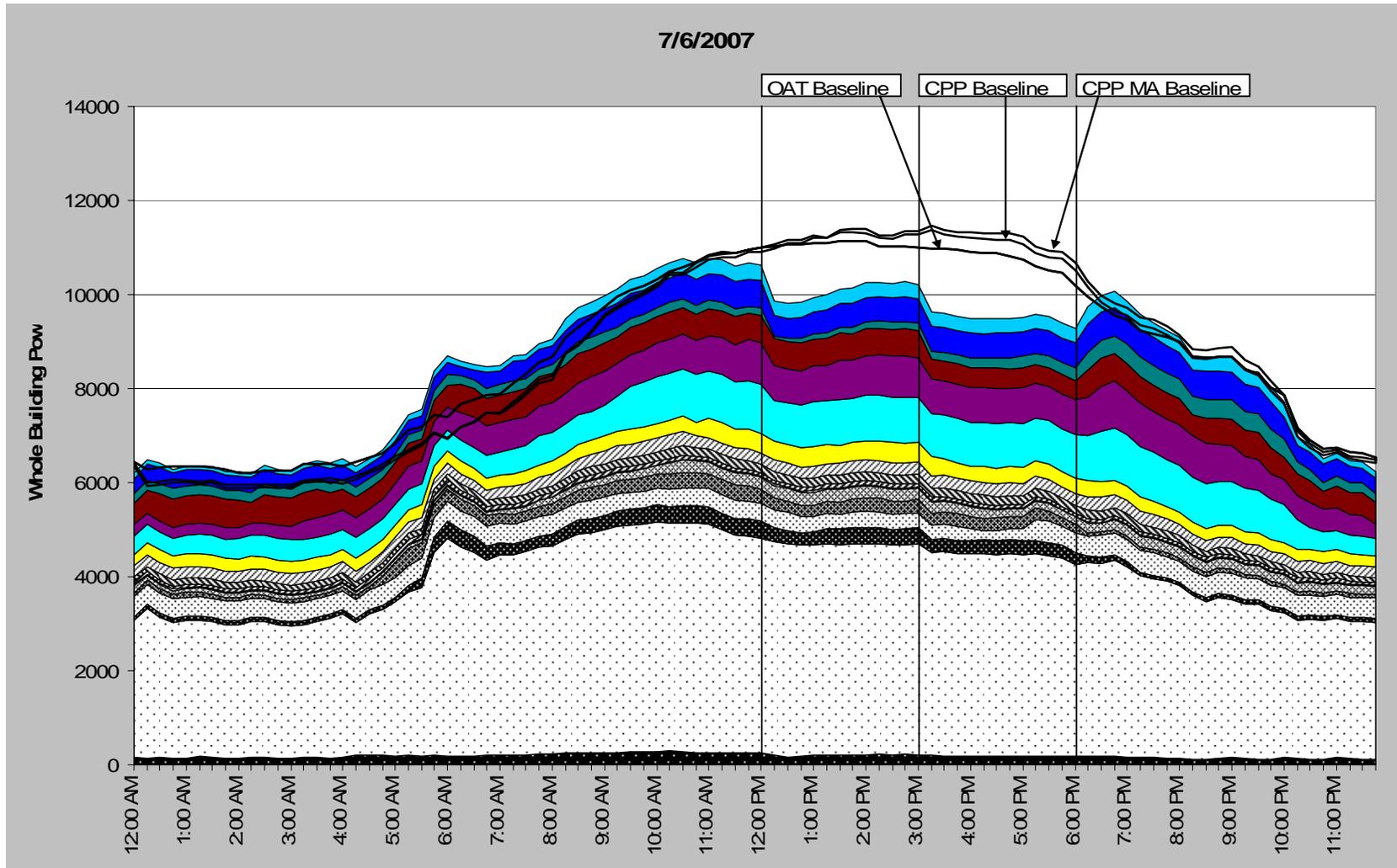
# 2006 Auto-CPP Participants (n=24)

Wide variety of building types

Short Name	Location	CPP Zone	Building Use	# of Bldg	Floor Space		Peak Load kW
					Total	Conditioned	
ACWD	Fremont	2	Office, lab	1	51,200	51,200	348
B of A	Concord	2	Office, data center	4	616,000	708,000	5712
Chabot	Oakland	2	Museum	2	86,000	86,000	336
2530 Arnold	Martinez	2	Office	1	131,000	131,000	536
50 Douglas	Martinez	2	Office	1	90,000	90,000	459
MDF	Martinez	2	Detention facility	1	172,300	172,300	561
Echelon	San Jose	2	Hi-tech office	1	75,000	75,000	523
Centerville	Fremont	2	Junior Highschool	1	N/A	N/A	332
Irvington	Fremont	2	Highschool	1	186,000	186,000	446
Gilead 300	Foster City	1	Office	1	83,000	83,000	288
Gilead 342	Foster City	1	Office, Lab	1	32,000	32,000	495
Gilead 357	Foster City	1	Office, Lab	1	33,000	33,000	662
IKEA EPaloAlto	East Palo Alto	1	Furniture retail	1	300,000	300,000	1466
IKEA Emeryville	Emeryville	2	Furniture retail	1	274,000	274,000	1191
IKEA WSacto	West Sacramento	2	Furniture retail	1	265,000	265,000	1055
Oracle Rocklin	Rocklin	2	Office	2	100,000	100,000	552
Safeway Stockton	Stockton	2	Supermarket	1	65,000	65,000	479
Solectron	Milpitas	2	Office, Manufacture	9	499,206	499,206	4655
Svenhard's	Oakland	2	Bakery	1	101,000	101,000	696
Sybase	Dublin	2	Hi-tech office	2	425,000	425,000	1995
Target Hayward	Hayward	2	Retail	1	130,000	130,000	449
Target Antioch	Antioch	2	Retail	1	140,686	140,686	572
Target Bakersfield	Bakersfield	2	Retail	1	143,941	143,941	645
Walmart Fresno	Fresno	2	Retail	1	125,503	125,503	571
				35	3,714,706	3,806,706	23,235



# Results From 2007 – 7/6 CPP Event





# DR Control Strategies Guide

**Objective:** Evaluate and compare DR strategies in buildings to reduce electric use

## Methods

- Evaluated DR strategies in over 40 commercial buildings
- Developed DR strategies guide for commercial buildings
- Beginning industrial strategies evaluation with utility audits and case studies
- Provided global temperature adjustment strategy for incorporation in Title 24
- Develop DR links to commissioning

## Future Work

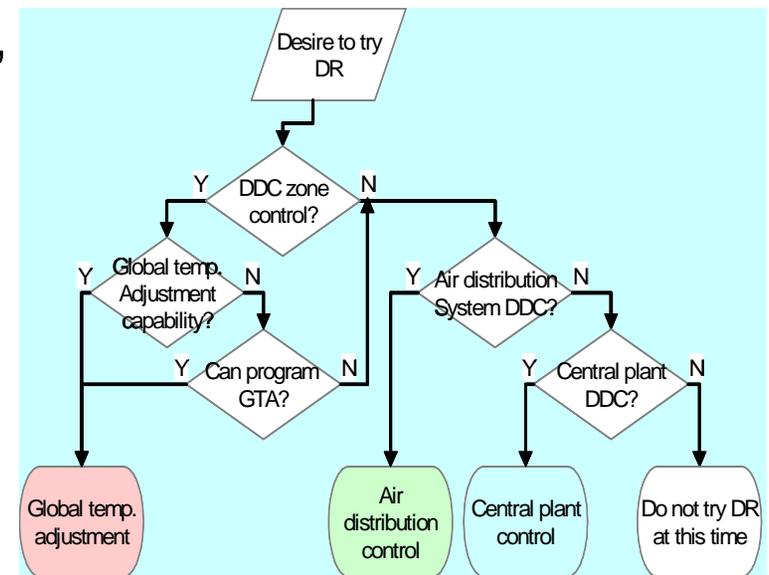
- DR simulation model for DR strategy assessment
- Benchmarking DR response
- Advanced DR lighting
- DR industrial strategy guide

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# Linking DR and Energy Efficiency

- ❑ **Ideal start - good commissioning, retro-commissioning, advanced/new controls**
  - ❑ **HVAC - Direct digital control (DDC) global temperature adjustment**
    - In process for Title 24 2008
    - Closed loop
  - ❑ **Lighting Continuum - Zone Switching, Fixture Switching, Lamp Switching, Stepped Dimming, Continuous Dimming**
  - ❑ **Maybe you “can” use a strategy every day?**





# Pre-Cooling

- **Objectives** – Evaluate capability of pre-cooling to improve comfort and DR capabilities in commercial buildings
- **Team** – UC Berkeley, Purdue University, SCE, and LBNL
- **Findings** – Field tests, simulations, and surveys in 6 large and 1 small building shows good opportunity in many buildings
- **Future Work**– Expand simulation tools to broad DR strategy assessment tools for DR audits





# Rate Design for Capturing Efficiency and Demand Response

## Project Outline

1. Develop a research paper on issues in rate design
  - a) Historical perspective
  - b) Describe existing rate design process
  - c) Evaluate impact California policy on EE and DR objectives
2. Participate in a CPUC rate design workshop
  - a) Two workshops
  - b) Discuss reactions to Rate Issues Paper (above)
  - c) Four topics: Costing, rate design, legislative and political adjustments, consumer rate experience
3. Prepare “straw man” rates  
Illustrate how new design principles can simultaneously achieve state DR and EE objectives while meeting other CPUC regulatory guidelines

# Today – DR is A Limited Resource

Today's Focus

	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



# The Vision – Two Components

## *Policy and Technology Integrated*

