



# Automated Demand Response in Large Facilities

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DRETD TAC Presentation Meeting

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



# Presentation Overview

- ★ **Automated DR Tests in 2003 and 2004**
- ★ **Related Project: Demand Shifting with Thermal Mass**
- ★ **Next Steps in Automating DR**



# Information Management for Auto-DR in Large Facilities

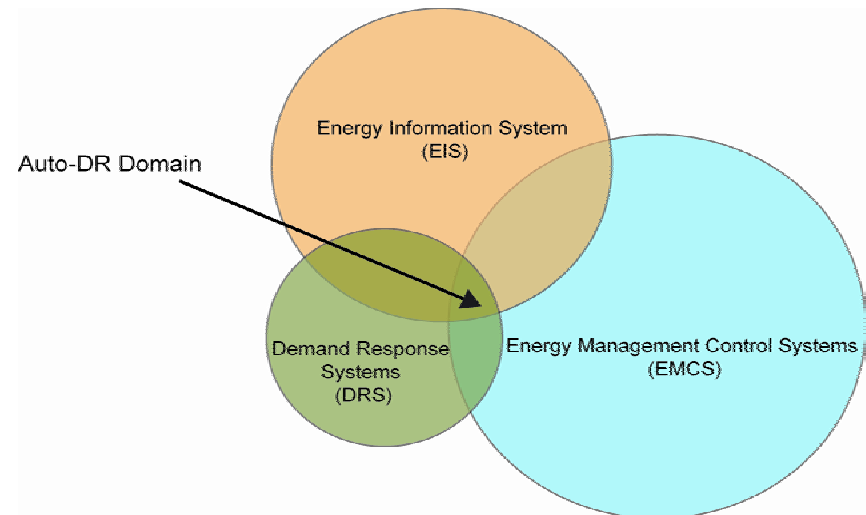
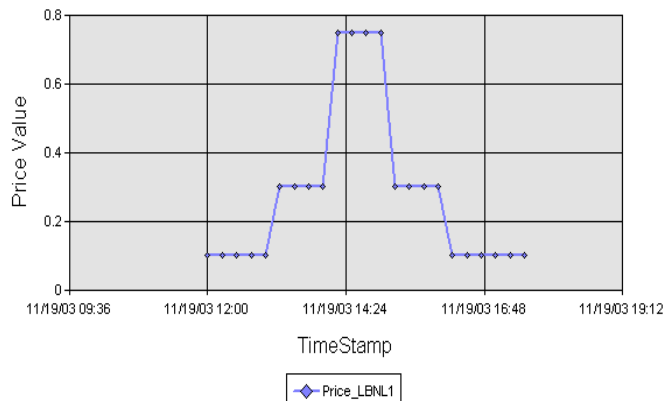


**Goal: Evaluate feasibility of Automated DR hardware & software systems in large facilities**

- Can control & communications systems receive signals & execute automated shedding?
- Control strategies for max load sheds & min service loss?
- See [drcc.lbl.gov/autodr2](http://drcc.lbl.gov/autodr2)

**R&D Team: LBNL, Infotility, Shockman Consulting**

## 15-Minute Price





# 2003 Automated-DR Sites



**Albertsons – East 9<sup>th</sup> St. Oakland**

**Engagenet**

**Bank of America – Concord Technology Center**

**Webgen**

**General Services Admin - Oakland Fed. Building**

**BACnet Reader**

**Roche Palo Alto – Office and Cafeteria**

**Tridium**

**Univ. of Calif. Santa Barbara – Library**

**Itron Silicon Energy**

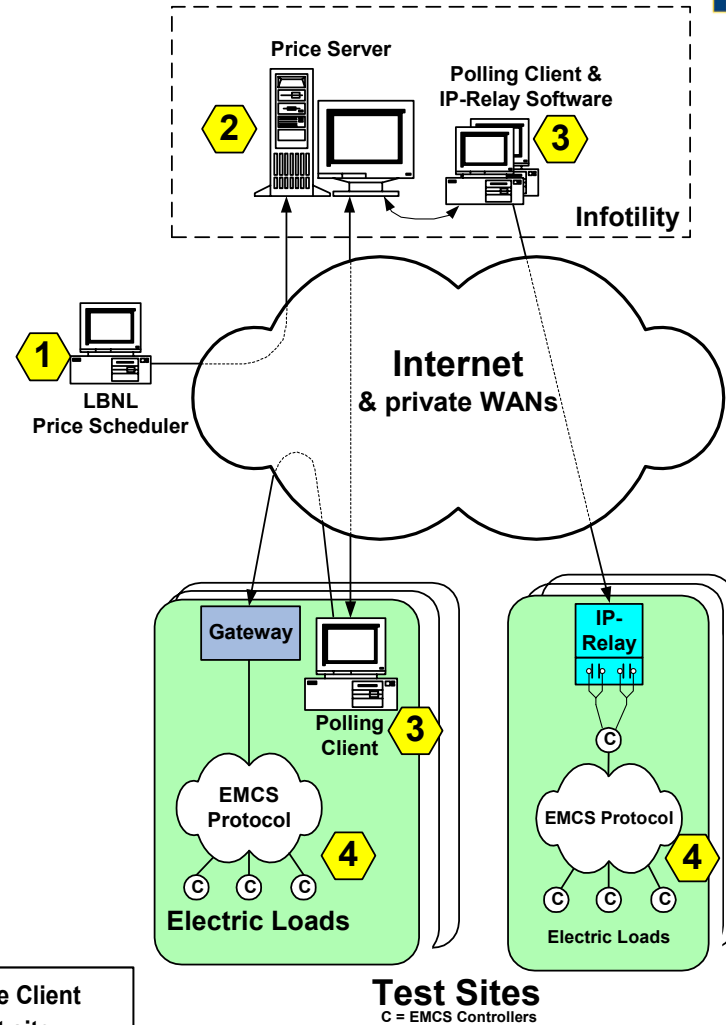
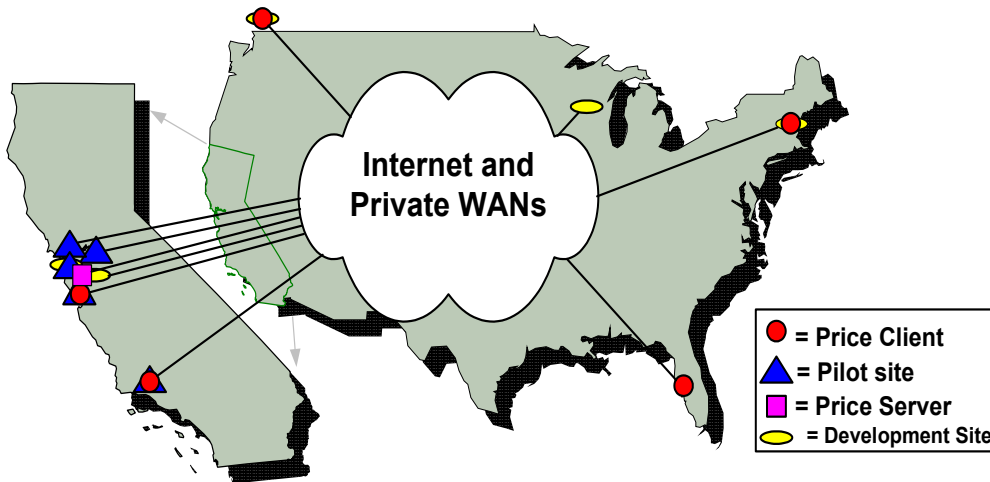




# Auto-DR System Communications

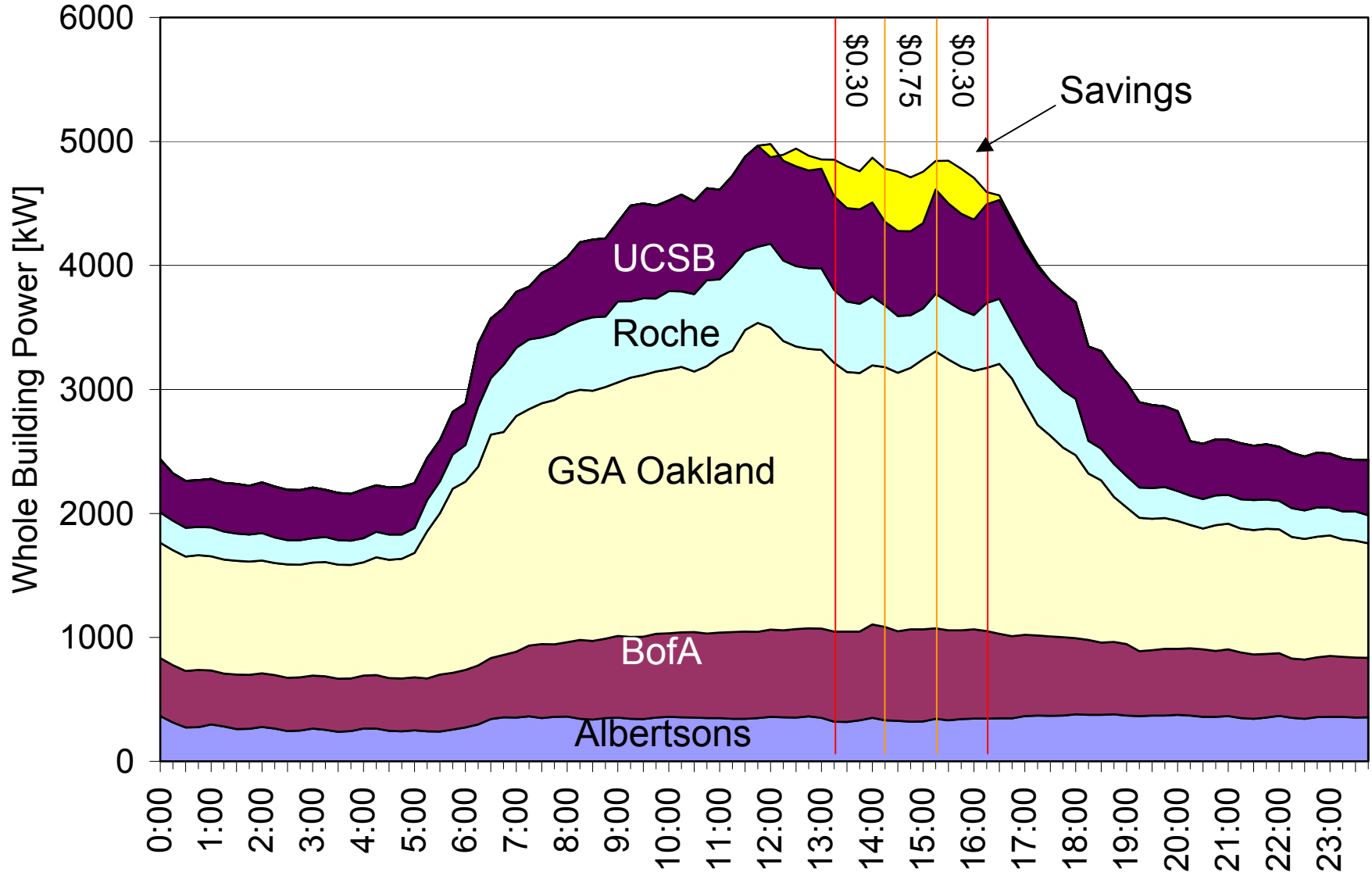


1. **LBNL defines price schedule**
2. **Price published on XML server**
3. **Clients request price from server every minute & send shed commands**
4. **EMCS carries out shed**





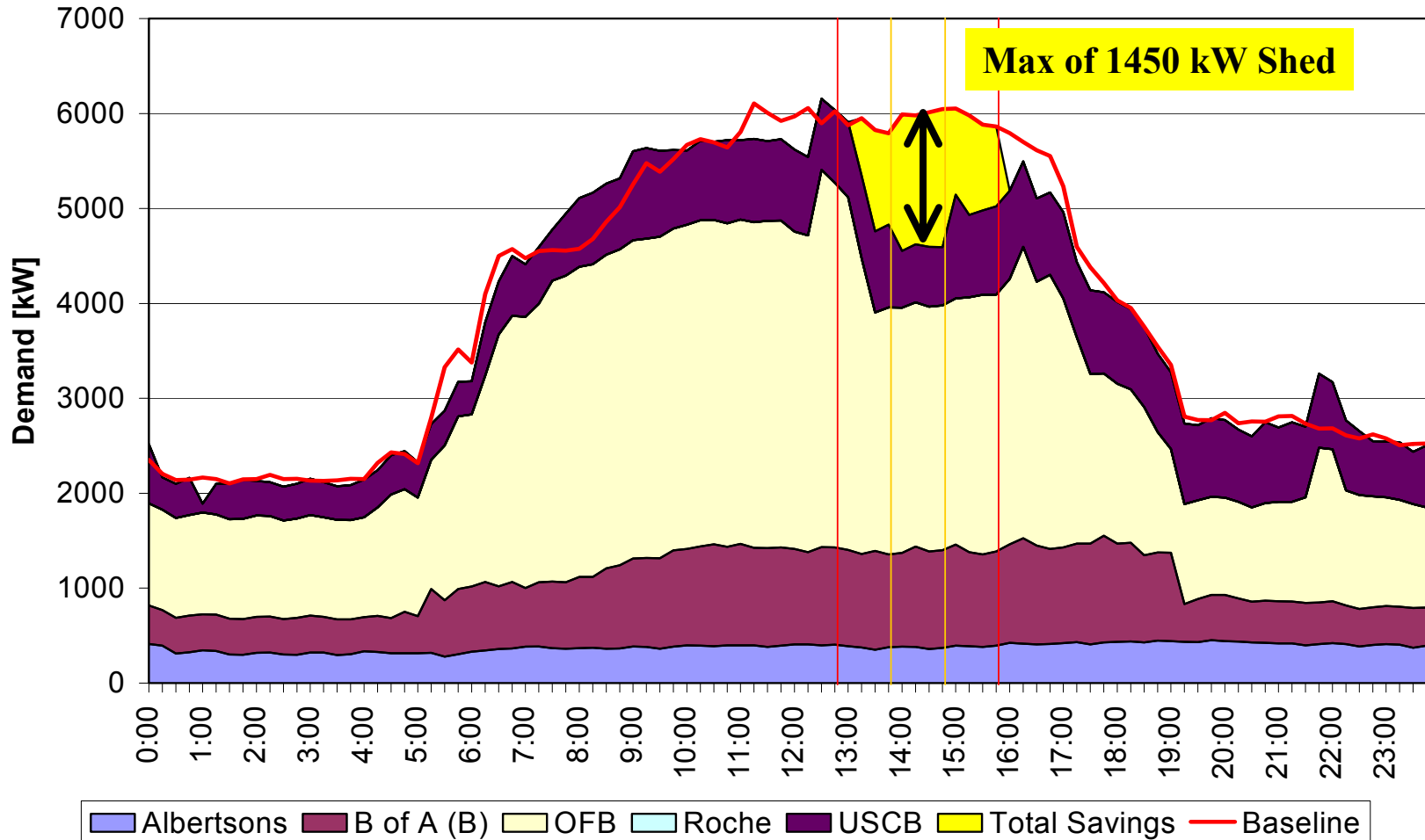
# 2<sup>nd</sup> Test November 2003





# 2004 Re-Test, 90 °F Day

Aggregated Demand Saving, Sept 8th

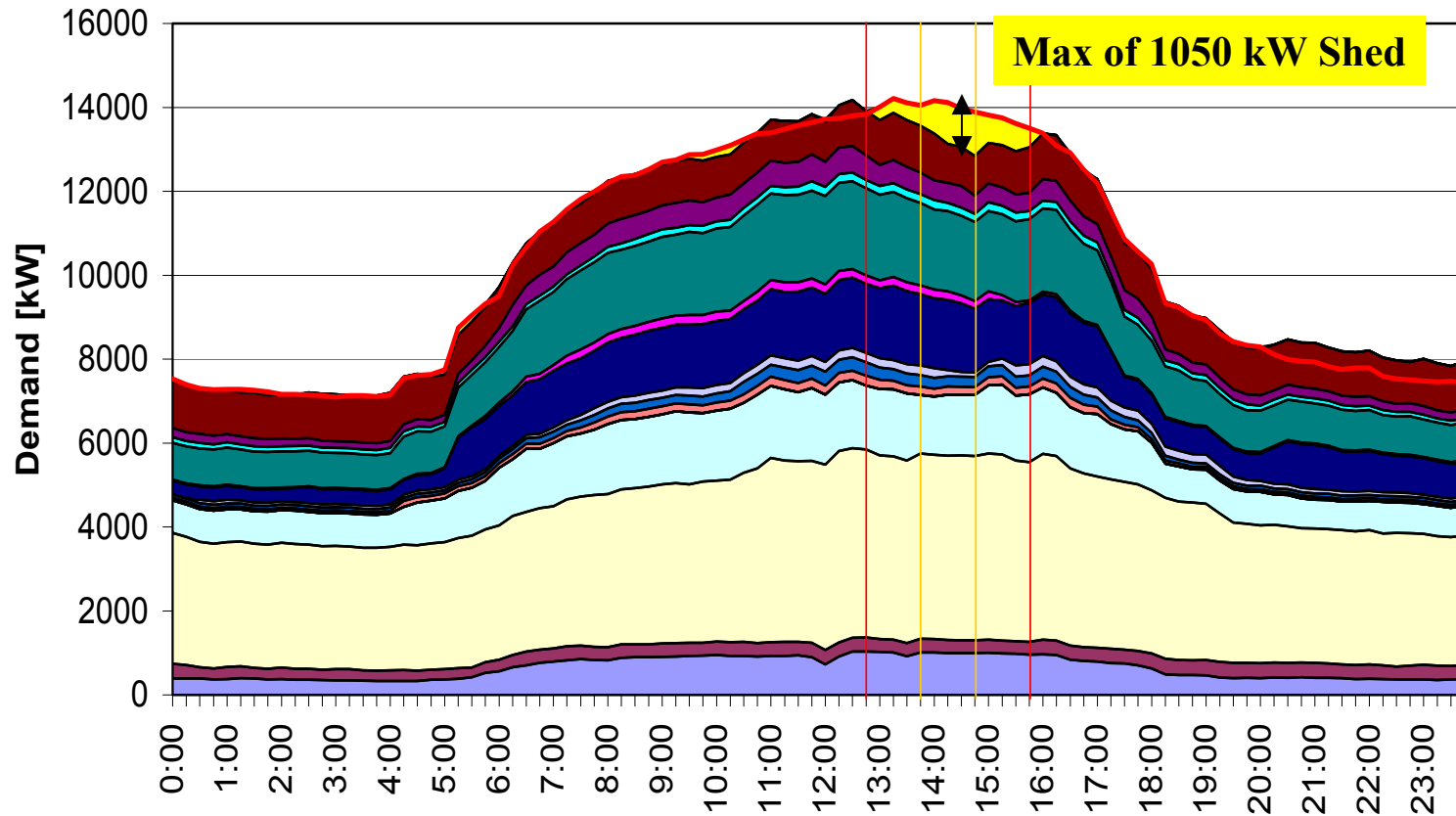




# Scaled-Up 2004 Test, 62 °F



Aggregated Demand Saving, Nov 5th



300CMall	Albertsons	B of A	Cal EPA
CISCO	50Douglas	SummitCtr	Echelon
450GG	NARA	OFB	OSIsoft
Roche	USPS	Total Savings	Baseline





# DR Shed Strategies

	HVAC										Lighting, misc.				
	Zone temperature increase	Supply air temp reset	Fan VFD limit	Fan off	Duct static pressure reset	Cooling valve close	Cooling fan-coil off	Direct chiller limit	Chilled water temp reset	Boiler pump (reheat) off	Electric humidifier off	Common area lighting	Office lighting shed	Anti-sweat heater shed	Fountain pump off
Albertsons											✓		✓		
B of A		✓	✓		✓										
GSA Oakland	✓														
Roche				✓											
UCSB Library			✓		✓	✓									
450 GG	✓														
NARA	✓														
Echelon	✓										✓	✓			
Monterey											✓				
300 CapMall	✓		✓	✓					✓					✓	
50 Douglas	✓														
Summit Ctr	✓														
Cal EPA					✓						✓	✓			
Kadent															✓
USPS SJ							✓								
CISCO	✓					✓			✓		✓	✓			
CETC				✓						✓					
OSI Soft	✓														



# Results: 1<sup>st</sup> 2004 Scaled Up Test

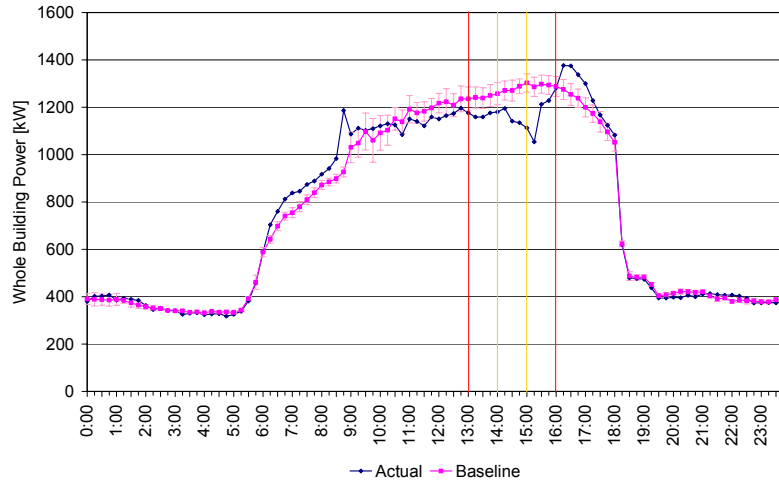
	IP Relay	Succeeded	Server Problem	Other Problem	Not Ready
Albertsons		x			
B of A	x	x			
GSA Oakland			x		
Roche		x			
UCSB				Gateway down	
450 GG			x		
NARA			x		
Echelon		x			
Monterey		x			
OSIsoft					x
300 Capitol	x	x		Maintenance	
50 Douglas	x	x			
Summit Ctr	x	x			
Cal EPA	x				x
Kadant				Maintenance	
USPS		x			
CISCO		x		EMCS	
CETC					x
<b>Total</b>	<b>5</b>	<b>10</b>	<b>3</b>	<b>4</b>	<b>3</b>



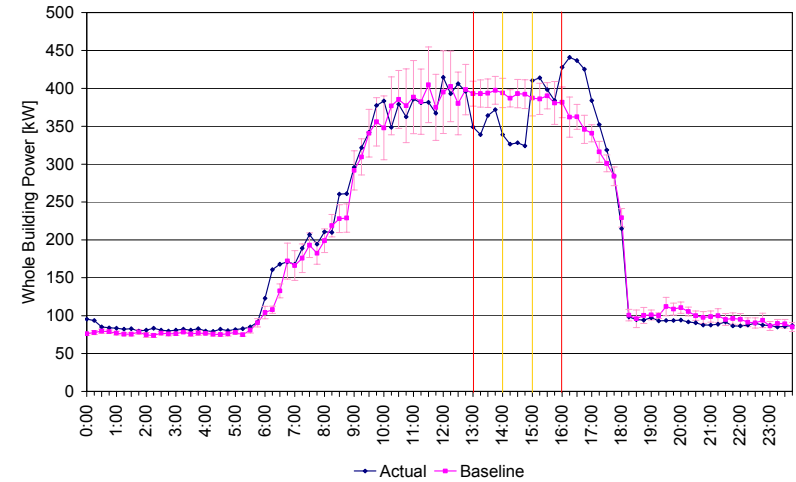
# Load Shapes from Office Buildings



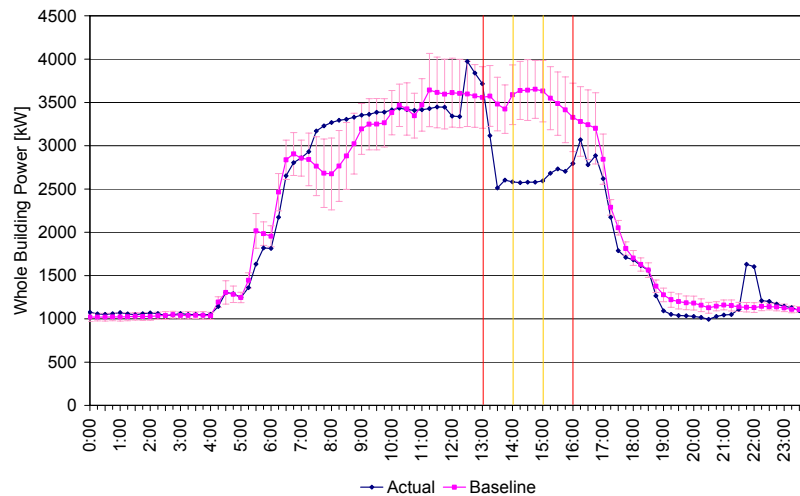
300 Capitol Mall: Whole Building Power, Oct 13th



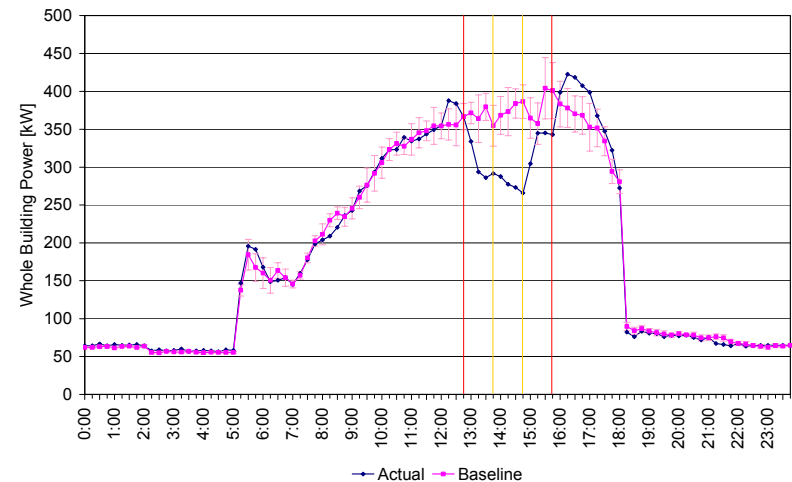
Summit Center: Whole Building Power, Oct 13th



GSA Oaklnad Fed: Whole Building Power, Sept 8th



50 Douglas: Whole Building Power, Oct 13th

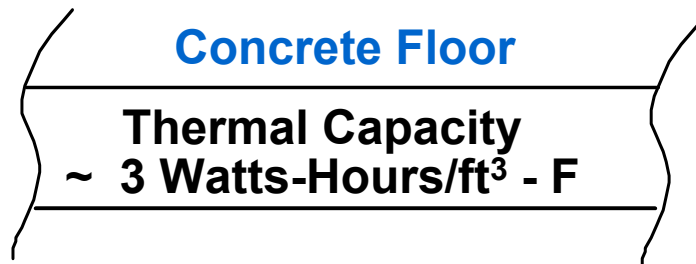




# Demand Shifting with Thermal Mass



- **Goal** - understand demand shifting with building mass & develop optimal control
- **R&D Team** – So. Cal. Edison, Purdue, UC Berkeley, LBNL
- **Research Questions**
  - Which strategies minimize demand while satisfying comfort for building occupants?
  - How might these techniques reduce building owners' operating costs?
  - What are perceptions regarding precooling strategies and market acceptance issues?
- **Current Work** – commercial building field studies & preliminary simulation study





# Summary and Next Steps



- ★ **Automated DR is technically feasible**
- ★ **New knowledge needed to develop, operate & evaluate technology & strategies for DR**
  - ◆ Rebound/recovery strategies needed
  - ◆ Link to daily efficiency clear to operators
- ★ **Future R&D**
  - ◆ Guides to DR shed strategies
  - ◆ Scalable automation, security, latency, XML standards
  - ◆ Pilot tests with utilities, peer to peer forums
  - ◆ Economic evaluation tools/real-time simulation/ scenario analysis