



# Automated Demand Response and the DR Research Center

**Mary Ann Piette**

**Workshop: Demand Response Enabling Technology  
Development Project**

**June 10, 2004**

**Sponsored by the California Energy Commission**



# Presentation Overview

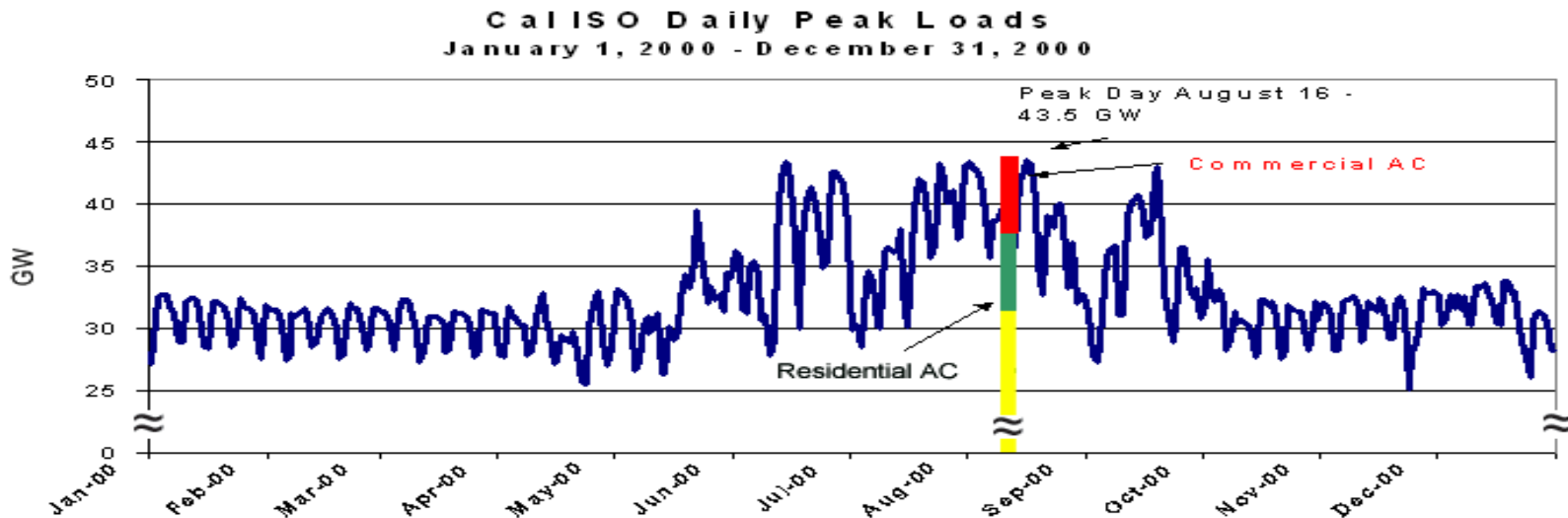


- **Demand Response Concepts**
- **Energy Information Systems**
- **Automated Demand Response Project**
- **Demand Response Research Center**
- **Next Steps**

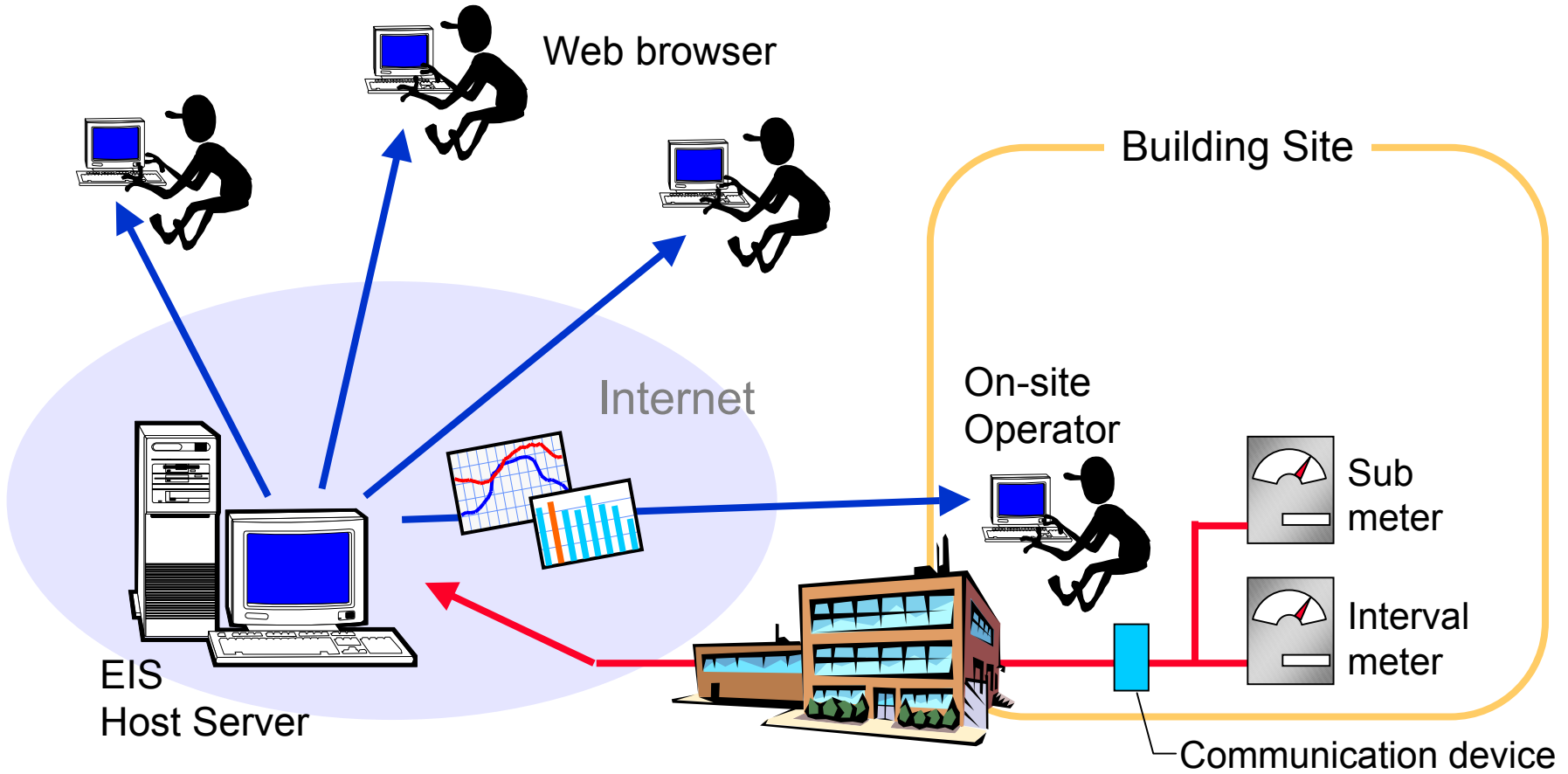
# Demand Response & Project Goal



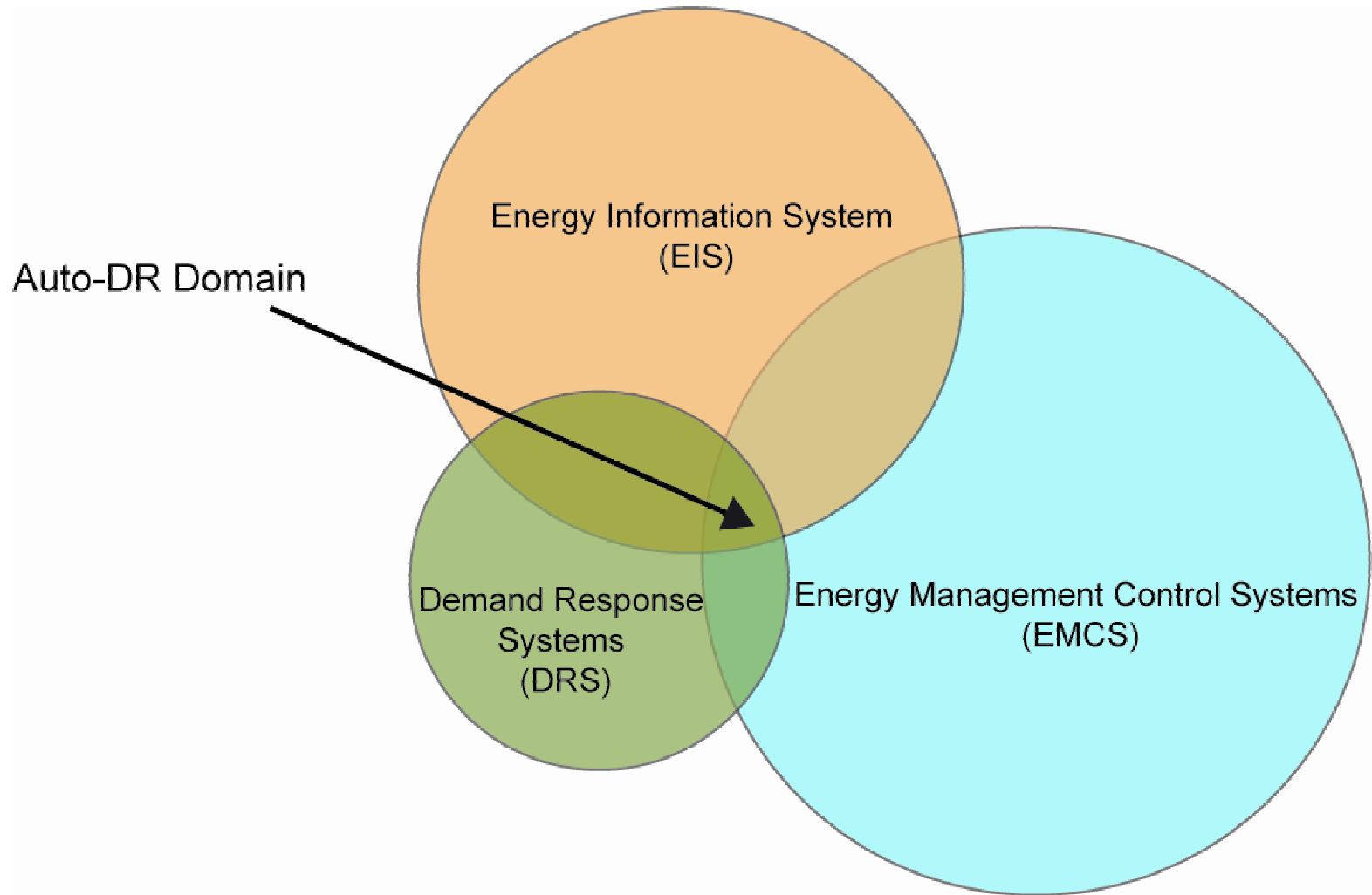
- **Motivations for Demand Response**
  - Improve grid reliability
  - Flatter system load shape
  - Lower wholesale and retail electricity costs
- **Primary Goal:** Evaluate technological performance of Automated Demand Response (Auto-DR) hardware & software systems in large facilities



# Energy Information Systems



# Types of Web-Based Energy Information Systems (EIS)



# Recruited Sites and EIS



**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**

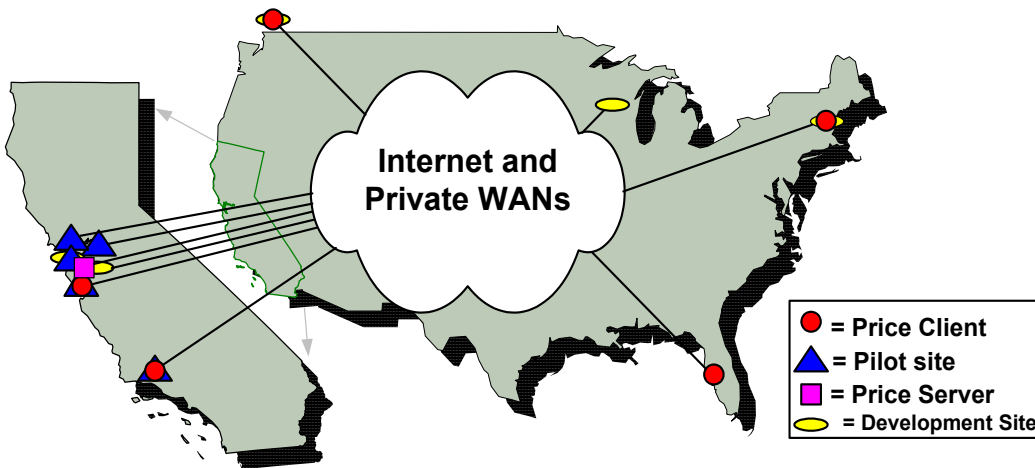
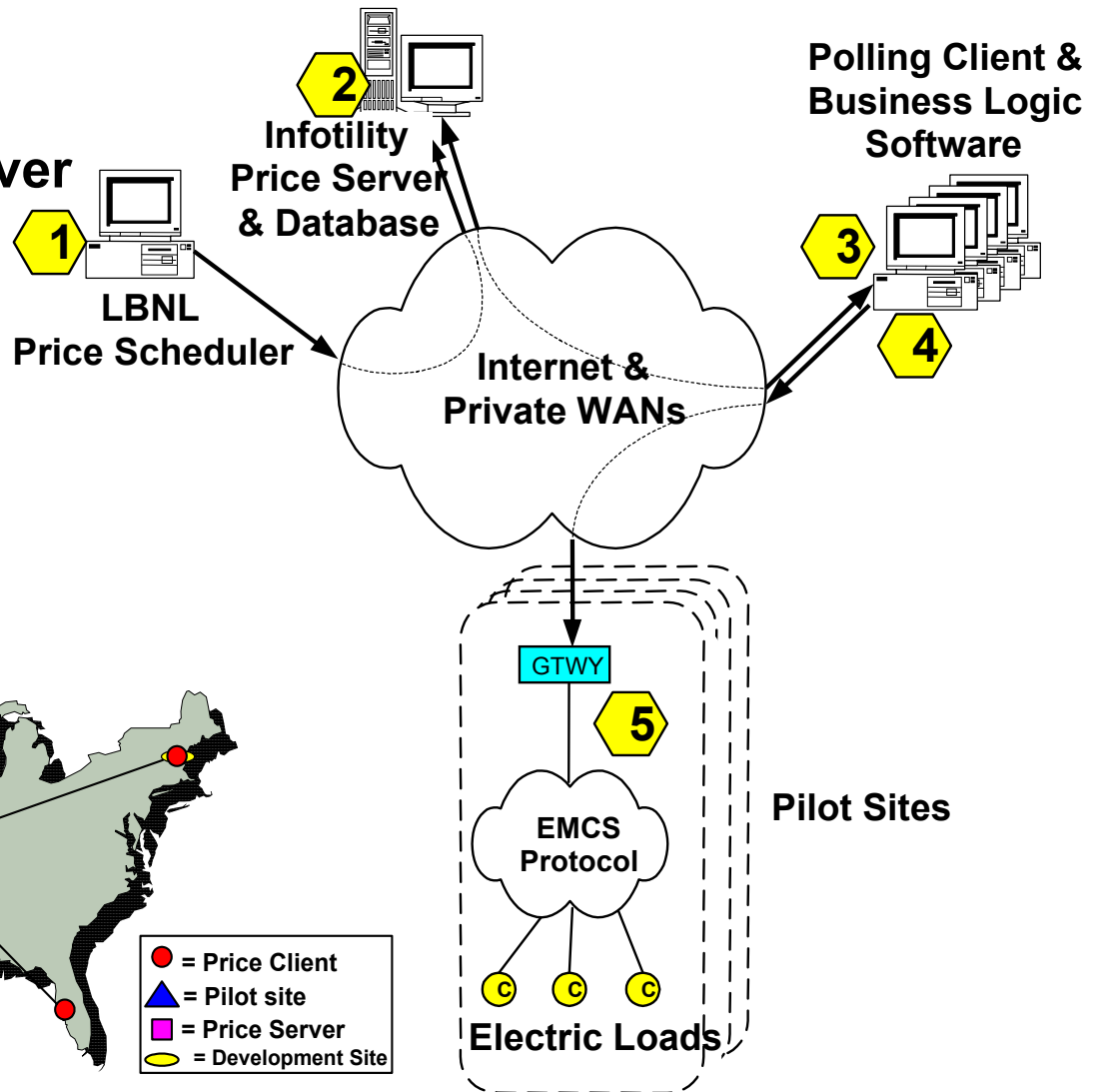
**Univ. of Calif. Santa Barbara – Library**

**Itron Silicon Energy**

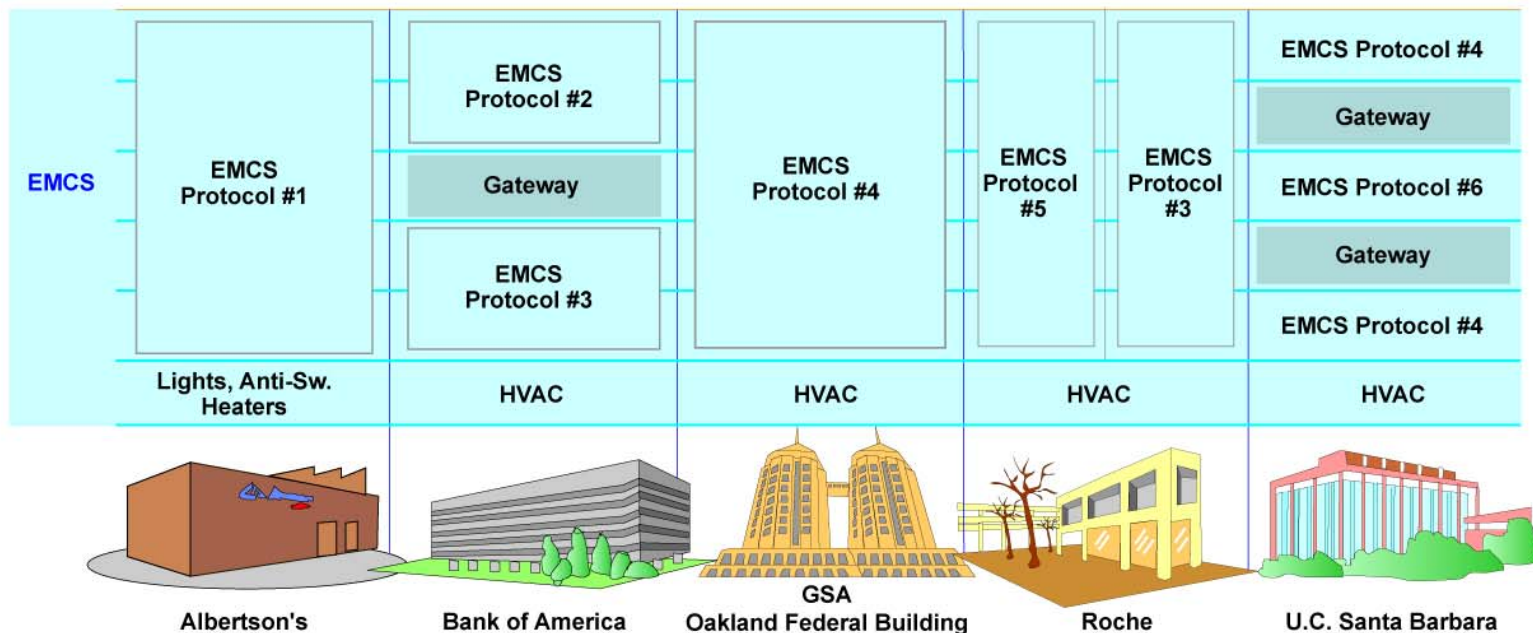


# Auto-DR System Communications

1. LBNL defines price schedule
2. Price published on server
3. Clients request price every 1-5 minutes & replies to server
4. Business logic determines response
5. EMCS carries out shed

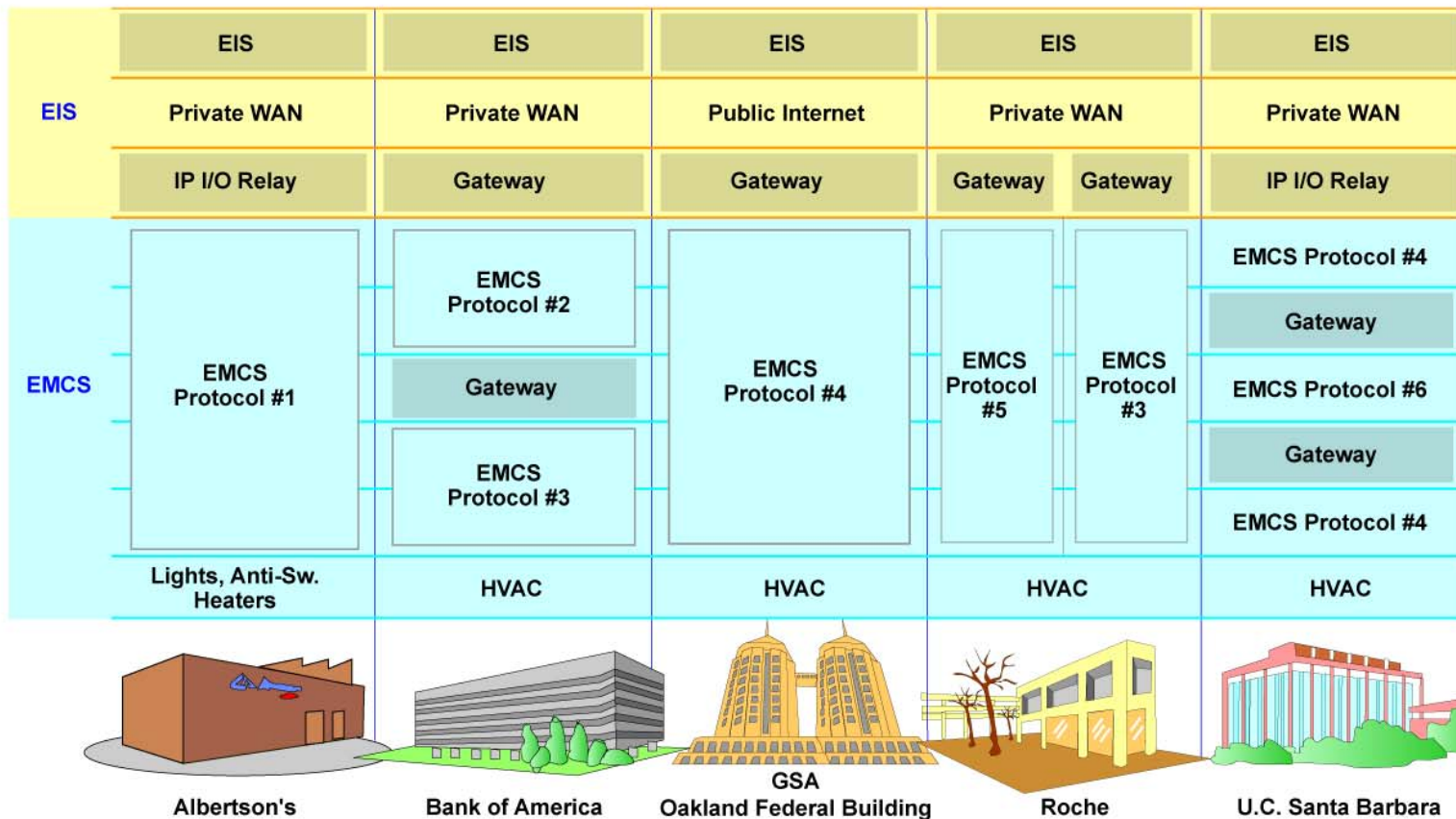


# Test Sites - Circa 1999 (1 of 3)

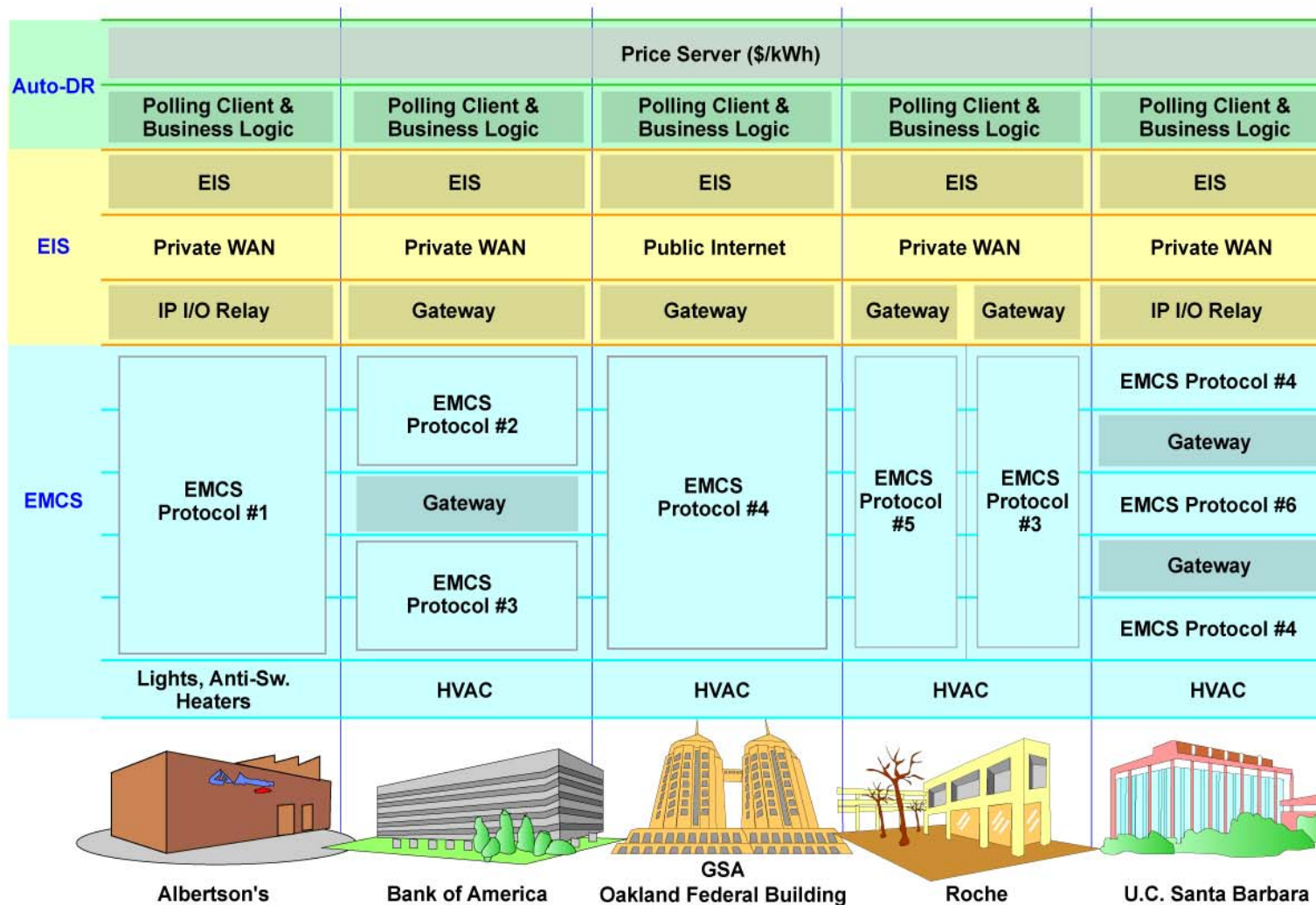




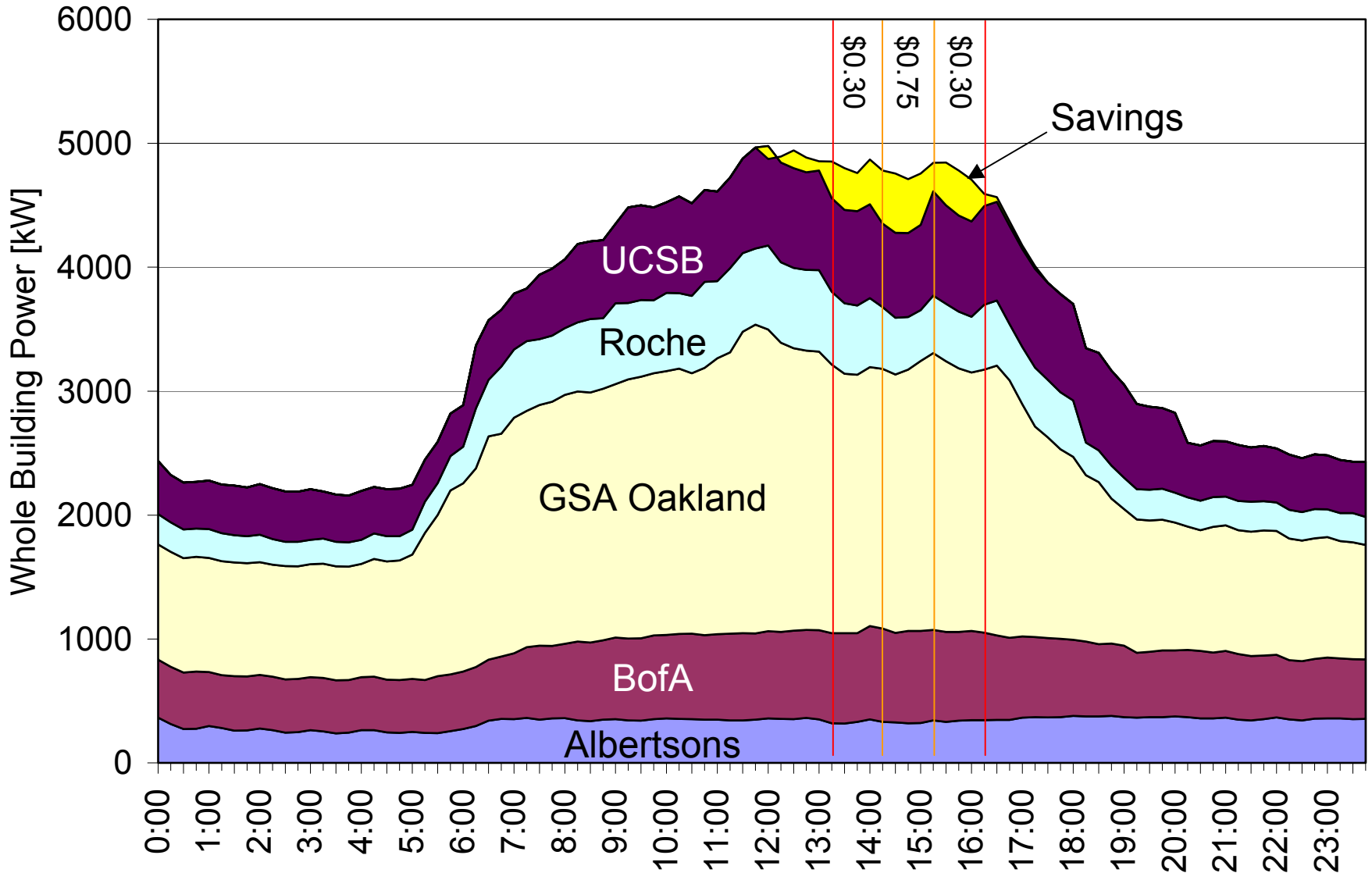
# Test Sites - After Energy Crisis (2 of 3)



# Test Sites –2003 Auto-DR Test (3 of 3)



# Results - Day-2 Test



# Summary of DR Strategies – Tests 1 & 2



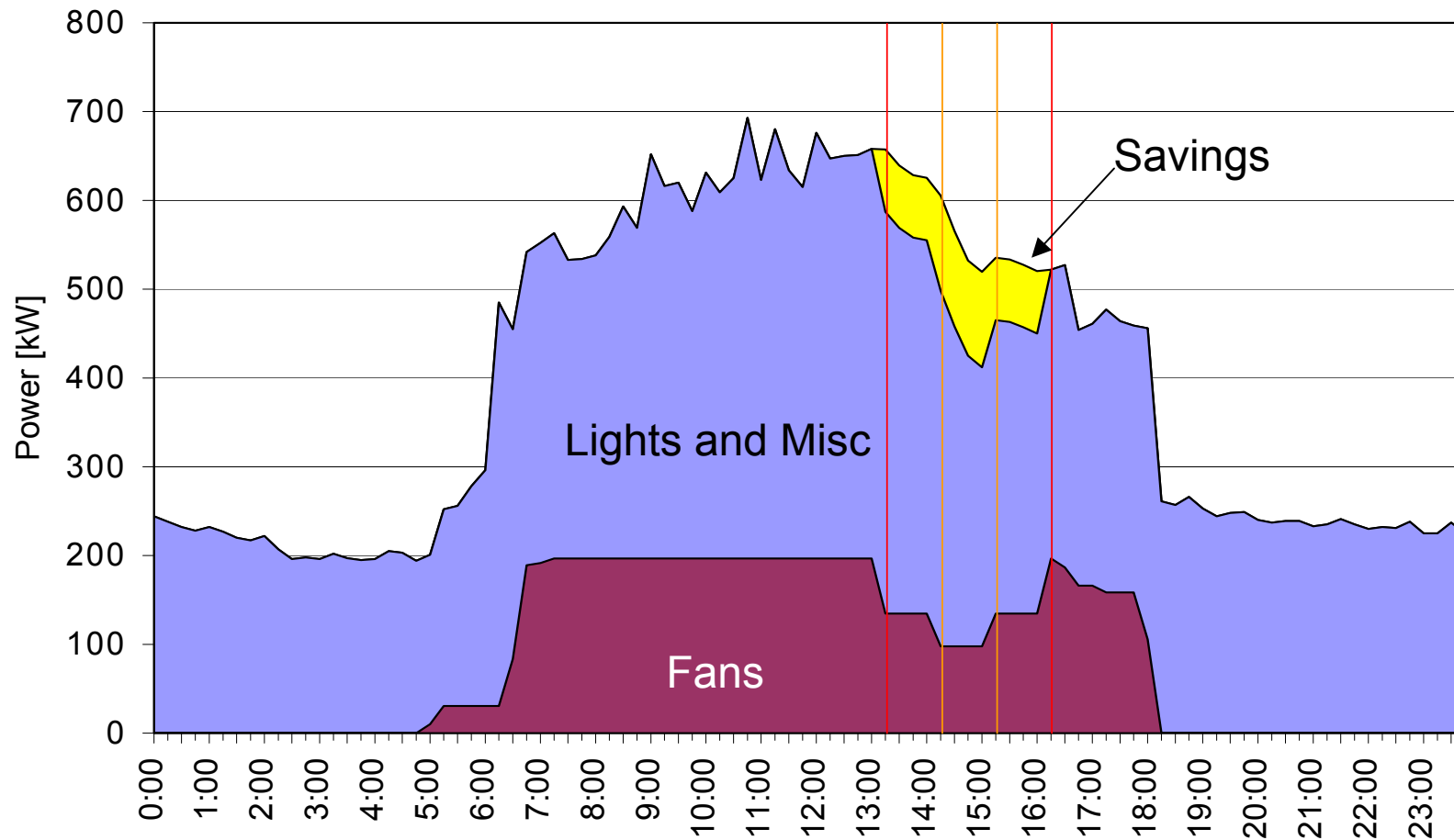
		Albertsons		B of A		GSA		Roche		UCSB	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
<b>HVAC</b>	Global zone set-point increase					X	O				
	Direct control of fans							O	O	X	O
	Reset duct static pressure			X	O					O	O
	Reset cooling and heating valves									O	O
<b>Lighting</b>	Reduce ambient lighting	O	O								
<b>Other</b>	Reduce Anti-sweat Heaters	X	O								

O – Succeeded  
 X – Planned, but failed

# Whole-Building and Component Savings at Roche Pharmaceuticals

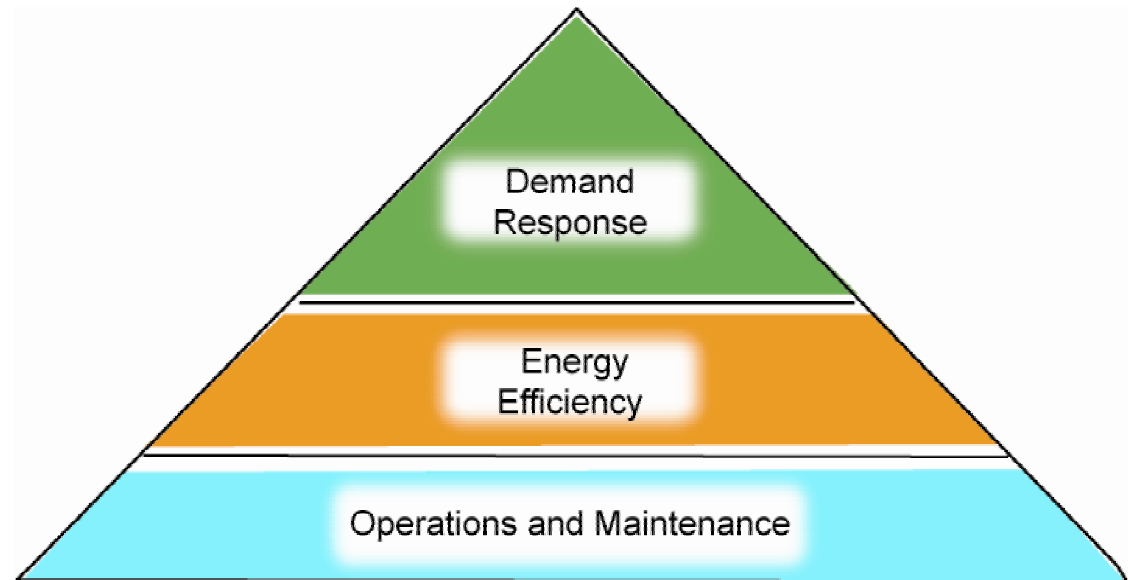


## Whole Building and Fan Electricity Use



# Findings on Automated-DR

- Fully automated DR is feasible with current technology
- Automation enhances demand response programs
- Large facilities support the objectives of DR
- New knowledge is needed to procure and operate technology and strategies for DR



- **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 & metering system developers
  - Aggregators
  - Program implementers
  - Utilities
  - Industry trade associations
  - Building owners, engineers & operators
  - Building equipment manufacturers
  - Other end-use customers

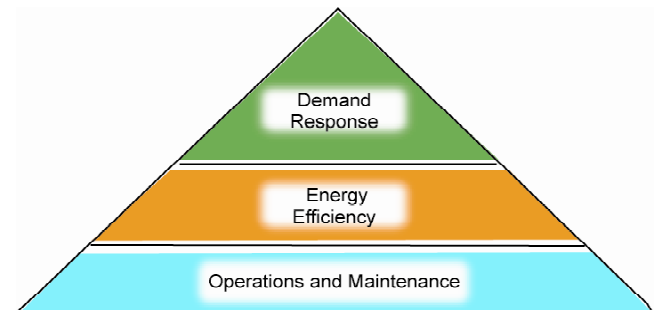
- **Create a PIER Research roadmap for DR**
- **Establish multi-institutional partnerships to broaden expertise and leverage funding**
- **Foster connections with stakeholders through outreach efforts**
- **Sustain long-term attention to DR research topics**
- **Conduct DR related research, development, demonstrations, and technology transfer**



# First Year Projects



- **Automated-DR in Large Facilities**
- **Follow on to RTP Program Evaluation in NY**
- **Scoping Study for Annual R&D Plan**
  - Policies, Programs, and Tariffs
  - Utility Markets, Technology, and Systems
  - Customer and End-Use Technology & Systems
  - Consumer and Institutional Behavior



# Next Steps

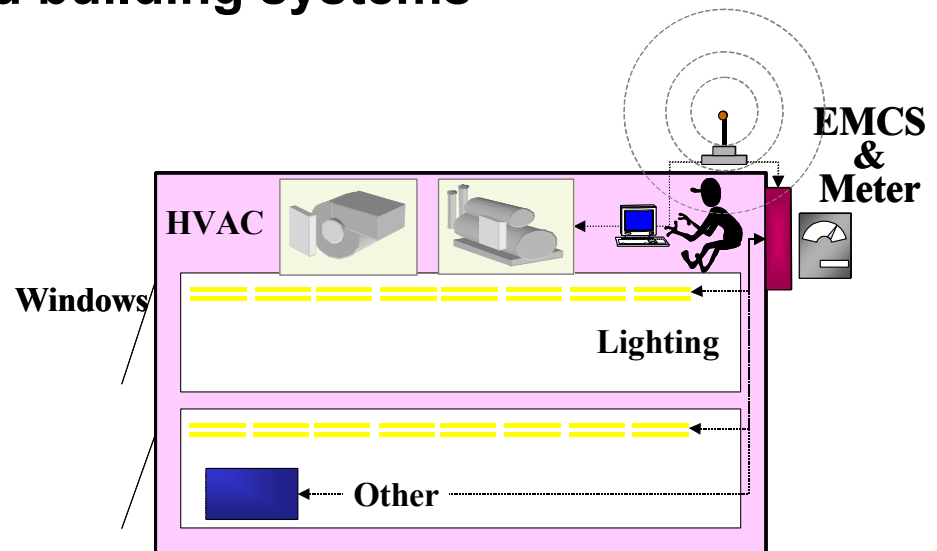
- **Launch Center**
- **Begin Two First Year Projects**
- **Recruit Partners Planning Committee**
- **Initiate Scoping Study**
- **Convene R&D Planning Workshops**
- **Create outreach materials**
  - Web site
  - Newsletters
  - Workshops and conferences



# Future Buildings Research



- **Scale Up Automation Research - Recruiting for 2004!**
  - Larger sheds (more buildings, more per building)
  - Bandwidth, throughput, costs and benefits, security
- **Review of Control Technologies and Strategies**
  - Scenarios on economics and building systems
    - **Lighting controls**
      - Dimmable ballasts
      - Bi-level switching
    - **HVAC control**
      - Thermostat set up
      - Pre-Cooling strategies
      - Fan & chiller control
  - Real-Time Simulation Tools
- **Building comfort, productivity, feasibility, behavior**



# Further Information



- **Contact: Mary Ann Piette, [mapiette@lbl.gov](mailto:mapiette@lbl.gov), 510 486-6286**
- **Demand Response Research Center**  
**[drrc.lbl.gov](http://drrc.lbl.gov)**
- **Current CEC Demand Response Sites**
  - Consortium for Electric Reliability Technology Solutions (CERTS)  
**[certs.lbl.gov](http://certs.lbl.gov)**
  - Center for the Study of Energy Markets (CSEM)  
**[www.ucei.berkeley.edu/power.html](http://www.ucei.berkeley.edu/power.html)**
  - Demand Response Enabling Technology Development (DRETD)  
**[ciew.ucop.edu/dretd](http://ciew.ucop.edu/dretd)**
- **[Buildings.lbl.gov/hpcbs/Pubs.html](http://Buildings.lbl.gov/hpcbs/Pubs.html)**
  - **Case Studies of Energy Information Systems and Related Technology: Operational Practices, Costs, and Benefits**
  - **Web-based Energy Information Systems for Energy Management and Demand Response in Commercial Buildings**