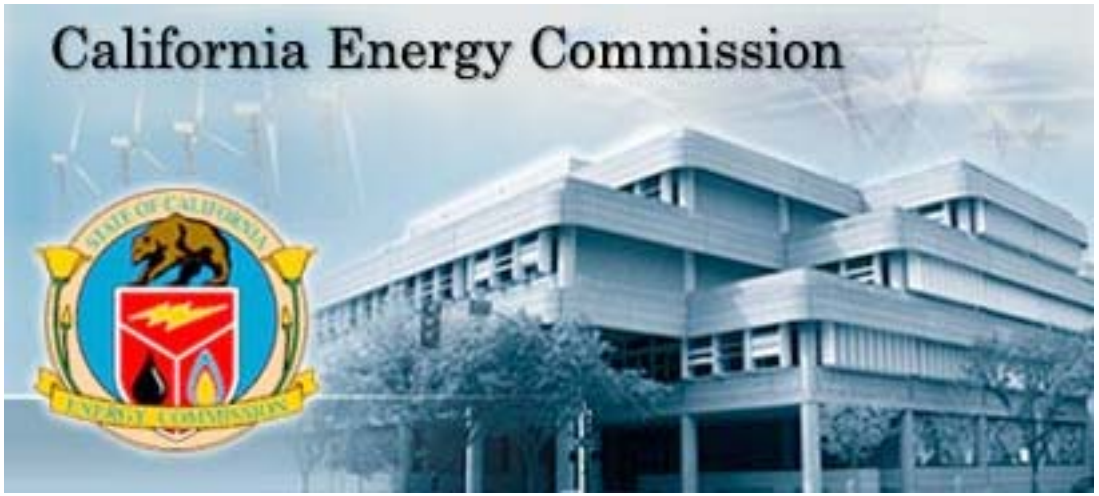
Using Advanced Metering and Communication Technologies to Promote Energy Efficiency



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My topics today:

- What is the CEC?
- Overview of the California electricity crisis
- New vision to use IT to facilitate demand response and energy efficiency
- New programs and results:
  - Real-time meters
  - Enhanced automation
  - Advanced metering and dynamic pricing
- Further research in demand response technologies and demonstrations

What is the CEC?

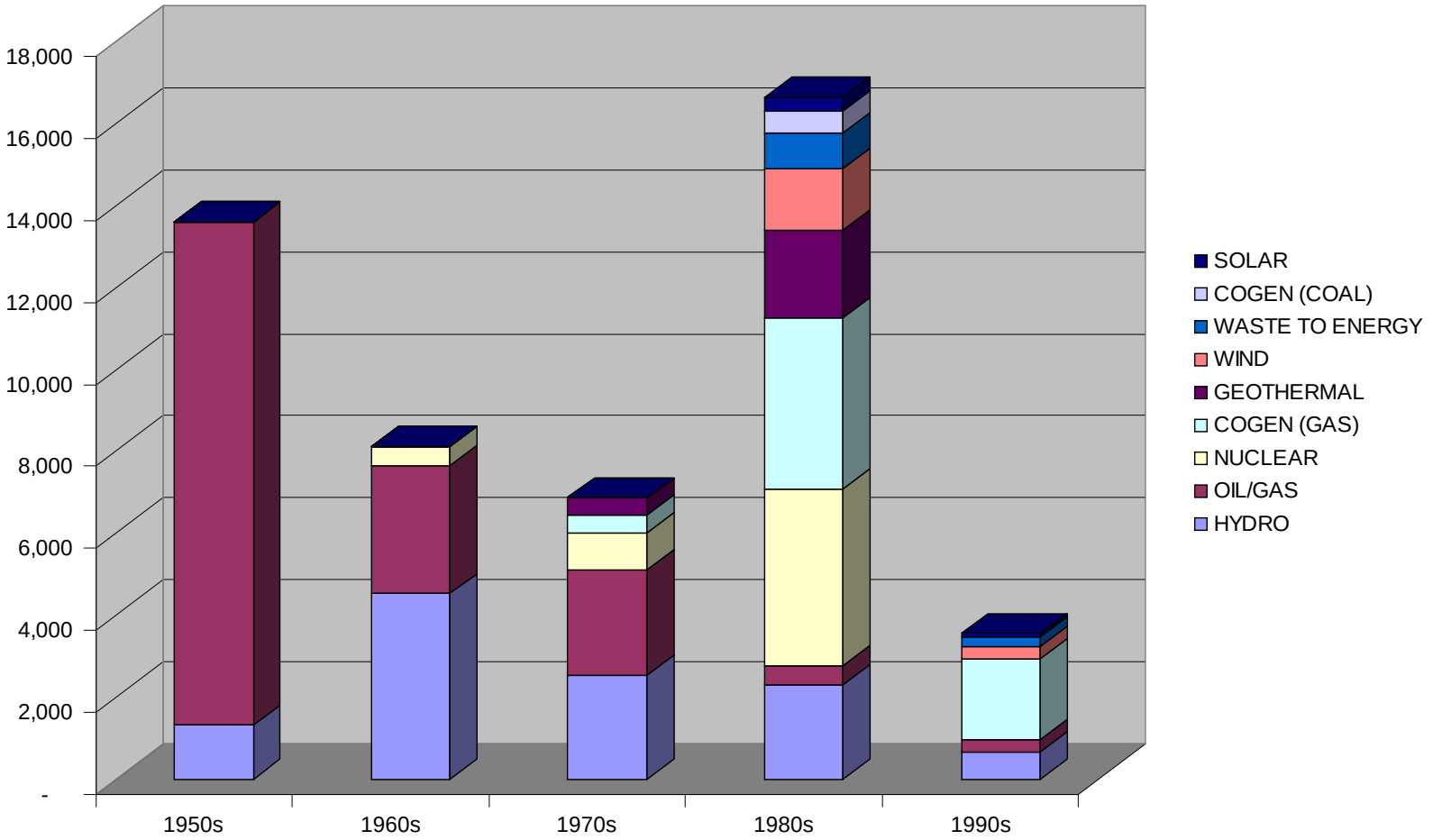
- Created in 1975 to be California's energy planning and policy agency.
- Funding is $260 million/yr. Staff is 450.
- Largest programs:
  - public interest R&D ($62 mil/yr)
  - renewable energy ($130 mil/yr)
  - building and appliance efficiency standards
  - power plant licensing
  - supply and demand assessment
- *More information:* *www.energy.ca.gov*

What was the crisis?

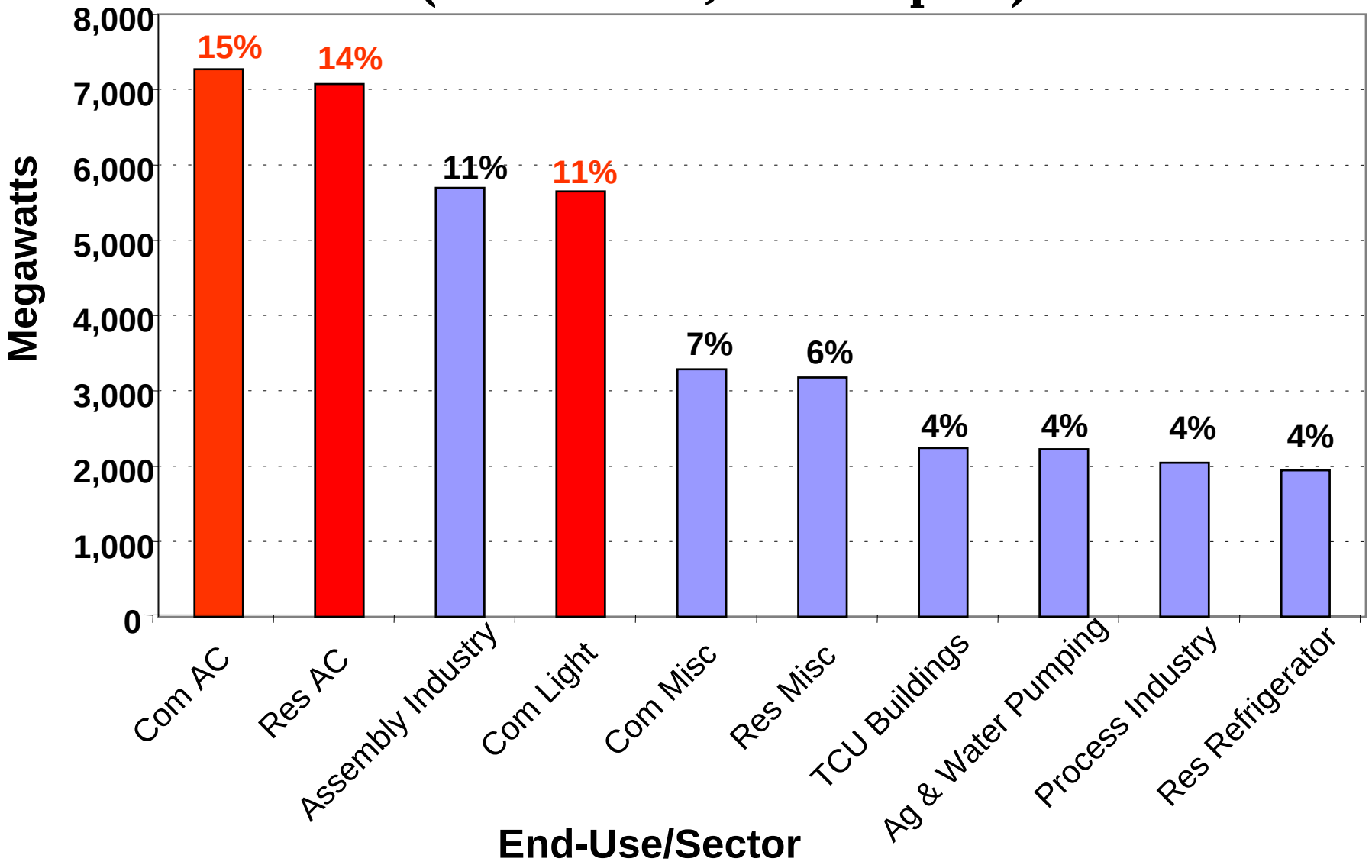
- Rising demand, lagging power plant construction, and less hydro generation led to power shortages.
- Rotating outages in June 2000 and January 2001 caused great concern among businesses.
- In response, the state created a $1 billion dollar portfolio of programs to reduce demand.
- *More information:*

www.energy.ca.gov/peakload/documents

Generating Capacity Additions In California
by Decade and Primary Energy Type, in Megawatts

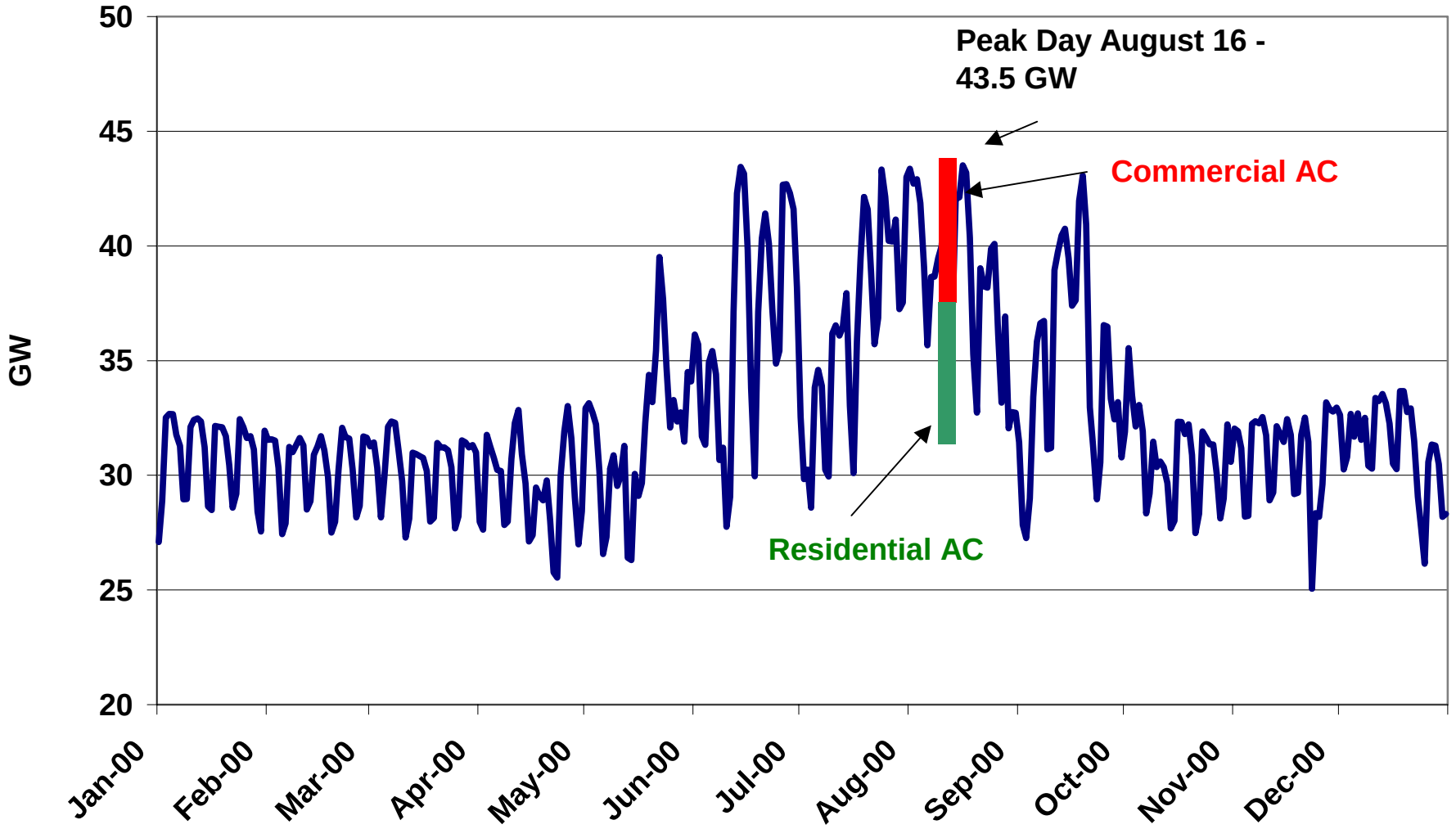


Top Ten California Peak Energy Uses/Sectors
(assumes a 50,000 MW peak)



Cal ISO Daily Peak Loads

January 1, 2000 - December 31, 2000



New reality:

- Rotating outages are extremely expensive
- Does not make economic sense to use generation to provide 100% reliability, especially for the 100 “peakiest” days of year
- Need to allow demand response to compete with generators (market power)
- Fixed rates and reading the meter once a month does not make sense when we have new IT technologies
- *Small inconveniences (higher temperatures, dimmer lights) better than random outages*

New vision:

- All customers:
  - receive real-time prices,
  - have real-time meters,
  - receive data via a user-friendly information system, and
  - have technology that enables automated (but customer-controlled) response to prices.
- Basically, a 21st Century electricity system

What this means:

- Controls for HVAC and lighting
  - 2-6 degree temperature float, 30% dimming
- Enhanced automation systems
  - Monitoring and controls
  - *Information* has high value to customers
  - *Customer* control of load response
    - Automation v “sneaker-net”
- Marketing, education, training

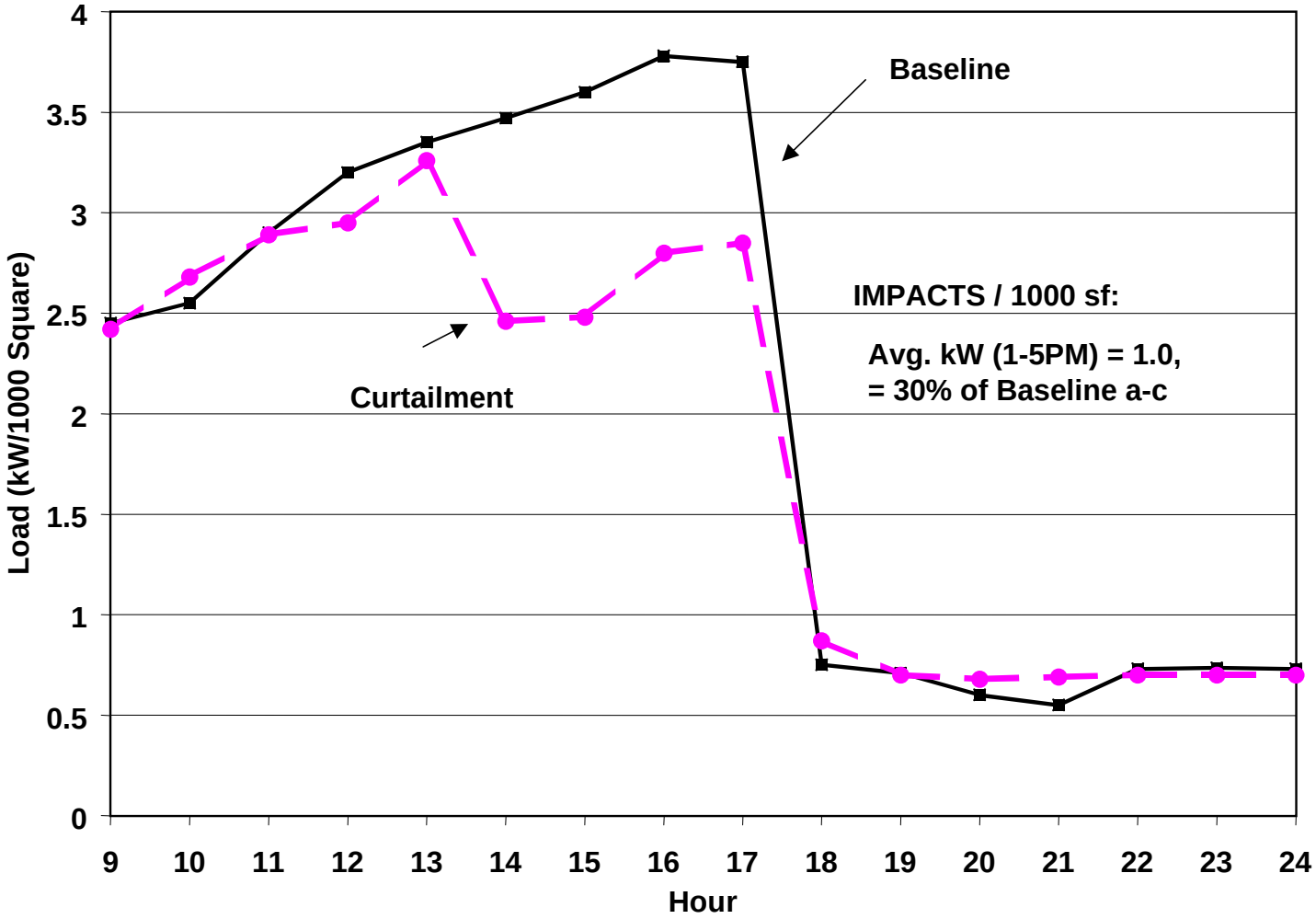
  Market: 12,000 MW AC, 5,000 MW comm lighting

  Goal: 2,000 MW load reduction (12%) and

  greater end use efficiency

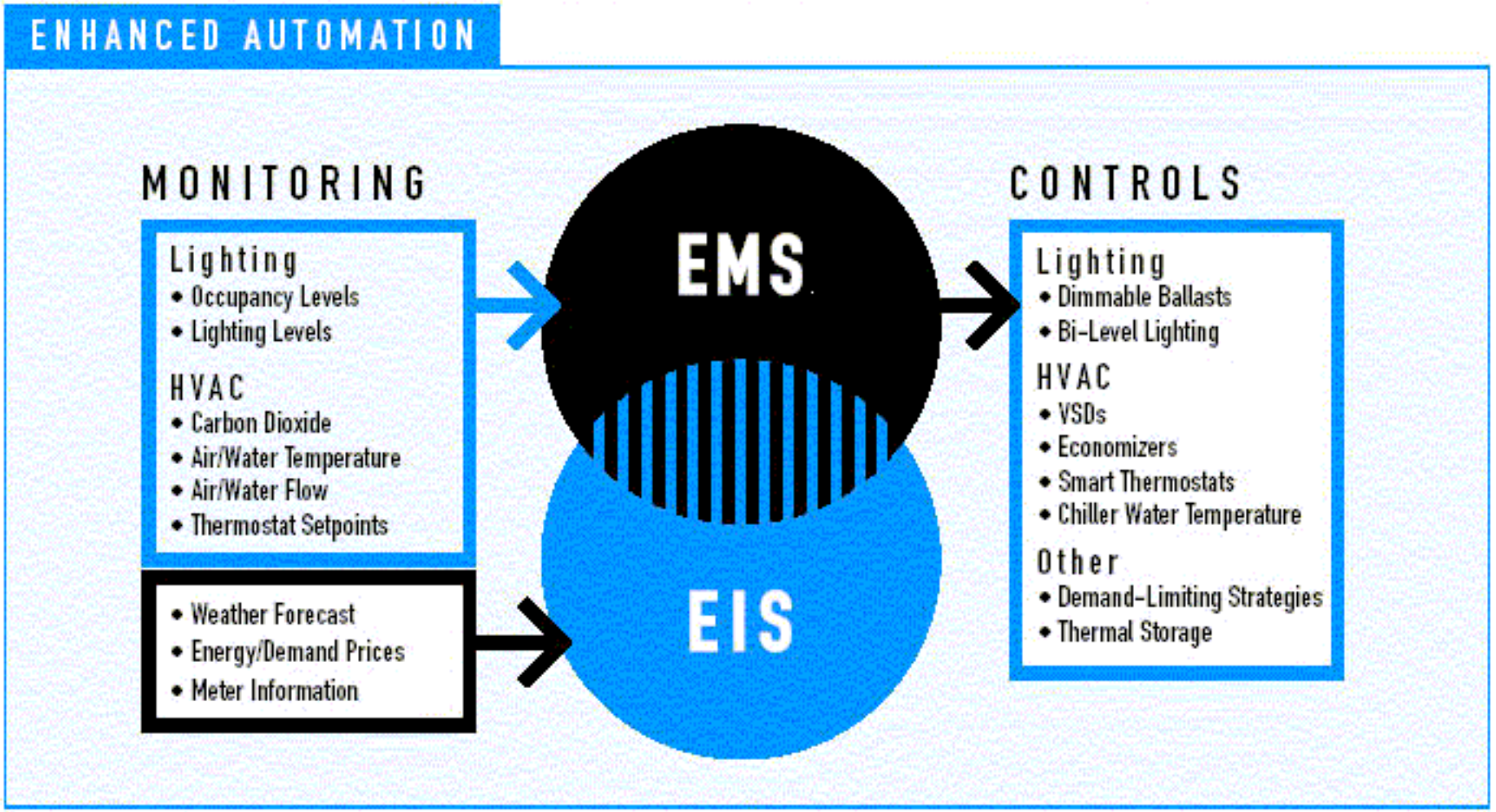
Measured hourly A/C loads - at SMUD office bldg

Curtailment = Setpoint + 4 Degrees (1 to 5 PM) + Dimmed Lights



Source: Ed Hamzawi SMUD, Oct. 20, 2000

New Programs



1. Real-time meters

- Lack of real-time meters was a major barrier to demand response efforts
- Lack of real-time data limits customer motivation and utility incentives
- Result: state provided $35 million to install meters on customers greater than 200 kW
- All customers on time-of-use rates
- *More information:*

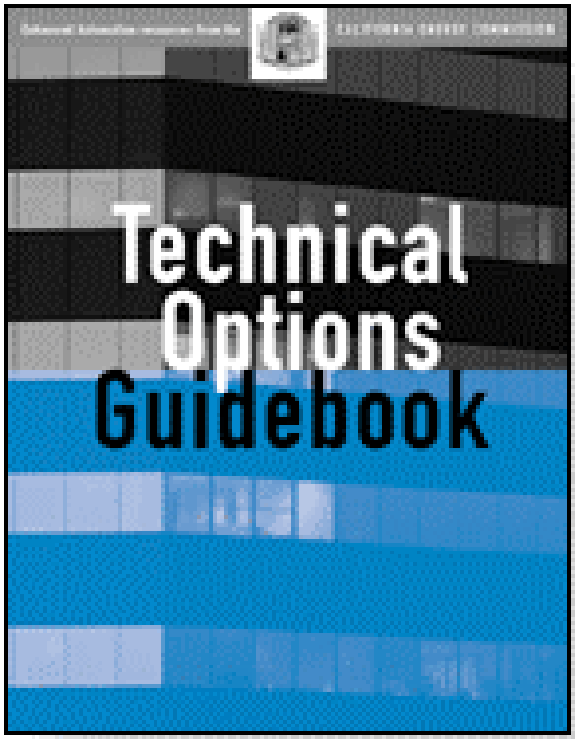
www.energy.ca.gov/reports/2003-10-31_400-03-020F.PDF

2. Enhanced automation program

- $21 million, 1,800 projects.
- Done very quickly in response to crisis, before demand responsive rates were in effect.
- Mostly low-tech, “sneaker net” applications
- *More information:*

www.ConsumerEnergyCenter.org/EnhancedAutomation

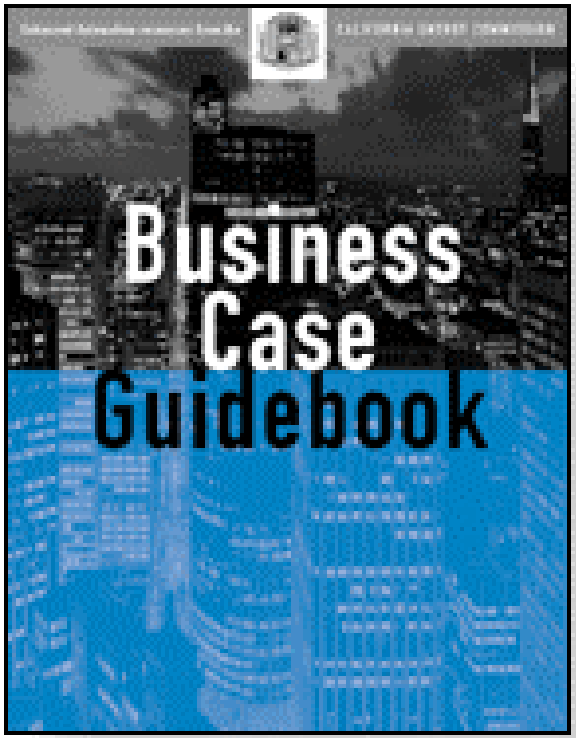
Technical Options Guidebook



- For facility managers
- Control technologies and costs/savings
- Strategies for selecting and implementing controls
- Includes:
  - vendor lists
  - Telephone hotline
  - Links to utility websites

Business Case Guidebook

- For financial managers
- Introduction to demand response technologies and costs/benefits
- Sample business case and Excel worksheet



Case studies

- Variety of buildings and strategies
- Brief description of project and results
- 1,800 projects saved 200 MW (18%) for $100/kW

3. Advanced metering and dynamic pricing

- Goal: 5% (2,500 MW) of peak load is demand responsive by 2007
- Installation of real-time meters for all customers
- All customers on some form of “dynamic prices”
- *More information:*

www.energy.ca.gov/sb1976

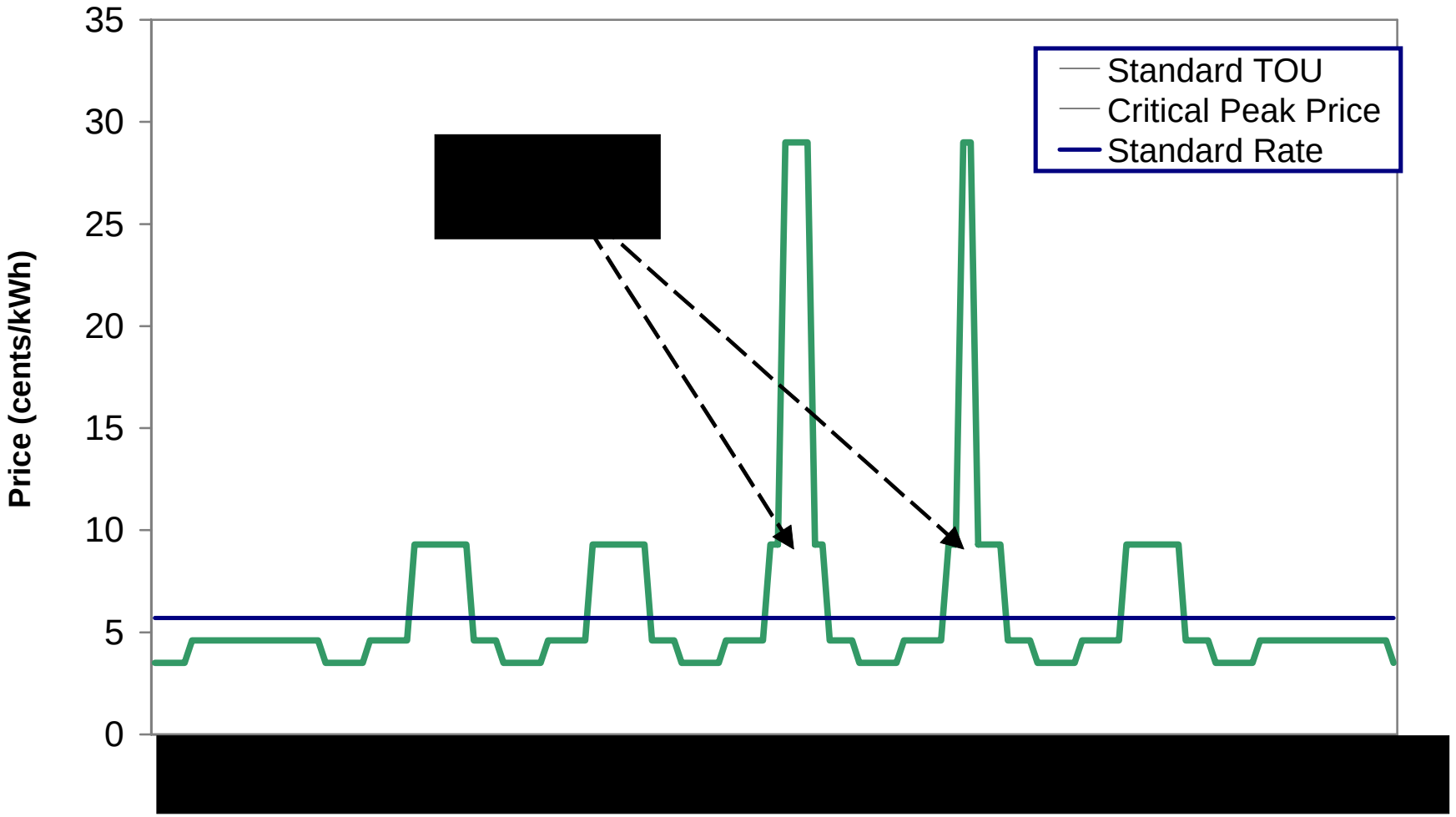
Progress to date

- Large customers (> 200 kW)
  - installed meters for all
  - developed CPP tariffs
  - Offered them starting August 2003
- Residential and small commercial
  - Extensive pilot program
  - Meters, communicating thermostats
  - CPP and TOU rates

Kinds of dynamic pricing

- **Time-of-use** (TOU) is typically 3 time blocks published in advance for entire season
  - Peak, mid-peak, off-peak
  - Cannot address unforeseen weather or equipment failures
- **Critical peak pricing** (CPP) imposes a high price only on a few days per year when energy is short.
  - Non-CPP hours are less expensive compared to TOU rates.
  - Customer pays the critical price when invoked by the utility
  - Day-ahead posting of CPP offers added time for response
- **Real-time pricing** (RTP) varies continuously.
  - Reflects hot weather, scarcity, or equipment failure
  - Day-ahead forecast of RTP offers added time for response

Critical peak pricing



Vision for dynamic prices & customer choice

All customers have choice, but pay more for less risk:

Class	Default	Hedge (safer)	Option (riskier)
Residential + Small commercial	CPP	TOU	-
Medium (20kW-1MW)	CPP	TOU	RTP
Large (> 1 MW)	RTP	CPP or TOU	-

Residential energy savings: CPP and TOU compared to a flat rate

Early pilot results show large peak reductions in response to both CPP and TOU rates, and also off-peak savings:

Rate	On-Peak	Off-Peak
CPP	9% (normal day) 19% (critical day)	5%
TOU	16%	6%

Research currently underway

- Funding about $6 million/year
- Demand Response Enabling Technology Project at UC Berkeley
  - Goal for meters and thermostats: 10x capability at 1/10th cost, using wireless systems

ciee.ucop.edu/dretd

- Demand Response Research Center at LBNL (Lawrence Berkeley National Lab)
  - Monitoring and diagnostics for automated systems

eetd.lbl.gov/btp/cbs