Demand Response Research Center

DRRC

BERKELEY LAB

New Directions for Demand Response

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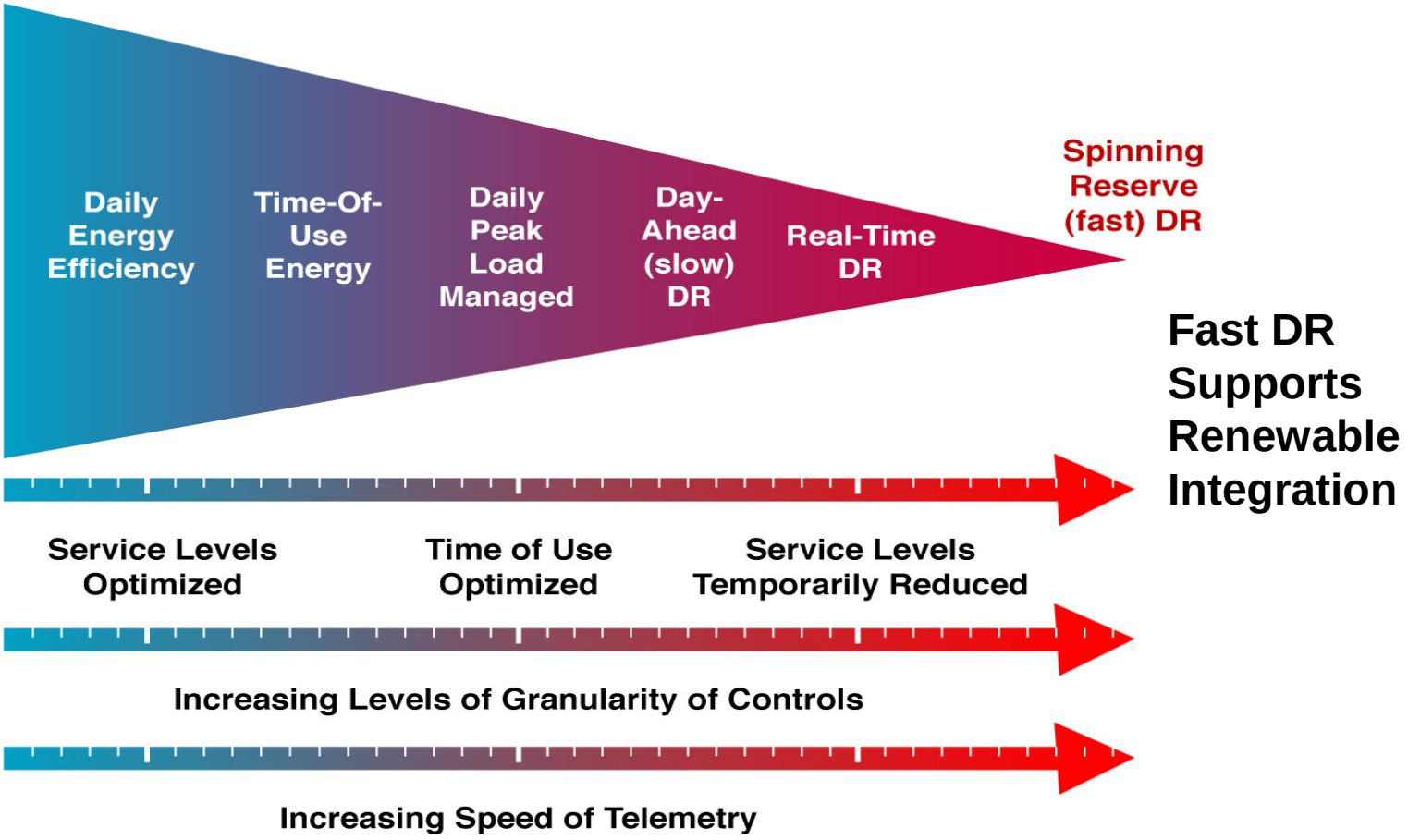
Presentation Overview

- **Linking energy efficiency and DR makes sense**
- **Activities in automation and building codes**
- **Demand Response for a cleaner grid to support renewables**

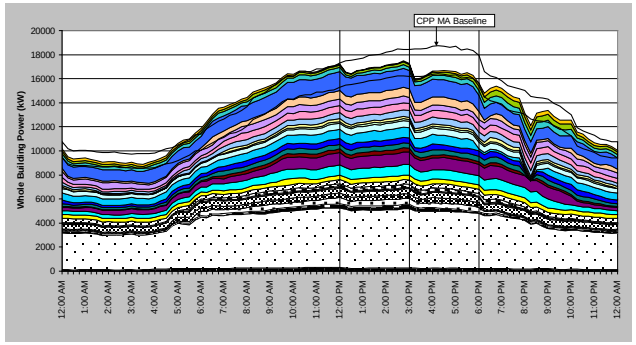
Linking Energy Efficiency and DR

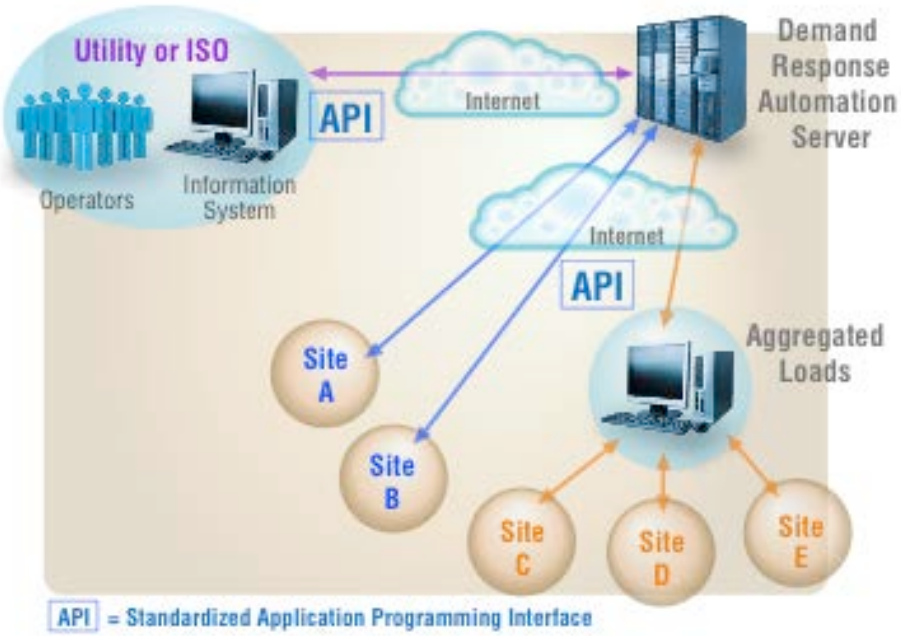


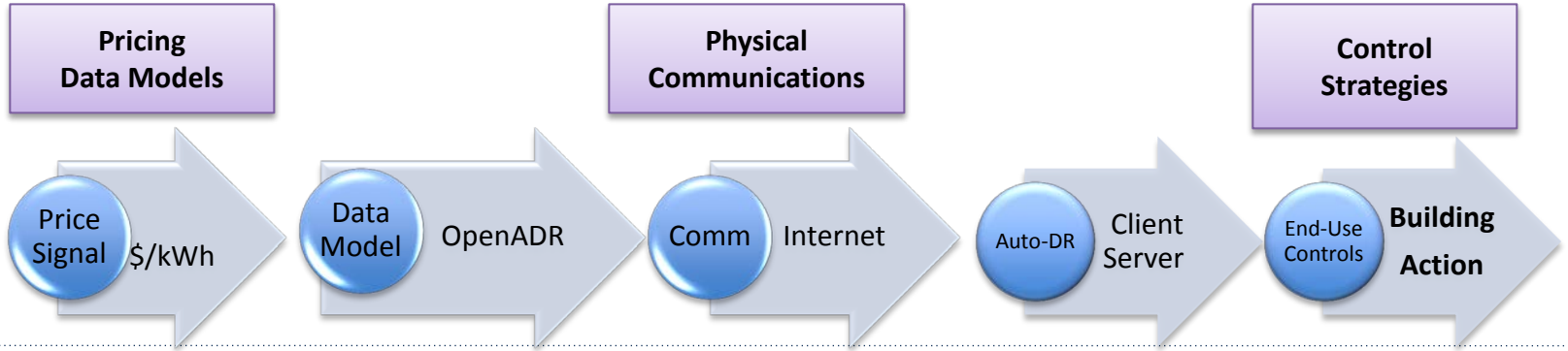
Customer perspective - Lower bills, integrate programs, make it simple

Open Automated Demand Response Standards Lower Cost of Automation

- Allows electricity providers to communicate DR signals directly to existing customers
- Uses common XML language and existing communications
- Over 1300 C&I sites in California

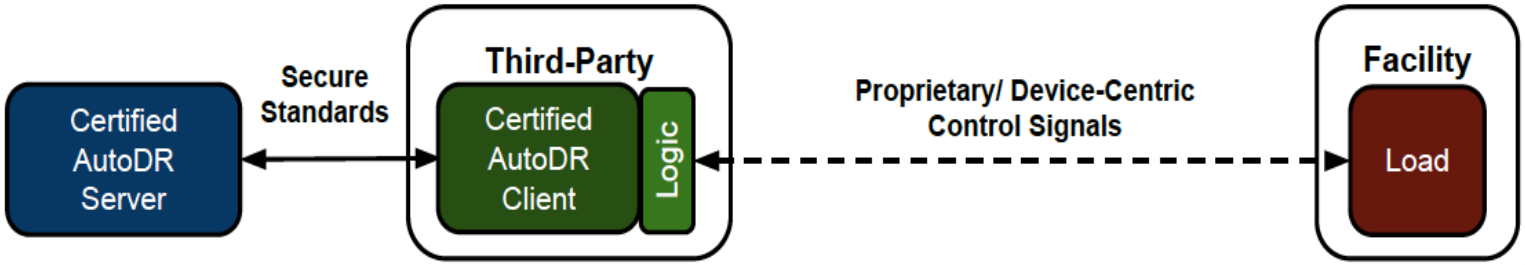






Demand Response in Emerging Building Codes Around the US

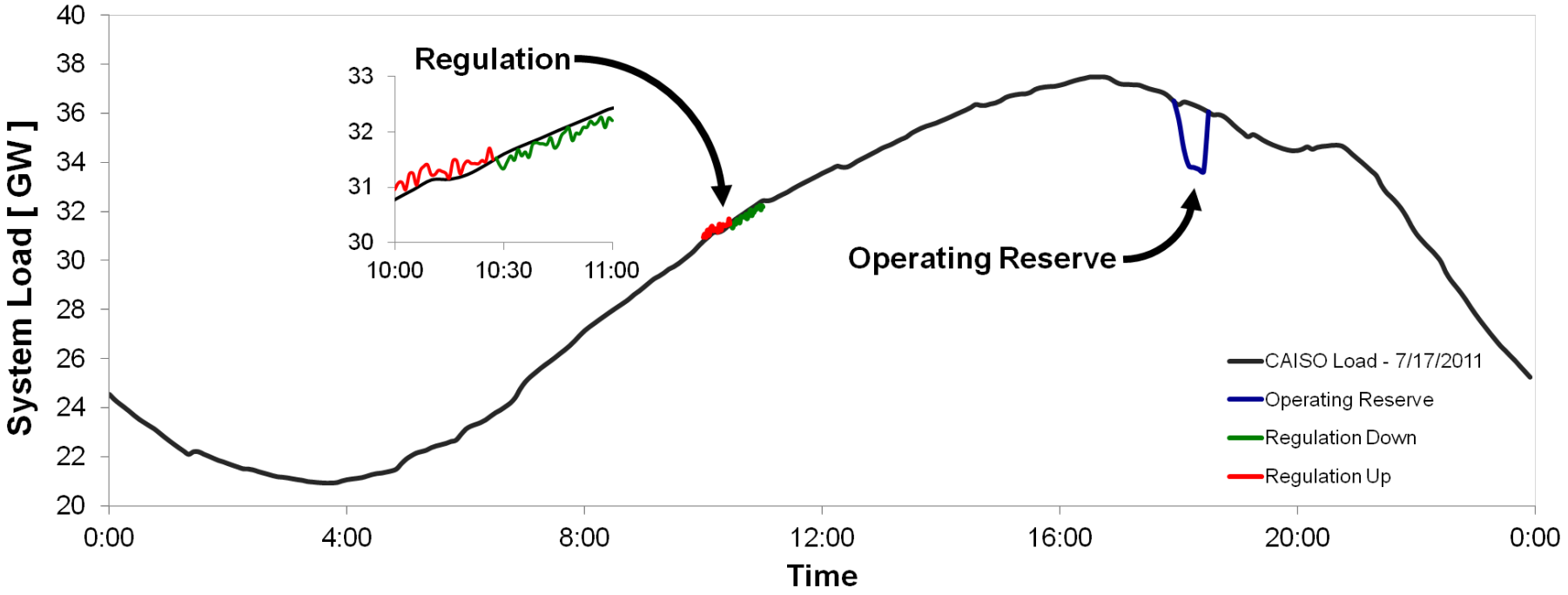
Building Code	Strategy for Encouraging Participation in DSM Mechanisms				
	Ensure Curtailable Load	Ensure Appropriate DR Controls	Require Certification of DR Systems	Require Participation in DR Events	Monitoring & Reporting Requirements
2013 Title 24 (Part 6)	Yes	Yes	Yes	No	Yes
2013 CALGreen (Title 24, Part 11)	Yes	Yes	Yes	No	Yes
ASHRAE 90.1-2013	Yes	No	No	No	Yes
ASHRAE 189.1-2011	Yes	Yes	No	No	No
2012 IECC	Yes	No	No	No	No
2012 IRC	Yes	No	No	No	No
IGCC	Yes	Yes	No	No	No
LEED (pilot credit 8)	Yes	Yes	Yes	Yes	No
National HERS	No	No	No	No	No
California HERS	No	No	No	No	No



New Markets for Responsive Loads

Product		Physical Requirements			
Product Type	**General Description**	**How fast to respond**	**Length of response**	**Time to respond**	**How often called**
Regulation	Response to random unscheduled deviations in scheduled net load	30 sec	Energy neutral in 15 min	5 min	Continuous w/in specified bid period
Flexibility	Load following reserve for un-forecasted wind/solar ramps	5 min	1 hr	20 min	Continuous w/in specified bid period
Contingency	Rapid & immediate response to supply loss	1 min	≤ 30 min	≤ 10 min	≤ Once/day
Energy	Shed or shift energy consumption over time	5 min	≥ 1 hr	10 min	1-2 x/day & 4-8 hr notification
Capacity	Ability to serve as an alternative to generation	Top 20 hrs coincident w/balancing authority peak			

Ancillary Services



Operating Reserves respond when a contingency event occurs to restore balance.

- respond within 10 minutes
- event duration typically 10-30 minutes
- Includes Synchronous and Non-Synchronous

Regulation rectifies small discrepancies between load and 5-minute real time dispatch

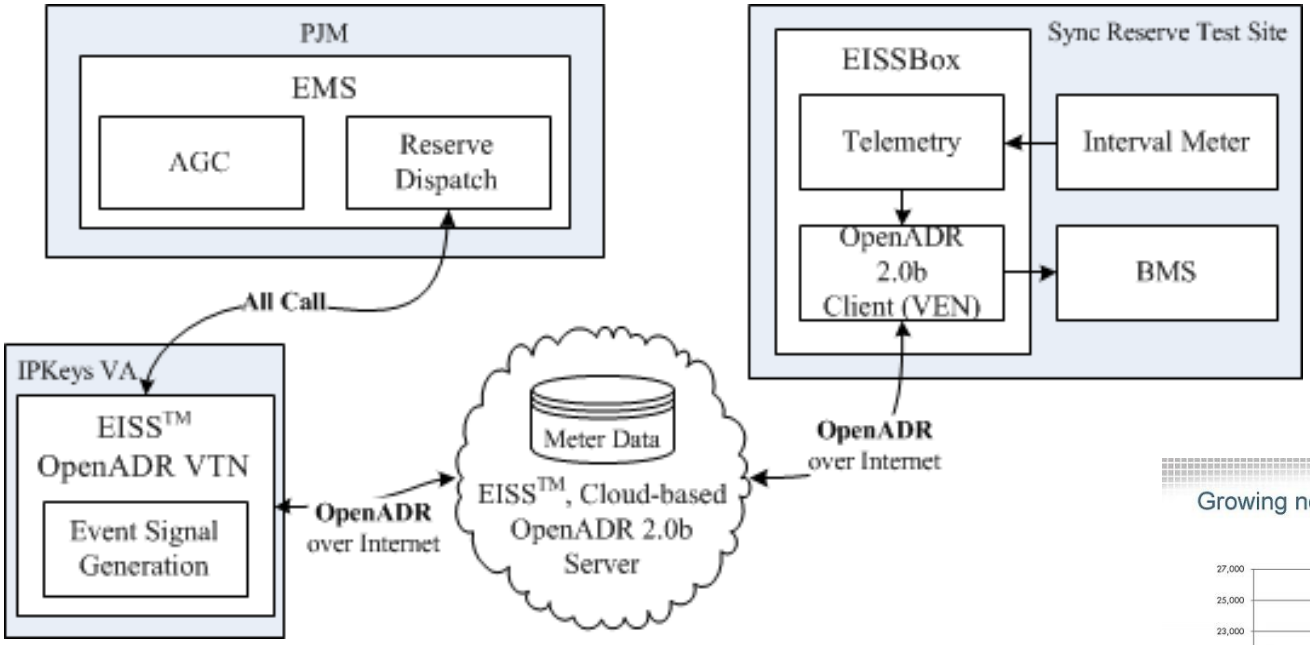
- receives an operating point instruction and responds within 4 seconds
- Theoretically energy neutral, although not in practice

Opportunities for Building to Grid Transactions

- **Match timing** and delivery of building services, and energy use, to actual needs of occupants
- **Adjust delivery of services** to local availability of energy generation and storage resources, to include power reliability during grid outage
- **Provide a "grid-interactive" load profile** and maximize use of variable renewable resources on grid
- **Provide ongoing info -** to users occupants/owners/about building's performance, inform building operation and capital investment

Load as a Resource for Renewable Integration

New communication systems provide fast demand response



Technical Potential of Any Time Demand Response

LOADS

Residential

Municipal

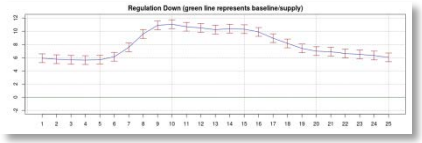
Commercial

Agricultural

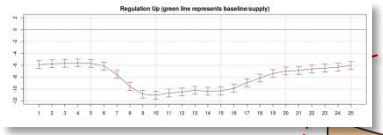
FLEXIBILITY FILTER

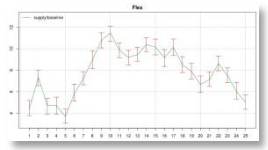
Response Parameters
Flexibility range (reg up, reg down, both)
Speed of Response
Store, Shift or Shed
Size of Response
Controllable
Sizing of Resource
Min and max daily consumption requirements
Cycling Rate Impacts (wear/tear)
Impacts on Overall Response
Rebound/Recovery Issues
Charge/Discharge
How to Predict
Predictable or Variable (daily, seasonal, geographic)
Time or Operational dependence
How it Participates
Individual or Aggregated

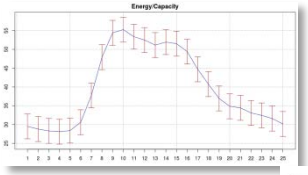
ANCILLARY SERVICES PRODUCTS

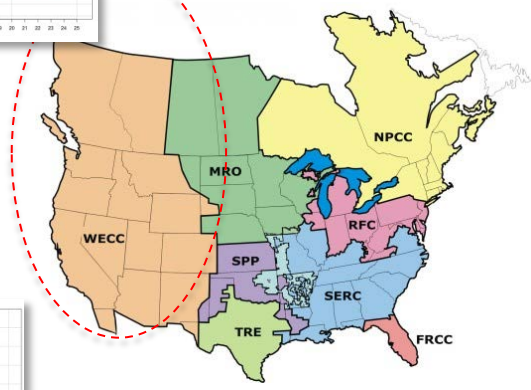


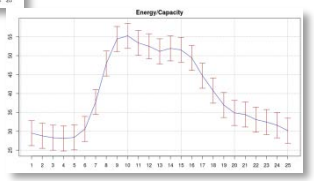
MODELS









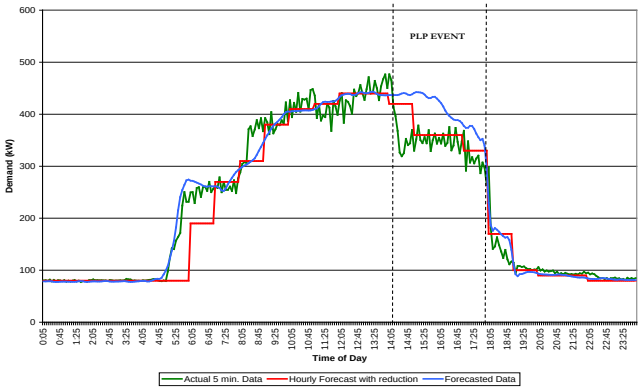


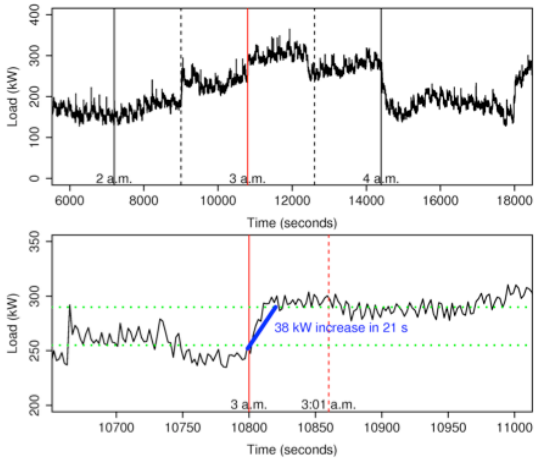
*Builds on 10 years of field work by DRRC

Fast DR in Commercial Buildings

Buildings can provide ramping

- Costs will be lower if used in many DR programs
- How often can load be called?





Site	Available Capacity (MW)	Min. Operating Limit (MW)	Max. Operating Limit (MW)	Ramp Rate (MW/min.)
UC Merced	0.16	0	0.17	Reg up: 0.022 Reg down: 0.022
West Hill Farms	0.03	0	0.16	Reg up/down:0.03
SMCC	0.2	0	0.2	Reg up: 0.05 Reg down_1: 0.066 Reg down_2: 0.134

How Can we Pay for this DR?
Integrated Incentives for Lighting from Sacramento

- Achieve 50-75% energy savings by managing lighting fixtures and lamps
- Create flexible schedules to turn on, off and dim lighting
- Improve lighting quality and increase employee satisfaction
- Track costs and savings, while observing data in real time
- Plan maintenance of lighting, by anticipating lamp replacement
- Control lighting onsite or remotely from internet based interfaces, like your smart phone, or computer terminal
- Incorporate automated demand response capability into your system

Summary

- **Linking energy efficiency and DR makes sense**
- **New technology helps us automate DR, and building codes provide lower cost path for technology**
- **Moving toward an integrated, efficient, cleaner, reliable and low cost grid**