



OpenADR Communications Standards

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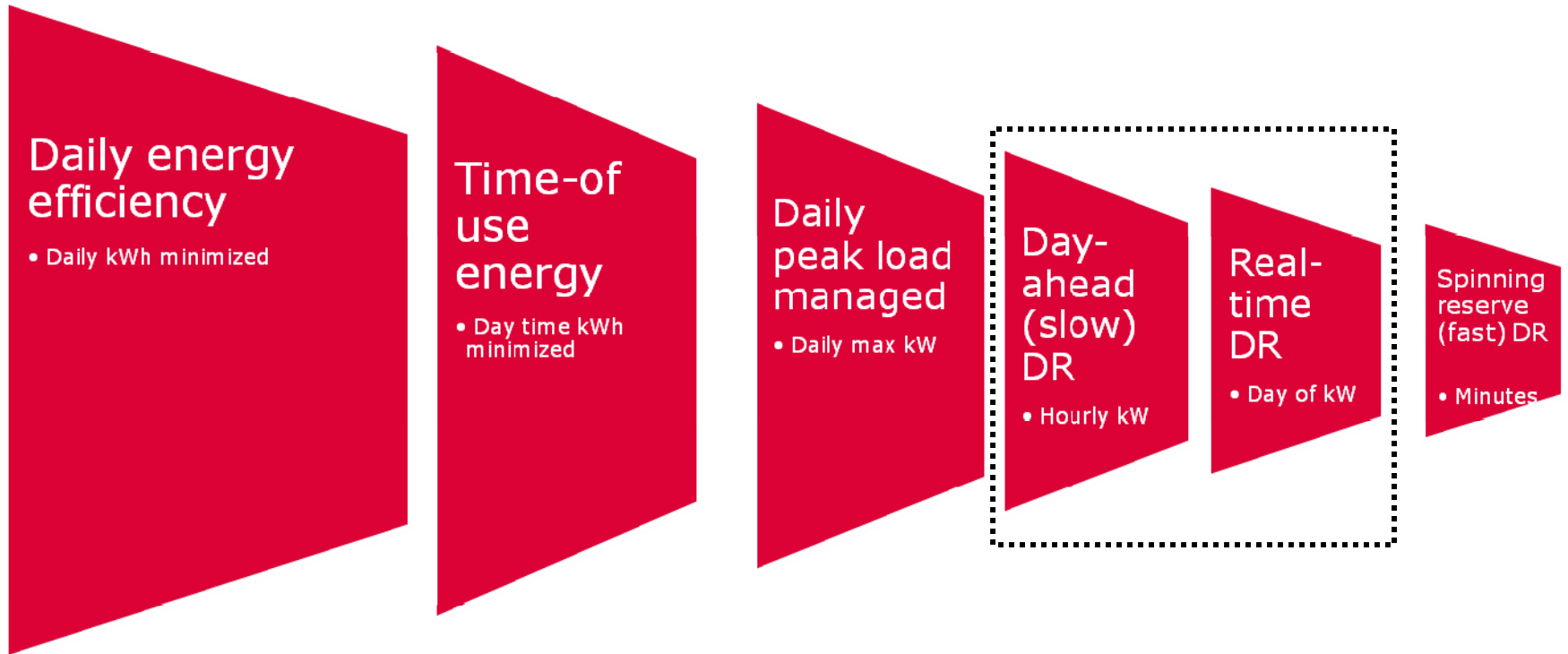


Learning Objectives

- Definition and history of Open Automated Demand Response (OpenADR) concept
- Empirical results from Automated Demand Response in CA
- DRAS concept and what is being standardized with OpenADR
- OpenADR and BACnet
- Standards effort and status

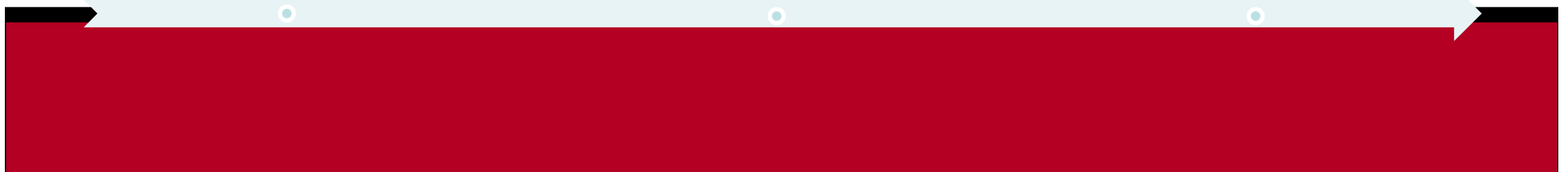


Energy Management/DR Spectrum



Service Levels Optimized

Service Levels Temporarily Reduced



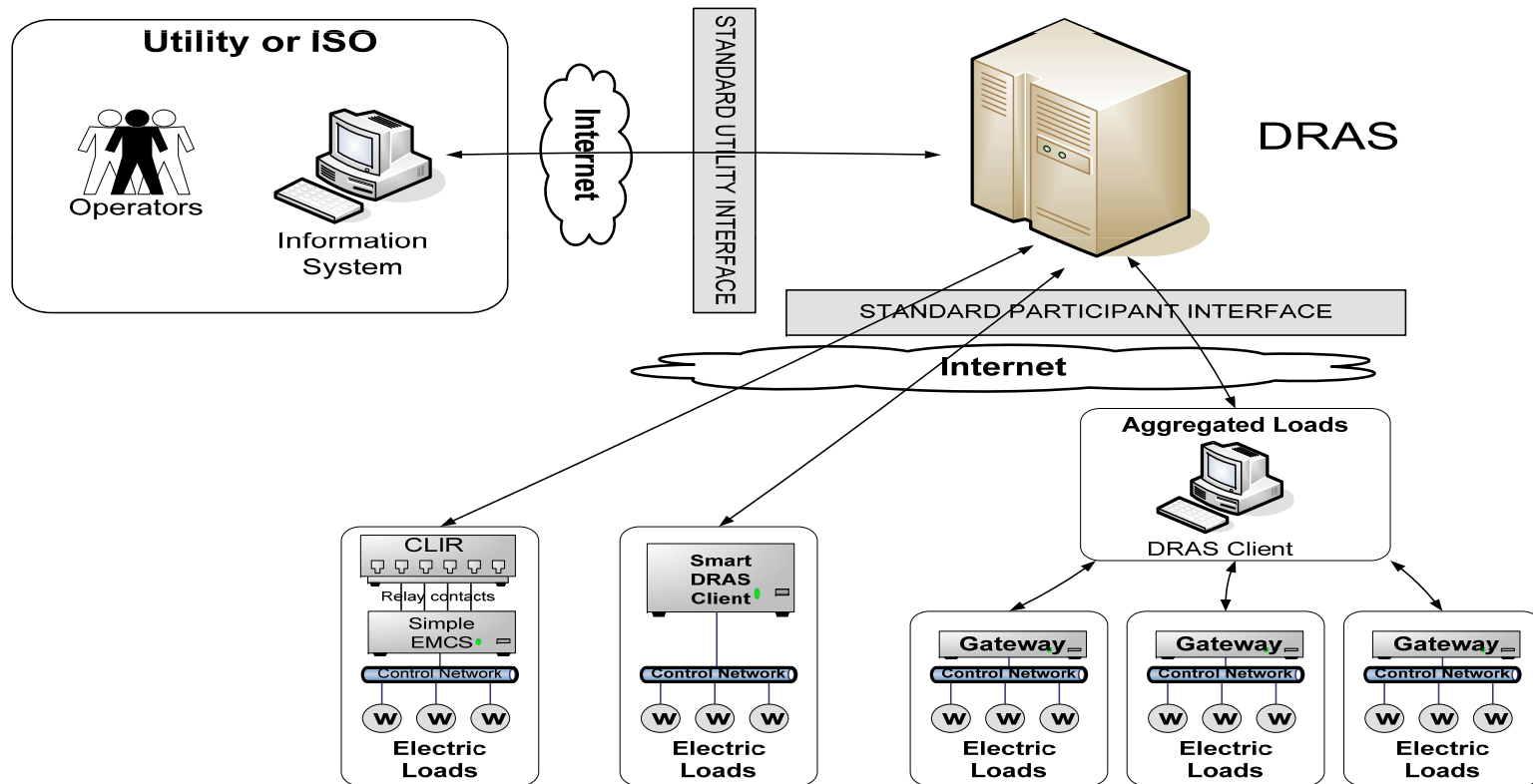


History

- 2002 - Research begun at LBNL Demand Response Research Center (DRRC) into automated DR. Funded by CEC and PIER.
- 2003 – Initial development at DRRC using XML exchange of information with limited field trials.
- 2004 – Use of internet relays in field trials to support automation with simple EMCS, scaled up field tests.
- 2005 – Development of DRAS concept. Collaboration with PG&E’s CPP DR program.
- 2006 – Expanded field trials and use in PG&E’s Pilot DR programs. Development of CLIR box for use as Simple DRAS Client.
- 2007 & 2008 – Commercialization and use of DRAS in PG&E, SCE, and SDG&E DR programs.
- **2007 – Standardization effort for Open-ADR begins**
- **2008 – First draft of proposed standard released for public review 5/08, second draft scheduled for 4th Qtr 08.**

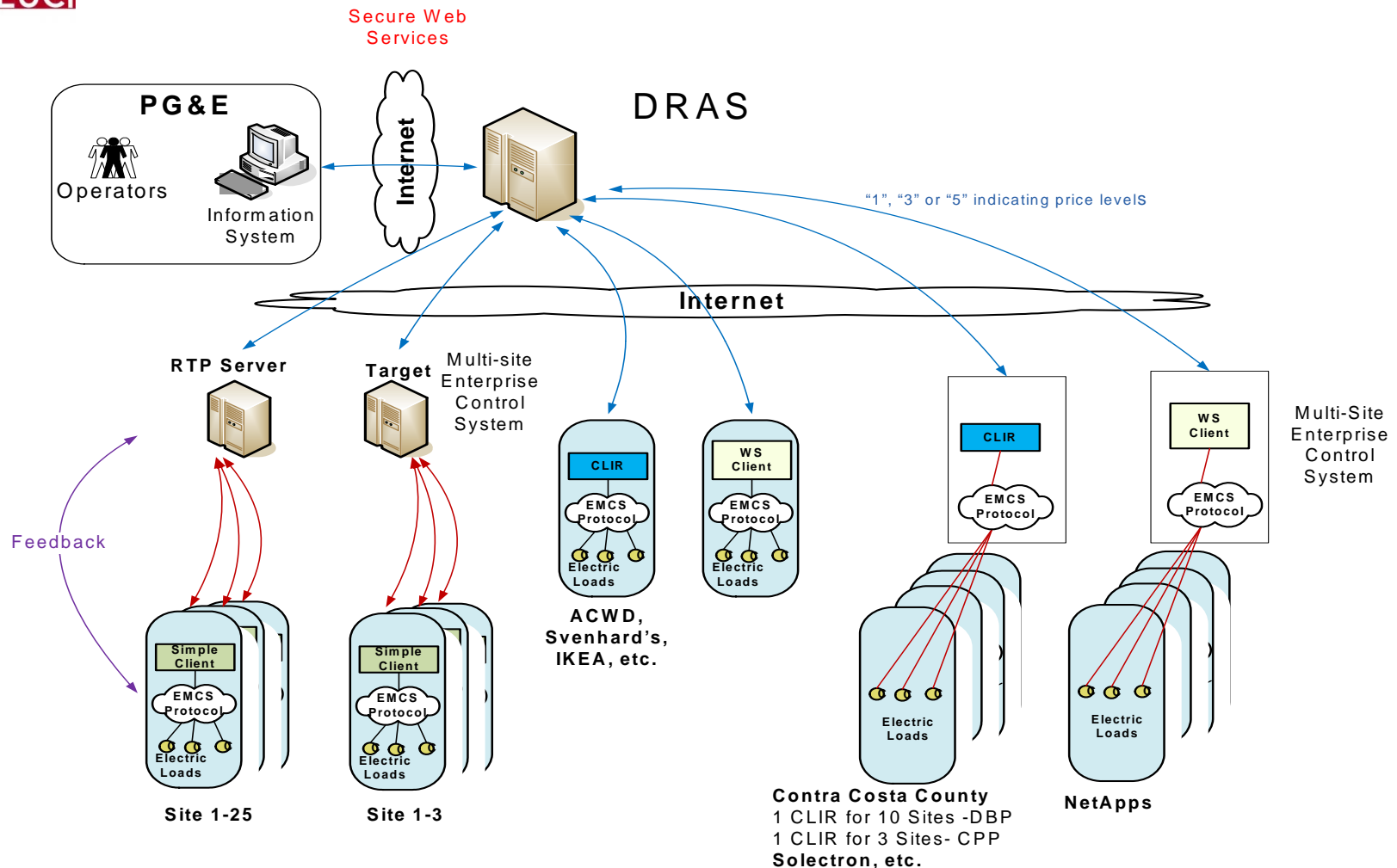


OpenADR and DRAS Concept (C&I)



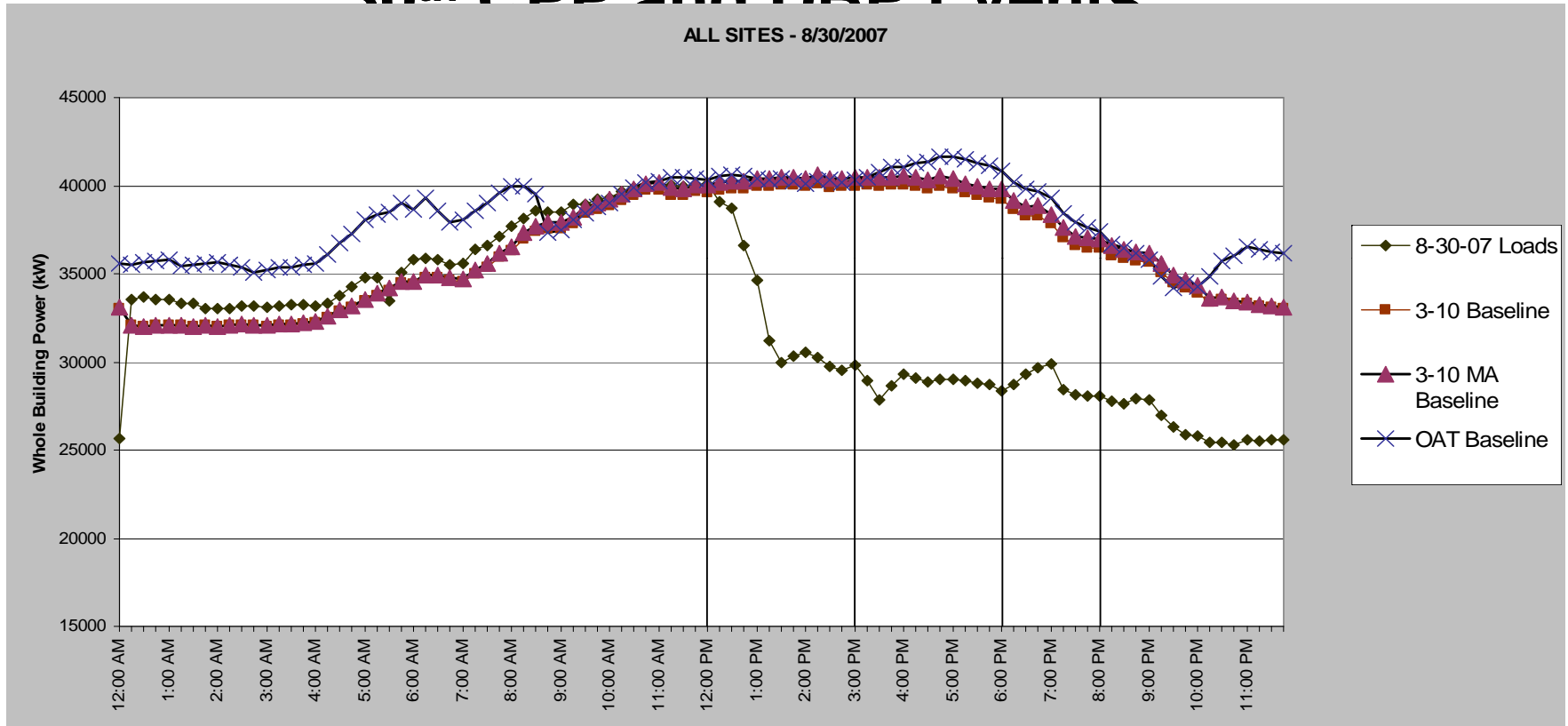


Actual Deployment Scenarios (PG&E)





PG&E Load Shape Impacts for August 30th CPP and DRP Events



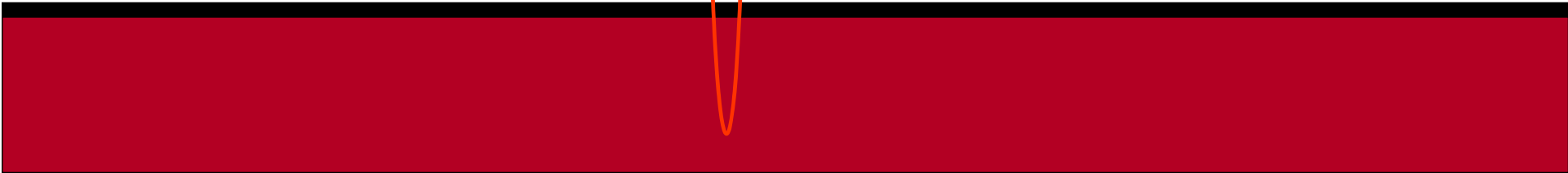
Reductions represented nearly 12 MW!



Sample DR Shed Strategies

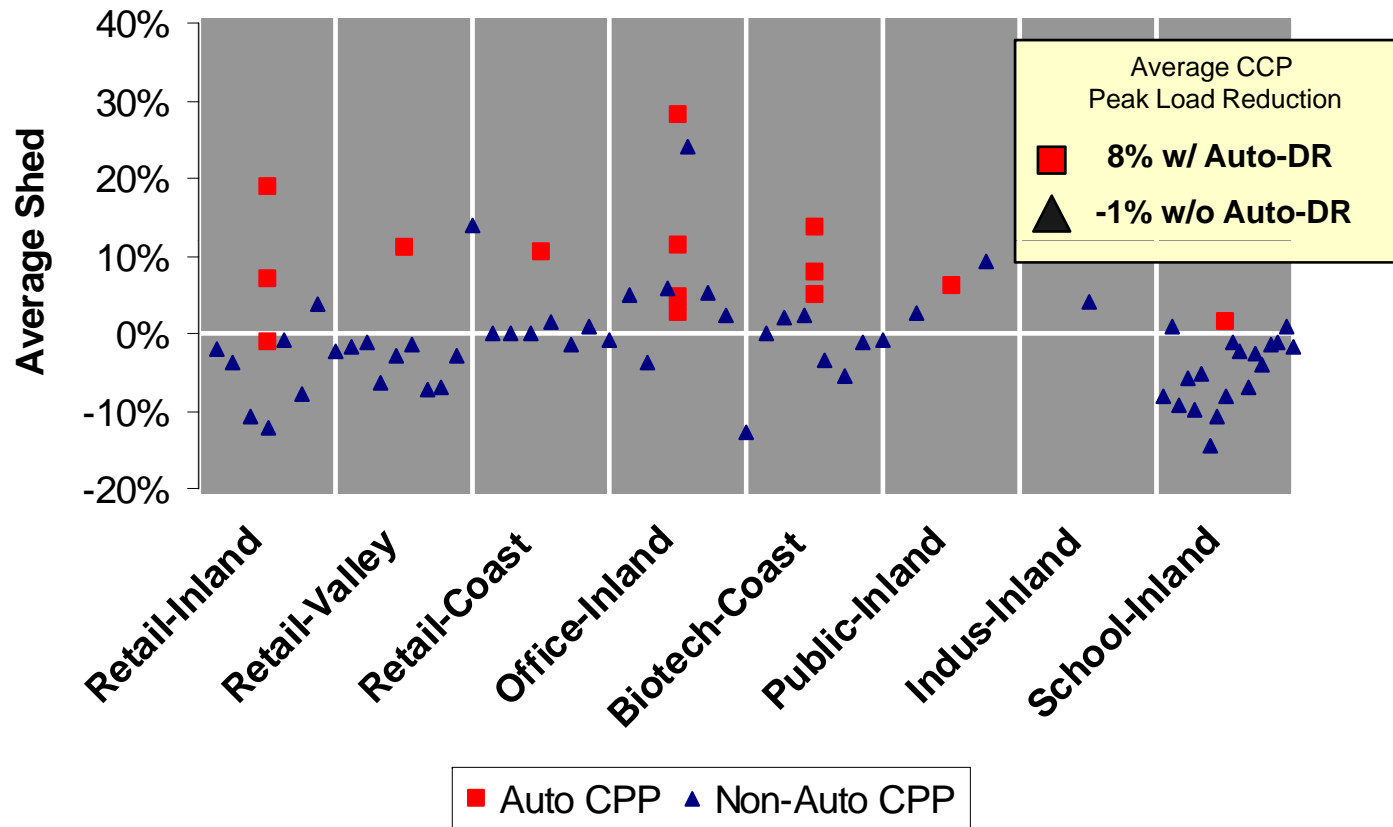
Global Temperature Reset Migrated to California Energy Code

	Building use	HVAC											Lighting					Other
		Global temp. adjustment	Duct static pres. Increase	SAT Increase	Fan VFD limit	CHW temp. Increase	Fan dy. reduction	Pre-cooling	Cooling valve limit	Boiler lockout	Slow recovery	Extended shed period	Common area light dim	Office area light dim	Turn off light	Dimmable ballast	E-level switching	Non-critical process shed
ACWD	Office, lab	X	X	X		X					X	X						
B of A	Office, data center	X	X	X	X	X					X							
Chabot	Museum	X						X										
2530 Arnold	Office	X									X							
50 Douglas	Office	X									X							
MDF	Detention facility	X																
Echelon	Hi-tech office	X	X	X			X					X	X	X	X			
Centerville	Junior Highschool	X						X										
Irvington	Highschool	X						X										
Gilead 300	Office			X														
Gilead 342	Office, Lab	X		X														
Gilead 357	Office, Lab	X		X														
IKEA EPaloAlto	Furniture retail	X																
IKEA EMerbyville	Furniture retail	X																
IKEA WSacto	Furniture retail	X																
Oracle Rocklin	Office	X	X															
Safeway Stockton	Supermarket																X	
Solectron	Office, Manufacture	X												X				
Svenhard's	Bakery																	X
Sybase	Hi-tech office												X					
Target Antioch	Retail	X					X											
Target Bakersfield	Retail	X					X											
Target Hayward	Retail	X					X					X					X	
Walmart Fresno	Retail	X															X	





Auto-DR Effectiveness





OpenADR Communications Standardization

- **Impact interoperability**
 - Reduces “vendor lock-in”
 - Increases innovation
 - Lowers technology costs
- **Change a utilities current business practices**
 - Allows DR technology specifications to be interoperable
- **Impact reliability**
 - AutoDR can be used for price or reliability DR
 - Standards are secure and reliable
- **Impact pricing or financial planning for a utility**
 - CORNERSTONE of technology development is to enable DR with dynamic tariffs – facilitate ubiquitous response capabilities



Synergistic Efforts

- **Facility/Building Systems**

- **BACnet Standard Project Committee (SPC) and Analysis Program** (<http://www.bacnet.org/>) – UIWG and XMLWG
- **LonMark™ International** (<http://www.lonmark.org/>)
- **Organization for the Advancement of Structured Information Standards (OASIS)** (<http://www.oasis-open.org/>) and **Open Buildings Information eXchange (oBIX)** (<http://www.obix.org/>)
- **Continental Automated Building Association (CABA)** (<http://www.caba.org/>)
- **American Society of Heating Refrigerating and A/C Engineers (ASHRAE)** (<http://www.ashrae.org/>) – RP1011

- **Utility/ISO and Smart Grid**

- **IntelliGrid™** (<http://intelligrid.info/>) Living Laboratory Project – EPRI and Enernex
- **Advanced Metering Infrastructure (AMI)** – SDG&E (<http://www.sdge.com/ami/>), PG&E (<http://www.pge.com/smartmeter/>), and SCE (<http://www.sce.com/PowerandEnvironment/ami/>)
- **OpenAMI** (<http://www.openami.org/>) and **UCA International Users Group** (<http://sharepoint.ucausersgroup.org/>) – **Open Home Automation Network (OpenHAN)** (<http://www.ucaiuug.org/OpenHAN/>)
- **Gridwise™** (<http://www.gridwise.com/>) and **Gridwise Architecture Council (GWAC)** (<http://www.gridwiseac.org/>)
- **Programmable Communicating Thermostats (PCT)** (<http://pct.berkeley.edu/>) – CEC/PIER
- **CA Independent Systems Operator (CAISO)** (<http://www.caiso.com/>) – MRTU & Standardization of Bidding Message Models
- **Southern Company RTP XML Demonstration** (<http://www.southerncompany.com/>) – OpenADR TAG
- **NIST Smart Grid Standards Interoperability Framework**

- **International Standard Bodies**

- **International Electro-technical Commission (IEC) Technical Committee (TC) 8** (<http://www.iec.ch/>) – 61850
- **American National Standards Institute (ANSI)** (<http://www.ansi.org/>) and **International Standards for Integrating Enterprise and Control Systems (ISA-95)** (<http://www.isa-95.com/>) – EPRI
- **UCA International Users Group** (<http://sharepoint.ucausersgroup.org/default.aspx>)
- **Institute of Electronic and Electrical Engineers (IEEE)** (<http://www.ieee.org/>) **Power Engineering Society (PES) Intelligent Grid Coordinating Committee** (<http://ieee-pes-td.com/>)

- **Industry Initiatives**

- **New Energy Alliance (NEA)** (<http://www.newenergy.com/>) – Constellation New Energy
- **Demand Response and Advanced Metering Coalition (DRAM)** (<http://www.dramcoalition.org/>)
- **Utility Standards Board (USB)** (<http://topics.energycentral.com/centers/datamanager/view/detail.cfm?aid=1699>)
- **Alliance for Retail Energy Markets (AReM)** (<http://www.retailenergymarkets.com/>)
- **IBM Smart Grid initiative**



OpenADR Standardization Status

- Recruited participation from major stake holders including:
 - Utilities and ISO's including CAISO, PG&E, SCE, SDG&E, etc.
 - Variety of national standards bodies including NIST, OpenAMI, OpenHAN, IEC TC-8, etc.
 - Facility controls vendors and organizations including BACnet, LonMark, OASIS/oBIX, etc.
 - End user organizations including aggregators and Retail Energy Alliance (Big box retailers representing 3B square feet of retail space)
- First draft released for public review released 5/08
 - <http://drrc.lbl.gov/openadr>
- **Updated draft for public review fall 08**



Future Directions

- Enabling technologies for Small Commercial facilities
- Integration with AMI efforts for residential DR
- Prediction of facility responses to future DR events
 - Feedback of facility state
 - Better models for predicting facility response
- Real-time monitoring of facilities responses to DR events



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