



# Baselines for Retail Demand Response Programs

Bruce Kaneshiro  
California Public Utilities Commission  
March 12, 2009  
Contact Info: [bsk@cpuc.ca.gov](mailto:bsk@cpuc.ca.gov)





## Purpose of Baselines in Demand Response

- **What is the “Baseline”?**
  - **An hourly estimate of what a customer’s load would have been on the day of the DR event without taking any DR actions, for the purpose of determining the customer’s peak load reduction.**
  
- **Proper baselines lead to accurate estimates of a customer’s peak load reduction, which is important for:**
  - **Settlement:** compensating the customer fairly for the load reduction he provided.
  
  - **Resource Planning:** the aggregate DR contribution of a entire program can be accounted for in Resource Adequacy and long-term procurement planning.
  
  - **Cost-effectiveness evaluation:** DR programs can be properly compared, evaluated and adjusted if regulators are able to assess what the program can deliver relative to their costs.





## The CPUC's Load Impact Protocol

- **A set of guidelines that the Investor-Owned Utilities (IOUs) follow in estimating load impacts from DR programs.**
  - **The purpose of the LI Protocols is to provide *ex ante* forecasts of DR programs that will then be used to inform the CPUC's Resource Adequacy (RA) and Long-Term Procurement Plan (LTPP) proceedings.**
  - **The LI Protocols require the IOUs to determine *ex-post* impacts of DR programs for the past year (2008), but these impacts are not intended for settlements.**
  - **The LI Protocols do not adopt specific baselines. Rather they provide guidance on what impacts should be estimated, issues to consider in selecting an approach and how to report/format the information.**
  - **The IOUs are required to file an annual report on April 1 that provides the load impacts for each program in their DR portfolio.**
  - **CPUC decision:**  
[http://docs.cpuc.ca.gov/PUBLISHED/FINAL\\_DECISION/81972.htm](http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/81972.htm)
  - **Load Impact Protocols:**  
[http://docs.cpuc.ca.gov/word\\_pdf/FINAL\\_DECISION/81979.pdf](http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/81979.pdf)





## IOU DR Programs: Variation in Methods of Settlement

### Most Non-Emergency DR Programs Rely on a Baseline for Settlements:

- Standard “3-in-10” baseline.

### DR Programs with No Baseline for Settlements

- **Critical Peak Pricing (CPP):** a time-of-use rate where participants pay higher energy rates during critical peaks
- **Base Interruptible Program (BIP):** participants agree to drop load to a firm service level.
- **Air Conditioner (AC) Cycling:** participants in PG&E’s program receive a one-time enrollment incentive. Load drops are not measured for settlements.





## Enrolled<sup>1</sup> MWs in IOU Demand Response Programs

	July 2003	July 2005	December 2008	5% of System Peak Demand (DR Goal)
Dynamic Pricing (CPP)	0 MWs	50 MWs	177 MWs	2,500 MWs
Price-Responsive Incentive-Based DR Programs	0 MWs	800 MWs	717 MWs	
IOU-Aggregator Contracts	0 MWs	0 MWs	181 MWs	
Sub-Total for Non-Emergency Programs			1075 MWs	
Emergency-triggered Programs	1,485 MWs	1,600 MWs	2,072 MWs	N/A

[1] “Upper-bound” estimates – represents highest potential load drop. Actual results may vary.





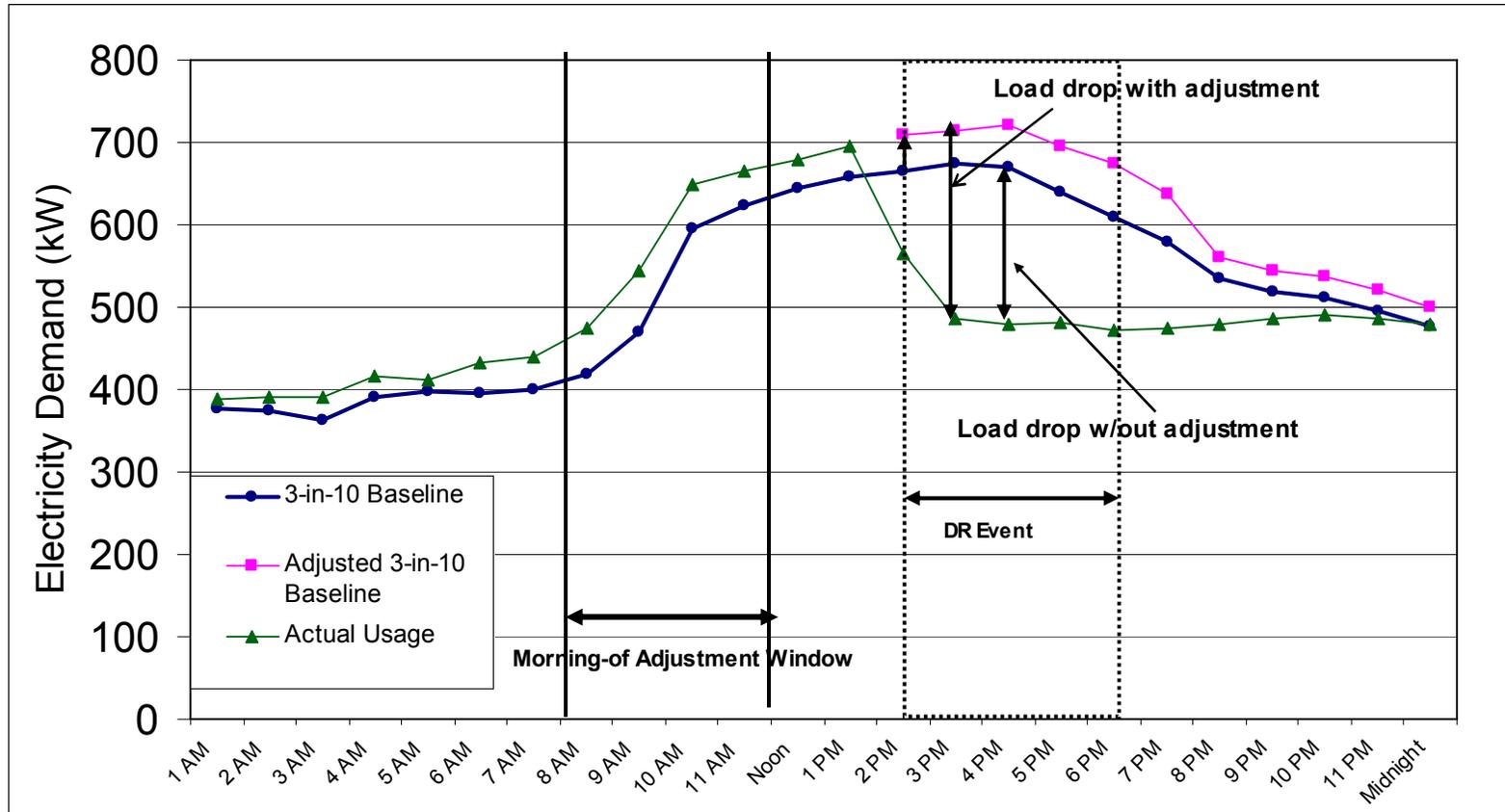
## Baselines Used in IOU's DR Programs for Settlements

- **Standard “3-in-10” baseline**
  - Based on the hourly average of the three (3) highest energy usages on the immediate past ten (10) similar days.
  - The three (3) highest energy usage days are those days with the highest total kilowatt hour usages within a certain time frame (e.g. noon and 8:00 p.m.)
  - The past ten (10) similar days includes Monday through Friday, excluding holidays, and excludes days when the customer was paid to reduce load for a DR event or days when rotating outages are called
  
- **The Morning-of Adjustment (PG&E Pilot)**
  - Intended to adjust for potential bias in the 3-in-10 baseline for weather-sensitive participants.
  - Participant's morning electricity usage for 4 hours used as a factor to adjust the participant's 3-in-10 baseline.
  - Any adjustment to the baseline is limited to plus or minus 20% of the existing baseline.
  - Participants who choose the morning-of adjustment are locked into this methodology for the year.





## Illustration of Morning-of Adjustment for a Weather-Sensitive DR Participant





## Baselines Under Consideration for '09-'11 Programs

- **10-Day Average Baseline**
  - Based on the hourly averages of energy usage on the immediate past ten (10) similar days.
  
- **3-in-10 Baseline**
  
- **5-in-10 Baseline**
  
- **Morning-of Adjustments:**
  - Default or Opt-in?
  - Two-way or Upward Only?
  - Cap or no cap?
  - Number of hours for the adjustment period
  
- **Aggregate vs. Individual Baselines**
  
- **CPUC Decision on Retail Baselines Expected by May 2009**





## Aggregate vs. Individual Baseline Issues

- **Aggregate Baseline Method (for 3-in-10 baseline):**
  - The hourly loads for all of an aggregator's nominated customers are summed for each of the past 10 days
  - The 3 highest days are identified from the 10 aggregated days
    - The three (3) highest energy usage days are those days with the highest total kilowatt hour usages within a certain time frame (e.g. noon and 8:00 p.m.)
  - The 3 highest days are then averaged to produce the baseline load for the aggregate group
- **Individual Baseline Method (for 3-in-10 baseline)**
  - The hourly loads for each of an aggregator's customers are evaluated separately to identify their *individual* 3 highest days of the past 10.
  - The average loads over those three days are calculated for a customer-specific baselines
  - The individual customer baselines are summed up to produce the baseline load for the aggregate group
- **The 3 highest days for the aggregated group is not necessarily the 3 highest days for each individual of the group.**





## Additional Baseline Issues

- **Baseline methodologies need to be accurate and difficult to game, yet also simple and transparent so that participants can understand how they will be compensated.**
- **The performance of baseline estimation methods depends crucially on the inherent variability of customers' loads.**
  - **One baseline cannot fit all**
- **If a multiple/individual-method baseline approach is the way to go, how would it be implemented?**
- **Customers with highly variable usage patterns: baselines do not work for them. How can these customers appropriately participate in DR?**
- **Should baselines adopted for wholesale settlements be the same or similar to the baselines adopted for retail settlements? What are the pros/cons if they are not the same/similar?**





## Recent Baseline Studies

- **Protocol Development for Demand Response Calculation - Findings and Recommendations. California Energy Commission Consultant Report. KEMA-XENERGY** Miriam L. Goldberg and G. Kennedy Agnew. February 2003  
[http://www.energy.ca.gov/reports/2003-03-10\\_400-02-017F.PDF](http://www.energy.ca.gov/reports/2003-03-10_400-02-017F.PDF)
- **Evaluation of 2005 Statewide Large Nonresidential Day-Ahead and Reliability Demand Response Programs.** Quantum Consulting Inc./Summit Blue Consulting, LLC. April 28, 2006
- **California Day-Ahead DR Program Baseline Load Analysis and PY-2006 Impact Evaluation.** Steven D. Braithwait, Michael Welsh, Dan Hansen, David Armstrong Christensen Associates Energy Consulting, LLC. January 2008
- **Estimating Demand Response Load Impacts: Evaluation of Baseline Load Models for Non-Residential Building in California**  
Coughlin, K., M.A. Piette, C. Goldman and S. Kiliccote. LBNL-63728. January 2008  
<http://drrc.lbl.gov/pubs/63728.pdf>

