Draft Final Proposal for Design of Proxy Demand Resource (PDR)

Margaret Miller
Senior Market & Product Economist

Stakeholder Meeting
July 28, 2009

Meeting Objectives

- To review policy and invite input on the policy features of proxy demand resource
  - Draft Final Proposal posted on July 21 at:

http://www.caiso.com/23f2/23f2f7866d050.pdf

ISO worked with DR working group to refine proposal

- Series of DR working group meetings held from May through July
- Added proposed baseline methodology and details around requirements for direct participation
  - Qualification
  - Registration
  - Scheduling & Bidding
  - Notification
  - Metering
  - Settlements

PDR will go to the board in September for a decision

- Final draft will be posted to ISO website on August 5
- Written comments are requested by close of business August 14 to mmiller@caiso.com
- Planned for implementation in May 2010

Proxy demand resource adds to demand response capability available to market participants

- Provides flexibility needed to incorporate price responsive retail demand response programs into the ISO markets
- Meets requirements of FERC Order 719 on direct participation
- Not considered an all encompassing product

PDR is a bid submitted by a CSP to curtail load at a CLAP using a proxy generator resource

- LSE continues to schedule forecasted load at the DLAP
- The LSE and the CSP may be the same or different entities
- Settlement for the curtailed portion of the load would be settled by the ISO directly with the CSP at the PDR's specified CLAP
- Determination of actual PDR delivery will be derived from measurement of aggregate meter usage, calculated from a pre-determined baseline

LECG raised concerns related to when dispatches are not settled at the same location as the underlying demand schedules

- The ISO believes gaming opportunities are limited with PDR for the following reasons:
  - Many DR programs that aggregate numerous customers have limits on hours of use
  - DR resources will tend to be high priced resources which limits the probability of guaranteed dispatch
  - Gaming concerns involving strategic moves by customers to manipulate the outcome of the baseline calculation appear to be less likely when customers are part of larger aggregations

The Market Steering Committee (MSC) issued an opinion to the April 27 proposal recommending that CSP's purchase their baseline in the preceding market

- The ISO identified a number of issues with the MSC approach that present challenges to implementing this approach in the short term
  - Earnings would depend more on whether real-time prices are higher or lower than day-ahead prices than on the performance of the demand response resource.
  - Possible conflicts with existing rules around direct access
  - Limited incentive for customers to provide demand response due to existing retail rate design
  - MSC proposal requires full participating load functionality which is not planned to be implemented until February 2011

To mitigate gaming concerns the ISO is proposing a minimum bid price at which PDR can be offered

- Prior proposal suggested the bid price be set to the Default LAP price that was exceeded for only 200 hours in the previous year
- The ISO will determine a revised methodology to determine the bid price and share that with stakeholders in the next version of the proposal

PDR Participant Qualification

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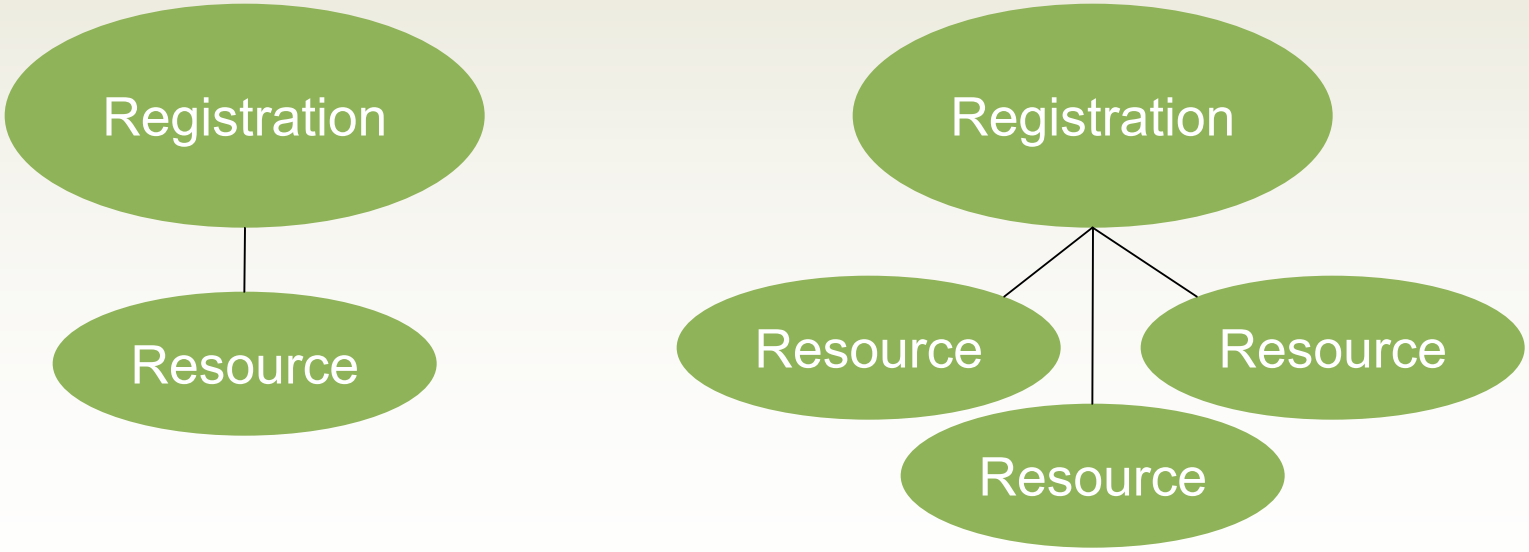
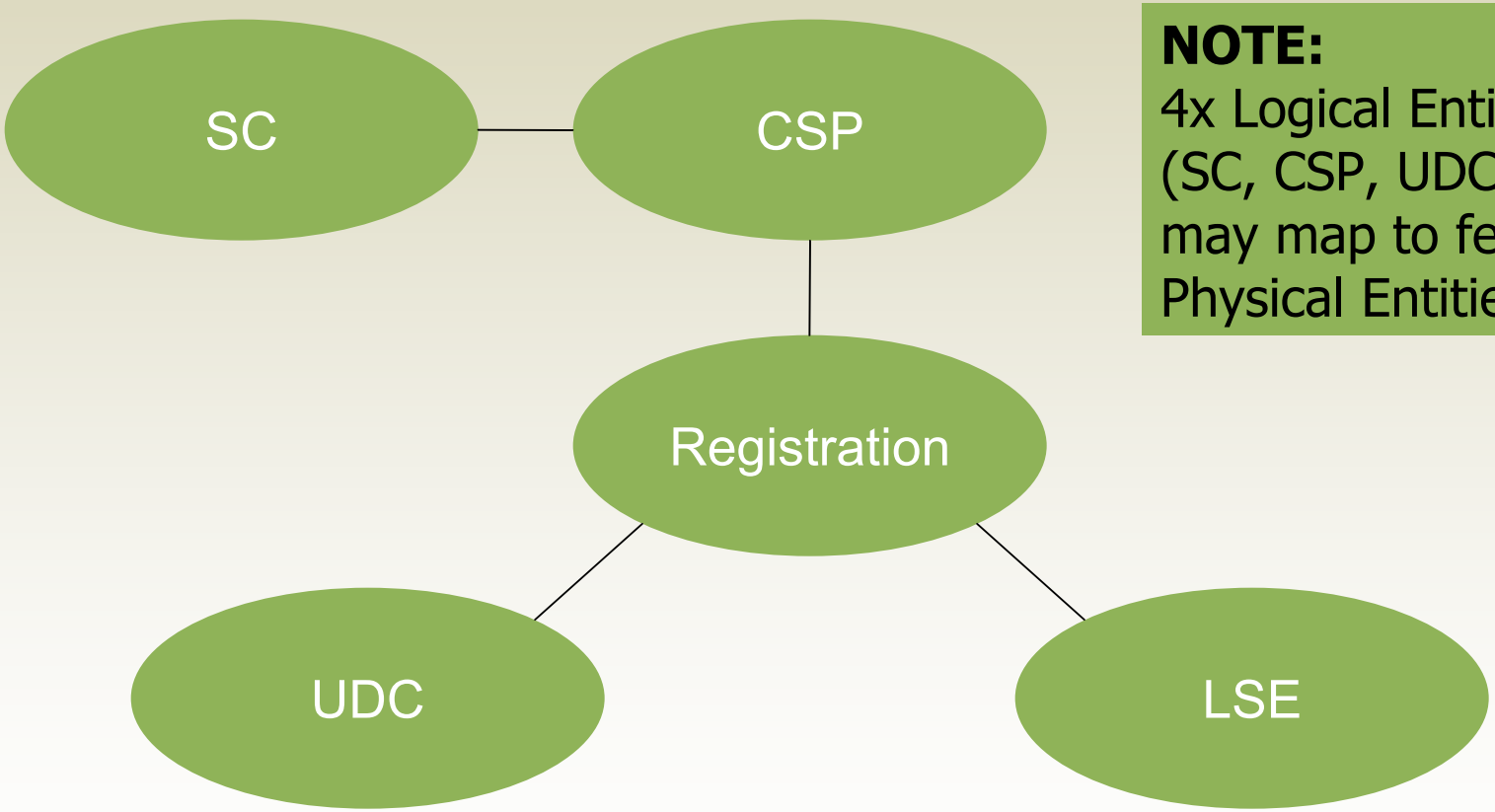
Qualification

- Definitions
  - Resource - refers to a specific metered site or location
  - Registration – refers to the recognized entity capable and approved for participation as a PDR



Qualification Requirements



NOTE:
4x Logical Entities (SC, CSP, UDC, LSE) may map to fewer Physical Entities

Qualification Restrictions

- All Resources in the Registration must be in the same CLAP and associated with same LSE
- Registration must meet minimum load size and curtailment amount limits as set for by PDR Program
- PDR must be able to provide hourly interval data
- For some programs (AS), additional metering telemetry may be required
- PDR participation explicitly precluded by LRA for UDC's that serve more than 4 million MWh in previous fiscal year
- LRA must explicitly notifiy CAISO that PDR participation is allowed for UDC's that serve 4 million MWh or under

PDR Participant Registration

California ISO

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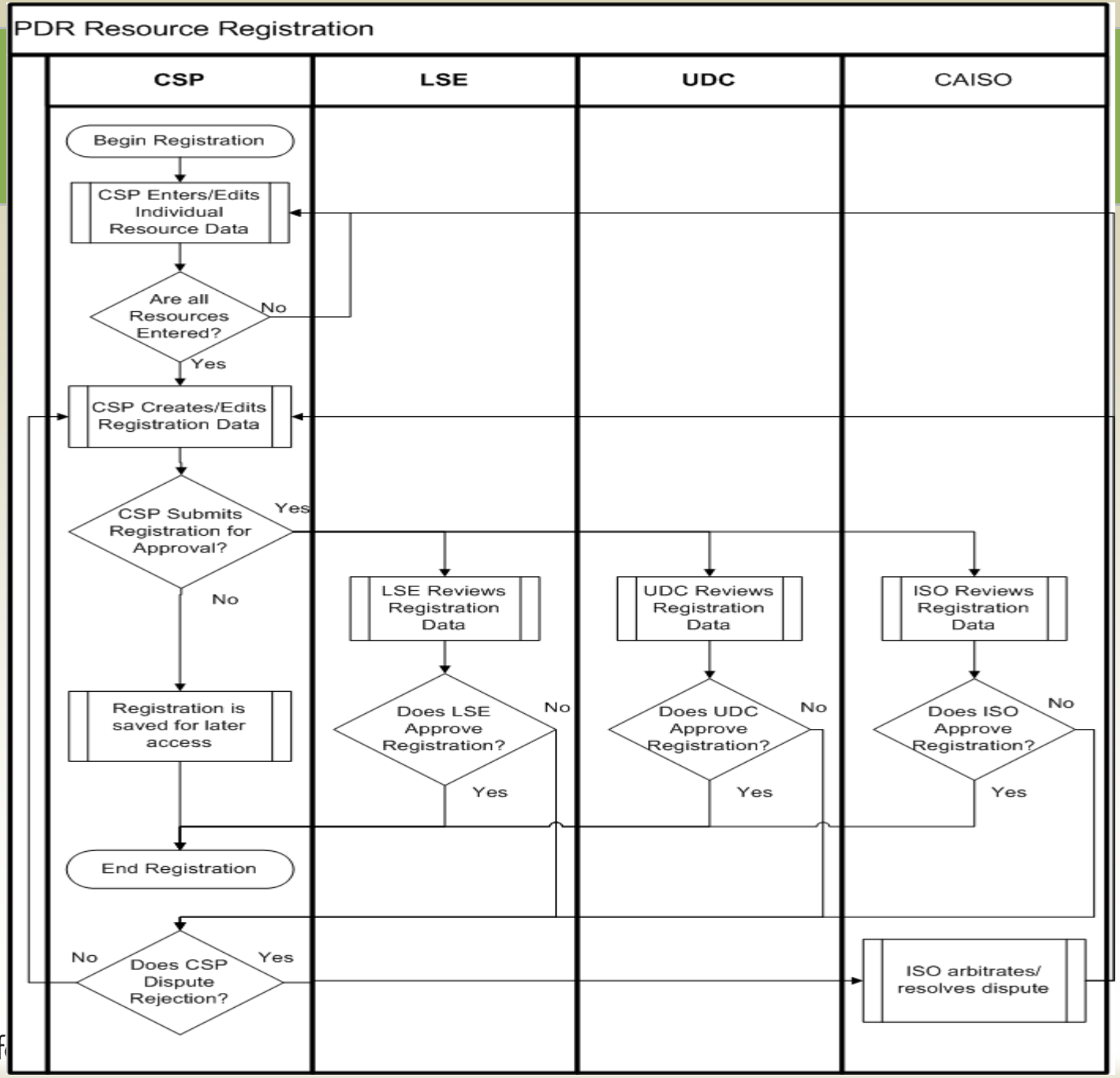
Registration Goals

- Capture locational, operational, and physical characteristics of each PDR
- Provides series of controls to ensure the appropriate acknowledgement to required parties of PDR registrations, most important being those to the LSE and/or UDC so that changes to functions such as forecasting can be altered.
- Unique identification of the target resource to identify duplicate or overlapping PDR registrations
- Manage effective dates to potentially match CSP contracts


PDR Resource Registration
CSP
LSE
UDC
CAISO
Begin Registration
CSP Enters/Edits Individual Resource Data
Are all Resources Entered?
No
Yes
CSP Creates/Edits Registration Data
CSP Submits Registration for Approval?
Yes
No
LSE Reviews Registration Data
UDC Reviews Registration Data
ISO Reviews Registration Data
Registration is saved for later access
Does LSE Approve Registration?
Does UDC Approve Registration?
Does ISO Approve Registration?
No
Yes
End Registration
No
Does CSP Dispute Rejection?
Yes
ISO arbitrates/ resolves dispute

Registration Considerations – Page 1

- LSE's and UDC's only review and approve PDR registrations
- LSE or UDC can reject a registration
  - Incorrect information
  - Resource does not belong to LSE or UDC
  - Resource already registered to another CSP
- Rejected registrations restart the approval process
- 10 time limit for LSE and UDC to take action on pending registration

Registration Considerations – Page 2

- Registrations cannot be modified once they are submitted for approval
- CSP can cancel registration in order to revise data before approvals are complete
- System will alert incumbent CSP if resource is attempted to be registered by another CSP
- Aggregations must contain resources that are all associated with the same LSE and UDC
- Resources contained in an aggregation must all also be within the same CLAP.

Registration Considerations – Page 3

- Aggregations cannot be changed once registered unless submitted for re-approval
- Entire aggregation is used to determine event performance
  - CSP cannot exclude some resources from event consideration
  - Resources that are no longer available for participation should be removed from aggregation

Registration Data

- Registration system/data storage is yet to be determined
- Likely will be mix of:
  - Existing Resource Data Template
  - Auxiliary system

Scheduling, Bidding & Notification

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Stakeholder Meeting
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A CSP must be a Scheduling Coordinator (SC) or be represented by a SC to bid a PDR into the ISO markets

- A PDR must have a minimum load size of 0.1 MW (100 kW)
- Smaller Loads may be aggregated together to achieve the 0.1 MW threshold.
- Bid segments may be as low as 0.01 MW (10 kW)
- PDR will be modeled as a pseudo generator and must be bid at a CLAP which may be as small as a single node or as large as an ISO defined Sub-LAP

A Scheduling Coordinator (SC) that represents a PDR can bid into the following markets:

- Day-ahead energy market including RUC
- Day-ahead and Real-Time Non-Spinning Reserve market
- Hour-Ahead Scheduling Process (HASP)
- 5- Minute Real-Time Energy market

PDR is qualified to provide Non-Spinning Reserve

- AS requirements for PDR will be revised as needed to reflect the outcome of WECC interpretation as well as the stakeholder process on AS requirements for non-generation resources
- the ISO will use a “meter before/ meter after” baseline determination for the purpose of compliance and settlement of capacity payments for AS

The ISO recognizes that LSEs as well as CSPs need to be aware of PDR Day-Ahead schedules and Real-Time dispatch information

- The ISO proposes that both LSE's and CSPs have access to the following CMRI reports
  - Day-Ahead Generation Market Results
  - Hour-Ahead Scheduling Process Schedules
  - Expected Energy
  - Real-Time dispatch information through ADS

In the case where the CSP and the LSE are separate entities, the LSE would have read only access only to the reports listed above and only for the specific resource IDs of any PDRs that are comprised of that LSE's customers

Metering & Telemetry

John Goodin
Demand Response Lead

Stakeholder Meeting
July 28, 2009

Section 9: Metering & Telemetry

- Purpose of Section 9:
  - Relationships & Responsibilities
  - Processes
  - Requirements

Relationships & Responsibilities- Metering

Section 9: Metering & Telemetry

Foundational:

- Curtailment Service Provider is the PDR 'Owner'
- PDR is a Scheduling Coordinator Metered Entity
- Scheduling Coordinator schedules, bids, settles PDR

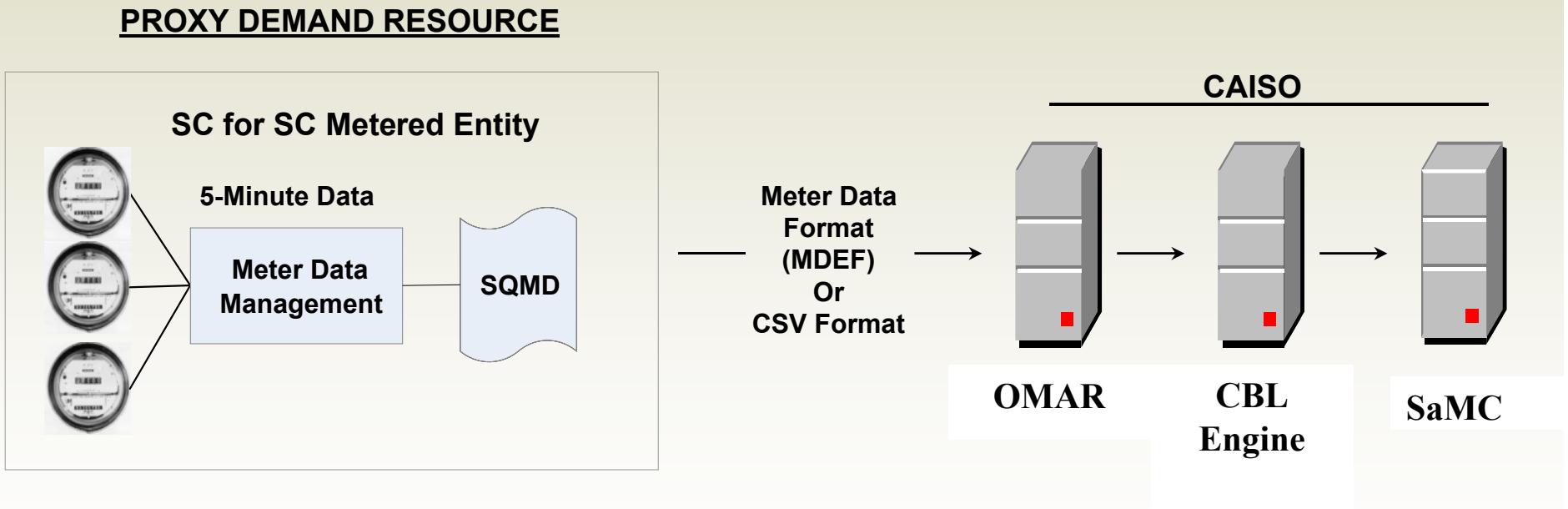
Formal Linkages:

- Participating Load Agreement or similar agreement between the CAISO and the CSP
- 'Certified' SC representing the PDR
  - Scheduling Coordinator Agreement
  - Meter Service Agreement for Scheduling Coordinators

Process- Metering

Section 9: Metering & Telemetry

Meter Data Process Flow



Requirements- Metering

Section 9: Metering & Telemetry

- Meter Data Intervals
  - For 5-Minute Dispatch of RT Energy and A/S
    - Data reported through OMAR in 5-minute intervals
    - 15-minute recorded interval data can be used but must be submitted as SQMD in 3 equal 5-minute intervals
  - For Day-Ahead Energy and RT HASP Participation
    - Data reported through OMAR in 1-hour intervals
- Meter Data Submission
  - Through OMAR On-line or OMAR via SFTP
  - MDEF or CSV format

Relationships & Responsibilities- Telemetry

Section 9: Metering & Telemetry

Foundational:

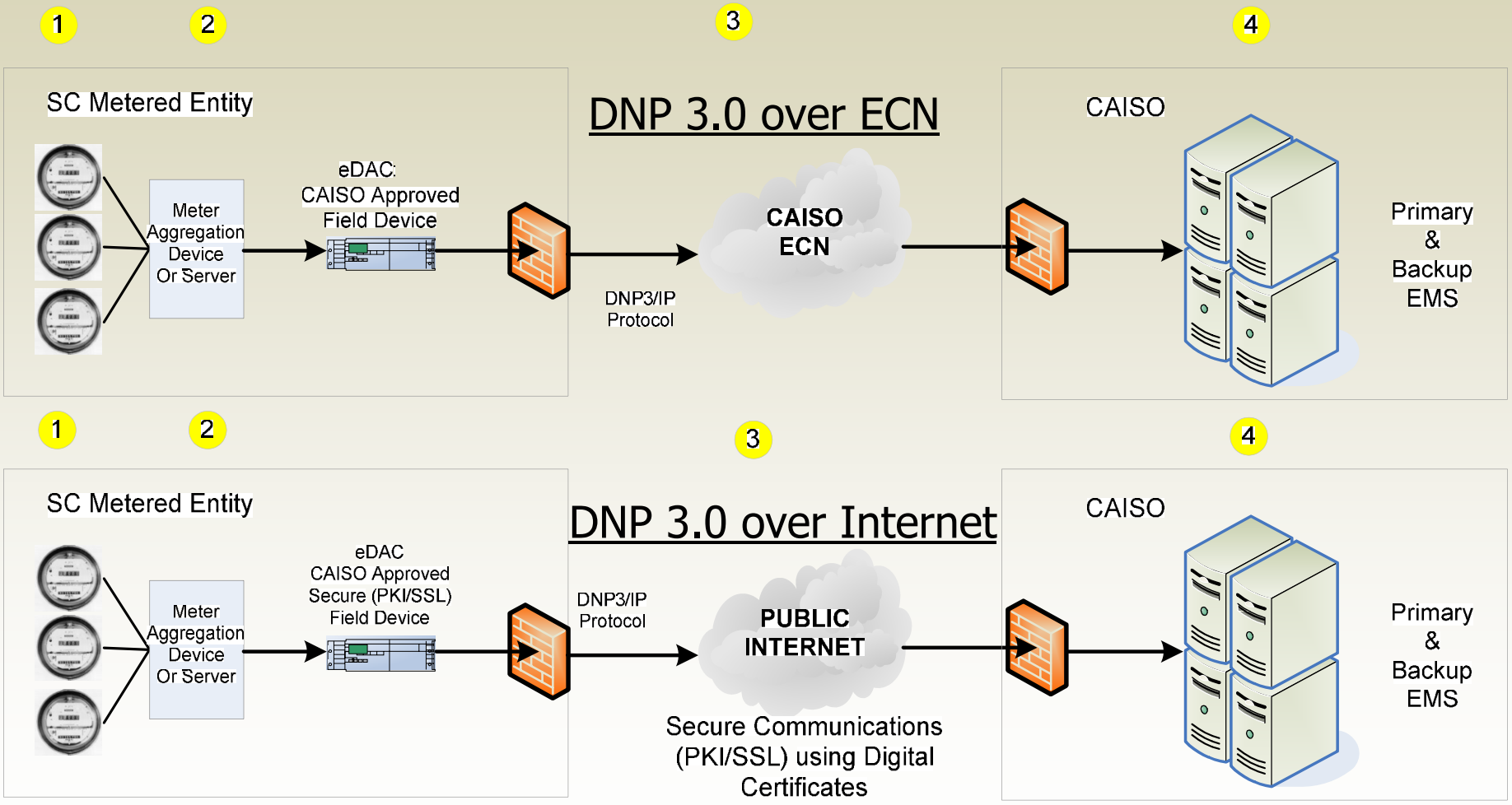
- Telemetry is only required to offer Ancillary Services
- Telemetry is not used for settlements, only for operations

Responsibilities of the CSP:

- 'Owner' of the PDR
- Maintain equipment and ensure data security
- Ensure PDR can meet telemetry requirements

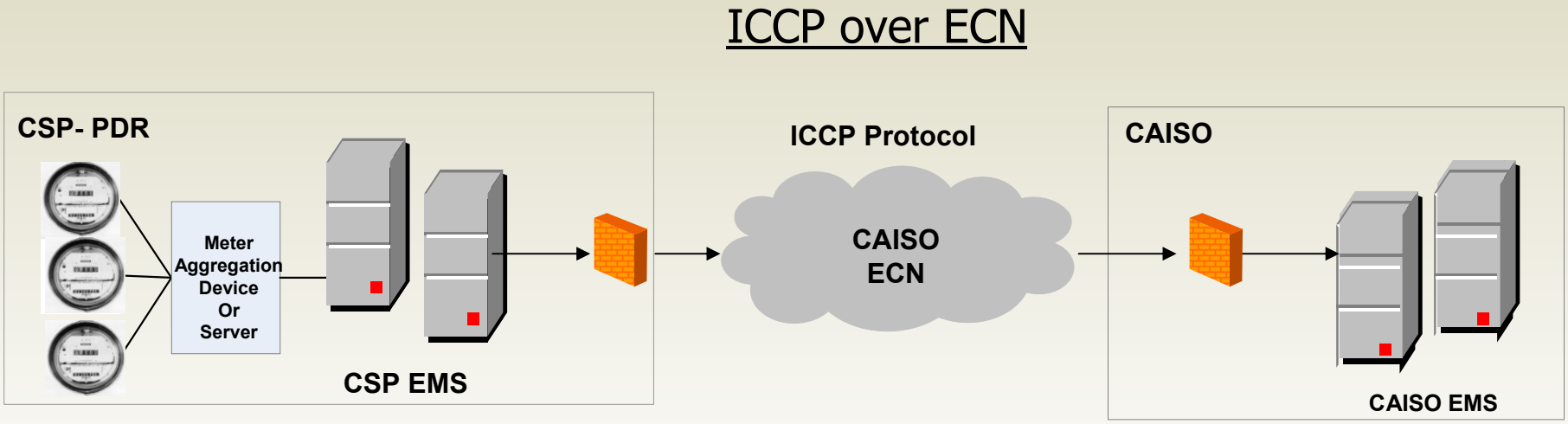
Process- Telemetry

Section 9: Metering & Telemetry



Process- Telemetry

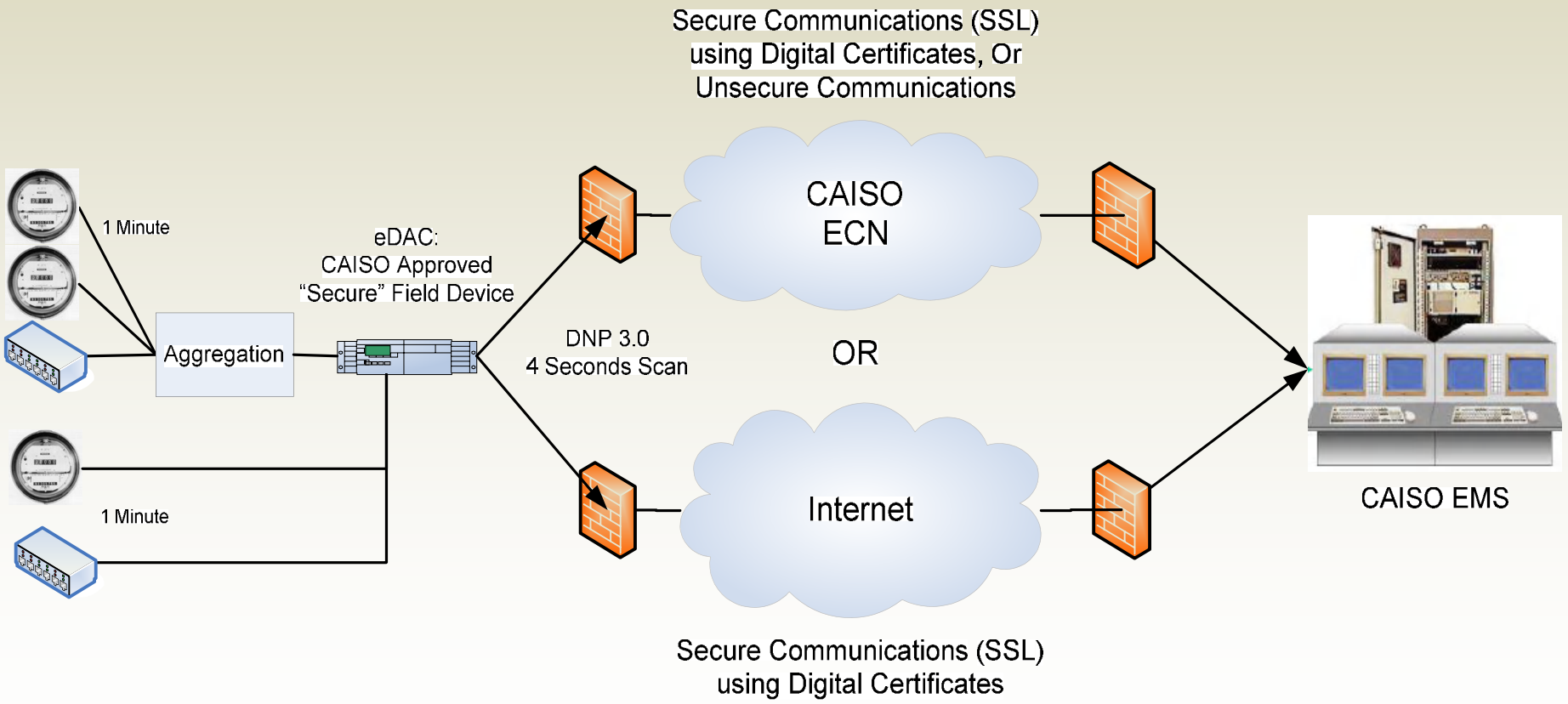
Section 9: Metering & Telemetry



Requirements- Telemetry

Section 9: Metering & Telemetry

Telemetry Timing Requirements



Requirements- Telemetry

Section 9: Metering & Telemetry

- Point of Telemetry Reporting
  - Reporting at same point used for energy settlement
  - Reporting at levels below the point of energy settlement will be considered on a case-by-case basis

Customer Baseline Review and Recommendation

California ISO

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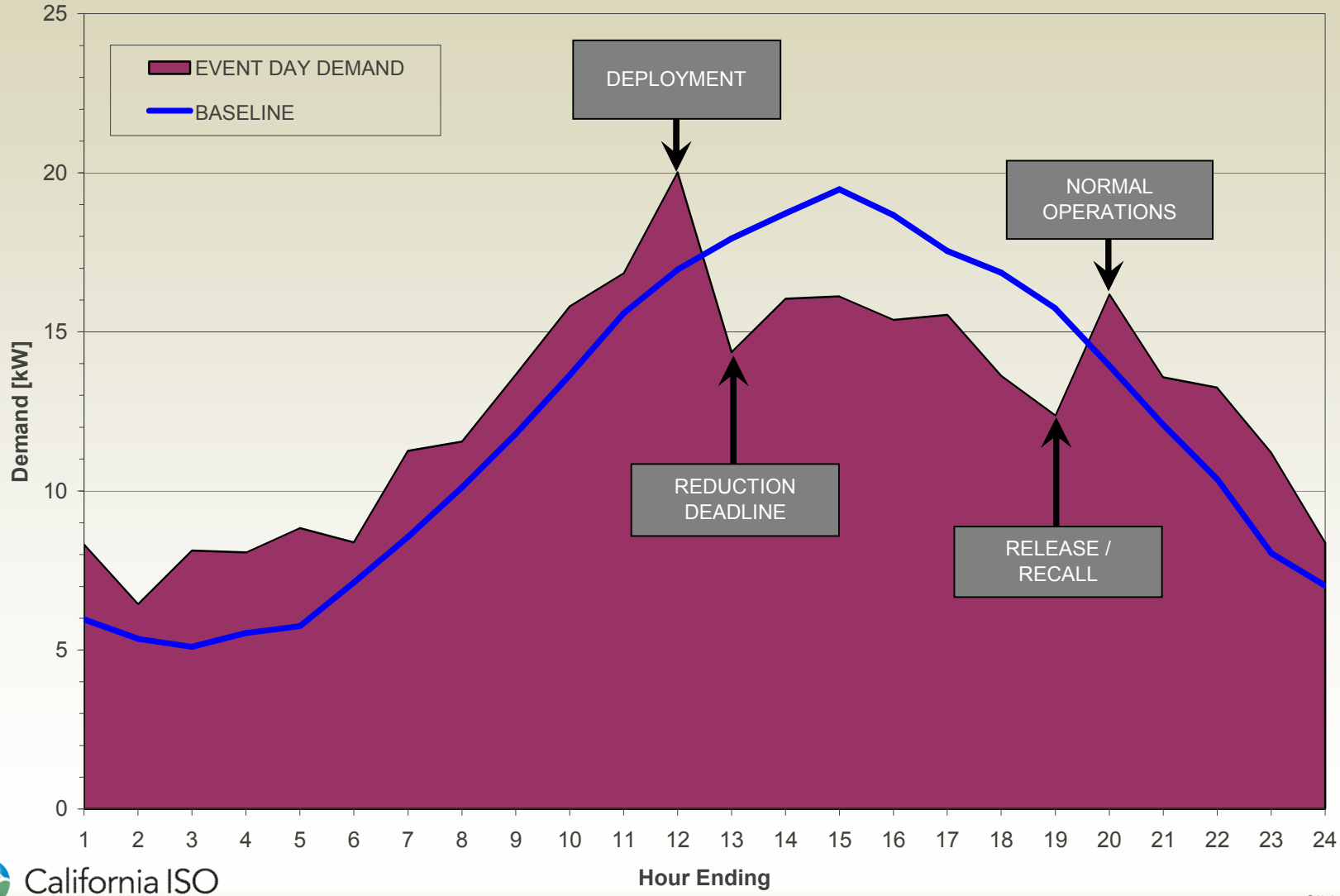
Customer Baseline Calculation

- Approach
  - Identify core CBL methodology – keep it simple
  - Add variations and alternatives as PDR develops
- Common Findings
  - There is no single CBL method that fits all needs
  - Several methods work reasonably well in most cases
  - Adjusted baselines are usually better than non-adjusted
  - Highly variable loads are most difficult to predict
    - These loads may not wish to participate in PDR

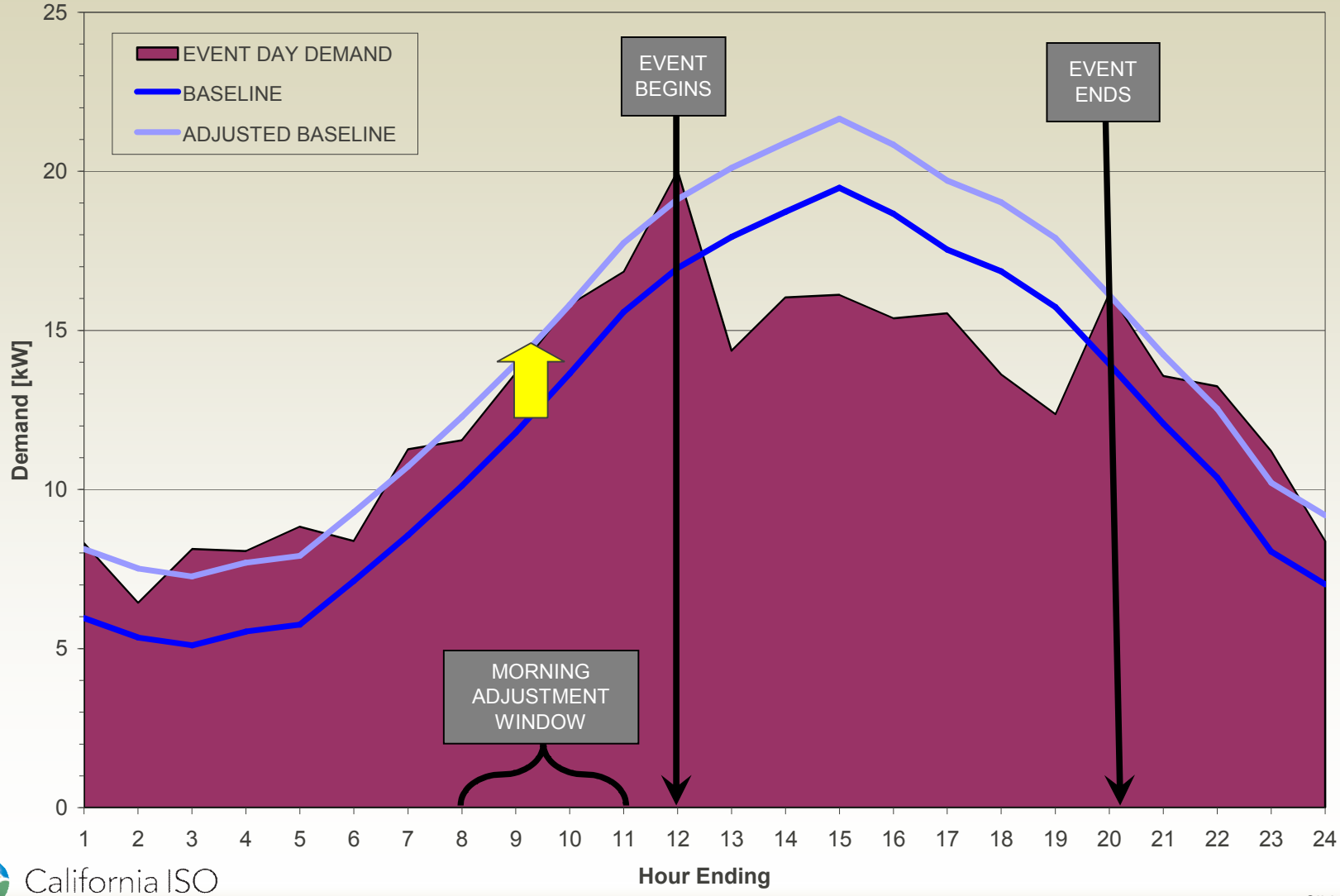
References

- 2008 Load Impact Evaluation of California Statewide Aggregator Demand Response Programs Volume 2: Baseline Analysis of AMP Aggregator Demand Response Program by Christensen Associates Energy Consulting, LLC (May 1, 2009)
- Evaluating Baselines for Demand Response Programs 2008 AEIC Load Research Workshop by Clifford Grimm, DTE Energy (February 25, 2008)
- Estimating Demand Response Load Impacts: Evaluation of Baseline Load Models for Non-residential buildings in California, Berkeley Lab, January 2008
- Various ISO-NE, NYISO, and PJM documents

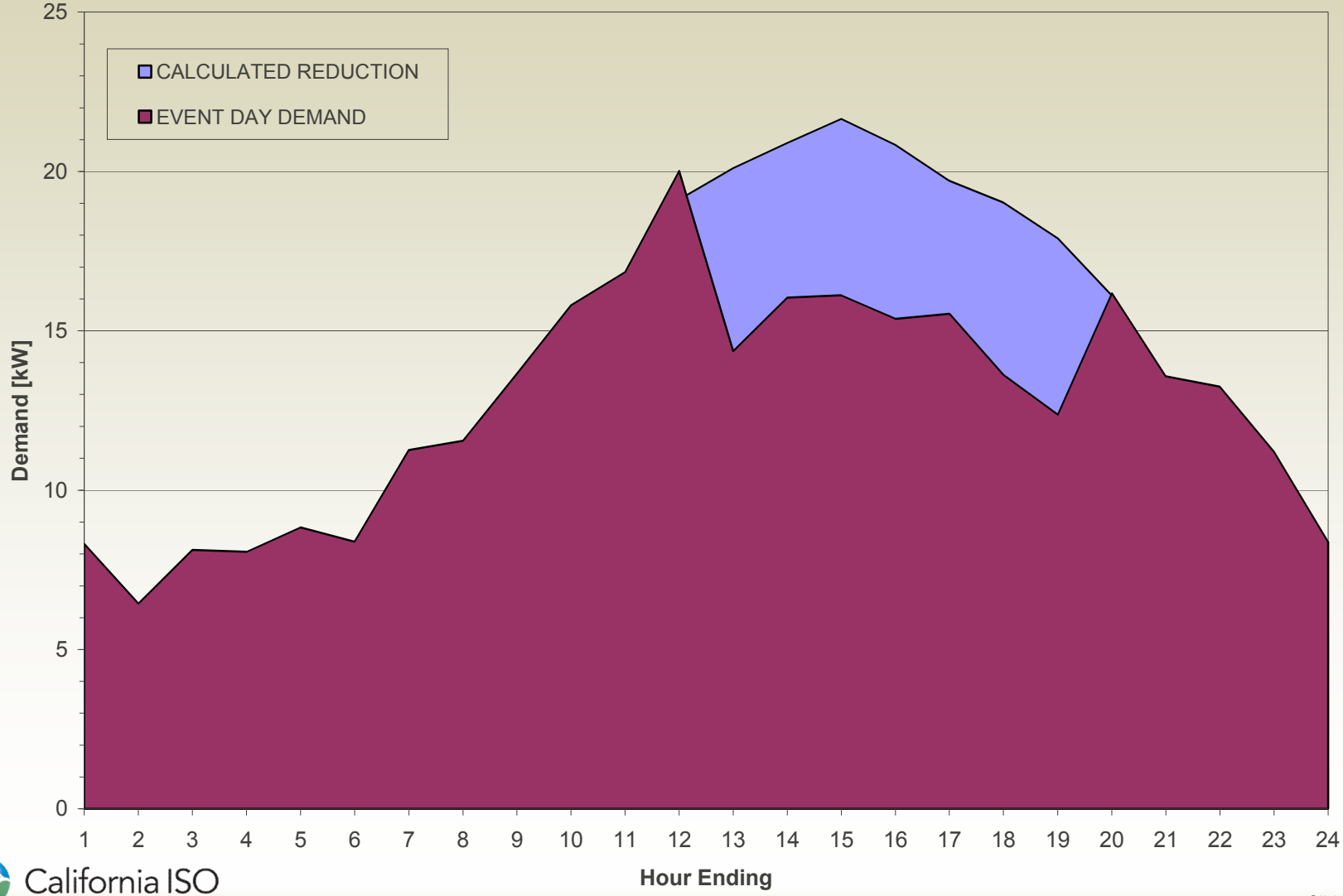
Examine Demand Response Event Stages



Apply “Morning Adjustment”



Calculate Demand Reduction



CAISO Proposal

- Calculation performed on Aggregation as defined within the CLAP
- Day Types – 2 Day types (M-F, Weekends + Holidays)
- Lookback window of 45 calendar days
  - No window extensions
  - Exclusions only for event days
- 10 in 10 non-event day selection method
  - No elimination of abnormally low days
  - 4 of 4 for weekend/holiday types
  - If 10 not available use number of available days unless < 5 days available,
  - Use highest event days to get to 5 (calculated by load for event period hours)
- Load point adjustment as default (symmetric multiplicative, exclude immediate hour prior to event, use 3 hours prior to that hour)
  - Limit of +/-20% for adjustment
  - No weather adjustment for now

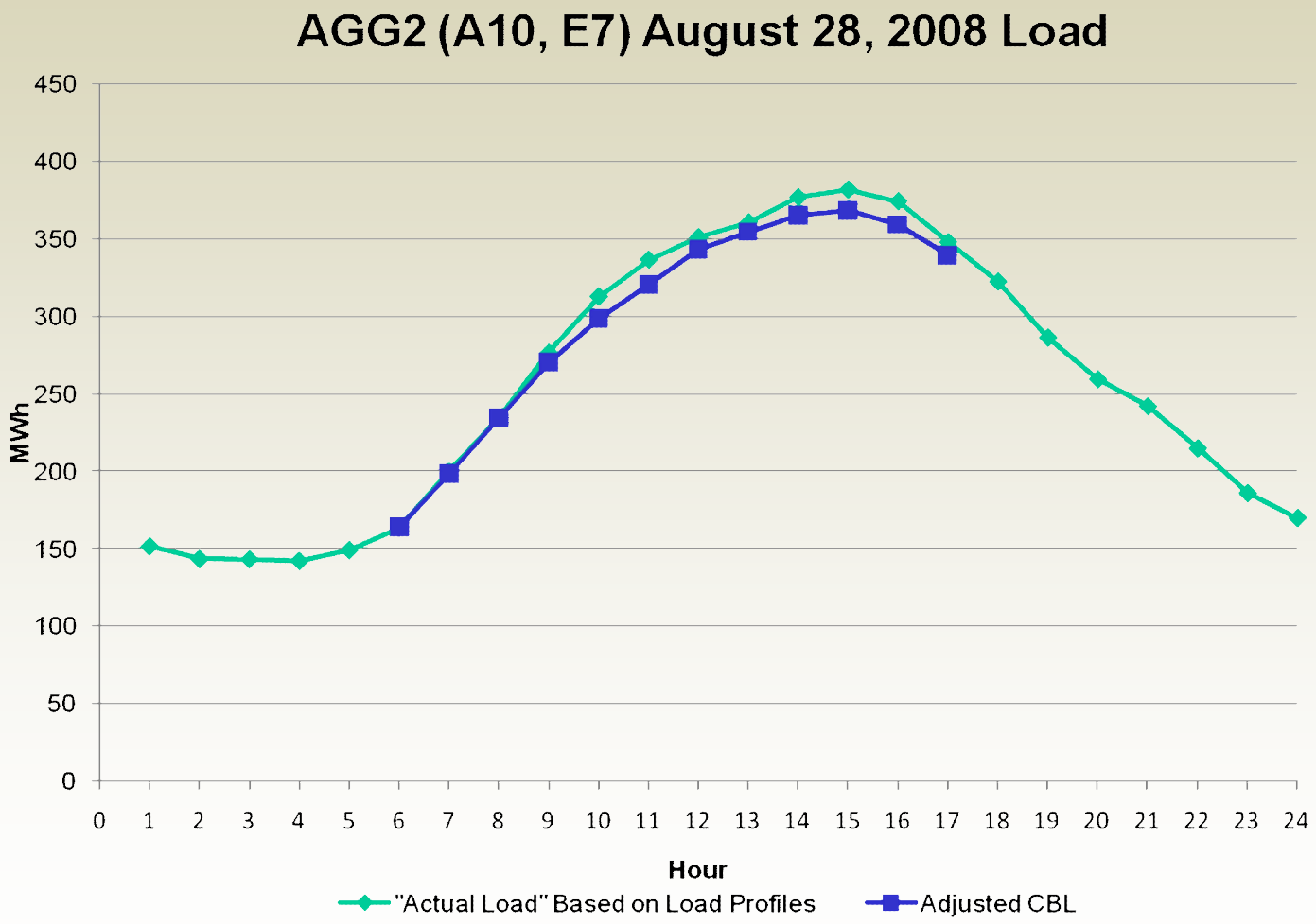
Operational Anomalies

- Participants should flag the following conditions to be excluded from CBL calculations
  - Participation in other DR programs
  - Testing of DR capabilities
  - Scheduled maintenance
  - Equipment failure
- In general operational anomalies should not be considered for event day participation

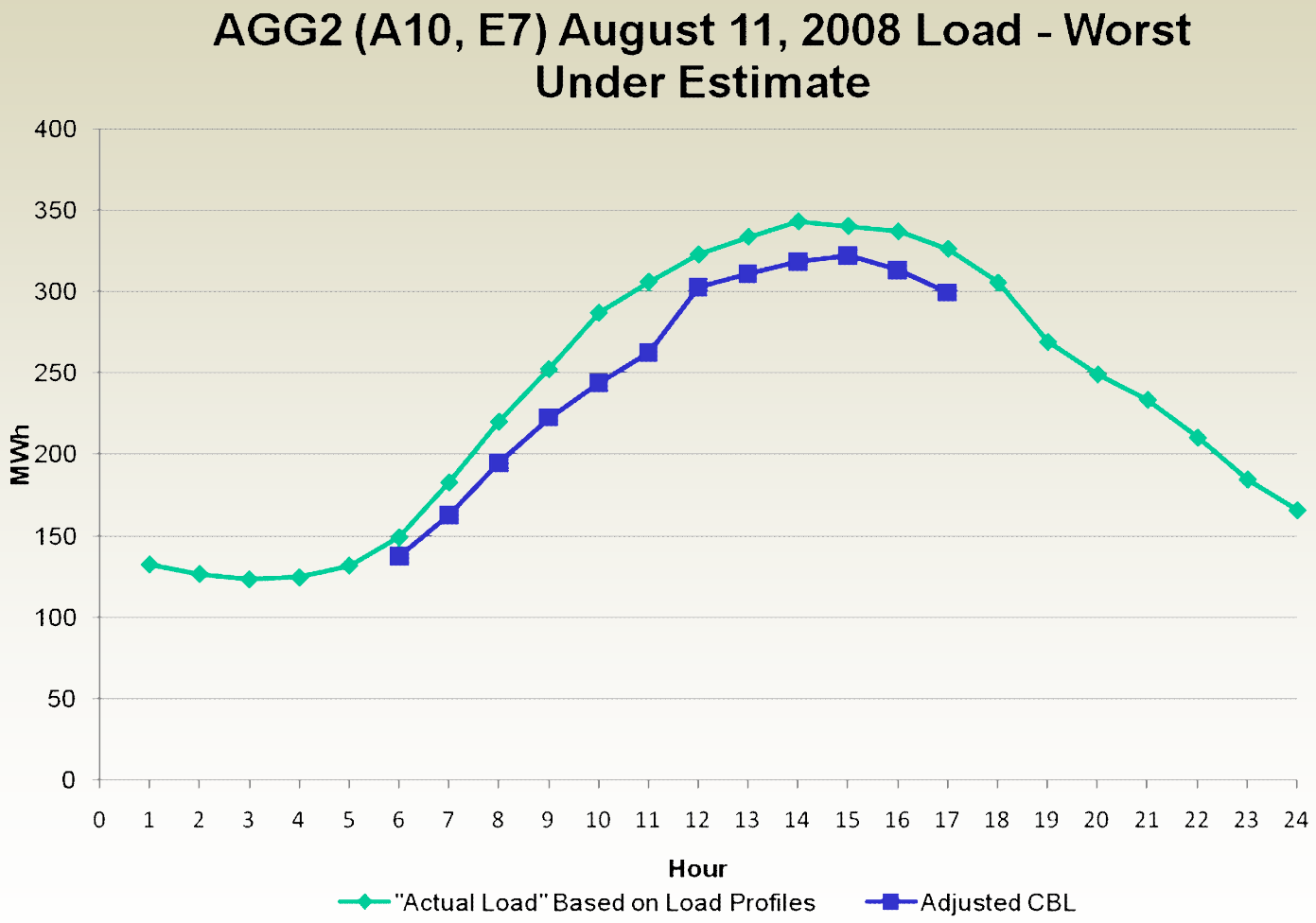
CBL Studies – Load Profile Data

- Load Profile data from PG&E
  - AGG1 is created by scaling the load profiles of E10P and E20T rate classes, representing industrial or large commercial customers
  - AGG2 was created by scaling the load profiles of E7 and A10 rate classes, representing residential and commercial TOU customers

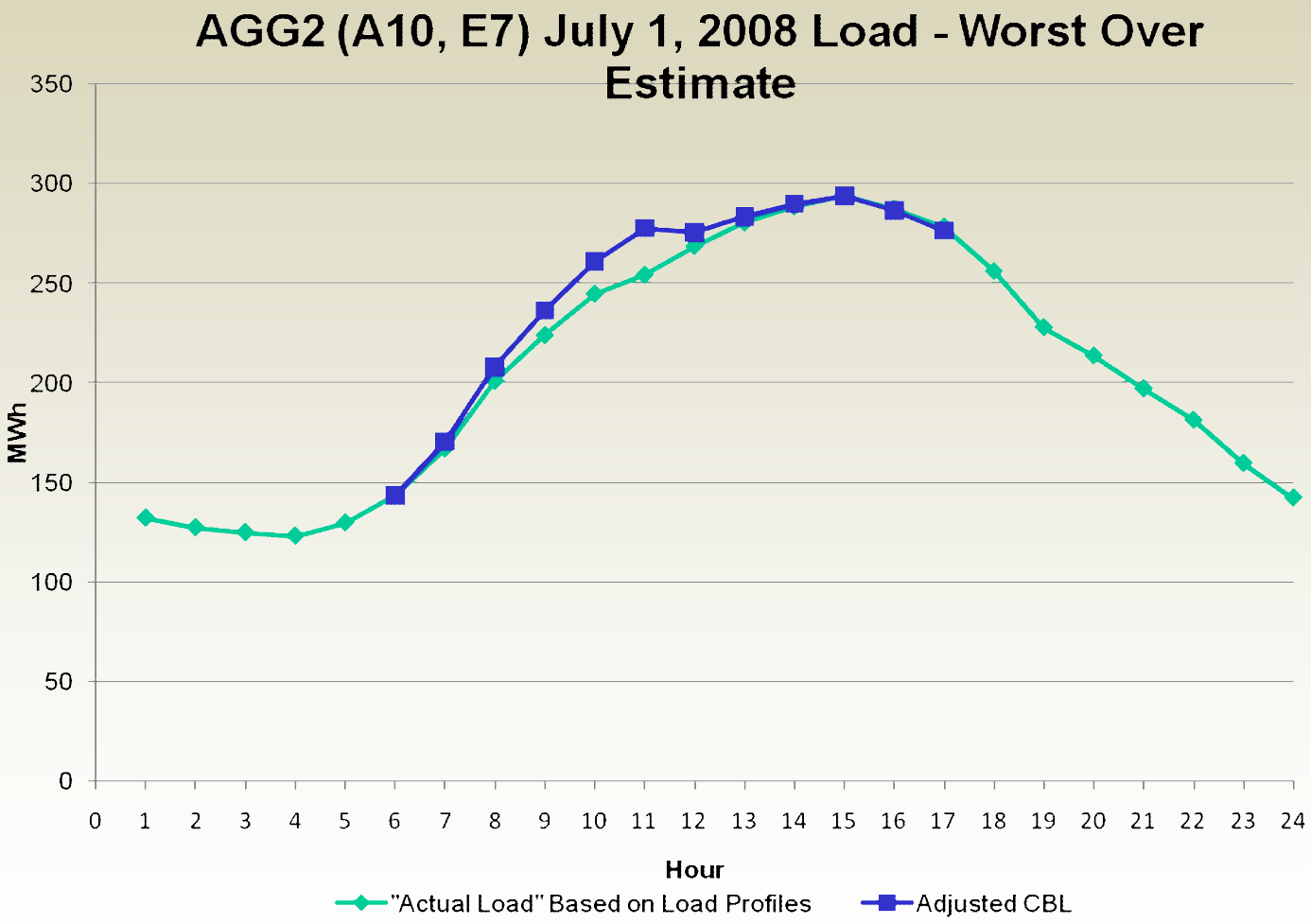
Example: AGG2



Example: AGG2



Example: AGG2



CBL Studies – Bay Area and Fresno Data

- Input Data
  - Sample PG&E loads: 50 from the Bay Area, 50 from the Fresno Area
  - Sample days: Jul., Aug. 2008 w/o weekends, holidays and event days
  - Period to calculate CBL: HE13 through HE18
  - Fictitious aggregator loads has one or multiple retail customer loads
- Output
  - Analysis performed for fictitious aggregators and individual customers
  - The UISOL CBL program was configured with CAISO PDR baseline model to calculate CBLs
  - U-Statistic and Median of percent errors reflect CBL accuracy and bias
  - Frequency distributions of adjustment factors computed
  - Charts are used to illustrate observations

Statistical Measures of Accuracy and Bias

- U-Statistic reflects relative accuracy (smaller is better):

$$\text{U-Statistic} = \sqrt{\frac{\sum_{h=1}^{H} e_h^2}{\sum_{h=1}^{H} L_h^2}}$$

Where e_h is the actual load in HE h minus the CBL in HE h, and L_h is the actual load in HE h, H being the total number of hours in the event hours over all sample days

- Median of Percent Errors reflects relative CBL bias (closer to zero percent is better)

Bias = Median of $\frac{e_h}{L_h}$ over h = 1, …, H

Fictitious Aggregators

Area	ID	Description
Bay Area	B-AGG1	15 Randomly Selected Loads
Bay Area	B-AGG2	4 Large Loads
Bay Area	B-AGG3	10 smallest loads
Bay Area	B-AGG4	One load, peak varies notably day to day
Fresno Area	F-AGG1	15 Randomly Selected Loads
Fresno Area	F-AGG2	4 Large Loads
Fresno Area	F-AGG3	10 smallest loads
Fresno Area	F-AGG4	One load, peak varies notably day to day

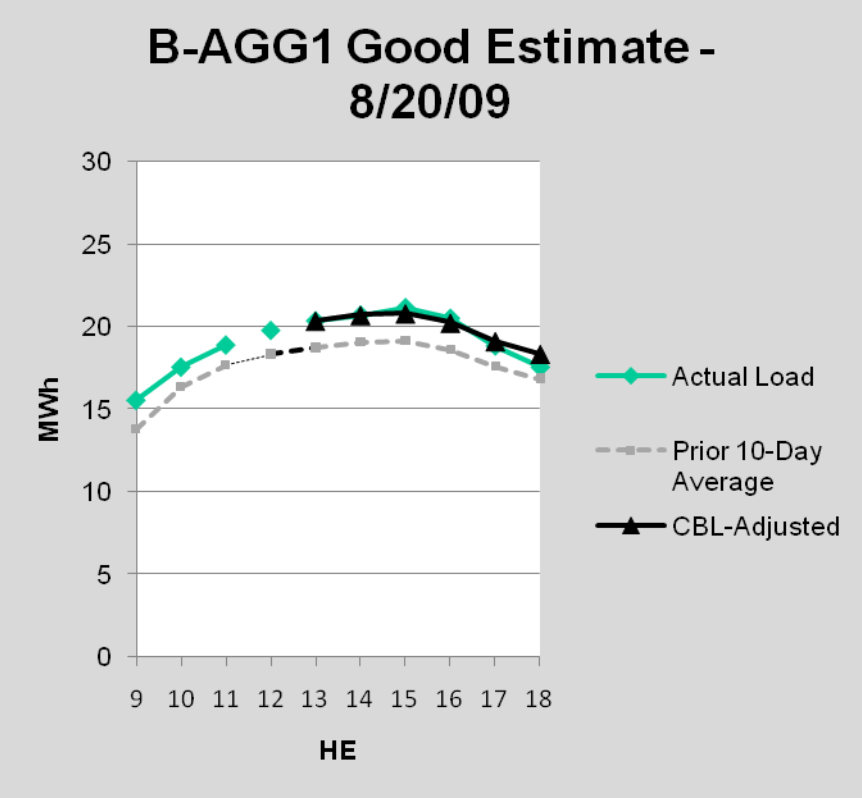
Summary of Observations

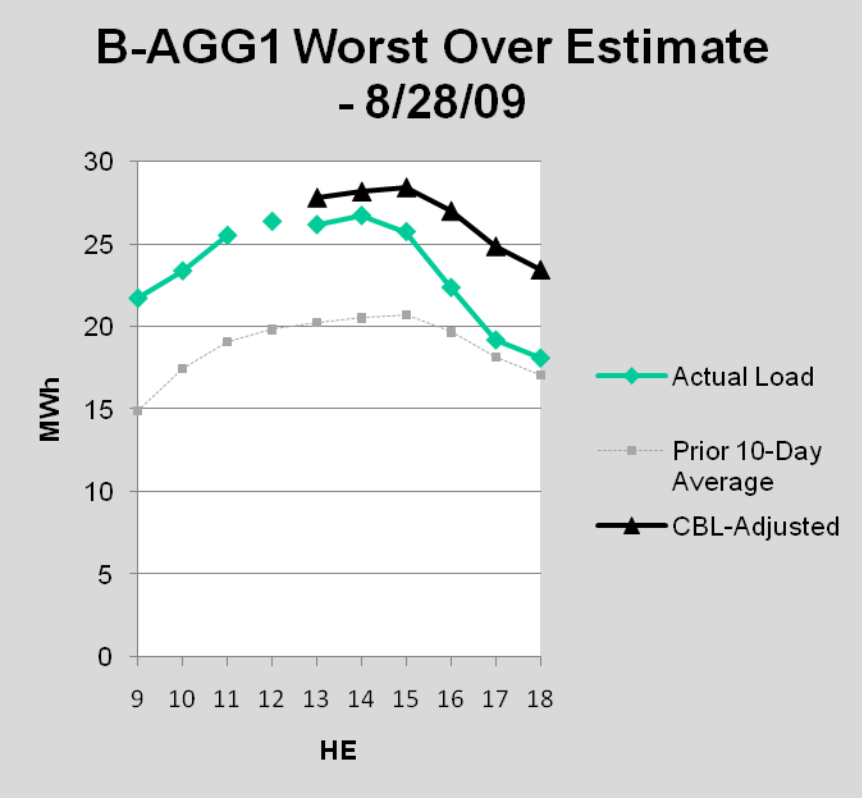
- CBL tends to be more accurate as number of aggregated loads increase (B-AGG1, F-AGG1)
- CBL accuracy is higher for larger, more predictable loads (B-AGG2, F-AGG2)
- When load profile vary widely from one day to another, the CBL can have sizable deviations (B-AGG4, F-AGG4)
- When morning loads do not correlate well with peak loads, (e.g., for some agricultural pump loads), the unadjusted CBL can be more accurate (F-AGG2)
- The adjustment factors can fall outside 1 $\pm$ 0.2, e.g, for loads with irregularly varying morning loads
- The CBL method can result in large deviations with single customer loads (See last slide)

Aggregator CBL Accuracy and Bias Statistics

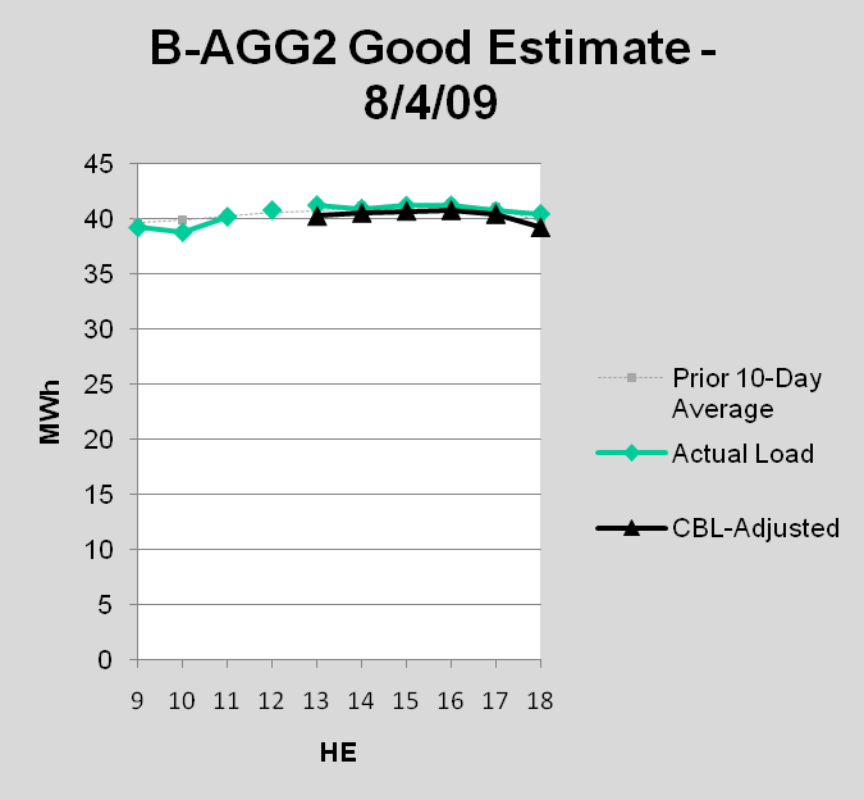
ID	Description	Deviation (%) (U-Statistic)	Bias (%) (Median)
B-AGG1	15 Randomly Selected Loads	5.88	0.68
B-AGG2	4 Large Loads	1.87	0.05
B-AGG3	10 smallest loads	6.06	1.18
B-AGG4	One load, peak varies notably day to day	17.89	2.96
F-AGG1	15 Randomly Selected Loads	5.80	-0.11
F-AGG2	4 Large Loads	9.44	-0.33
F-AGG3	10 smallest loads	10.53	5.20
F-AGG4	One load, load profile vary widely	36.93	-4.13

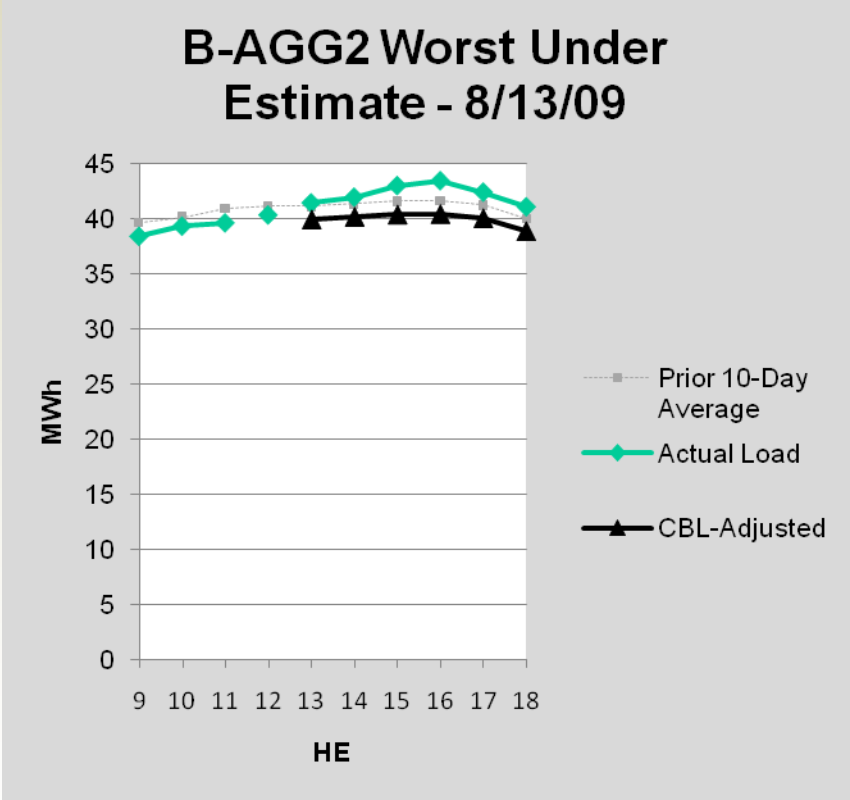
Sample Aggregator Charts: B-AGG1 (15 Random Loads)



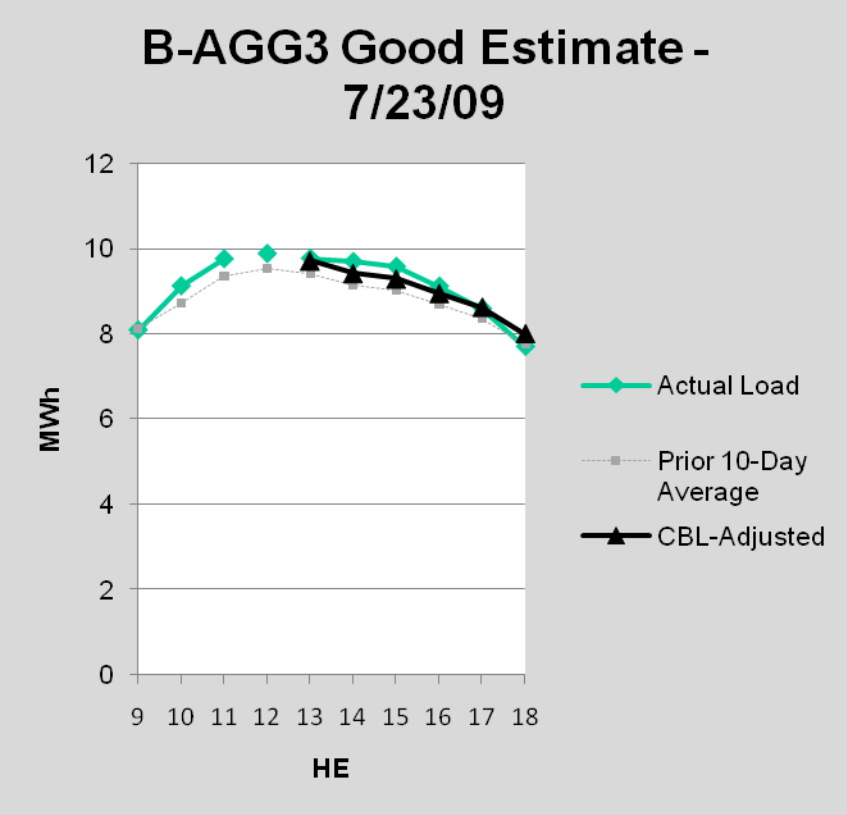


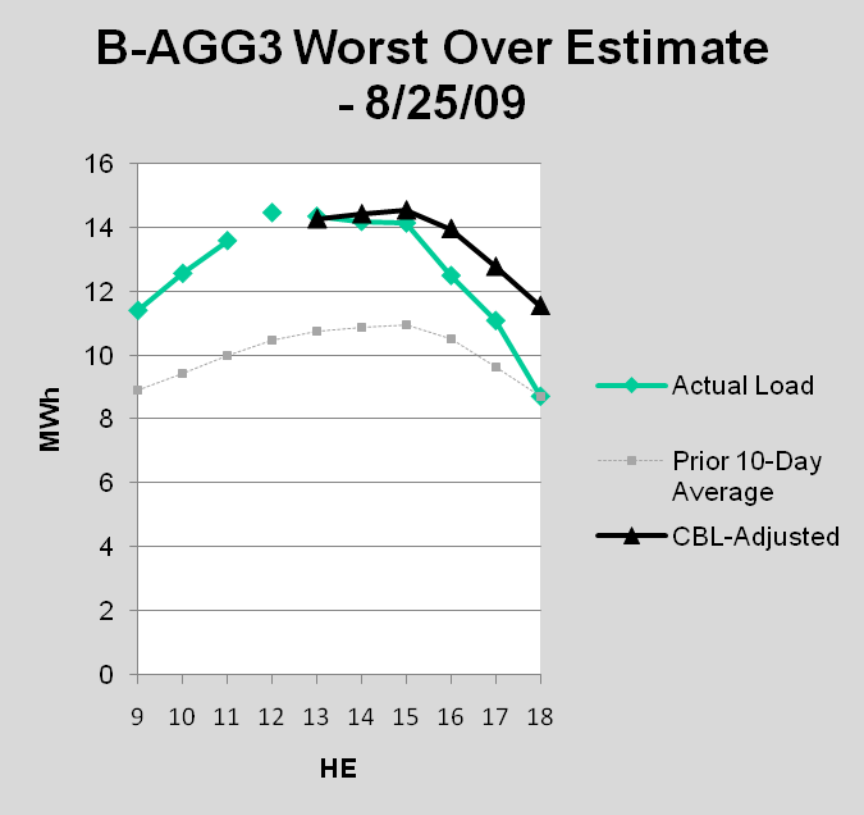
Sample Aggregator Charts: B-AGG2 (4 Large Loads)



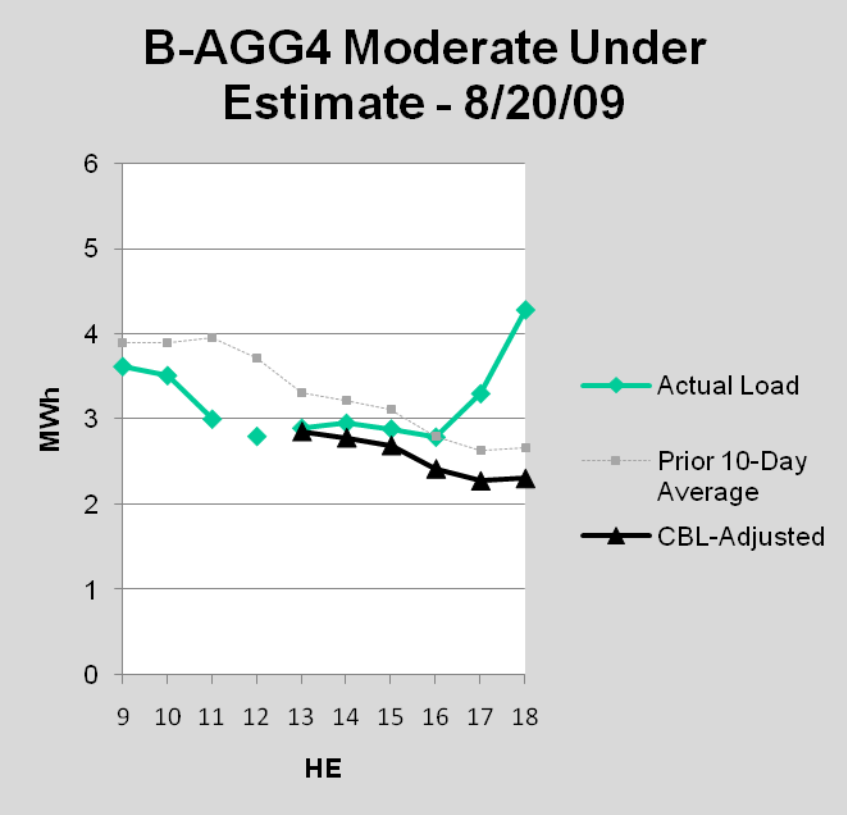


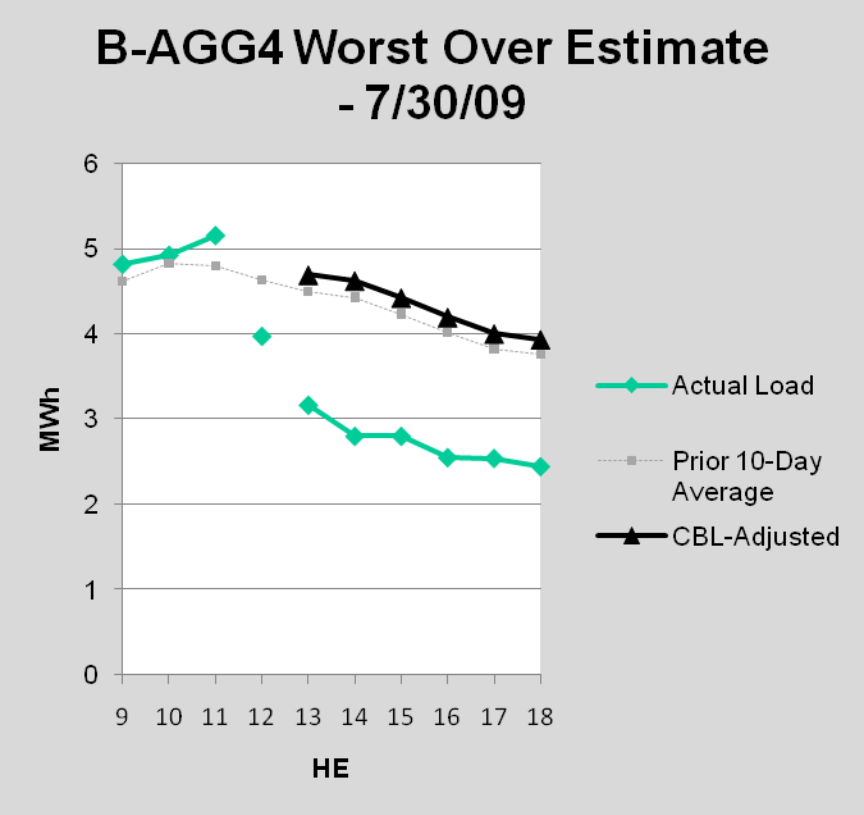
Sample Aggregator Charts: B-AGG3 (10 Smallest Loads)



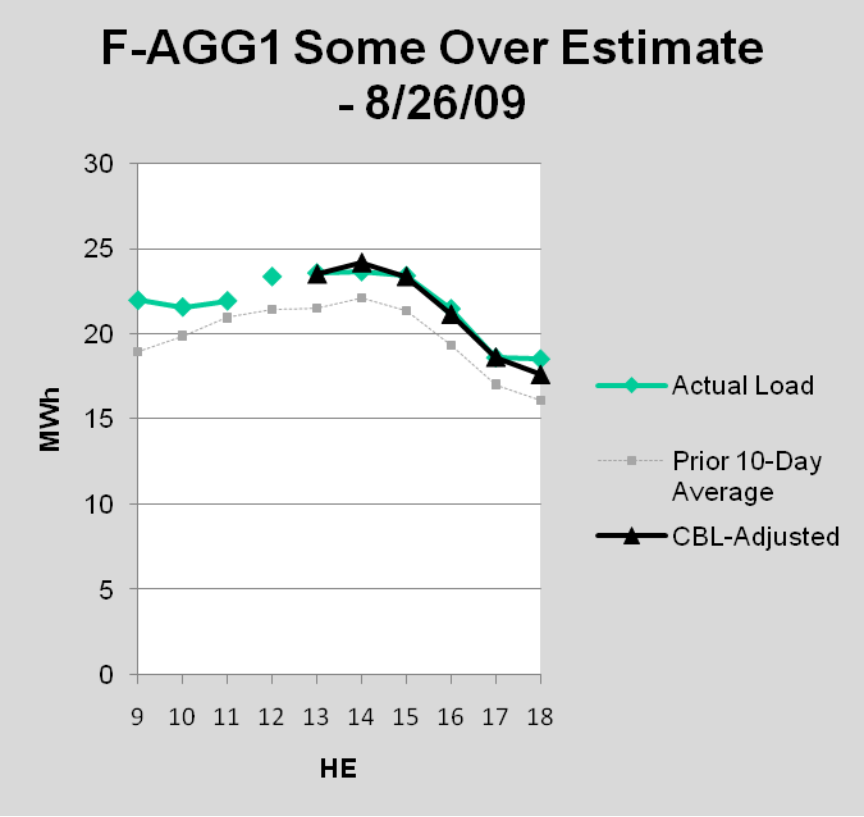


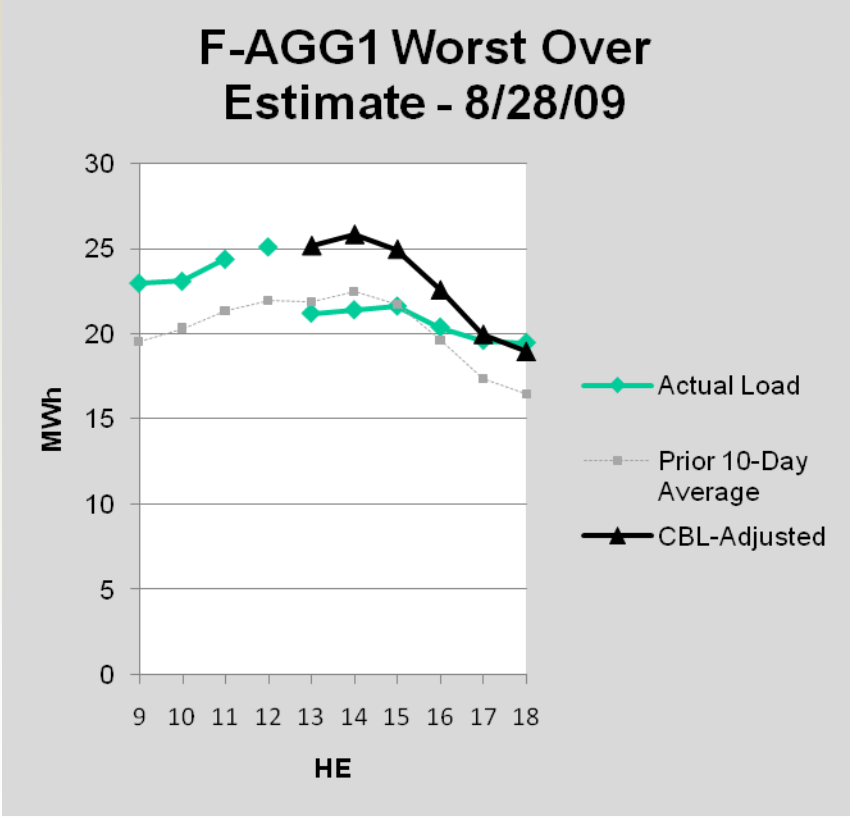
Sample Aggregator Charts: B-AGG4 (1 Load, Highly Variable)



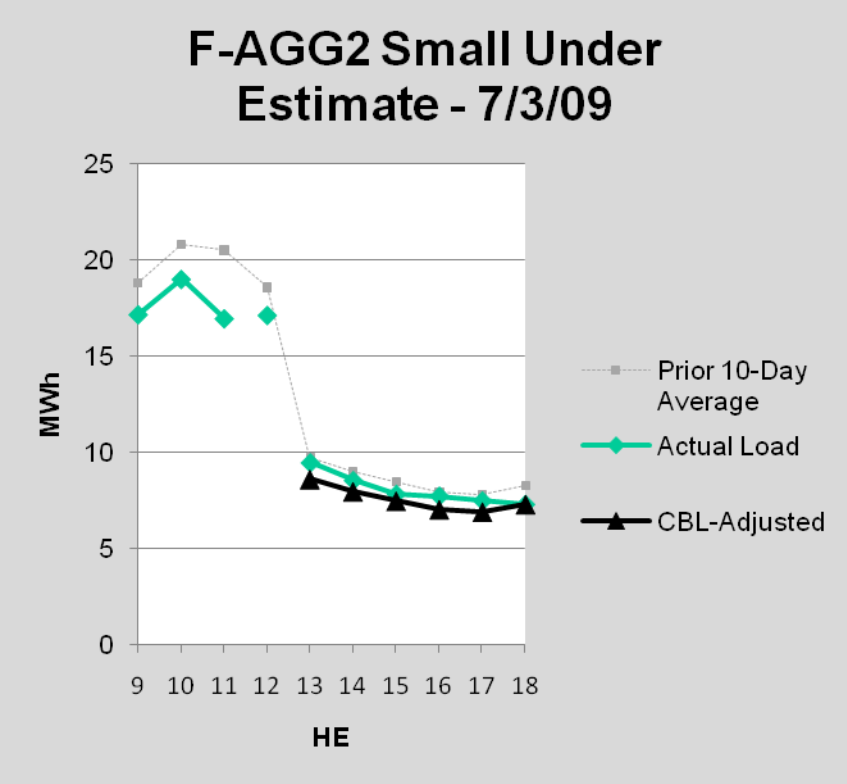


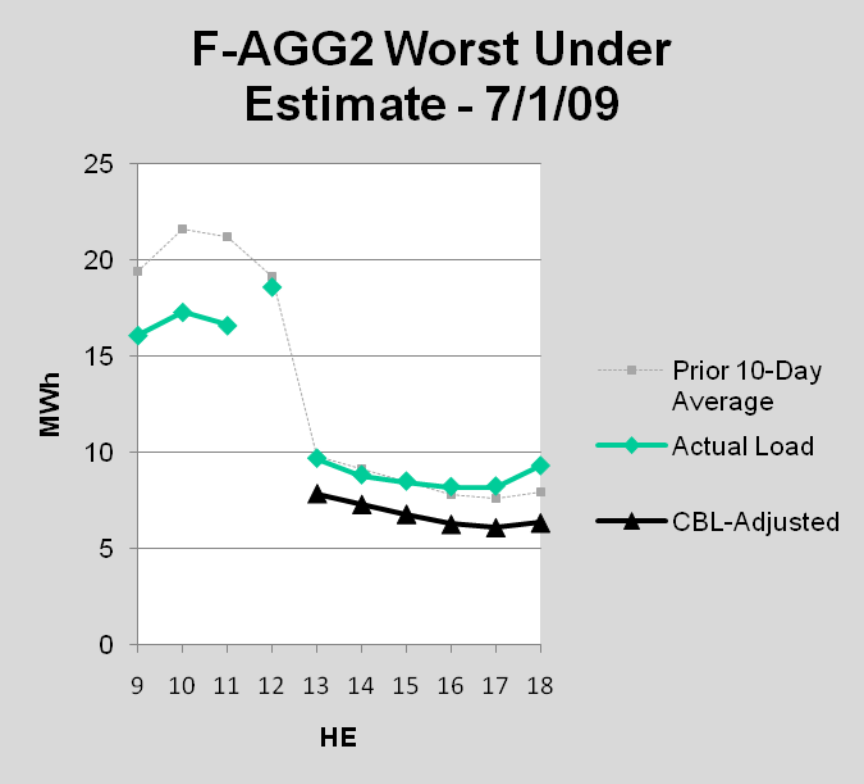
Sample Aggregator Charts: F-AGG1 (15 Random Loads)



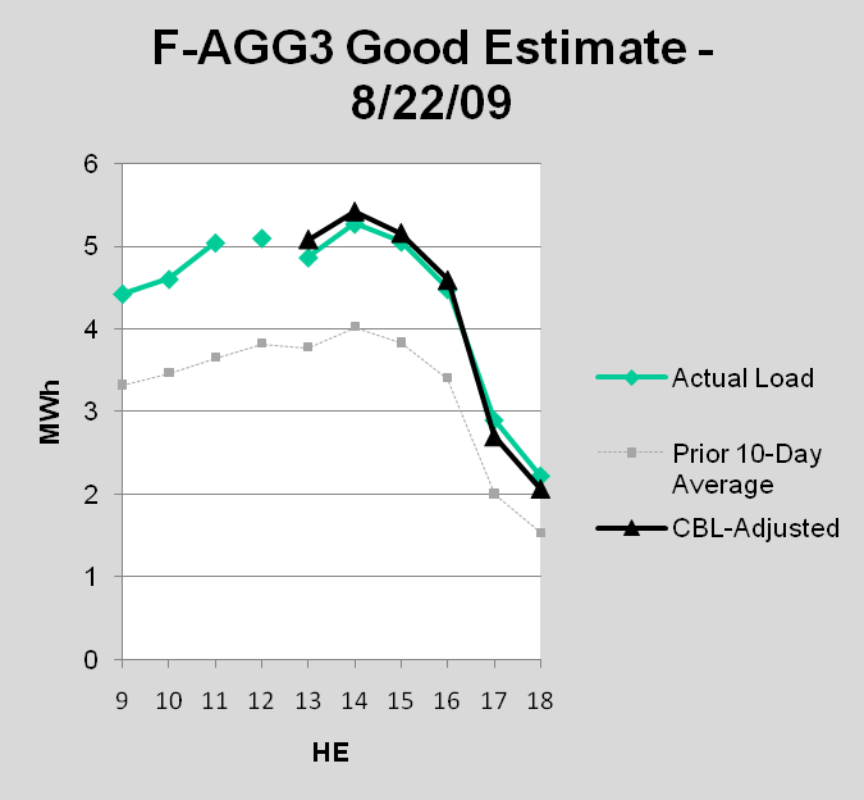


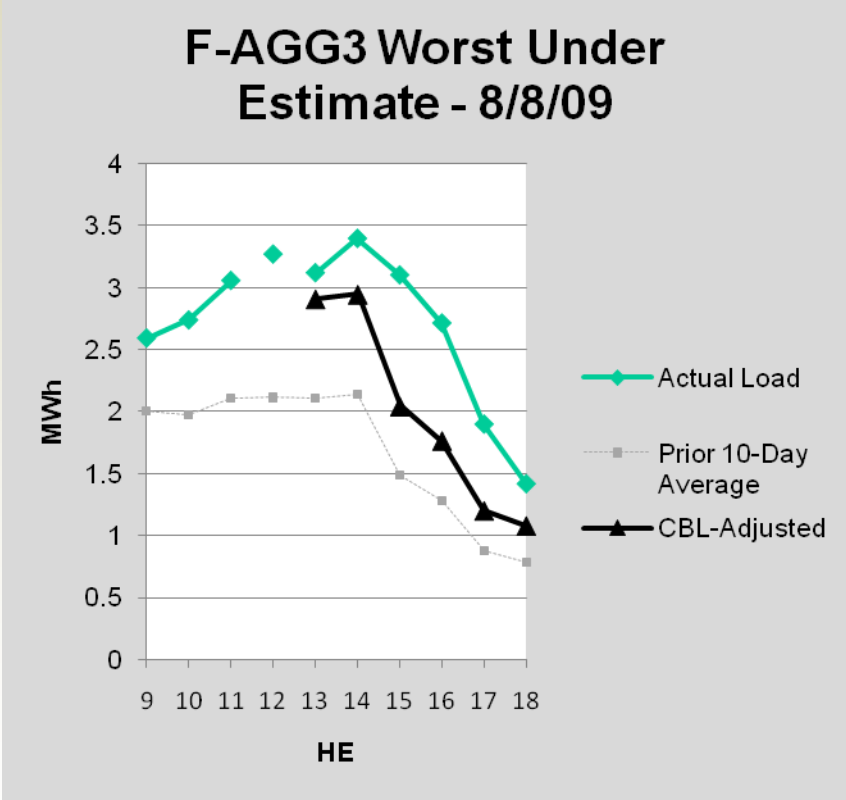
Sample Aggregator Charts: F-AGG2 (4 Large Loads)



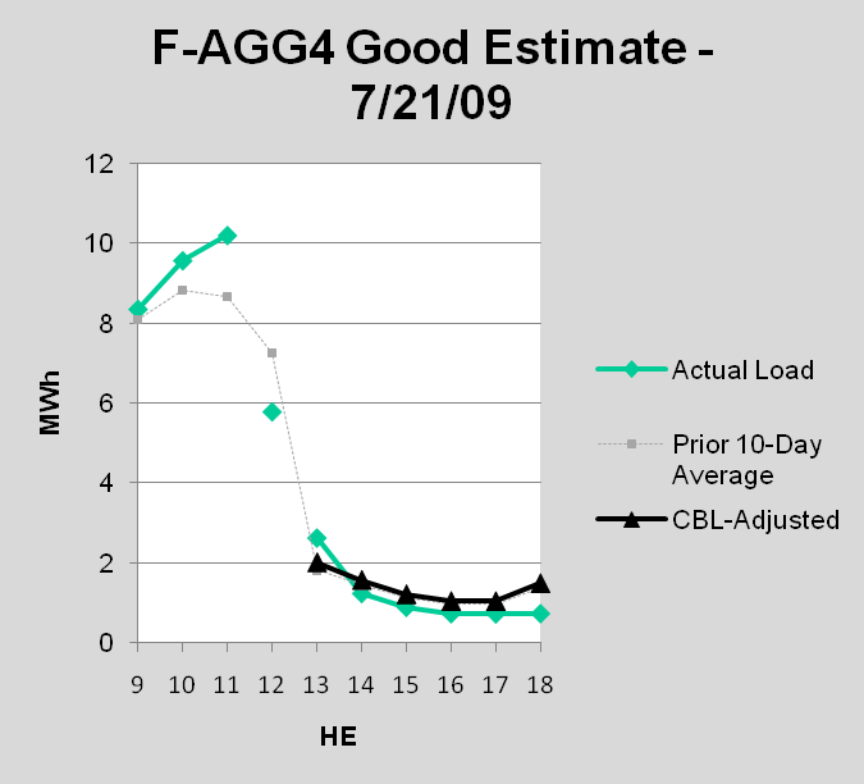


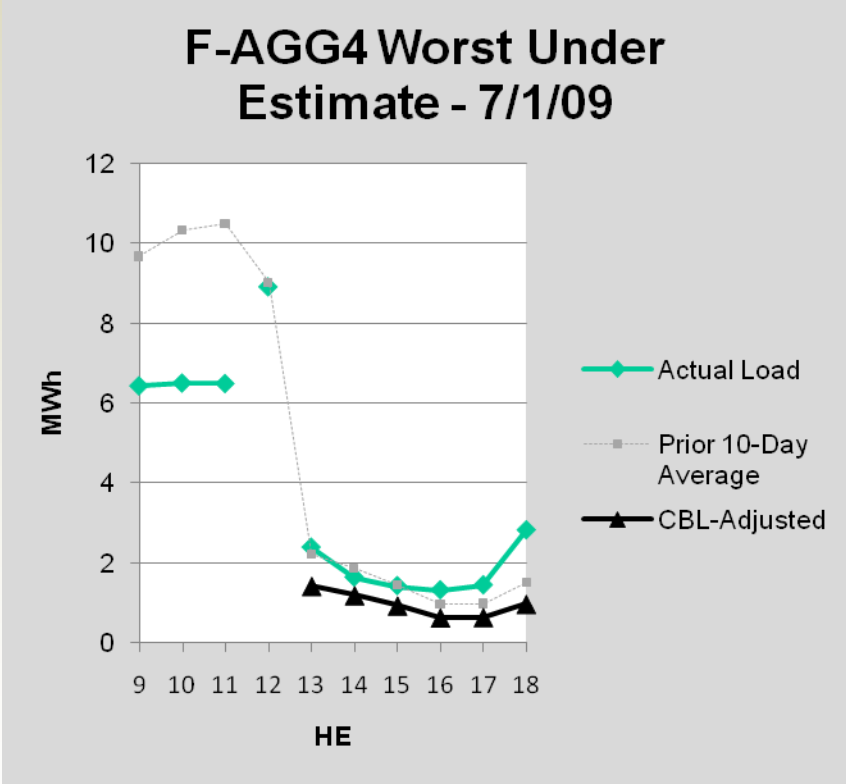
Sample Aggregator Charts: F-AGG3 (10 Smallest Loads)



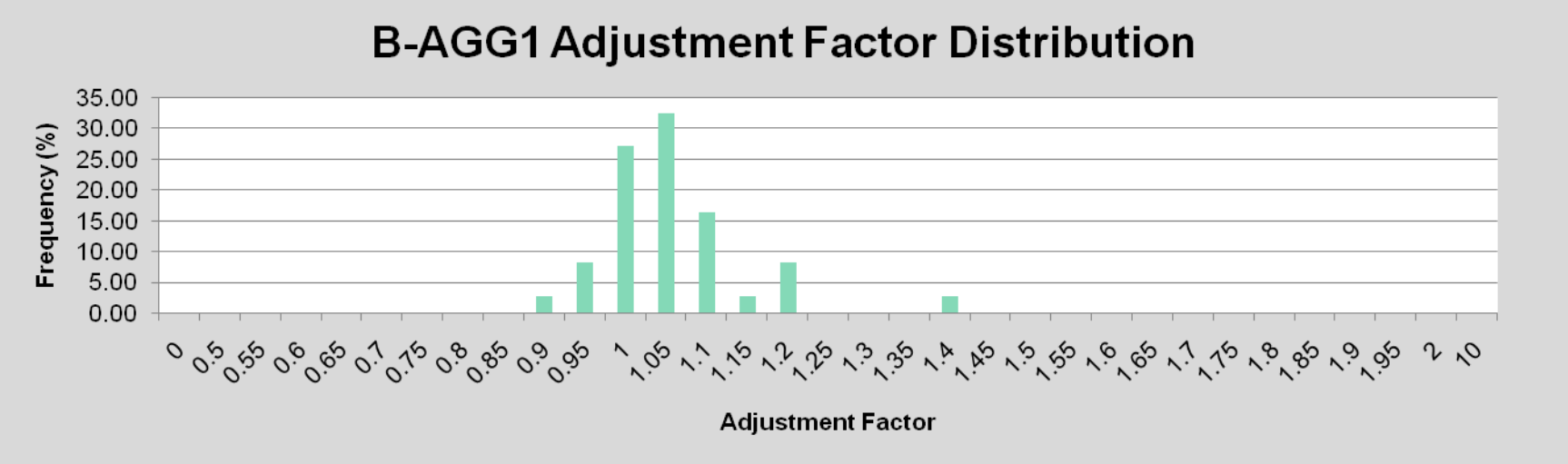


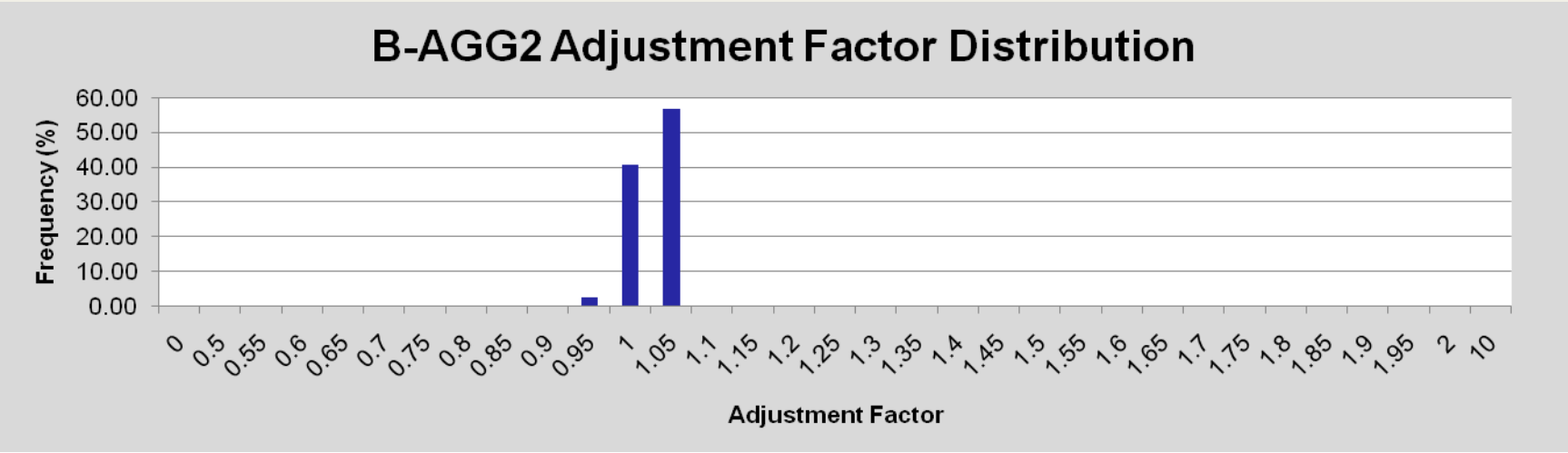
Sample Aggregator Charts: F-AGG4 (1 Load, Highly Variable)



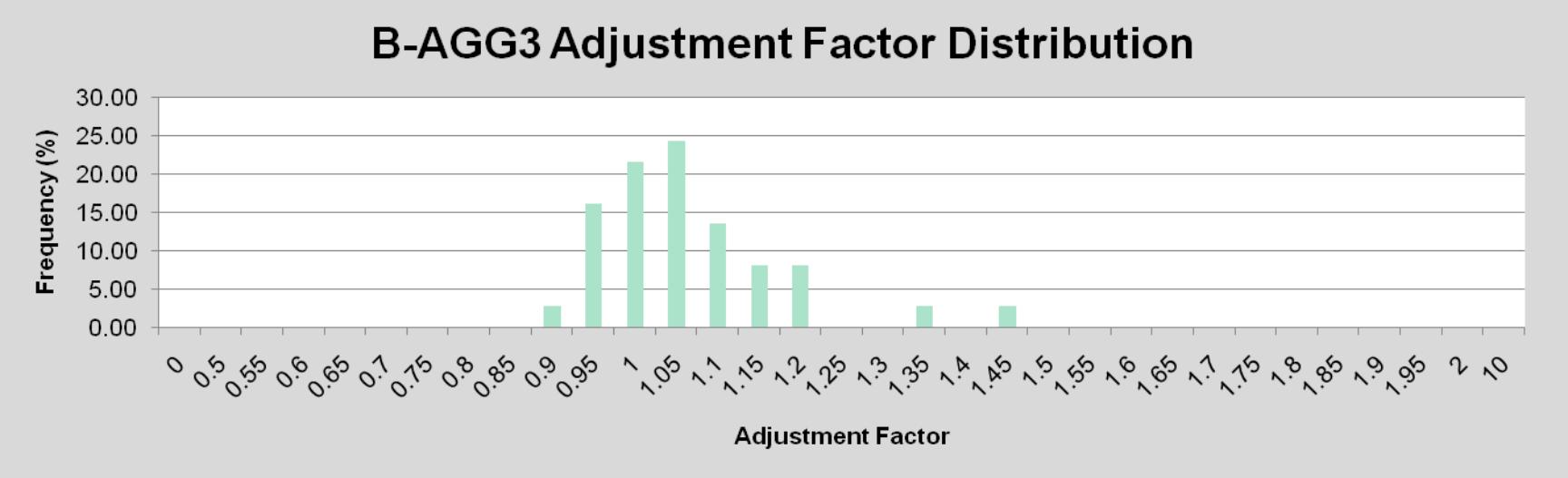


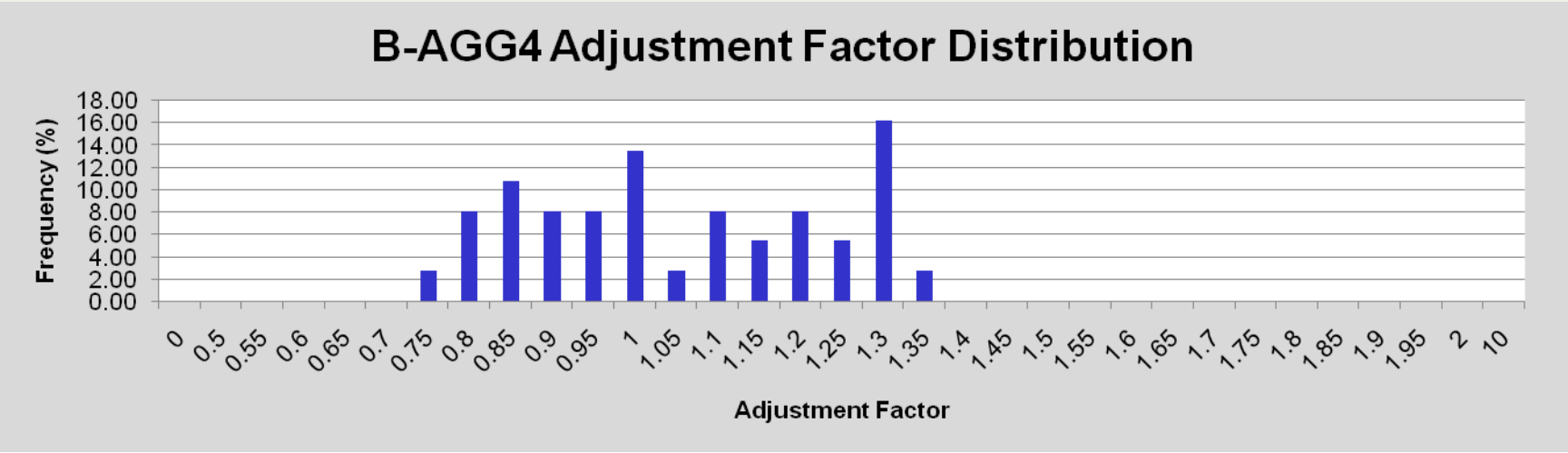
Sample Aggregator Adjustment Factor Distributions (1)



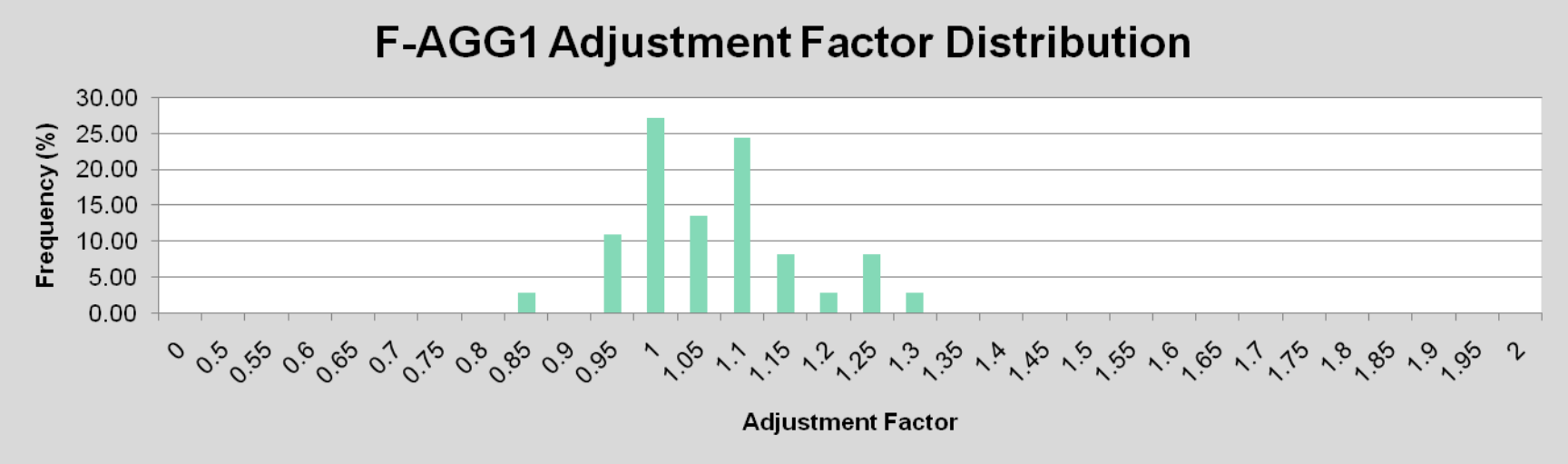


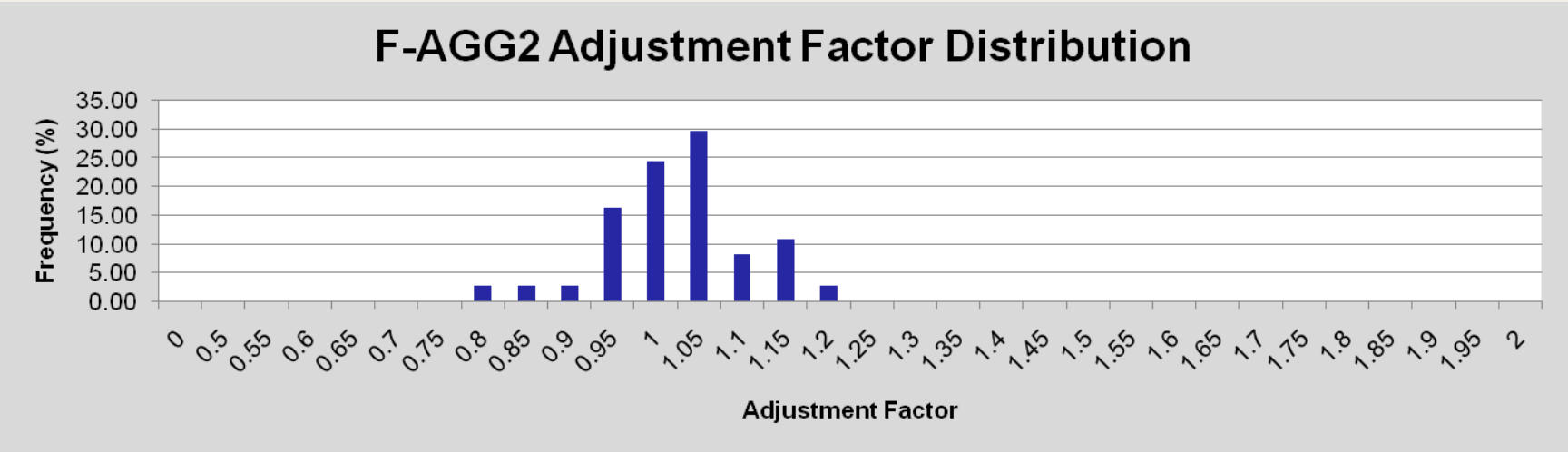
Sample Aggregator Adjustment Factor Distributions (2)



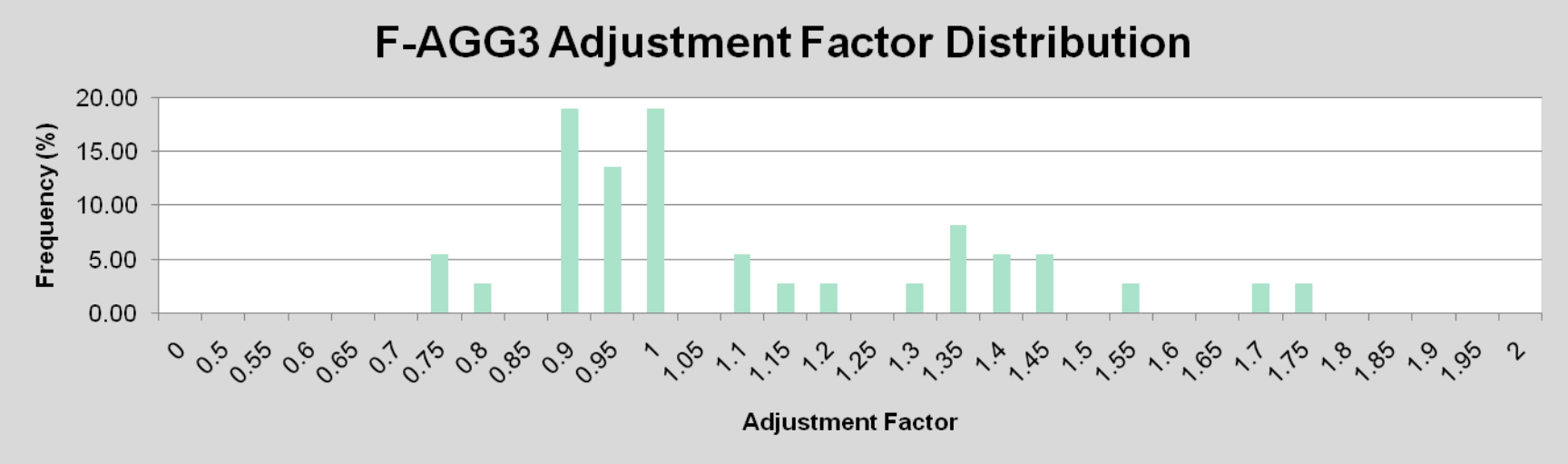


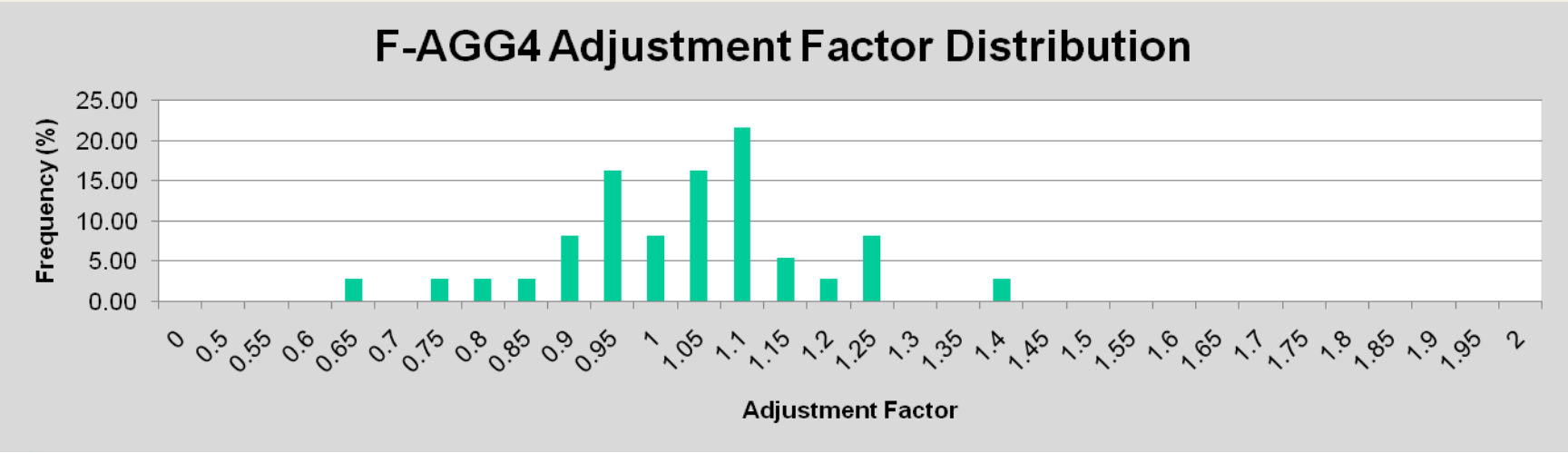
Sample Aggregator Adjustment Factor Distributions (3)





Sample Aggregator Adjustment Factor Distributions (4)





The ISO proposes that settlement for curtailed portion of load be settled directly with CSP

- CSP would be paid the Day-Ahead LMP at the CLAP for Day-Ahead PDR and the Real-Time LMP at the CLAP for Real-Time PDR
- Verified performance against the baseline would determine the energy settlement with the CSP at the CLAP
- LSE's Day-Ahead Load Schedule would be reduced based on the performance of the PDR as determined by the baseline for the purpose of settlement of uninstructed deviation.

Settlement Example

- LSE schedules 100 MW in the Day-Ahead Market
- LSE has perfect load forecast
- CSP clears 10 MW in Day-Ahead Market
- CSP clears an additional 5 MW in 5-minute Real-Time Market
- PDR resource does not have perfect performance
- Day-Ahead DLAP Price = $80
- Day-Ahead CLAP Price = $ 95
- Real-Time CLAP Price = $ 100

Settlement Example Part 1

	LSE	CSP
LSE's DA Demand Schedule		
Cleared DA Schedule	100 MW	
LSE owes ISO 100MW * DLAP price ($80) CC 6011 Day-Ahead Energy, Congestion Losses Settlement	$-8000	
CSP's operation in DA Market		
Cleared PDR		10 MW
Settlement to CSP		
ISO owes CSP 10MW * CLAP Price ($95) CC 6011 Day-Ahead Energy, Congestion & Losses Settlement		$950
CSP's operation in RT Market		
Cleared Demand Reduction (5-minute market)		5MW

Settlement Example Part 2

Settlement to CSP	LSE	CSP
ISO owes CSP 5 MW * RT CLAP Price ($100) CC 6470 Real-Time Instructed Imbalance Energy		$ 500
Performance of PDR as determined by 10 out of 10 baseline		14 MW
Uninstructed Deviation (Based on deviation between performance and Day-Ahead Schedule) CSP owes ISO 1 MW * RT CLAP Price ($100) CC 6475 Real-Time Uninstructed Imbalance Energy Settlement		- $100

Settlement Example Part 3

LSE's Final Metered Demand		
Meter Read	86	
Settlement to LSE		
Calculation of "Uninstructed" Deviation :		
LSE's Original DA Schedule	100	
"Actual PDR" (baseline - meter reads)	-14	
LSE's Adjusted DA Schedule	86MW	
Actual Meter Read	86 MW	
"Uninstructed" Deviation to LSE	$0	
Total Net Settlement		
CSP		**$1350**
LSE	**$ - 8000**	

Next Steps

- Final draft of proposal posted on August 5
- Written comments due August 14
- Board of Governors meeting September 10 - 11