

# Accuracy of Alternative Baseline Methods

---

Dr. Steven Braithwait  
Christensen Associates Energy Consulting

IEPEC - Paris

*June 2010*

# Outline

---

- ❑ Demand response & role of baseline loads
- ❑ Measures of baseline performance
- ❑ Findings from baseline assessments for two California DR programs
- ❑ Conclusions

# Baselines in Demand Response Programs – *Background*

---

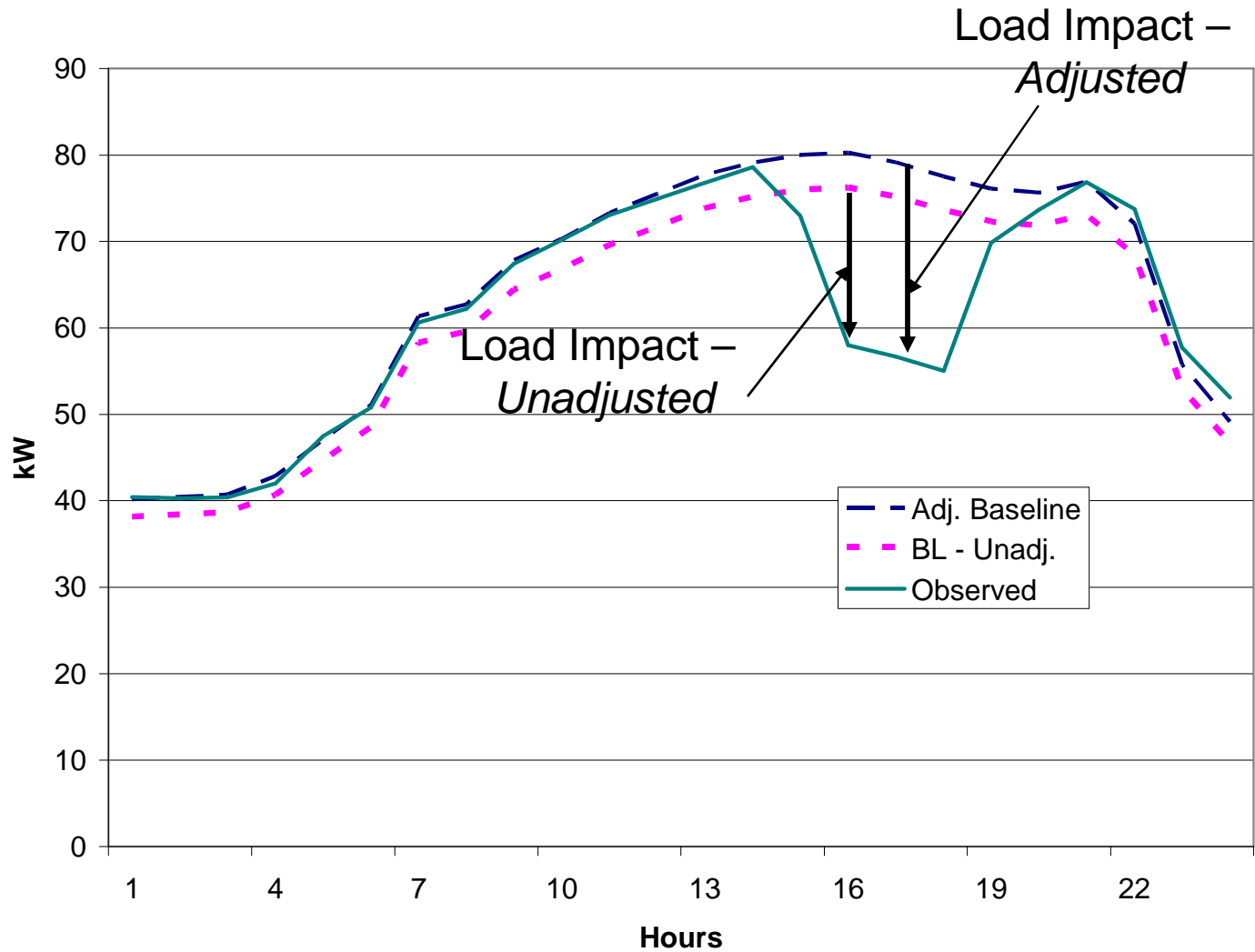
- ❑ In the U.S., most electricity consumers face *fixed retail prices*
  - No incentive for *price-responsive demand* when supply is tight and wholesale prices rise
  - Wholesale markets require costly *extra capacity* to meet load under these conditions
- ❑ Solution – *demand response (DR) programs* operated by utilities or regional system operators

# Importance of Baseline Accuracy

---

- ❑ Baseline loads are used to calculate *load reductions* and *payments* for DR programs
  - *Load Reduction = Baseline - Observed load*
- ❑ Typical baseline estimation methods in U.S.
  - Average customers' loads over some number (3, 5 or 10) of recent days (excluding weekends & other events)
  - Sometimes, *adjust* the baseline using pre-event usage on the event day

# Hypothetical Unadjusted & Adjusted Baselines



# Measuring Baseline Performance

---

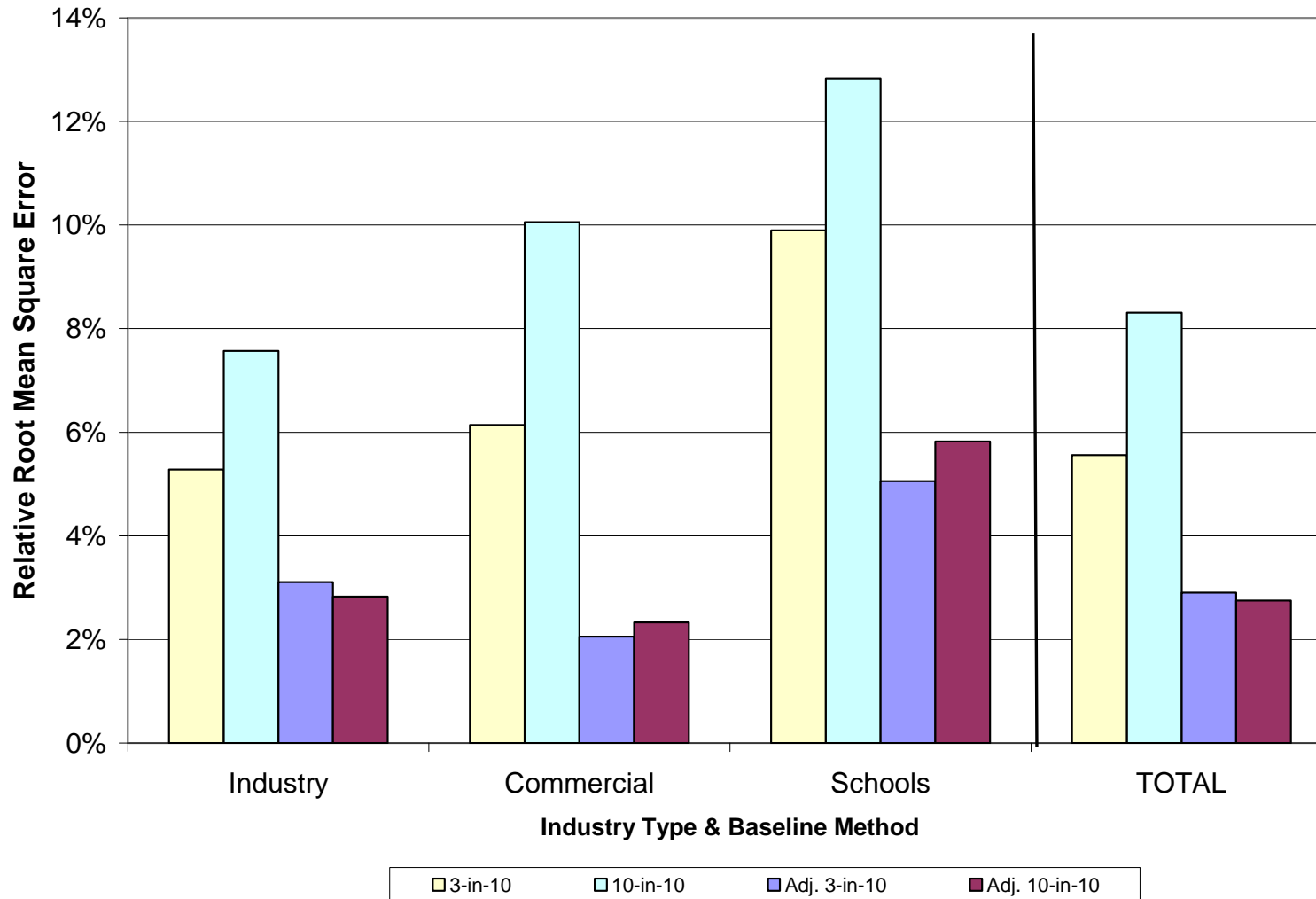
- ❑ Baseline error = *True* BL – *Estimated* BL
- ❑ *Overall accuracy* – Relative (%) root mean-square error (think average of absolute value of % errors)
- ❑ *Bias* – Median (and distributions) of % errors indicate tendency to over-state or under-state “true” baseline

# Baseline Performance for Two DR Programs in California

---

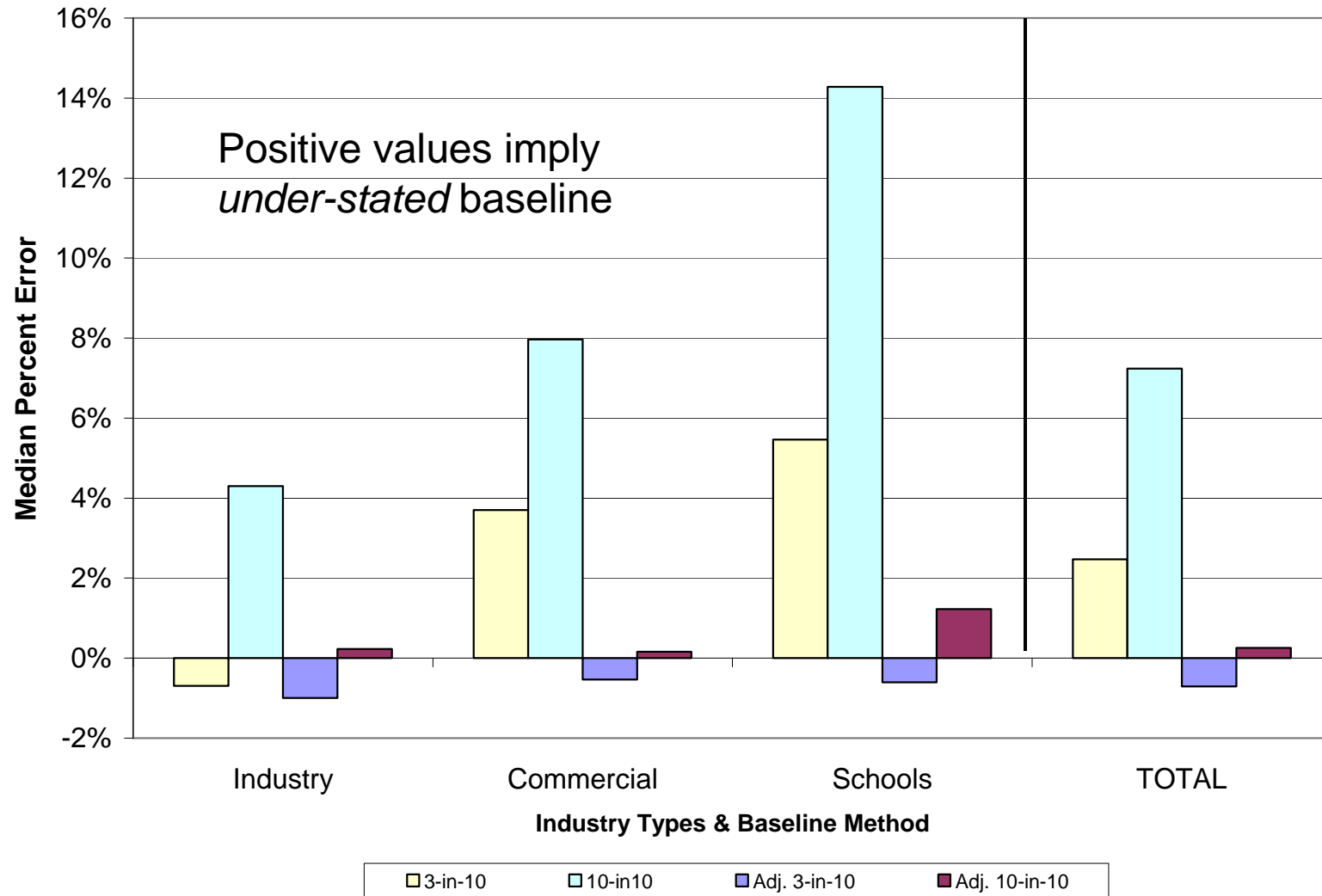
- *Aggregator DR program* –
  - Third party “Aggregator” enrolls customers & nominates load reductions
  - BL calculated at Aggregator level
- *Demand Bidding Program (DBP)* –
  - Individual customers bid load reductions
  - BL calculated at customer level

# Aggregator Unadjusted & Adjusted Baselines – Accuracy





# Aggregator Unadjusted & Adjusted Baselines – Bias



# Summary of Aggregator Baseline Performance

---

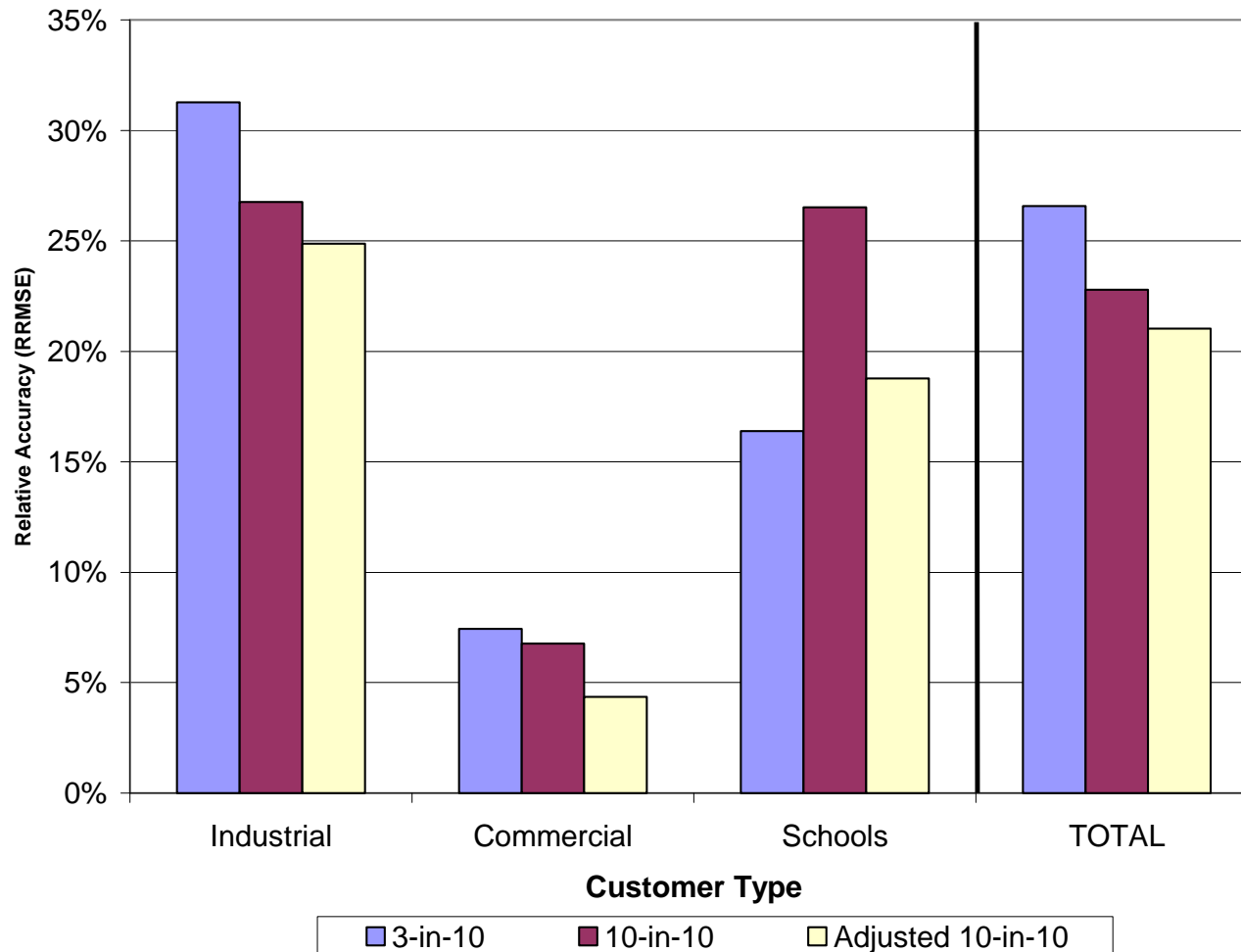
- ❑ BL compared to *actual* loads on *event-type* days
- ❑ Results varied by *industry type* (commercial & industrial)
- ❑ Adjustments to the 3-in-10 baseline *reduced the downward bias* of the unadjusted baseline.
- ❑ The *adjusted 10-in-10 method* produced the greatest accuracy and smallest bias.

# 2009 Baseline Analysis: *Demand Bidding Program*

---

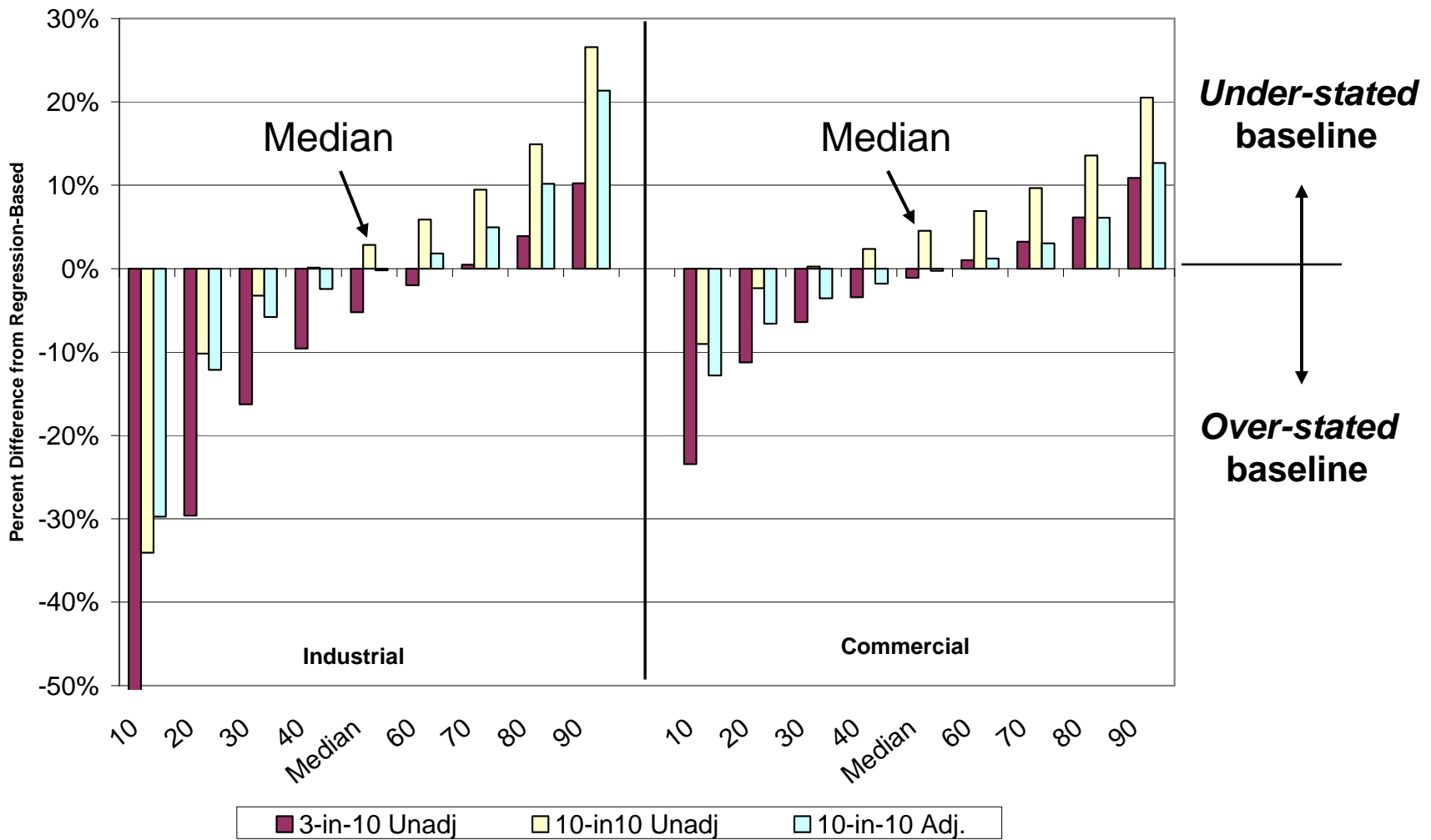
- ❑ Assessed three alternative baselines:
  - “3-in-10”
  - “10-in-10”, and
  - *Adjusted* 10-in-10.
  
- ❑ Compared each to the “true” baseline on *event days* implied by regression analysis

# Baseline Accuracy, *by Method & Customer Type* (Relative Root Mean-Square Error)



# Distributions of Baseline Differences

## (Smallest for Commercial & Adj. 10-in-10)



# DBP Baseline Analysis: *Key Findings*

---

- Key findings
  - Baselines for *commercial* accounts were more accurate and less biased than for *industrial* and *school* accounts
  - The unadjusted 3-in-10 baseline tended to *over-state* the regression-based baseline, while the unadjusted 10-in-10 baseline tended to *under-state* it – though wide range of errors
  - The *adjusted* 10-in-10 baseline was more accurate and less biased than the unadjusted baselines

# Conclusions

---

- Unadjusted baseline loads are *most accurate* for:
  - Customers/aggregators whose load patterns have relatively *low variability* and are not very weather sensitive
- Event-day *adjustments* to baseline improve accuracy; scheduled for use in 2010
- *Alternative approach* – Customers commit to pay for a fixed baseline load at their retail rate on event days (like forward contract); then receive credit for reducing load below fixed baseline
  - Eliminates issue of “over-” and “under-” payments

# Questions?

---

- Contact – Steve Braithwait,  
Christensen Associates Energy Consulting  
Madison, Wisconsin
  - [Steve@CAEnergy.com](mailto:Steve@CAEnergy.com)
  - 608-231-2266