
Measuring Whole-Building Performance

Recent Results and New Efforts

Cathy Turner, New Buildings Institute

Is building energy use improving?

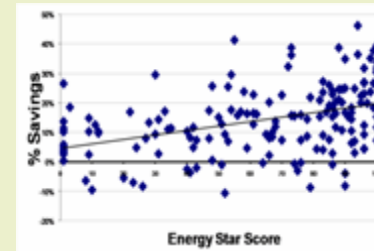
- Performance measurement background
- Recent LEED building performance
- Moving forward
 - Accessible data
 - Meaningful benchmarks
 - Actionable reporting

Measurement attempts, results, objectives

- Energy Edge, Probe , etc.

Wide variations in actual energy use

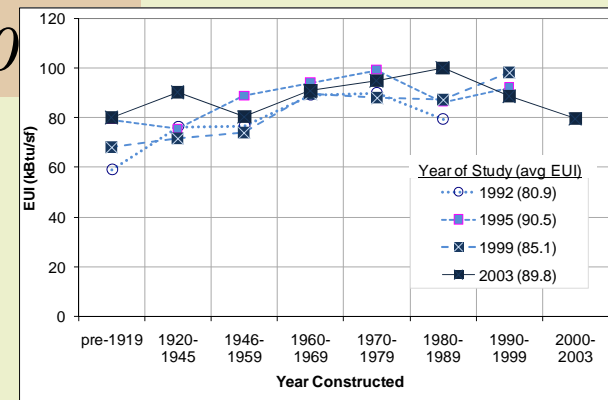
- NBI / EPA study: Is what they want what they get?



- NBI / NEEA market assessment

Focus on energy, comfort, and how to improve – for just \$2,000 - \$5,000

- CBECS EUIs by vintage



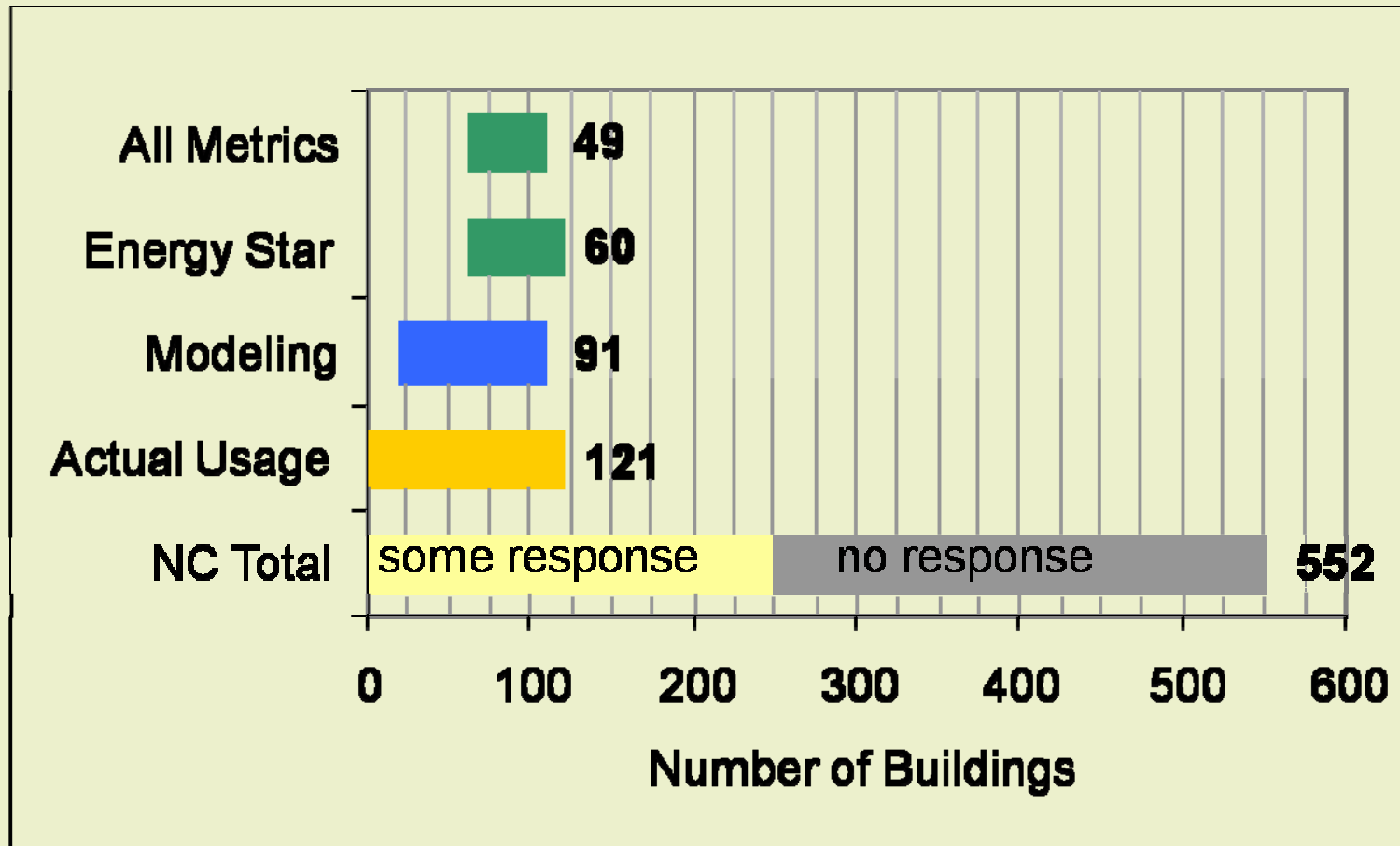
LEED NC STUDY

Evaluate actual performance in relation to:

- Energy Star scores
- Original modeling
- LEED points

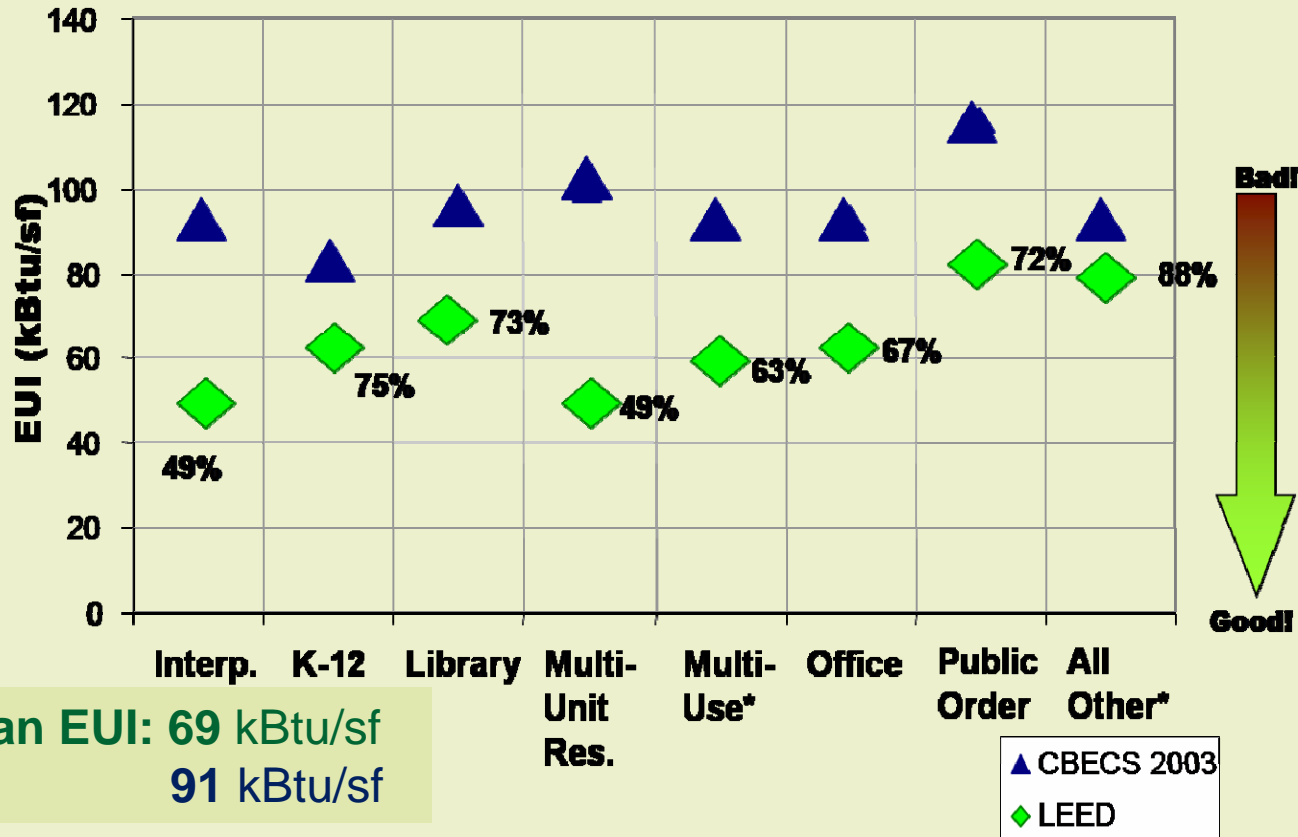
Provide useful feedback to owners

Multiple metrics



Average LEED savings of 25 – 30%

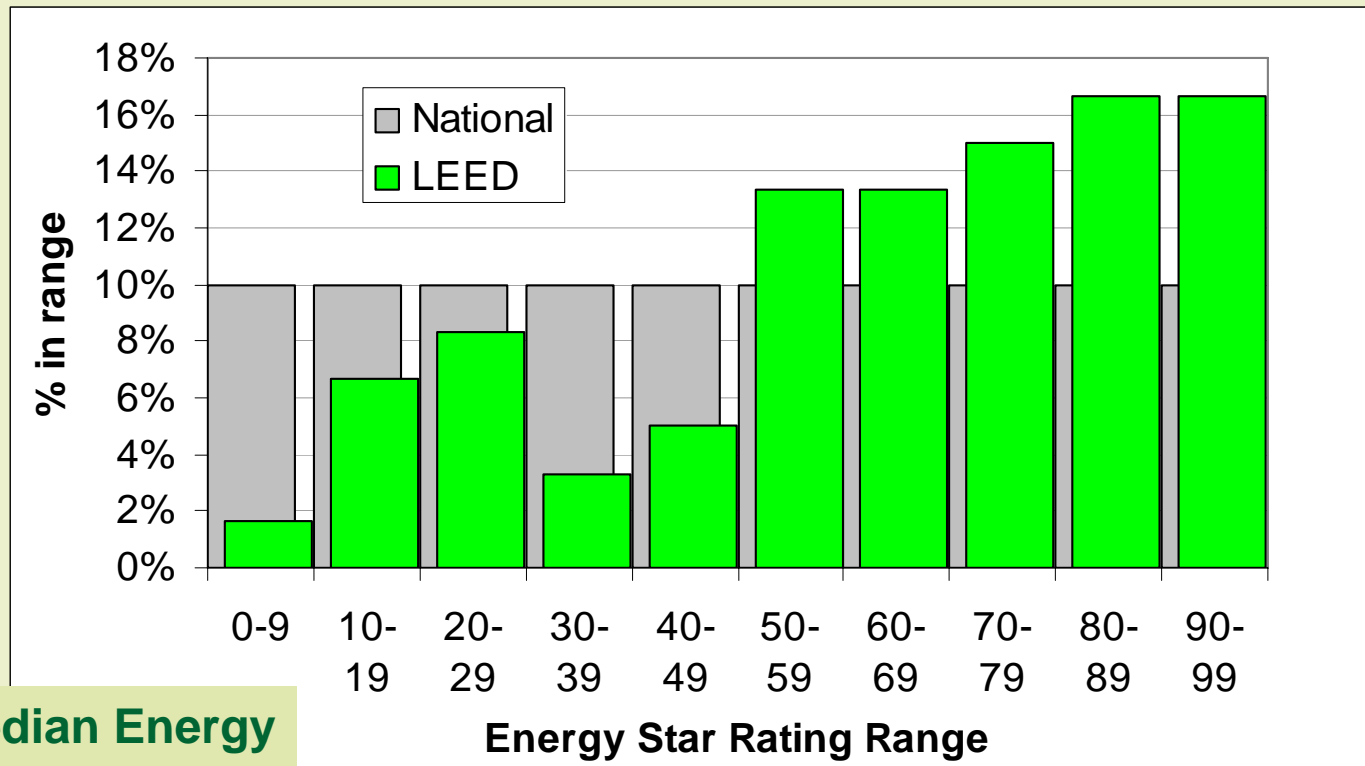
Compared to National Building Stock (CBECS)



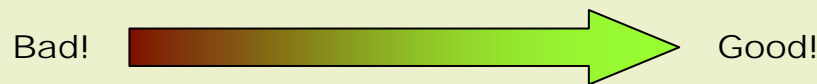
(*) these LEED type groups compared to CBECS all buildings

Average LEED savings of 25 – 30%

Refined Building Stock Comparison – Energy Star



LEED Median Energy Star Rating: 68



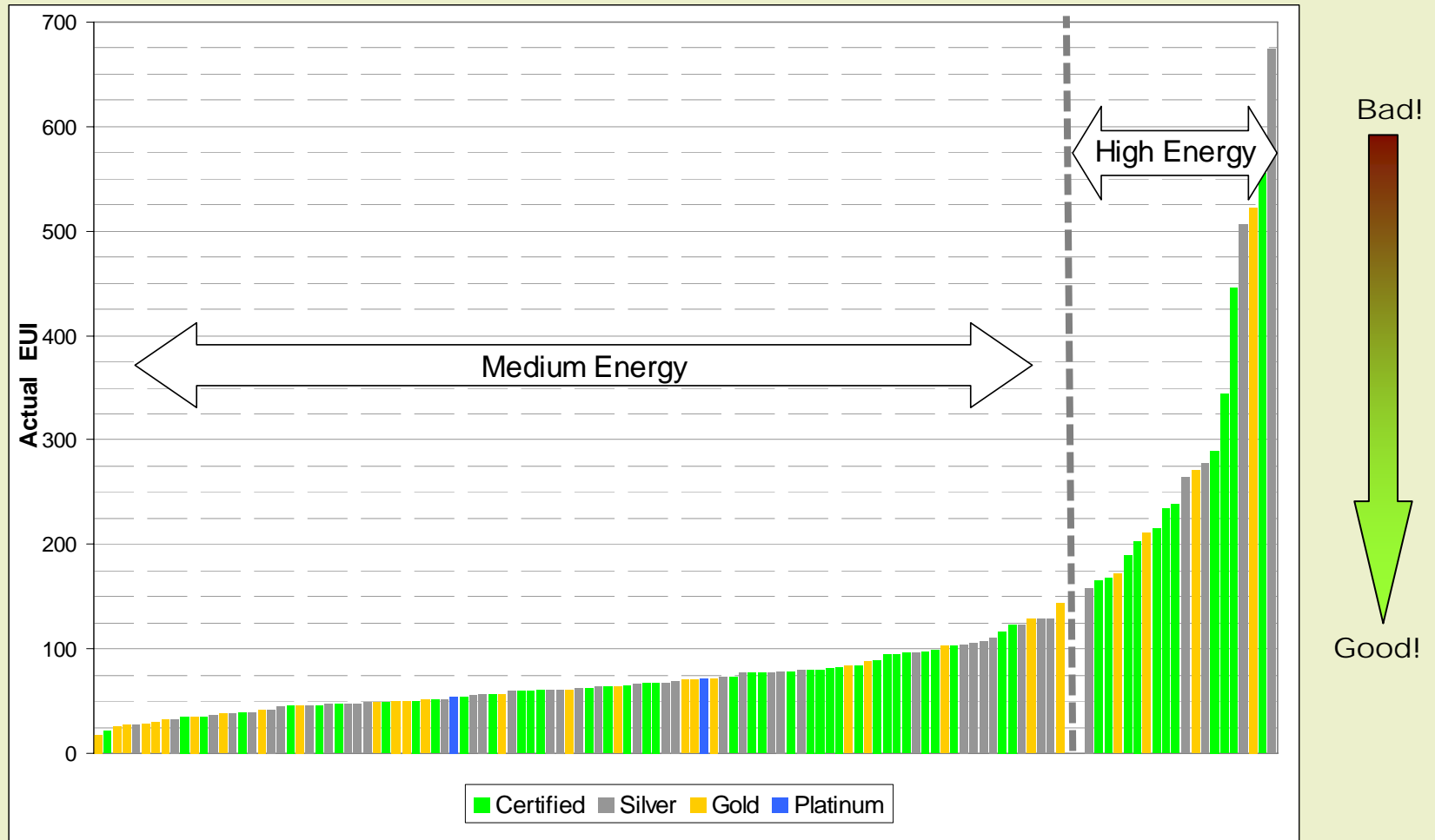
Average LEED savings of 25 – 30%

Measured and Design Compared to Baseline Modeling

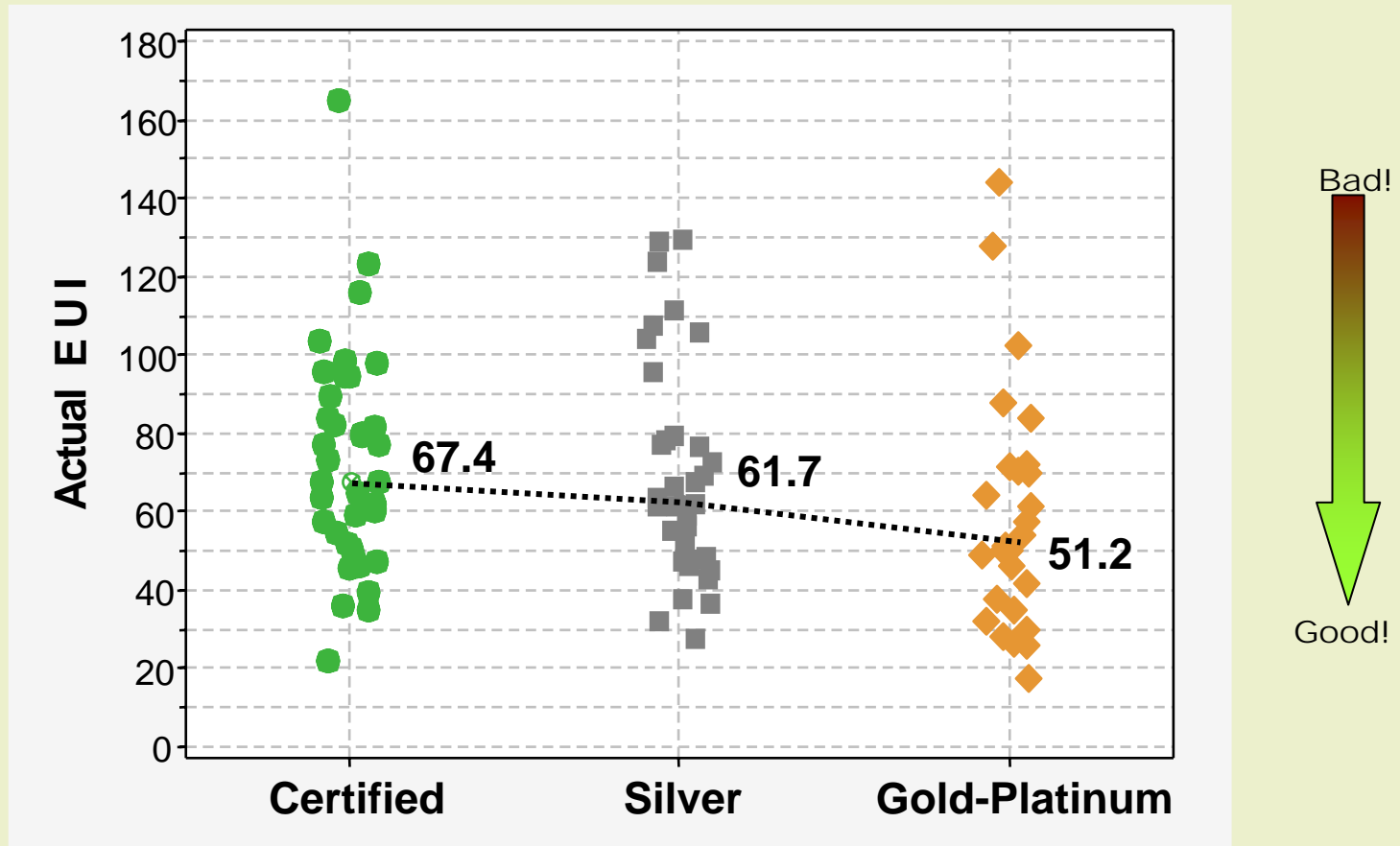


Measured Savings 28%
Proposed Savings 25%

Individual results are varied

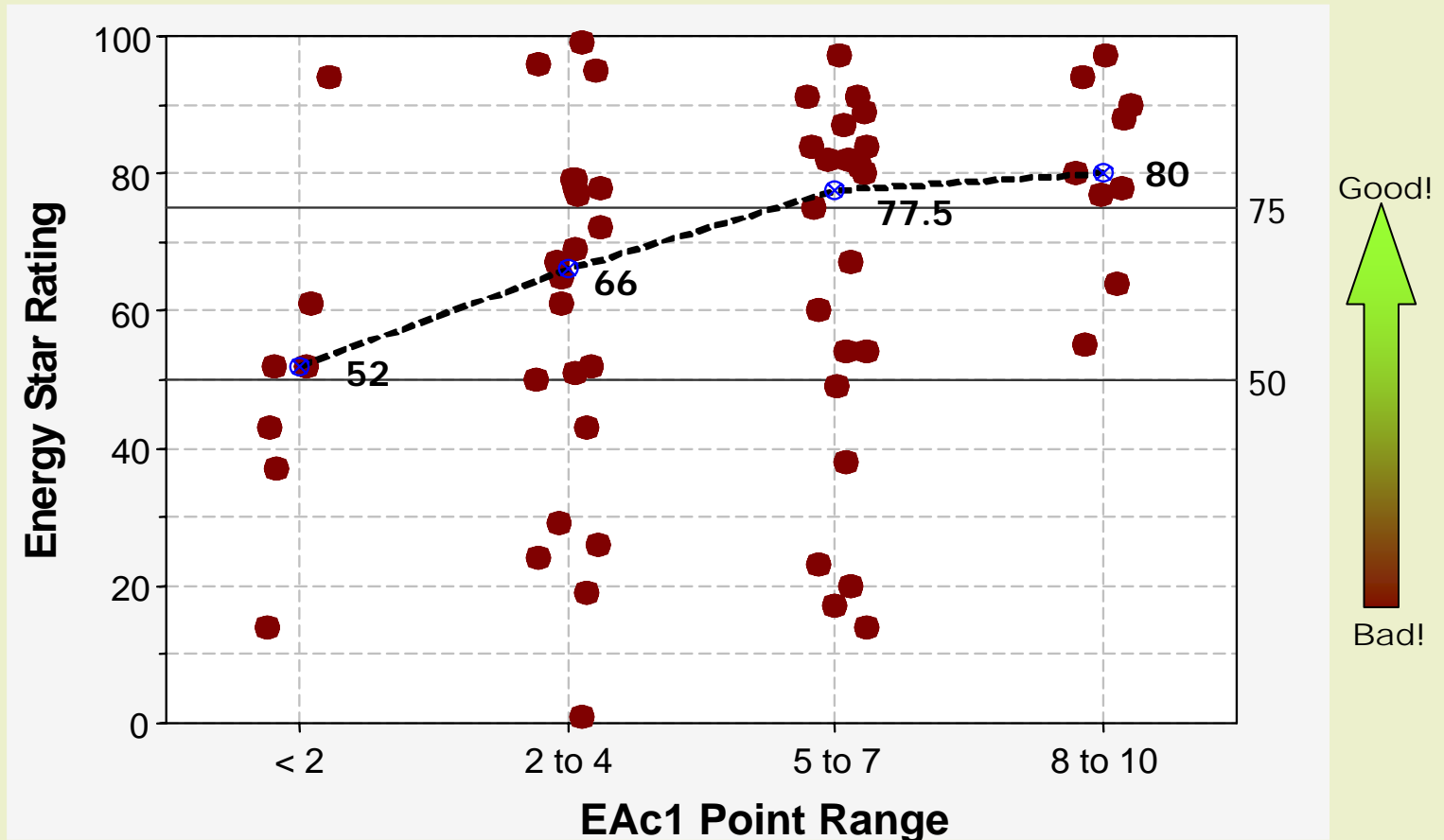


EUIs by LEED level

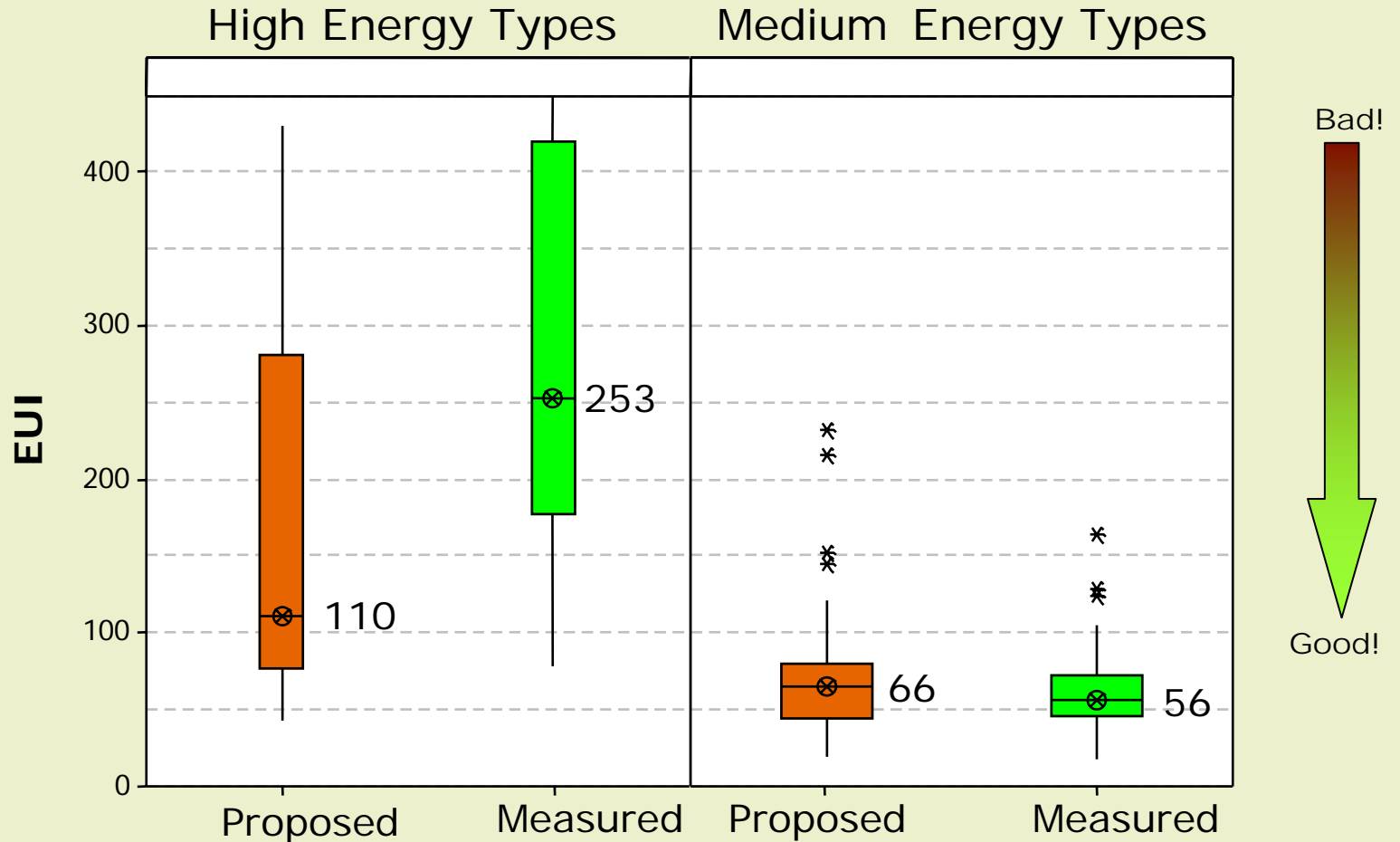


this and later slides based on just on the medium energy type buildings unless noted

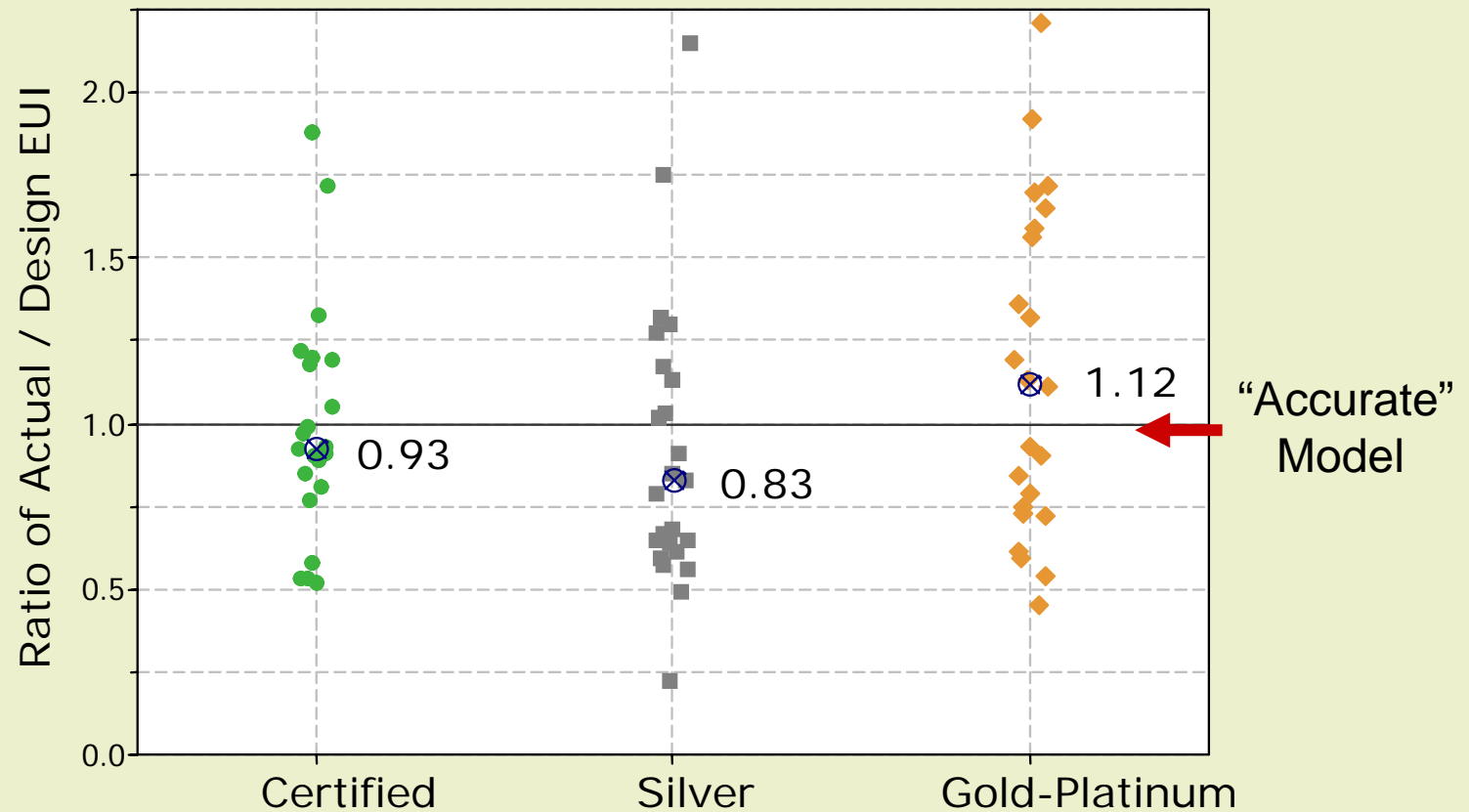
Energy Star scores by EAc1 points



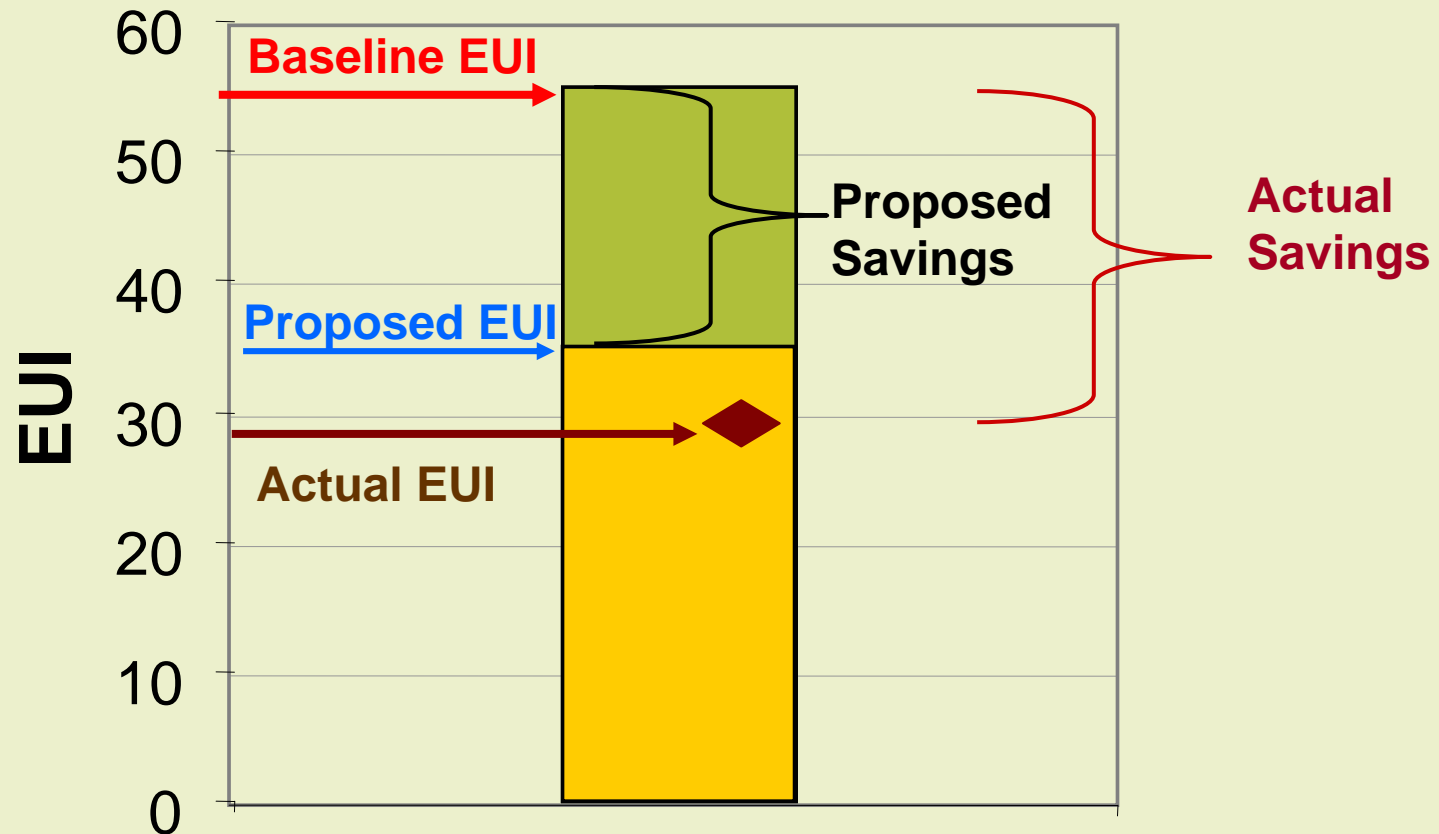
Modeled EUI ranges



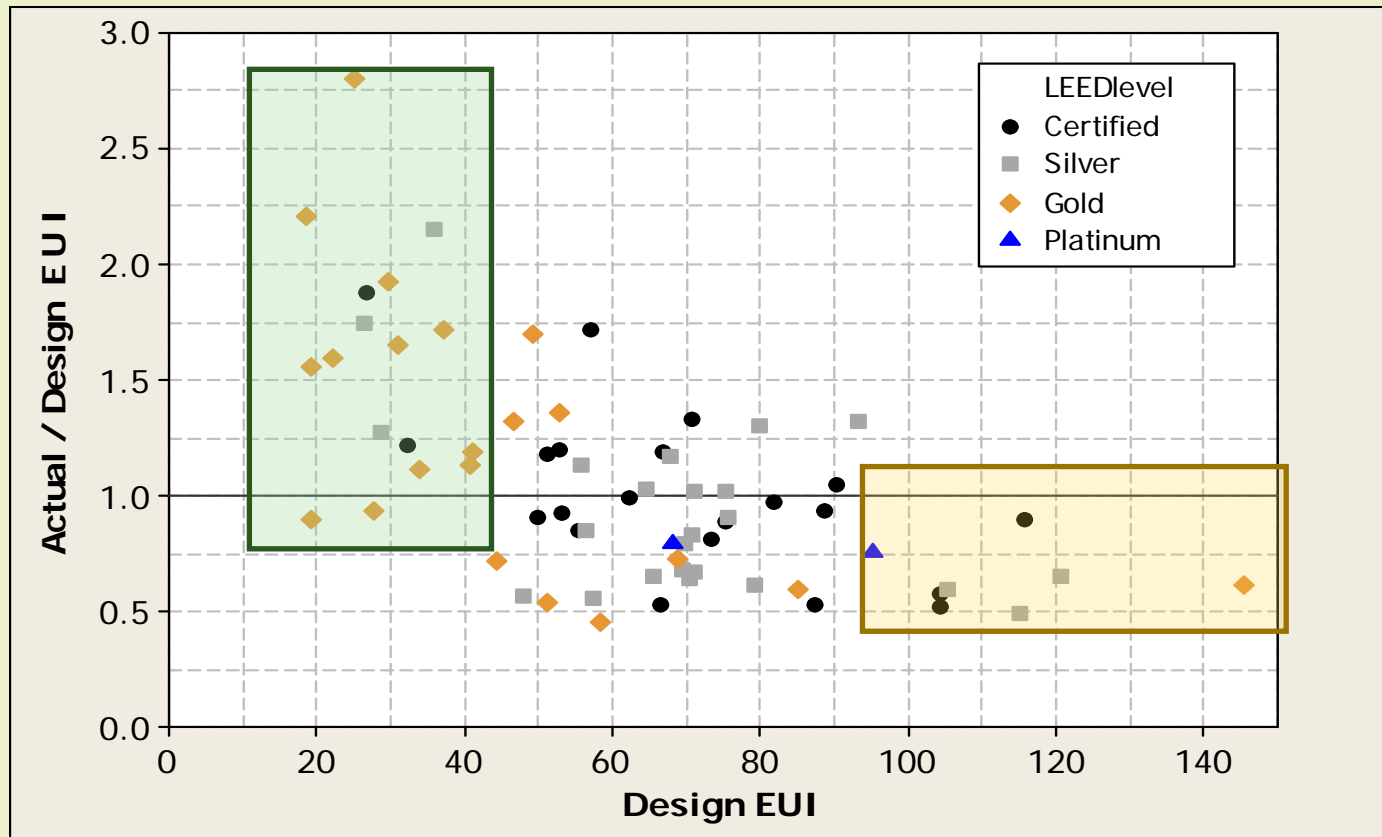
Actual to Design ratios vary



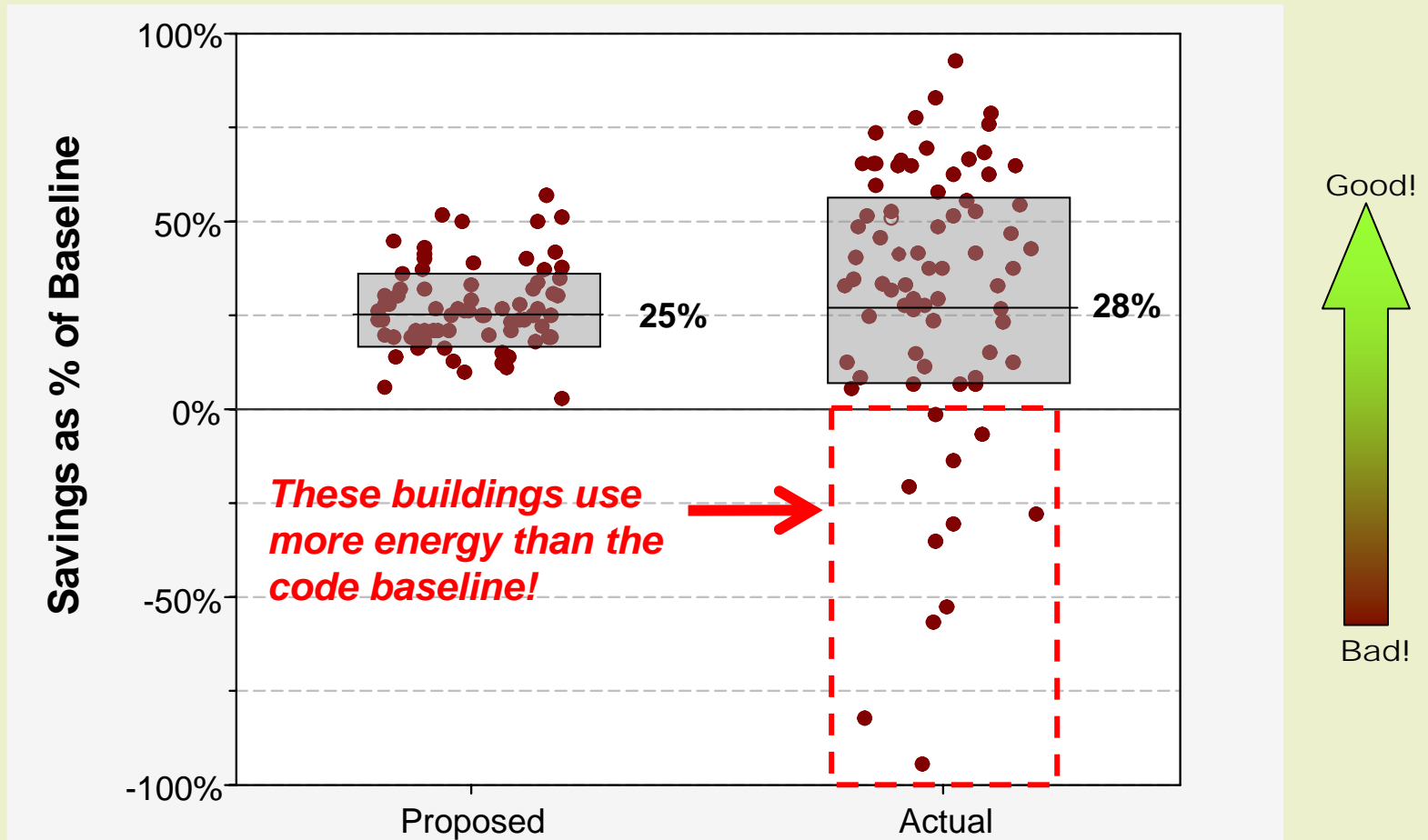
Modeling savings terminology



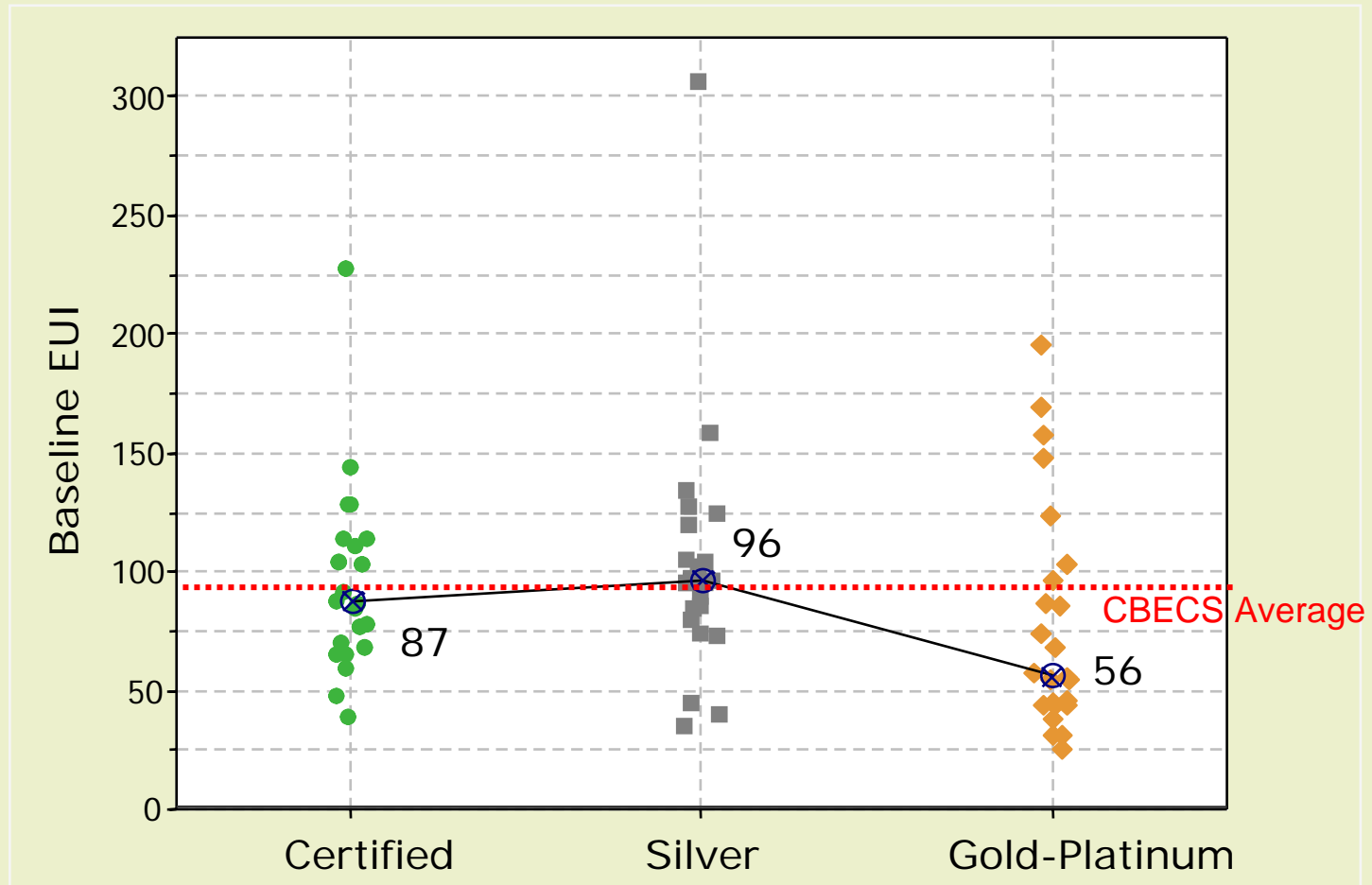
Models are more optimistic at lower predicted EUIs



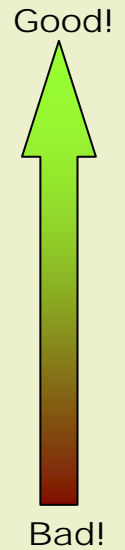
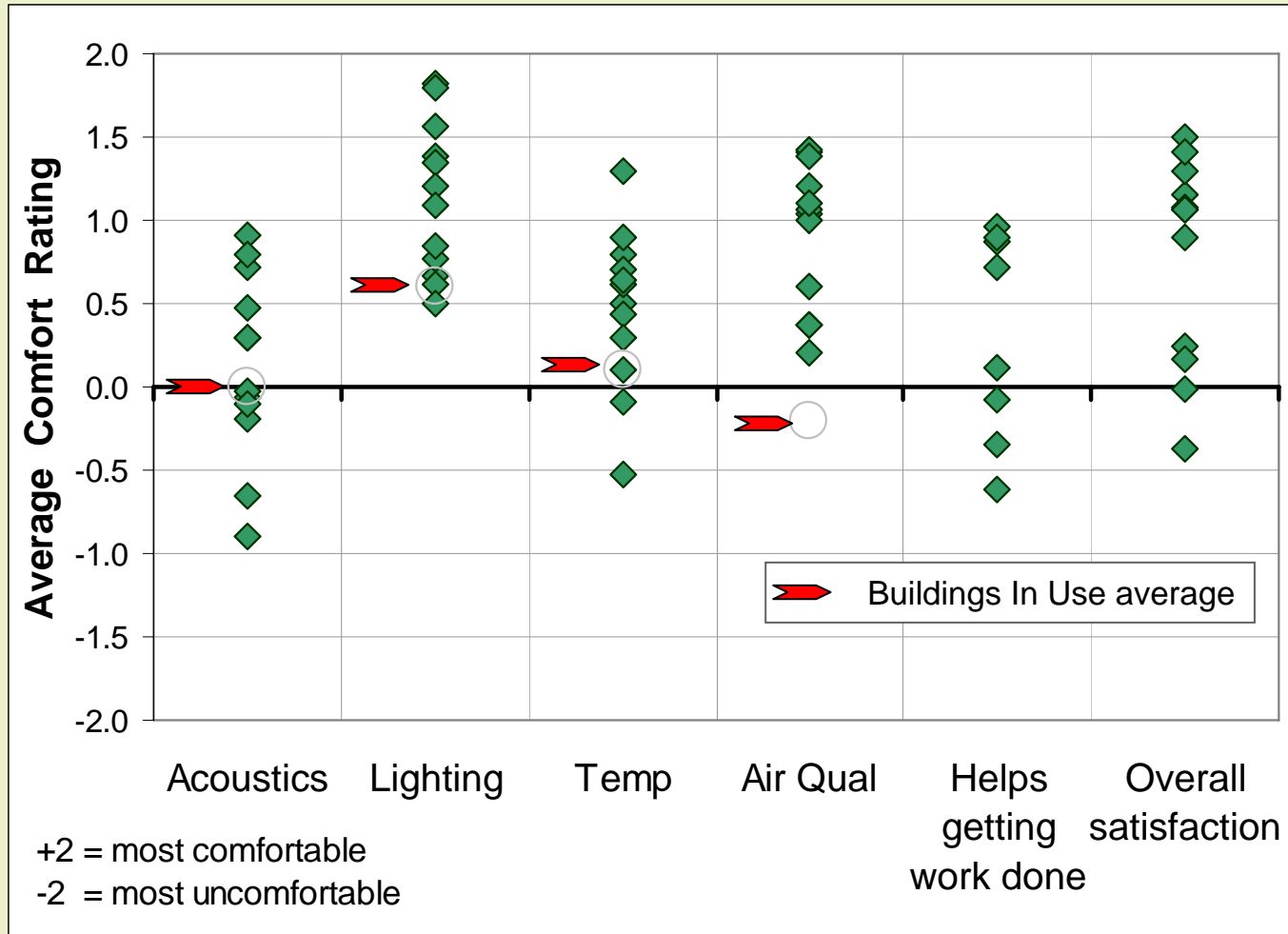
Actual savings vary



Baseline EUIs are near CBECS averages



Energy savings + Occupant comfort



LEED Study Conclusions

- Consistent average savings 25 – 30%
- Wide variability suggests need for:
 - better understanding of actual performance drivers
 - improved modeling guidance
 - more actionable feedback to owners
 - easier access to energy data
 - program refinements to support good performance

MEASURED PERFORMANCE INITIATIVE

- Feedback for multiple audiences
 - Accessible data
 - Meaningful benchmarks
 - Actionable reporting

What's needed?

- Meaningful benchmarks
- Feedback for multiple audiences
- Feedback at multiple levels
- Multiple reporting formats
 - Case studies
 - Simple dashboards
 - Aggregate analyses
 - Supporting benchmark datasets, consistent definitions

Who needs feedback?

Audience	Feedback Needs	Uses
Owners & operators	<ul style="list-style-type: none"> ▪ Whole building report cards ▪ 	<ul style="list-style-type: none"> ▪ Prioritize enhancements ▪

action-oriented guidance

baselines for tracking progress

“In the case of green building, the risks of not moving quickly enough almost certainly will outweigh the risks of moving too quickly.”
 results-responsibility alignment
 Andrew Nelson, RREEF

“Everyone agrees we have a problem, but no one has told me what to do about it”
 LEED building owner

“It was a perfectly good building until people moved in.”
 Steve Fry, Washington Dept of Ecology

Who needs feedback?

Audience	Feedback Needs	Uses
Financial decision-makers	<ul style="list-style-type: none">▪ Market return impacts▪ Cost and savings of EEMs▪ Productivity impacts	<ul style="list-style-type: none">▪ Appraisal, marketing, leasing▪ New building design decisions

“It’s essential to translate energy usage to cost savings.”
Leanne Tobias, Malachite LLC

“77% of corporate space users would pay a premium to rent or buy green space”
CoreNet, Jones Lang LaSalle

“Green doesn’t cost *more*; It just costs *different*.”
Gary Christensen

Who needs feedback?

Audience	Feedback Needs	Uses
Design community	<ul style="list-style-type: none">▪ What worked at the component level▪ Whole building report cards▪ Compatible benchmarks	<ul style="list-style-type: none">▪ Verify design-intent is met▪ Improve future designs▪ Benchmark to national goals

“All models are wrong. Some models are useful.”

George E.P. Box, U Wisconsin

“Design tool metrics must be comparable to information that is actually measured.”

Mary Ann Lazarus, HOK

Who needs feedback?

Audience	Feedback Needs	Uses
Program & policy managers	<ul style="list-style-type: none">▪ Achieved savings and costs▪ Actual performance drivers	<ul style="list-style-type: none">▪ Program result reporting▪ Program, policy development

“We live in the constructive tension between what’s technically needed and what’s financially acceptable.”

Brendan Owens, USGBC

Common needs

- Focus on the marketplace
 - Accessible reporting,
 - Actionable information
- Measure the basics
 - Usage by month and fuel
- Support multiple layers
 - Whole building, primary components, diagnostic detail
- Develop the right benchmarks
 - Common metrics
 - Data gathering and aggregation tools



A few activities underway

- Financial
 - CoStar Database, Davis Langdon report, IPD Environment code
- Metrics & Benchmarking tools
 - ASHRAE protocols
 - Portfolio Mgr and Target Finder enhancements
- New studies and data-gathering approaches
 - Performance studies
 - Databases: DOE's High Performance Buildings database, DASH
- Programs
 - USGBC Existing Buildings O&M refinement
- Communication channels

Wayfinding tools

Measured Performance Materials

Filter for:

Sort by:

Topic = **Financial**
Found: **4 resources**

Title	Author	Year	Brief Description	Topics
Cost of Green Revisited	Matthiessen, L.F., Morris, P., Davis Langdon	2007	Reviews the cost/sf of 221 buildings, comparing LEED and non-certified.	Financial
Does Green Pay Off?	Miller, Spivey and Florance for NAIOP	2007	Preliminary results from a comparison market and occupancy factors for green and non-green (Energy Star or LEED) class A office space from the CoStar database	Financial
Green Building Finance Consortium website	Muldavin, S., Green Building Finance Consortium	ongoing	The site's Resources pages have GBFC publications, links to many other finance articles/sites, and a database of article references searchable by topic, author or title.	Financial, Market Research
Greening of U.S. Investment Real Estate	RREEF	2007	Study of institutional investment in green real estate, including comparisons of LEED, Energy Star, and conventional market performance based on the CoStar database	Financial

In Review



- Performance measurement background
- Recent LEED building performance
 - ❑ Consistent average savings
 - ❑ Variability shows room for improvement
- Moving forward
 - ❑ Accessible data
 - ❑ Meaningful benchmarks
 - ❑ Actionable reporting
 - ❑ Communication channels