Bridging the Gap

Between Design and Operating Performance

Jesse Sycuro, PE, CEM | May 2014

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Learning objectives

Improve the understanding of the following:

1. The gap between designed performance and actual building performance
2. The shift in the building industry towards expected performance outcomes
3. Approaches that can be leveraged to achieve better operational outcomes
4. Risk management strategies to achieve performance expectations

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Operational performance lags behind design performance

Why?

State of the industry

Efficient design

≠

Efficient operations

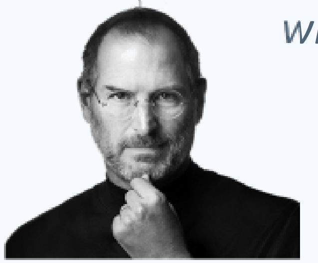
Why do we care?

- ***Pride in our work***

- Quality → Reputation →
  Long Term Client Relationships

- Increasingly knowledgeable clients →
  Increased Client Expectations

> *Your work is going to fill a large part of your life, and the only way to be truly satisfied is to do what you believe is great work. And the only way to do great work is to love what you do.*
>
> *Steve Jobs*



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Bridging the gap

How can we improve?

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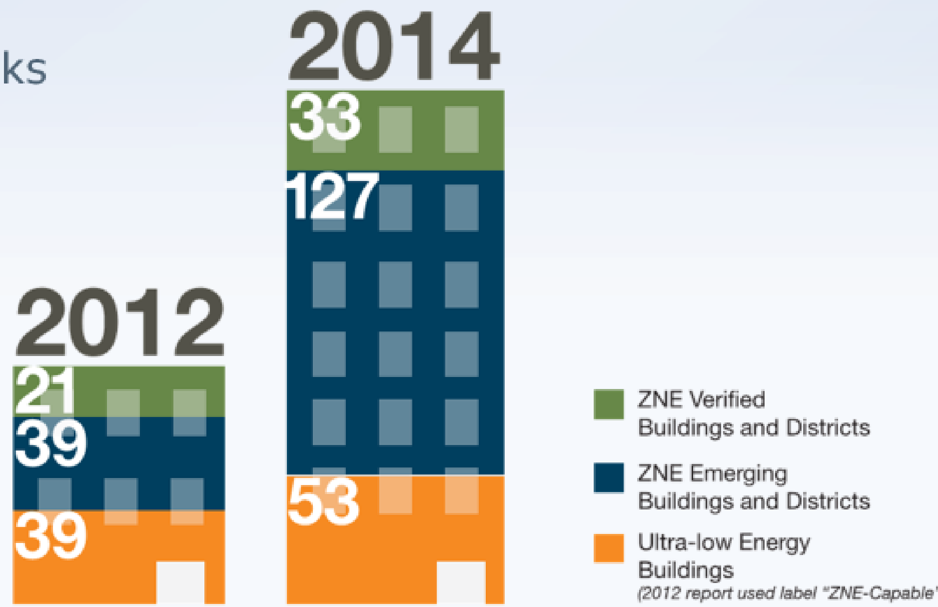
Market shift to outcome focused delivery

- Utility driven Pay-for-Performance programs
  - Pilots in WA & OR
  - Programs in CA, CT, NJ, NH, NY

- Client driven shift of performance risks

- Net Zero Energy Projects



Getting to Zero Status Update, NBI, 2014

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A new take on a proven approach

PRE-DESIGN

DEFINE PERFORMANCE CRITERIA

- Guaranteed performance

Owner's Project Requirements

DESIGN

RISK MANAGEMENT PLANNING

- Model for operational tracking
- Performance evaluation plan

Design Review

CONSTRUCTION

BUILT FOR PERFORMANCE

- Equipment deployed for performance measurement
- Commissioning test requirements
- Early performance tracking

Systems point to point and functional testing

OCCUPANCY & OPERATIONS

OPERATE FOR LONGTERM PERFORMANCE

- KPI tracking
- Performance verification
- Performance optimization

Transition to stable operations

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More than energy performance contracting

SIMILARITIES

- M&V plan
- M&V methods: Option D model verification
- ESPC serves as foundation for structure of performance guarantee

DIFFERENCES

- Magnitude of performance guarantee
- Pass/fail basis for success
- Procurement methods
- Distribution of project risks across team

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Thomas S. Foley U.S. Courthouse

Case study

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case study

THOMAS S. FOLEY U.S. COURTHOUSE

General Services Administration

Spokane, WA

- 300K sqft, 9 stories
- Total infrastructure replacement, design-build modernization
- Fully occupied
- Conversion to Higher Performance Green Building
- Guaranteed performance outcome of 30% EUI reduction

Project Result -

50% reduction in EUI

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Project details

Scope of work

- Converted boilers to modular condensing boilers
- Replaced cooling towers with induced draft towers
- Replaced one fluid cooler
- Overhaul and expansion of BAS
- Lighting upgrades
- Resealing and repairing external windows
- Replaced multi-zone AHUs with mix of constant and variable air volume AHUS
  - Included heat recovery systems, dampers, filters, demand control ventilation, and UV lights.
- Complete second floor tenant improvement
- Replaced all perimeter fan coil units
- Replaced domestic hot water system
- Upgraded electrical infrastructure

Project financials

- $40 million construction cost
- Annual savings
  - 1,027,000 kWh
  - 55,200 therms
  - 693 metric tons of carbon
  - Roughly $150,000 in utility costs

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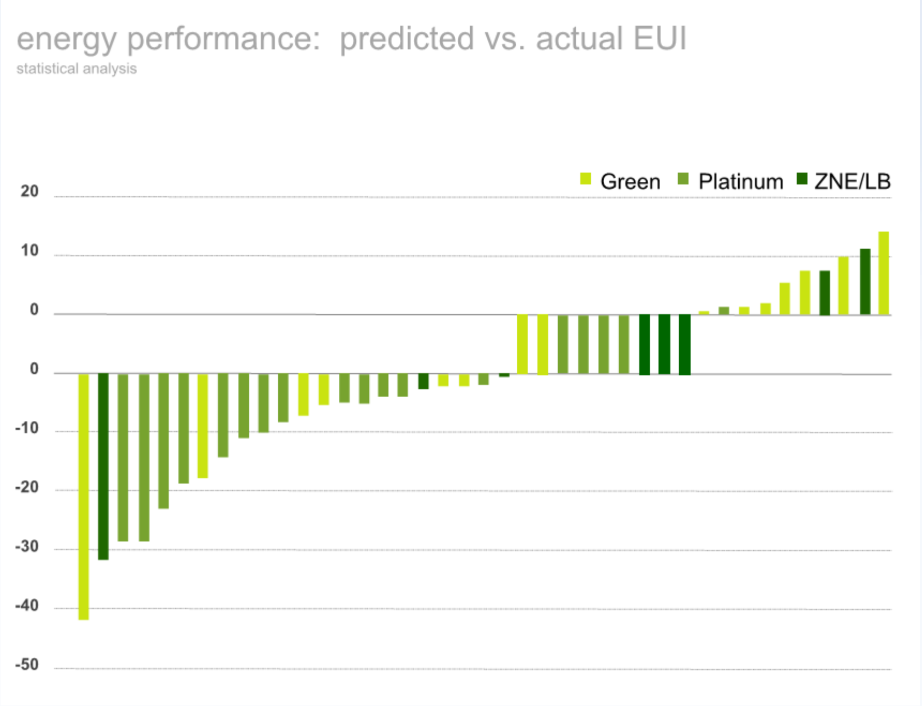
Pre-design

Performance criteria

Defining success

- Hardened, clear targets improve outcomes
- Guaranteed performance connects design process to operational expectations



"Getting to Zero", New Buildings Institute 2014

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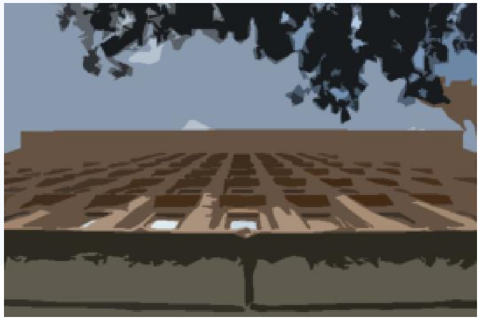
CASE STUDY: Project Goals

- Energy focused expectations
  - 32% Energy Reduction, 43 EUI
  - ENERGY STAR Score of 97
  - LEED Silver Certification
  - Federal Energy Conservation Goals
- $800K Performance Retainer
  - 4% of project costs



LESSONS LEARNED

Guaranteed outcome and clear client focus on goals enabled team to ensure the right decisions were made throughout the project cycle.

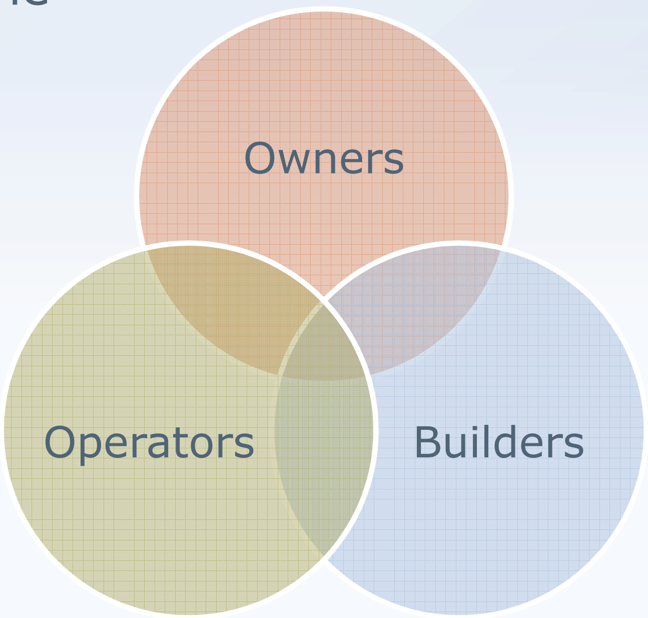
Design

Risk management

Risk management

- Performance Evaluation Plan
  - Define how performance is to be evaluated
  - Move operational risk from the owner to the total project team
  - Align guaranteed outcomes to specific responsibilities

- "Operational" Modeling
  - Rethink how we model buildings
  - Shift from ideal state to reality focus
  - Intent for long term use and application



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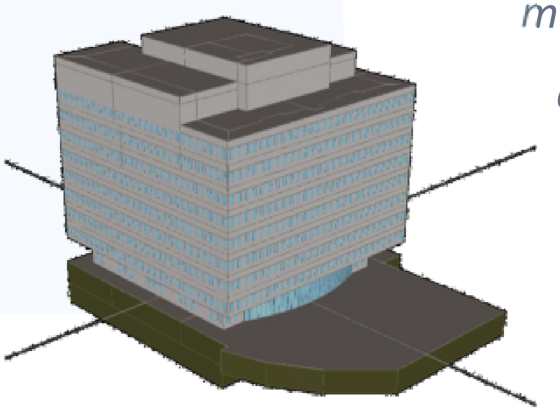
Distribution of risk

CASE STUDY: refining energy model

Iterative process used for collaborative development of the Performance Evaluation Plan

Modeling limitations identified early in design:

- eQuest capacity limited
- Specialty systems calculated outside of model



LESSONS LEARNED

Energy Modeling was revisited multiple times to ensure it fit operational conditions.

M&V adjustment methodology was challenging to finalize post contract.

Construction

Built for performance

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Performance tracking

- Deploy and commission performance measurement technology
- Start tracking performance of systems during construction
- OPRs may change, but how does it affect the guarantee?

Working in an occupied building presented challenges

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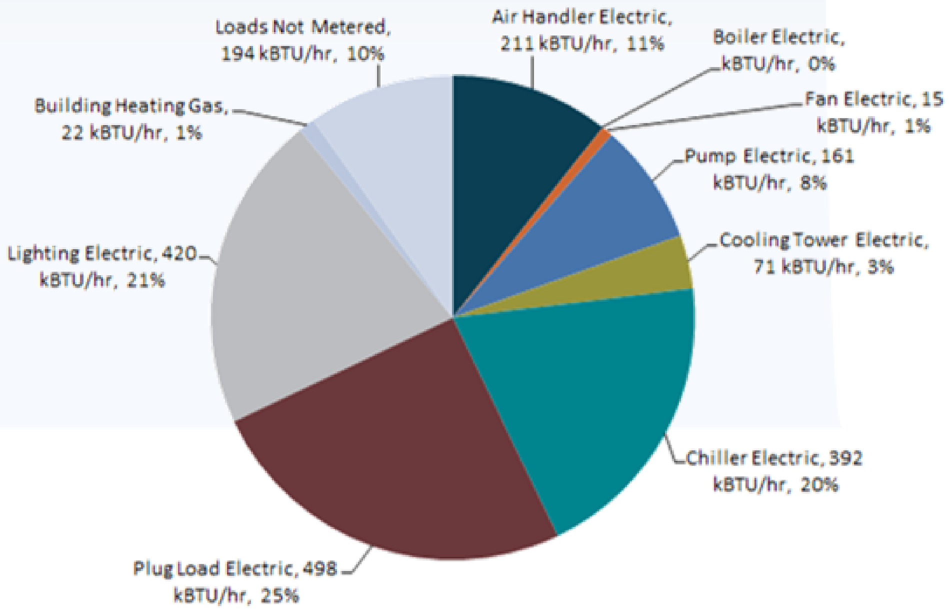
CASE STUDY: Implementation

Implemented technology solution encompassing:

- 90% of energy end-use metered
- Over 4,000 data points collected
- Key performance indicators for whole building and end-use performance monitored in real time



LESSON LEARNED

Getting the right data at the right time in a manner that it can be leveraged efficiently is an ongoing challenge for any project.

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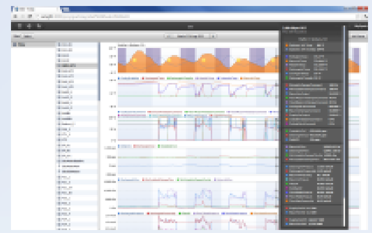
Occupancy & Operations

Performance management

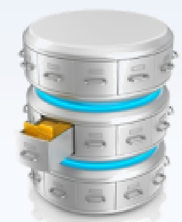
Performance measurement

- Technology is an enabler – NOT a tool
- Means to improve timeliness and efficiency by which we measure performance

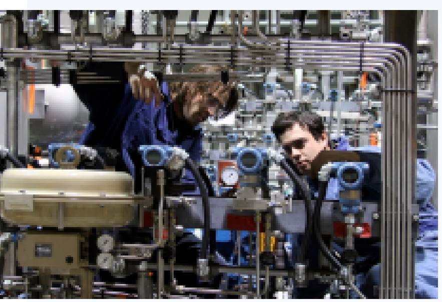


Analytics – Automation of Performance Valuation

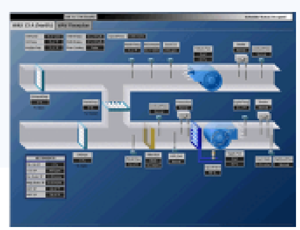
Reporting – Work Flow



Database – System of Record



Action



Building Systems – Raw Data

Performance evaluation

Adjust
Correct for parameters not related to design and operational performance

Analyze
Gap analysis of model performance deviations

Report
Communicate and enable action for performance issues

*Don't shoot the messenger – **you may miss the message***

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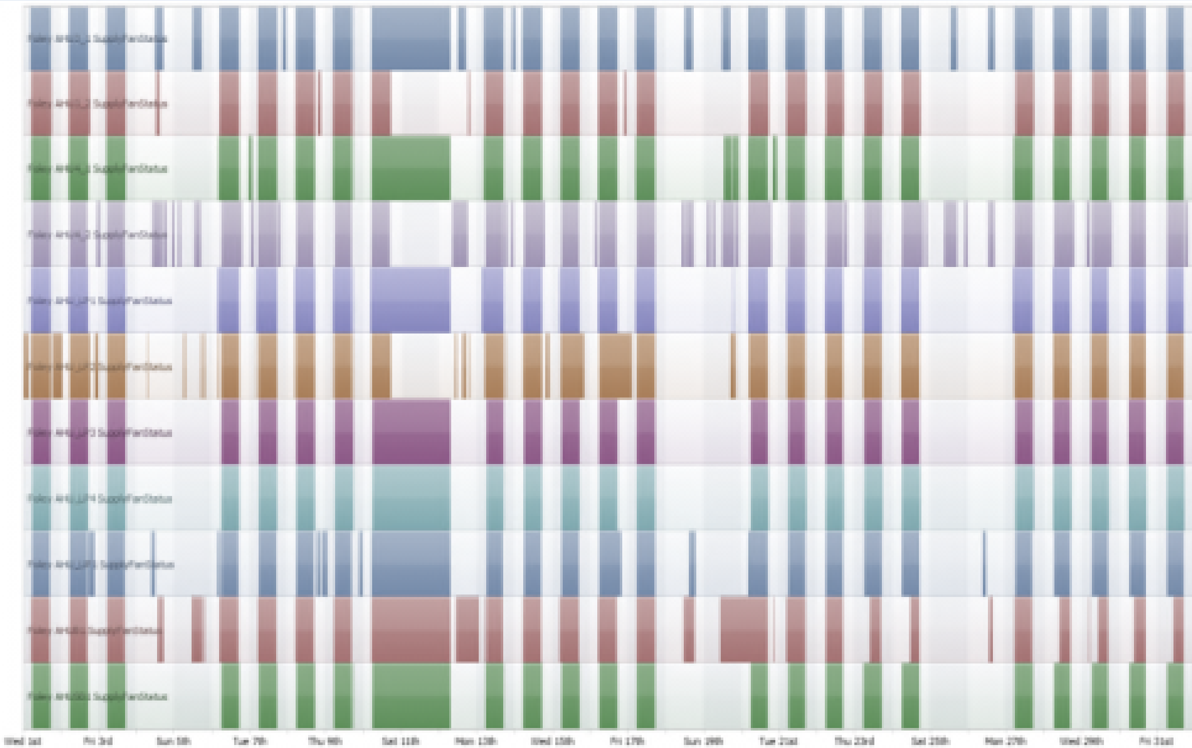
CASE STUDY: Shared responsibility



LESSON LEARNED

The project team helped both the building owners and operators understand how small changes (e.g. changing set points) would affect energy performance and – most importantly – the guarantee.

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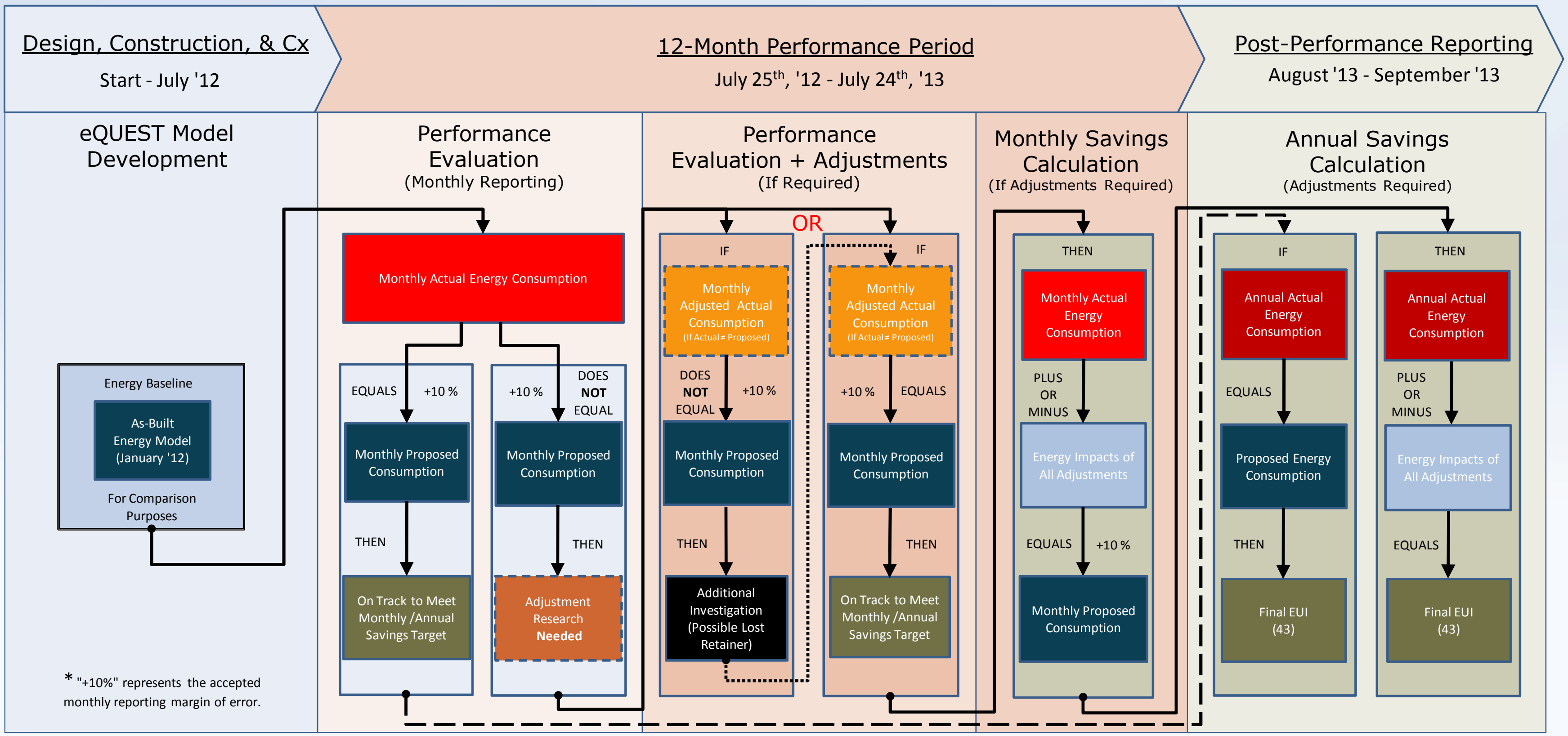
Conclusion

Evaluation process



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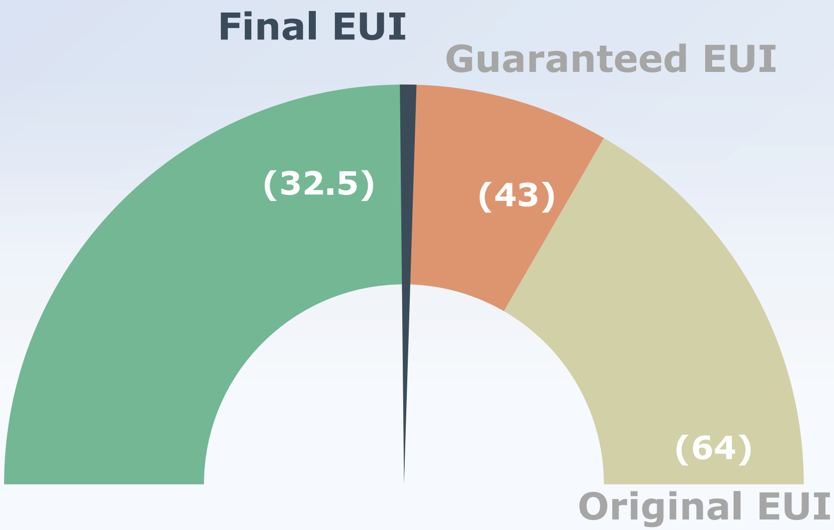
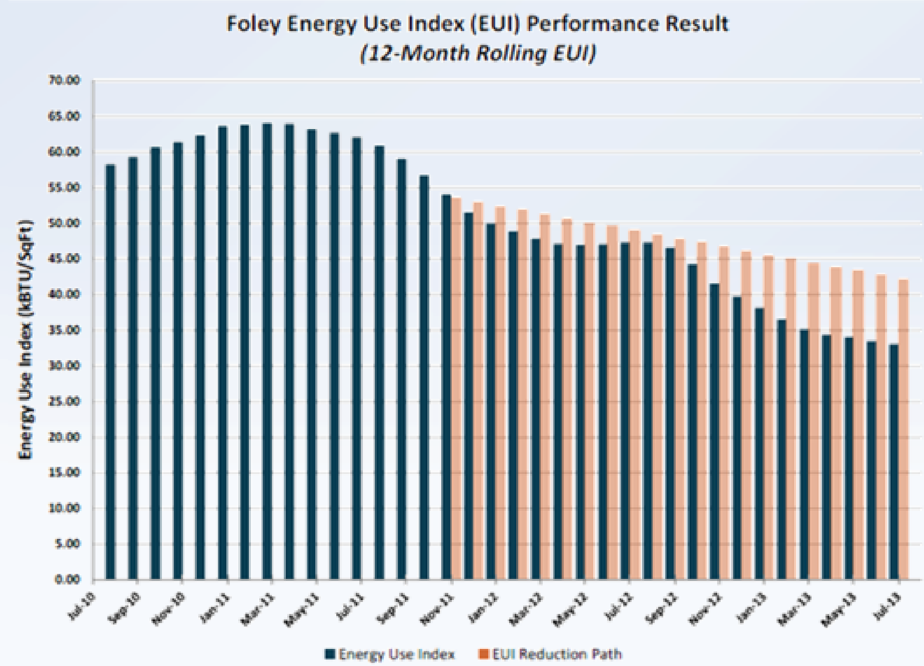
Performance results achieved





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Questions

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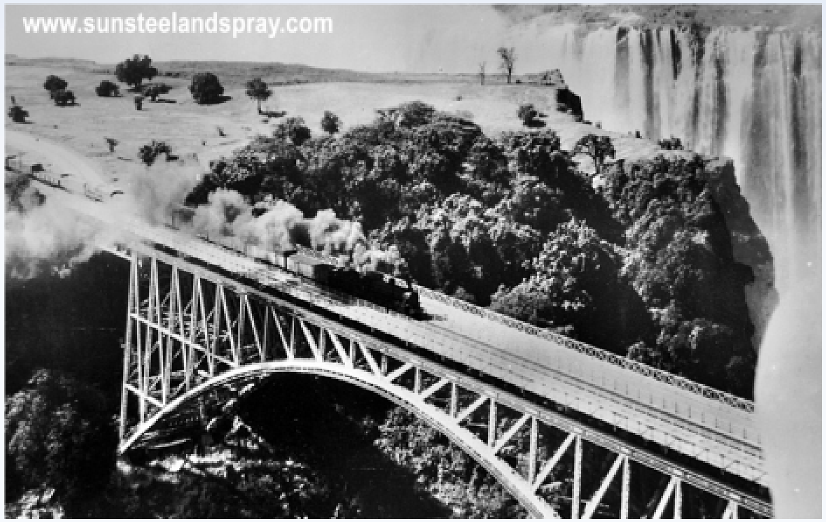

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