

Deep Energy Retrofits

A Search for Commercial Examples of Deep Savings

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ACEEE Energy Efficiency as a Resource

September 26, 2011



Three Lessons

1. 30-60% savings are possible
2. Opportunities and approaches differ:
 - a. Retrofits-occupied space needs phases/multiple touches 25-35%
 - b. Renovations-transitioning spaces, where the current action is, 30-60%
3. Stories matter - it's human nature to compare – Case Studies are a tool

The Search

Deep = 30%+ savings CBECS, target = 50%+

- NBI Contacted 47 organization/firms
- Researched 28 leading industry websites
- Reviewed over 500 case studies
- Identified 50 Existing building projects
- **Very Difficult to get data:**
 - Energy bills
 - Measure Descriptions (definition barriers)
 - Cost Information
 - Occupant satisfaction



Objective: Find existing buildings that incorporated 2 or more efficiency measures within the past 10 years, with energy savings greater than 30%.
From these select ~10 for a deeper dive

What about Data?

of the 50 buildings found

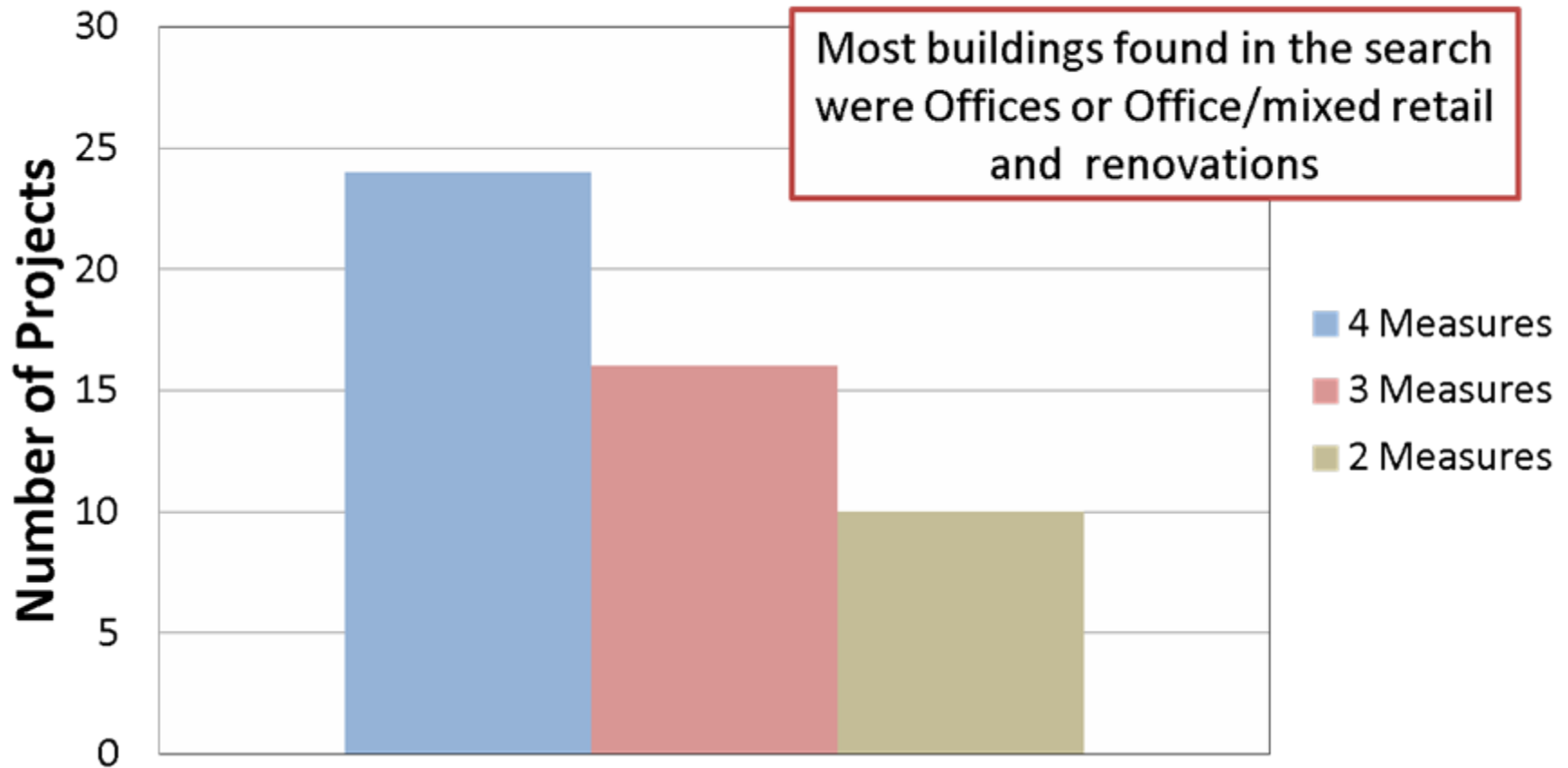


The search is hard and good data is rare, but:

- > 40% avg. savings
- 46% had measured performance data
- Almost 50% used 4 or more measures
- Advanced HVAC and lighting most commonly cited, along with controls and daylighting
- 86% were offices - 88% were renovations

EXISTING BUILDINGS

Number of Energy Conservation Measures



Initial Search Conclusions: 30–60% is feasible



Offices are the most common building type when searching for examples of green or high performance



Deep savings are more likely in deeper building upgrades / **renovations**, and these projects are more likely to have **information or PR** available



Measures used are not unusual, but **integrated** into the upgrade. **Advanced HVAC, Lighting, Controls and Daylighting** most cited



A data collection **vocabulary, protocol and repository** are badly needed

11 Deeper looks at Deep Savings

- > 50% avg. savings*
- 14 LEED Certifications
- Diverse sizes, locations, vintage, and ownerships
- Includes technical, performance, motivations, business/financial and owner quotes



nbi new buildings institute



Case Studies of Deep Energy Retrofits

September 2011

11 Case Studies in support of NGBA's Existing Building Renewal Initiative and NBI's Getting to 50 work



Preservation Green Lab



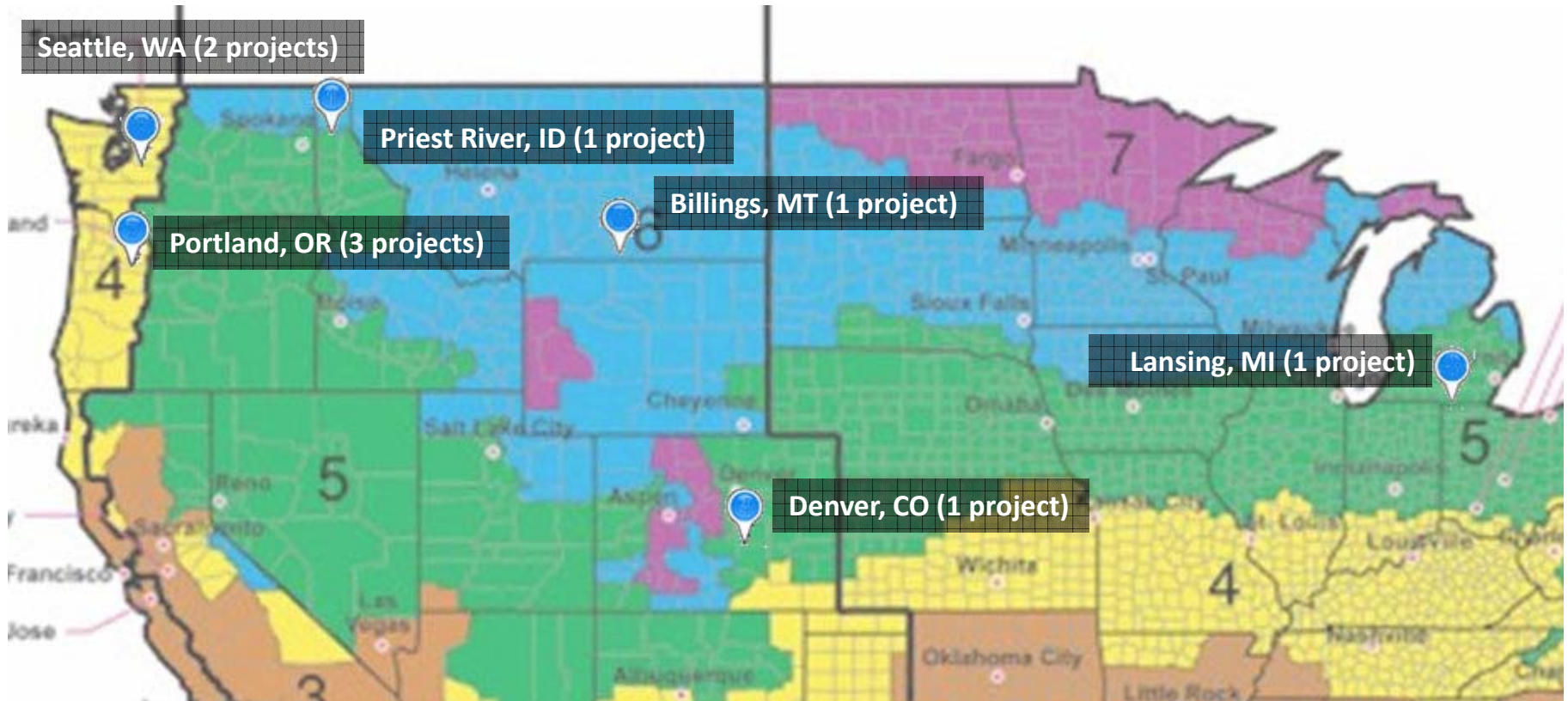
THE KRESGE FOUNDATION

Project: California City Highrise - HighriseGreenBuildings.org



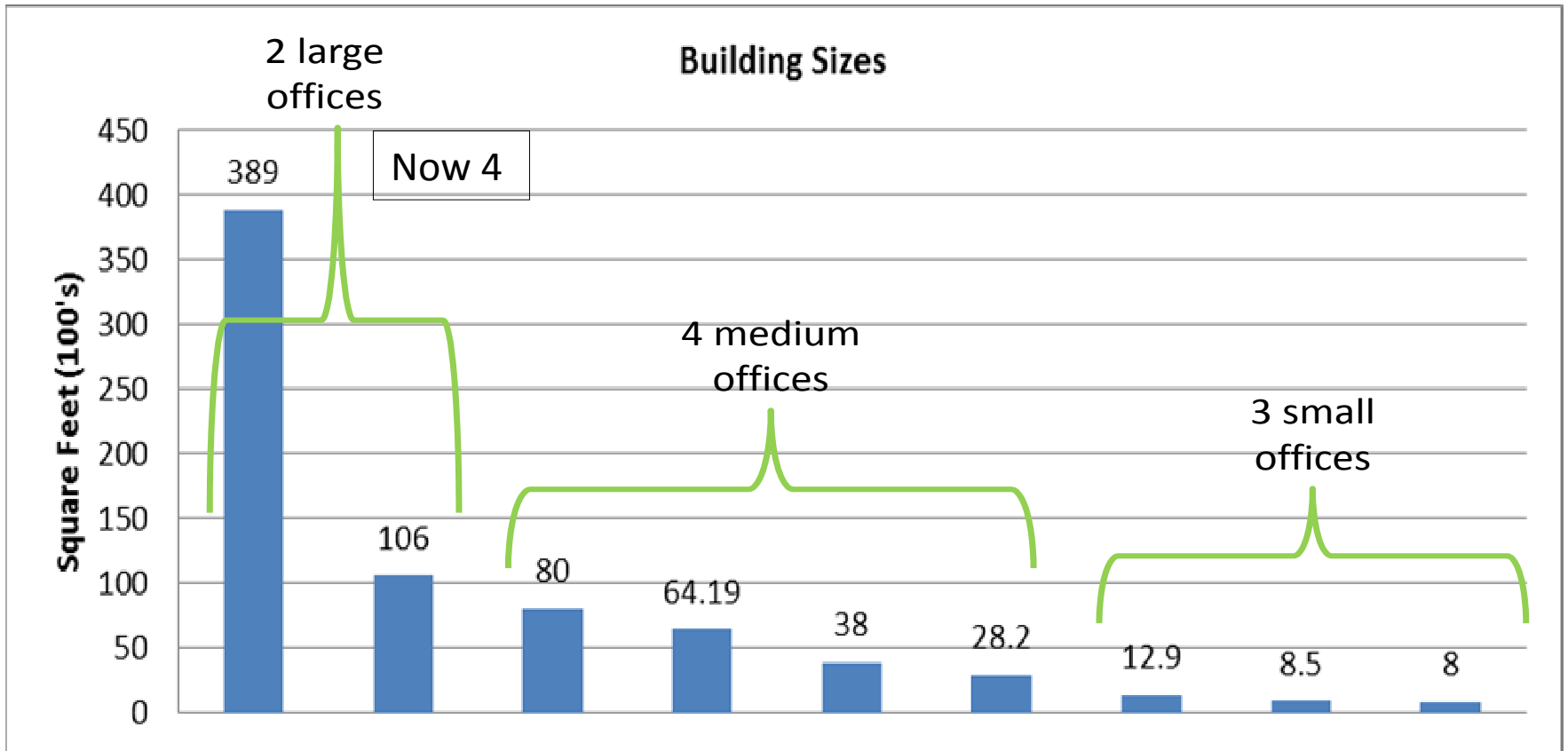
*over CBECS 2003

WA, OR, ID, MT, CA, CO, MI, VA



Plus Southern California and Virginia

Building Sizes

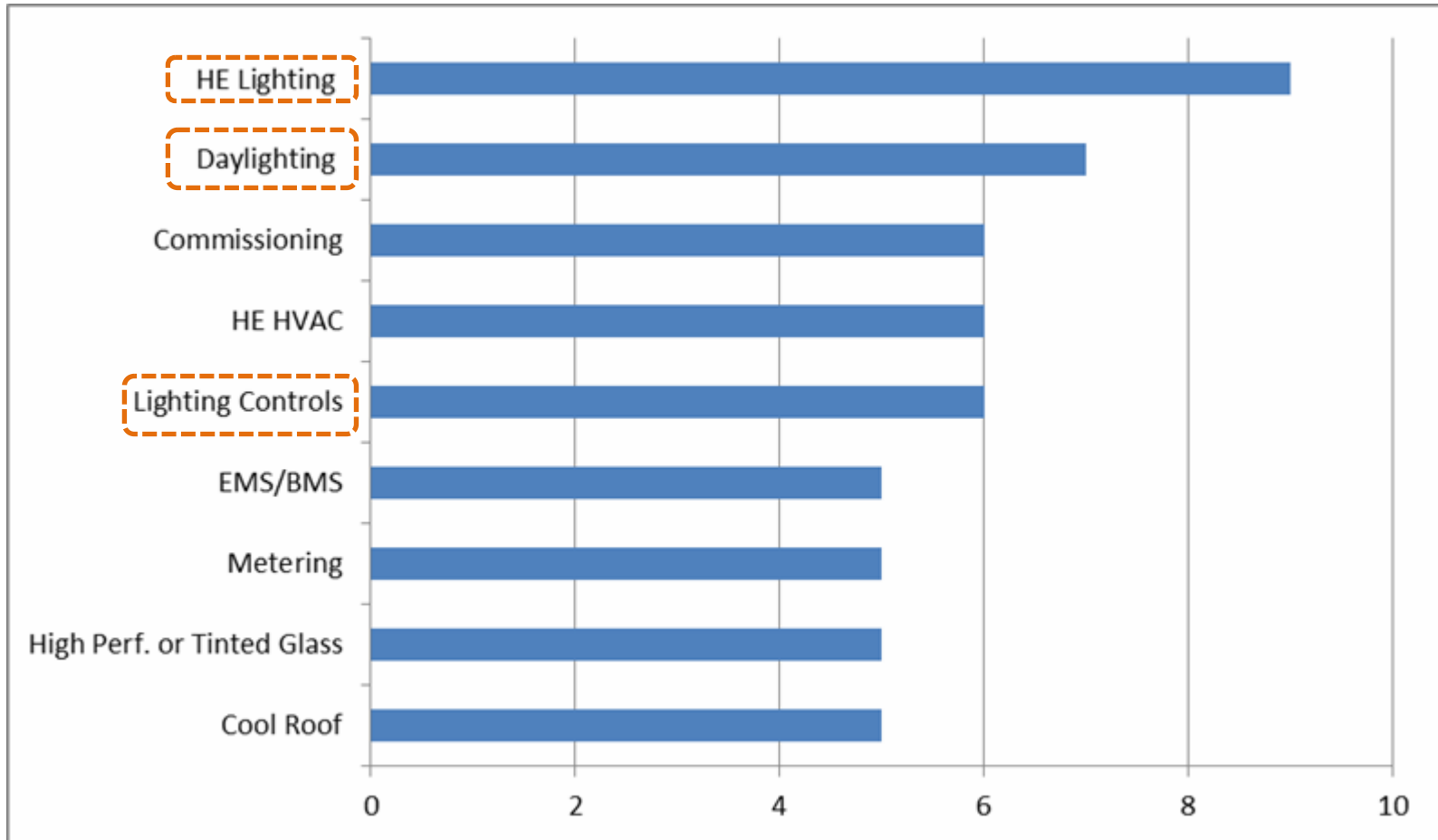


Ownership & Occupancy

Owner Categories	#
Owner Occupied: Private Green Firm*	3
Owner Occupied: Non profit & with tenants	3
Private Investor: Tenant Occupied	5
Total Projects:	11

*firms in the business of demonstrating and/or recommending green design practices.

Frequency of Efficiency Measure



Daylighting

- Daylighting only “counted” when coupled with controls
- Majority applied integrated daylighting controls (auto dimming) in whole or part
- Daylight management was combined with architectural strategies



Lovejoy Offices

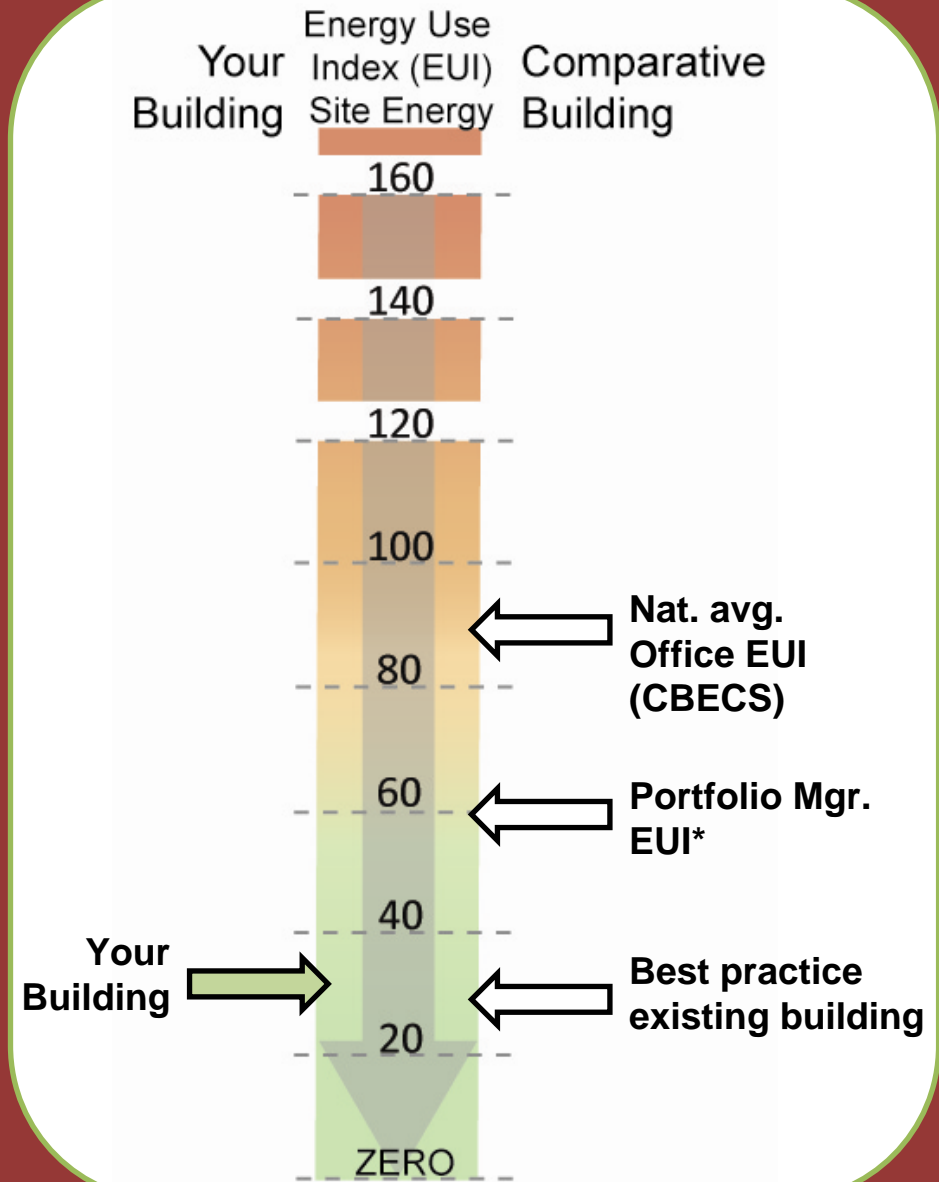
Advanced HVAC Measures

- Two radiant system installations
- One case of evaporative cooling
- Heat recovery or energy recovery installed in three buildings
- One variable refrigerant flow (VRF) installation



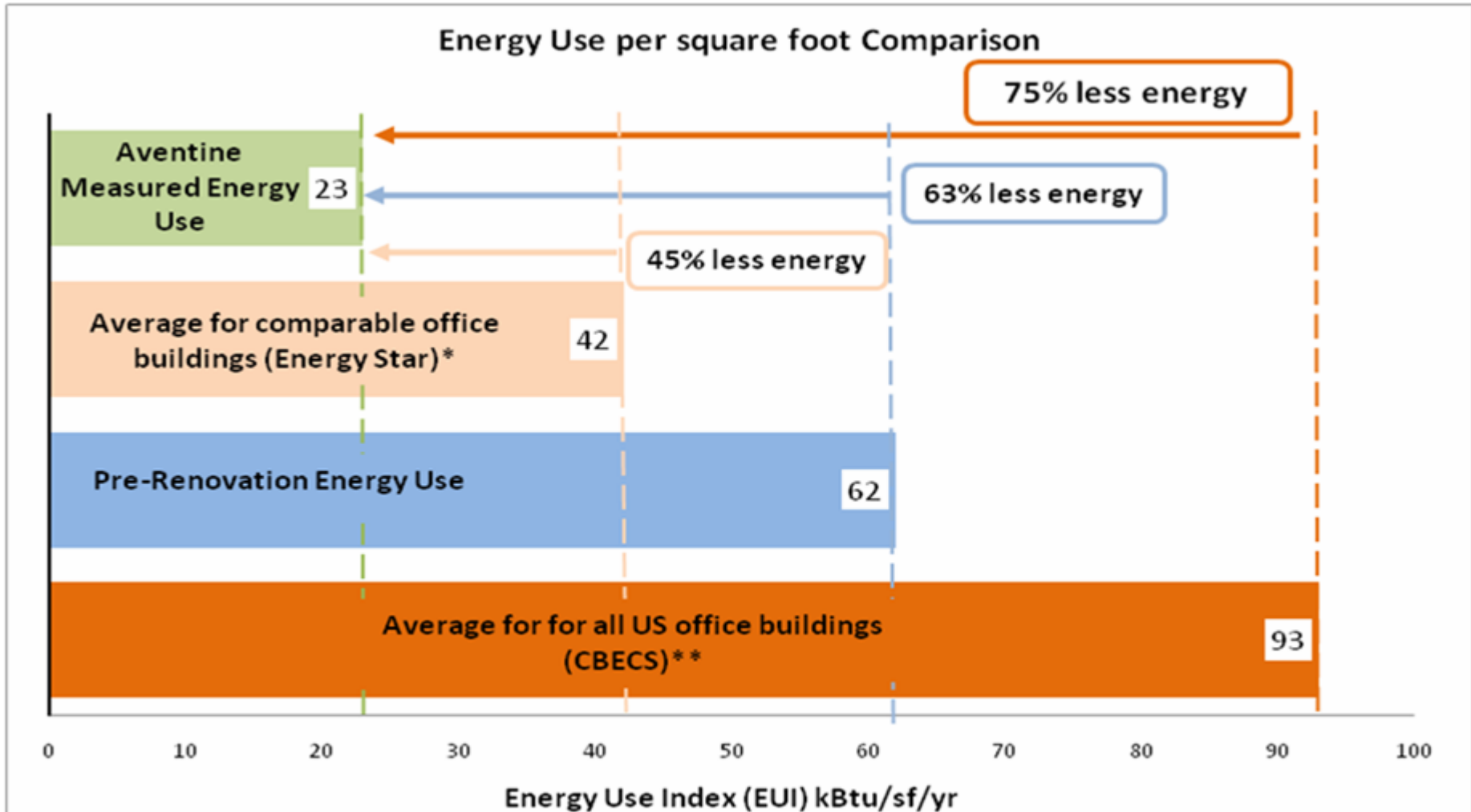
Compared to what? Baselines:

- Pre data
- ASHRAE 90.1-99, 04 or 07
- CA Title 24
- CBECS
- Portfolio Mgr.
- Other like buildings



*Energy Star **Portfolio Manager** calculates an EUI for a building based on like building types, climate, size, occupancy and loads

Percent Savings...

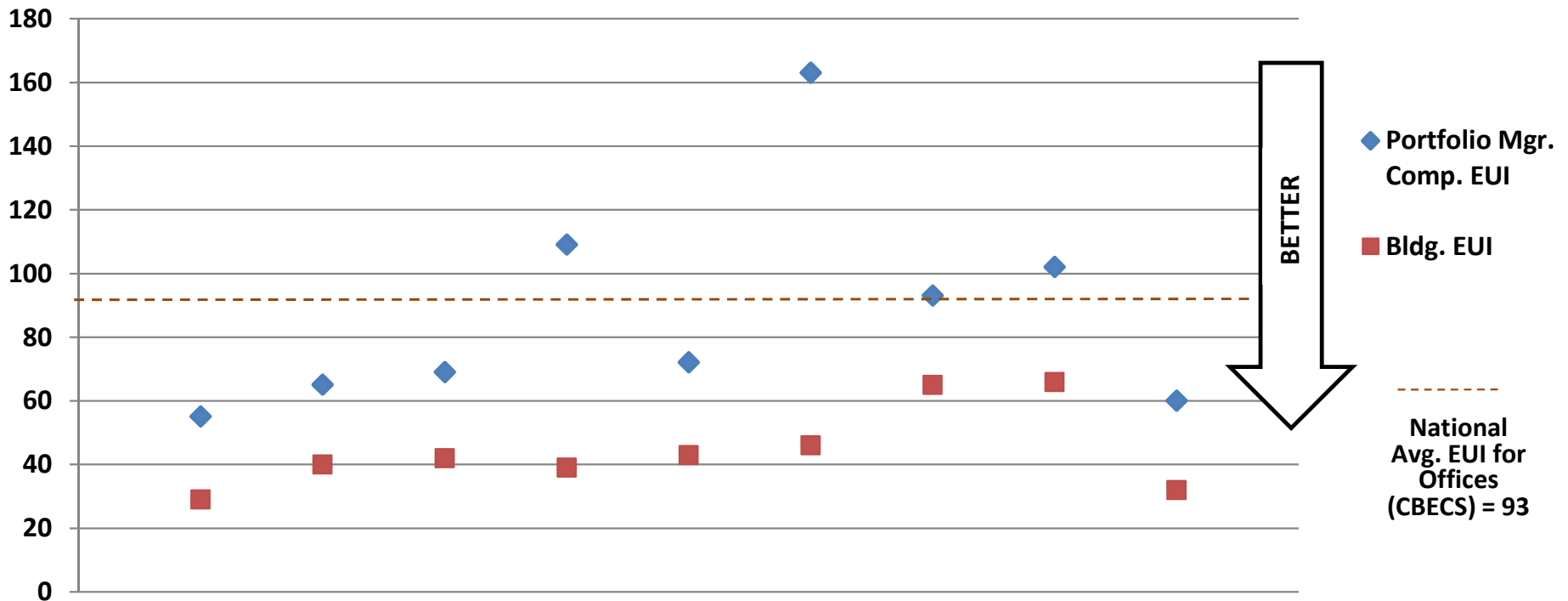


* Comparable office average energy use from the Energy Star Portfolio Manager program based on like type, size, occupancy, hours, and climate - determined from statistical analysis of the CBECS dataset

** Average energy use for all U.S. Office buildings through the Commercial Building Energy Consumption Survey (CBECS)

EUI comparison ($n=9$)

Measured EUI and Porfolio Mgr. Comparative EUI



Market Case

- **Increased occupancy:** owners cited an increase in occupancy despite the economic downturn
- **Ratings & labels:** recognition are valuable motivators.
- **EnergyStar scores:** becoming a more visible metric required during real estate transactions and, in some cases, tenant lease negotiations



Credit: Cushman & Wakefield

What mattered?

- **Integrated design of multiple measures** is more critical than any given technology
- Creativity and **project champions** overcome barriers
- Tracking and acting-**monitoring** and **continuous** commissioning contributed to savings
- **Control strategies** to HVAC and lighting systems



The Beardmore Building | Priest River, ID – Overview

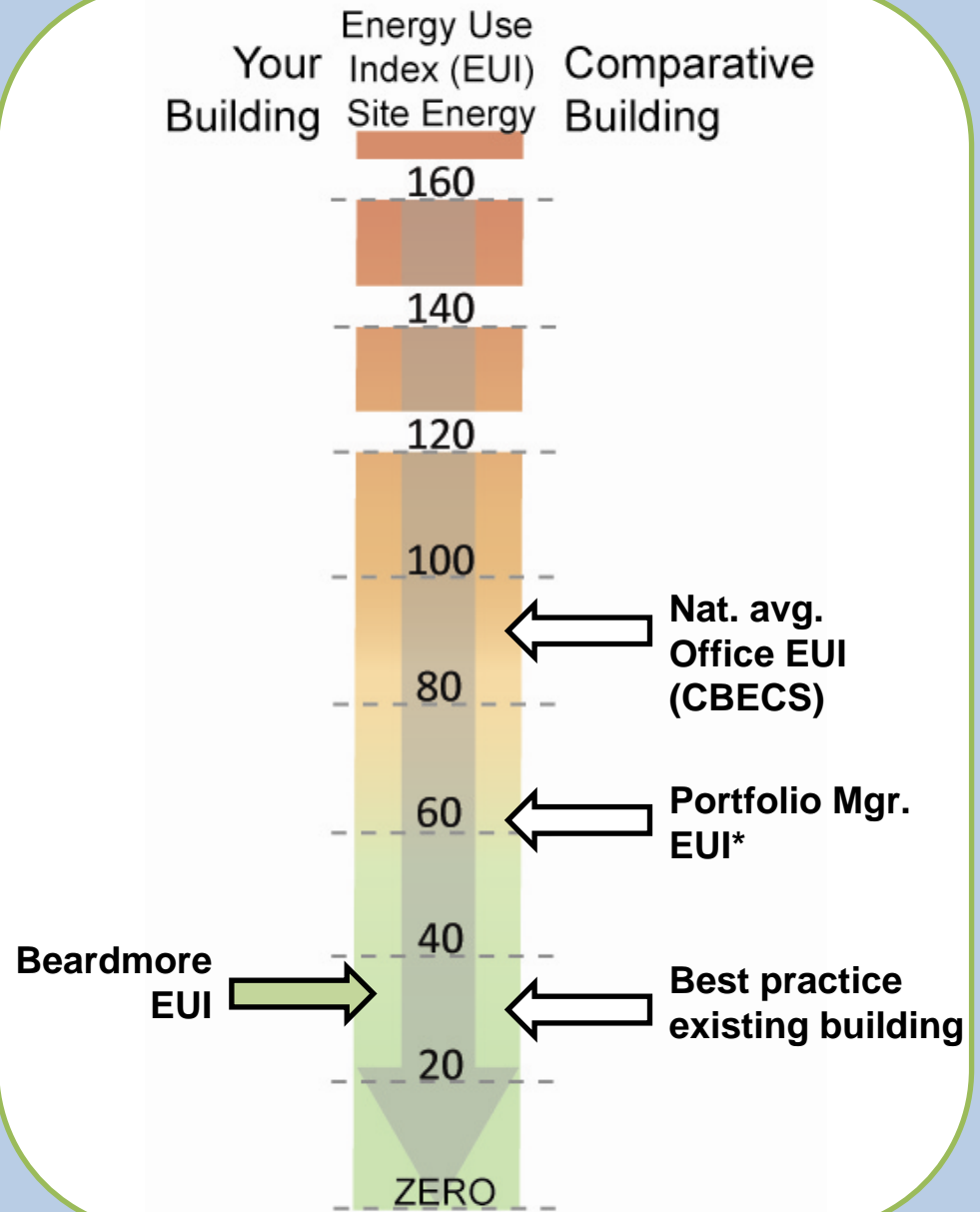
- Multi-Tenant Office
- 2-Story, 28,800 sf
- Constructed in 1922
- Retrofit 2006 – 2008
- EUI: 32 kBtu/sf/yr
- Energy Star Rating: 90
- LEED Gold and National Historic Registry



“sparked new economic life into the community, giving it a renewed sense of pride and entrepreneurial spirit.” **Brian Runberg, Owner**

Efficiency Measures

- High-efficiency HVAC package units with economizer controls
- DCV with CO₂ sensors
- Increased insulation
- Improved roofing materials with high solar reflectance
- Low - e glazing
- Lighting exceeds utility advanced lighting requirements
- Lighting night set-back and occupancy sensors
- Commissioning



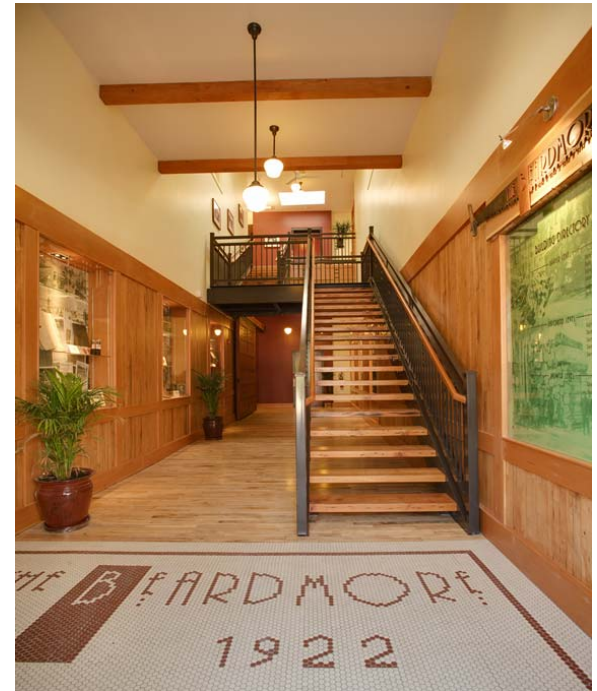
Case Study

*Energy Star **Portfolio Manager** calculates an EUI for a building based on like building types, climate, size, occupancy and loads

The Beardmore Building | Priest River, ID – Business

- Complete rebuild \$105/sf*
- ~ \$25,000 yr. energy savings
- Applied cost/benefit analysis to energy measures
- Rents average ~ 35% higher than other local properties.

**after tax credits and incentives*



“The initial investment has proven itself to be financially prudent, with substantially lower operation costs, greater lasting quality, and a healthy environment for its users. Equally important is the preservation of an important historic landmark...” **Brian Runberg, Owner**

Commonalities

Market Awareness

- Owners
- Leaders
- High Profile
- Trends
- Policies
- Future Proofing

Mission Driven

- Green Firms
- Non-Profits
- Corporate Leaders
- Passion
- Fun
- Visionary

Money Matters

- Assess the full Value
- Leverage incentives & tax credits
- Trade offs possible
- Go bigger, lose less
- Internal Capital

Integrate Technologies

- Controls
- Daylighting
- Reduce loads, then upgrade HVAC
- Monitoring
- Plug Loads
- Document

- Ongoing Learning
- Share Stories (Self Promote)

Three (+1) Lessons

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 3. Stories matter - it's human nature to compare – Case Studies are a tool
- Small/medium bldgs. need more help

Questions

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Reports and Case Studies:
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