Welcome!

Redefining the Rules:

A Deep Energy Retrofit Presentation

for

Architects and Facility Managers

THU., November 5, 2015 1:00 - 2:15 PM EDT

Earn 1.25 HSW LUs

Moderator

Casey Martin, AIA, CEM, LEEP AP

- AIA CAFM Advisory Group
- Program Manager at Stanford Health Care
- Jacobs Strategic Advisory Services group

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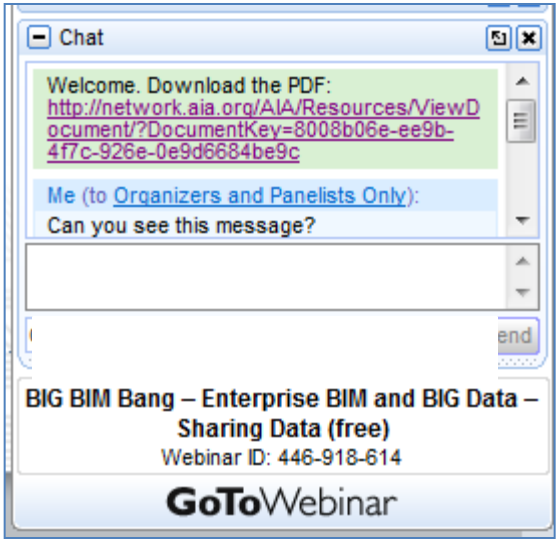
Questions?

Submit a question to the moderator via the chat box.

Content-related questions will be answered during the Q&A portion as time allows.

Tech support questions will be answered by AIA staff promptly.



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- **in the Chat box** at the conclusion of the live presentation;
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Featured Presenter

Tate Walker, AIA, LEED AP BD+C

- Director of Sustainability at OPN Architects
- AIA Wisconsin - Treasurer 2016
- Technical Team Leader on USDOE's Commercial Building Partnership Program
- USGBC Energy and Atmosphere Technical Advisory Group 2009-2013

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Course Description

This session will explain how architects & facility managers can use the deep energy retrofit approach to broaden their portfolio to include retrofit projects on a wide scale of building types and sizes.

To complete deep energy retrofit projects successfully, new skills are required such as energy modeling, life cycle cost assessment, commissioning, and measurement and verification.

Additionally, this session will explain the market forces and government regulations that are driving the energy retrofit market and familiarize the audience with financial tools and incentives available to help make the deep energy retrofit market a reality.

Learning Objectives

1. Learn how to identify “retrofit triggers” and how to time energy upgrades to reach deep energy savings economically.
2. Understand financial tools, from incentive programs to tax credits, that can be used to lessen the financial burden of deep energy retrofits.
3. Implement an Integrated Delivery Process to bring key consulting team members to the table earlier in the design process.
4. Understand and evaluate plans to measure and verify performance after occupancy.

And now for our presentation:

Redefining the Rules:

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for

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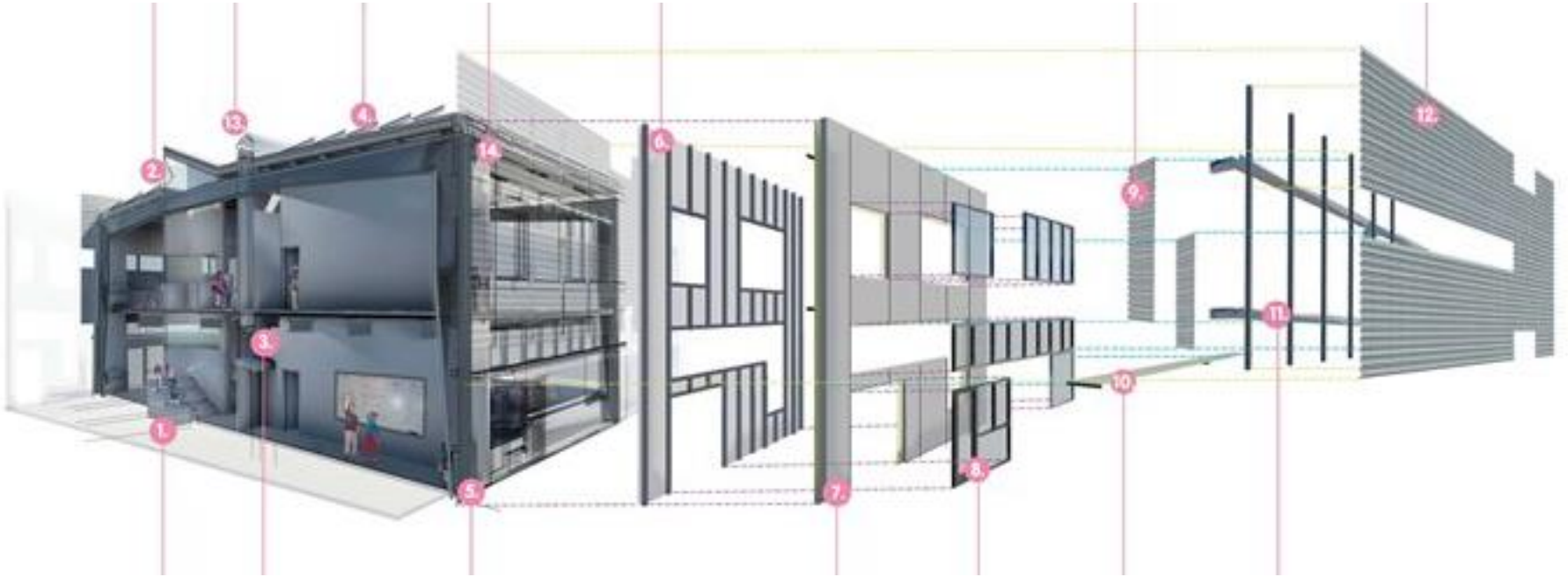
What is a Deep Energy Retrofit?

The design-based, comprehensive approach to evaluating and improving whole building performance.



Role of the architect

- Architects are well-practiced in ***translating the owner's project goals*** into programming and design
- Architects have experience ***expressing technical ideas*** to the owner
- Although deep energy retrofits require a collaborative project team, there must still be a strong and ***knowledgeable project leader***
- Architects have experience ***coordinating an array*** of professionals to ensure the work meets overall project design and performance goals
- Architects that include construction administrative services in their practice are will positioned to ***oversee the implementation*** of system upgrades/replacement necessary to achieve performance goals.

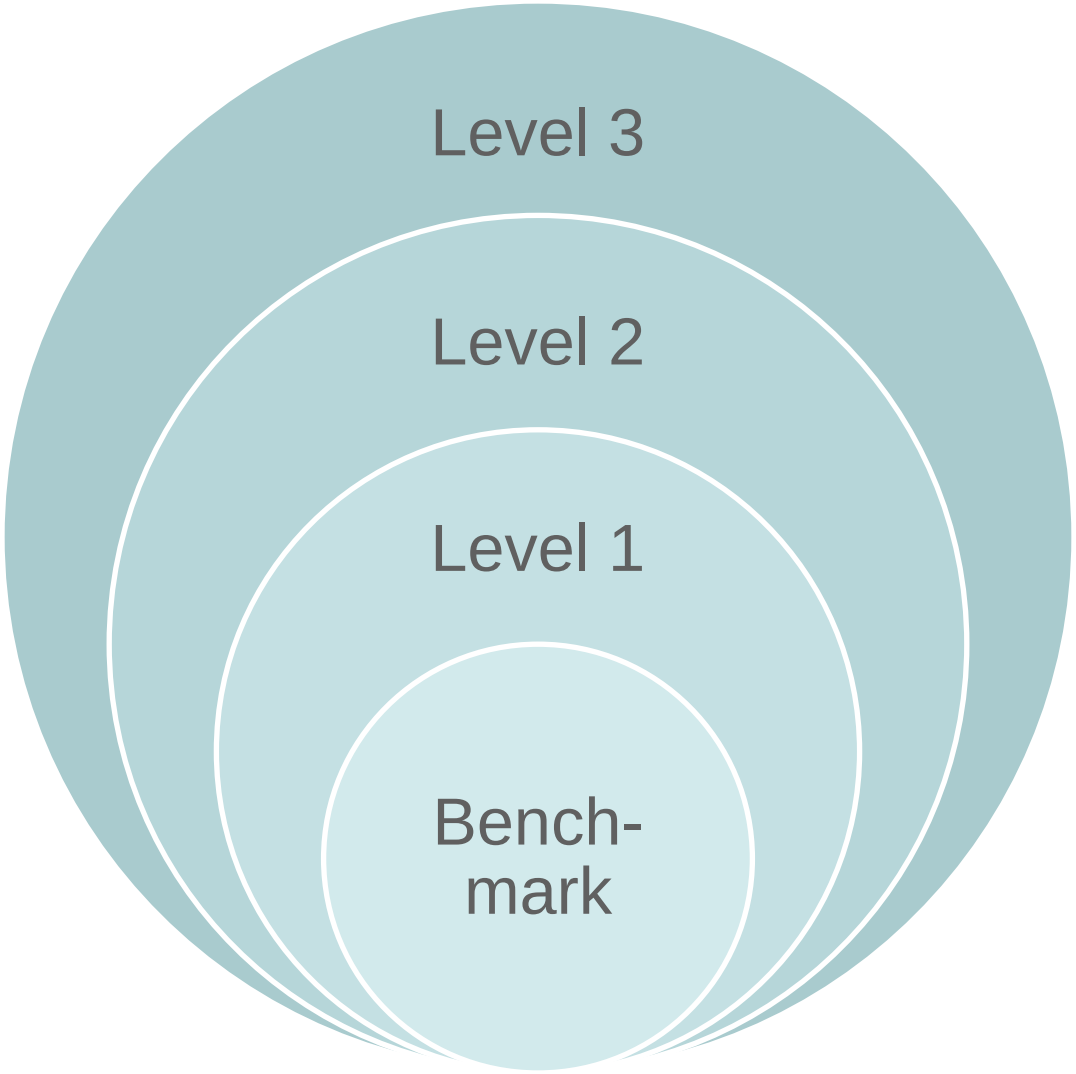
TECHNICAL

FINANCIAL

IMPLEMENTATION


TECHNICAL

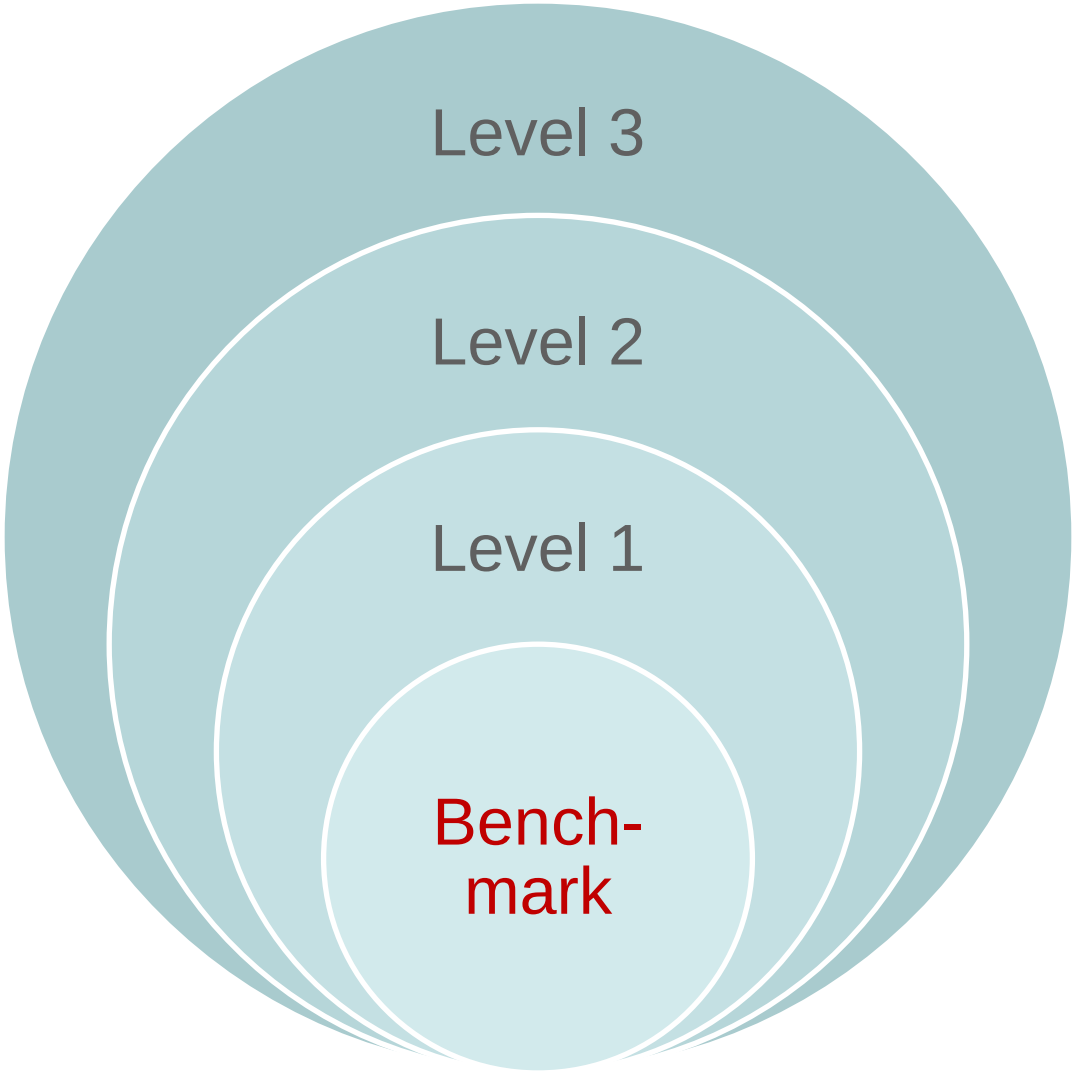
Energy Audit - Plan for Efficiency



Increasing Detail

Based on ASHRAE *Procedures for Commercial Energy Audits*, 2 Edition

Energy Audit – Benchmark



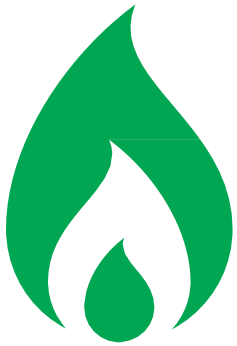
- Energy Use Intensity (EUI) kBtu/sf-yr
- Energy Cost Index (ECI)
- Compare to peer facilities
  - CBECS
  - DOE Buildings Databook
  - Other facilities in your portfolio

Based on ASHRAE *Procedures for Commercial Energy Audits*, 2 Edition

SITE EUI =

ANNUAL ELECTRIC KBtu

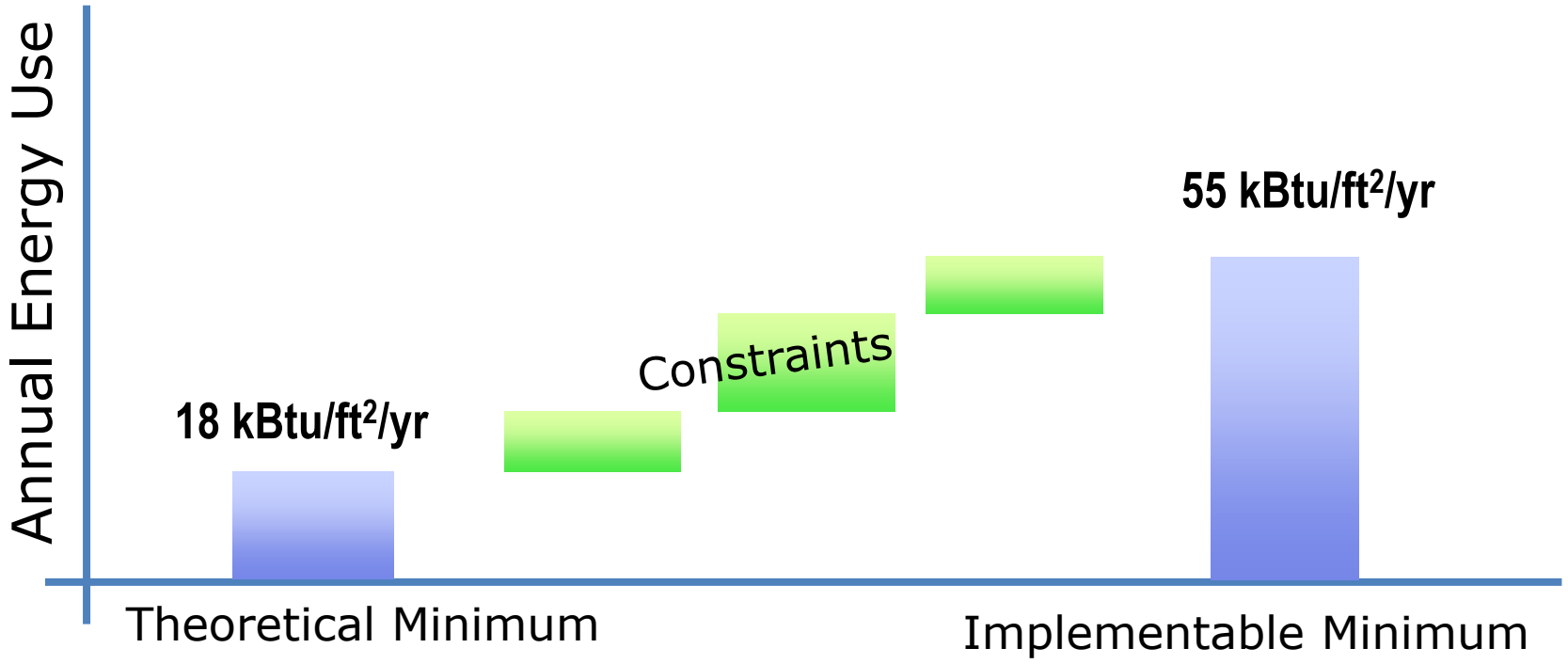
+



ANNUAL KBtu

BUILDING SQUARE FOOTAGE

Set Goals First



Start with the theoretical minimum energy use

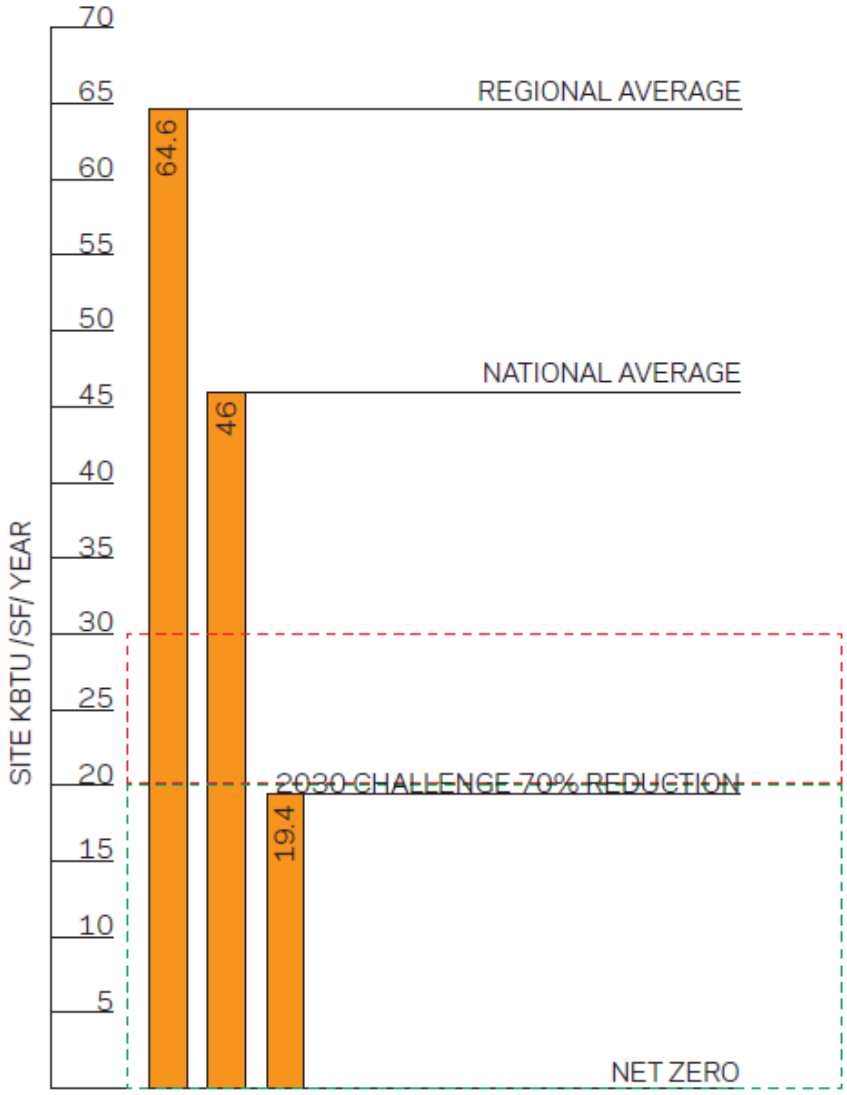
Then

Consider project budget, constructability concerns, and other project requirements

Then

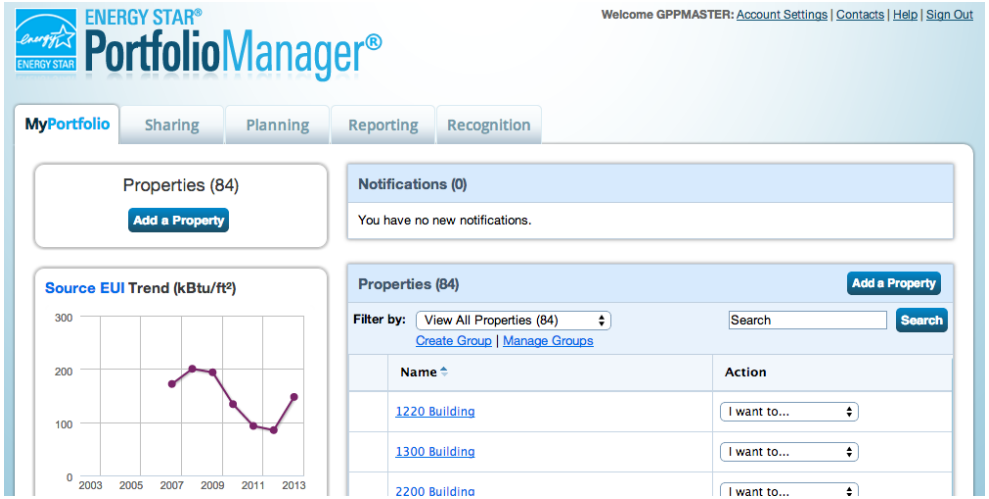
Deliver a project with the best energy performance under the given constraints

RELIGIOUS WORSHIP ENERGY USE INTENSITY
SITE KBTU / SF / YEAR

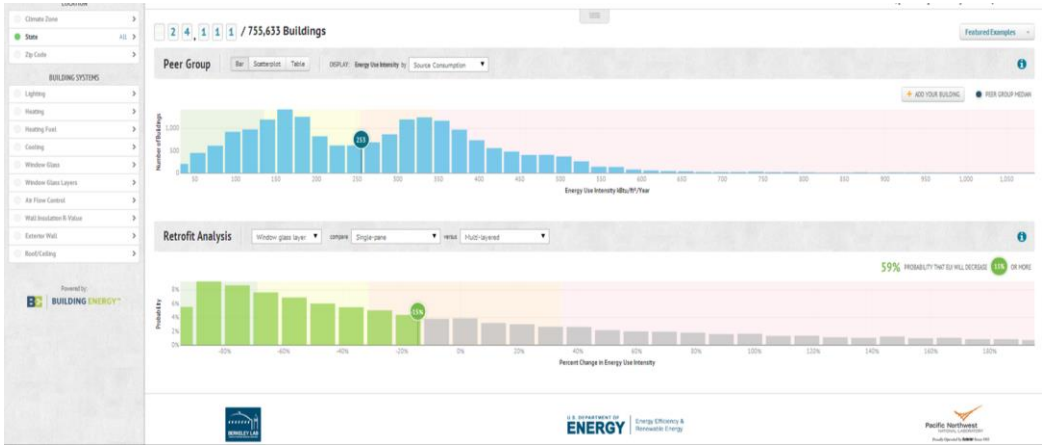


BENCHMARKING

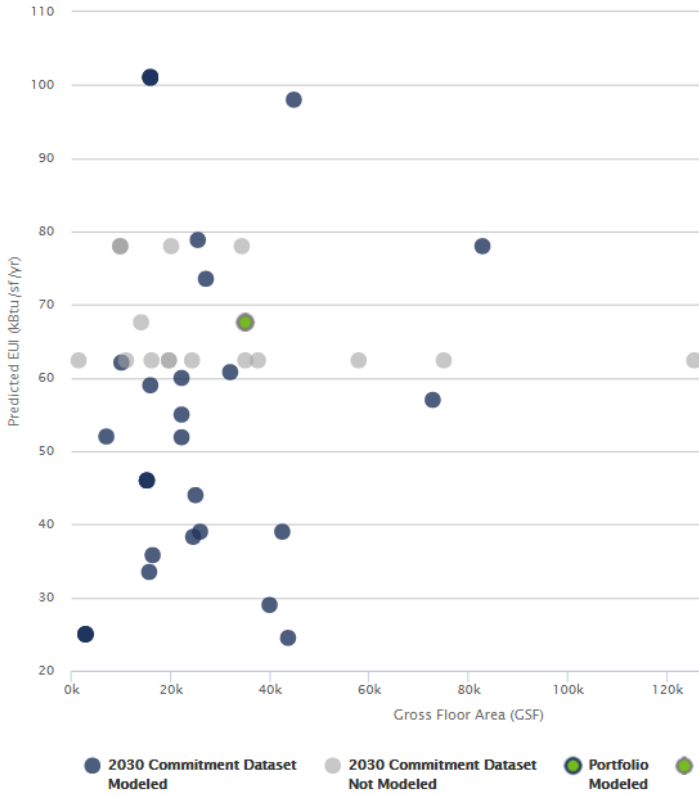
Energy Star Portfolio Manager



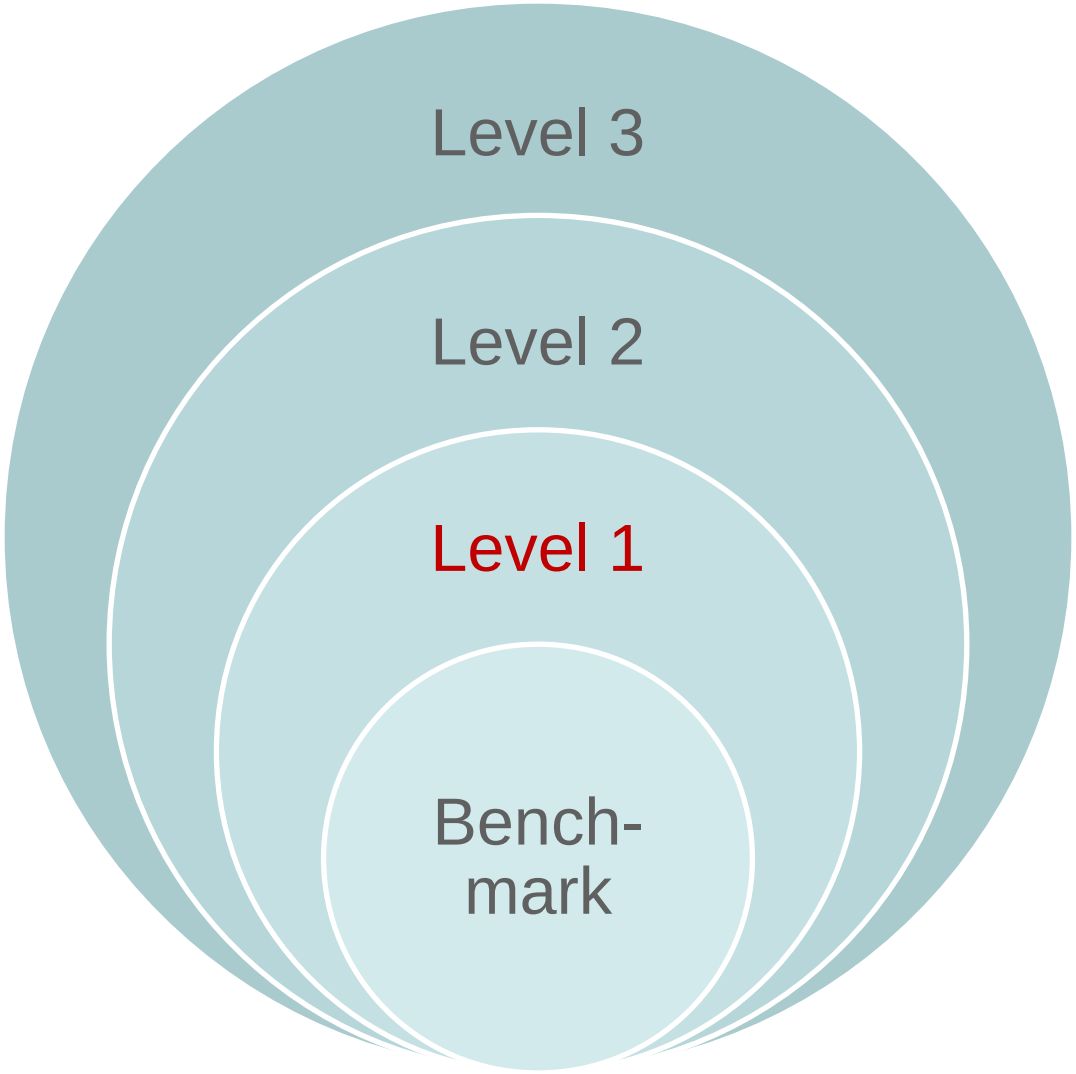
Building Performance Database



AIA DDx (Design Data Exchange)



Energy Audit – Level 1



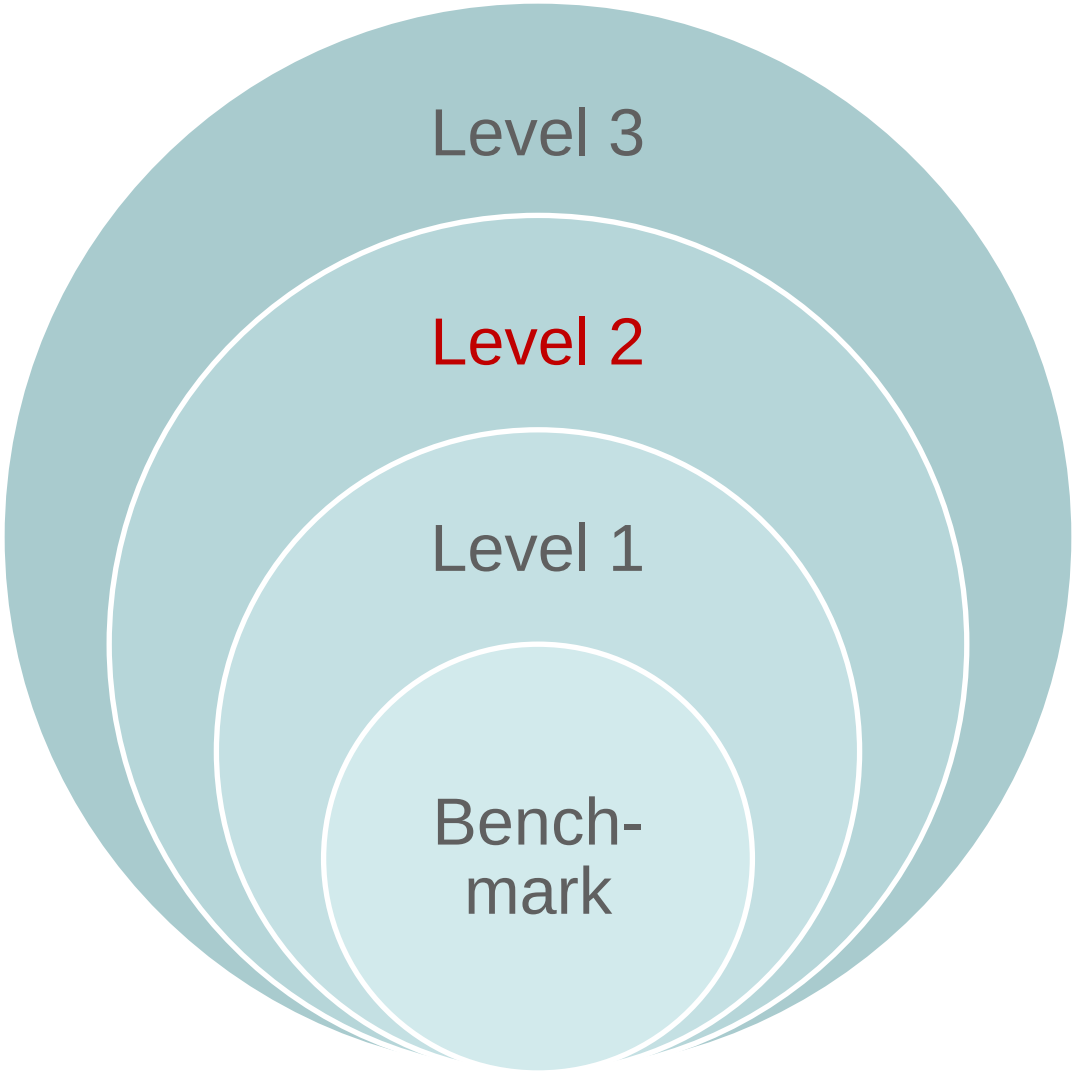
- Brief Walkthrough
- Identify O+M (low/no cost) EEMs
- Identify capital EEMs
- Approximate cost and energy savings potential
- Establish Goals and Targets

Based on ASHRAE *Procedures for Commercial Energy Audits*, 2 Edition

Common O+M Measures

- Schedule AHU for space
- Economizer OA control
- Duct static pressure reset
- Reduce VAV minimum position
- Supply air temperature reset
- Optimum start for AHU
- Condenser water temperature reset
- Demand control ventilation

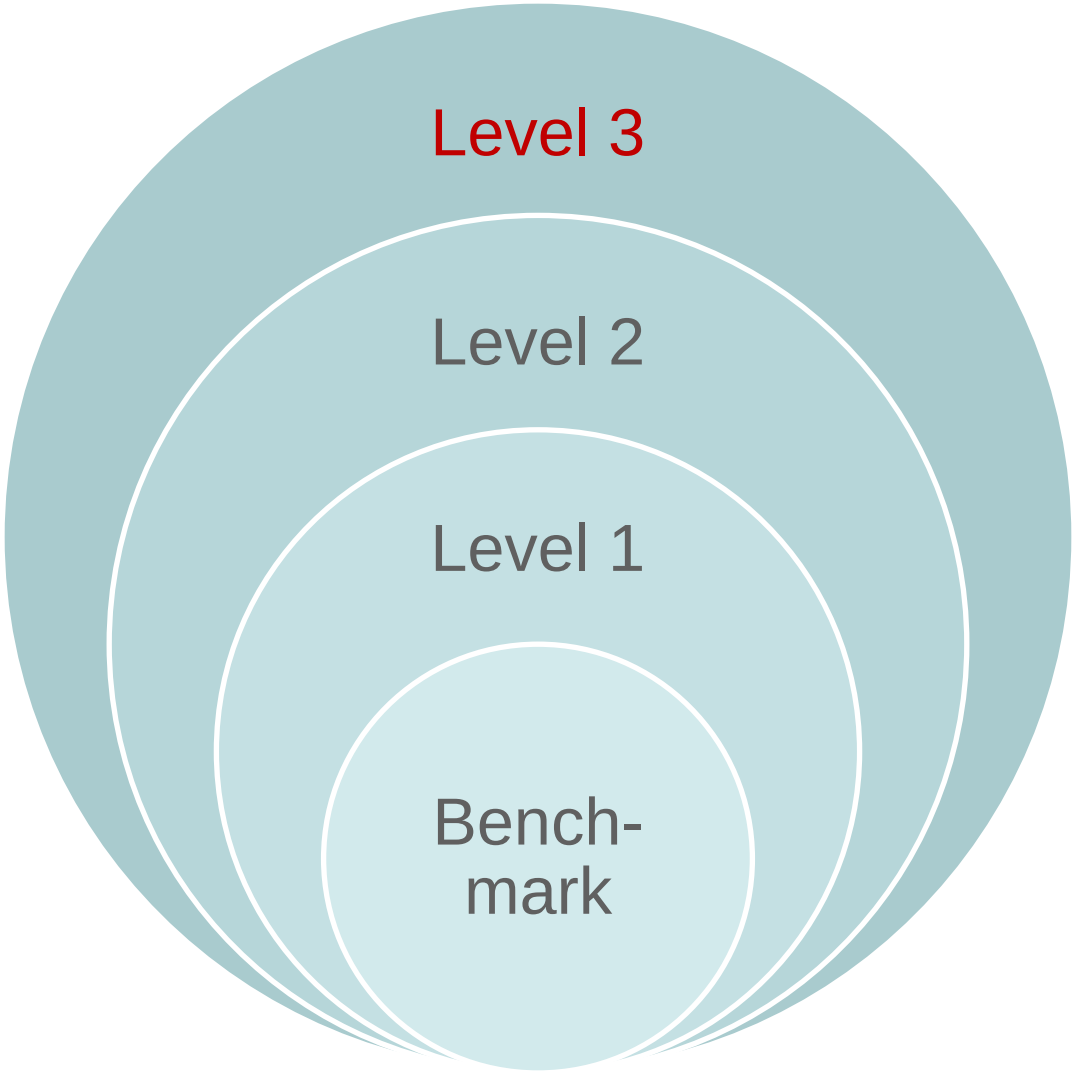
Energy Audit – Level 2



- In-depth walkthrough and user/operator interviews
- Develop end-use breakdown of systems
- Detailed analysis of O+M EEMs
- Detailed analysis costs/savings

Based on ASHRAE *Procedures for Commercial Energy Audits*, 2 Edition

Energy Audit – Level 3



- Most refined analysis
- Additional measurements
- O+M and Capital EEMs
- Detailed LCC/LCA
- Energy modeling (simulation)

Based on ASHRAE *Procedures for Commercial Energy Audits*, 2 Edition

Electricity Savings	43%
Natural Gas Savings	29%
Annual Energy Savings	$41,745

	Energy Efficiency Measures (see page 3 for detailed descriptions)	Energy Savings	
		$/yr	%
1	Install a new condensing HW boiler and controls	$11,006	9.8%
2	Control OA dampers on AHUs to close at night[1]	$3,305	3.0%
3	Install DDC system on AHUs	$6,897	6.2%
4	Control exhaust fans (not pool) off at night	$1,356	1.2%
5	Control DHW pump using an aquastat	$26	0.0%
6	Install VFDs on all pumps (HW & CHW loops; pool)	$1,761	1.6%
7	Replace cooling tower with new HE tower w/VFD	$148	0.1%
8	Replace T12s, high watt T8s, and pool MHs	$9,802	8.8%
9	Replace all incandescent light bulbs (incl. exit signs)	$3,923	3.5%
10	Install occupancy sensors in all enclosed spaces	$1,089	1.0%
11	Install R30 of roof insul. on underside of tower roof	$1,567	1.4%
12	Replace showerheads with low flow (<= 1.5 gpm)	$711	0.6%
13	Add sensors to boiler on residential space	$157	0.1%
	Totals (1-13)	**$41,745**	**37.3%**

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START ENERGY ANALYSIS EARLY!

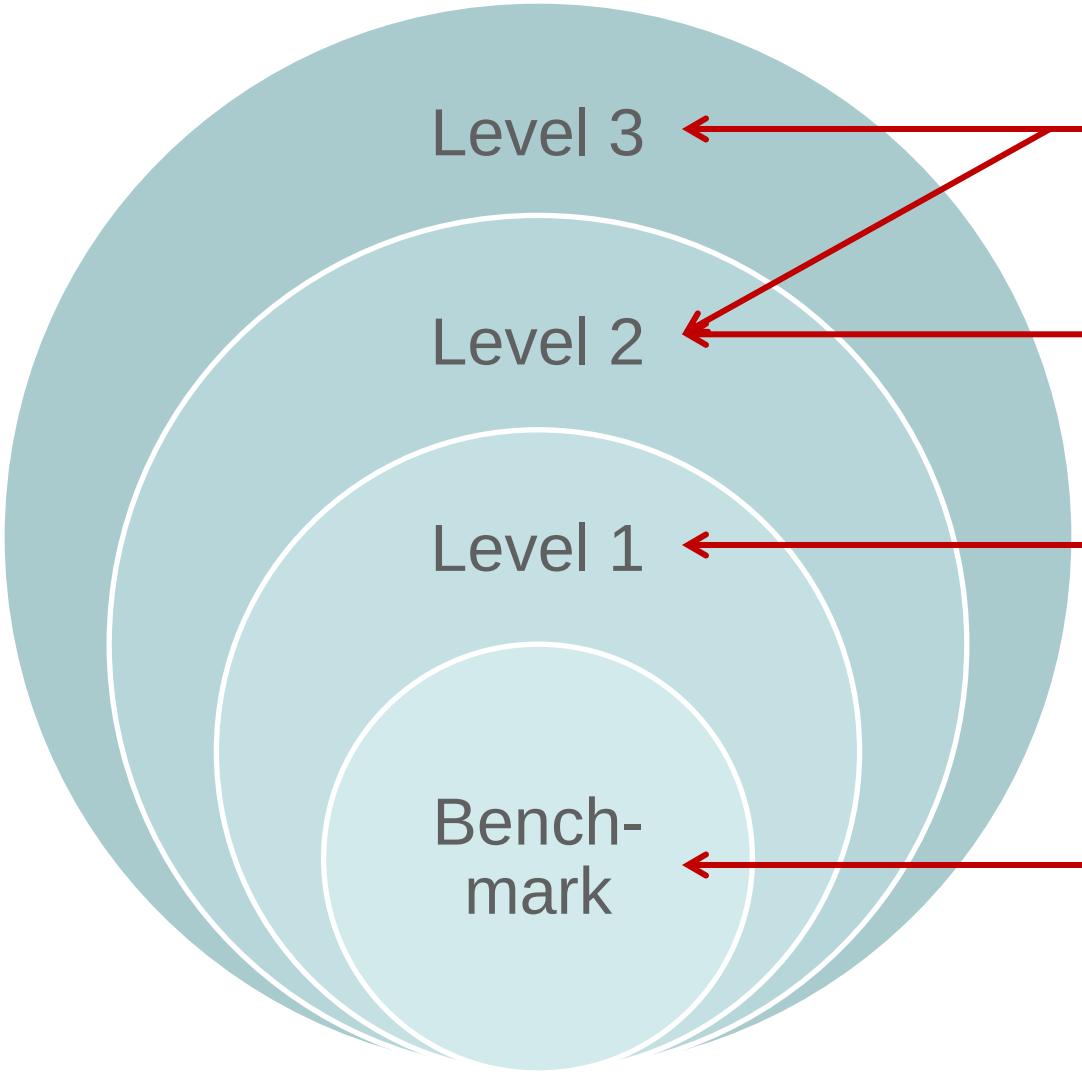
- RS Means
- “Shoebox” energy model

- Cost estimate
- DD energy model

- GC cost estimate
- CD energy model

Greater data accuracy

Energy Audit – Level of Effort



Investment grade

LEED v4 O+M EA Cx
Analysis option 2

LEED v4 O+M EA Prerequisite
Minimum Energy Performance

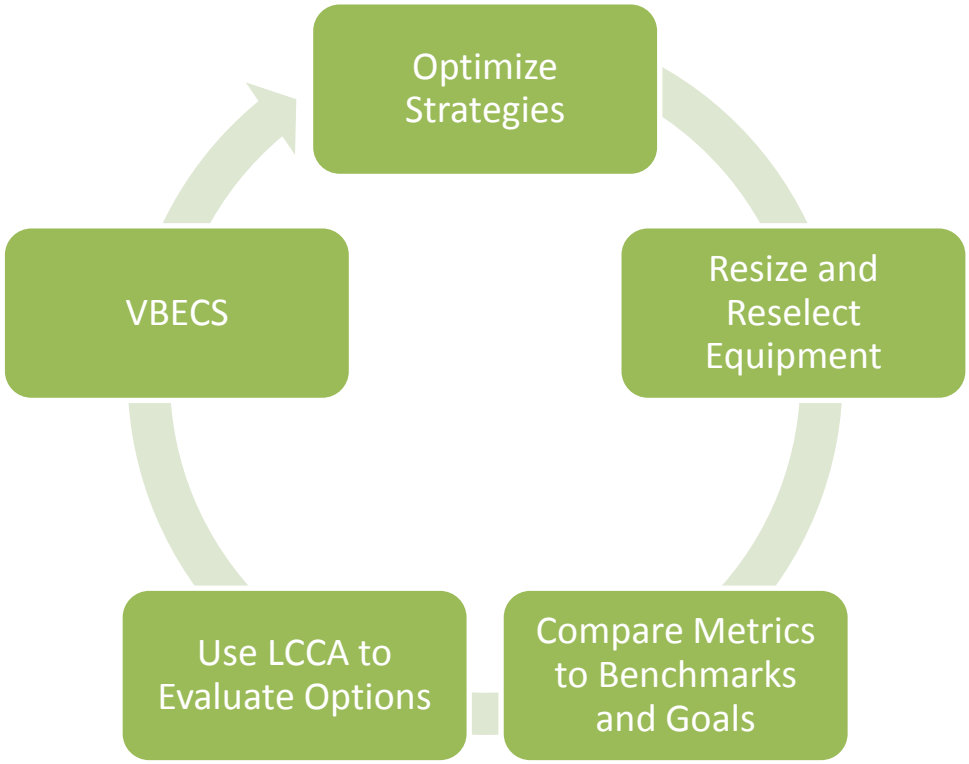
Energy Star Portfolio Manager

Based on ASHRAE *Procedures for Commercial Energy Audits*, 2 Edition

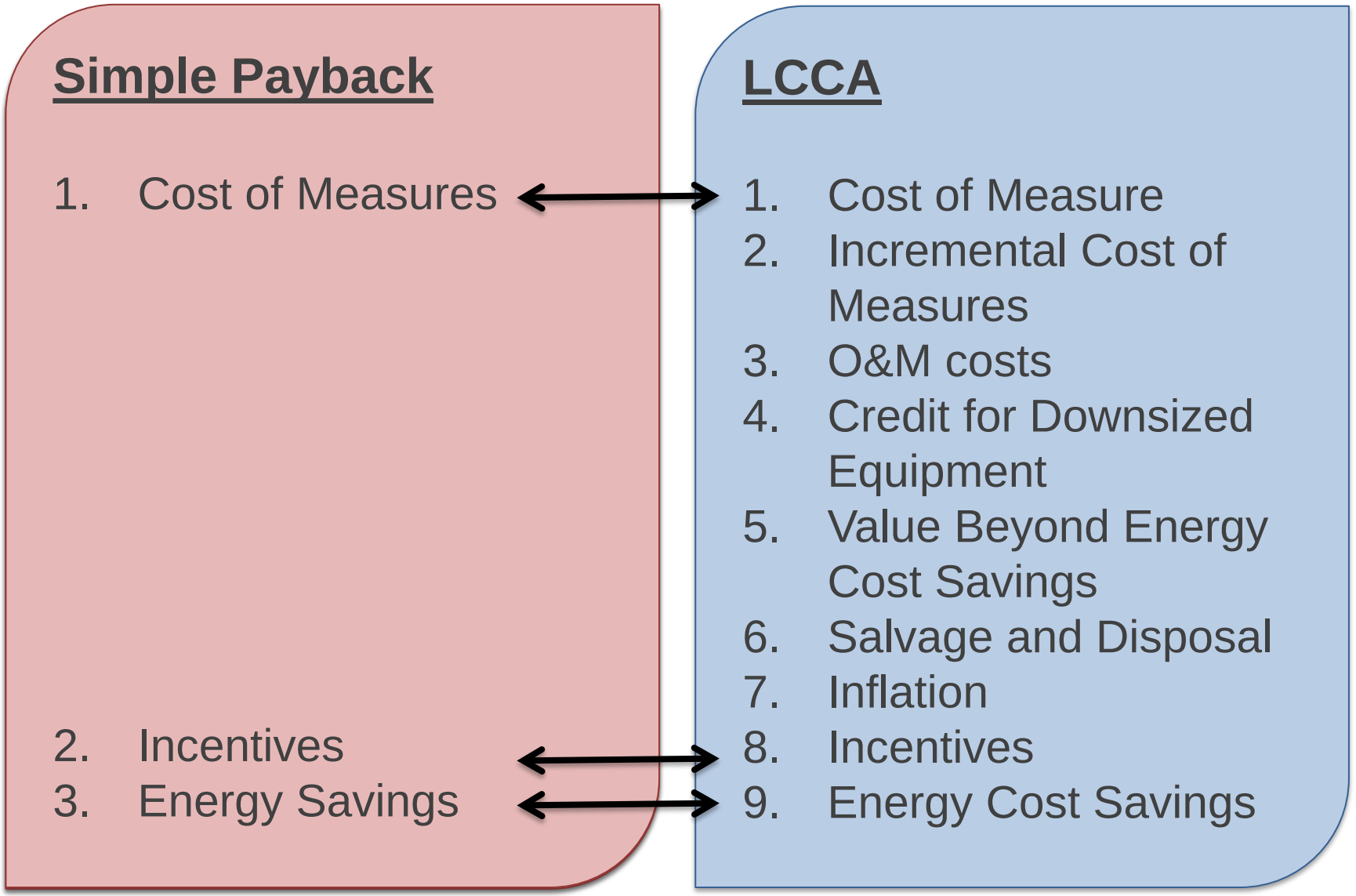

FINANCIAL

LIFE CYCLE ANALYSIS

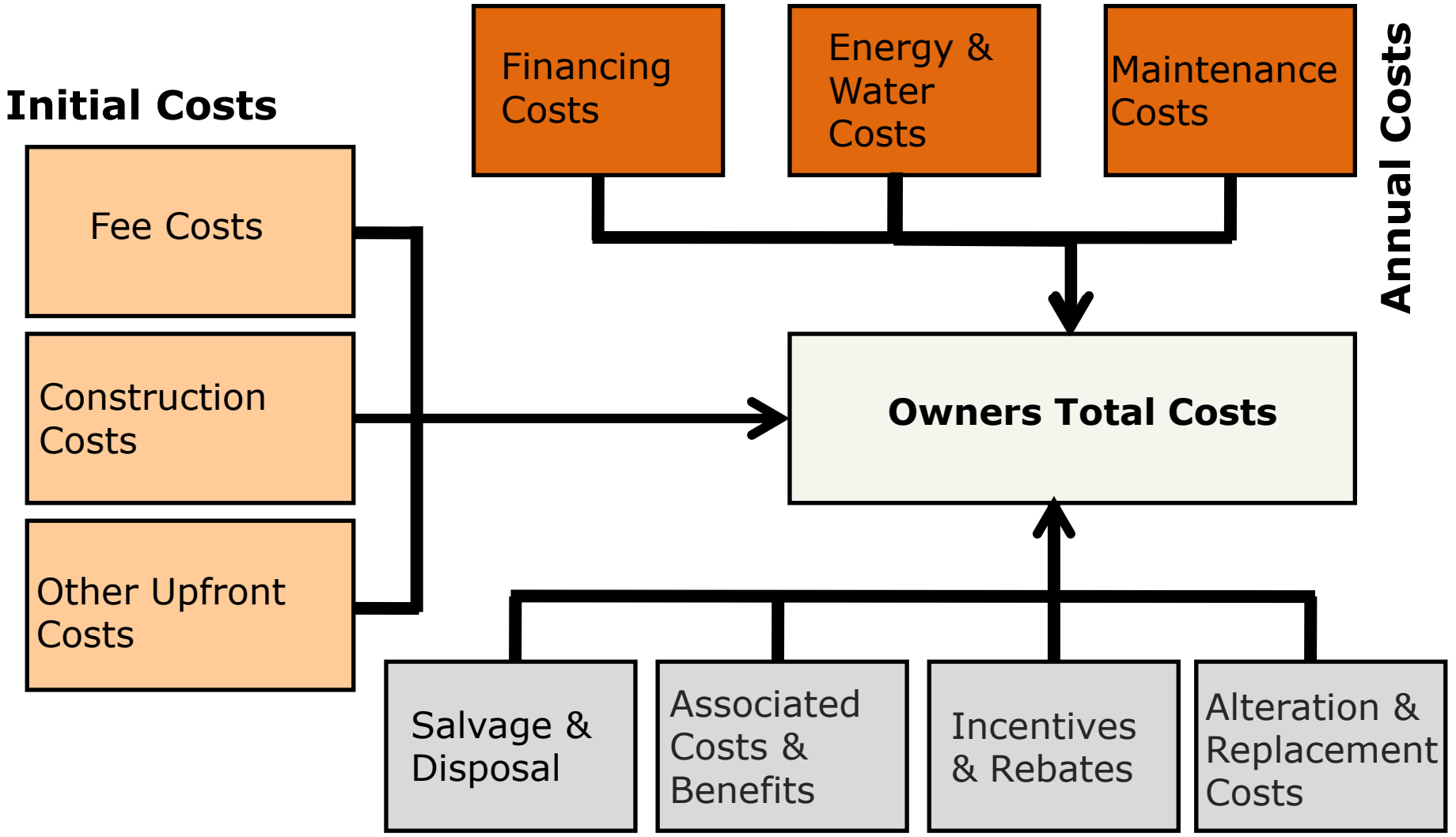
- LCCA is in ***iterative process***
- LCCA is best done by a combination of the owner, architect engineer, cost estimators and financier
- One party needs to take ownership of the analysis



SIMPLE PAYBACK VS. LIFE CYCLE



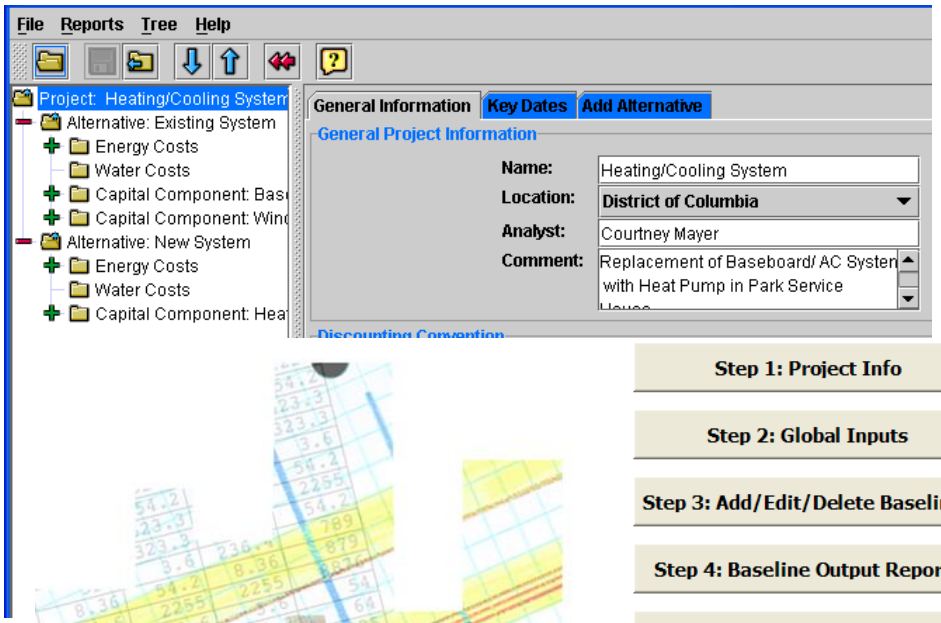
COMPONENTS OF AN LCCA

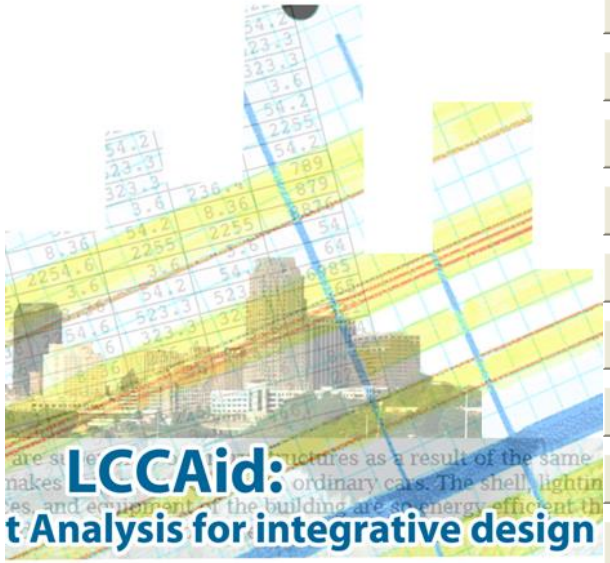


Adapted from Kirk and Dell'isola *Life Cycle Costing for Design Professionals (1995)*

LCCA TOOLS

DOE: Life Cycle Cost Analysis for Sustainable Buildings - (BLCC 5.3-14)





Step 1: Project Info

Step 2: Global Inputs

Step 3: Add/Edit/Delete Baselines

Step 4: Baseline Output Reports

Step 5: Add/Edit/Delete Measures

Step 6: Measure Output Reports

Step 7: Add/Edit/Delete Bundles

Step 8: Bundle Output Reports

Step 9: Sensitivity Analysis

igure 5.1 ENERGY LIFE CYCLE COST SPREADSHEET

ELCCA2005.xls 25-Mar-11

PROJECT DATA

ROJECT: Facility Name (Firm Name)
LT. No.: Description (Analyst's Name)

DISCOUNT & ESCALATION Real Rates as of November 2004

			Years:	Rate:
ter 1 or 0 for each fuel type:				
	1 = Yes	Real Discount Rate (i)	2005 - 2,040	2.0%
	0 = No	Electricity	2005 - 2,015	1.0%
DU Electricity Source*	1	(Investor Owned Utility)	2,016 - 2,025	2.0%
DU Electricity Source**	0		2,026 - 2,040	2.0%
atural Gas Fuel?	1	Natural Gas	2005 - 2,015	1.0%
opane Fuel?	0	And other fossil fuels	2,016 - 2,025	1.0%
l Fuel?	0		2,026 - 2,040	1.0%
		Maintenance	2005 - 2,040	2.0%
		Inflation (Nominal , not used)	2005 - 2,040	3.0%

IOU = Invester Owned Utility
POU = Publicly Owned Utility

$0 =30-year LCC

ANNUAL REAL CASH FLOWS

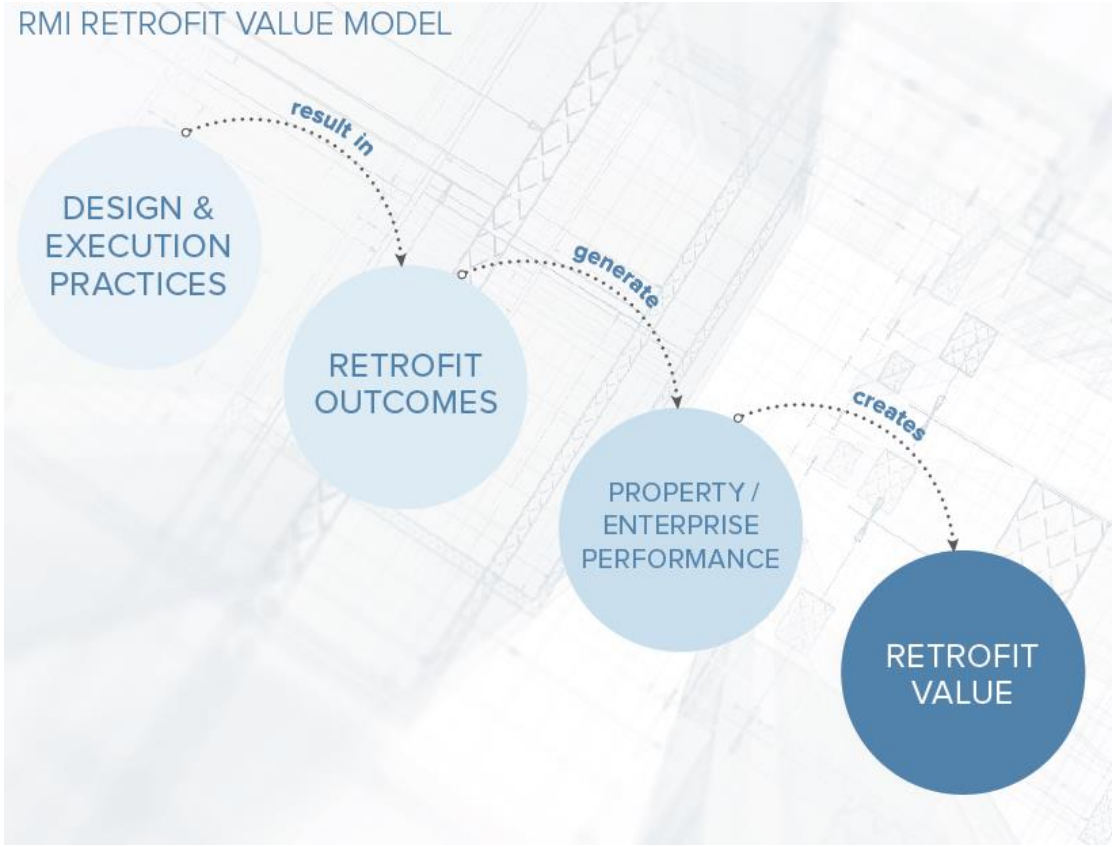
	(Begin) Year	First & Replace. Costs	Annual Maint. Costs	Annual Nat.Gas Costs	Annual Electric Costs	Total Annual Costs	Present Worth Factor	Present Worth of Annual Costs	Present Worth of Cumulative Costs
	2,006	$0	$0	$0	$0	$0	(1+i)^-n	Costs	Costs
	2,006	$0	--	--	--	$0	1.00	$0	$0
31	2,007	0	0	0	0	0	0.98	0	0
32	2,008	0	0	0	0	0	0.96	0	0

RETROFIT VALUE BEYOND ENERGY COST SAVINGS

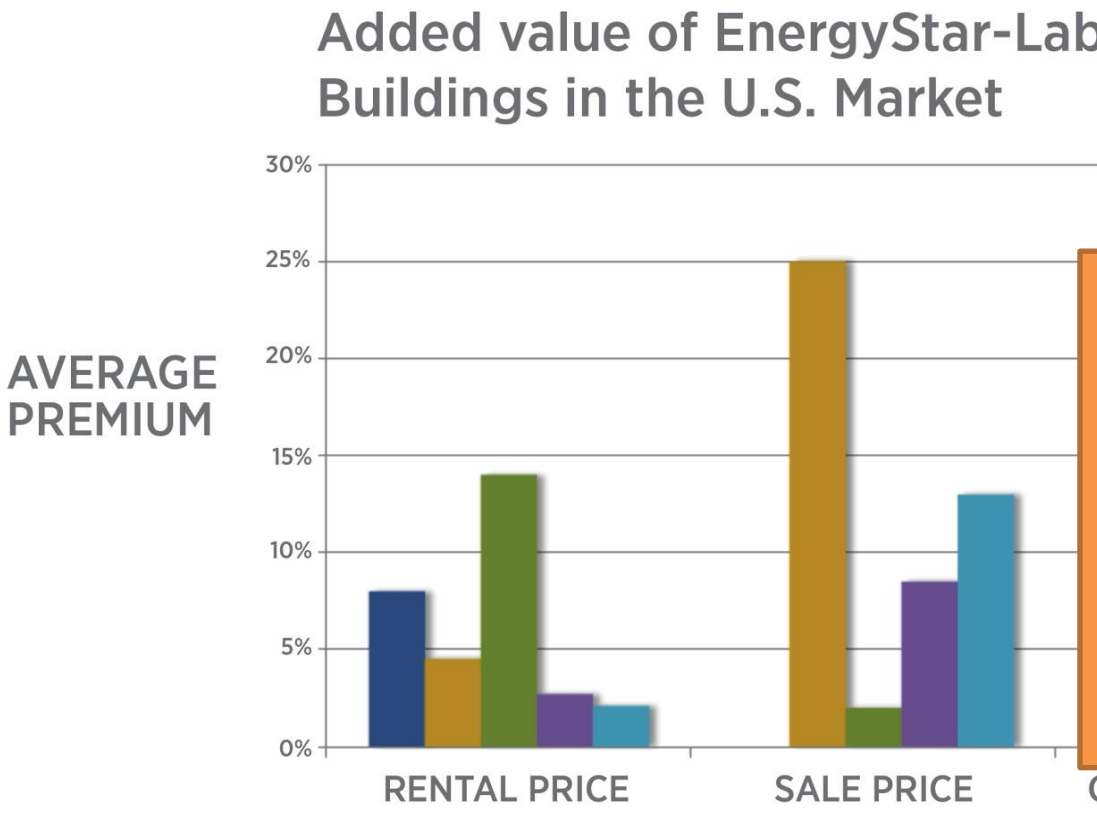
- Transition Energy Efficiency and Renewable Energy away from being talked about in simplistic terms like “payback”

- Simple payback example:
  - $1,000,000 total project cost
  - $250,000 annual savings
  - No utility rebate included
  - “Payback” of 4.0 years

- But… **<u>the value of energy efficiency extends far beyond cost savings.</u>**



ADDRESSING THE BENEFITS BEYOND ANNUAL SAVINGS



For LEED-certified buildings:

- ✓ Occupancy rates **4% higher**
- ✓ Lease Rates **7.4% higher**

*These studies only tracked two of the listed indicators.
All studies controlled for multiple factors, including building size and location.
For more information, please contact David Leipziger at david@imt.org.

IMT Institute for Market Transformation

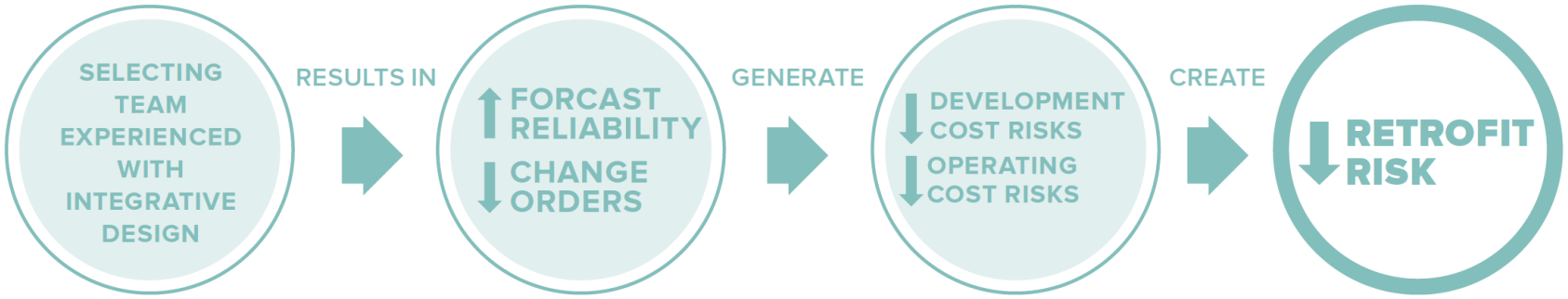
BuildingRating.org

STRENGTHEN THE CASE FOR DEEP RETROFITS

What **owner-occupants** likely value most:

- Improved Employee Productivity ↑ **1-10%**
- Greater Occupant Satisfaction ↑ **27-76%**
- Fewer Employee Sick Days ↓ ***0-40%***
- Lower Maintenance Costs ↓ ***9-14%***
- Greater Property Value ↑ **11-26%**

RETROFIT MANAGEMENT EXAMPLE:

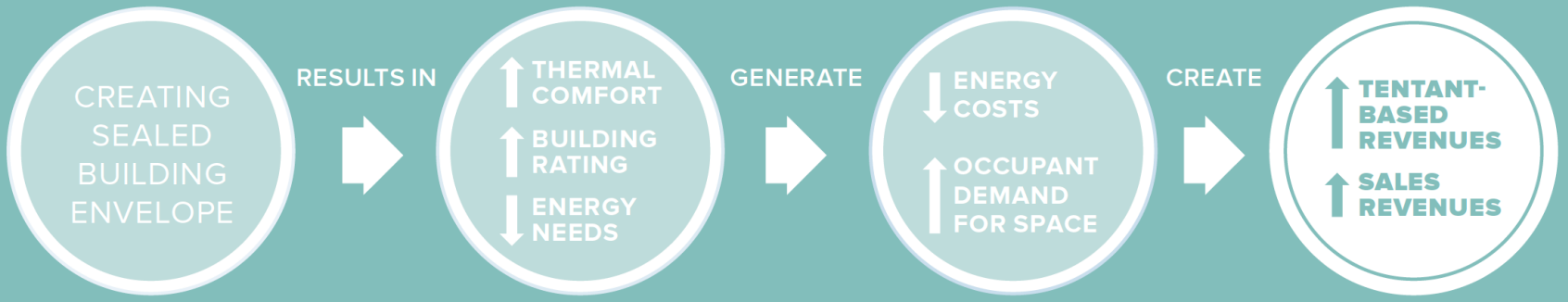


STRENGTHEN THE CASE FOR DEEP RETROFITS

What **building investors** likely value most = NOI

- Lower Maintenance Costs ↓ ***9-14%***
- Improved Occupancy Rates ↑ **3-18%**
- Greater Rental Rates ↑ **2-17%**
- Higher Property Value ↑ **11-26%**

DESIGN OPPORTUNITY EXAMPLE:



NET OPERATING INCOME

Potential Rental Income
-Vacancy Losses

Effective Rental Income
+ Other Income (parking etc.)

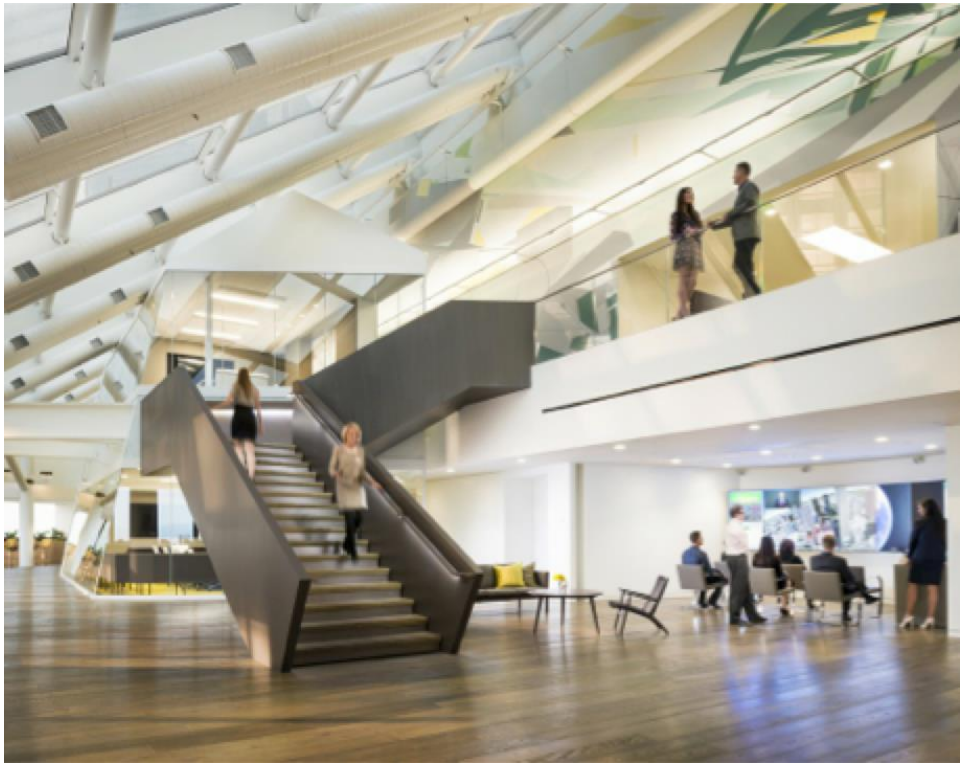
Gross Operating Income
- Operating Expenses (repairs and maintenance, utilities, taxes, insurance, management fees etc)

= Net Operating Income

CATEGORIZING VALUE BEYOND ENERGY

Value Elements:

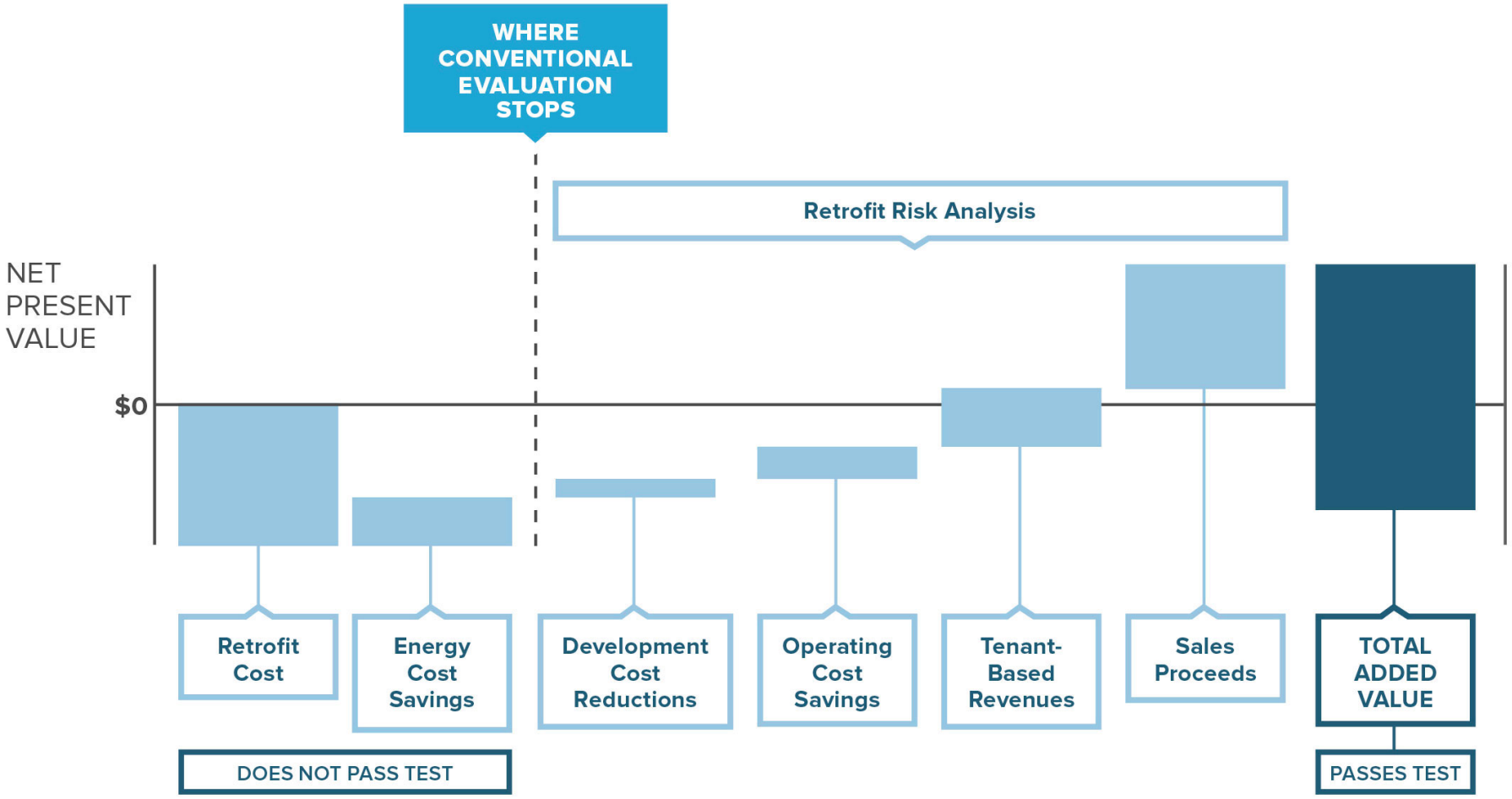
1. Retrofit Capital Costs
2. Non-Energy Operating Costs
3. Risk Mitigation
4. Health Costs
5. Employee Costs
6. Tenant Revenue
7. Sales Revenue



Source: Adopted from How To Calculate and Present Deep Retrofit Value for Owner-Occupants, Rocky Mountain Institute, January 2014 and How To Calculate and Present Deep Retrofit Value: A Guide for Investors, Rocky Mountain Institute, April 2015

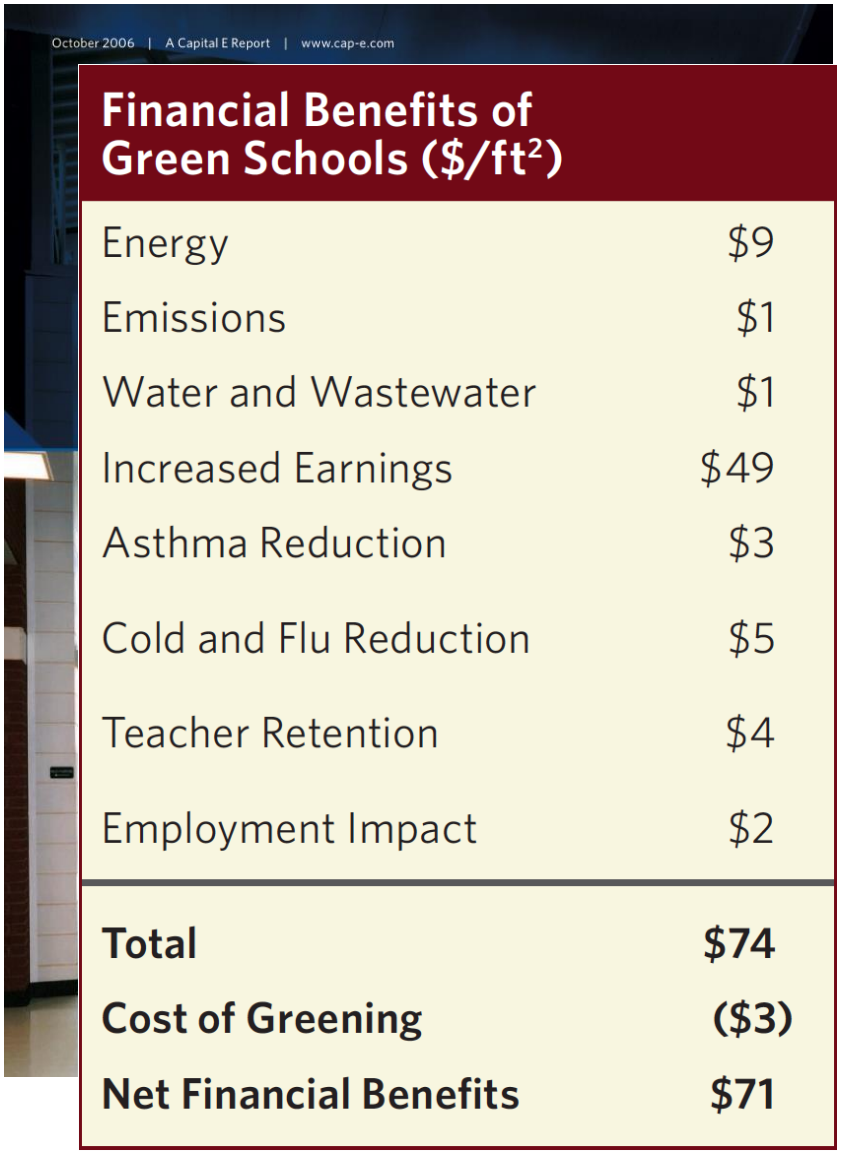
Photo of CBRE's new HQ in in Los Angeles, a retrofitted building; Source: ArchDaily

INCLUDING ADDED VALUE IN EVALUATION



Source: How To Calculate and Present Deep Retrofit Value: A Guide for Investors, Rocky Mountain Institute, April 2015

HUMAN ASPECT OF RETROFITS THAT ‘GREEN’



Financial Benefits of Green Schools ($/ft²)

Energy	$9
Emissions	$1
Water and Wastewater	$1
Increased Earnings	$49
Asthma Reduction	$3
Cold and Flu Reduction	$5
Teacher Retention	$4
Employment Impact	$2
Total	**$74**
Cost of Greening	**($3)**
Net Financial Benefits	**$71**

TWO TYPES OF PROJECTS: CASH OR NO CASH

STRATEGIES

Available Capital

- ❑ Compare risk and value of efficiency to other investments
- ❑ Convince CFO to invest in efficiency

Lack of Available Capital

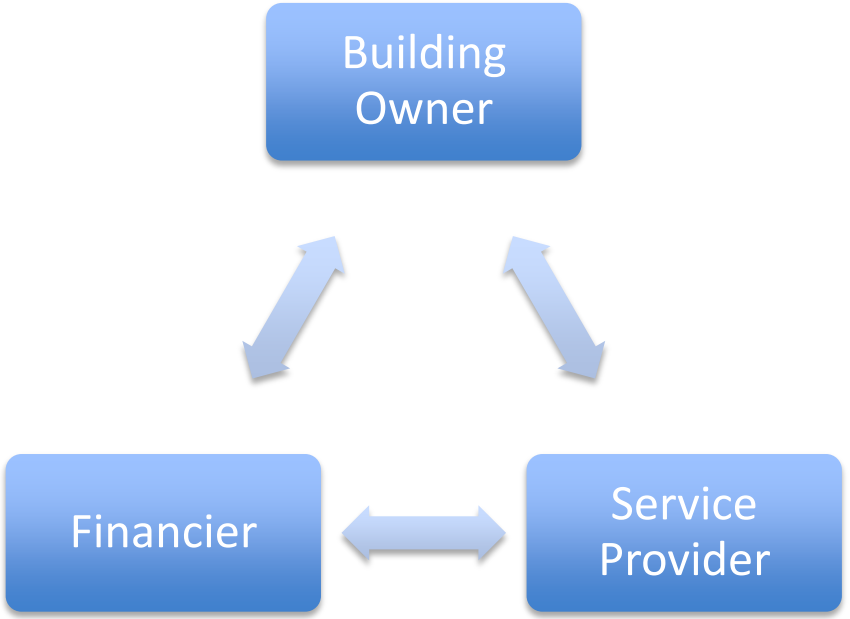
- ❑ Pursue various funding/financing options
- ❑ Consider incentives, public/private options, and foundation investments

WHAT WE KNOW TODAY

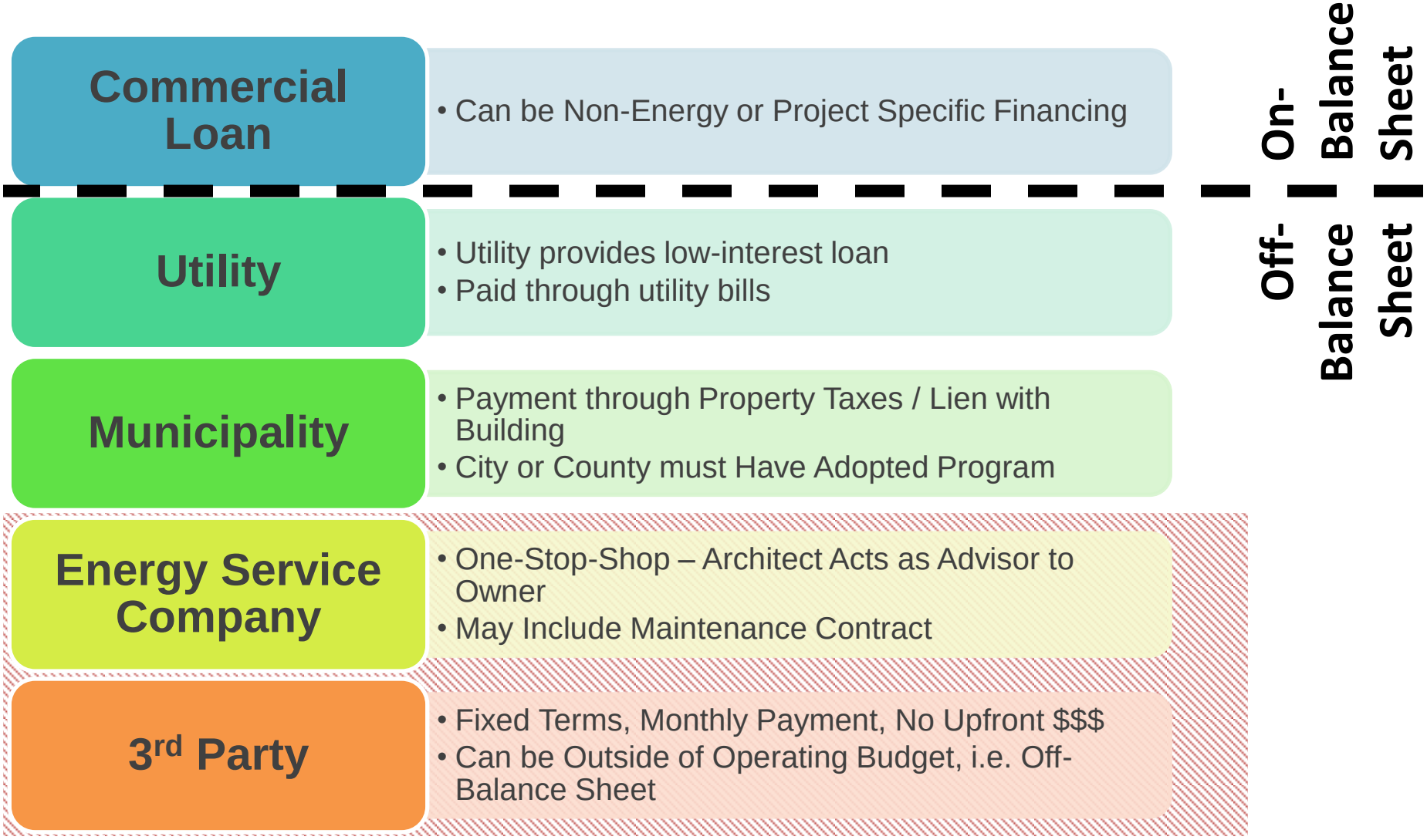
- Deep retrofits are feasible and can be cost-effective
- Deep retrofits are not cost-effective for every project
- New financing strategies are emerging

➢ **Retrofit financing has not been *figured out***

➢ U.S. Government, largest landlord & tenant, has taken the lead in financing retrofits



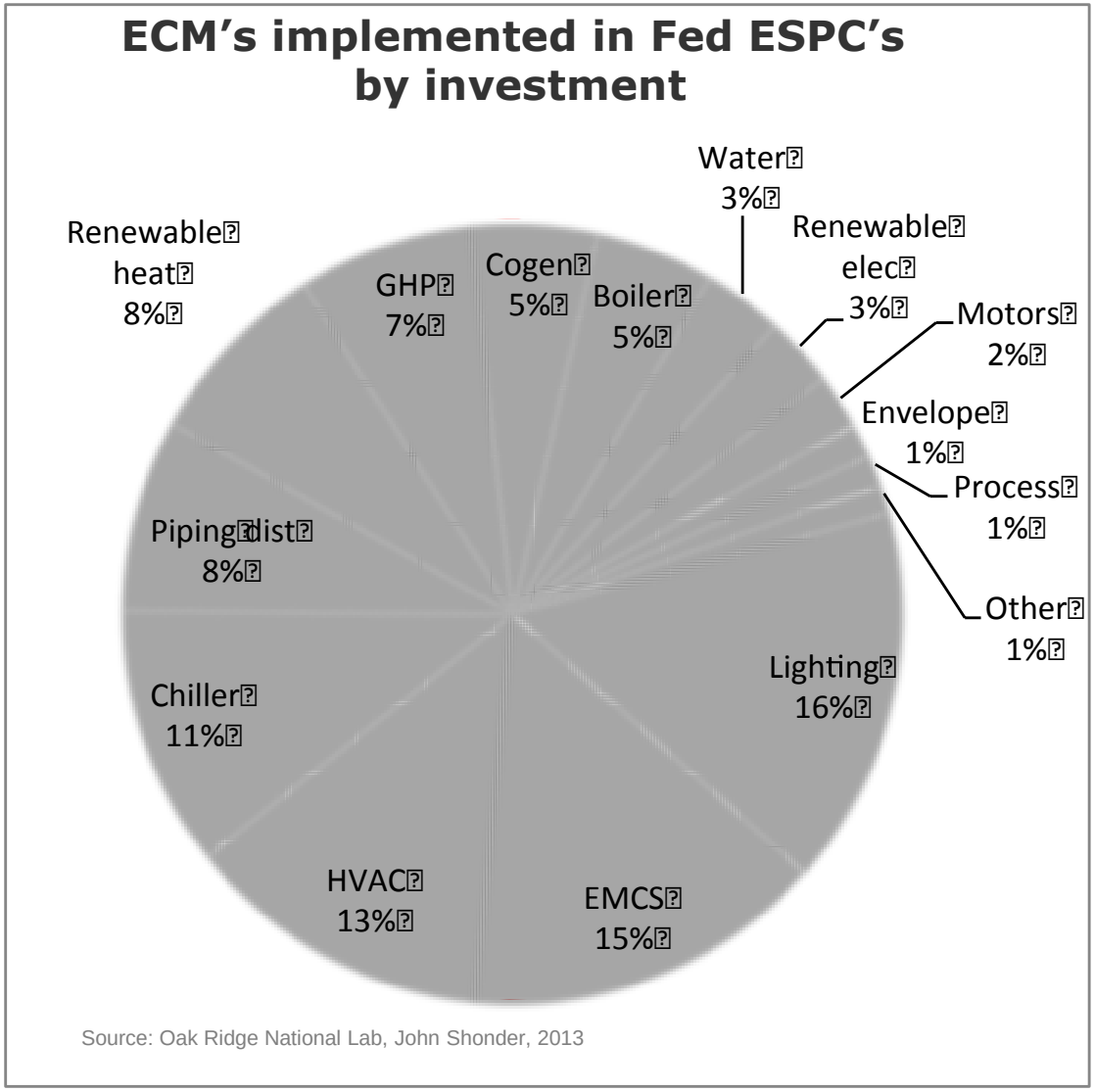
RETROFIT FINANCING OPTIONS



RETROFIT REBATE AND CREDIT OPTIONS

Utility Incentives	• Energy Modeling • Enrollment in Utility Rebate Program(s)
Historic Tax Credit	• 20% of Construction Cost • 20% from State or Local Gov't (ex. WI)
179D Tax Deduction	• Allocation letter • Energy Model • Verification by 3rd Party
Innovation Tax Credits	• Development or Improvement • Process of "Experimentation" • Technological in Nature

ENERGY SAVINGS PERFORMANCE CONTRACTING (ESPC)



Key observations:

1. Apart from lighting, little/no load reductions

2. 60% ECM's are HVAC related

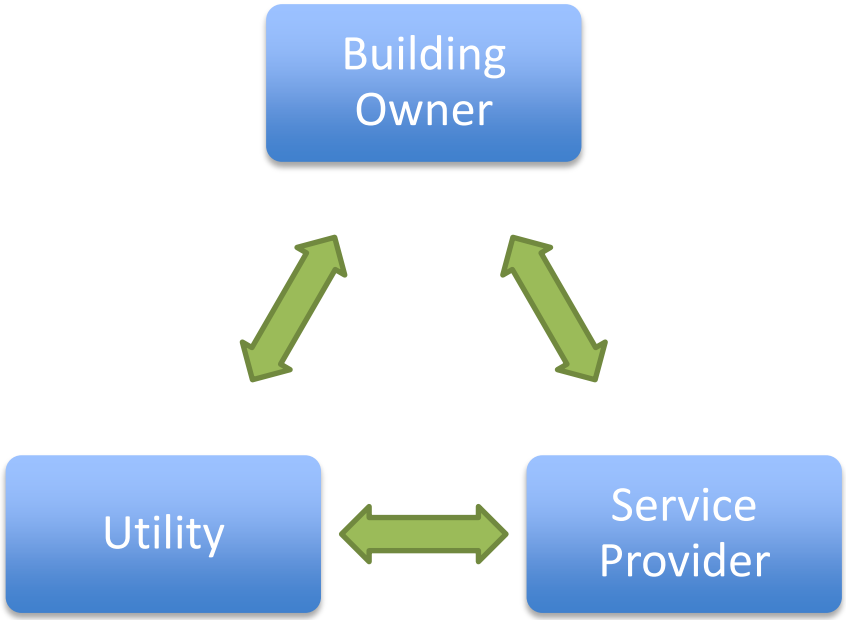
1. Envelope, occupant related upgrades are rare (<1% of projects)

- **Architects can recommend or incorporate ESPCs into their existing projects**

MEETS

Metered Energy efficiency transaction structure

- Cutting Edge finance mechanism intended to break down all conflicts between landlords, tenants, investors, and utilities
- 20 year contract that is beneficial to all parties



IMPLEMENTATION

OPTIMIZE THE WHOLE

DEEP TRIGGERS

1. Adaptive Reuse, Market Repositioning or Modernization
2. Roof, Window or other Major Envelope work
3. Deferred Maintenance / Replacement for HVAC and Similar Equipment
4. Code-Required Updates
5. New Acquisition and Refinancing Announcements of Utility Rate Hikes or other Related News
6. Major Occupancy Change
7. Significant Comfort or Maintenance Issues
8. Owner-Initiated Energy Management Planning

DEEP RETROFIT ANALYSIS

Deep Retrofit =

Integrative Design

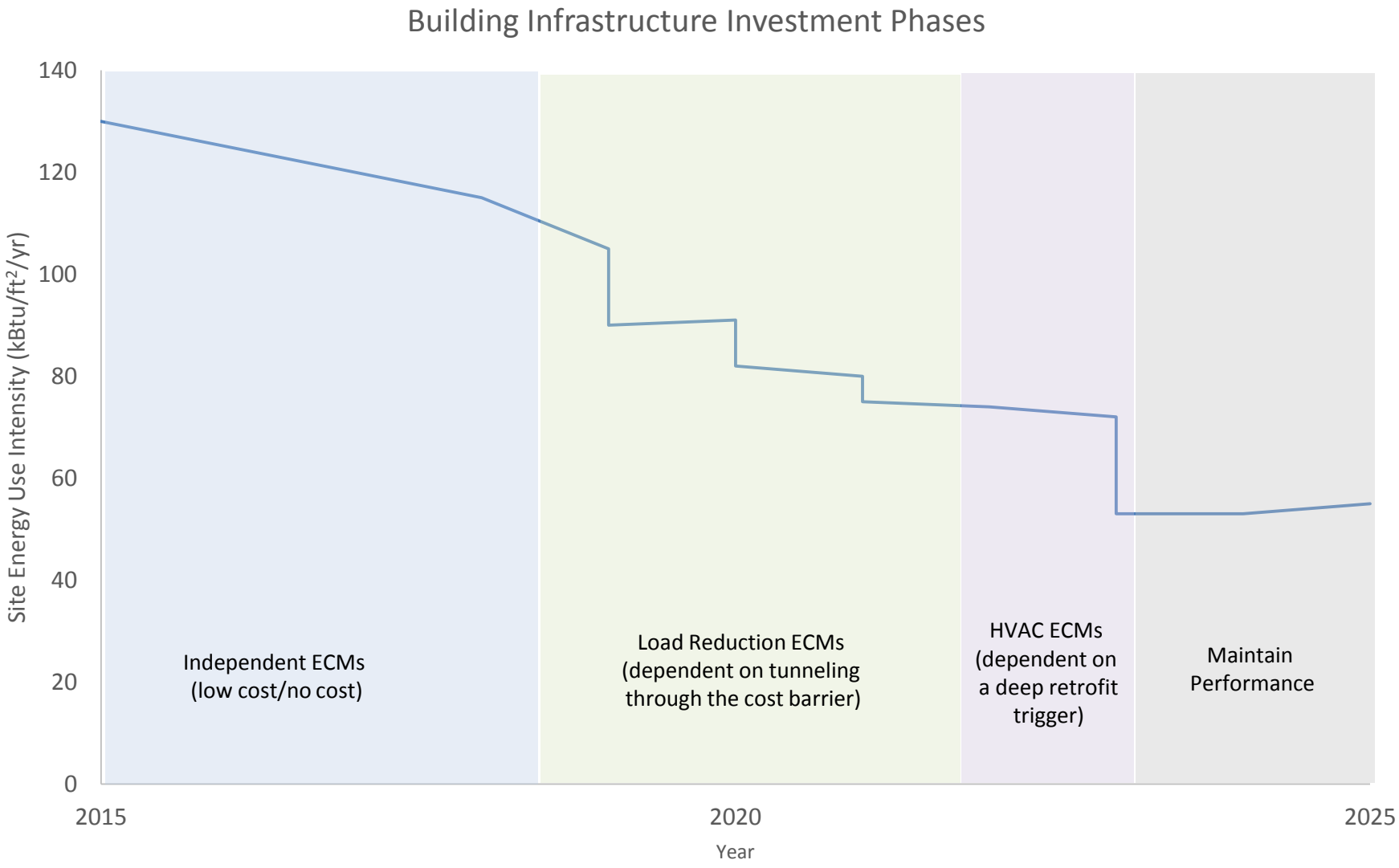
+

Economic Triggers

+

Existing Operation Evaluation

DEFINING A COMPREHENSIVE ENERGY SAVINGS PLAN



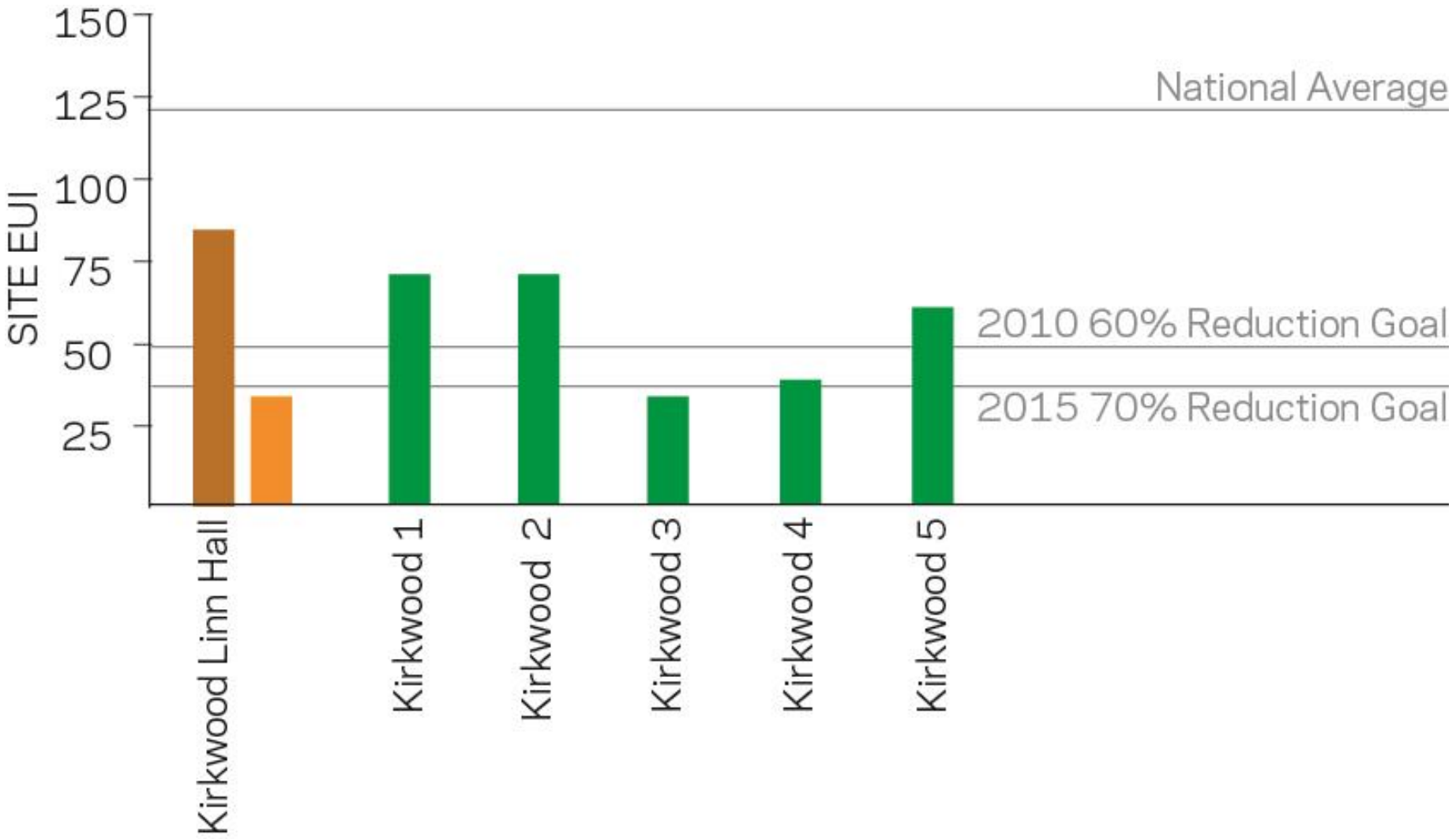
Kirkwood - Linn Hall


EXIT

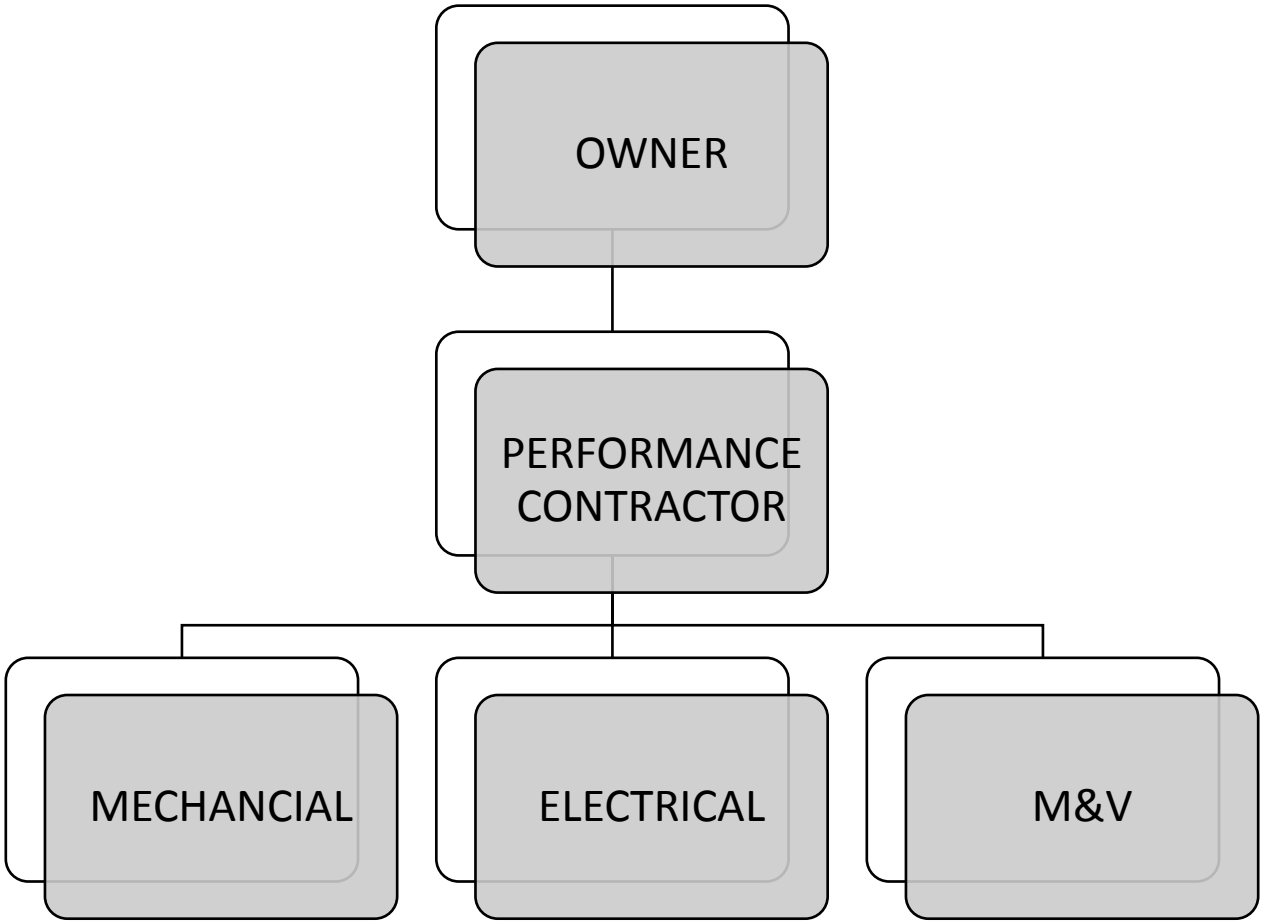
Linn Hall

Uneven thermal plane on exterior of structure

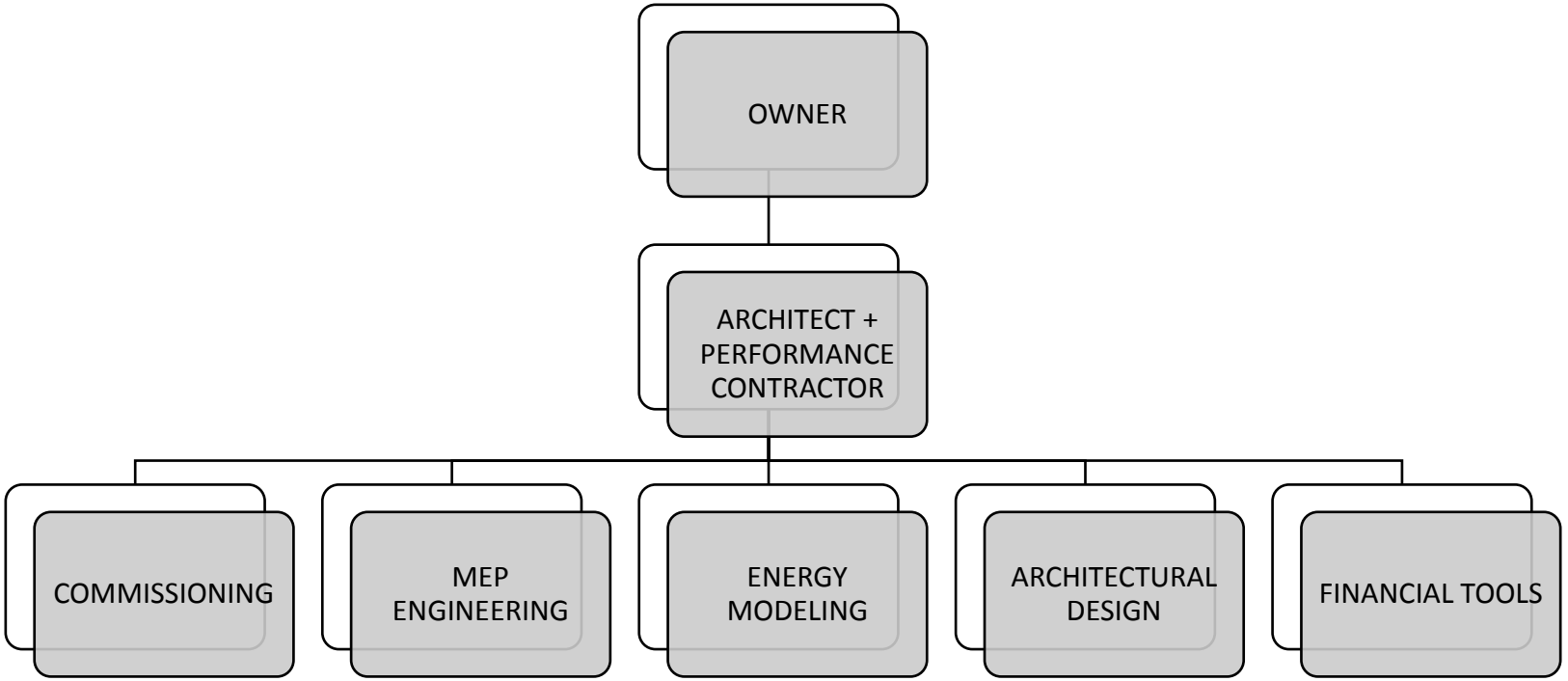
Linn Hall


150
125
100
75
50
25
SITE EUI
National Average
2010 60% Reduction Goal
2015 70% Reduction Goal
Kirkwood Linn Hall
Kirkwood 1
Kirkwood 2
Kirkwood 3
Kirkwood 4
Kirkwood 5

‘Retrofit’ Relationship Diagram



‘Deep Retrofit’ Relationship Diagram



EE Tools for Existing Buildings

Activity	% Savings Range	Cost/ft²
RCx	16%	$0.30
Capital Improvement	20-40%	Varies
M+V	1-3%	1-10% project
Total	**37-59%**	Varies

Evan Mills, *Building Commissioning, A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions*, Lawrence Berkeley National Laboratory 2009

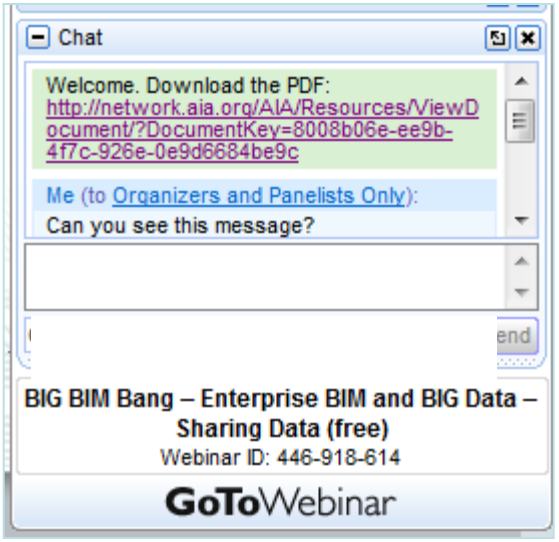
Energy Star Portfolio Manager™, *Data Trends,* Oct 2012

Measurement and Verification and the IPMVP, EPC Toolkit for Higher Education| APRIL 2009

Questions?

Submit a question to the moderator via the chat box.

Content-related questions will be answered during the Q&A portion as time allows.



Thank you for joining us!

This concludes the AIA/CES Course **#CAFM1502**. The webinar survey/report form URL is listed in the chat box ***and*** will be included in the follow-up email sent to you in the next hour.

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