



Keeping Score: DOE's Asset Score in the Marketplace

Better Buildings Summit

May 11, 2016, 3:45 – 5:00 pm

Agenda

- Asset Score Overview
- Presentations
- Moderated Q&A
- Audience Q&A

Today's Presenters

- Andrew Burr, U.S. DOE
- Sara Schoen, Clarion Partners and Verdani Partners
- Greg Thomas, Performance Systems Development

Asset Score Overview

- National, free software tool that diagnoses opportunities to improve EE
 - Assesses structural, mechanical, electrical building components
 - Runs an EnergyPlus energy simulation
 - Diagnostic tool, not an energy management tool





Asset Score Overview

825

Buildings scored

83M

Square feet

30

States

155M

Square feet in process

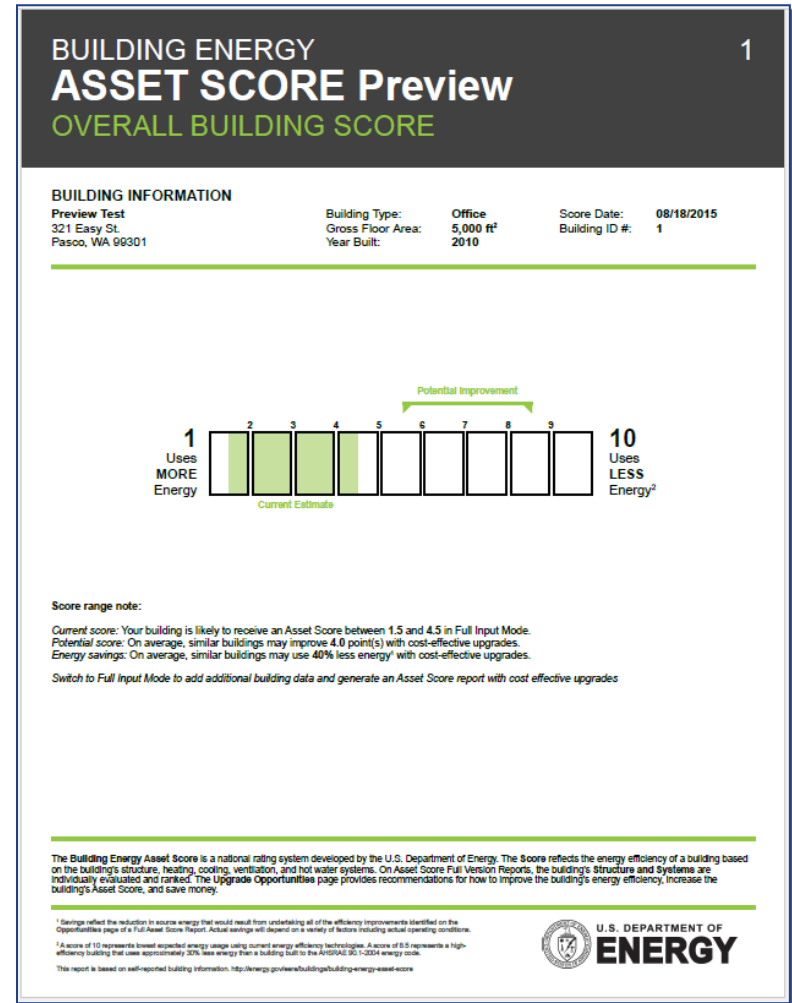
National Leadership Network

Announced in January 2016 at the White House, 21 organizations will work with DOE to use the Asset Score, conduct case studies, and help improve the tool

- AECOM
- Arup
- Association of Energy Engineers
- CH2M Hill
- City of Milwaukee
- DNV GL
- FS Energy
- Ingersoll Rand
- JBG Companies
- Liberty Property Trust
- Marriott International
- Marx Okubo
- National Oceanic and Atmospheric Administration
- Performance Systems Development
- Skidmore, Owings & Merrill
- State of Missouri
- State of Rhode Island
- Steven Winter Associates
- Transwestern
- U.S. General Services Administration
- YR&G

Asset Score Preview

- Our newest Asset Score family member
 - Reduces inputs to seven total
 - Enables bulk upload for portfolio analysis
 - Moves information seamlessly into full Asset Score



Asset Score Training

- New training opportunities:
 - Free online training and certificate of proficiency developed by New Jersey Institute of Technology (NJIT) and Penn State with DOE funding
 - Free in-person training at WEEC 2016 in September in Washington, DC

INTEGRATING SUSTAINABILITY INTO ACQUISITIONS DUE DILIGENCE USING DOE'S BUILDING ENERGY ASSET SCORE



U.S. DOE Better Buildings Summit, May 2016

Sara Schoen, Director of Sustainability
Clarion Partners & Verdani Partners



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SUSTAINABILITY DUE DILIGENCE DRIVERS

- INVESTOR DEMAND



- GRESB

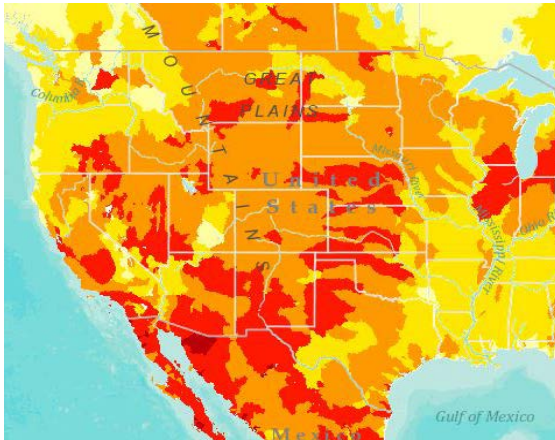


- UNPRI



SUSTAINABILITY DUE DILIGENCE DRIVERS: WIDER SUSTAINABILITY CONSIDERATIONS

Flooding



Ratings

BREEAM®



Borrower Credentials

 Principles for Responsible Investment

 G R E S B®  FTSE4Good

SUSTAINABILITY & CREDIT RISK: better performing properties may have better credit risk

20-30% lower default rates associated with Energy Star & LEED-certified buildings

Financial Benefits:

- Higher occupancy
- Lower operating costs
- Increased asset liquidity

STATE OF THE MARKET

Most office sector GRESB respondents include some sustainability risks in new acquisitions risk assessments, but exclude key factors such as transportation access and indoor air quality performance

Proportion of GRESB respondents that perform risk assessments	86%
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Proportion that address the following ESG issues in their risk assessments:

Energy Efficiency	86%
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Building Safety and Materials	86%
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Water Efficiency	78%
------------------	-----

Contamination	73%
---------------	-----

Natural Hazards	69%
-----------------	-----

Regulatory	69%
------------	-----

Health, Safety and Well-being	52%
-------------------------------	-----

Climate Change	30%
----------------	-----

Transportation access	21%
-----------------------	-----

GHG Emissions	17%
---------------	-----

ASHRAE and IAQ Audits	13%
-----------------------	-----

Socio-economic	8%
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*Source: GRESB 2015 Report / Office Sector Respondents

INTEGRATING SUSTAINABILITY CRITERIA INTO CLARION'S DUE DILIGENCE PROCESS

TARGET

- Implement sustainability screening for all new investments

GOALS

- Gain a thorough understanding of asset's environmental performance
- Ensure that environmental risk is accurately assessed as part of DD process
- Factor environmental performance into negotiations with seller
- Incorporate sustainability considerations into underwriting, deal structuring, and loan documentation
- Identify potential capital improvements as part of the acquisition process

BENEFITS

- Get new assets' data profiles off to a strong start
- Improve lender relationships

CLARION SUSTAINABILITY DUE DILIGENCE CRITERIA

- Walk Score
- Transit Score
- Bike Score
- LEED certification
- Energy Star rating – sellers often can't provide energy use data
- DOE Building Energy Asset Score – doesn't require energy use data

Systems addressed via DOE Building Energy Asset Score:

- Envelope (roof (green roof, reflective roof), insulation, windows) U-values
- HVAC (heating, cooling, ventilation)
- Lighting
- Occupancy sensors
- Hot water
- Refrigerants
- Plumbing
- Landscaping

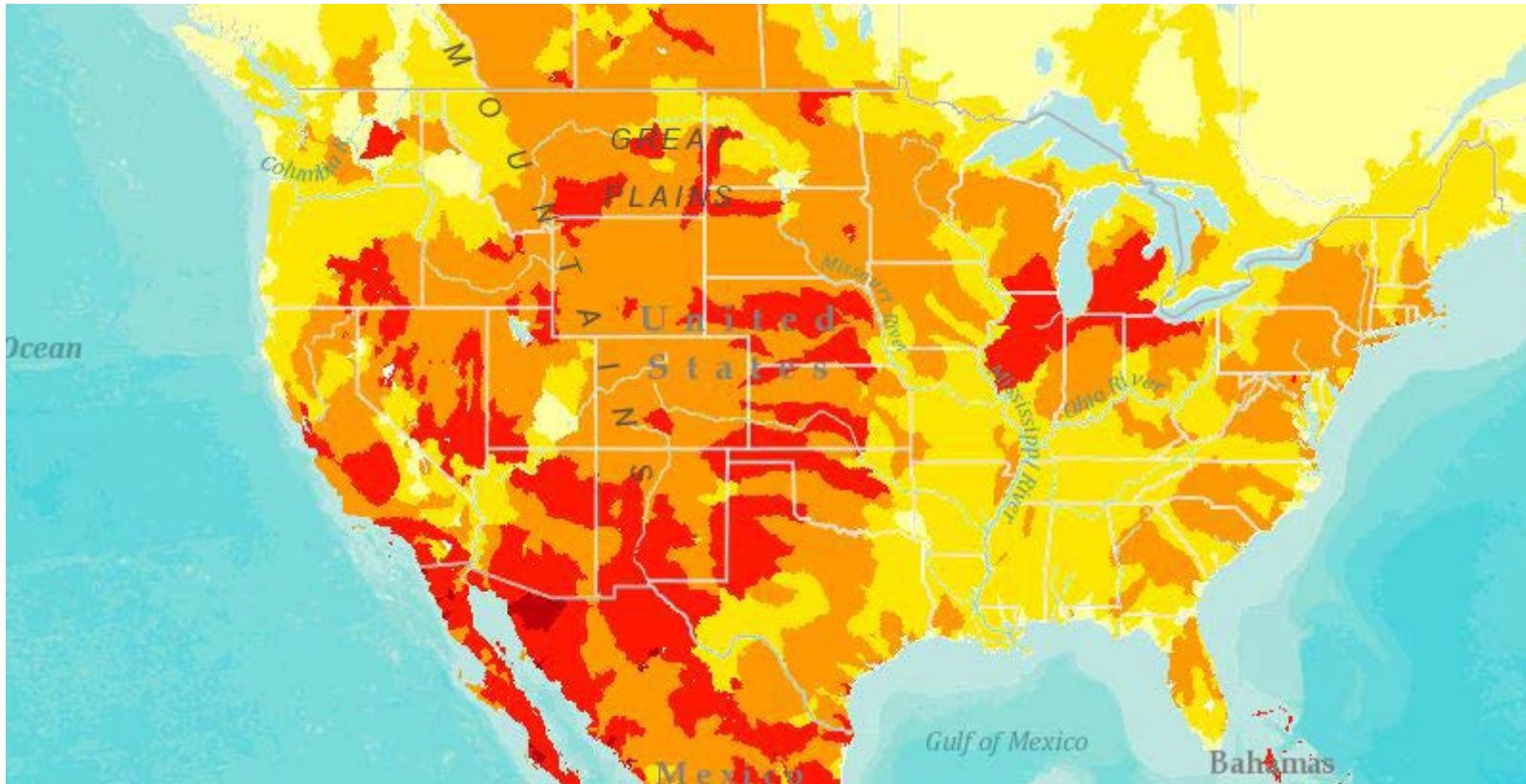
CLIMATE RISKS AND WATER RISKS

- Check for climate risks and vulnerability of the property based on its location.
- Check for water risks including flood occurrence, drought severity, groundwater stress and regulatory and reputational risks.



http://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/CB_Home/Climate+Risks_Adaptation/

WATER RISKS



Overall Water Risk

- Low risk (0-1)
- Low to medium risk (1-2)
- Medium to high risk (2-3)
- High risk (3-4)
- Extremely high risk (4-5)
- No Data

Definition

Overall water risk identifies areas with higher exposure to water-related risks and is an aggregated measure of all selected indicators from the Physical Quantity, Quality and Regulatory & Reputational Risk categories.

Sources: [WRI Aqueduct 2014](#)

343-unit multifamily acquisition in the Medical District submarket of Dallas, TX



Energy Star score: N/A (12 months of utility data, including utility bills paid by tenants, were not available during the assessment period)

Asset Score (Light Version): 7.5/10

Potential Score: 9/10

Estimated Savings: 20%

Due Diligence Sustainability Recommendations

RECOMMENDATIONS FOR ENERGY CONSERVATION

Energy Conservation Measure	Estimated Cost of Implementation	Estimated Savings in Energy	Estimated Annual Energy Cost Savings (consumption + demand)	Estimated Simple Payback period
	(\$)	(kWh)	(\$)	(years)
1. Exit lights Halogen to LED Retrofit	\$2,500	32,000	\$2,200	1
2. Closet lights Incandescent to LED Retrofit	\$8,600	63,000	\$4,500	2
3. Stairwell Lights Fluorescent T8's to LED	\$2,000	16,000	\$1000	2
Total	\$13,100	111,000	\$7,700	2 yrs.

ADDITIONAL RECOMMENDATIONS

4. Adding Daylight sensor for garage lighting

From Clarion's "Final Investment Memorandum":

"Implementing the sustainability recommendation yields a xx bps increase to the unlevered IRR and has been included in the base case underwriting."

PERFORMANCE SYSTEMS
DEVELOPMENT

We Speak  Building



Adding Value to the Asset Score

By Greg Thomas

CEO, Performance Systems Development

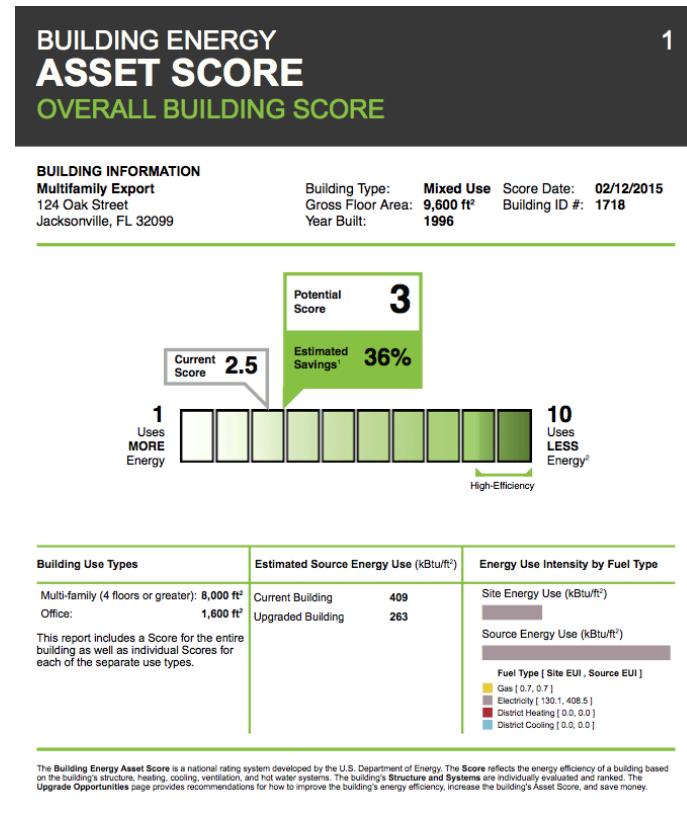


Who is Performance Systems Development?

- **18 Year old EE Consulting and IT Firm**
 - Strong R&D focus on bringing whole building EE to scale
 - Program implementation and support
 - Software
 - Training
- **Clients**
 - Utilities
 - DOE and Labs
 - Program Implementers
 - EE Service Providers
 - Portfolio Owners

What is Behind the Curtain Makes a Difference

- Optimized reduced input energy simulation
- Built on OpenStudio platform
- Exports OSM model
 - Code compliance
 - Lite audits
- API available



¹ Savings reflect the reduction in source energy that would result from undertaking all of the efficiency improvements identified on the Opportunities page. Actual savings will depend on a variety of factors including actual operating conditions.

² A score of 10 represents lowest expected energy usage using current energy efficiency technologies. A score of 8.5 represents a high-efficiency building that uses approximately 30% less energy than a building built to the ASHRAE 90.1-2009 energy code.

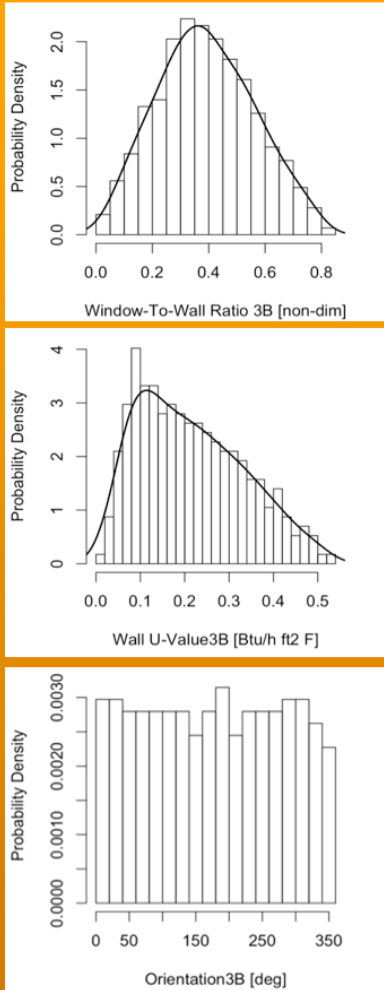
This report is based on self-reported building information.

<http://energy.gov/buildings/commercial-building-energy-asset-score>

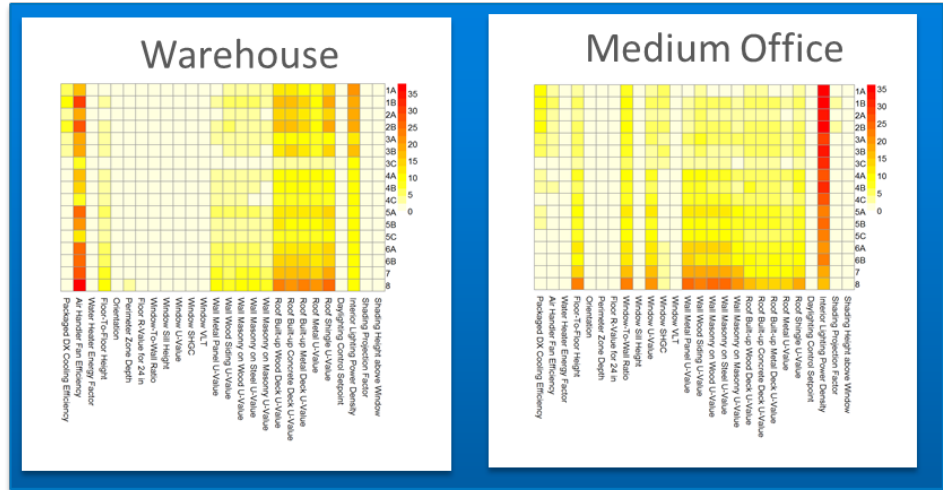


Analysis Supporting the Tool Development

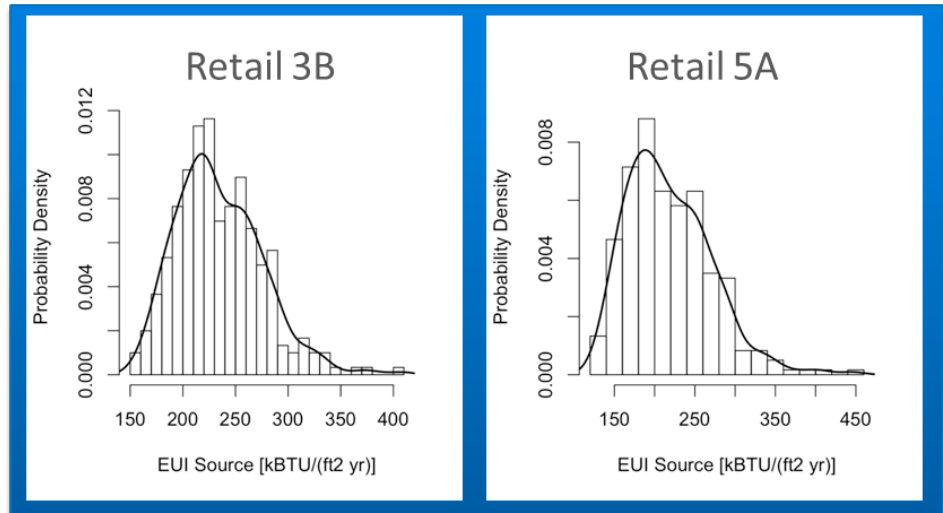
Input Parameters



Impact of each variable across all climate zones



Potential range of EUI combing all variables



Exporting the OpenStudio Model Behind the Score

The screenshot displays the 'Asset Score' interface for a multifamily building. The top navigation bar includes 'BUILDING ENERGY Asset Score', 'My Buildings', 'Home', and a user profile for 'cbalbach@psdconsulting.com'. The U.S. Department of Energy logo is also present. The main content area is titled 'Multifamily Export' and features two buttons: 'Download Report' and 'Download Model'. A large yellow arrow points to the 'Download Model' button. Below the buttons, building details are listed: '124 Oak Street, Jacksonville, FL 32069', 'Building Type: Mixed-Use', 'Floor Area: 9,600 ft²', and 'Year Built: 1996'. Report information includes 'Report #: FL-1718-4016' and 'Award Year: 2015'. A score visualization shows a 'Current Score' of 2.5 and a 'Potential Score' of 3, with 'Estimated Savings**' of 36%. A bar chart at the bottom indicates the score range from 1 (Uses MORE Energy) to 10 (Uses LESS Energy).

BUILDING ENERGY Asset Score My Buildings Home cbalbach@psdconsulting.com U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

Multifamily Export Download Report Download Model

124 Oak Street
Jacksonville, FL 32069

Building Type: Mixed-Use
Floor Area: 9,600 ft²
Year Built: 1996

Report #: FL-1718-4016
Award Year: 2015

Current Score **2.5**

Potential Score **3**

Estimated Savings** **36%**

1 Uses MORE Energy 10 Uses LESS Energy

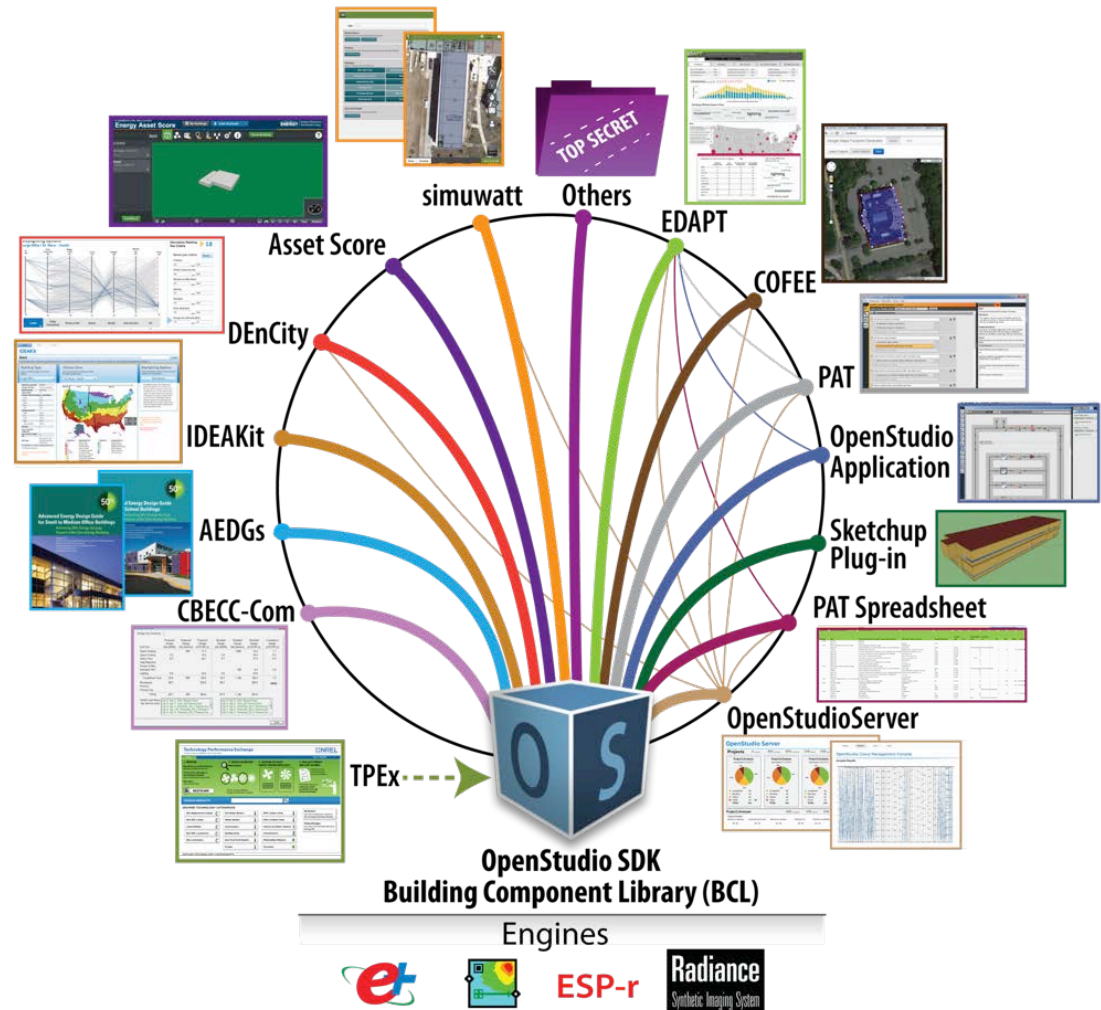
What is DOE's OpenStudio?

OpenStudio is **BOTH**

- a Software Development Kit (SDK) for building energy modeling tools

and

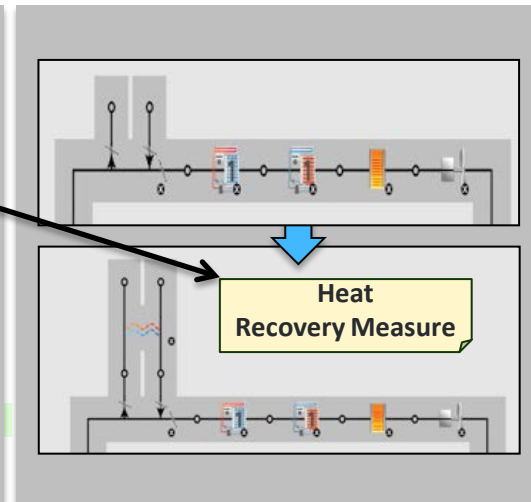
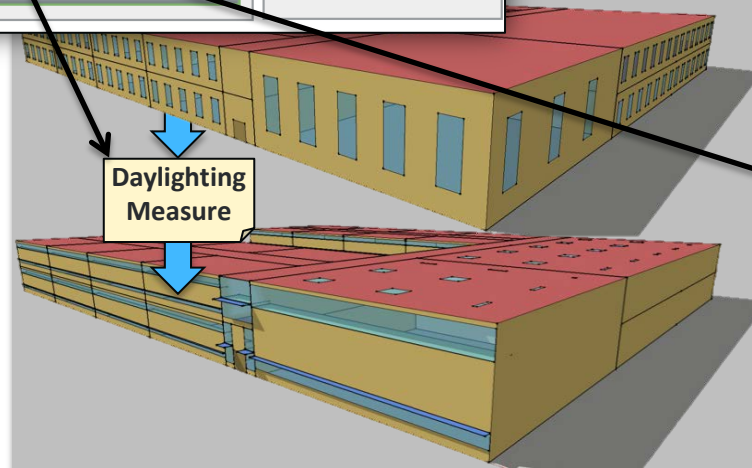
- an Open Source Energy Modeling Application
- Developed by NREL



The screenshot shows the 'Building Component Library' website. At the top, it says 'Welcome, Guest!' and has 'Login' and 'Register' links. A search bar is present with the placeholder text 'Enter the terms you wish to search for.' Below the search bar, there are four numbered steps: 1. Search for a component or energy conservation measure. 2. Filter results and download the specific file or files you need. 3. Add component data to your building energy model. 4. Run simulation and review results. The main content area is titled 'Building Component Library' and describes it as a repository of building data used to create building energy models. It lists examples of components: windows, walls, schedules, and weather information. Below this, there are two search filters: 'Components' (Total Components: 28,652) and 'Energy Conservation Measures' (Total Measures: 1). Both filters have a search bar and a 'Browse' button. On the right side, there is a 'Developer Access' section with a 'News' link and a message 'Initial Component Upload Complete'.

**Small scripts
that can quickly
and easily
transform a
building model**

**Standardized
and transparent
modeling and
reporting**



Tax Abatement Strategies

1

Configure Building Energy Asset Score framework variables

2

Simulate iterations of the model

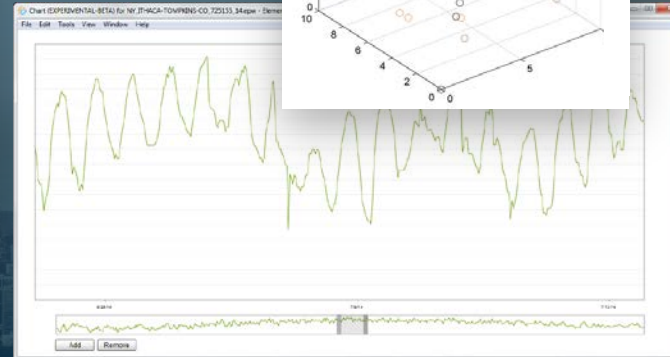
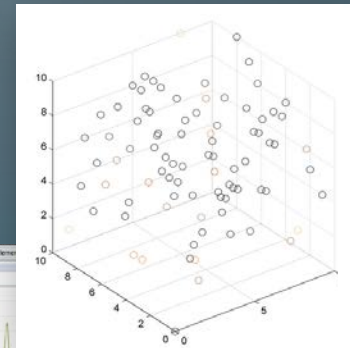
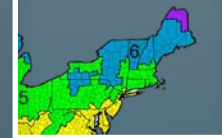
Table 5.5-6 Building Envelope Requirements for Climate Zone 6 (A,B)*

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.032	R-30 c.i.	U-0.032	R-30 c.i.	U-0.063	R-15 c.i.
Metal Building ^a	U-0.031	R-25 + R-11 Ls	U-0.029	R-30 + R-11 Ls	U-0.060	R-0 + R-9.8 c.i.
Attic and Other	U-0.021	R-49	U-0.021	R-49	U-0.034	R-30
Walls, above Grade						
Mass	U-0.080	R-13.3 c.i.	U-0.071	R-15.2 c.i.	U-0.151 ^b	R-5.7 c.i. ^b
Metal Building	U-0.050	R-0 + R-19 c.i.	U-0.050	R-0 + R-19 c.i.	U-0.094	R-0 + R-9.8 c.i.
Steel Framed	U-0.049	R-13 + R-12.5 c.i.	U-0.049	R-13 + R-12.5 c.i.	U-0.084	R-13 + R-3.8 c.i.
Wood Framed and Other	U-0.051	R-13 + R-7.5 c.i. or R-19 + R-5 c.i.	U-0.051	R-13 + R-7.5 c.i. or R-19 + R-5 c.i.	U-0.089	R-13
Wall, below Grade						
Below Grade Wall	C-0.092	R-10 c.i.	C-0.063	R-15 c.i.	C-0.119	R-7.5 c.i.
Floors						
Mass	U-0.051	R-16.7 c.i.	U-0.051	R-16.7 c.i.	U-0.087	R-8.3 c.i.
Steel Joist	U-0.032	R-38	U-0.032	R-38	U-0.052	R-19
Wood Framed and Other	U-0.027	R-38	U-0.027	R-38	U-0.051	R-19
Slab-on-Grade Floors						
Unheated	F-0.510	R-20 for 24 in.	F-0.434	R-20 for 48 in.	F-0.730	NR
Heated	F-0.688	R-20 for 48 in.	F-0.671	R-25 for 48 in.	F-0.860	R-15 for 24 in.
Opaque Doors						
Swinging	U-0.500		U-0.500		U-0.700	
Nonswinging	U-0.500		U-0.500		U-0.500	

Fenestration	Assembly Max. U	Assembly Max. SHGC	Assembly Min. VT/SHGC	Assembly Max. U	Assembly Max. U	Assembly Max. U	Assembly Max. U	Assembly Max. U	Assembly Max. U
Vertical Fenestration, 0%–40% of Wall (for all frame types)									
Nonmetal framing, all	U-0.32			U-0.32					
Metal framing, fixed	U-0.42			U-0.42					
Metal framing, operable	U-0.50	SHGC-0.40	1.10	U-0.50					
Metal framing, entrance door	U-0.77			U-0.68					
Skylight, 0%–3% of Roof									
All types	U-0.50	SHGC-0.40	NR	U-0.50					

* The following definitions apply: a.i. - continuous insulation (see Section 3.2), R-C - filled cavity (see requirements).
 a. When using the R-value compliance method for metal building roofs, a thermal spacer block is req.
 b. Exemption to Section 5.5.3.2 applies for mass walls above grade.

Ithaca Specific Analysis



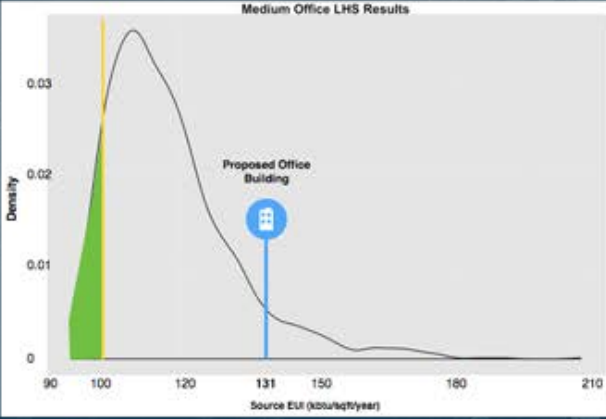
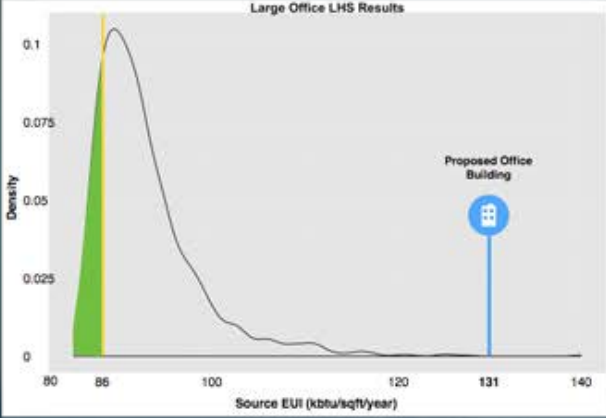
Node	Value
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simulation-id	hvac/2020/PTC/AssetScore/2_271_5016943db75c3f693d3e791ac1506
building-name	Ithaca Small Office_2018
base-model	true
model-type	base
simulator	6A
year-completed	2018
total-floor-area	5493.3999234375
address	
lighting	
wall	
window	
id	windows-235
framing-type	metal-frame
glass-type	Double Pane
gas-rl-type	ar
operable	false
u-value	0.42
shgc	0.40
vt	0.7
floor	
roof	
hvac	
service-hot-water	
blocks	
software-version	Asset Score Version: 2.1.0 Build: AssetScore_Build_1244
software-version	Asset Score Reference Tool Service, Version 1.0.5822.2605, Thursday, December 10, 2015 2:43:30 PM
software-version	InferenceGenerator 1.0.5818.2140
software-version	fedbackand Dynamic Link Library 7.0.0.1412c

3

Review output variations & set threshold

4

Evaluate candidate building design using standardized Building Energy Asset Score Report



■ High Performance Building — Proposed Office Building
— High Performance Threshold

BUILDING ENERGY ASSET SCORE

OVERALL BUILDING SCORE

BUILDING INFORMATION
Proposed Office Building
 Single Block
 120 Market Street
 Ithaca, NY 14850

Building Type: Office
 Gross Floor Area: 11,978 ft²
 Year Built: 2014

Score Date: 03/16/2016
 Building ID #: 1596
 Software Release: 2.0.3

Potential Score **8.5**

Current Score **6.5**

Estimated Savings **25%**

1 Uses MORE Energy 10 Uses LESS Energy

High Efficiency

Standard Occupancy and Operating Conditions	Estimated Source Energy Use (kBtu/ft ²)	Energy Use Intensity by Fuel Type
Number of Assumed Occupants: 64	Current Building: 131 Upgraded Building: 98	Site Energy Use (kBtu/ft ²)
Hours of Operation: 45.6 hrs/wk		Source En
Cooling Set Point: 75° F		Fuel Type
Heating Set Point: 70° F		Gas [20.4, 21.4]
Misc. Energy Loads: 0.75 W/ft ²		Electricity [34.8, 109.2]
		District Heating [0.0, 0.0]
		District Cooling [0.0, 0.0]

The Building Energy Asset Score is a national rating system developed by the U.S. Department of Energy. The Score reflects the building's structure, heating, cooling, ventilation, and hot water systems. The building's Structure and Systems are individual Upgrade Opportunities page provides recommendations for how to improve the building's energy efficiency, increase the building's

Energy Use Intensity by Fuel Type

Site Energy Use (kBtu/ft²)

Source Energy Use (kBtu/ft²)

Fuel Type [Site EUI , Source EUI]

- Gas [20.4, 21.4]
- Electricity [34.8, 109.2]
- District Heating [0.0, 0.0]
- District Cooling [0.0, 0.0]

21.4 + 109.2 = 130.6

5

Apply Quality Assurance/Quality Control Framework

- Use credentialed provider
- Review score?
- Use of the tool in policy creates responsibility for the Building Energy Asset Score to be increasingly stable over time
- Similar issues exist for ENERGY STAR portfolio

Certificate of Proficiency in the Asset Score Tool

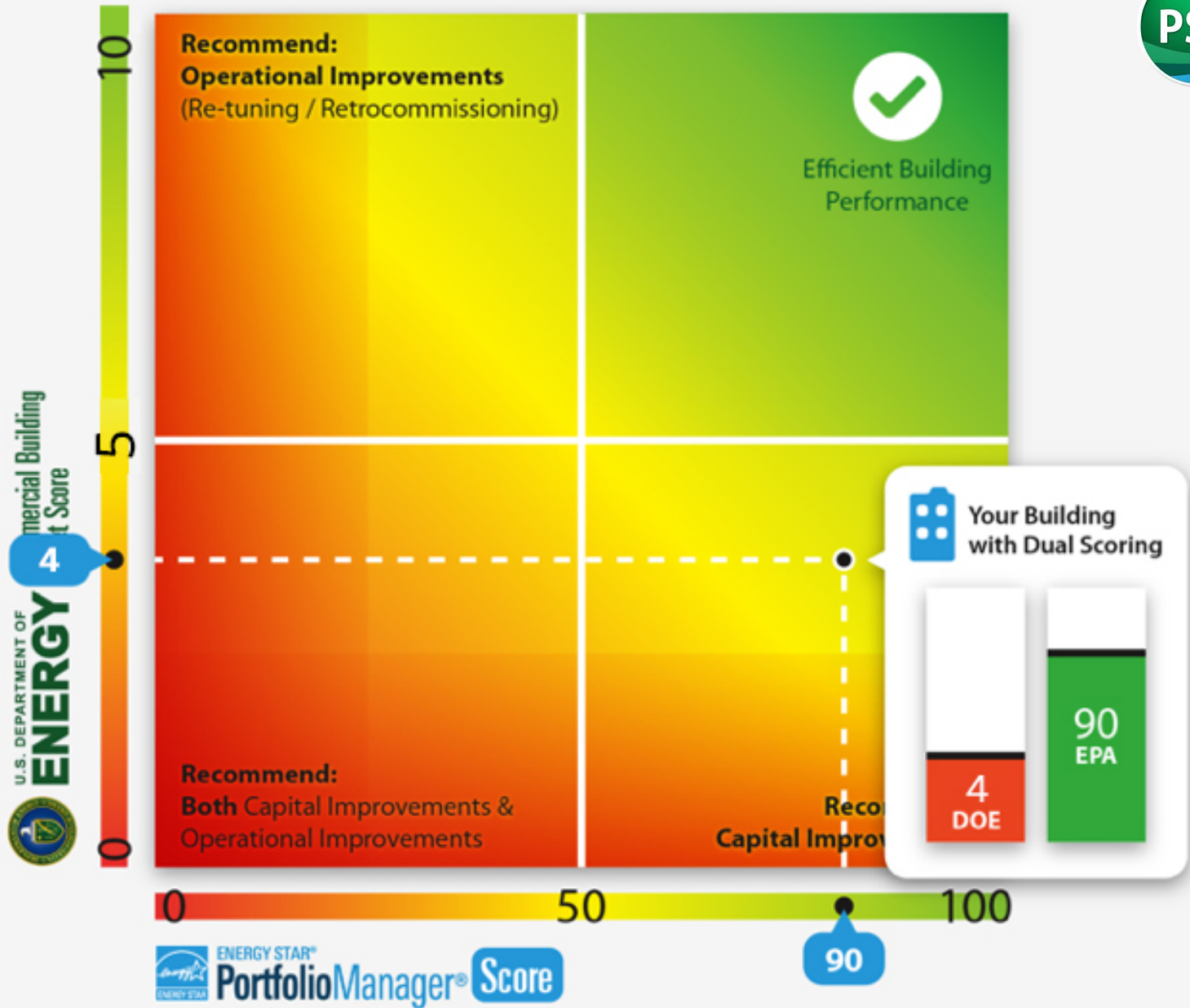
6

Determine Abatement Status

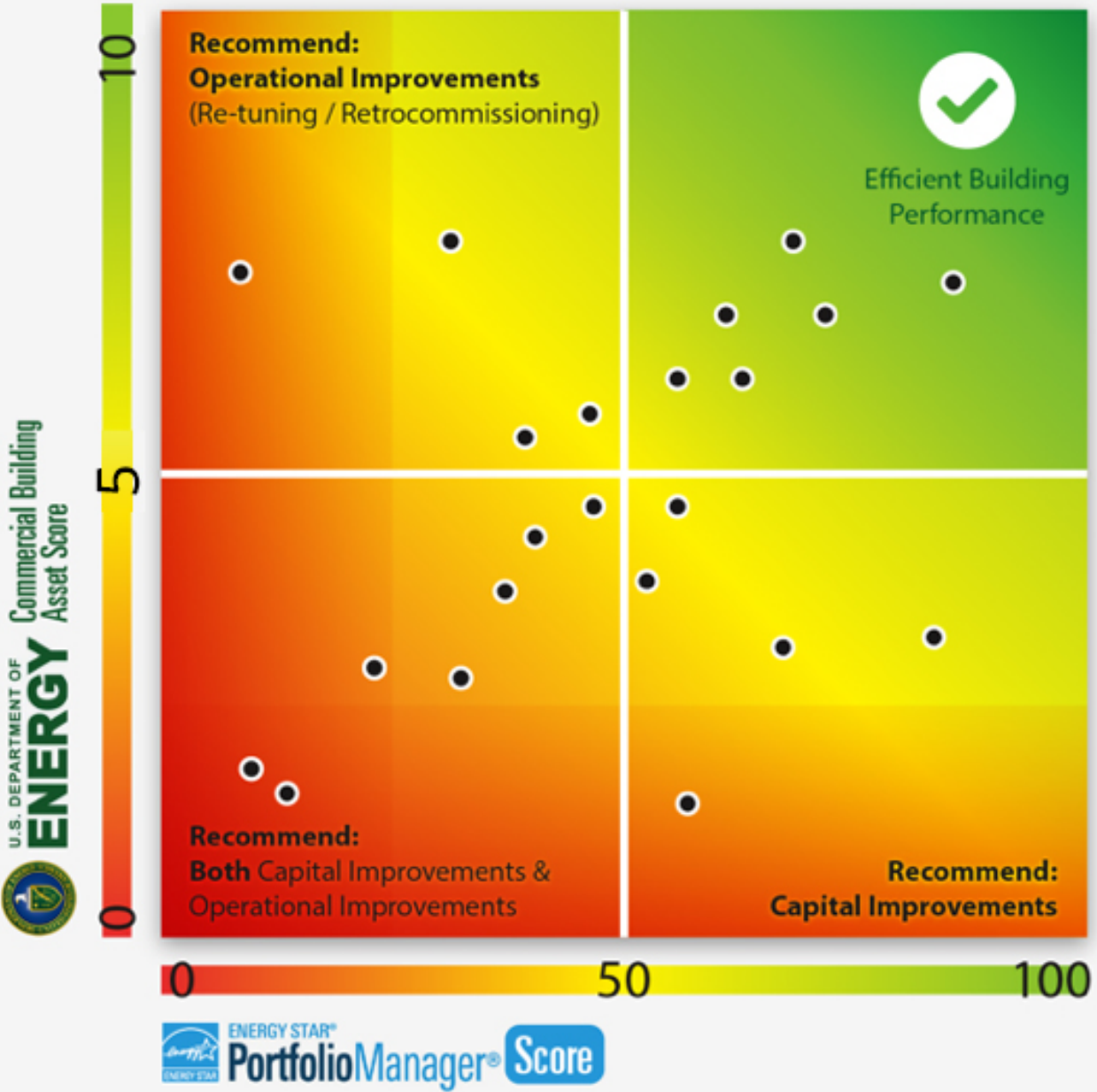
Additional Research

- Study which building characteristics are falling on both tails
- Compare to other site and source indices
- Test application of approach to mixed use buildings
- Explore the use of cost instead of site or source
- Test on recent real buildings

Moving From Benchmarking to Targeting



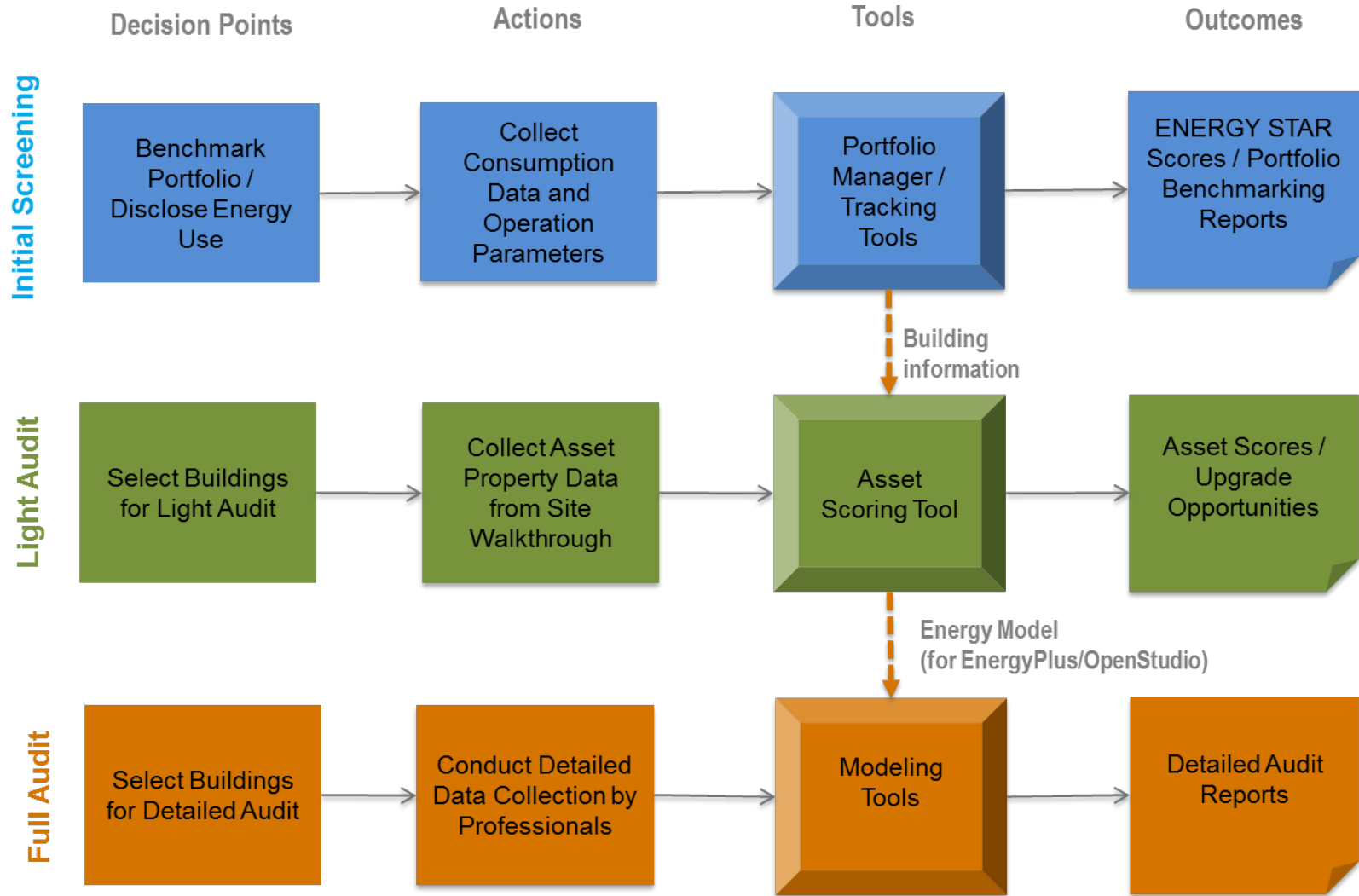
Using a Scoring Matrix for Portfolio Assessment



U.S. DEPARTMENT OF ENERGY
Commercial Building Asset Score

ENERGY STAR®
PortfolioManager® Score

Fitting These Tools into a Whole Building Upgrade Process





OpenEfficiency

INITIATIVE

Making the Business of Efficiency More Efficient:
Lower cost, less risk, and decreased complexity
for whole building EE programs

OpenEfficiency Initiative's Key Impacts on Whole Building Programs

Impact the Market

- Increase pool of potential modelers through standardization
- Meet goals with deeper savings from integrated approaches
- Gain flexibility to align programs with building owner non energy interests
- Reduce cream skimming and repeated treatments of buildings
- Reduce the effort to adopt new program designs

Reduce Risk

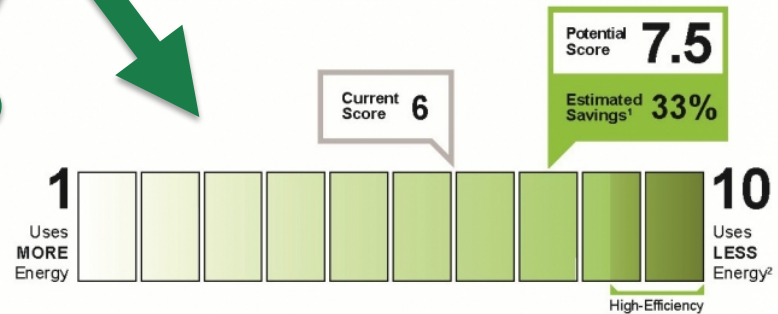
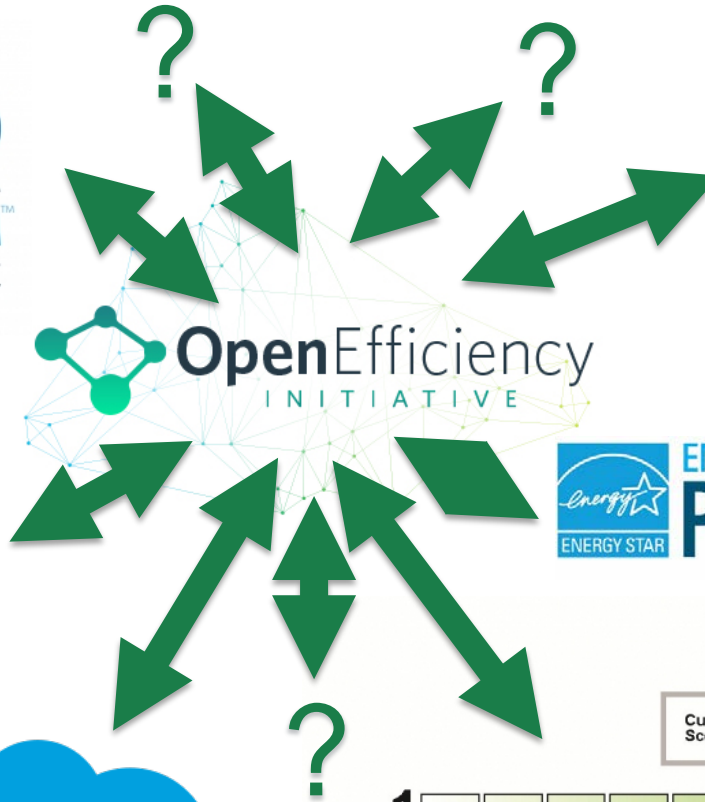
- Reduce acquisition costs by reducing admin costs and streamlining data flow
- Help manage attribution documentation
- Improve realization rates
- Expand participation through market based approaches
- Integrate with utility tracking and customer engagement systems

PERFORMANCE SYSTEMS
DEVELOPMENT

An Open Source Hub to Support Data Transfer and Reduce the Cost of Connecting to Federal Tools



OpenStudio



BEDES Data Taxonomy and BuildingSync Data Transfer

Discussion

Thank you!

Greg Thomas

Performance Systems Development

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