

Commercial Building Energy Asset Score

A Free Tool to Diagnose
Your Building Energy Efficiency

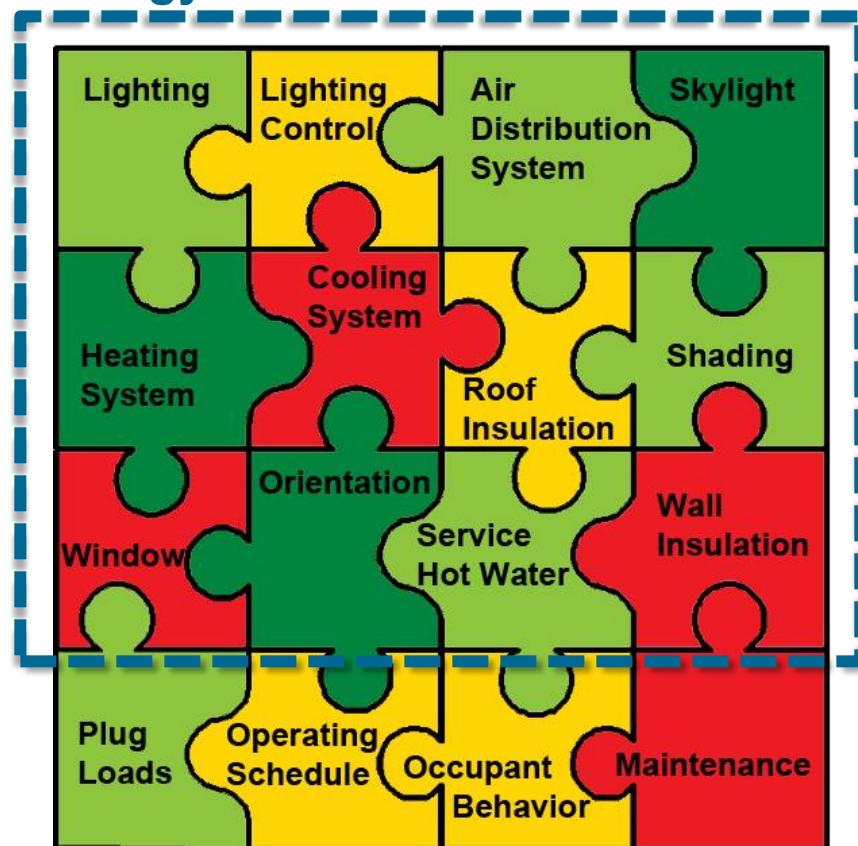
Glenn Dickey
SRA International

- **Develop a national energy asset rating to --**
 - encourage investment in energy efficiency, and
 - reduce energy use in the commercial building sector.

- **Provide useful information through simplified scoring tool**
 - Highlight a building's as-built efficiency and its potential efficiency.
 - Differentiate installed system efficiency from O&M issues and occupant behavior.
 - Provide insight into the performance potential of individual energy systems.
 - Identify short-term and long-term capital investment needs.

- Energy asset score evaluates the as-built physical characteristics of a building and its overall energy efficiency, independent of occupancy and operational choices.
- The physical characteristics include
 - Building envelope (window, wall, roof)
 - HVAC system (heating, cooling, air distribution)
 - Lighting system (luminaire and lighting control systems)
 - Service hot water system
 - Other major energy-using equipment (e.g. commercial refrigerator, commercial kitchen appliances, etc.)

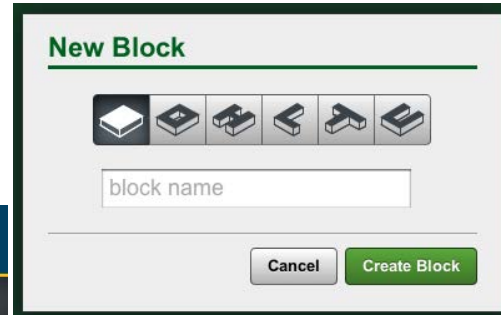
Energy Asset Score



Building energy use is affected by many factors.

Energy Asset Scoring Tool

- Free online tool
- Manage multiple buildings and building types



Create Your Building Block(s)

Block: 1

Fields marked with a * are required.

- *Use type: Office
- *Total Number of Floors: 5
- *Below Ground Floors: 0
- *Avg. Floor-to-Floor Height: 12 ft
- Suspended Ceiling
- *Avg. Floor-to-Ceiling Height: 9 ft
- *Orientation: 0 * from North

Diagram dimensions: 100 ft, 200 ft, 300 ft, 100 ft

- ### Define building characteristics
- Footprint
 - Envelope
 - Window layout
 - Lighting
 - HVAC
 - Service Hot Water

Energy Asset Scoring Tool

COMMERCIAL BUILDING

Energy Asset Score

na.wang@pnnl.gov ▾

← My Buildings

Test 2

Save

Score Building →

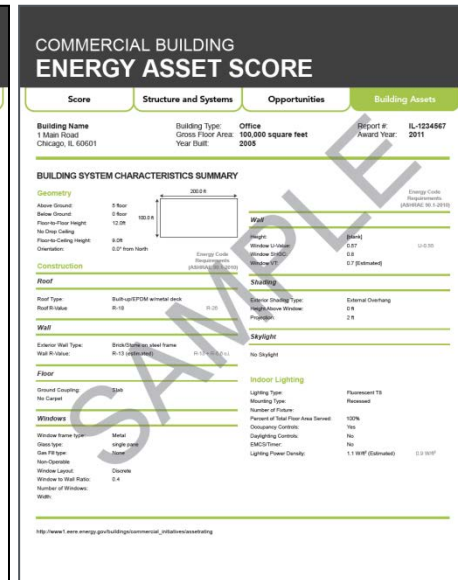
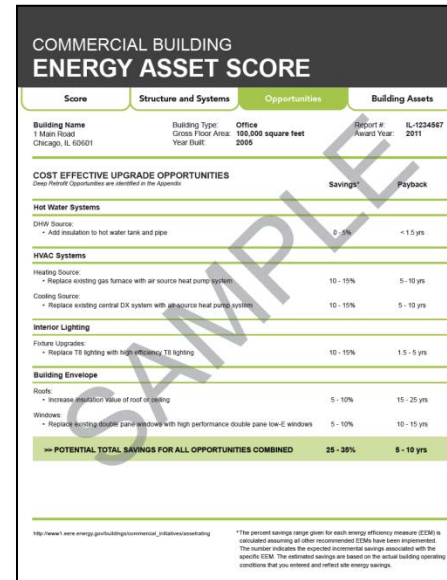
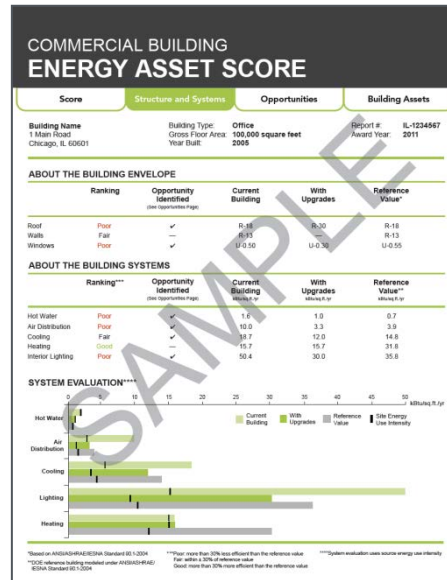
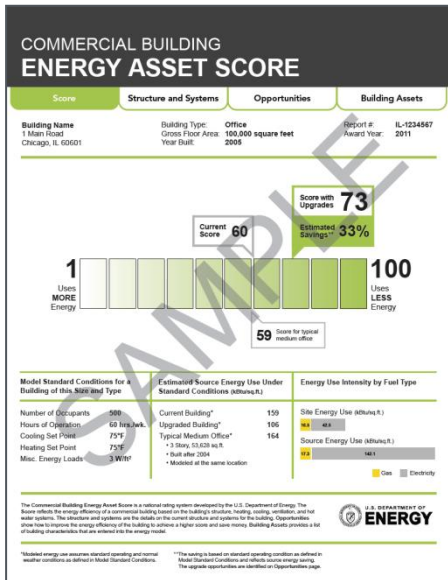
User clicks “Score Building” and receives Energy Asset Score Report

- EnergyPlus engine used to generate an EUI and asset score based on the building envelope, mechanical and electrical systems, and other major energy-using equipment.
- Building system evaluations for building envelope, service hot water, HVAC, and lighting systems.
- Identifies cost-effective improvements.
- An additional "after upgrades" score that demonstrates the potential energy impact of the recommendations.



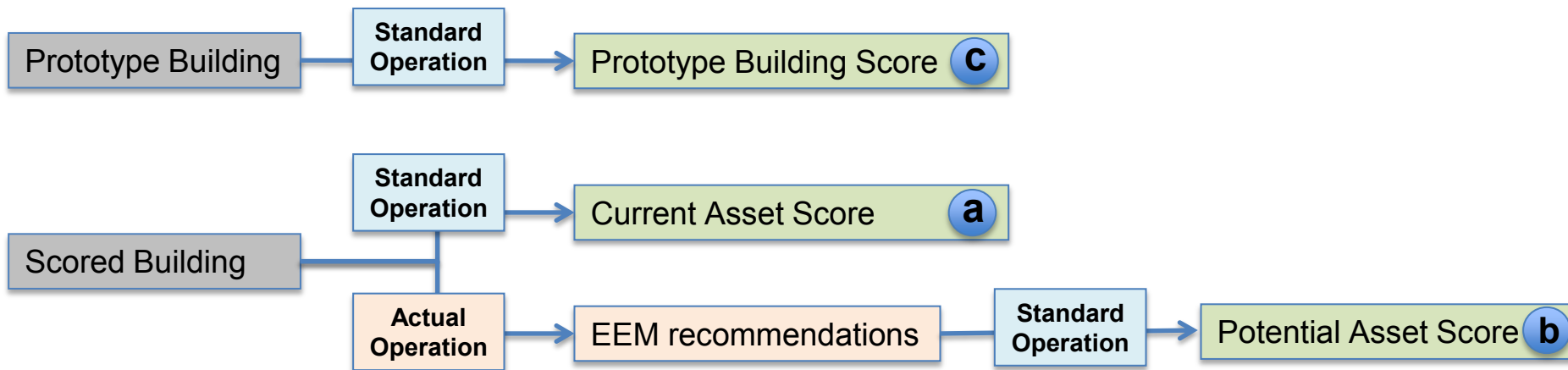
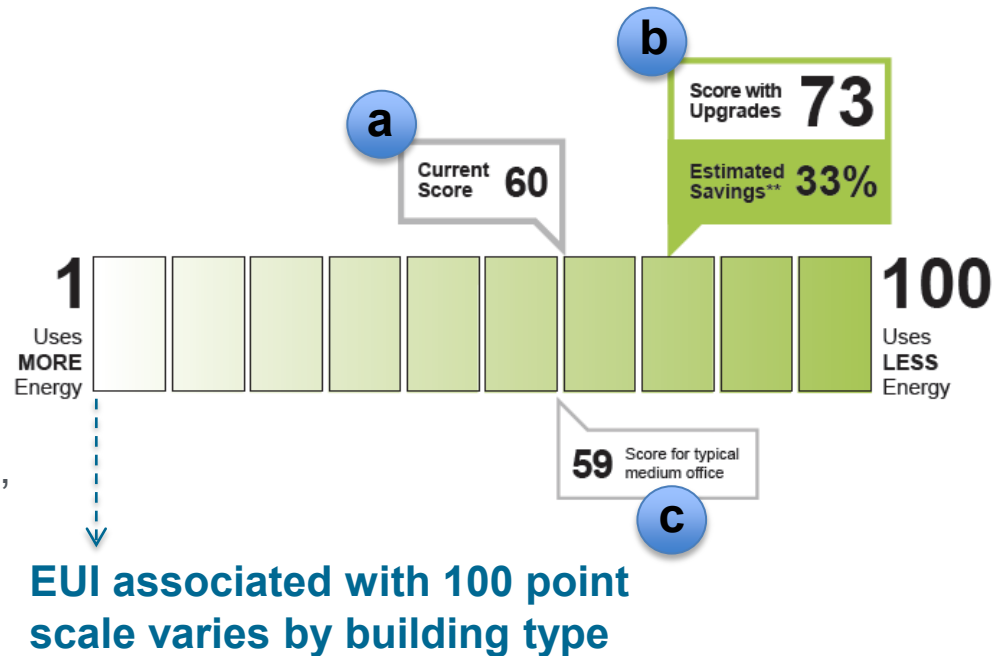
Energy Asset Score Report

- Report (four sections)
 - Score
 - Structure and Systems
 - Opportunities
 - Building Assets
- Appendices
 - How to read the report
 - Implementation guides



Building Score

- **Current Score of your building**
- **Potential Score of your building**
- **Score of Prototype Building**
 - For informational purposes only; not used as baseline to rate your building
 - Same use type
 - Same climate zone
 - Same size range (e.g. small, medium, large office buildings)
 - Compliant to ASHRAE 90.1-2004



- Rank building envelope, HVAC, lighting, and service hot water systems.
- Indicate system performance before and after upgrades.

ABOUT THE BUILDING ENVELOPE

	Current Building	With Upgrades	Reference Value ¹	Ranking ²	EEM Identified ³
Roof U-Value, Non-Attic (Btu/ft ² h °F)	0.056	0.033	0.027 - 0.065	Good	✓
Floor U-Value, Mass (Btu/ft ² h °F)	0.052	—	0.033 - 0.087	Good	
Walls U-Value, Framed (Btu/ft ² h °F)	0.077*	—	0.064 - 0.113	Good	
Windows U-Value (Btu/ft ² h °F)	0.68	0.30	0.35 - 0.67	Fair	✓
Walls + Windows U-Value (Btu/ft ² h °F)	0.38	0.19	0.13 - 0.30	Fair	
Window Solar Heat Gain Coefficient	0.60	—	0.40 - 0.49	Fair	

ABOUT THE BUILDING SYSTEMS

	Current Building	With Upgrades	Reference Value	Ranking	EEM Identified
Interior Lighting ⁴ (kBtu/ft ²)	50.40	30.00	21.99 - 38.74	Fair	✓
Heating ⁵	0.32	—	0.11 - 0.18	Superior	
Cooling ⁵	0.50*	1.10	0.46 - 1.32	Good	✓
Overall HVAC Systems ⁵	0.46	0.80	0.31 - 0.97	Good	
Hot Water ⁵	0.65	0.71	0.70 - 0.76	Fair	✓

- Inform building owners of most cost-effective efficiency opportunities.
- Applies life-cycle-cost analysis.
- Estimates are given for potential energy savings and payback time.

COST EFFECTIVE UPGRADE OPPORTUNITIES¹

Estimated Savings² Simple Payback

Building Envelope

- | | Estimated Savings ² | Simple Payback |
|---|--------------------------------|----------------|
| • Add roof insulation in Multi-Family Residential and Retail | 5 - 10% | 15 - 25 yrs |
| • Upgrade windows in Multi-Family Residential with high performance double pane windows | 5 - 10% | 10 - 15 yrs |

Interior Lighting

- | | | |
|--|----------|-------------|
| • Upgrade Incandescent lighting in Multi-Family Residential and Retail to compact fluorescent lighting | 10 - 15% | 1.5 - 5 yrs |
|--|----------|-------------|

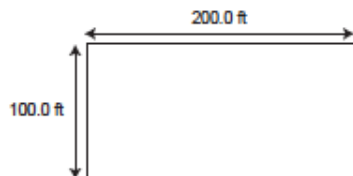
HVAC Systems

- | | | |
|--|---------|------------|
| • Upgrade cooling system in Multi-Family Residential and Retail with high efficiency electric DX | 10 -15% | 5 - 10 yrs |
|--|---------|------------|

BUILDING SYSTEM CHARACTERISTICS SUMMARY

Geometry

Above Ground: 5 floor
 Below Ground: 0 floor
 Floor-to-Floor Height: 12.0ft
 No Drop Ceiling
 Floor-to-Ceiling Height: 9.0ft
 Orientation: 0.0° from North



Energy Code
Requirements
(ASHRAE 90.1-2010)

Construction

Roof

Roof Type: Built-up/EPDM w/metal deck
 Roof R-Value: R-18 R-26

Wall

Exterior Wall Type: Brick/Stone on steel frame
 Wall R-Value: R-13 (estimated) R-13 + R-5.6 c.i.

Floor

Ground Coupling: Slab
 No Carpet

Windows

Window frame type: Metal
 Glass type: single pane
 Gas Fill type: None
 Non-Operable
 Window Layout: Discrete
 Window to Wall Ratio: 0.4
 Number of Windows:
 Width:

Energy Code
Requirements
(ASHRAE 90.1-2010)

Wall

Height: [blank]
 Window U-Value: 0.57 U-0.55
 Window SHGC: 0.8
 Window VT: 0.7 [Estimated]

Shading

Exterior Shading Type: External Overhang
 Height Above Window: 0 ft
 Projection: 2 ft

Skylight

No Skylight

Indoor Lighting

Lighting Type: Fluorescent T8
 Mounting Type: Recessed
 Number of Fixture:
 Percent of Total Floor Area Served: 100%
 Occupancy Controls: Yes
 Daylighting Controls: No
 EMCS/Timer: No
 Lighting Power Density: 1.1 W/ft² (Estimated) 0.9 W/ft²

Relationship to Portfolio Manager

ENERGY STAR Portfolio Manager provides Statement of Energy Performance, including

- Benchmark Score (statistical ranking)
 - 70 means your building ranks in the 70th percentile of similar buildings in terms of utility usage
- Based on actual utility bills and current operations
- 100 point scale based on regression developed using CBECs data

Energy asset rating provides a standard report including

- Current score and potential score
 - Buildings with the same current score may have different potential scores.
- Uses EnergyPlus model to predict EUI given standard set of operating assumptions
- Scale still under development
 - Adjusted for climate to allow comparison across U.S.
 - Adjusted for building type

STATEMENT OF ENERGY PERFORMANCE
Office Sample Facility

Building ID: 273334
For 12-month Period Ending: September 30, 2011
Date SEP becomes effective: January 28, 2012

Year Built: 2000
Gross Floor Area (ft²): 222,452

Energy Performance Rating: (1-100) 70

Site Energy Use Summary
Electricity (kWh): 716,000
Natural Gas (MMBtu): 16,000

Energy Intensity*
Site (kBtu/ft²): 3.1
Source (kBtu/ft²): 3.1

Emissions (based on site energy)
Greenhouse Gas Emissions (MMCO₂e): 16,000

Electric Distribution Utility
Virginia Electric & Power (Dominion Resources)

National Weather Center
National Weather Service
National Weather Service
National Weather Service
Building Type: Office

Professional Engineer Stamp
Signature: _____
Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this Statement is accurate and is consistent with the Licensed Professional's duties.

Professional Engineer
License Number: 000001
State: VA
John Doe
325 Old Sande Lane
Arlington, VA 22201
056-050-0124

Tracking Number: SEP211400000102470

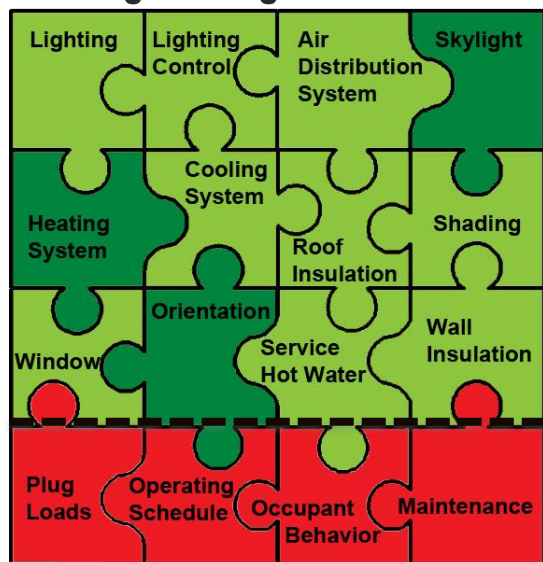
Asset Score

- No requirement for utility bills
- Not comparing to CBECs or other building database
- Allows comparison of buildings given standard assumed operation

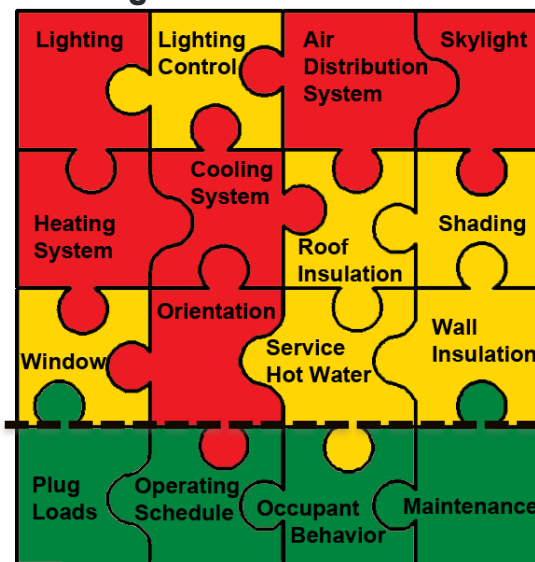
Relevance of Asset Score

- Buildings #1 and #2 have similar ENERGY STAR scores, but widely divergent asset scores.
- Used together, an energy asset score and an energy benchmark can inform the decisions of a building owner, operator, buyer, or lessee.

Building #1: High Asset Score



Building #2: Low Asset Score




Equivalent
ENERGY STAR
Portfolio
Manager
Score

Energy Assets
O&M/
Occupant Behavior

- **Good energy assets**
- **Poor operation**
- **May be a candidate for low-cost operational improvements.**

- **Poor energy assets**
- **Good operation**
- **Low asset score may highlight need to replace outdated equipment or prepare for replacement costs in the near future.**

- Users can enter varying amounts of data and receive results of varying degrees of specificity for their building.



Verified	<ul style="list-style-type: none">• Detailed inputs with validation by qualified party	<ul style="list-style-type: none">• Requires a qualified professional to verify and submit the data• Suitable for making public statements about building asset
Advanced	<ul style="list-style-type: none">• More detailed input set	<ul style="list-style-type: none">• Users provide data for as many of the additional fields as they choose
Simple	<ul style="list-style-type: none">• Basic minimum data needed	<ul style="list-style-type: none">• Required to generate score and report• Inference engine generates default values for a few fields

Type of Report Generated

Simple Level

- Step 1** Collect & input data using energy asset scoring tool
- Step 2** Submit data online
- Step 3** System infers values that user leaves blank
- Step 4** Receive **preliminary** energy asset score report

Verified Level (still under development)

- Will require **greater amount of data** as well as **verification by a qualified professional**
- Submit data online
- Limited** inferences allowed.
- Receive **verified** energy asset score report

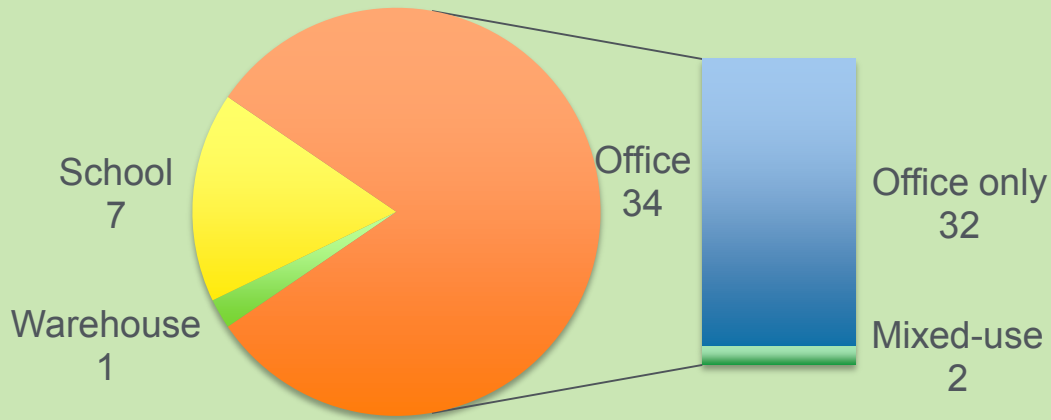
For building owner or operator's information



For appraisal, real estate transaction, or public display



Building Types



- **Scored 42 buildings**
 - Office buildings, schools, and a non-refrigerated warehouse
- **User feedback**
 - 33 responded to pre-rating questionnaire covering 55 buildings
 - 14 responded to post-rating questionnaire covering 27 buildings

Pilot #1 considered following aspects of the asset scoring system and tool:

- Data Collection Experience
 - Ease of use
 - Reliability of data
- Usefulness of Score Report
 - Usefulness of upgrade recommendations
 - How does the asset score complement or relate to ENERGY STAR Portfolio Manager score?

- **Evaluate tool application to new building types**
 - Most commercial building types can be modeled using the asset scoring tool.
 - Mixed use, lodging, library, multifamily, court house, other
 - Exception: Buildings with commercial refrigeration.
 - This feature will be added in next version of the tool.
- **Simple vs. Advanced Score**
 - How long does it take to complete the different levels of score (given latest requirements)?
 - How much do the time requirements vary depending on the type or complexity of building?
 - What is perceived as reasonable time needed to produce Simple score?
Advanced score?

- **Pilot #2 Summer 2013**
 - **Participate in the pilot** by scoring your building(s) and providing feedback for program development.
 - All buildings from Pilot #1 will automatically be rescored in Summer 2013 using latest version of the scoring tool and latest report.

- **Join our mailing list to hear about program offerings**

- **Please email us at asset.score@ee.doe.gov for more information.**
- Webinars, opportunities to review program materials, etc.

- **Energy Asset Score website**
<http://www1.eere.energy.gov/buildings/commercial/assetscore.html>
- **Energy Asset Scoring Tool**
buildingenergyscore.energy.gov/

