



**Better  
Buildings**  
U.S. DEPARTMENT OF ENERGY

**Using Whole Building Data for Decision-Making:  
The Real-World Experiences of Public and Private  
Building Owners**



U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy



# Using Whole Building Data for Decision-Making

May 2014

**Elena Alschuler**

[Elena.alschuler@ee.doe.gov](mailto:Elena.alschuler@ee.doe.gov)

Building Technologies Program

U.S. Department of Energy

# DOE's Vision for Performance-Based Approaches

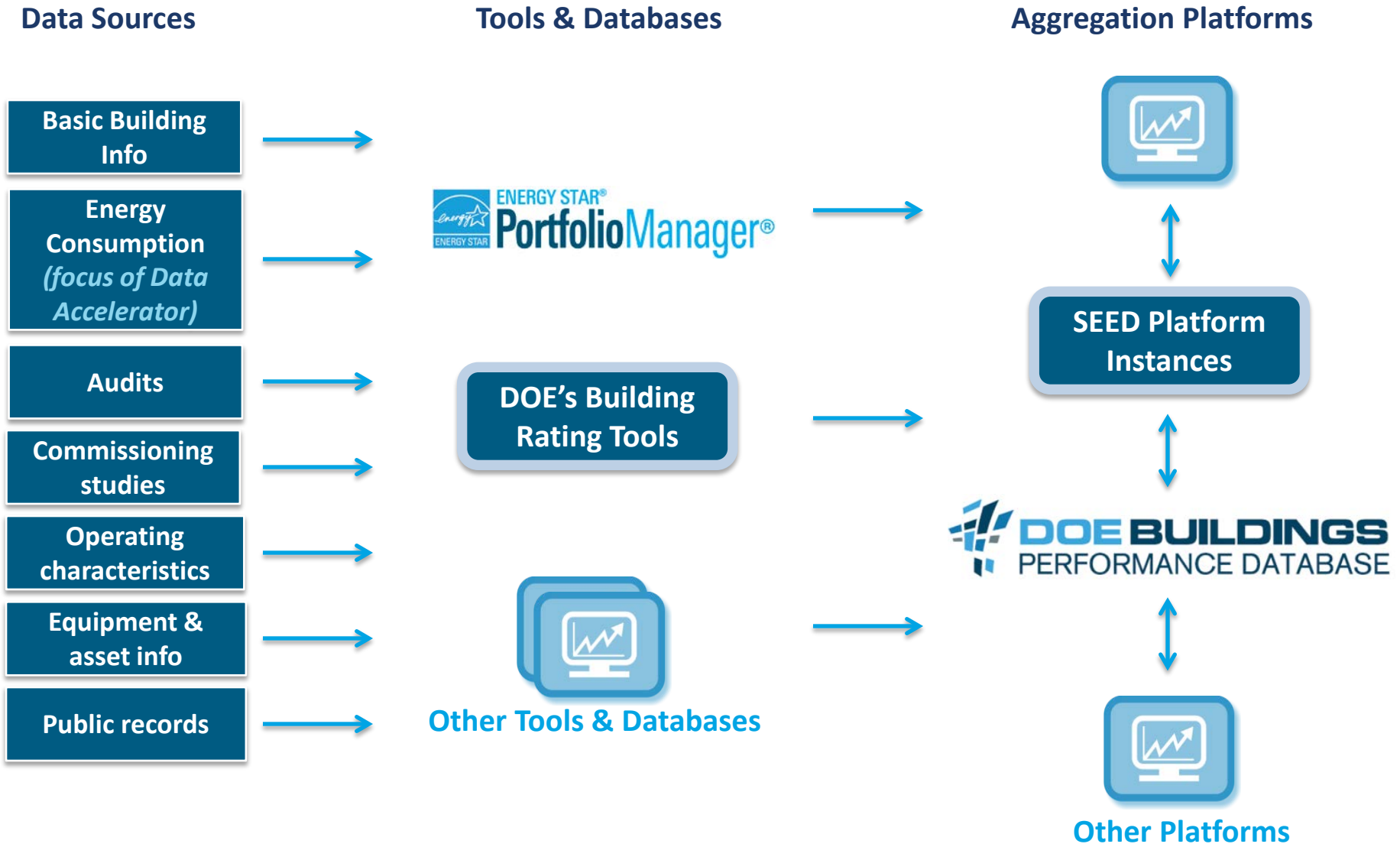
**By making building energy performance clearly traceable:**

- **Owners, operators, and product and service providers** can understand the drivers of variations in building performance, identify efficiency investment opportunities, and project the likely savings from investments.
- **Public sector actors** can tailor the design and implementation of energy efficiency programs and policies to be most effective given local market conditions and trends.

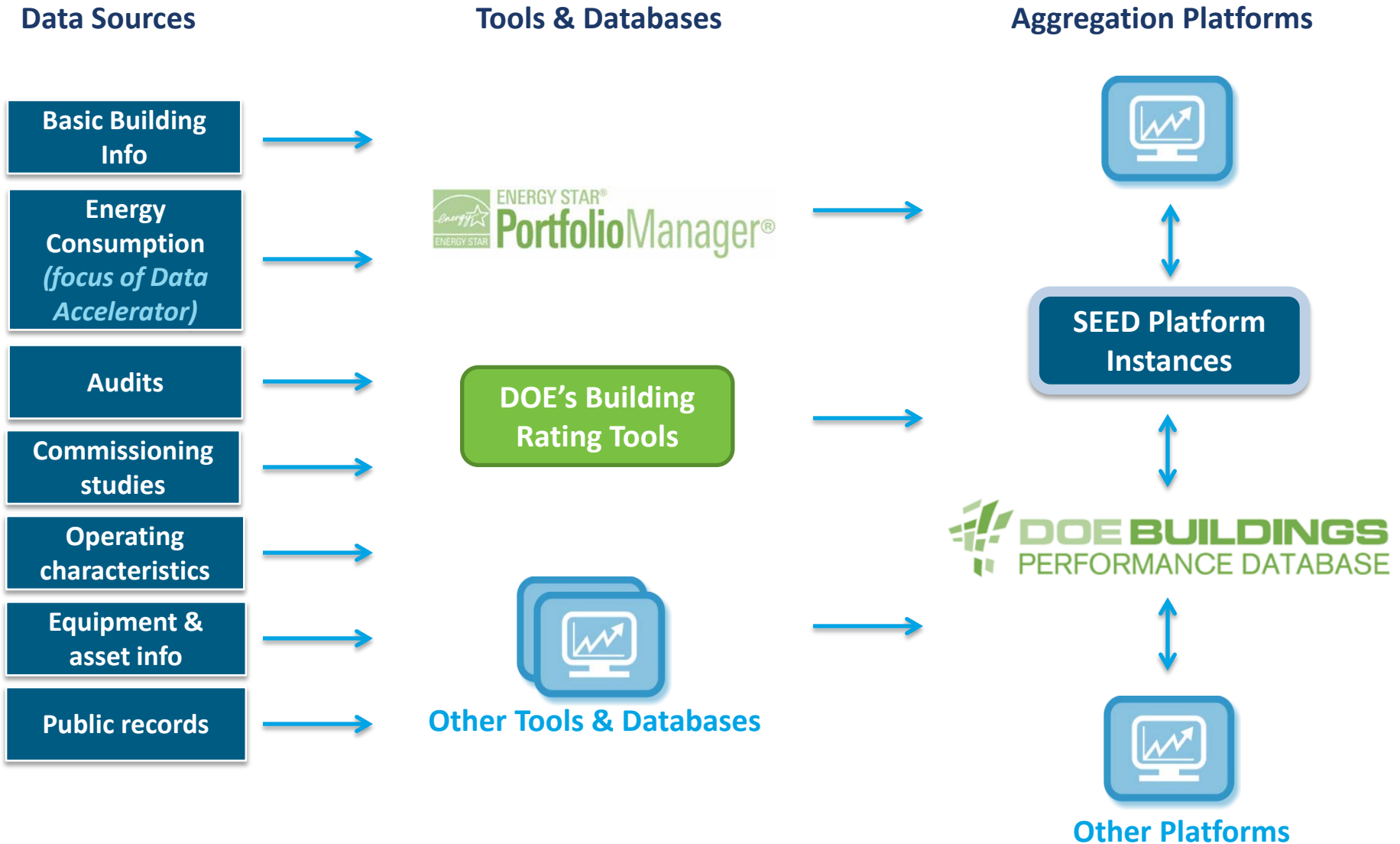
**DOE is establishing a foundation that the private sector can build on, through:**

- **Tools and methods** to analyze actual performance, and
- Standard **definitions and data exchange specifications**

# Complementary & Interoperable Tools



# Complementary & Interoperable Tools



# ENERGY STAR Portfolio Manager

Tracks building energy and water consumption, and provides a weather normalized EUI and a whole building score, based on actual energy performance.

The screenshot displays the ENERGY STAR Portfolio Manager interface for a property named "Example Office". The interface is divided into several sections:

- Header:** "MyPortfolio" with tabs for "Sharing", "Planning", "Reporting", and "Recognition".
- Property Information:**
  - Address: 1100 Lee Hwy, Fairfax, VA 22031 | [Map It](#) EXISTING
  - Portfolio Manager Property ID: 5000074 | Primarily: [Office](#)
  - Year Built: 1987 EXISTING
- Weather-Normalized Source EUI:**
  - Current EUI: [N/A](#)
  - Baseline EUI: [N/A](#)
- Summary Tab:**
  - Basic Information:** Construction Status: EXISTING; Federal Property: Empty; [Service & Product Finder](#); [Edit](#)
  - Unique Identifiers (IDs):** Portfolio Manager ID: 5000074; Standard ID's: None; Custom ID's: None. Note: "You can define custom unique IDs for your property so that you can cross reference your property in other systems or select from standard IDs to include."
  - Notifications:** "You have no new notifications."
  - My Properties (5):** Filter by: "View All Properties (5)"; [Create Group](#) | [Manage Groups](#). List includes: [Federal Building](#), [Higher Campus](#), [Hill Store](#), [Insurance Office](#), [Sunnyside Elementary](#).
  - Properties (5):** [Add a Property](#)
  - Source EUI Trend:** Line graph showing EUI from 2002 to 2012. Values range from approximately 200 to 900.
  - Total GHG Emissions Trend:** Line graph showing GHG emissions from 2002 to 2012. Values range from 0k to 40k.
  - This Property's Overall Use:** [View as Diagram](#); [Add Another Type of Use](#). Table:
 

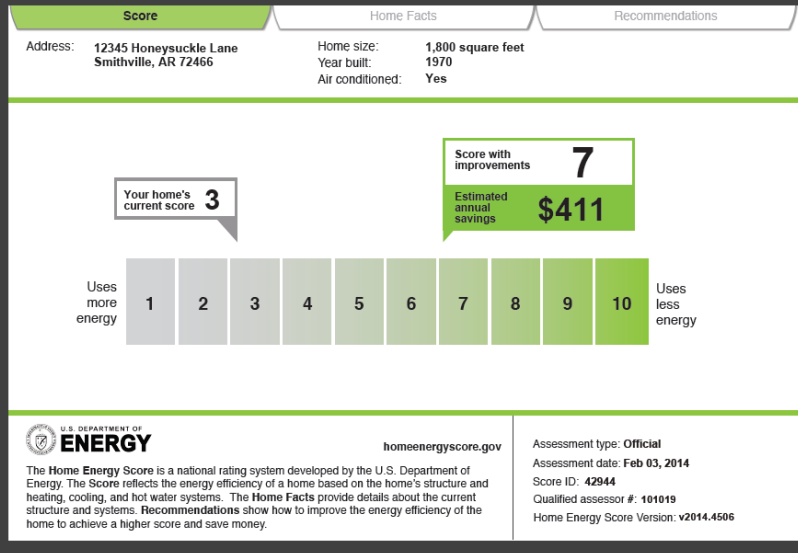
Name	Function	Gross Floor Area	Action
Vacant Space	Office	10000	I want to...
Building Use	Office	100000	Correct Mistakes
  - Gross Floor Area Comparison:** Bar chart comparing "Use Total GFA" (dark blue, 110,000) and "Property GFA" (light green, 100,000). Note: "The total of the Gross Floor Area for your uses does not equal the Gross Floor Area for your property. [Learn more](#)."
  - Helpful Tip:** "If you're a pro, you may want to [upload and/or update multiple properties](#) at once using an Excel spreadsheet. This can be done to create new properties, add use details, create meters and add meter consumption data."



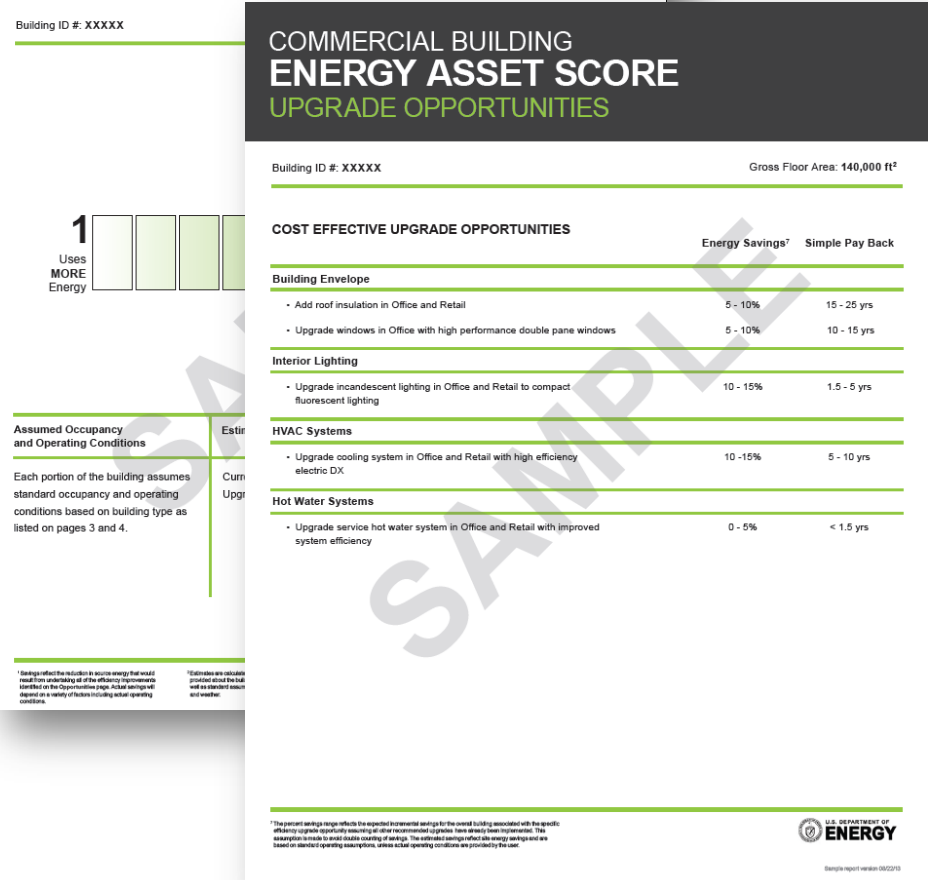
# Commercial Building Energy Asset Score & Home Energy Score

DOE developed these tools to **encourage investment in energy efficiency**, **inform real estate transactions** by allowing “apples to apples” comparisons, and **reduce energy use** in commercial and residential buildings.

## Home Energy Score



## COMMERCIAL BUILDING ENERGY ASSET SCORE OVERALL BUILDING SCORE



# Commercial Building Energy Asset Score

**Complements Portfolio Manager and provides a consistent platform for:**

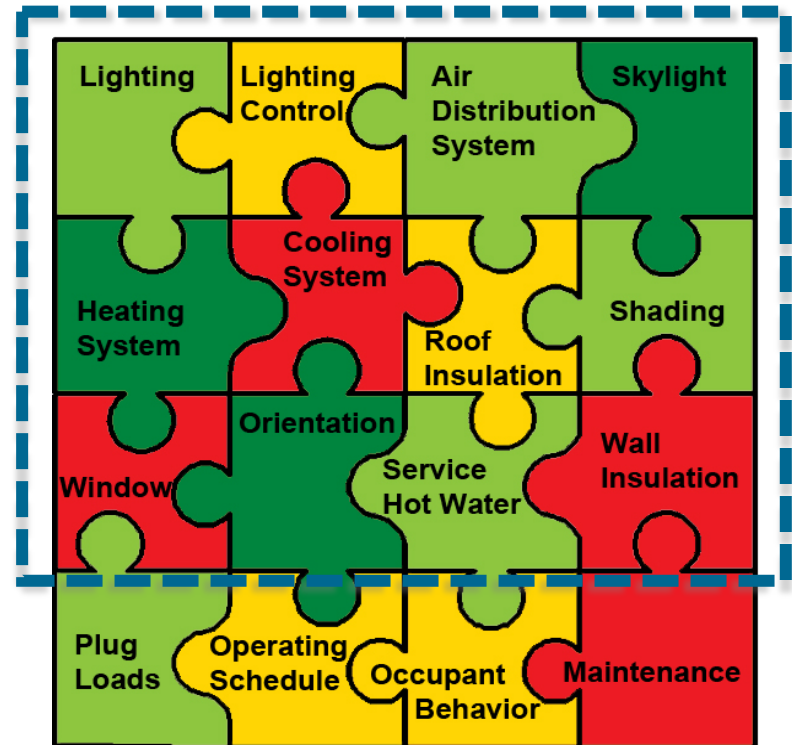
- Evaluating the inherent energy performance of buildings' physical characteristics while controlling for building operation and tenant behavior
- Identifying energy efficiency upgrade opportunities

**Pilot tested with users across the country in 2012 and 2013**

**Public release in summer/fall 2014**

**Adding new building types like commercial refrigeration in 2015**

## Asset Score

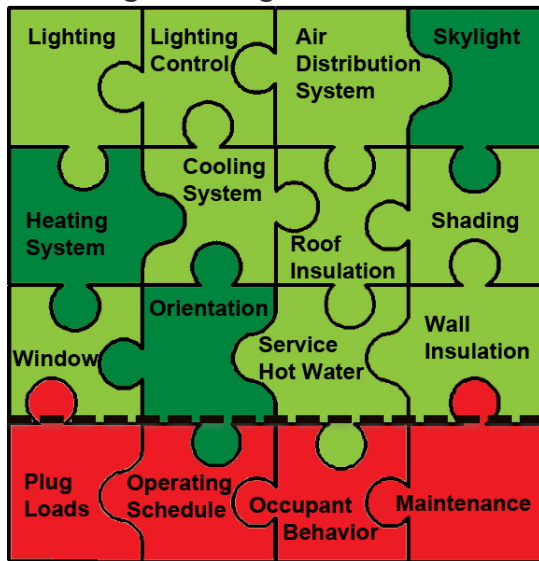




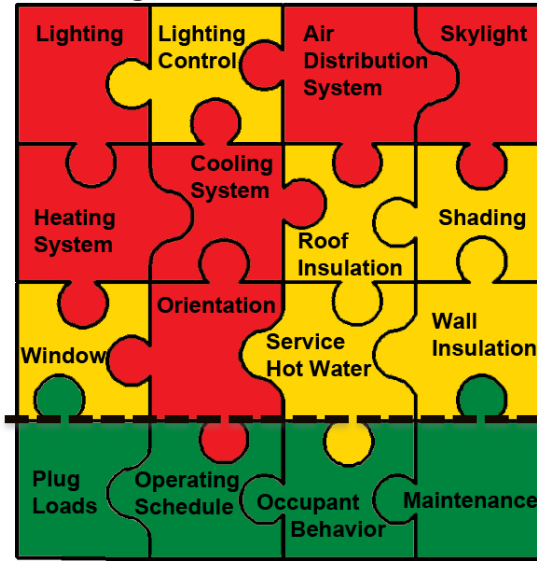
# Relevance of Asset Score

- 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.**

# Asset Scoring Tool

## Free online tool

- Requires limited number of user inputs
- Runs real-time energy simulation
- Identifies upgrade opportunities tailored to individual buildings



## Tool can be used to score a variety of building types

- Office, school, retail, warehouse, lodging, multifamily, library, courthouse, senior center, mixed use
- Additional building types will be available in 2014/2015 (e.g., buildings with commercial refrigeration)

## Score is based on building envelope and major energy systems (heating, cooling, hot water, lighting)

- Applies standard operating assumptions to allow “apples to apples” comparison of buildings

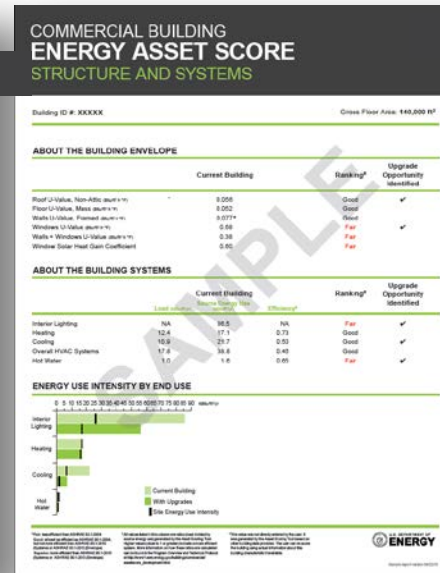
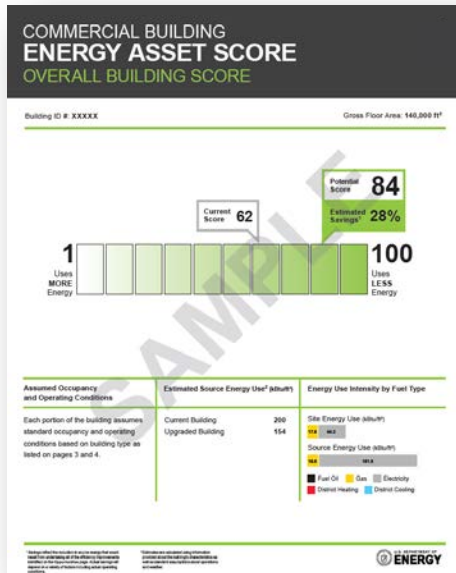
# Asset Score Report

## Four sections

- Score
- Upgrade Opportunities
- Structure and Systems
- Building Assets

## Additional Guides Available

- Report Guide: Understanding Your Score
- Building Upgrade Guide: Next Steps for Improving Your Building

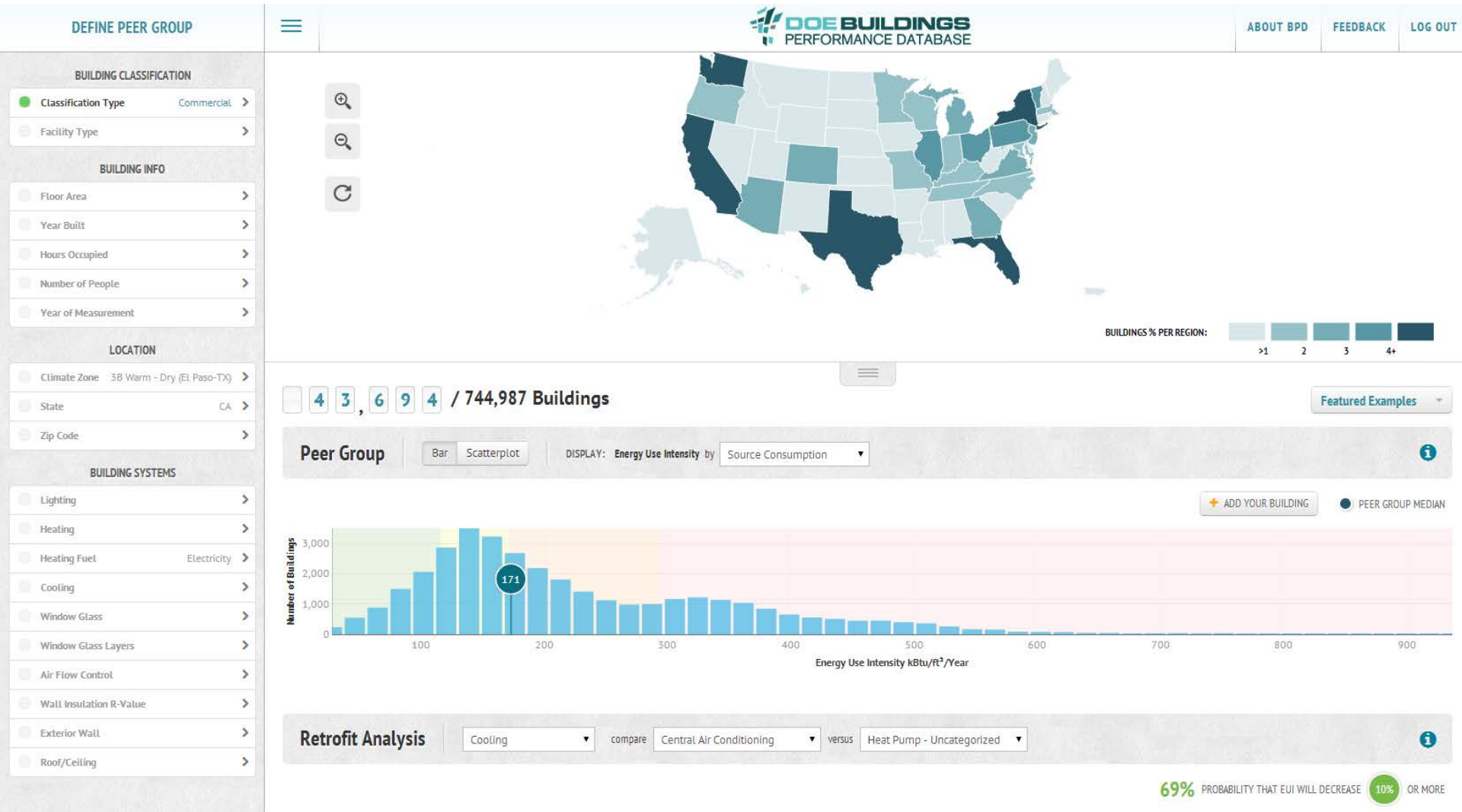


# Asset Score: Potential End Uses

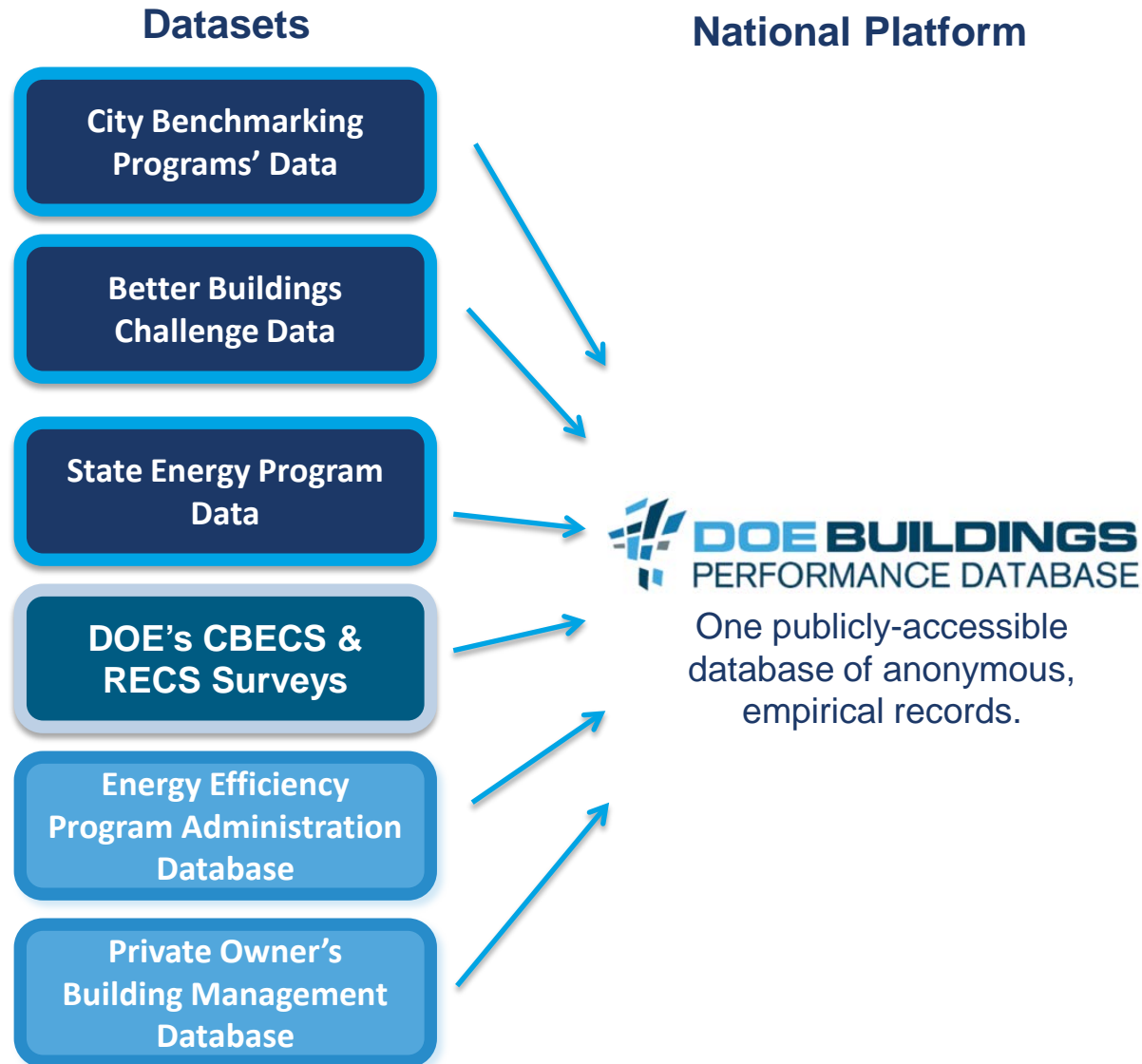
- **Low-cost method to identify potential energy efficiency improvements**
- **Screening and data collection tool**
  - Look across multiple buildings to determine where to focus investments
  - Data collection tool to inform program design
- **Inform real estate transactions**
  - Inform purchase and leasing decisions
- **Compliance with disclosure policies and other requirements**
  - “Lite” Phase II Audit to be paired with state and local disclosure requirements
  - Assist Federal agencies in meeting legislative and executive order requirements

# The Buildings Performance Database

The BPD statistically analyzes trends in the energy performance and physical & operational characteristics of real commercial and residential buildings.



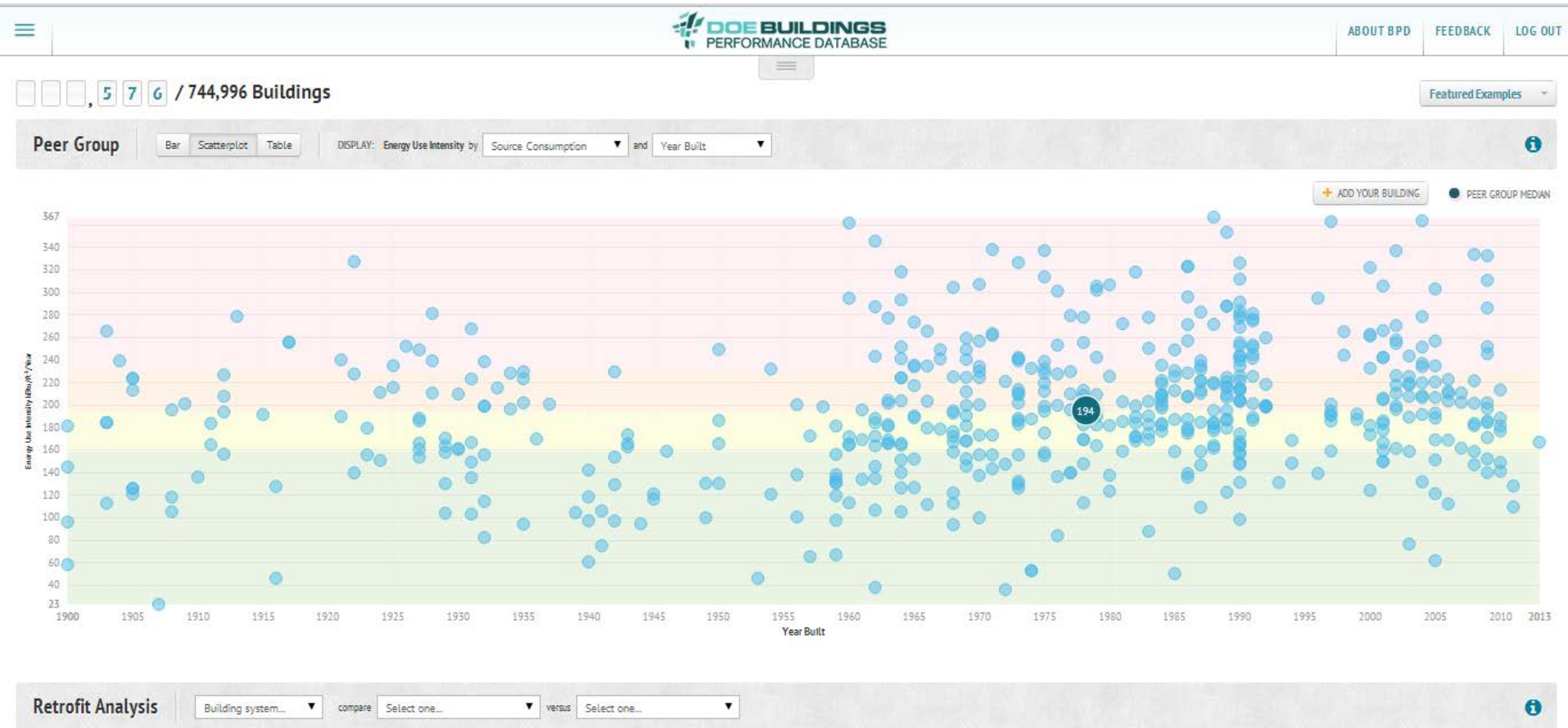
# The BPD aggregates data from many tools & databases





# Peer Group Tool

## Office Buildings <1M SF, built since 1900 Source Consumption by Year Built



# Retrofit Analysis Tool: *Cooling in California Big Box Retail*

CA Retail Buildings >50,000 SF

Compare Packaged Direct Expansion to Air Source Heat Pump

540 / 744,987 Buildings

Featured Examples

Peer Group

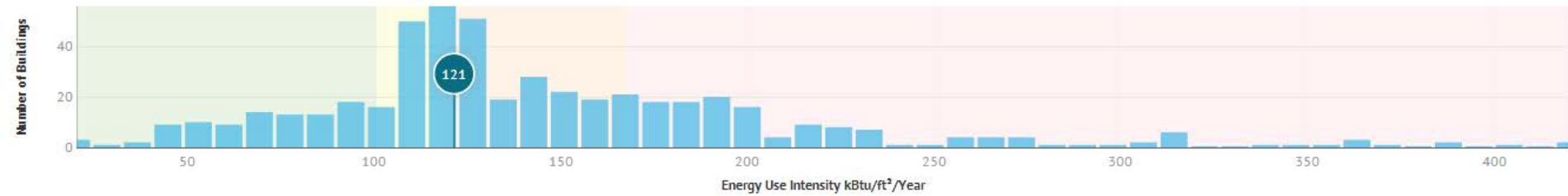
Bar Scatterplot

DISPLAY: Energy Use Intensity by Source Consumption

i

+ ADD YOUR BUILDING

PEER GROUP MEDIAN



Retrofit Analysis

Cooling

compare

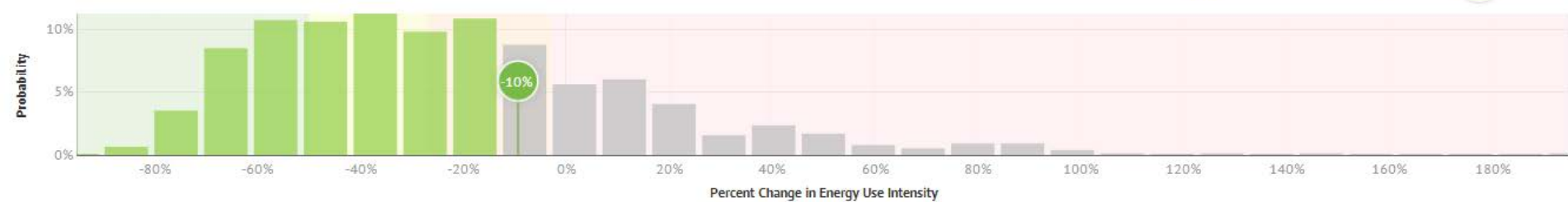
Packaged Direct Expansion

versus

Heat Pump - Air Source

i

66% PROBABILITY THAT EUI WILL DECREASE 10% OR MORE





# New Mexico is WISE

Erica R. Velarde  
Mechanical Engineer  
Energy, Minerals and Natural Resources Department  
Energy Conservation and Management Division

*(Signature)*

# What is WISE?

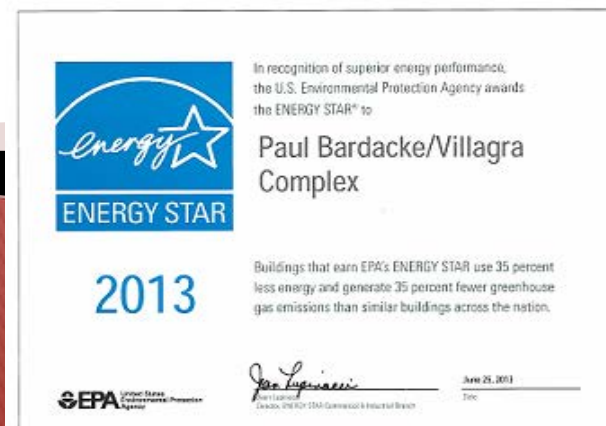
**W** hole-Building

**I** nvestments

for

**S**ustainable

**E**fficiency





# WISE Showcase Project – Simms



Simms – 60,768 ft<sup>2</sup>

GEOMETRY

2 floors

Potential Score **39**

Current Score **38**

1  
Uses  
MORE  
Energy



100  
Uses  
LESS  
Energy



# WISE Showcase Project – Montoya



Montoya – 133,104 ft<sup>2</sup>

GEOMETRY

3 floors

Potential Score **76**

Current Score **49**

1  
Uses  
MORE  
Energy

100  
Uses  
LESS  
Energy

Building Name: Montoya Copy

Gross Floor Area: 133,104 ft<sup>2</sup>

Potential Score **93**

Current Score **93**

1  
Uses  
MORE  
Energy

100  
Uses  
LESS  
Energy



# WISE Showcase Project – Runnels



Runnels – 175,692 ft<sup>2</sup>

GEOMETRY

Potential Score **90**

4 floors

Current Score **75**

1  
Uses  
MORE  
Energy



100  
Uses  
LESS  
Energy



# Rebate Readiness



## Retro-commissioning

### **Savings Rebate**

#### Customer Eligibility

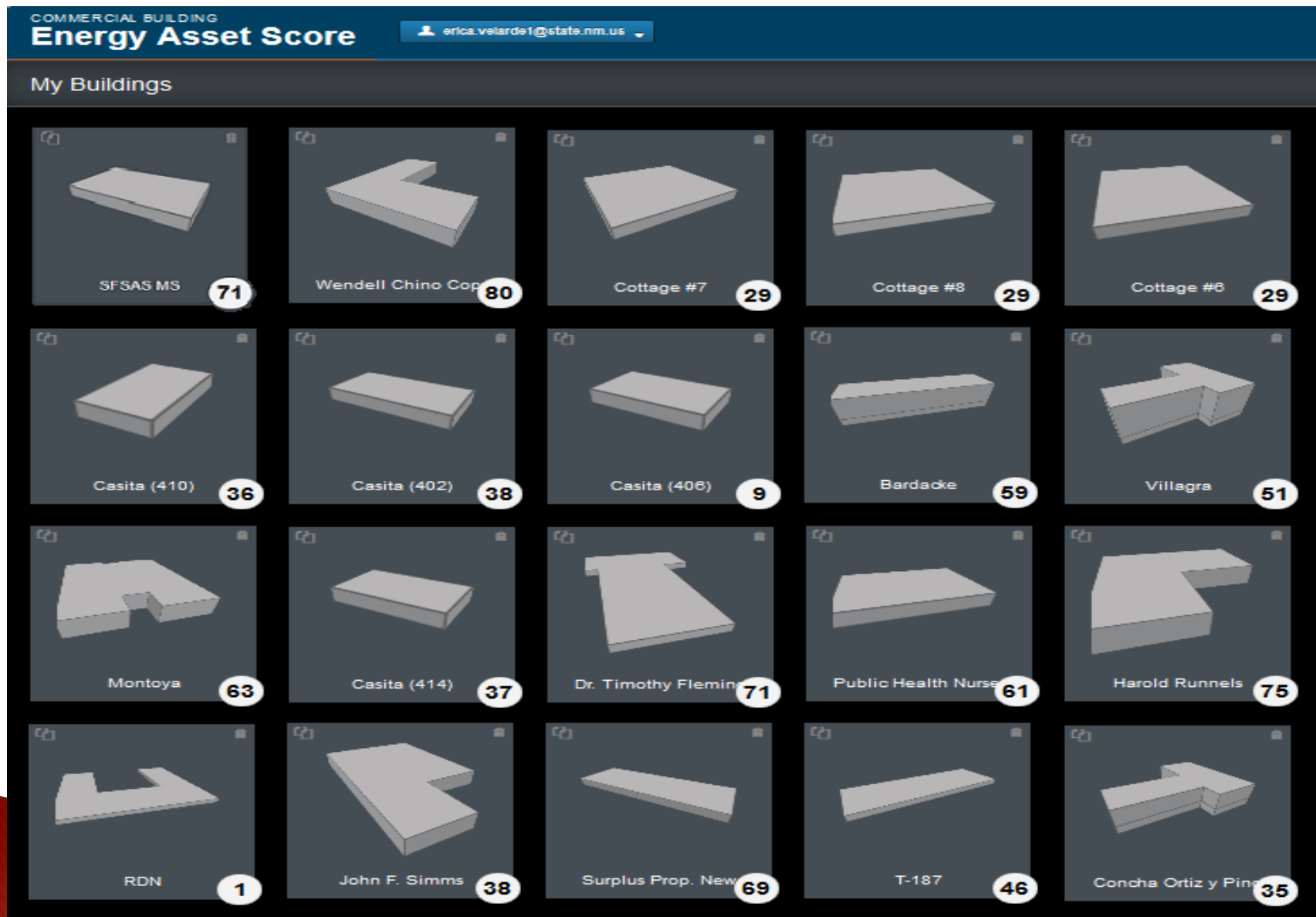
##### **RCx Tier 1**

- 1) Provide PNM program team with an Energy Star Portfolio Manager benchmarking report

##### **RCx Tier 2 pre-application**

- 4b) Provide PNM program team with an Energy Star Portfolio Manager benchmarking report

# Scored Buildings





# Wendell Chino



Wendell Chino – 73,257 ft<sup>2</sup>

GEOMETRY

Potential Score **90**

3 floors

Current Score **80**

1  
Uses  
MORE  
Energy

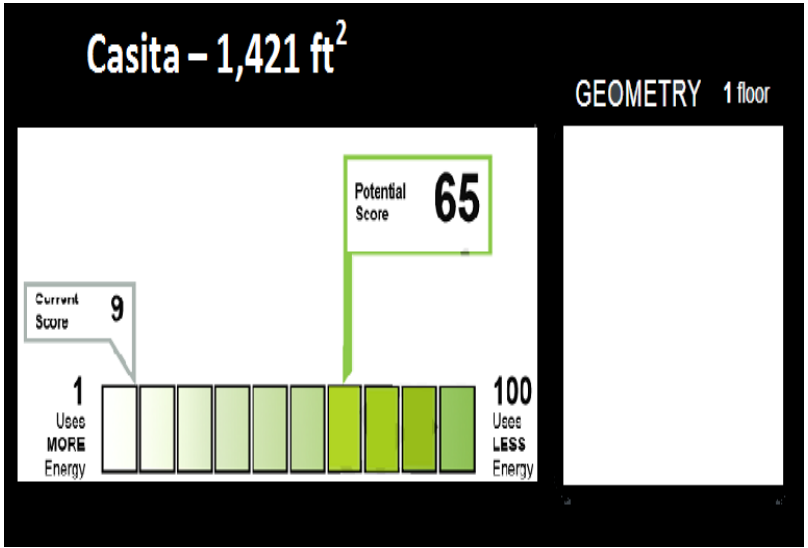


100  
Uses  
LESS  
Energy





# Casita





# Educating for the Future



Santa Fe School for Arts and Sciences – 3,563 ft<sup>2</sup>

USE TYPE  
Education

Potential Score **84**

Current Score **71**

1  
Uses  
MORE  
Energy



100  
Uses  
LESS  
Energy

GEOMETRY





# Going Forward

**20% energy  
reduction in  
500 state  
owned  
buildings by  
2020!**



# THANK YOU



NEW MEXICO ENERGY CONSERVATION  
AND MANAGEMENT DIVISION

[www.CleanEnergyNM.org](http://www.CleanEnergyNM.org)

*Your Source for Energy Efficiency  
and Clean Energy Information*

[www.CleanEnergyNM.org](http://www.CleanEnergyNM.org)



LIBERTY  
PROPERTY  
TRUST

# Whole Building Data for Decision Making

Marla Thalheimer, LEED AP ID+C  
Director of Sustainability





## Who We Are

- \$8 billion publicly-traded office and industrial REIT
- 103 million square feet across the U.S. and the U.K.
- A key corporate strategy to be a leader in sustainability and “High Performance” Buildings
- 69 LEED Projects Completed or Under Construction
  - 16+ million square feet
  - \$2+ billion invested in sustainable development



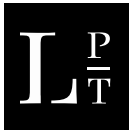
STOP! Copyright protected. Don Pease Photographers, Inc. All rights reserved.  
www.donpeasephotographers.com

# Progress Over Time

<u>Energy Goal Tracking - Same Store</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>Dec-13</u>
Energy reduction over 2008 baseline	0	-5.1%	-12.3%	-20.2%	-27.0%	-33.2%
Portfolio average	50	54	59	67	74	<b>74</b>
Source Energy Use - Adjusted to Current Year (kBtu)	2,066,908,994	1,960,857,674	1,813,361,621	1,648,378,157	1,508,858,745	1,381,064,966
Energy Star Certifications; Same Store	0	4	29	38	44	<b>52</b>
Energy Star Certifications; Current Portfolio	6	11	50	66	89	<b>92</b>
Energy Star Certifications; Including Sold Buildings	6	15	64	84	106	<b>118</b>
Gross Square Feet	<b>652,288</b>	<b>1,146,739</b>	<b>7,577,841</b>	<b>11,143,806</b>	<b>14,522,634</b>	<b>15,791,765</b>
Energy Reduction and Portfolio Average based off of average of 68 buildings consistently tracked since 2008 (vacant building excluded)						

- Benchmark 100% of managed buildings
- Improved progress year over year
- Estimated over \$5M in savings





# Portfolio Breakdown

## Managed portfolio

multi-tenant office = ~130 bldgs



## NNN Portfolio

Single Tenant Office & Industrial = ~700 bldgs



**“But what about the rest of the portfolio?”**



## Liberty Energy Efficiency Partnership (LEEP)



- Tenant shares energy data – we benchmark for them and share info
  - 71 Tenant partners to date
  - 16 ENERGY STAR labeled warehouses
- Challenges
  - Generating interest
  - Skeptical of why we care
  - Data access issues
- Opportunities
  - Strengthen tenant relationships
  - Educate them on the value of benchmarking
  - Help them save energy and money
  - Keep them in our buildings!



## COMMERCIAL BUILDING ENERGY ASSET SCORE SUMMARY

### DOE Asset Scoring Tool

- Possible utilization for “the rest of the portfolio”
- Understanding of the efficiency without tenant usage data
- Overlay with ESPM where possible
- Challenges
  - Understanding the scoring (related to ESPM)
  - Obtaining valuable recommendations
  - Growing the datasets
- Opportunities
  - Helping us gather important attribute information
  - Eventually rank the entire portfolio for better asset management

## Warehouse in North Carolina

- 341,000 SF non-refrigerated warehouse
- Build in 2007
- LEED Silver



### BUILDING ASSET SCORE

Current Score

77

Potential Score

80

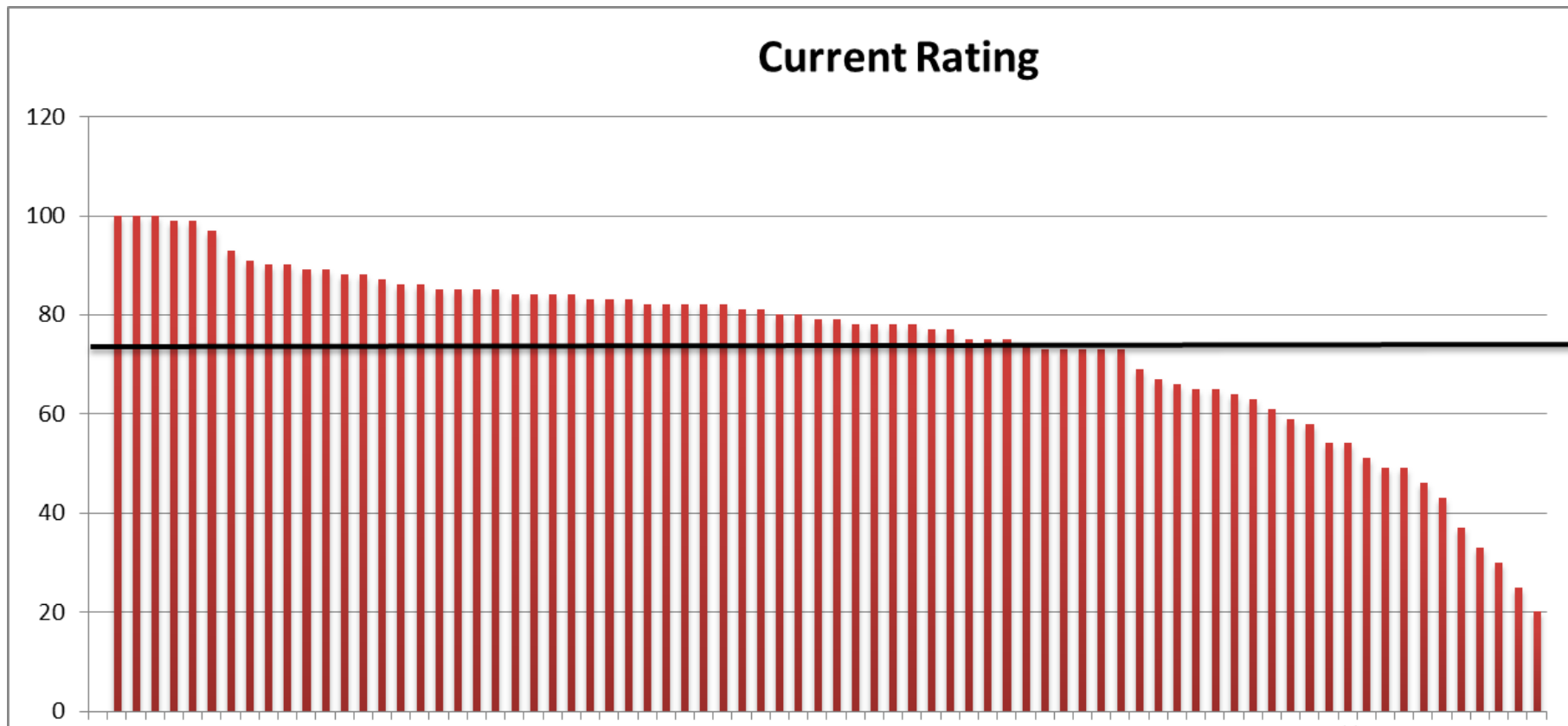
### ENERGY STAR Score (1-100)

Current Score: 73

Baseline Score: 83

**BPD**

## Managing What You Measure



**Illinois Program Effort  
under USDOE Grant DE-EE0005859**

**“Enhancing Energy Efficiency in the  
Illinois Public Sector through  
Holistic Retrofits Strategies and  
Targeted Educational Efforts”**



**Illinois  
Department of Commerce  
& Economic Opportunity**  
Pat Quinn, Governor

# Illinois Implementation Model

## Goal:

Meet the state's goal of a 20% improvement in public sector energy efficiency by 2020 through enhanced marketing of the Illinois Energy Now Program.

## Barrier:

The major obstacle to this goal is overcoming lack of organizational buy-in in the public sector for energy efficiency investments in public facilities.

## Solution:

Revise the marketing and technical assistance approach of the state incentive program to increase implementation of energy efficiency projects by public-sector clients.



Illinois  
Department of Commerce  
& Economic Opportunity  
Pat Quinn, Governor



# Illinois Implementation Model Strategies

The project team is overcoming barriers and achieving our savings goals by:

- Completing the Public Sector Energy Efficiency Potential Study utilizing completed surveys from 900 public sector clients. The survey was used as documentation in developing a three year extension of the Illinois Energy Now Program effort approved by the Illinois Commerce Commission.
- Aggressively expanding the Trade Ally Program. To date we have over 350 active Trade Ally members.



Illinois  
Department of Commerce  
& Economic Opportunity  
Pat Quinn, Governor

# Illinois Implementation Model Strategies (continued)

- Improving pre- and post- assessment assistance to public clients by developing new systems for energy data collection (USDOE Energy Asset Scoring Tool).
- Developing and promoting showcase projects.
- Increasing the marketing of the Illinois Energy Now Program through energy education events such as Trade Ally rallies, meetings, technical webinars, seminars, and conferences.



Illinois  
Department of Commerce  
& Economic Opportunity  
Pat Quinn, Governor

# Current Success and Continuing Progress.

- Have over 350 Active Trade Ally Partners promoting the Illinois Energy Now Program and developing energy saving projects.
- Added 30 public sector buildings into the USDOE Energy Asset Scoring Tool and USEPA Portfolio Manager.
- Completed six major Public Sector/Trade Ally Rallies with a total attendance of over 1200 participants. Completing 12 webinars and seminars with over 1400 additional participants.
- Developed an ongoing and active relationship with the Illinois Association of Park Districts, IGEN, Illinois Dept. of Corrections, and the Illinois Library Association to promote energy efficiency programs and projects.
- Approval by the Illinois Commerce Commission for the next three year Illinois Energy Now Program.
- Expanding Efforts to Incorporate the EPA Portfolio Manager and the USDOE Asset Scoring Tool into the Program.



# USEPA Portfolio Manager and USDOE's Commercial Building Asset Scoring Tool Pilot Efforts

A pilot effort with USDOE to:

- Assess the feasibility of the tools for targeting public sector buildings.
- Assess the ability of program clients to utilize the tools.
- Incorporate the tools as part of data management for the Illinois Energy Now Program.



Illinois  
Department of Commerce  
& Economic Opportunity  
Pat Quinn, Governor

# Progress To Date

Thus far, Program Staff have worked with USDOE to:

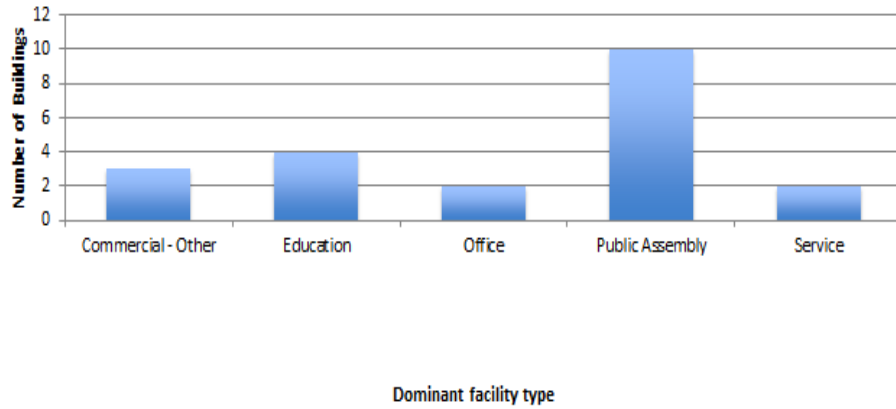
- Enter building data for 37 Illinois Public Sector Buildings into Portfolio Manager and the Energy Asset Tool.
- Coordinate the data entry and work to modify data existing entries to ensure accuracy and usable outputs.
- Examine the results to determine best future usage of the Tools.



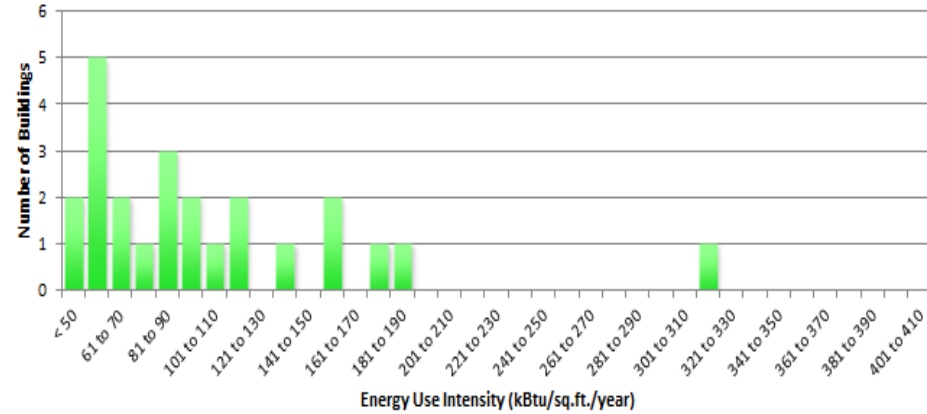
Illinois  
Department of Commerce  
& Economic Opportunity  
Pat Quinn, Governor



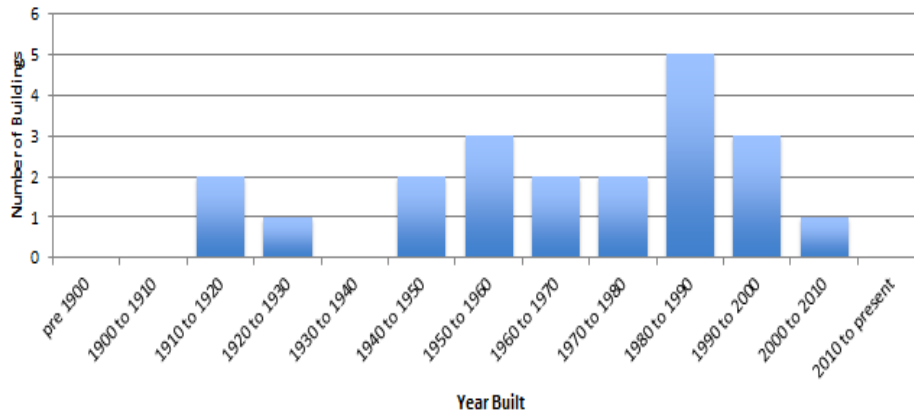
### Distribution by Commercial Facility Type



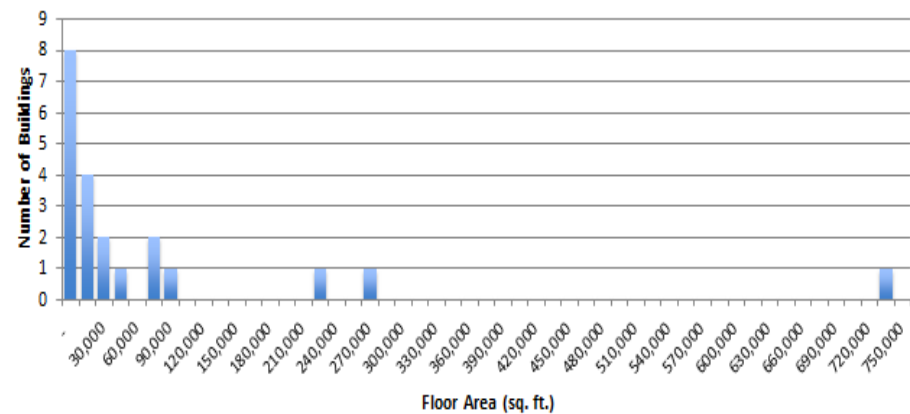
### Distribution by Energy Use Intensity



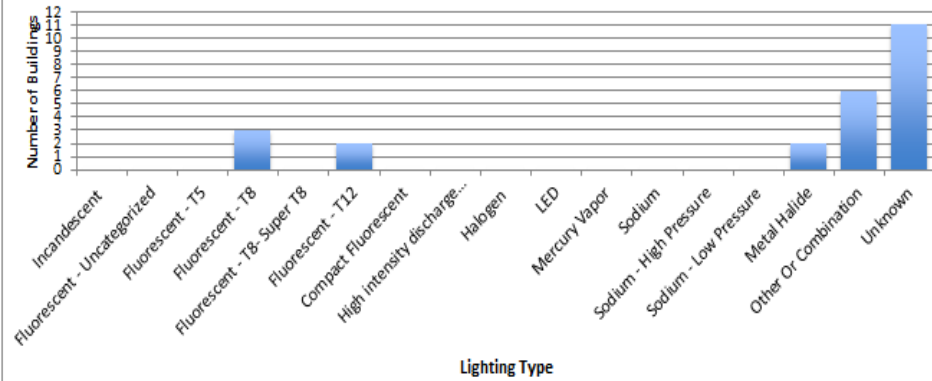
### Distribution by Vintage



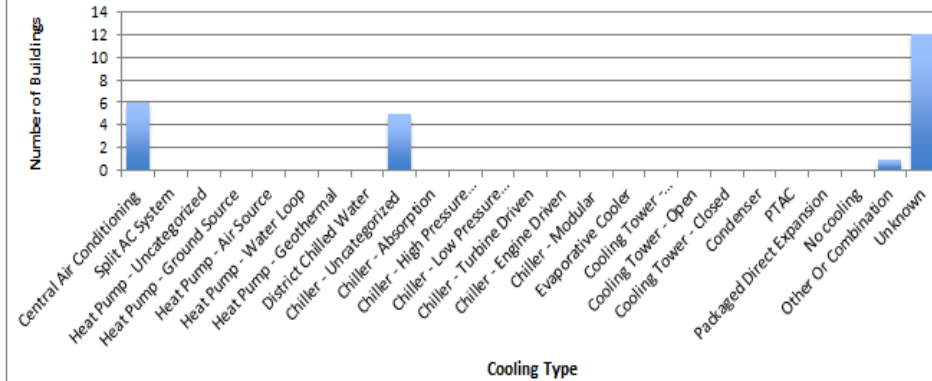
### Distribution by Floor Area



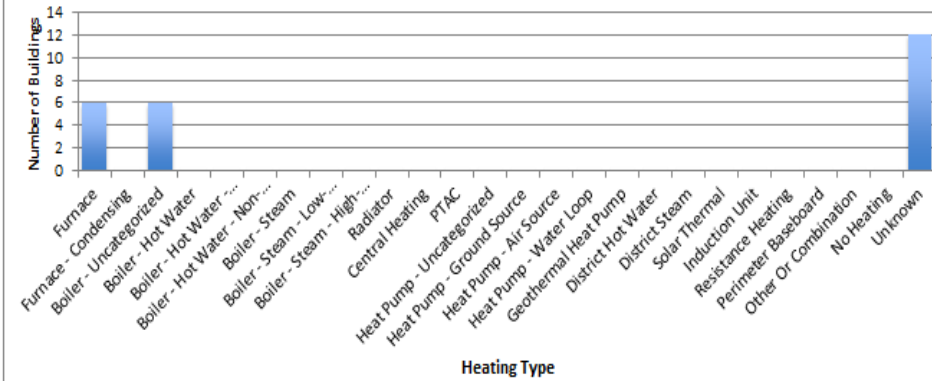
### Distribution by Lighting Type



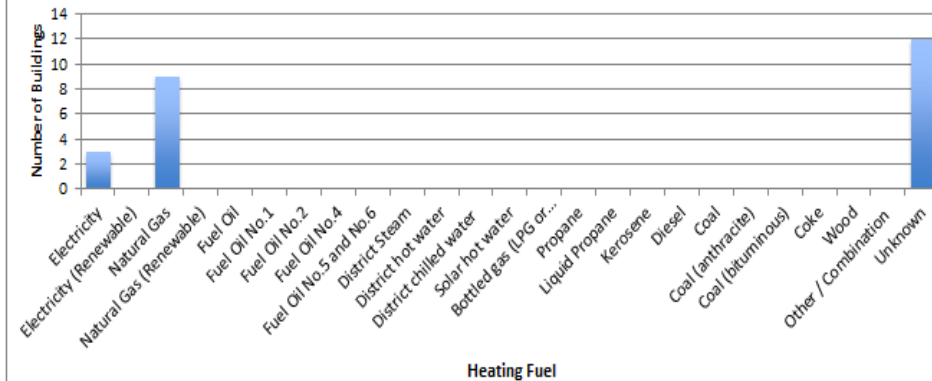
### Distribution by Cooling Type



### Distribution by Heating Type



### Distribution by Heating Fuel



# Future Plans

- Coordination of our efforts with the Chicago Public School District to pilot 100 school buildings into the Energy Asset Scoring Tool.
- Expand the number of public sector buildings into the Scoring Tool.
- Continued assessment of utilizing the Tools as part of the “Illinois Energy Now” public sector energy efficiency incentive program.



Illinois  
Department of Commerce  
& Economic Opportunity  
Pat Quinn, Governor

# Thank You

Henry Kurth, Associate Director

Energy Resources Center

University of Illinois at Chicago

[hkurth@uic.edu](mailto:hkurth@uic.edu)

312-9539631

Sara Wilcockson, Program Manager

Illinois State Energy Office

[Sara.wilcockson@illinois.gov](mailto:Sara.wilcockson@illinois.gov)



Illinois  
Department of Commerce  
& Economic Opportunity  
Pat Quinn, Governor