U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

# Unlocking the Value of Empirical Building Performance Data

## Overview of Data Tools & Initiatives

5/15/13

Elena Alschuler

Elena.Alschuler@ee.doe.gov

# DOE Building Technologies Office: Data-related Tools & Initiatives

## Goal: Facilitate performance-based approaches

**What?:**

Market participants must be able to track the performance of buildings, equipment and energy conservation projects.

**Why?:**

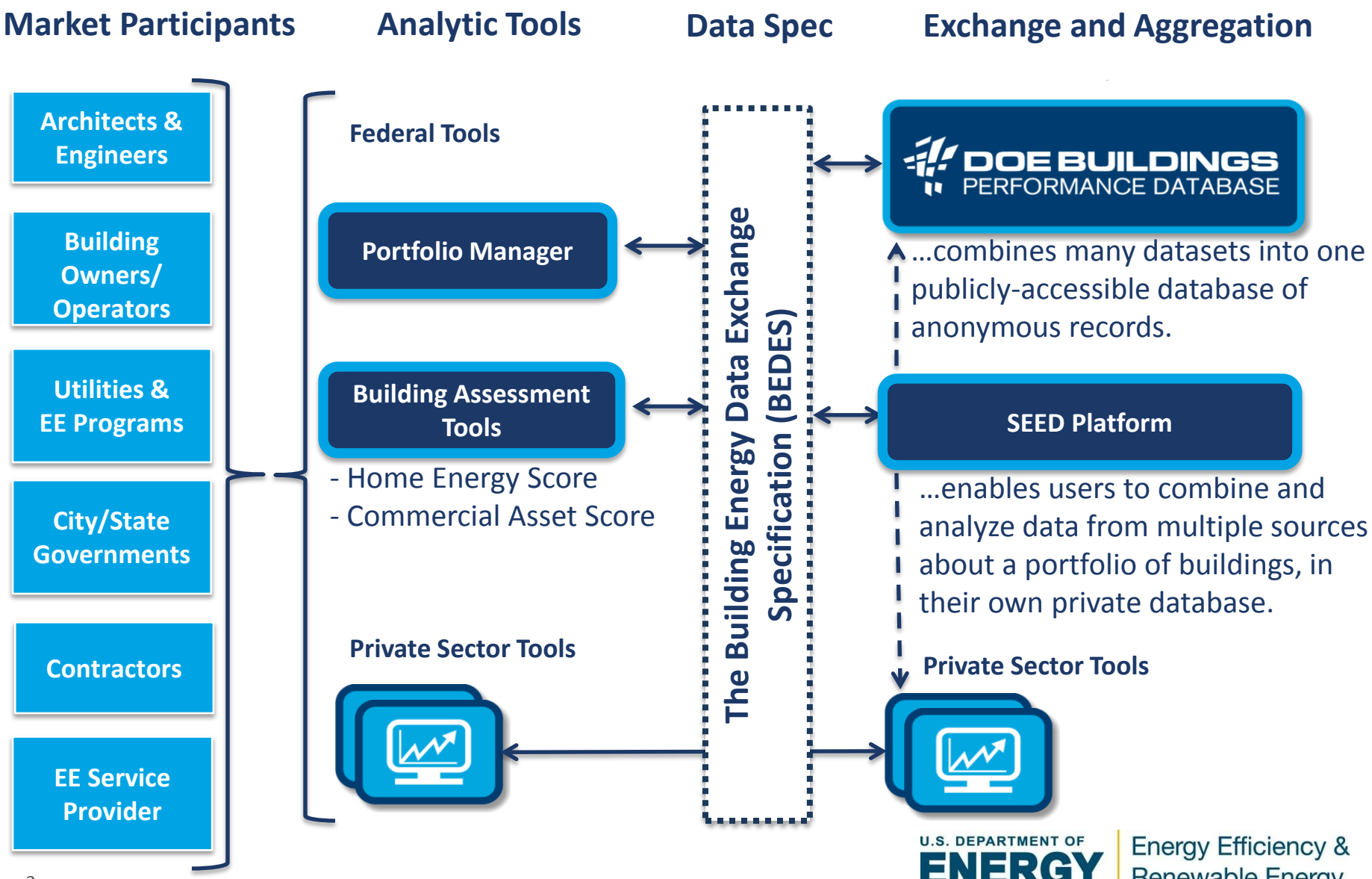
By making energy performance clearly traceable:

- Savings from energy efficiency improvements are more easily verified
- Better products & solutions succeed
- Energy performance can be incorporated into real estate asset valuation

**How?:**

- Facilitate consistent measurement and recognition of energy efficiency in buildings and establish the foundation that the private sector can build on.
- Create standard definitions, performance metrics, data exchange specifications, and methods to demonstrate performance (EM&V)
- Demonstrate the value of tracking actual performance

# Vision: Linked Federal Data Platforms and Initiatives



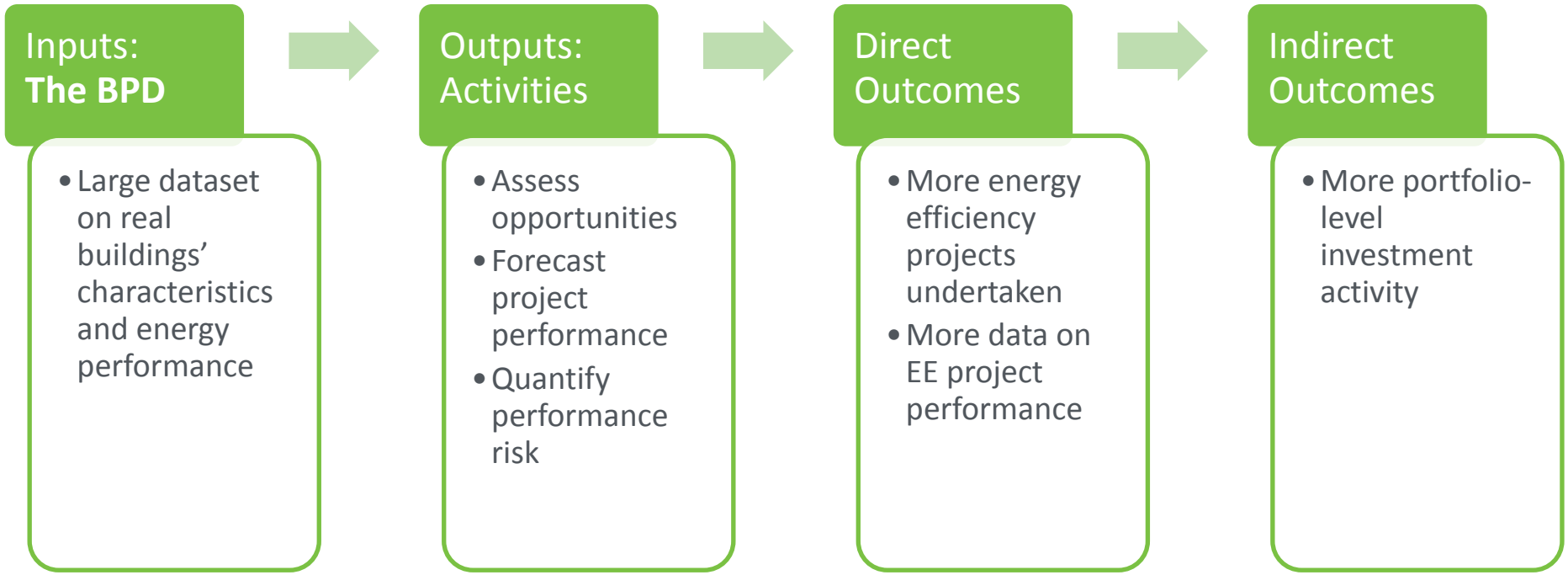



U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

# The Buildings Performance Database

DOE BUILDINGS PERFORMANCE DATABASE

- The BPD can statistically analyze trends in the energy performance and physical and operational characteristics of commercial and residential buildings across the country.

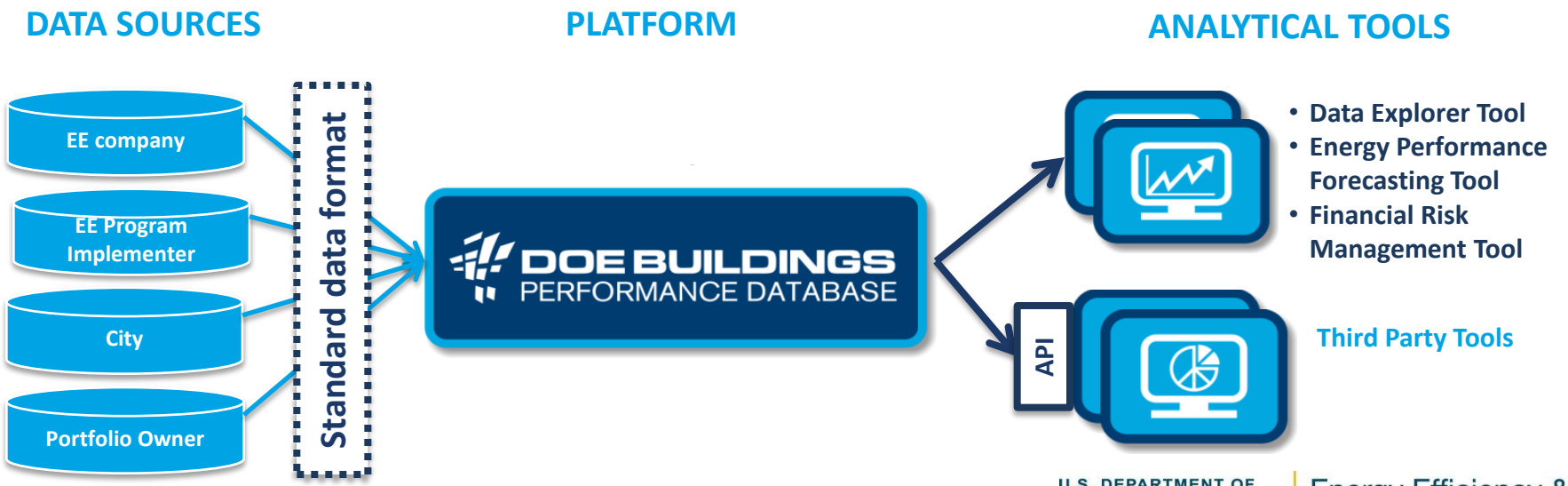





U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

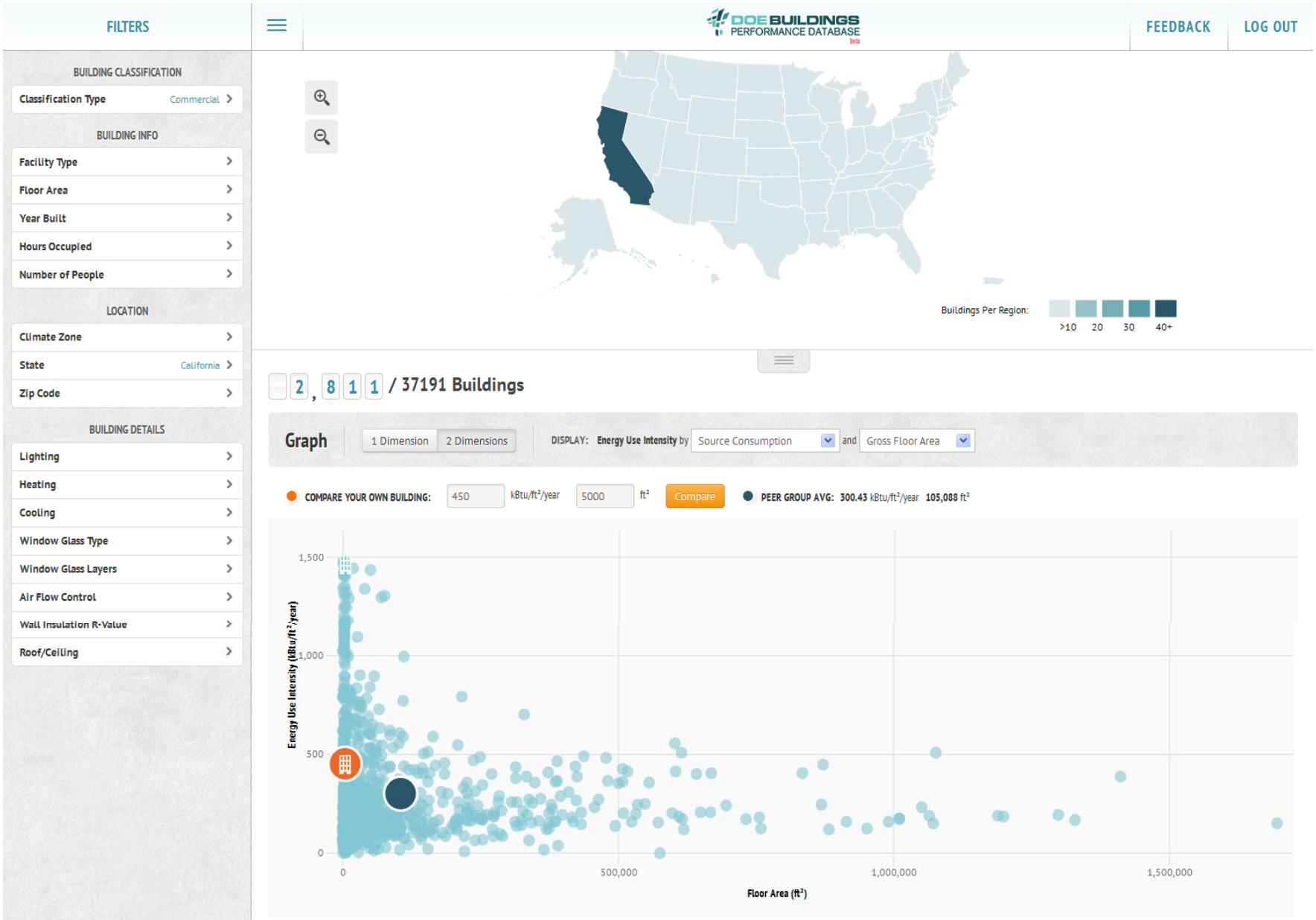
# BPD design principles

- The BPD contains *actual data* on tens of thousands of existing buildings - not modeled data or anecdotal evidence.
- The BPD enables statistical analysis without revealing information about individual buildings.
- The BPD cleanses and validates data from many sources and translates it into the standard format.
- In addition to the BPD's analysis tools, an API will enable third parties to create applications using the database.



# Data Explorer Tool *(available now)*

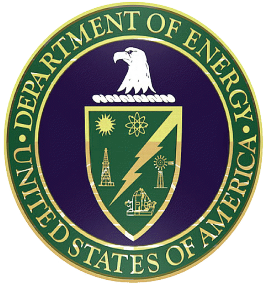
# Commercial Buildings in California



# BPD is the largest publicly available dataset of building energy performance data

DOE BUILDINGS PERFORMANCE DATABASE

- >70,000 buildings, including commercial, single family and multifamily.
- More datasets are being added regularly. There is no upper limit for the number of buildings the BPD can hold.
- More analyses will become possible as data is added.














# 1,000 users within two months of beta launch

DOE BUILDINGS PERFORMANCE DATABASE

- Building Owners & Managers
- Government Agencies
- EE Program Administrators
- Financial Institutions
- Contractors & Software Developers
- Research Institutions

# Technology Impact Tool *(end of May 2013)*
# Commercial building lighting retrofit

DOE BUILDINGS PERFORMANCE DATABASE

DEFINE PEER GROUP

DOE BUILDINGS PERFORMANCE DATABASE

FEEDBACK LOG OUT

BUILDING CLASSIFICATION

Classification Type: Commercial

Facility Type

BUILDING INFO

Floor Area: 206,226 – 1,684,825

Year Built: 1901 – 2015

Hours Occupied: 0 – 168

Number of People: 0 – 1,000

LOCATION

Climate Zone: All

State: All

Zip Code: All

BUILDING SYSTEMS

Lighting: 3 14

Heating: 1 15

Cooling: All

Window Glass Type: All

Window Glass Layers: All

Air Flow Control: All

Wall Insulation R-Value: 0 – 80

Roof/Ceiling: All

17,395 / 61,523 Buildings

Featured Examples

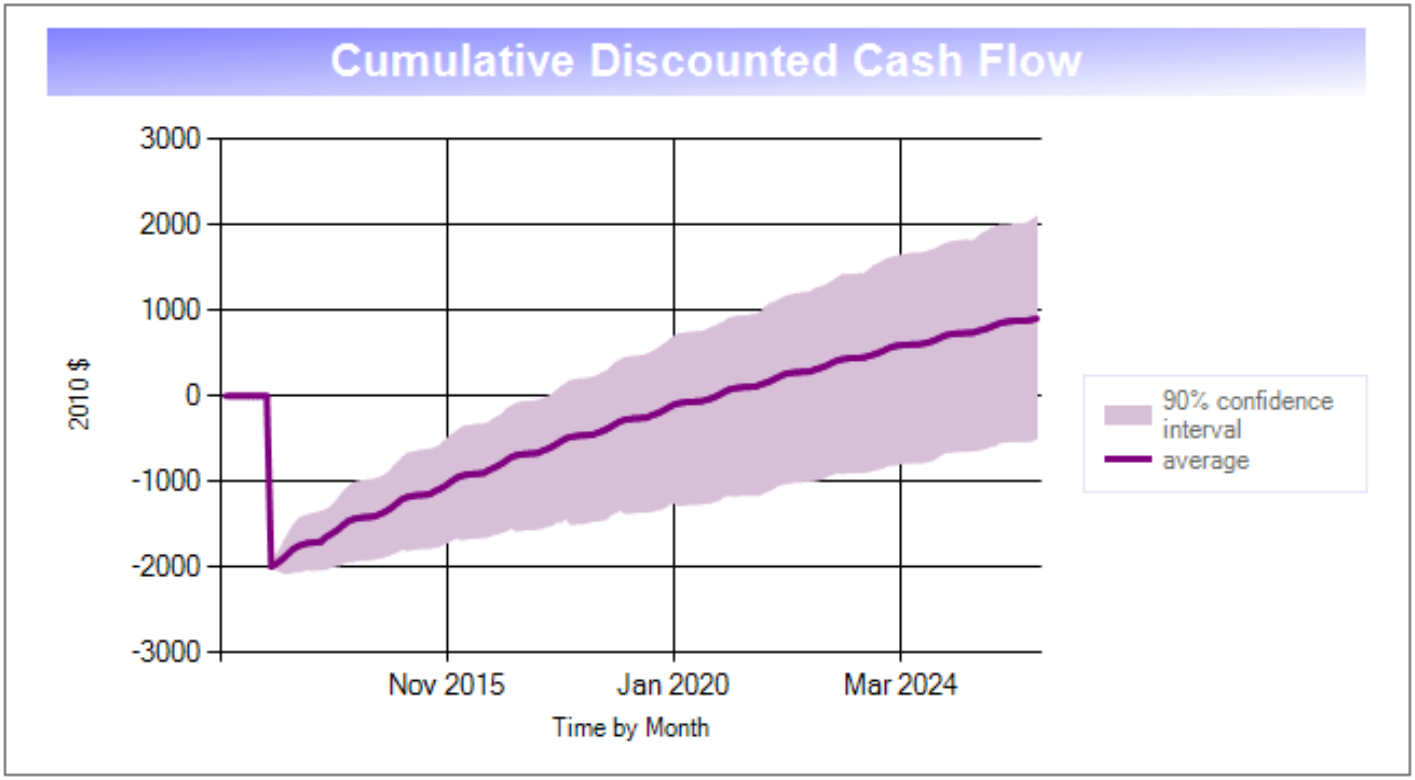
Peer Group | Bar | Scatterplot | DISPLAY: Energy Use Intensity by Source Consumption


Technology Impacts | Lighting | Incandescent | versus | Compact Fluorescent

# Financial Forecasting Tool *(summer 2013)*
## *DRAFT: Residential furnace retrofit cash flow*

DOE BUILDINGS PERFORMANCE DATABASE

**Results** Help *Pre:* **529** records *Post:* **141** records




- Forecast Charts - Electric
- Forecast Charts - Gas
- Financial Charts

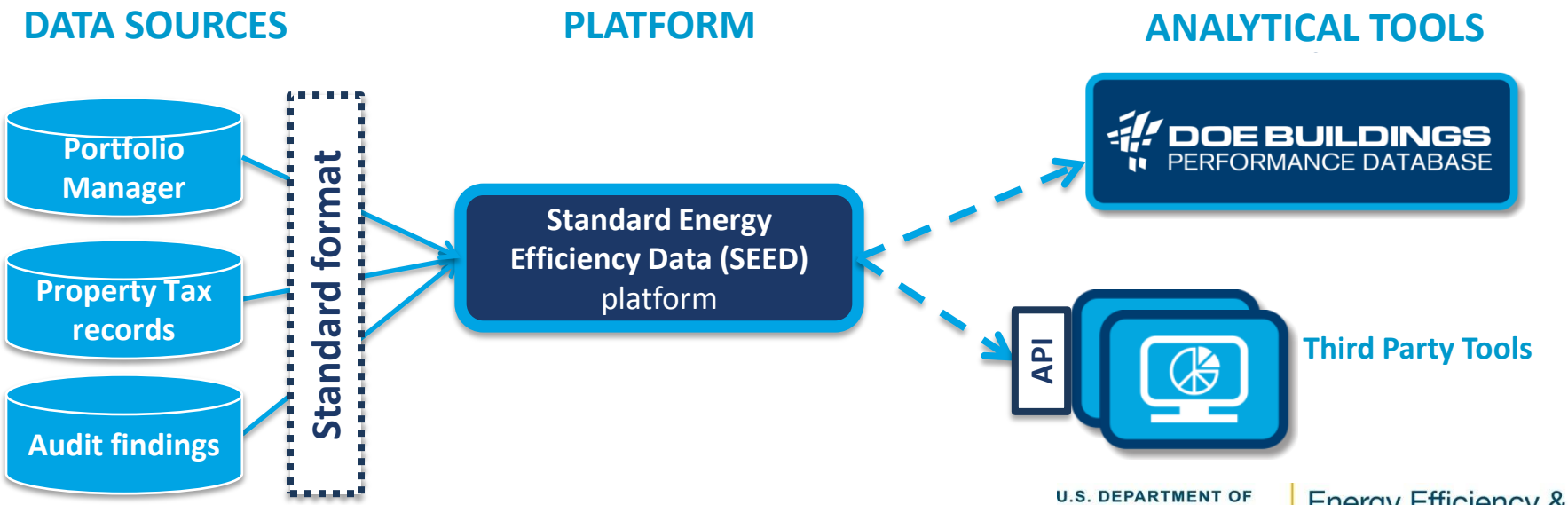
Please select a category:

- Financial Case Summary
- Cumulative Energy Cost Savings
- Cumulative Discounted Cash Flow
- Energy Cost Savings Probability
- Monthly Cash Flows
- Details

- Data Export Tools

# Standard Energy Efficiency Data (SEED) platform

- The SEED platform is a blank database structure. Each user can create their own "instance" of the platform.
- SEED enables users to import data from multiple sources about the same group of buildings, and conduct analysis and reporting of the information.
- The SEED platform utilizes a standard format.
- The owner of each SEED instance can choose which external parties can access the information, and what fields to share.
- An API will enable third-parties to develop additional tools that can be used by many SEED users.






U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

# SEED Pilot Users

- The Dec 2012 beta release was tested by governments with disclosure laws.
- In the future it could be used by large portfolio owners, energy efficiency programs, and energy efficiency service providers.

*San Francisco*

*Seattle*

*Austin*

*Washington D.C.*

*New York City*

*Philadelphia*


1. Andre Gunther Photography. http://www.aguntherphotography.com/california/san_francisco/parks/downtown-skylines/downtown.html
2. Christopher Reiger. *Hungry Hyaena*. http://hungryhyaena.blogspot.com/2008_04_01_archive.html
3. *Put Up Your Dukes.* http://putupyourdukes.files.wordpress.com/2008/08/austin_tx_downtown.jpg
4. *Best Travel Wallpapers.* http://www.travelskyline.net/flying_high_washington_dc-wallpapers.html
5. Patrick Theiner. *Creative Commons*. http://famouswonders.com/new-york-skyscrapers-and-its-marvelous-skyline/
6. http://www.listofimages.com/wp-content/uploads/2011/11/philadelphia-skyline.jpg

# SEED Platform Release v.1.0 *(RFP in process; delivery fall 2013)*

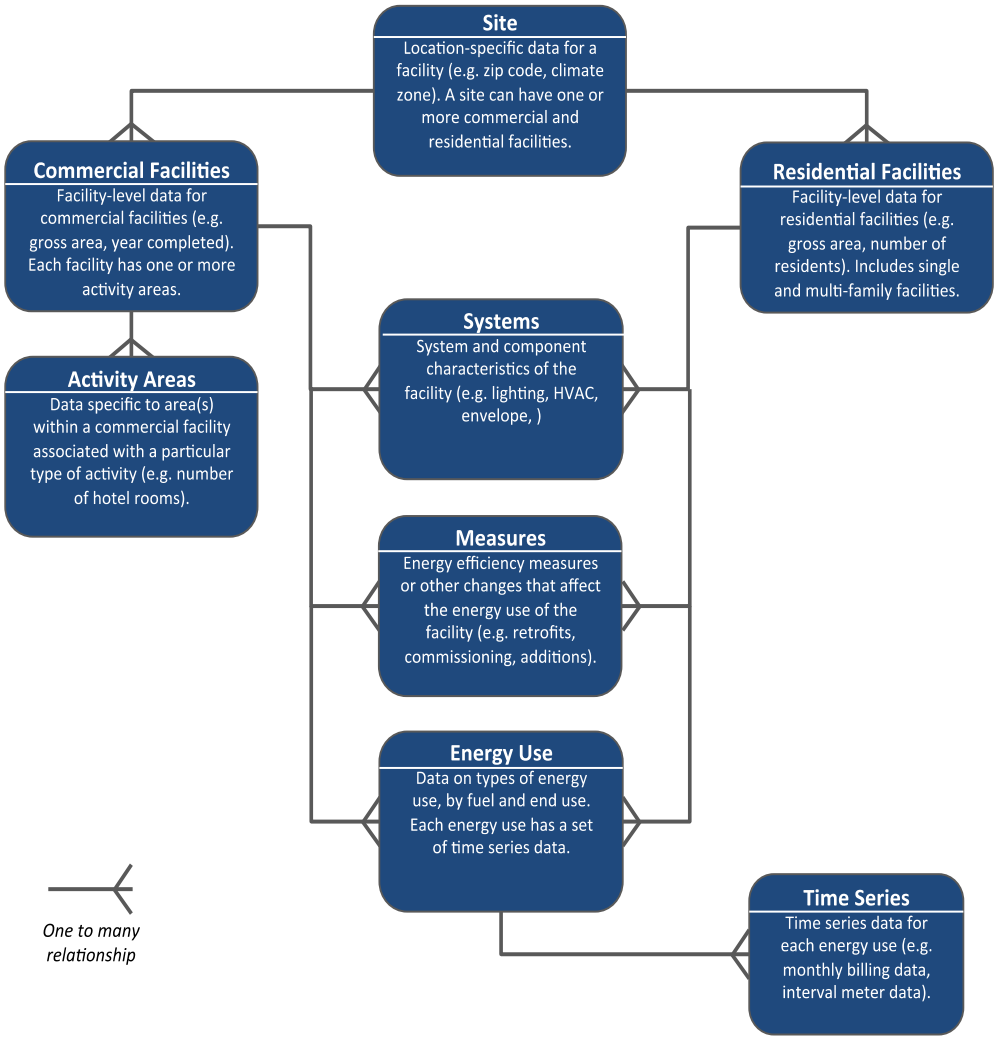
- Data importing and merging
  - Support for importing datasets via API, XML, excel and .csv
  - Ability to import multiple years of data
  - Help users to reformat and match-up records from different sources
- Data editing, matching and updating
  - View/edit all data for given building and/or for select periods of time
  - Assist with data cleansing and management
  - Annotation: error log, edit log, etc.
- Data analysis and reporting
  - Generate custom reports with ability to add/edit/delete reports
  - Define fields and records than can be viewed publicly or by authorized parties
  - Ability to export data in various formats, including via the API
- Platform Architecture
  - Host on local servers or cloud
  - Application Programming Interface & Plug in architecture
  - User roles & permissions

# The Building Energy Data Exchange Specification (BEDES)

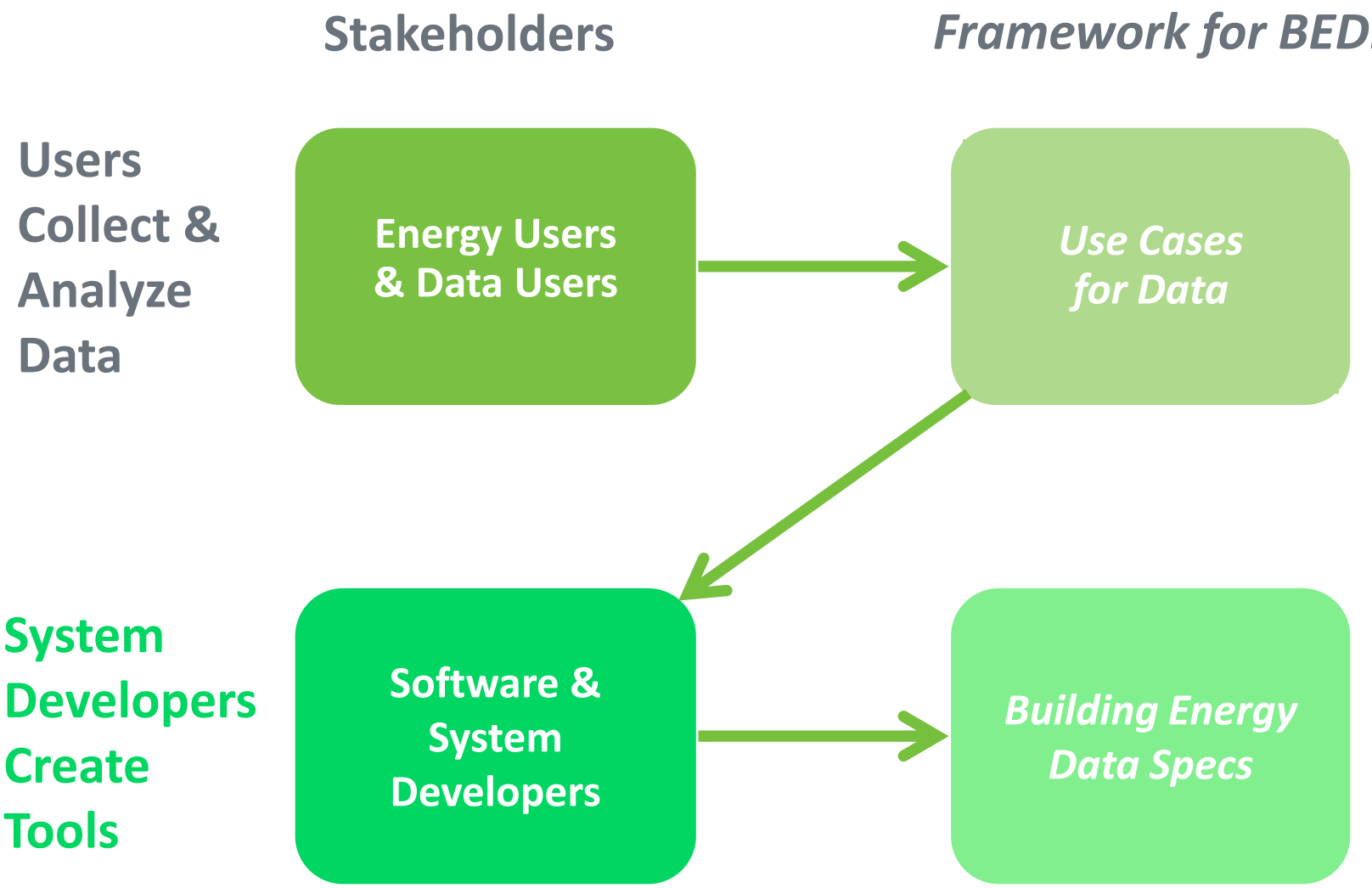
- BEDES 2.0 is *a common format for empirical data about building energy performance.*
- BEDES 2.0 covers building equipment, operations, energy performance, ECM projects, etc.
- The current version is based on a review of 40 common data formats.

- BEDES was developed for use in BPD, SEED and other DOE tools.
- Yet many stakeholders experience similar challenges in exchanging and combining datasets.
- DOE is planning a working group to engage the market in refining BEDES

## BEDES 2.0 structure



# BEDES Stakeholder & Market Assessment (expected June 2013)



# Use Cases for Building Energy Data by User Category

| | Use Cases | 1 Owners Building Owners & Managers | 2 Implementers Energy Auditors, A/E, | 4 Administrators Utility & State Program | 6 Cities Cities with Benchmarking | 5 Financiers Lenders & Investors |
|---|---|---|---|---|---|---|
| 1 | Benchmark buildings against peers | ✓ | ✓ | ✓ | Core | ✓ |
| 2 | Manage portfolio energy use over time | Core | | | | |
| 3 | Track energy use data to target opportunities | ✓ | ✓ | ✓ | ✓ | |
| 4 | Target actual buildings for auditing | ✓ | ✓ | ✓ | ✓ | |
| 5 | Select ECMs for a building | ✓ | ✓ | | | |
| 6 | Conduct audits & estimate ECM costs/savings | | Core | | | |
| 7 | Analyze ECM financial performance & risk | ✓ | ✓ | ✓ | | Core |
| 8 | Design & retrocommission buildings | ✓ | ✓ | | | |
| 9 | Develop EE contracts (ESCO, ESA, other) | ✓ | Core | ✓ | | ✓ |
| 10 | Evaluate ECM performance across buildings | ✓ | | ✓ | | ✓ |
| 11 | Monitor, verify, evaluate | | | ✓ | | |
| 12 | Target ECM types for program design | | | ✓ | | |

# Review and Mapping of Related Data Specifications

**Related Data Specs:**

*ASHRAE PMP Best Practice*
*Asset Rating Tool*
*ASTM BEPA*
*Building Component Library*
*CEC's HVAC Data Model*
*CEUS*
*EPA BASE Study*
*Fannie Mae Multifamily Survey*
*GRI's Reporting Protocols*
*HES Data Dictionary*
*HPXML*
*IAI's IFC*
*IEP*
*ISO Standard 12655*
*NAESB*
*NREL Building Component Library*
*OmniClass*
*OpenADE*
*Sky Foundry's Haystack*
*Smart Grid's NAESB PAP10*
*…and more*

**How do these vary?**

1. **Overall scope.**
   *e.g. Is water use, IEQ data included?*
2. **How a feature is defined.**
   *e.g. qualitative vs. quantitative description of air tightness*
3. **Classification of building system types.**
   *e.g. types of heat pumps*
4. **Granularity.**
   *e.g. multiple lighting types in each space vs. predominant lighting type for building.*

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

# Unlocking the Value of Empirical Building Performance Data

## Overview of Data Tools & Initiatives

5/15/13

Elena Alschuler

Elena.Alschuler@ee.doe.gov