

DOE Buildings Performance Database

2014 Building Technologies Office Peer Review



U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

Richard Brown, REBrown@lbl.gov
Lawrence Berkeley National Laboratory

Project Summary

Timeline:

Start date: FY11

Planned end date: ongoing

Key Milestones

1. v1.0 release; June 2013
2. Public Beta API launch; Feb 2014
3. v1.3 release, including 600k new buildings; Apr 2014
4. Publish data cleansing methods; Apr 2014

Budget:

Total DOE \$ to date: \$2,205,000 (LBNL)

Total future DOE \$: FY15 TBD

Target Market/Audience:

target market is all commercial and residential buildings

Key Partners:

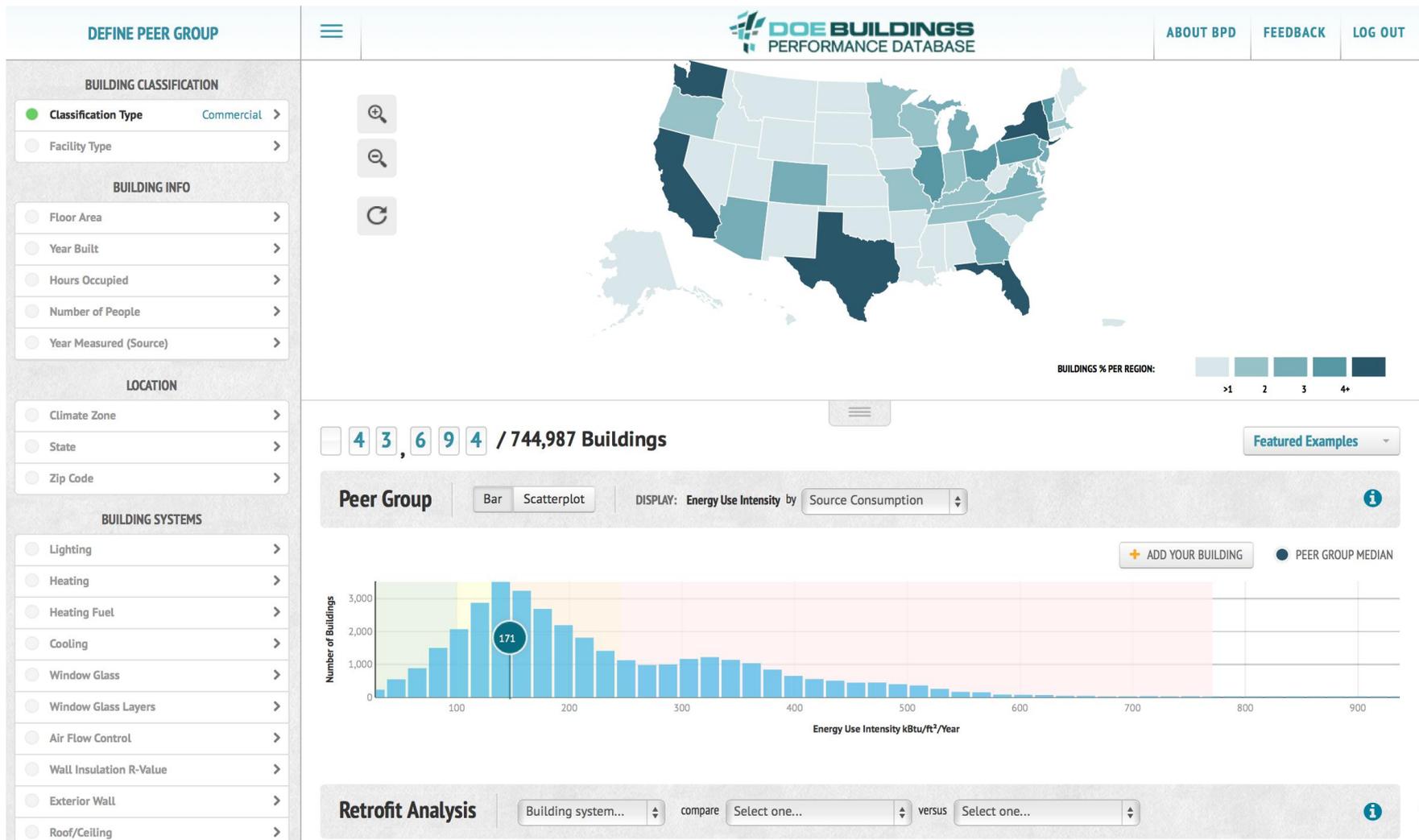
Building Energy, Inc.	Energy Information Administration
Energy Star Portfolio Manager	Better Buildings Challenge
State & Local Governments	Real Estate Owners
Energy Efficiency Programs	

Project Goal:

Expand the building energy efficiency retrofit market by providing trusted data on the relationship between building retrofits and energy performance.

The Buildings Performance Database

The BPD enables users to statistically analyze trends in the energy performance and physical & operational characteristics of real commercial and residential buildings



Purpose and Objectives

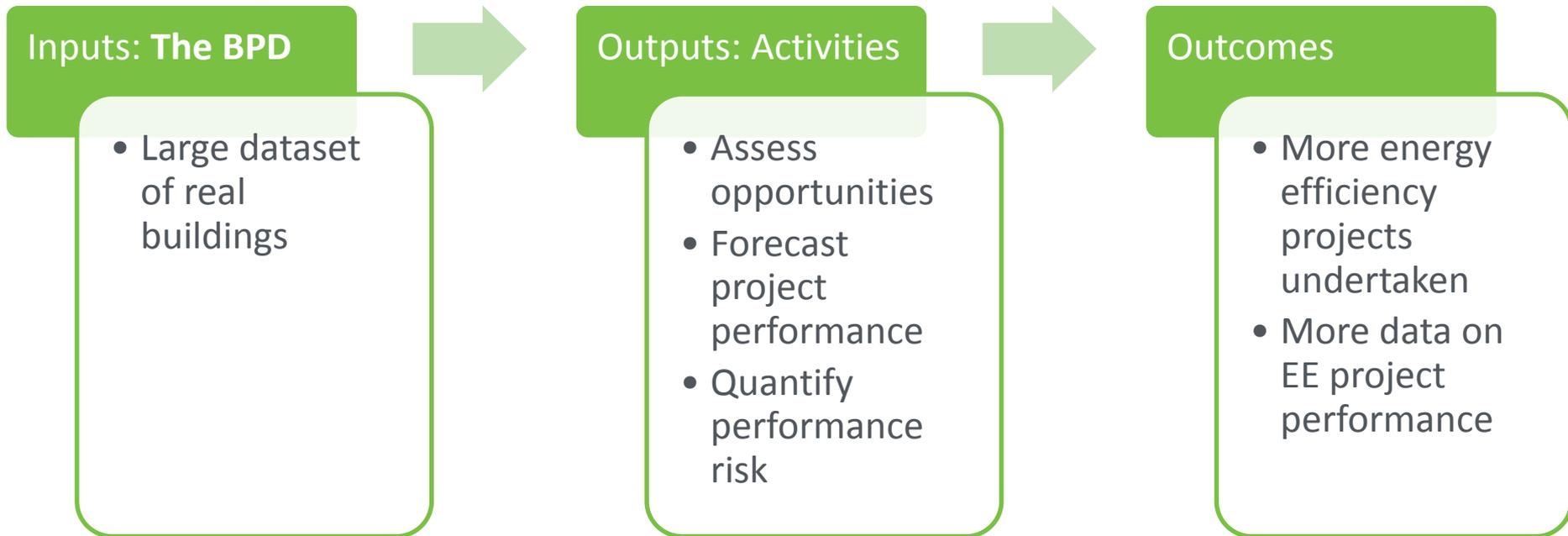
Problem Statement:

- Large-scale, high-quality empirical data on building energy performance is critical to support decision-making and increase confidence in energy efficiency investments.
- While there are a many potential sources for such data, they:
 - are dispersed and not easily obtainable;
 - do not have a common data definitions;
 - vary widely in scope, formats and data quality.

Objective:

Make freely available the most extensive buildings data set, along with tools to analyze those data, through both web and API

Unlock the Power of Building Energy Performance Data



Design Principles

- The BPD contains *actual data* on 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 a standard format.
- In addition to the BPD's analysis tools, third parties will be able to create applications using the database.

Impacts

Target Market and Audience: The target market is all commercial and residential buildings

Impact of Project: The BPD is an enabling technology that provides information to support energy efficiency investment decision-making

- Improve access to data on energy performance of buildings
- Lower analysis and transaction costs
- Expand availability of energy efficiency products
- Improve energy efficiency program design
- Provide venue for cities to publish local benchmarking data

Success Metrics:

- Near-term: Users of web application and APIs; # of buildings in DB
- Intermediate-term: Successful applications built on API
- Long-term: Retrofit activity influenced by BPD analysis

Impacts: Example Applications of BPD

- **Local Benchmarking:**
 - New York, San Francisco, and DC contribute data from local energy-disclosure ordinances
 - Allow local building owners to easily compare their buildings to local peer groups
- **Portfolio Planning:**
 - Several states combining data from BPD, Energy Star Portfolio Manager, and the DOE Commercial Building Asset Score
 - Plan capital upgrades to their publicly owned buildings
 - Funded by grants from DOE State Energy Program
- **Utility Program Planning:**
 - Local utilities can use energy performance data to target specific sectors and building types within the local building stock
 - Best in areas with many buildings in BPD

The BPD Aggregates Data From Many Other Tools...

Data Sources

Software Tools

Aggregation Platform

Collect data and conduct diagnostic analysis about individual buildings

Combine and analyze data from many sources



An energy management tool that tracks & assesses energy & water consumption in user's buildings.

DOE's Building Rating Tools

Includes the Home Energy Score & Commercial Building Energy Asset Score



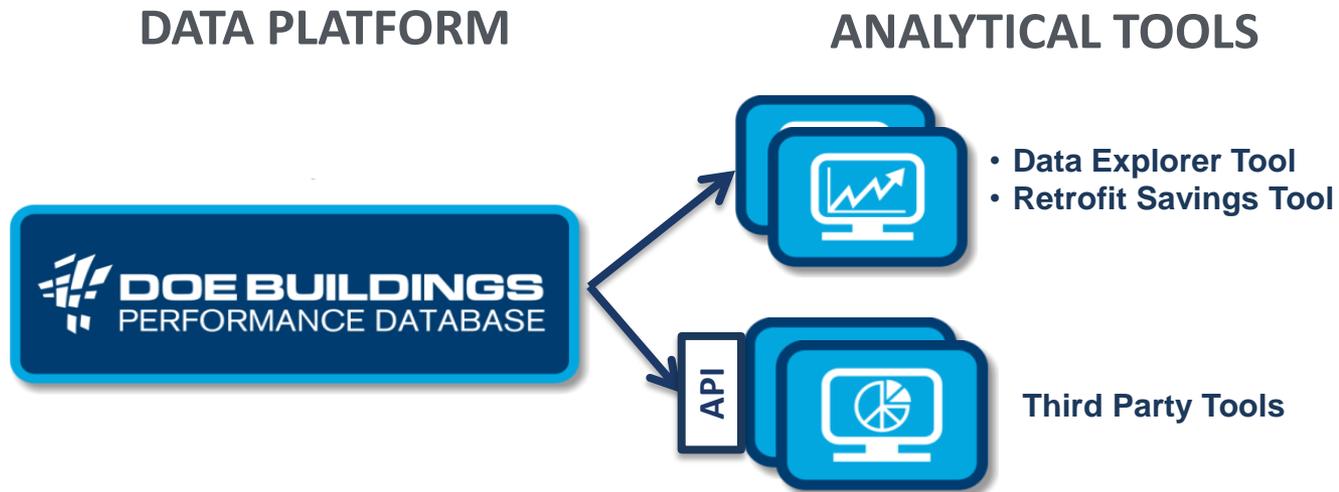
Other Tools & Databases

Includes Building Management Tools, Energy Efficiency Program Administration Databases, CBECS and RECS, etc.



One publicly-accessible database of anonymous, empirical records.

...And Makes it Available to a Broad Audience



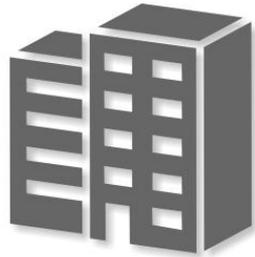
Approach – Key Issues

- Data acquisition, mapping & cleansing
 - Expand coverage of datasets to better represent building stock;
 - Obtain richer datasets that include more building characteristics data
 - Standardize and automate data preparation to more efficiently handle large datasets.
- Data analysis tools
 - Develop and evaluate various algorithms suited to building energy analysis use cases and data.
 - Encourage development of third party tools via API
- Case studies
 - Document how users employ BPD in their decision processes.
- *What Makes BPD Unique?*
 - Largest publicly available data set of actual building energy use and characteristics

Progress and Accomplishments

- Formal launch of v1.0 and two additional releases in last year
- Database more than doubled in last six months, >700,000 buildings
- Over 7,000 registered users
- Spun off BEDES as separate project
- Publicly released beta version of APIs for third-party app builders
 - Featured in DOE’s American Energy Data Challenge “Apps for Energy” Contest (<http://energychallenge.energy.gov/>)
 - Presidential Innovation Fellow organized five hackathons during Jan/Feb 2014 to promote the use of DOE’s APIs
- Publishing data preparation and cleansing methods
- Developed linear regression method for comparing peer groups in retrofit analysis — to be launched next quarter
- **Lessons Learned:**
 - Harder than expected to get building asset data to allow meaningful technology comparisons
 - “Easy” data often comes from energy efficient buildings; potential bias

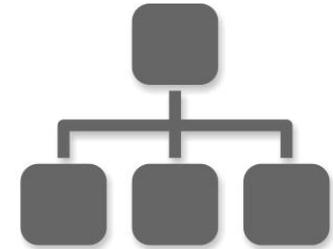
The Building Energy Data Exchange Specification



Residential,
commercial and
multifamily
sectors



Activity areas,
equipment and
operational characteristics,
energy consumption,
energy conservation
measures and costs



Project, building,
campus or
program-level
information



BEDES establishes
data fields,
definitions,
units of measure,
and file formats

Peer Group Tool: Washington DC Benchmarking Data

Office Buildings <1M SF, built since 1900

Source Consumption by Gross SF

DEFINE PEER GROUP

BUILDING CLASSIFICATION

- Classification Type Commercial >
- Facility Type 7 / 78 >

BUILDING INFO

- Floor Area 64 - 1,000,000 >
- Year Built 1900 - 2013 >
- Hours Occupied >
- Number of People >
- Year of Measurement >

LOCATION

- Climate Zone >
- State DC >
- Zip Code >

BUILDING SYSTEMS

- Lighting >
- Heating >
- Heating Fuel >
- Cooling >
- Window Glass >
- Window Glass Layers >
- Air Flow Control >



ABOUT BPD FEEDBACK LOG OUT

3 4 5 / 744,987 Buildings

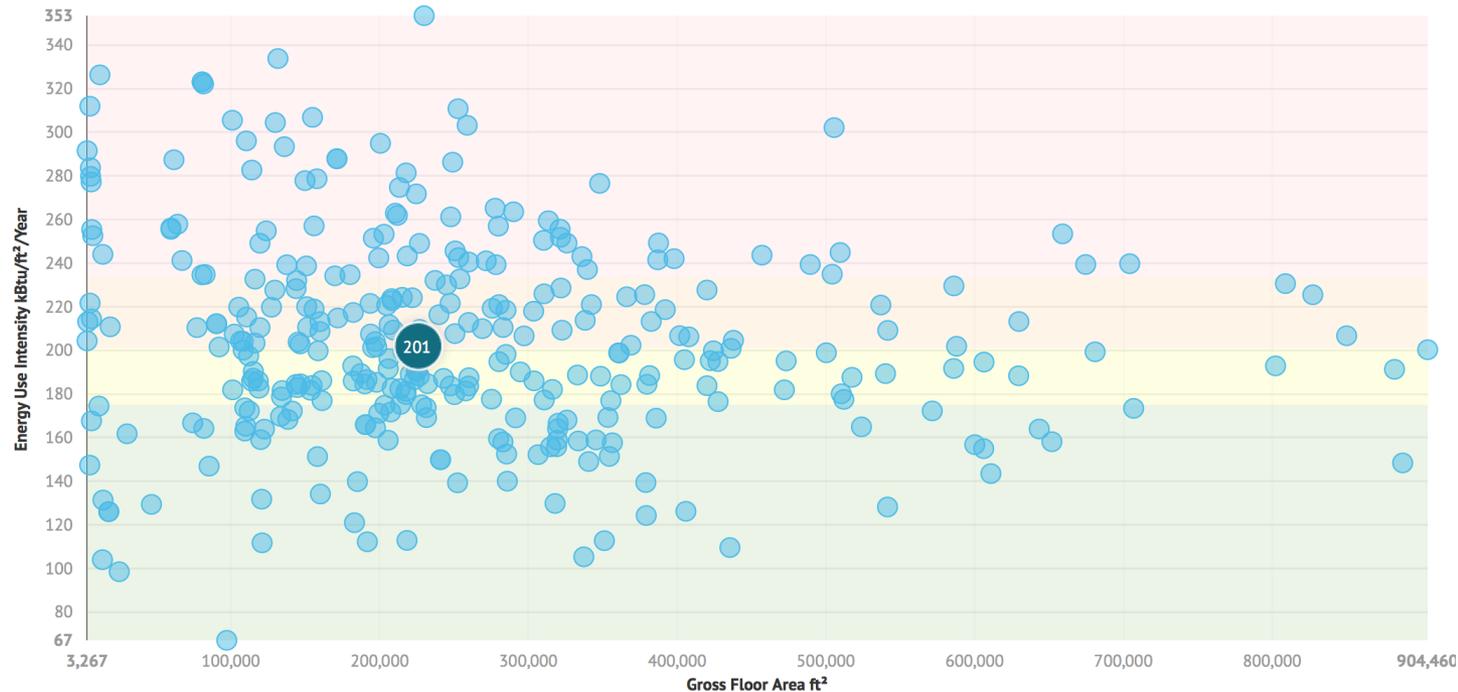
Featured Examples

Peer Group

Bar Scatterplot

DISPLAY: Energy Use Intensity by Source Consumption and Gross Floor Area

ADD YOUR BUILDING PEER GROUP MEDIAN

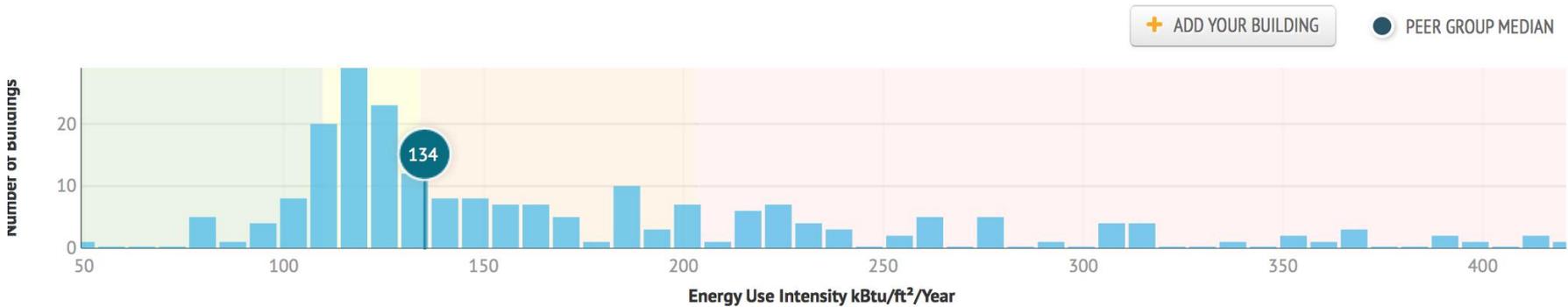


Retrofit Analysis Tool: CA Big Box Retail, Cooling Retrofit

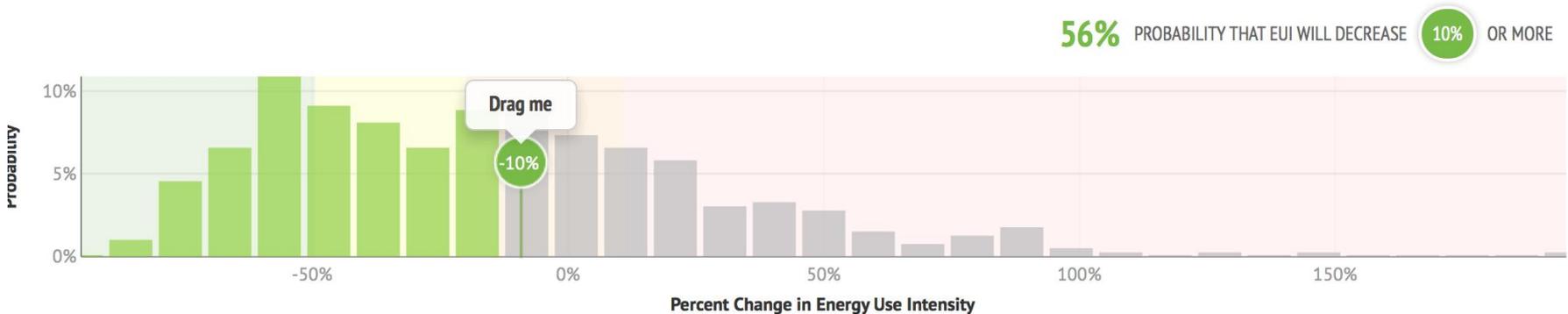
CA Retail Buildings >50,000 SF; N = 214

Compare Packaged Direct Expansion to Air Source Heat Pump

Peer Group | | DISPLAY: Energy Use Intensity by 



Retrofit Analysis | versus 



Project Integration and Collaboration

Project Integration: Frequent presentations to groups of potential users and data contributors; BTO policy that building performance data collected by projects should be contributed to BPD

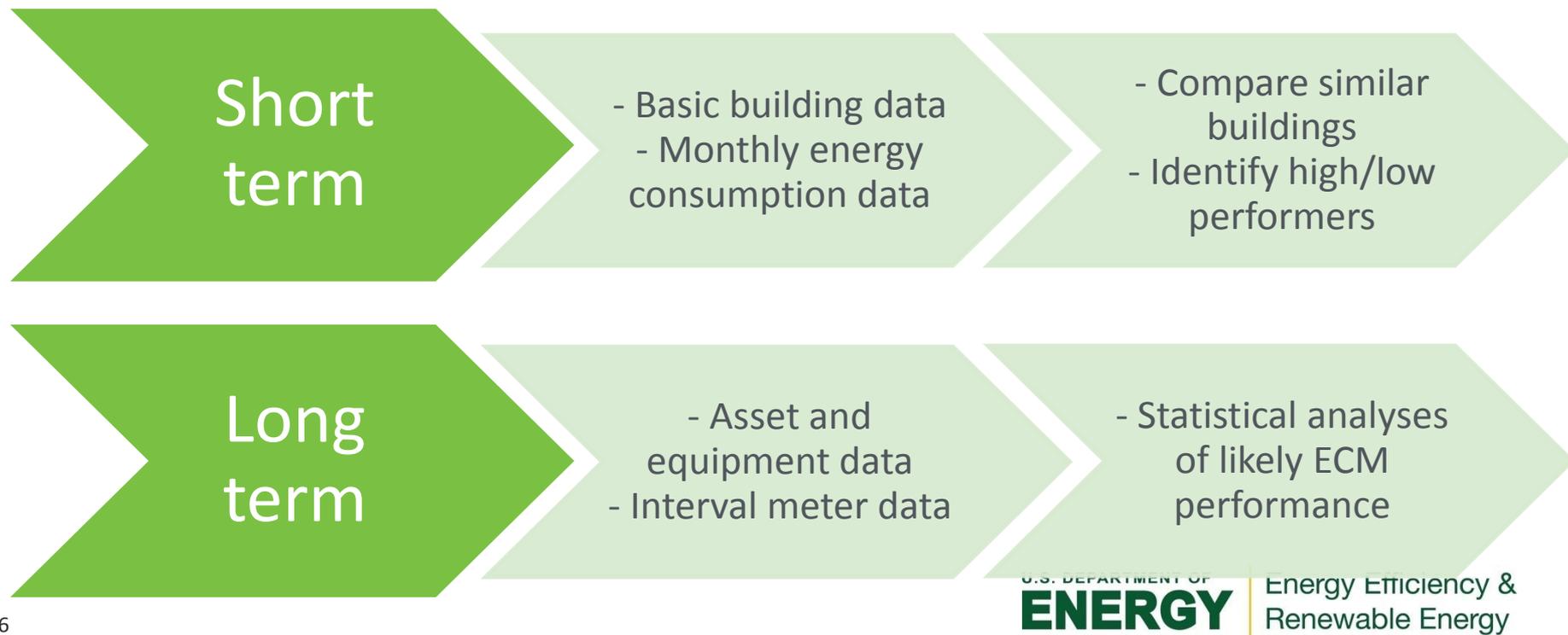
Partners, Subcontractors, and Collaborators:

- Building Energy is software implementation partner
- ~200 stakeholders engaged in BPD development as advisors, data contributors, and API beta testers

Communications: API user email list; Presented at: Advanced Energy Conference, Energy Efficiency Finance Forum, Real Estate Roundtable, NYC's REBNY and BOMA chapters, Better Buildings Summit, ASHRAE/AIA NYC Chapter, SEE Action, Greengov, Greenbuild, MEEA, SWEEP, CEE, US Sustainability Directors Network, ACEEE Market Transformation Conference, and several public webinars

Future plans: Iterative strategy to take BPD to scale

- The BPD demonstrates the value of aggregating the kind of data that is commonly collected today.
- As stakeholders begin to collect and contribute richer data, the BPD will support more advanced analysis.
- Need case studies of organizations using BPD, to build the business case.



REFERENCE SLIDES

Project Budget

Project Budget:

FY13: \$1,105,000 (\$950,000 original budget with a \$155,000 increase)

FY14: \$1,175,000

Variances:

FY13: \$155,000. increase for taxonomy stakeholder assessment and working group planning.

FY14: \$75,000 still to be funded

Cost to Date: \$790,800 or 67% of total \$1,175,000 budget

Additional Funding: Note, if any, other funding sources.

Budget History

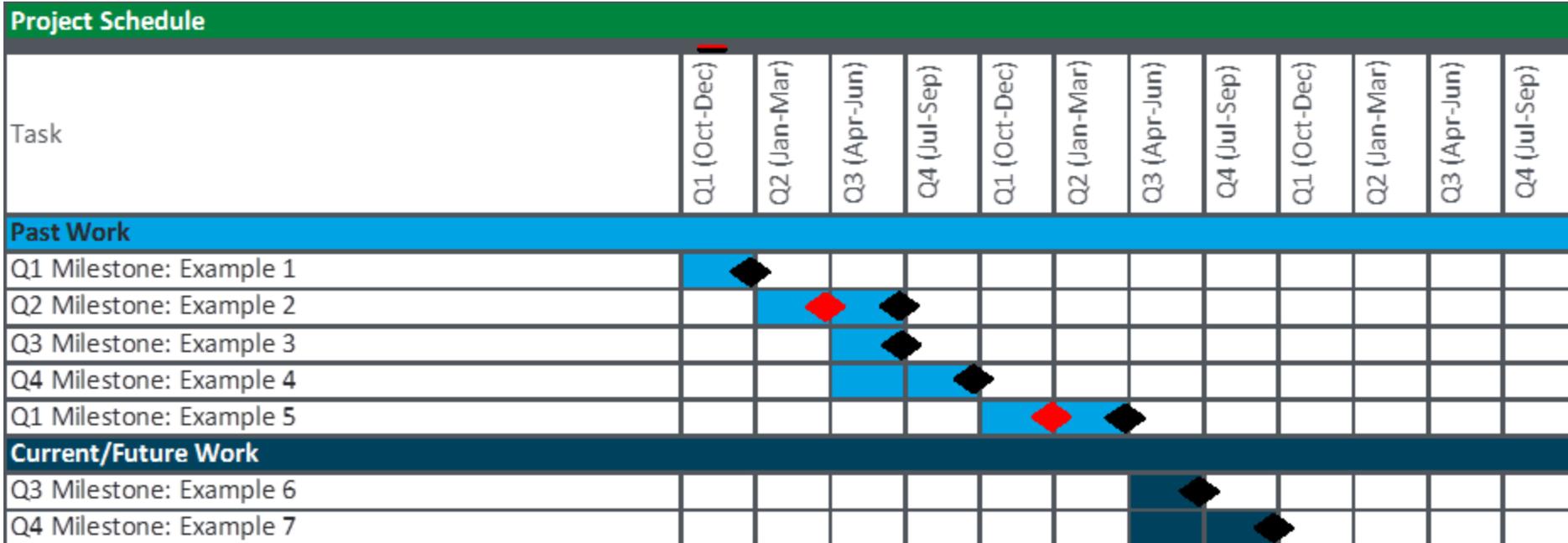
Oct. 1, 2012– FY2013 (past)		FY2014 (current)		FY2015 – (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
\$1,105,000	0	\$1,175,000	0	TBD	

Project Plan and Schedule

Required to complete, but does not count towards total slide count and doesn't need to be focused on during presentation

Describe the project plan including:

- Project original initiation date & Project planned completion date
- Schedule and Milestones
- Explanation for slipped milestones and slips in schedule
- Go/no-go decision points
- Current and future work



Alignment with EERE and BTO Goals

- BPD is a key component of the DOE and White House Energy Data Initiative.
- BPD directly addresses three strategies identified in the BTO multi-year plan:
 - Increase transparency of energy use by allowing comparisons of energy efficiency between buildings to encourage owner/occupier action and drive demand
 - Increase awareness among commercial building owners and operators of opportunities to cost-effectively save energy ...
 - Reduce investment risk to increase financing for commercial retrofits

Market Impact: Usage Tracking

7,244

Total BPD user signups



Daily BPD user signups

46

Users signed up in the past week



Users signed up in the past week

4,711

Users opted-in to mailing list



Users opted-in to mailing list

5

Users signed up during the past day

217

Users signed up in the past month



Users by Industry Type

13

Users logged in the past day

345

Users logged in during the past month

7,215

Users logged in during the past year

Approach – Project Management

Initial effort (Jan 2011 – Sep 2012)

- Booz Allen Hamilton – overall project management and software implementation.
- National labs (ANL, LBNL, NREL, PNNL) – technical approach, methods, data.

Current effort (Oct 2012 – Sep 2014)

- LBNL is primary performer
 - Software implementation by Building Energy (subcontractor to LBNL).

- ~700,000 buildings, from both public and private contributors.
- More datasets are being added regularly. There is no upper limit for the number of buildings the BPD can hold.

Public Sector

U.S. Energy Information Administration
U.S. General Services Administration
U.S. Environmental Protection Agency
U.S. Office of Housing and Urban Development
New York City Dept. of Citywide Administrative Services
New York Power Authority
Pennsylvania Keystone HELP Home Energy Loan Program
San Francisco Department of the Environment
State of California Public Utilities Commission
State of California Energy Commission
Seattle, Washington
University of Arizona
University of Dayton
District Department of the Environment: Washington, DC
Vermont Energy Investment Corporation

Private Sector

Brandywine Realty Trust
Connexion Asset Group
CNT Energy
Kohl's
Liberty Property Trust
Lucid Design Group
Prudential
Related
Tishman Speyer
Transwestern
USAA
And other private building owners

Better Buildings Challenge Data Sources*

Corporate

Ascension Health
Best Buy
Cleveland Clinic Foundation
Forest City Enterprises
HEI Hotels & Resorts
IHG (InterContinental Hotels Group)
Jones Lang LaSalle
Kohl's Department Stores
Lend Lease
Macy's
New York Presbyterian Hospital
Parmenter Realty Partners
Prologis
RREEF Real Estate
Shorenstein Properties LLC
Sprint
Staples
Starbucks Coffee Company
The PNC Financial Services Group

The Tower Companies
TIAA-CREF
Transwestern
University of Pittsburgh Medical Center
USAA Real Estate Company
Walgreens Co.
Wyndham Worldwide

Community

Arlington County, VA
Arvada, CO
Atlanta, GA
Beaverton, OR
Boston, MA
Chicago, IL
Clark County, NV
Cleveland, OH
Columbia, MO
Denver, CO
District of Columbia
Forth Worth, TX
Hillsboro, OR

Houston, TX
Huntington, NY
Los Angeles, CA
Milwaukee, WI
Omaha, NE
Placer County, CA
Roanoke, VA
Sacramento, CA
Seattle, WA
Toledo, OH
West Palm Beach, FL
Will County, IL

*Will be live this week

State and Municipal

Commonwealth of Massachusetts
El Paso, TX
Gillette, WY
Hall County, GA
Kauai, HI
Kitsap County, WA
Knoxville, TN
Margate, FL
Medford, MA
Pittsburgh, PA
Rochester, NY
Santa Fe, NM
Spokane County, WA
State of Delaware
State of Iowa
State of Maryland
State of Minnesota
State of North Carolina
State of Rhode Island
Thurston County, WA

Worcester, MA

Education

Alachua County Public Schools
Allegheny College
Camas School District, WA
Delaware State University
Douglas County School District, NV
Dysart Unified School District No. 89, AZ
Fort Atkinson School District, WI
Houston Independent School District, TX
Indian River Central School District, NY
Kentucky Community and Technical College System
Mesa County Valley School District 51, CO
Michigan State University
Portland Public Schools, OR

Poudre School District, CO
University of California, Irvine
University of Hawaii at Manoa
University of Utah
University of Virginia

*Will be live this week

Better Buildings Challenge Data Sources*

Multifamily Residential

ACTION-Housing, Inc.
Aeon
BRIDGE Housing Corporation
Campus Crest Communities
Columbia Residential
Community Housing Partners
Corcoran Management
Denver Housing Authority
EAH Housing, Inc.
East Bay Asian Local
Development Corporation
Eden Housing
Forest City Enterprises
Green Coast Enterprises
Hispanic Housing Development
Corporation
Homes for America
Housing Authority of City of
Atlanta, GA
Housing Authority of City of
Baltimore, MD
Housing Authority of City of
Bristol, CT

Housing Authority of City of
Buena Ventura, CA
Housing Authority of City of
Freeport, IL
Housing Authority of City of
Helena, MT
Housing Authority of City of
Palatka, FL
Housing Authority of City of
Philadelphia, PA
Housing Authority of City of
Tampa, FL
Housing Authority of Knox
County, IN
Housing Partnership Equity
Trust
Jersey City, NJ Housing
Authority
LINC Housing Corporation
McCormack Baron Salazar
Mercy Housing, Inc.
Multi-Family Mission Ministries
National Church Residences
National Housing Trust
NHP Foundation

Preservation of Affordable
Housing
REACH CDC
Retirement Housing Foundation
Rural Ulster Preservation
Company
Satellite Affordable Housing
Associates
Tenderloin Neighborhood
Development Corporation
The Community Builders, Inc.
The Economic Development
Authority of the City of
Mankato, MN
The Evangelical Lutheran Good
Samaritan Society
The Tower Companies
TIAA-CREF
Tonti Properties
Trinity Management
Village of Hempstead Housing
Authority

***Will be live this week**