**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:**

<table>
<thead>
<tr>
<th>Building Energy, Inc.</th>
<th>Energy Information Administration</th>
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</thead>
<tbody>
<tr>
<td>Energy Star Portfolio Manager</td>
<td>Better Buildings Challenge</td>
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<tr>
<td>State &amp; Local Governments</td>
<td>Real Estate Owners</td>
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<tr>
<td>Energy Efficiency Programs</td>
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</tbody>
</table>

**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

Inputs: The BPD
- Large dataset of real buildings

Outputs: Activities
- Assess opportunities
- Forecast project performance
- Quantify performance risk

Outcomes
- More energy efficiency projects undertaken
- More data on EE project performance

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...

<table>
<thead>
<tr>
<th>Data Sources</th>
<th>Software Tools</th>
<th>Aggregation Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Building Info</td>
<td>Collect data and conduct diagnostic analysis about individual buildings</td>
<td>Combine and analyze data from many sources</td>
</tr>
<tr>
<td>Energy Consumption</td>
<td>An energy management tool that tracks &amp; assesses energy &amp; water consumption in user’s buildings.</td>
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<td>Audits</td>
<td><strong>DOE’s Building Rating Tools</strong></td>
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<tr>
<td>Commissioning studies</td>
<td>Includes the Home Energy Score &amp; Commercial Building Energy Asset Score</td>
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<tr>
<td>Operating characteristics</td>
<td><strong>Other Tools &amp; Databases</strong></td>
<td>One publicly-accessible database of anonymous, empirical records.</td>
</tr>
<tr>
<td>Equipment &amp; asset info</td>
<td>Includes Building Management Tools, Energy Efficiency Program Administration Databases, CBECS and RECS, etc.</td>
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<tr>
<td>Public records</td>
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</table>
And Makes it Available to a Broad Audience

DATA PLATFORM

ANALYTICAL TOOLS

- Data Explorer Tool
- Retrofit Savings Tool
- Third Party Tools

API
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
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

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**Retrofit Analysis**

- **Cooling**
- **compare** Packaged Direct Expansion **versus** Heat Pump - Air Source

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56% PROBABILITY THAT EUI WILL DECREASE 10% OR MORE
**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.

Short term
- Basic building data
- Monthly energy consumption data
- Compare similar buildings
- Identify high/low performers

Long term
- Asset and equipment data
- Interval meter data
- Statistical analyses of likely ECM performance
REFERENCE SLIDES
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.

<table>
<thead>
<tr>
<th></th>
<th>Budget History</th>
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<tr>
<td>DOE</td>
<td>Cost-share</td>
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<td>$1,105,000</td>
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</table>
Project Plan and Schedule

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

### Project Schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Q1 (Oct-Dec)</th>
<th>Q2 (Jan-Mar)</th>
<th>Q3 (Apr-Jun)</th>
<th>Q4 (Jul-Sep)</th>
<th>Q1 (Oct-Dec)</th>
<th>Q2 (Jan-Mar)</th>
<th>Q3 (Apr-Jun)</th>
<th>Q4 (Jul-Sep)</th>
<th>Q1 (Oct-Dec)</th>
<th>Q2 (Jan-Mar)</th>
<th>Q3 (Apr-Jun)</th>
<th>Q4 (Jul-Sep)</th>
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<td>Q1 Milestone: Example 1</td>
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<td>Q3 Milestone: Example 3</td>
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<td>Q1 Milestone: Example 5</td>
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<td>Current/Future Work</td>
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<td>Q3 Milestone: Example 6</td>
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<td>Q4 Milestone: Example 7</td>
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Required to complete, but does not count towards total slide count and doesn’t need to be focused on during presentation
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
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).
Current Data Sources for the BPD

• ~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

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
- 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

**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

*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

**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*
## 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 Buenaventura, 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*