

NREL - DOE Technology Performance Exchange

2015 Building Technologies Office Peer Review

The screenshot shows the homepage of the Technology Performance Exchange (TPE). At the top left is the TPE logo with the tagline "Confidence through data." and the NREL logo with "NATIONAL RENEWABLE ENERGY LABORATORY" below it. A navigation bar includes links for Home, Technology Categories, Companies, About, Developers, and Log in | Register. The main content area is divided into four steps: 1. REGISTER (for manufacturers, test labs, and basic users), 2. SEARCH OR BROWSE TECHNOLOGIES (with a search bar and fan icons), 3. COMPARE DETAILED ENERGY PERFORMANCE DATA (with fan icons and data lists), and 4. EVALUATE ENERGY AND COST SAVINGS (with a document icon and a person presenting). Below this is a "SEARCH PRODUCTS" bar and a "BROWSE TECHNOLOGY CATEGORIES" section with a grid of technology types like SSL Replacement Lamps, Hot-Water Boilers, DHP: Indoor Units, etc. Two callout boxes on the right provide instructions for "Manufacturers" and "Partners/Developers".

TPE Technology Performance Exchange
Confidence through data.

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Home Technology Categories Companies About Developers Log in | Register

1. REGISTER
Manufacturers and Brand Owners add your products to the site
3rd Party Test Laboratory or Contributing Evaluators add detailed performance data
Basic Users view product data
REGISTER NOW

2. SEARCH OR BROWSE TECHNOLOGIES
Search for cost-effective, energy-efficient technologies

3. COMPARE DETAILED ENERGY PERFORMANCE DATA

4. EVALUATE ENERGY AND COST SAVINGS
Use data in your calculations and energy simulations
Present the results to encourage capital investment in energy saving technologies

SEARCH PRODUCTS

BROWSE TECHNOLOGY CATEGORIES

- SSL Replacement Lamps
- Non-SSL Lamps
- Lamp Ballasts
- Non-SSL Luminaires
- SSL Luminaires
- Hot-Water Boilers
- Steam Boilers
- Compressors
- Rooftop Units
- Gas-Fired Unit Heaters
- Pumps
- DHP: Indoor Units
- DHP: Outdoor Units
- Heat Pump Water Heaters
- Transformers
- Photovoltaic Modules
- Inverters

Manufacturers
Learn how to submit your products to the Technology Performance Exchange.

Partners/Developers
Learn about the Technology Performance Exchange API.

Project Summary

Timeline:

Start date: January 27, 2012

Planned end date: November 20, 2015

Key Milestones

1. Calibrated Energy Model; 5/22/15
2. BPA Sector Simulation; 10/16/15

Budget:

BTO \$ to date: \$769,000

FEMP \$ to date: \$565,000

Other \$ to date: \$323,759

Total future DOE \$: TBD

Target Market/Audience:

Utilities/implementers, commercial building owners, energy modelers, manufacturers

Key Partners:

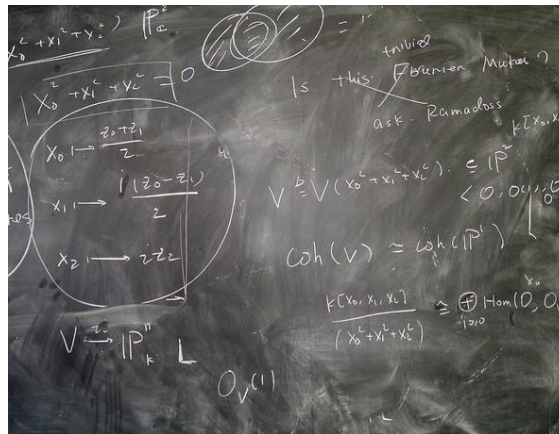
DOE Federal Energy Management Program
Bonneville Power Administration
LG Electronics, USA

Project Goal:

Provides a pipeline for product-specific performance data submitted by manufacturers, utilities, and HIT Catalyst demonstrations to be quickly vetted, analyzed, and adopted by utilities and building owners.

Problem Statement

The perceived fiscal risk associated with the installation of unfamiliar technologies impedes adoption rates for cost-effective, energy-saving products.



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RSF: Dennis Schroeder, NREL, <http://images.nrel.gov/viewphoto.php?imageId=6316259>

Money: Andrew Magill, Flickr, Not Modified, Creative Commons License, <https://creativecommons.org/licenses/by/2.0/>

3 Chalkboard: KimManleyOrt, Flickr, Cropped, Creative Commons License, <https://creativecommons.org/licenses/by-nd/2.0/>

Data: Eric, Flickr, Cropped, Creative Commons License, <https://creativecommons.org/licenses/by-nc-sa/2.0/>

Approach

Approach:

- Define the characteristics necessary to credibly predict performance
 - Bottom-up philosophy
- Create the infrastructure necessary to find, share, and leverage data
 - Restricted workflows
 - Web-based UI
 - Read/write API

Fan Power Input (W) ?

- None -

Cooling Performance Map Download ?

Cooling Performance Map Upload ?

No file chosen

Heating Performance Map Download ?

Heating Performance Map Upload ?

No file chosen

Self-Measured, Field

- None -
- Non-Measurable Physical Property/Design Criteria
- Self-Measured, Field**
- Self-Measured, Laboratory
- Measured By Others, Field
- Measured By Others, Laboratory
- Calculated Using Self-Measured Field Data
- Calculated Using Self-Measured Laboratory Data
- Calculated Using Others' Measured Field Data
- Calculated Using Others' Measured Laboratory Data
- Reported by External Source, Derivation Unknown
- Calculated Using External Data, Derivation Unknown

or

Credit: Daniel Studer, NREL

Approach






Quality Control: Transparency provided via metadata

Provenance

▼ **Module Efficiency** 
(average of 5 reports)

18.40 %



Source	Posted on	Derivation	Data	
Manufacturer of This Product	1/3/2014	Self-Measured, Laboratory	18.43	
National Renewable Energy Laboratory	3/6/2014	Calculated Using Others' Measured Laboratory Data	18.37	
Federal Energy Management Program	3/12/2014	Calculated Using External Data, Derivation Unknown	18.41	
Testing Laboratory Alpha	3/20/2014	Self-Measured, Laboratory	18.39	
Utility X	3/21/2014	Self-Measured, Field	18.40	

KEY:  CONTRIBUTING EVALUATOR

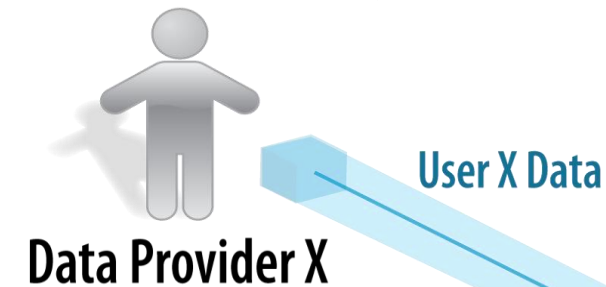
 3RD PARTY TEST LABORATORY

 MANUFACTURER/ BRAND OWNER

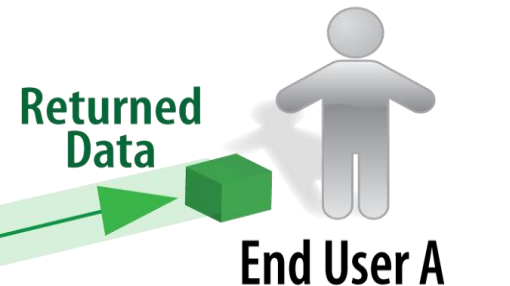
Credit: Marjorie Schott, NREL

Approach

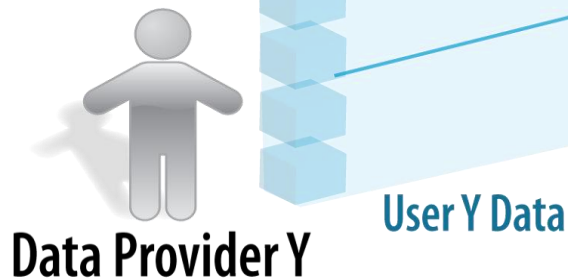
Manual Data Entry



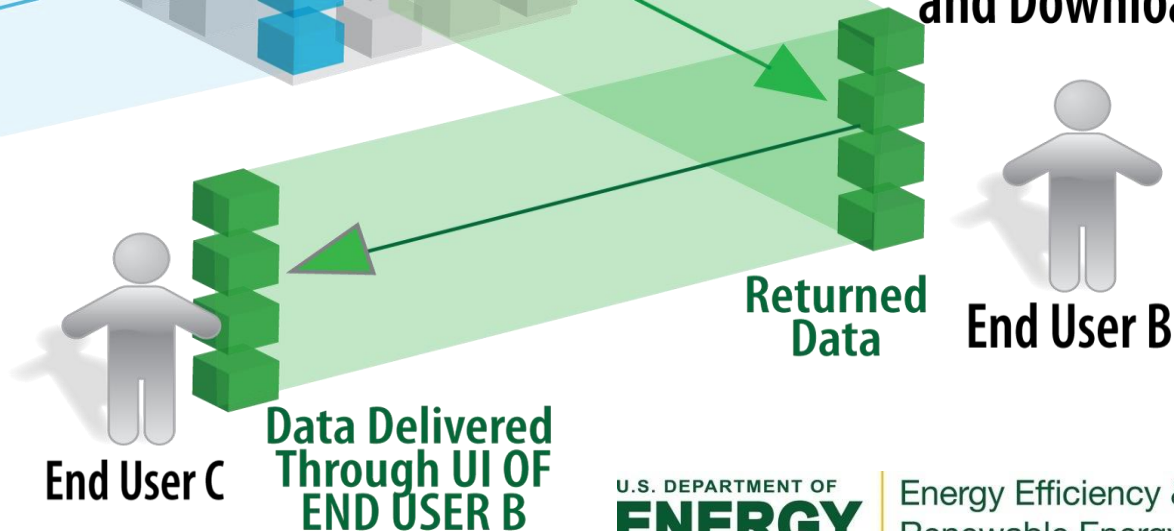
Manual Search and Data Download



Automated Data Upload

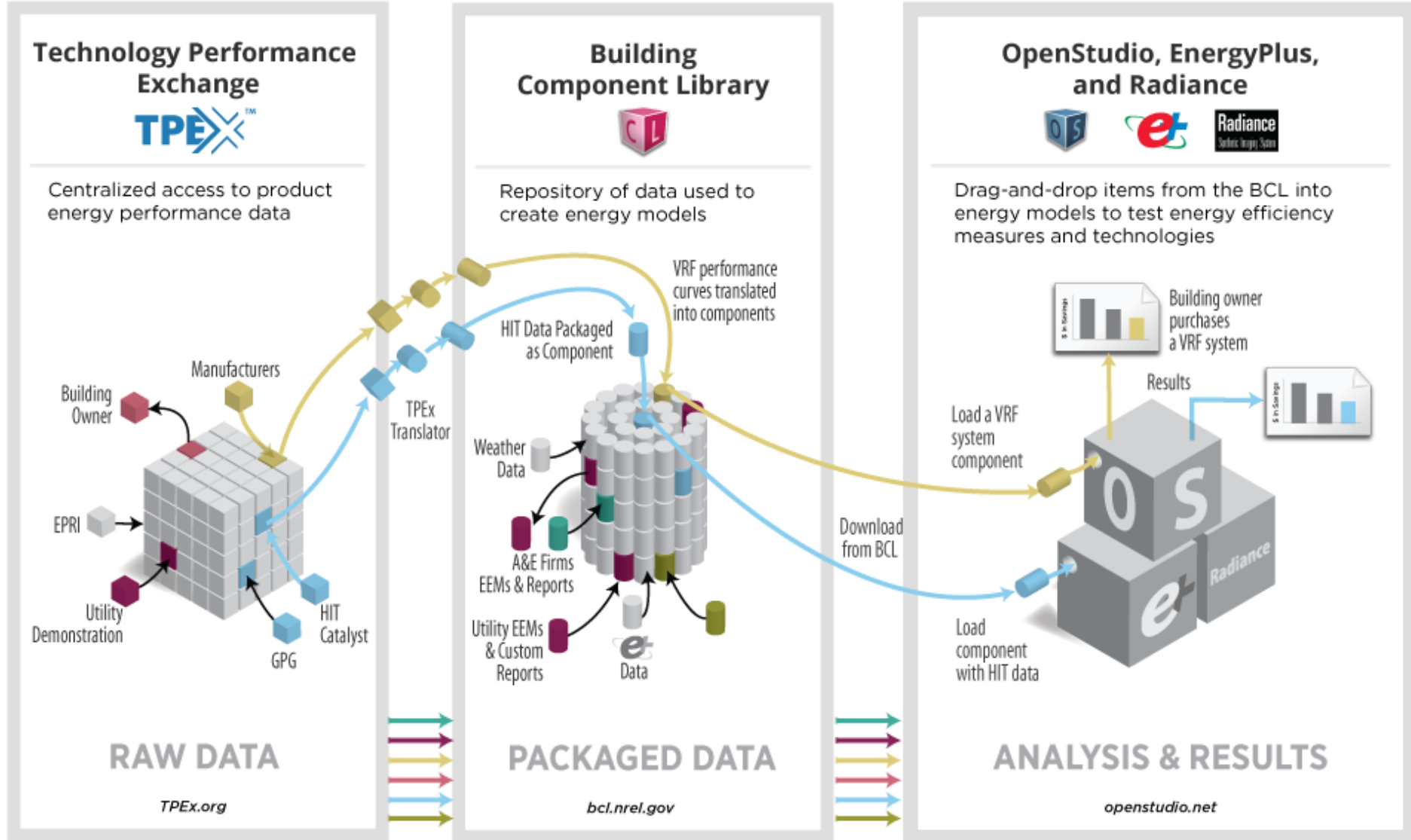


Automated Search and Download



Credit: Marjorie Schott, NREL

Distinctive Characteristics: An Integrated Ecosystem



Distinctive Characteristics: End-to-End Functionality

The screenshot displays the OpenStudio interface for modeling HVAC systems. The main workspace shows a VRF system layout with components like 'Drop VRF Terminal', 'Drop Thermal Zone', 'Core Zone', 'Perimeter Zone 2', and 'Perimeter Zone 1'. A green arrow points to a VRF terminal icon in the left toolbar, with a blue callout box stating: 'Drag and drop TPEX data into OpenStudio model here'. Another green arrow points to a specific VRF terminal in the workspace, with a blue callout box stating: 'TPEX data downloaded from the BCL'. On the right, a 'VRF Terminal' library panel lists various terminal models, including 'VRF Zone Terminal' and several 'LG Electronics USA' models (e.g., ARNU073SER.2, ARNU183VJA2, ARNU243B2G2, ARNU303NJA2, ARNU543NKA2), each with a 'BCL' label. A green arrow points from the 'BCL' label of the ARNU073SER.2 model to the callout box.

Credit: Daniel Studer, NREL

Key Issues

- Growing the dataset
 - Currently >22,000 products



Target Market and Audience



2013 electricity sales: 4,567 TBtu (commercial buildings)
2013 electricity savings: 437 TBtu (commercial buildings)

Analysts/engineers/implementers
(EE boots on the ground)



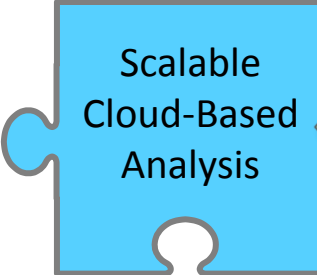
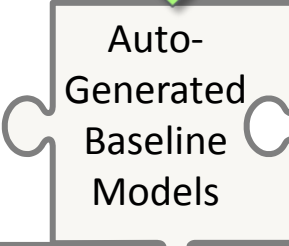
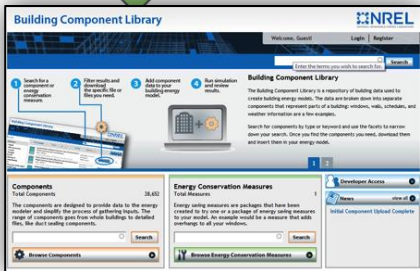
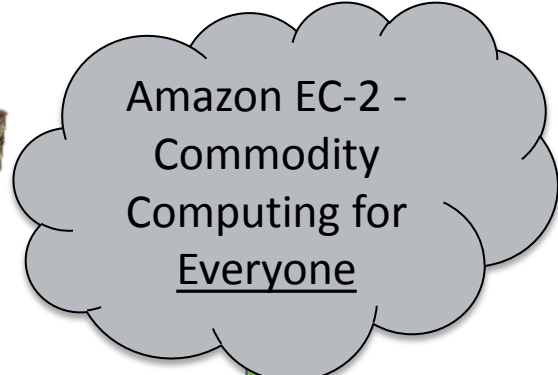
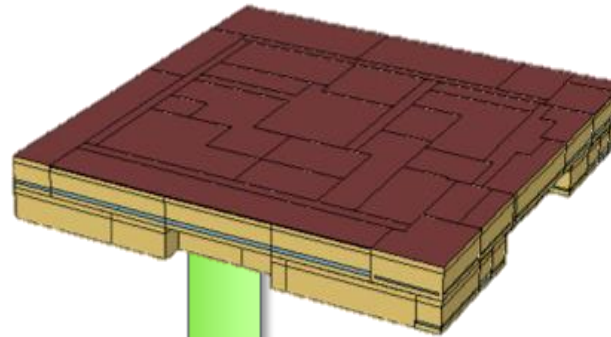
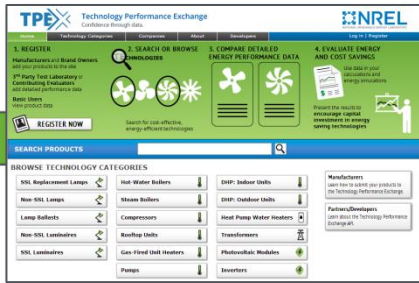
Power Lines: Michael Mandiberg, Flickr, Not Modified, Creative Commons License, <https://creativecommons.org/licenses/by-sa/2.0/>
Power Plant: Bret Arnett, Flickr, Not Modified, Creative Commons License, <https://creativecommons.org/licenses/by-nc-sa/2.0/>
Commercial Building: Steven Martin, Flickr, Not Modified, Creative Commons License, <https://creativecommons.org/licenses/by-nc-nd/2.0/>
Engineers: Seattle Municipal Archives, Flickr, Not Modified, Creative Commons License, <https://creativecommons.org/licenses/by/2.0/>
Table 2.3 – Commercial Sector Energy Consumption, EIA, <http://www.eia.gov/totalenergy/data/monthly/#consumption>
2013 EIA-861 Energy Efficiency, <http://www.eia.gov/electricity/data/eia861/>

Current Work

- Typical utility field study:
 - \$300k - \$2M
 - 12-18 months to complete¹
- **Need a better way to establish rebates and incentives for new technologies!**
- Mid TPEX pilot with BPA
- If successful, manufacturers have a strong value proposition to add technologies
 - TPEX -> BCL -> OpenStudio -> PTool analogue -> Product Rebate -> Sales

¹ Callahan, Jack. *Smart Internet Connected Controls and Variable Capacity Heat Pumps: New Technologies Need New M&V*. Bonneville Power Administration. May 16, 2014.
www.utilityforum.org/2014/presentations/Callahan-VCHP%20and%20Smart%20Devices.pdf. Accessed November 17, 2014.

Current Work



Everything Else
OpenStudio
Is Used For

Market Impact

Accelerating Impact:

- Working with BPA to integrate TPEX into technology evaluation programs
- Relationship development at key events
 - Better Buildings Summit
 - ACEEE Summer Study on Energy Efficiency in Buildings
 - ASHRAE Annual and Winter Meetings
- TPEX VRF data now available to 27,000+ OpenStudio users
 - Additional products available as data added to TPEX

Long-Term Market Impact Goal:

- Three utilities using TPEX for product rebate M&V or development by 2017

Tracking Impact

TPEX™ Techno
Confiden

Home Technology Categori

Results (114)

Narrow Your Results

Data Contributed By: ▶

Technology Category: ▼

- Ductless Heat Pumps 114
- Indoor Unit 114

Rated Cooling Capacity (W): ▶

Rated Cooling Sensible Heat Ratio: ▶

Outdoor Unit (32)

- MEL (1)
- Display (1)
- Plasma Television (1)

Filter by group

- NREL Technology Performance Exchange (131)
- NREL (1)

Filter by attributes

Apply filters

TPEX™ Technology Performance Exchange™ **NREL**

Results (114)

Narrow Your Results

Data Contributed By: ▶

Technology Category: ▼

- Ductless Heat Pumps 114
- Indoor Unit 114

Rated Cooling Capacity (W): ▶

Rated Cooling Sensible Heat Ratio: ▶

Rated Heating Capacity (W): ▶

Working Refrigerant: ▶

Mounting Technique: ▶

Rated Cooling Air Flow: ▶

PRODUCT LINE / FAMILY NAME	MODEL	Rated Cooling Capacity (W)	Rated Heating Capacity (W)	Working Refrigerant	Mounting Technique	CEILING CAPACITY
Electronics Ceiling Cassettes	ABN0023792	1800	1800	410A	Ceiling Cassette	
Electronics Ducted	ABN00728102	2200	2500	410A	Ducted	
Electronics Ducted	ABN00238302	2200	2500	410A	Ducted	
Electronics Ducted	ABN00338602	2200	2500	410A	Ducted	

Building Component Library **NREL**

Sort by: Enter term, LG [Search] Download Selected

Filter by type

- Component (102)

Filter by tags

- HVAC (17)
- Ductless Heat Pump (17)
- Indoor Unit (7)
- Outdoor Unit (32)
- MEL (1)
- Display (1)
- Plasma Television (1)

Filter by group

- NREL Technology Performance Exchange (131)
- NREL (1)

Filter by attributes

Apply filters

Reference Title	Year	Author	Date	Organization	Technology	Performance Exchange
LG SIPRA...	26/11/2013	NREL		LG Electronics USA	ABN1832E4	
LG Electronics USA ABN1832E4	10/3/2015	NREL Technology Performance Exchange		LG Electronics USA	ABN1832E4	
LG Electronics USA ABN1832E4	10/3/2015	NREL Technology Performance Exchange		LG Electronics USA	ABN1832E4	
LG Electronics USA ABN1832E4	10/3/2015	NREL Technology Performance Exchange		LG Electronics USA	ABN1832E4	
LG Electronics USA ABN1832E4	10/3/2015	NREL Technology Performance Exchange		LG Electronics USA	ABN1832E4	
LG Electronics USA ABN1832E4	10/3/2015	NREL Technology Performance Exchange		LG Electronics USA	ABN1832E4	
LG Electronics USA ABN1832E4	10/3/2015	NREL Technology Performance Exchange		LG Electronics USA	ABN1832E4	
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LG Electronics USA ABN1832E4	10/3/2015	NREL Technology Performance Exchange		LG Electronics USA	ABN1832E4	

Credit: Daniel Studer, NREL

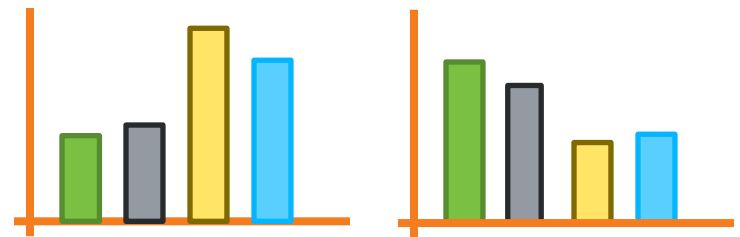
Tracking Impact

Internal checkpoints

- **Calibration data** – Do we have a dataset we can calibrate a model against?
- **Calibration results** – Are the calibrated model results sufficiently accurate?
- **Manufacturer data sufficiency** – Have manufacturers provided data for the calibration test?

Go/No-Go Decision Points:

- **Sector data sufficiency (8/21/2015)**– Have manufacturers provided enough data to run a sector analysis?



Project Integration and Collaboration

Project Integration:

- Better Buildings Alliance specifications
- Utility interactions (PG&E, Xcel, National Grid, SDG&E)
- Bonneville Power Administration partnership
- Manufacturer outreach (LG, Mitsubishi, Sanden, etc.)
- Building Energy Data Exchange Specification (BEDES)

Partners, Subcontractors, and Collaborators:

- Federal Energy Management Program
- Bonneville Power Administration

Communications:

- 2014 ACEEE Summer Study on Efficiency in Buildings
- January Interagency Sustainability Working Group (ISWG) meeting
- SPC 205 Meetings, 2014 Annual and Winter ASHRAE Conferences
 - VRF subcommittee

Progress and Accomplishments

Accomplishments:

- 19 total technology categories developed
- End-to-end ecosystem interlinks completed
- Enter TPEX data -> drag-and-drop in OpenStudio
- Public commitments from Target, Walmart, Bonneville Power Administration, and LG Electronics
- 131 total OS-quality VRF product submissions from LG
- Pilot demonstration underway with BPA

Lessons Learned:

- Diversity of technology evaluation workflows/processes
- Institutional inertia

Next Steps and Future Plans:

- Expansion to additional utilities
- Manufacturer support

REFERENCE SLIDES

Project Budget

Project Budget:

- FY2012: \$223,000 BTO; \$200,000 FEMP
- FY2013: \$257,000 BTO; \$290,000 FEMP
- FY2014: \$134,000 BTO; \$75,000 FEMP
- FY2015: \$155,000 BTO

Variances: No variance

Cost to Date: 24% of DOE funds spent in FY2015

Additional Funding: Bonneville Power Administration

- FY2013: \$222,870
- FY2014: \$100,889

Budget History

FY2012 – FY2014 (past)		FY2015 (current)		FY2016 (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
1,179k	324k	155k	0k	TBD	TBD

Project Plan and Schedule

Project Schedule												
Project Start: January 27, 2012	Completed Work											
Projected End: November 20, 2015	Active Task (in progress work)											
	◆ Milestone/Deliverable (Originally Planned) use for missed											
	◆ Milestone/Deliverable (Actual) use when met on time											
	FY2013				FY2014				FY2015			
Task	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Past Work												
Q1 Milestone: Develop Data Entry Forms	◆											
Q2 Milestone: Release TPEX v1.0		◆										
Q4 Milestone: Bulk Upload Scripts				◆								
Q4 Milestone: Formal API Enhancement				◆								
Q4 Milestone: Site Maintenance and Server Upgrades				◆								
Q4 Milestone: Industry Outreach Activities				◆								
Q1 Milestone: Add 6 New Technology Categories					◆							
Q1 Milestone: Add PV Module and Inverter Datasets					◆							
Q2 Milestone: Progress Report on Utility Collaborative						◆						
Q3 Milestone: Utility Technology Status Report							◆					
Q4 Milestone: Integrate Utility Technologies of Interest								◆				
Q4 Milestone: Recruit 3 Utilities to Support/Use TPEX								◆				
Q4 Milestone: Launch TPEX with 15 Technologies								◆				
Current/Future Work												
Q3 Milestone: Calibrated Energy Model											◆	