NREL - DOE Technology Performance Exchange

2015 Building Technologies Office Peer Review

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

Daniel Studer, Daniel.Studer@nrel.gov
National Renewable Energy Laboratory

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

Key Partners:

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

Budget:

BTO $ to date: $769,000

FEMP $ to date: $565,000

Other $ to date: $323,759

Total future DOE $: TBD

Project Goal:

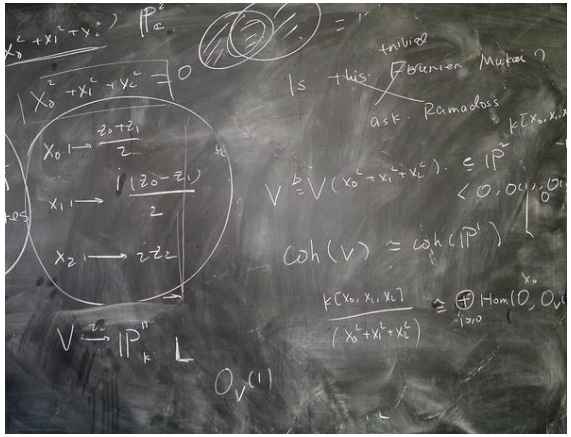
Provides a pipeline for product-specific performance data submitted by manufacturers, utilities, and HIT Catalyst demonstrations to be quickly vetted, analyzed, and adopted by utilities and building owners.

Target Market/Audience:

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

Problem Statement

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

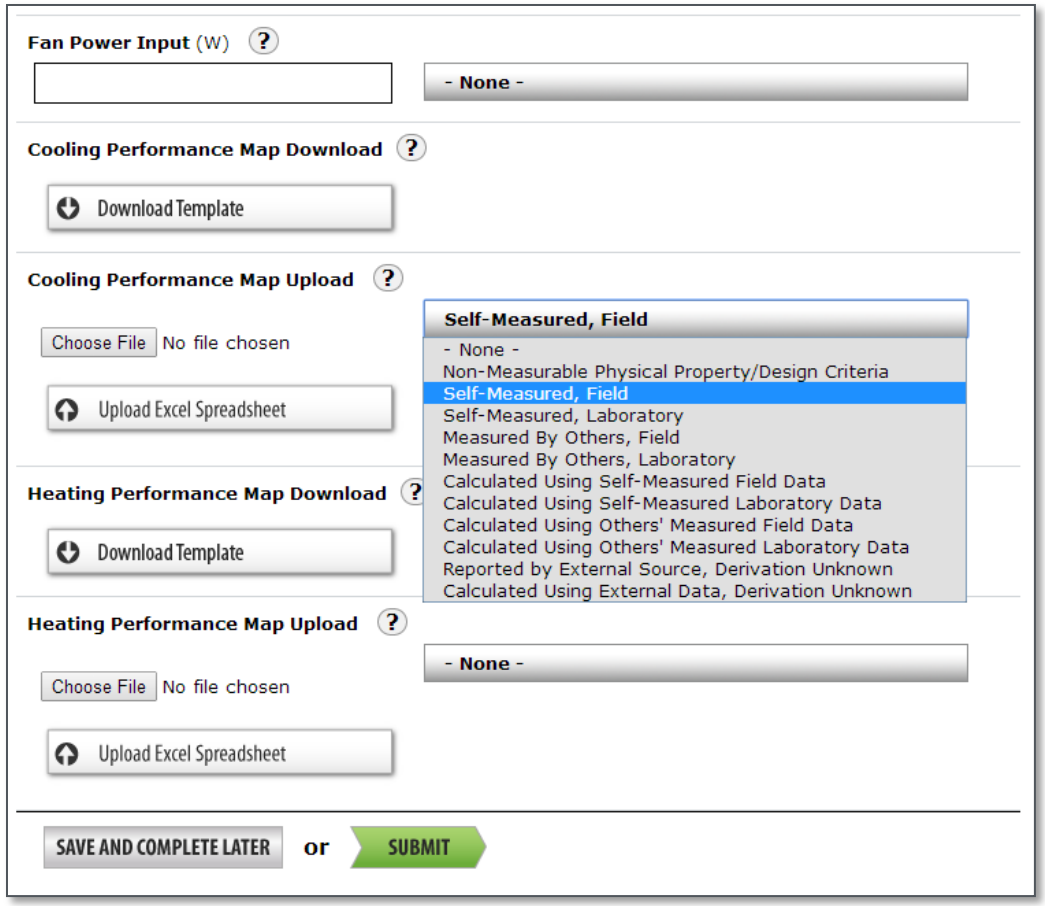


Secretary Moniz: National Nuclear Security Administration, Flickr, Cropped, Creative Commons License, https://creativecommons.org/licenses/by-nd/2.0/
Los Angeles: Metro Library and Archive, Cropped, Creative Commons License, https://creativecommons.org/licenses/by-nc-sa/2.0/
RSF: Dennis Schroeder, NREL, http://images.nrel.gov/viewphoto.php?imageId=6316259
Money: Andrew Magill, Flickr, Not Modified, Creative Commons License, https://creativecommons.org/licenses/by/2.0/
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



Credit: Daniel Studer, NREL

Approach

Quality Control: Transparency provided via metadata

Provenance

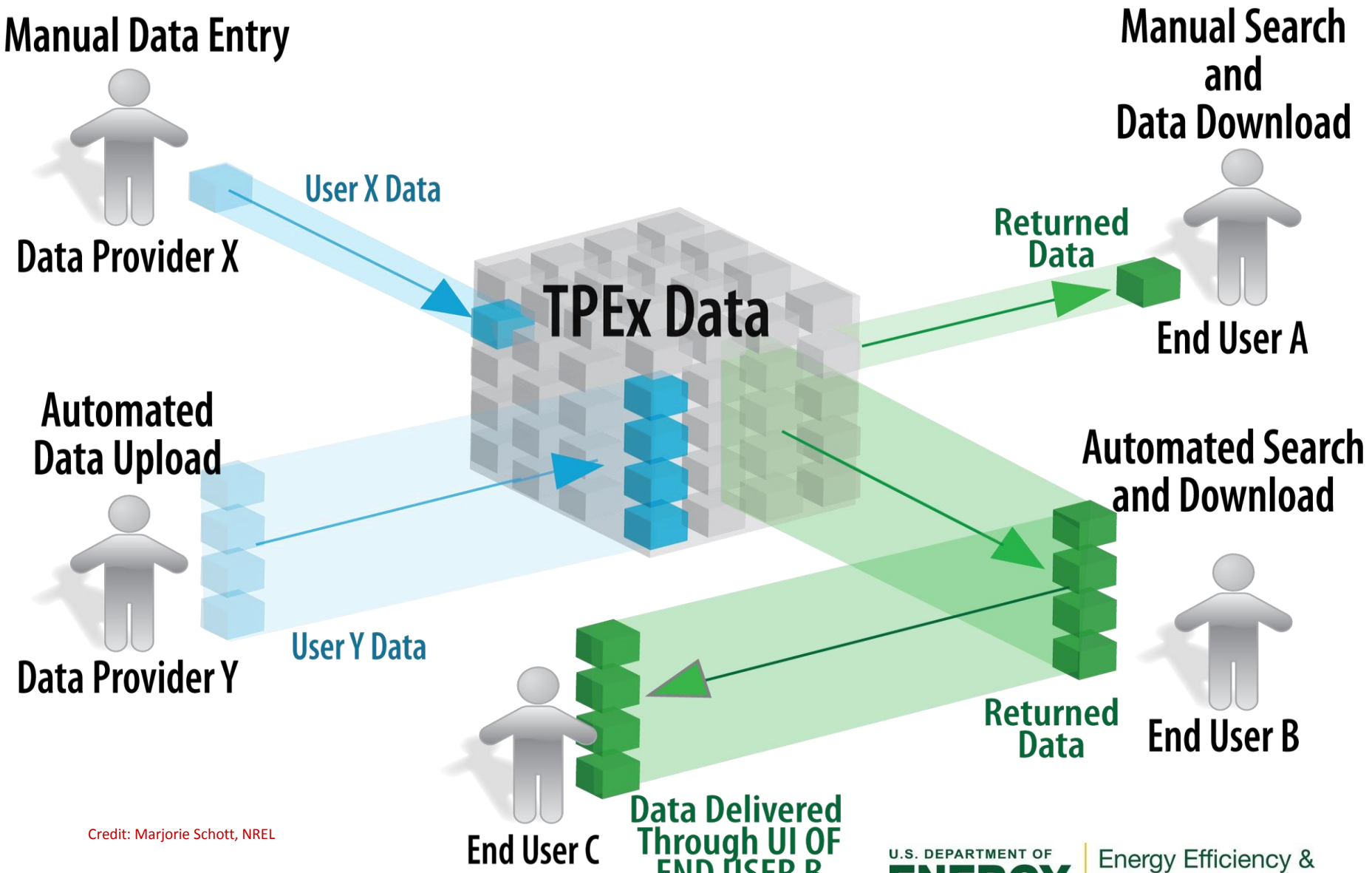
Module Efficiency (average of 5 reports) **18.40 %**

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

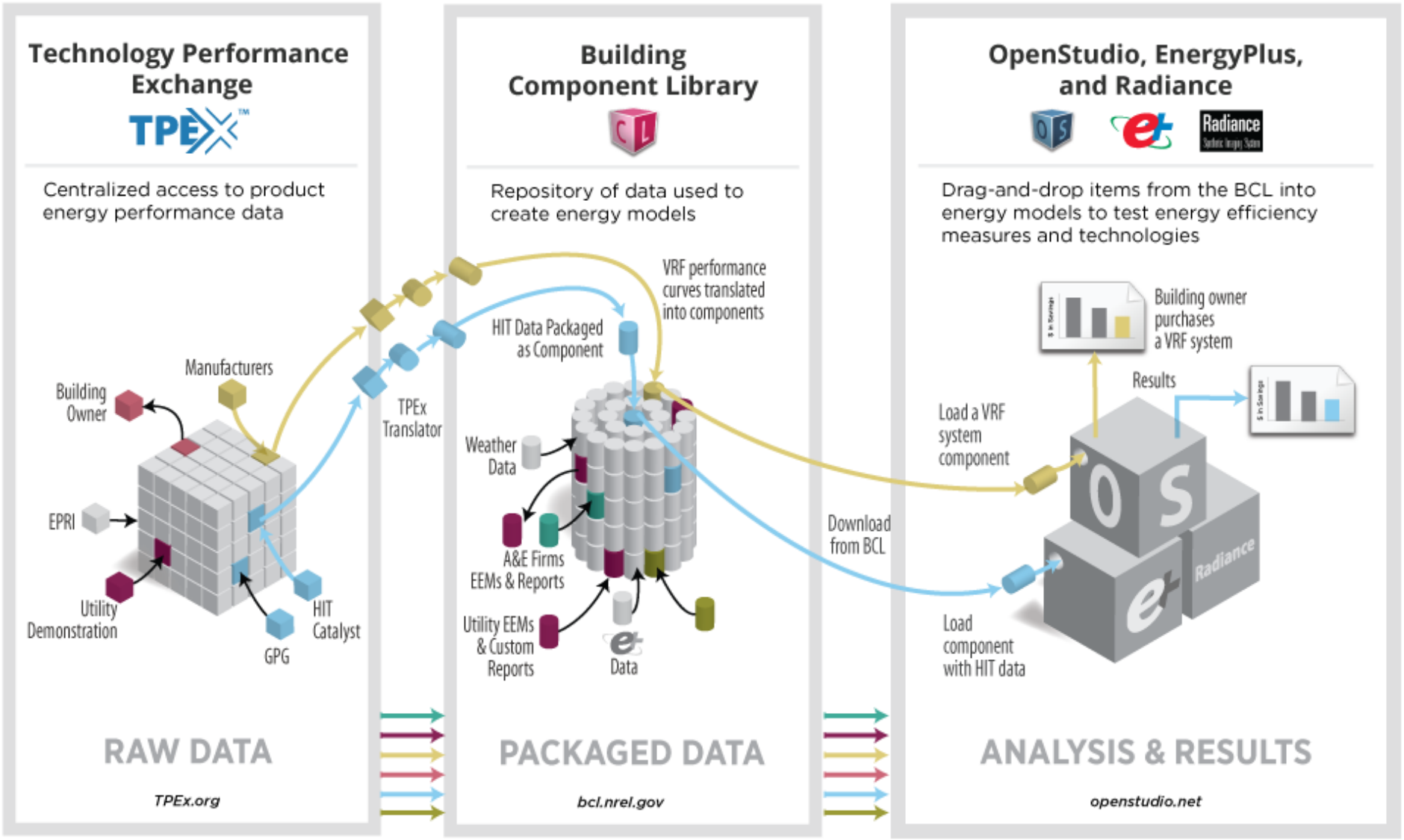
Credit: Marjorie Schott, NREL

Approach

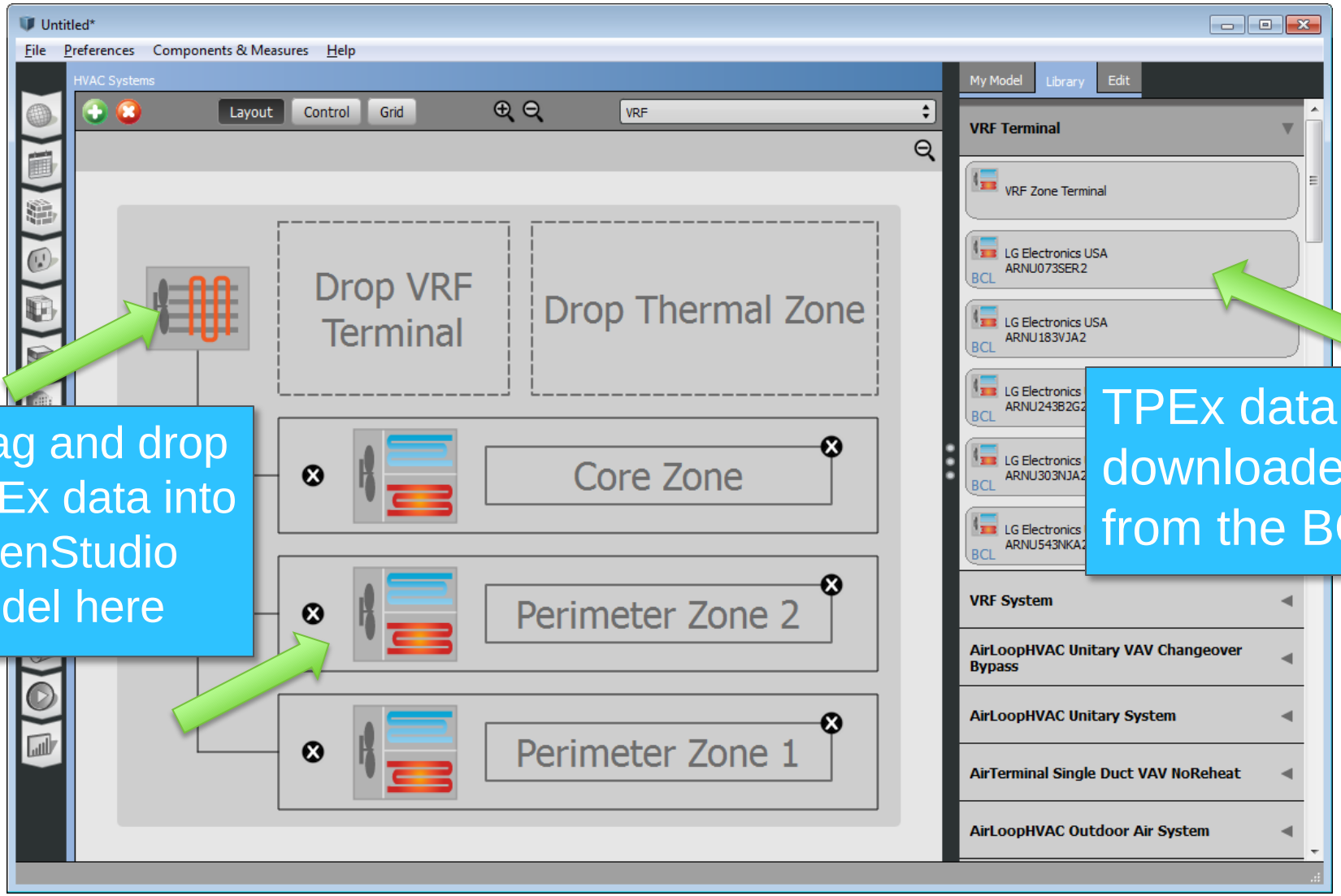


Credit: Marjorie Schott, NREL

Distinctive Characteristics: An Integrated Ecosystem



Distinctive Characteristics: End-to-End Functionality



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)

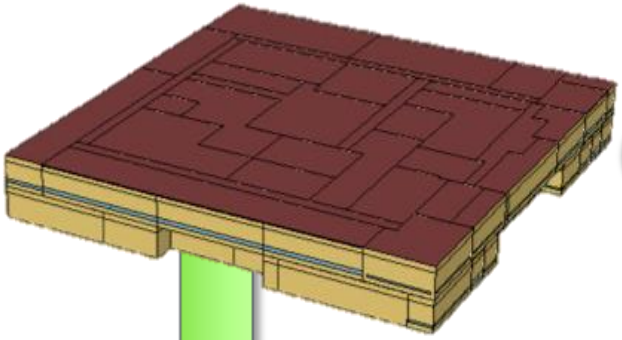
Power Lines: Michael Mandiberg, Flikr, Not Modified, Creative Commons License, https://creativecommons.org/licenses/by-sa/2.0/
Power Plant: Bret Arnett, Flikr, Not Modified, Creative Commons License, https://creativecommons.org/licenses/by-nc-sa/2.0/
Commercial Building: Steven Martin, Flikr, Not Modified, Creative Commons License, https://creativecommons.org/licenses/by-nc-nd/2.0/
Engineers: Seattle Municipal Archives, Flikr, 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 complete[1]
- **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



Amazon EC-2 - Commodity Computing for Everyone

Measures, Measures, & More Measures

Auto-Generated Baseline Models

Scalable Cloud-Based Analysis

Everything Else OpenStudio Is Used For

OpenStudio Platform

Extensible Portfolio-Scale Analysis

Market Impact

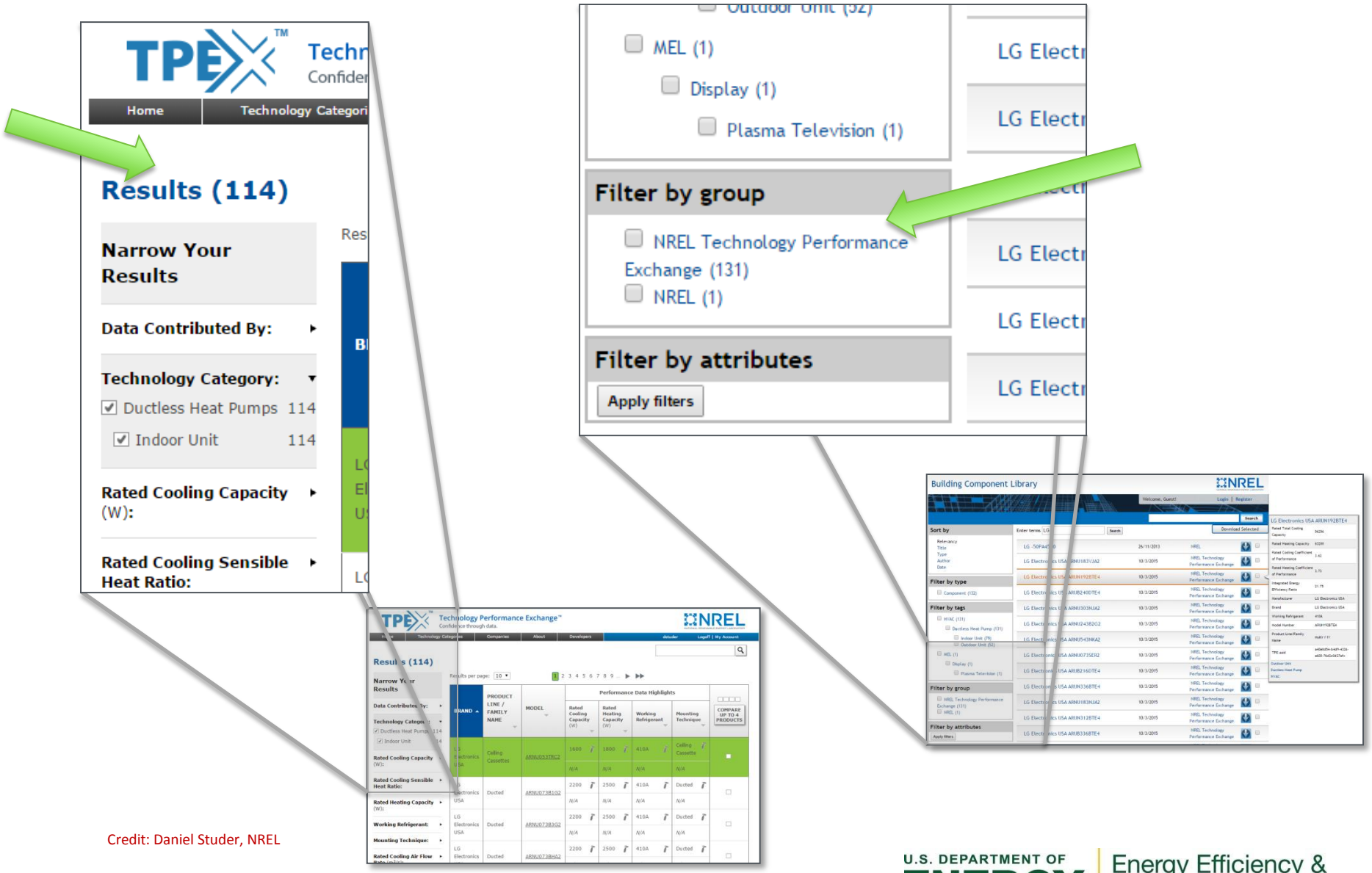
Accelerating Impact:

- 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



Credit: Daniel Studer, NREL

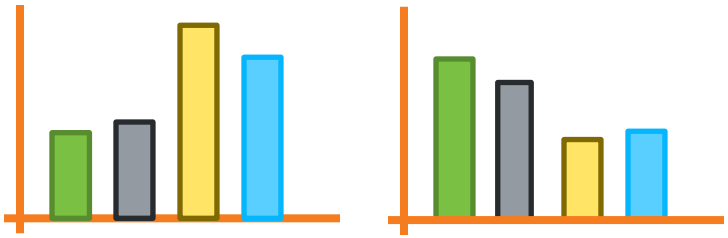
Tracking Impact

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