

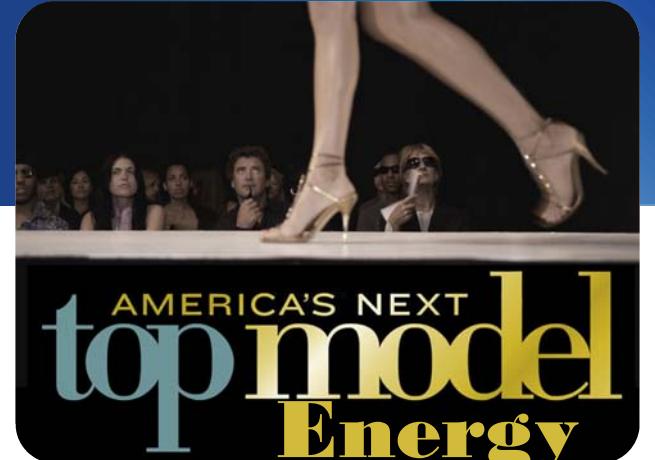


**Better Buildings Residential Network Peer Exchange Call Series: America's Next Top Energy Model: Tools and Best Practices (101)**

December 1, 2016

*Call Slides and Discussion Summary*

# Agenda



- Agenda Review and Ground Rules
- Opening Polls
- Brief Residential Network Overview
- Featured Speakers
  - **Nora Wang**, Pacific Northwest National Laboratory
  - **Jennifer Thorne Amann**, American Council for an Energy-Efficient Economy (ACEEE) (*Network Member*)
  - **Ryan Moore**, OptiMiser
- Discussion
  - In what ways has your organization incorporated energy modeling tools and practices into your program offerings?
  - What are the benefits of energy modelling tools and practices?
  - What challenges have you encountered in identifying and incorporating new energy modeling tools and practices?
  - Other questions/topics related to modeling?
- Closing Poll and Upcoming Call Schedule

2

# Better Buildings Residential Network

**Better Buildings Residential Network:** Connects energy efficiency programs and partners to share best practices and learn from one another to increase the number of homes that are energy efficient.

**Membership:** Open to organizations committed to accelerating the pace of home energy upgrades.

## Benefits:

- Peer Exchange Calls 4x/month
- Tools, templates, & resources
- Recognition in media, materials
- Speaking opportunities
- Updates on latest trends
- Voluntary member initiatives
- Residential Program Solution Center guided tours

**Commitment:** Provide DOE with annual number of residential upgrades, and information about associated benefits.

*For more information or to join, email [bbresidentialnetwork@ee.doe.gov](mailto:bbresidentialnetwork@ee.doe.gov), or go to [energy.gov/eere/bbrn](http://energy.gov/eere/bbrn) and click Join*

# Peer Exchange Call Series

***We hold one Peer Exchange call the first four Thursdays of each month from 1:00-2:30 pm ET***

Calls cover a range of topics, including financing & revenue, data & evaluation, business partners, multifamily housing, and marketing & outreach for all stages of program development and implementation

## Upcoming calls:

- December 8: Oh, the Weather Outside is Frightful: Weatherizing Manufactured Homes (301)
- December 15: Hibernation Mode: What Smart Thermostats Can Do for You (301)
- December 22 and 29: No calls – Winter break

**We will resume our normal call schedule on Thursday, January 12!**

*Send call topic ideas to [peerexchange@rossstrategic.com](mailto:peerexchange@rossstrategic.com)*

*See the Better Buildings Residential Network Program [website](#) to register*



# **Best Practices: Pacific Northwest National Laboratory**



Pacific Northwest  
NATIONAL LABORATORY

*Proudly Operated by Battelle Since 1965*

# Asset Score for Multifamily Buildings

Better Buildings Webinar

America's Next Top Energy Model: Tools and Best Practices (101)

1:00-2:30 ET / Dec 01, 2016

NORA WANG

Pacific Northwest National Laboratory

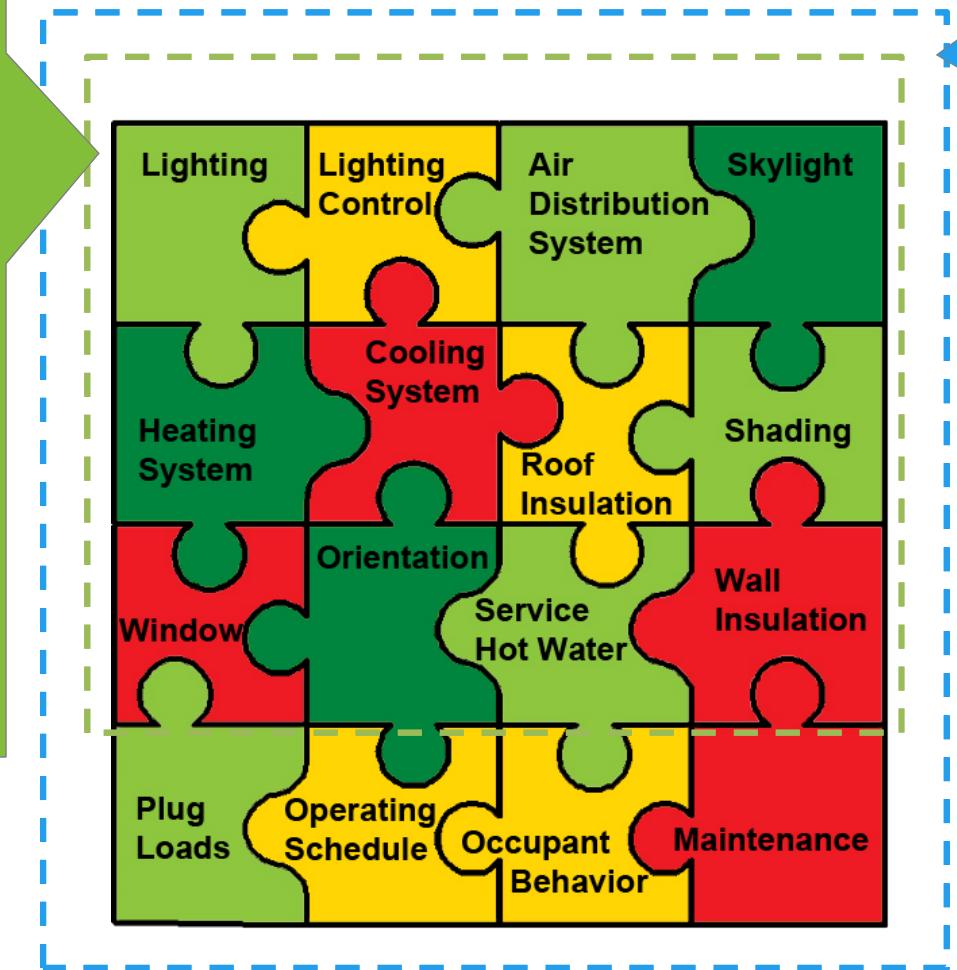


Pacific Northwest  
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

# What is Asset Score?

**Asset Score** evaluates the as-built physical characteristics (envelope, HVAC, lighting, service hot water) of a building and its overall energy efficiency, independent of occupancy and operational choices.



**ENERGY STAR** benchmarks the overall building performance against peers.



Pacific Northwest  
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

## How it Works

Asset Score runs an *energy simulation* using a powerful building energy modeling engine (EnergyPlus through OpenStudio)

- The simulation normalizes for building operations, occupancy and tenant behavior
- Users (owner, operator, service, provider, etc.) enter building information through a web interface
  - General information: # of floors, footprint dimension, orientation, use type
  - Envelope components: Roof, exterior wall, floor types, insulation levels
  - Fenestration: Skylights, windows, shading
  - Lighting: Fixture types, # of fixtures or % of served floor area, lighting controls
  - Mechanical components: Cooling/heating types, controls, equipment efficiency
  - Service water heating: Fuel type, distribution type, equipment efficiency



Pacific Northwest  
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

# Asset Score Tool

The screenshot shows the 'New Building' dialog box. It includes fields for 'Building Name', 'Year Completed', 'Gross Floor Area (sq ft)', and 'Location' (Street, City, Alabama, Postal Code). Buttons for 'Cancel' and 'Create Building' are at the bottom.

The screenshot shows the 'New Fixture' dialog box under the 'Lighting' section. It includes fields for 'Mounting Type' (Recessed), 'Lighting Type' (Compact Fluorescent), 'Lamp Wattage (W)', and 'Number of Lamps in Fixture'. Buttons for 'Cancel' and 'Create Fixture' are at the bottom.

1. Create a new building and enter basic building information

The screenshot shows the main interface with a 3D building model. On the left, a sidebar lists 'USE TYPES': 'Multi-family (4 floors or greater)' (1 block, 92,155.0 ft<sup>2</sup>, 53% of total building area), 'Retail' (1 block, 27,507.0 ft<sup>2</sup>, 16% of total building area), and 'Parking Garage (Ventilation Only)' (1 block, 55,014.0 ft<sup>2</sup>, 31% of total building area).

3. Create 3-D block(s) of your building and apply use type(s) and features to your building block(s)

2. Identify building use type(s) and create an inventory of your building features (HVAC, windows, etc.)

The screenshot shows the 'Score Building' summary page for 'Test Building !'. It displays:

- Block:** Retail - 40,000.00 ft<sup>2</sup>
- USE TYPE:** Retail
- GEOMETRY:** Above Ground, 1 floor, Floor-to-Floor Height: 12.00ft, No drop ceiling, Floor-to-Ceiling Height: 10.00ft, Orientation: 0.0° from North
- CONSTRUCTION:** Roof Type: Built-up/EPDM w/ concrete deck, No skylights, Floor Type: Slab-on-Grade
- LIGHTING:** Recessed Incandescent/Halogen - 100 fixtures
- HEATING/COOLING:** Cooling-Terminal DX

4. Score your building and receive your Asset Score Report

# Asset Score Report



Pacific Northwest  
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

The Asset Score generates a report with the following information:

- 10-point score based on the EE of the building envelope and the mechanical, electrical, and service hot water systems
- EE assessment of the building's individual systems
- Total estimated building energy usage and energy use by end use under standard operating conditions
- Opportunities to upgrade building efficiency, and a "potential" energy efficiency score based on identified upgrades

# Asset Score Report



Pacific Northwest  
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

## BUILDING ENERGY ASSET SCORE

### OVERALL BUILDING SCORE

**BUILDING INFORMATION**

Example Building - Single Use  
2000 A Street  
Chicago, IL 60601

Building Type: Office  
Gross Floor Area: 100,000 ft<sup>2</sup>  
Year Built: 2005

Score Date: 09/22/2015  
Building ID #: XXXXX

1

Potential Score **9.5**

Estimated Savings<sup>1</sup> **45%**

Current Score **6**

1 Uses MORE Energy      10 Uses LESS Energy<sup>2</sup>

Building Use Types	Estimated Source Energy Use (kBtu/ft <sup>2</sup> )	Energy Use Intensity by Fuel Type
Office: 100,000 ft <sup>2</sup> <small>This report includes a Score for the entire building as well as individual Scores for each of the separate use types.</small>	Current Building 143 Upgraded Building 79	<p>Site Energy Use (kBtu/ft<sup>2</sup>)</p> <p>Source Energy Use (kBtu/ft<sup>2</sup>)</p> <p>Fuel Type [ Site EUI , Source EUI ]</p> <ul style="list-style-type: none"> <li>Gas [ 8.1, 8.5 ]</li> <li>Electricity [ 42.8, 134.5 ]</li> <li>District Heating [ 0.0, 0.0 ]</li> <li>District Cooling [ 0.0, 0.0 ]</li> </ul>

The Building Energy Asset Score is a national rating system developed by the U.S. Department of Energy. The Score reflects the energy efficiency of a building based on the building's structure, heating, cooling, ventilation, and hot water systems. The building's Structure and Systems are individually evaluated and ranked. The Upgrade Opportunities page provides recommendations for how to improve the building's energy efficiency, increase the building's Asset Score, and save money.

**U.S. DEPARTMENT OF ENERGY**

Example report version 3/3/2015

## Four sections

- Score
- Upgrade Opportunities
- Structure and Systems
- Building Assets

## BUILDING ENERGY ASSET SCORE

### STRUCTURES AND SYSTEMS

Building Name: Example Building - Single Use  
Gross Floor Area: 100,000 ft<sup>2</sup>

**ABOUT THE BUILDING SYSTEMS**

Ranking <sup>3</sup>	Heating	Cooling	Overall HVAC Systems
Poor	Medium	Good	Superior

**ABOUT THE BUILDING ENVELOPE**

Ranking <sup>4</sup>	Roof Up Grade, Non-metal, Insulation > R-10	Window U-Value, Framed, Double pane	Window U-Value (min > R)	Window U-Value (max < R)	Window Solar Heat Gain Coefficient
Good	Medium	Medium	Medium	Medium	Good

**SOURCE ENERGY USE INTENSITY BY END USE**

Current Energy Use Intensity or Building Envelope are less efficient than a typical building built to the 2004 energy code. Building Envelope is the highest efficiency levels with normal operating conditions. Building Envelope & Heating Systems are evaluated as Poor and Average.

4

**U.S. DEPARTMENT OF ENERGY**

Building Name: Example Building - Single Use  
Gross Floor Area: 100,000 ft<sup>2</sup>

**BUILDING ENERGY ASSET SCORE**

### UPGRADE OPPORTUNITIES

3

**Cost Effective Upgrade Opportunities**

	Energy Savings <sup>5</sup>	Cost <sup>6</sup>
Building Envelope	High	\$ 1 - \$5
Interior Lighting	High	\$5 - \$55
HVAC Systems	Medium	\$5
Hot Water Systems	Low	\$5

5

**U.S. DEPARTMENT OF ENERGY**

Building Name: Example Building - Single Use  
Gross Floor Area: 100,000 ft<sup>2</sup>

**BUILDING ENERGY ASSET SCORE**

### BUILDING ASSETS

5

**Office Block CHARACTERISTICS SUMMARY**

Current Building	Office Block
Surface	Brick/Stone or masonry
Wall Type	Estimated
Window Frame Type	Wood
Window Glass Type	Single pane
Window Day Fit Type	None
Window Layout	Continuous
Window-to-Bldg Ratio	0.40
Roof	Flat roof or metal deck
Roof Type	0.00 Btu/ft <sup>2</sup> R-10
Roof U-value	0.88 Btu/ft <sup>2</sup> R-10
Skylights	Estimated
No. Skylights	0
Floor	Ground
Floor Type	Concrete
Floor U-value	Estimated
Walls and Windows	Brick/Stone or masonry
Wall Type	Estimated
Window Frame Type	Wood
Window Glass Type	Single pane
Window Day Fit Type	None
Window Layout	Continuous
Window-to-Bldg Ratio	0.40
Windows	Brick/Stone or masonry
Window U-value	0.88 Btu/ft <sup>2</sup> R-10
Window SHGC	0.8
Window VT	Estimated
Exterior Shading Type	External Overhang
Wall Type	Estimated
Window Day Fit Type	None
Window Layout	Continuous
Window-to-Bldg Ratio	0.40

1. These costs reflect the reduction in source energy that would result from undertaking all of the efficiency improvements identified on the Opportunities page. Actual savings will depend on a variety of factors including actual operating conditions.

2. A score of 10 represents lowest expected energy usage using current energy efficiency technologies. A score of 8.5 represents a high-efficiency building that uses approximately 30% less energy than a building built to the ASHRAE 90.1-2004 energy code.

3. These costs are based on Advanced Energy Retrofit Costs and RHI terms. The costs are maximum costs, not minimum costs. The data used to calculate these costs are from the 2012 ASHRAE 90.1-2010 energy code.

4. Overall operating assumptions are used for building envelope if no values are entered by the user.

U.S. DEPARTMENT OF ENERGY

<sup>1</sup> Savings reflect the reduction in source energy that would result from undertaking all of the efficiency improvements identified on the Opportunities page. Actual savings will depend on a variety of factors including actual operating conditions.

<sup>2</sup> A score of 10 represents lowest expected energy usage using current energy efficiency technologies. A score of 8.5 represents a high-efficiency building that uses approximately 30% less energy than a building built to the ASHRAE 90.1-2004 energy code.

<sup>3</sup> This report is based on self-reported building information. <http://energy.gov/eere/buildings/building-energy-asset-score>

<sup>4</sup> The overall energy usage reflects the weighted operational savings for the overall building envelope with the specific efficiency improvements identified on the Opportunities page. Actual savings will depend on a variety of factors including actual operating conditions and priority areas.

<sup>5</sup> The costs are based on Advanced Energy Retrofit Costs and RHI terms. The costs are maximum costs, not minimum costs. The data used to calculate these costs are from the 2012 ASHRAE 90.1-2010 energy code.

<sup>6</sup> Overall operating assumptions are used for building envelope if no values are entered by the user.

# Asset Score Preview



Pacific Northwest  
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

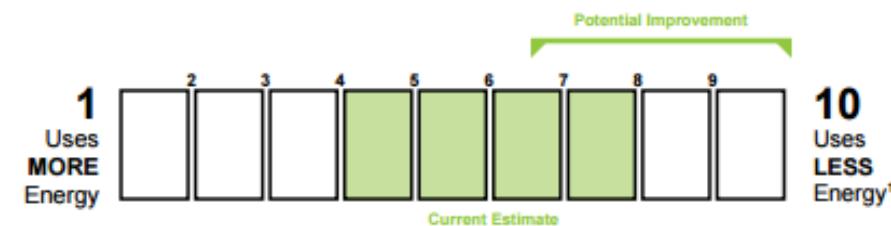
## Asset Score Input Mode

### PREVIEW

Select this mode to obtain an estimated score range and an Asset Score report preview based on a limited amount of inputs.

[Learn More](#)

Preview



### Full Report

Select this mode to obtain a full Asset Score report with current and potential scores, total energy use values, building upgrade opportunities, and system evaluations.

[Learn More](#)

Asset Score



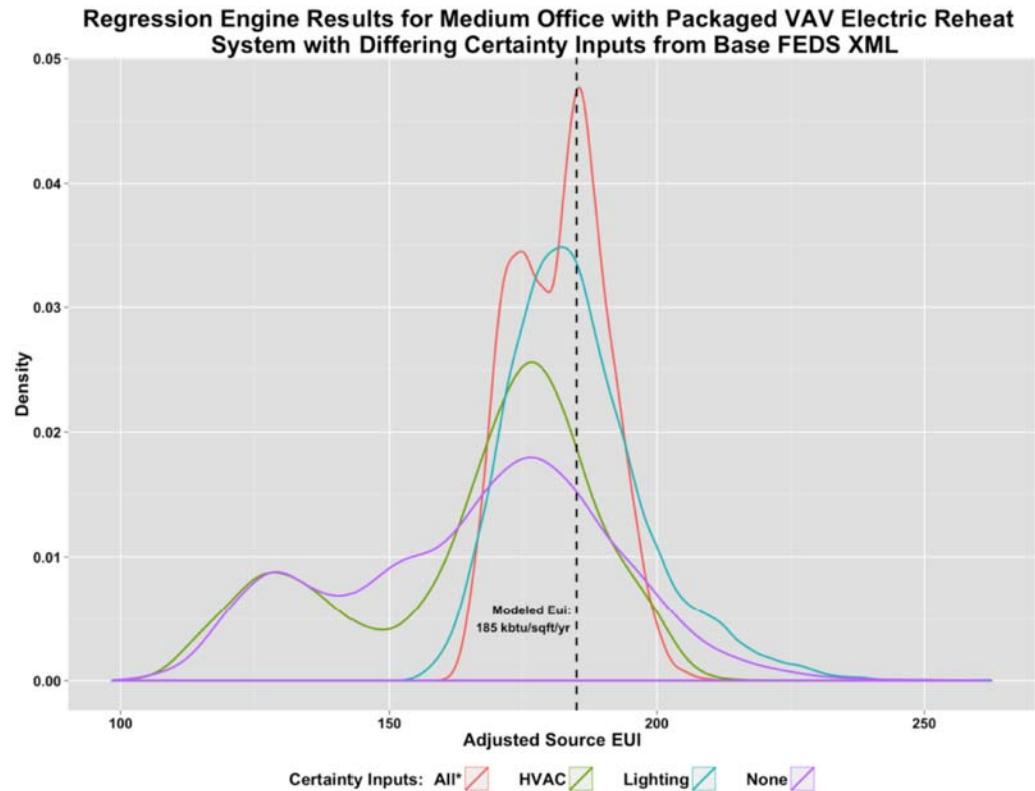
# Asset Score Preview



Pacific Northwest  
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

- Provides a quick assessment of a building, based on a minimum of 7 inputs
- Uses a pre-simulated database and regression analysis
- Providing additional inputs improves accuracy of results





Pacific Northwest  
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

# Asset Score Preview: Workflow

Release 2.1.4.353 Version AssetScore\_Rails\_release\_353 U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy PREVIEW

Building Info

Building Name\* Preview Office Building

Year Completed\* 1990

Total Floor Area\* 100000 m<sup>2</sup>

Location

123 Street

Portland Oregon 97202

Add notes about this building

Next →

Release 2.1.4.353 Version AssetScore\_Rails\_release\_353 U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy PREVIEW

Use Types

The available Use Types refer to the general primary business or function of the building, not the specific activity of a particular space within the building.

Medical Office

Back Next →

Release 2.1.4.353 Version AssetScore\_Rails\_release\_353 U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy PREVIEW

Building Details

Number of floors\* 6

Orientation of longest facade\* North/South

Major retrofits since construction?

Enter the year of manufacture for major retrofits:

Heating System 2004

Cooling System 2004

Service Hot Water System 2016

Lighting

Back Next →

Preview requires high level building inputs:

1. Building name
2. Location
3. Year of construction
4. Conditioned floor area
5. Predominant use type
6. Number of floors
7. Building orientation

# Asset Score Preview: Workflow



Pacific Northwest  
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

- Defaults can be edited, verified, or marked as unknown. User verification will affect the uncertainty model.
- Preview building can be converted to a Full building.

Office Building Preview Score SWITCH TO FULL VERSION PREVIEW

Medical Office - 100,000.00 ft<sup>2</sup>

**CONSTRUCTION**

**Roof:** Built-up w/ metal deck [Edit] [Checkmark] [Question]

**Floor:** Slab-on-Grade [Edit] [Checkmark] [Question]

**Wall:** Brick/Stone on masonry [Edit] [Checkmark] [Question]

**Window Details:**

**Framing Type:** Metal w/ Thermal Breaks [Edit] [Checkmark] [Question]

**Glass Type:** Double Pane [Edit] [Checkmark] [Question]

**Layout:** Continuous [Edit] [Checkmark] [Question]

**Window-to-Wall Ratio:** 0.30 [Edit] [Checkmark] [Question]

**SERVICE WATER HEATING**

**Fuel Type:** Gas [Edit] [Checkmark] [Question]

**LIGHTING**

Your building may have 1-3 lighting fixtures. Use [Delete] to delete a fixture or [Add] to add a new fixture. If any lighting detail is marked as uncertain, the entire lighting section will be evaluated as uncertain.

**Fixture:** Recessed Fluorescent T12 [Edit] [Checkmark] [Question]  
90.0% served [Edit] [Checkmark] [Question]

**Fixture:** Recessed Incandescent/Halogen [Edit] [Checkmark] [Question]  
10.0% served [Edit] [Checkmark] [Question]

[Add] [Info] Lighting will be evaluated overall as uncertain.

**HEATING/COOLING**

**System:** Packaged Rooftop VAV with Hot-Water Reheat [Edit] [Checkmark] [Question]

**Equipment Type:** Air Handler

**Distribution Type:** Multiple Zone

**Cooling Source:** Central DX

**Heating Source:** Boiler

**Heating Fuel Type:** Gas [Edit] [Checkmark] [Question]

As of August 2016...



Pacific Northwest  
NATIONAL LABORATORY

*Proudly Operated by Battelle Since 1965*

**952** Buildings scored

**124M** Square feet

**44** States

**1413** Registered users

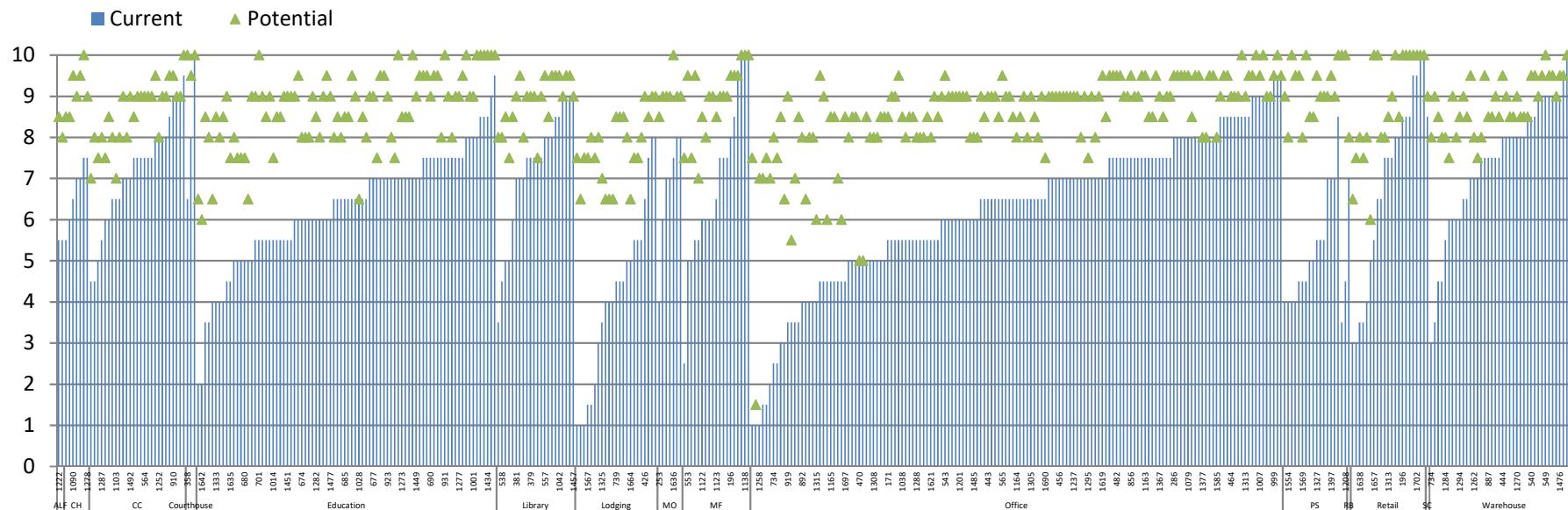
# Buildings in Asset Score Tool



Pacific Northwest  
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

Average energy savings identified range from 20-40%

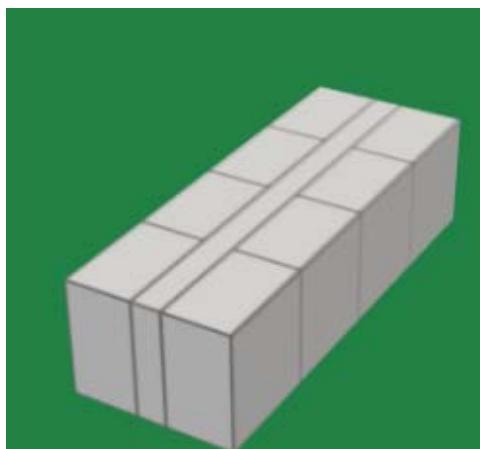


# Example of Multifamily Building Model

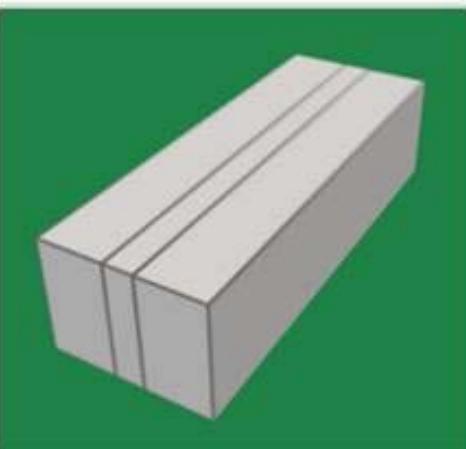


Pacific Northwest  
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965



Building Name: MidRise Apartment Example



Gross Floor Area: 34,048 ft<sup>2</sup>

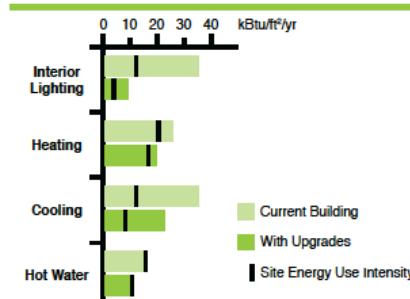
## ABOUT THE BUILDING SYSTEMS

	Ranking <sup>4</sup>
Interior Lighting	Fair
Heating	Superior
Cooling	Good
Overall HVAC Systems	Superior

## ABOUT THE BUILDING ENVELOPE

	Ranking <sup>5</sup>
Roof U-Value, Non-Attic (Btu/ft <sup>2</sup> h °F)	Fair
Walls U-Value, Framed (Btu/ft <sup>2</sup> h °F)	Good
Windows U-Value (Btu/ft <sup>2</sup> h °F)	Good
Walls + Windows U-Value (Btu/ft <sup>2</sup> h °F)	Good
Window Solar Heat Gain Coefficient	Good

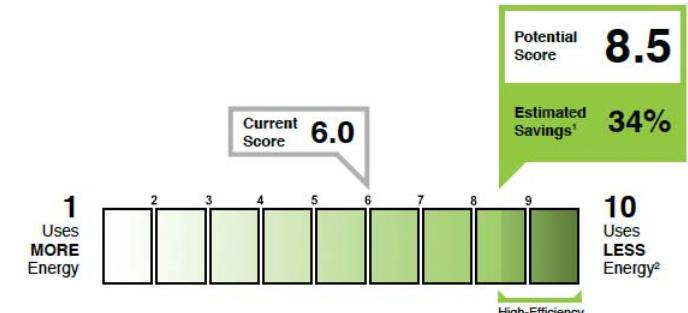
## SOURCE ENERGY USE INTENSITY BY END USE



## BUILDING ENERGY ASSET SCORE OVERALL BUILDING SCORE

1

BUILDING INFORMATION	MidRise Apartment Example	Building Type:	Multi-family (4 floors or greater)	Score Date:	11/18/2016
ABC street Baltimore, MD 21201		Gross Floor Area: Year Built:	84,360 ft <sup>2</sup> 1996	Building ID #: Software Release:	4943 2.2.0.378



Standard Occupancy and Operating Conditions	Estimated Source Energy Use (kBtu/ft <sup>2</sup> )	Energy Use Intensity by Fuel Type
Number of Assumed Occupants	89	Site Energy Use (kBtu/ft <sup>2</sup> )
Hours of Operation	115.0 hrs/wk	Source Energy Use (kBtu/ft <sup>2</sup> )
Cooling Set Point	75° F	Fuel Type [ Site EUI , Source EUI ]
Heating Set Point	70° F	Gas [ 31.2, 32.8 ]
Misc. Energy Loads	0.62 W/ft <sup>2</sup>	Electricity [ 36.7, 115.4 ]
		District Hot Water [ 0.0, 0.0 ]
		District Steam [ 0.0, 0.0 ]
		Propane [ 0.0, 0.0 ]
		Fuel Oil [ 0.0, 0.0 ]
		District Cooling [ 0.0, 0.0 ]

The Building Energy Asset Score is a national rating system developed by the U.S. Department of Energy. The Score reflects the energy efficiency of a building based on the building's structure, heating, cooling, ventilation, and hot water systems. The building's Structure and Systems are individually evaluated and ranked. The Upgrade Opportunities page provides recommendations for how to improve the building's energy efficiency, increase the building's Asset Score, and save money.

<sup>a</sup> Savings reflect the reduction in source energy that would result from undertaking all of the efficiency improvements identified on the Opportunities page. Actual savings will depend on a variety of factors including actual operating conditions.

<sup>b</sup> A score of 10 represents lowest expected energy usage using current energy efficiency technologies. A score of 8.5 represents a high-efficiency building that uses approximately 30% less energy than a building built to the AHSRAE 90.1-2004 energy code.

This report is based on self-reported building information. <http://energy.gov/eere/buildings/building-energy-asset-score>

U.S. DEPARTMENT OF  
**ENERGY**

# Thank You



Proudly Operated by **Battelle** Since 1965

## ► Asset Score Website

[http://www1.eere.energy.gov/  
buildings/commercial/assetscore.html](http://www1.eere.energy.gov/buildings/commercial/assetscore.html)

## ► Asset Scoring Tool

[buildingenergyscore.energy.gov/](http://buildingenergyscore.energy.gov/)

## ► Asset Score Email Box

[asset.score@ee.doe.gov](mailto:asset.score@ee.doe.gov)

The screenshot shows the "Asset Score" section of the U.S. Department of Energy's Energy Efficiency & Renewable Energy website. At the top, there is a green header bar with the "U.S. DEPARTMENT OF ENERGY" logo and the text "Energy Efficiency & Renewable Energy". Below this, the main content area has a title "Asset Score" and a sub-section "Building Energy Asset Score » Asset Score Home". A "Log In" form is displayed, containing fields for "Email" (with the value "supriya.goel@pnnl.gov") and "Password" (with several dots). A "Log In" button is located below these fields. Below the form, there is a link "Forgot your password? | Register" and a note: "Note: The Asset Scoring Tool is optimized to work with the Google Chrome or Apple Safari web browsers." To the right of the log-in form, there is descriptive text about the Asset Score tool, followed by sections for "Follow the steps below to get started:", "Collect Building Data:", "Enter Data:", and "Receive an Asset Score Report:". At the bottom left of the screenshot, there is a "Help Desk" button.

The Department of Energy Building Energy Asset Score (Asset Score) is a national standardized tool for evaluating the physical and structural energy efficiency of commercial and multifamily residential buildings. The scoring tool will store user-provided data and generate an asset score and system evaluation for your building envelope and mechanical and electrical systems. The tool will also identify cost-effective upgrade opportunities and help you gain insight into the energy efficiency potential of your building.

**Follow the steps below to get started:**

**Collect Building Data:** Use the Data Collection Form – either “Preview” or “Full” Input Mode versions (Short Form or Long Form) – to gather information about your building’s physical characteristics. Review the Data Collection Priority Map to help focus on the most important building data given your building’s use type and climate zone.

**Enter Data:** Register for an account, log in, create a building, and input the building data you have collected.

**Receive an Asset Score Report:** Select the “Score Building” button to generate a report that includes your Asset Score, building system evaluation, and potential energy savings upgrade opportunities.

# Presentation Highlights: Pacific Northwest National Laboratory

- The Building Energy Asset score helps building owners to make **informed decisions on building upgrades** and **inform real estate transactions**.
- Energy modeling tools need to balance **accuracy and usability**.
  - The Asset score requires only key data from users and generates a **model that can be further tailored** if more information is known.
- Users can also compare between multiple buildings' energy efficiency performances through an **Asset score batch analysis**.
- In some cases, **residential energy aggregated data** can be made publicly **available by the local utilities**, for information and educational purposes only.
- **The Asset score can also be used outside the U.S.**, in which case the respective climate zone should be chosen, for an accurate analysis.

# **Best Practices: American Council for an Energy-Efficient Economy (ACEEE)**



American Council for an Energy-Efficient Economy

# Narrowing the Gap Between Predicted and Actual Energy Savings

*BBRN Webinar: America's Next Top Energy Model:  
Tools and Best Practices*

Jennifer Amann

Buildings Program Director, ACEEE

December 1, 2016



The American Council for an Energy-Efficient Economy is a nonprofit 501(c)(3) founded in 1980. We act as a catalyst to advance energy efficiency policies, programs, technologies, investments, & behaviors.

Our research explores economic impacts, financing options, behavior changes, program design, utility work, international needs as well as US national, state, & local policy.

Our work is made possible by foundation funding, contracts, government grants, and conference revenue.

## Home performance delivers proven energy savings and other benefits

Yet,

market growth is slow

program participation remains low

project/program energy savings fall short

program cost-effectiveness is hard to prove

*What solutions can address the challenges facing programs and the industry at large?*

*How do we narrow the gap between predicted and actual energy savings?*

# Getting accurate savings estimates from models

## Standardize project data collection

- avoid duplicative modeling practices
- reduce data gathering/sharing cost
- accelerate approval of work scopes

## Include operational use characteristics

- don't rely on preset/standard values
- key data: thermostat set points, hours/frequency of operation for appliances, electronics, etc.



## Getting accurate savings estimates from models (2)

Expand access to energy use data

better understanding of energy use

allow for model calibration (BPI-2400)



Project year and fuel	Total number of projects	Contractor reported savings (sum)	Calibration adjusted savings (sum)	Percent change due to calibration	Reported realization rate (median)	Adjusted realization rate (median)
2007–2008 gas (therms)	903	312,366	201,075	-36%	0.69	1.00
2009–2011 gas (therms)	1,241	316,880	225,585	-29%	0.63	0.86
2007–2008 electricity (kWh)	482	508,190	535,295	5%	1.65	1.40
2009–2011 electricity (kWh)	572	336,673	390,675	16%	3.18	2.84

Source: Gagliano 2015

# Achieving expected project savings

Evaluate projects in real-time  
understand project & contractor performance  
gauge progress toward program goals  
diagnose and address problems



Incorporate home energy management tools  
smart thermostats, smart meter data

Pay-for-performance  
tie incentives to actual energy savings

# **Program Opportunities for Scaling the Residential Retrofit Market**

Rachel Cluett and Jennifer Amann  
October, 2016

Available at: <http://aceee.org/research-report/a1605>

**Thank you!  
Jennifer Amann**

# Presentation Highlights: American Council for an Energy-Efficient Economy (ACEEE)

- There are **many factors that might affect the accuracy of energy savings estimates** like the occupants' behavior or the duplicative modeling practices.
- Increasing accuracy of savings estimates can encourage **more participation in programs**.
- **Some of the solutions that could address the current barriers:**
  - **Data standardization:** through which homeowners see the financial benefits of energy efficient upgrades recognized when they sell their homes.
  - **Calibrating energy models to actual energy use.**
  - **Real-time evaluation of project performance:** addressing potential improvements while the program is in progress and incentivizing contractors to further improve the accuracy of their predictions.
  - **The use of other data collection tools** like smart thermostats.

# Best Practices: OptiMiser



PT1M1SER®

power | simplicity | accuracy

Advances in audit software  
for productivity and  
quality management



1. OptiMiser software overview and recent advances
2. Integrated quality management example

# OptiMiser Software Design Criteria

- 1. Fast:** Efficient data entry - no guesswork or double-entry
- 2. Auto-Calibrated:** Automatically calibrate to bills
- 3. Accurate:** Advanced physics-based, hourly modeling
- 4. Convenient:** Touch tablet optimized with photo capture
- 5. Reporting:** Homeowner-friendly report out of the box
- 6. Customizable:** Reports, forms, inputs, interface
- 7. Exchanges Data:** Integrate with your database
- 8. Automates Workflow:** Schedule, track and review jobs
- 9. Extensible:** Home Energy Score, custom modules

# OptiMiser Quick Facts

Founded 2007 in Colorado

Used across the country for hundreds of audits each week,  
including in:

Arizona (APS and SRP Home Performance with ENERGY STAR)

New York (NYSERDA Home Performance with ENERGY STAR)

California (Energy Upgrade California Home Upgrade)

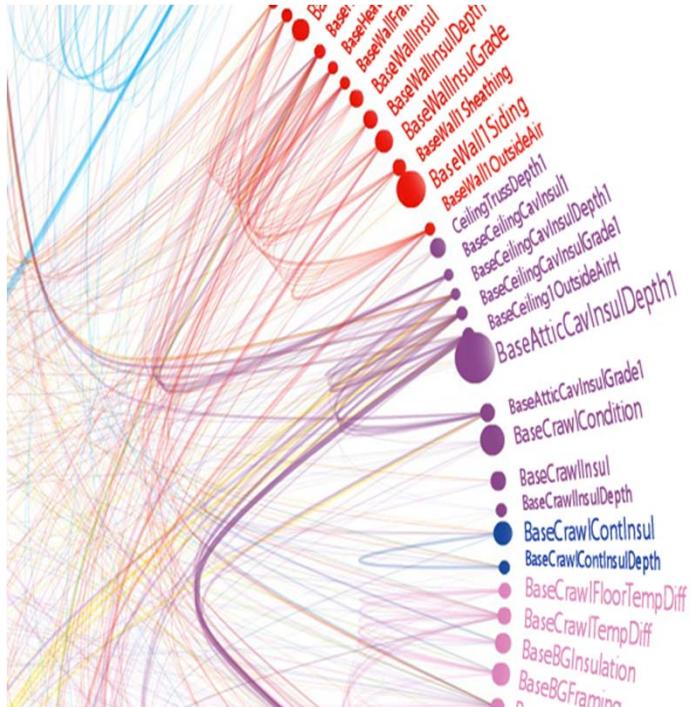
And through implementation partners like GoodCents

Distributed team, spread across U.S.

Develops residential audit software, commercial audit  
software, program management platform

Custom software and analysis (e.g. utility data)

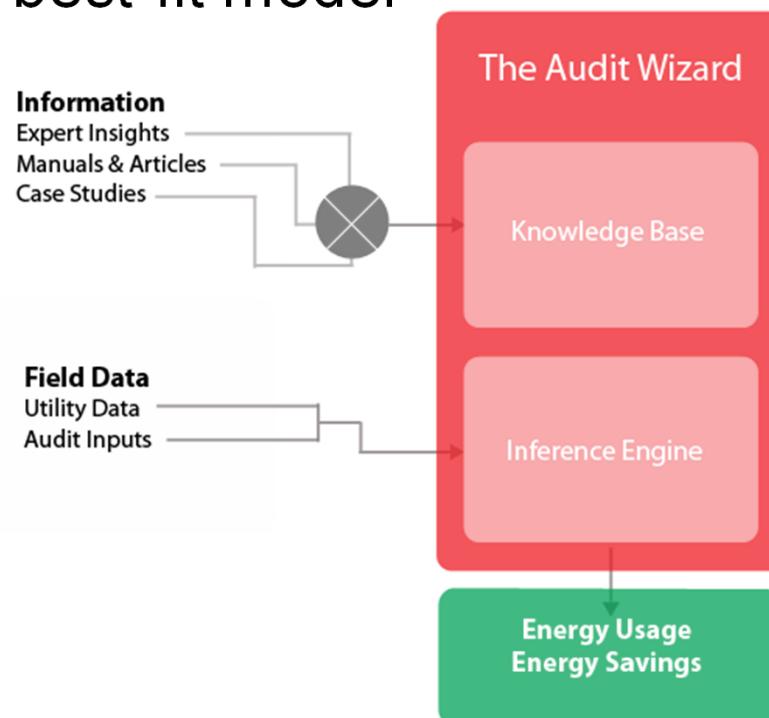
# Audit approach: leverage information, minimize data entry



- Hybrid hourly/degree-day real-time modeling engine
- As detailed as you need
- Automated utility bill calibration
- Instant feedback on audit completeness, quality, incentive qualifications

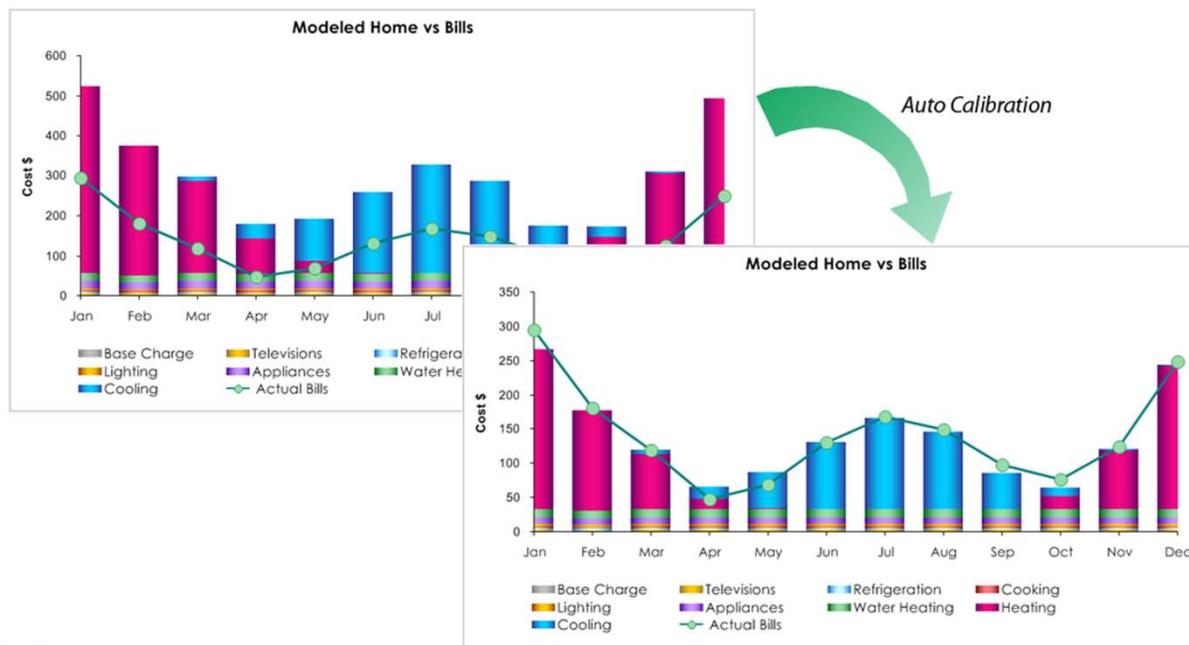
# The Audit Wizard

- Takes the guesswork out of true-up
- Enter only information you *know*
- OptiMiser works within known boundaries to find best-fit model



# Audit Wizard: auto-calibration

- Inputs allow for uncertainty
  - Categorical controls (insulated wall, uninsulated wall)
  - Numerical ranges (attic insulation between 8" and 12")
  - Use regional/age defaults as starting points
- Range of models consistent with user inputs
- Identifies model with best fit to utility bills



# Custom analyses and data collection

The screenshot shows the OptiMiser software interface with a custom analysis titled "SMART STRIP INSTALLATION". The top menu bar includes File, Report, Tools, Help, and various buttons like Status, Workflow, Utility Chart, Photo..., Report..., Note..., Calc..., Draw..., Recm'd..., and Print... The toolbar below the menu has tabs for Owner, Envelope, Systems, Appl & DHW, Improvements, Setup, Deemed Savings, Infiltration, Ceiling Insulation, Air Conditioner, Heat Pump, Duct Sealing, Wall Insulation, Smart Strips, Faucet Aerator, LF Shower Head, WH Pipe Insul, WH Jacket, CFL, Evaluation, and Generate Coupons. A dropdown menu "▼ Savings" is open. The main content area displays instructions, utility incentive information (\$28.60 /7-plug strip), and several tables for annual savings, total annual savings, and total demand savings. A notes/comments section is also present. A detailed measure description and baseline information are included at the bottom. A numeric input field for "Number of Strips Installed" is at the bottom left.

NUMBER OF STRIPS INSTALLED		Strip Type		ANNUAL SAVINGS		NOTES/COMMENTS:	
				kWh	kW		
0		7-plug		0.00000	0.00000		

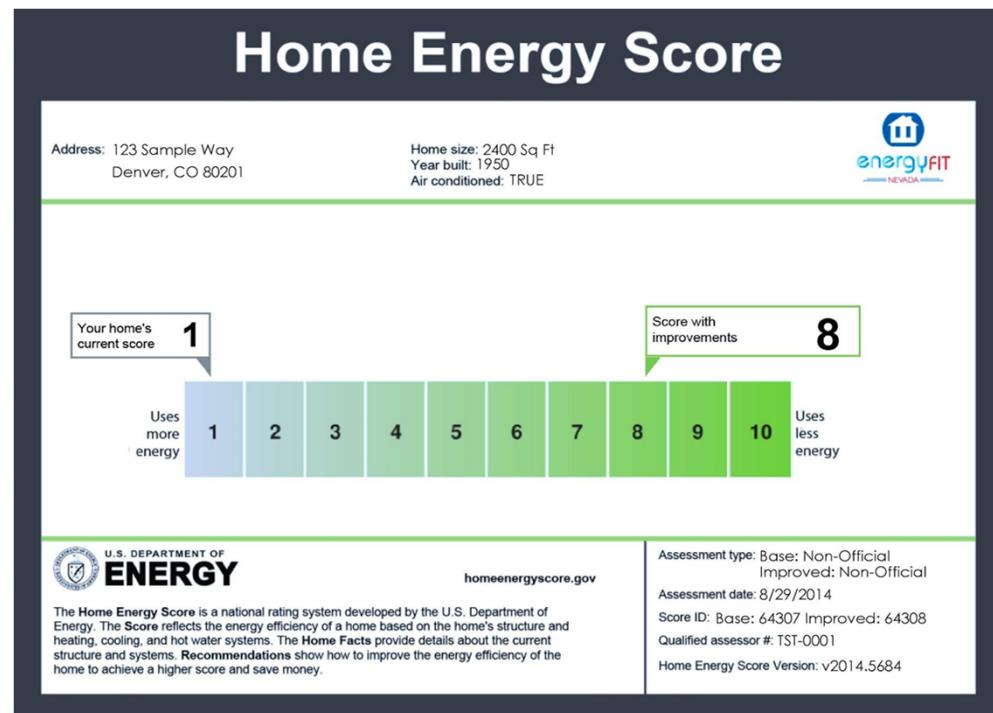
TOTAL ANNUAL SAVINGS	
kWh	\$/yr
0.00000	\$0.00

TOTAL DEMAND SAVINGS	
0.00000	\$28.60
	Incentive

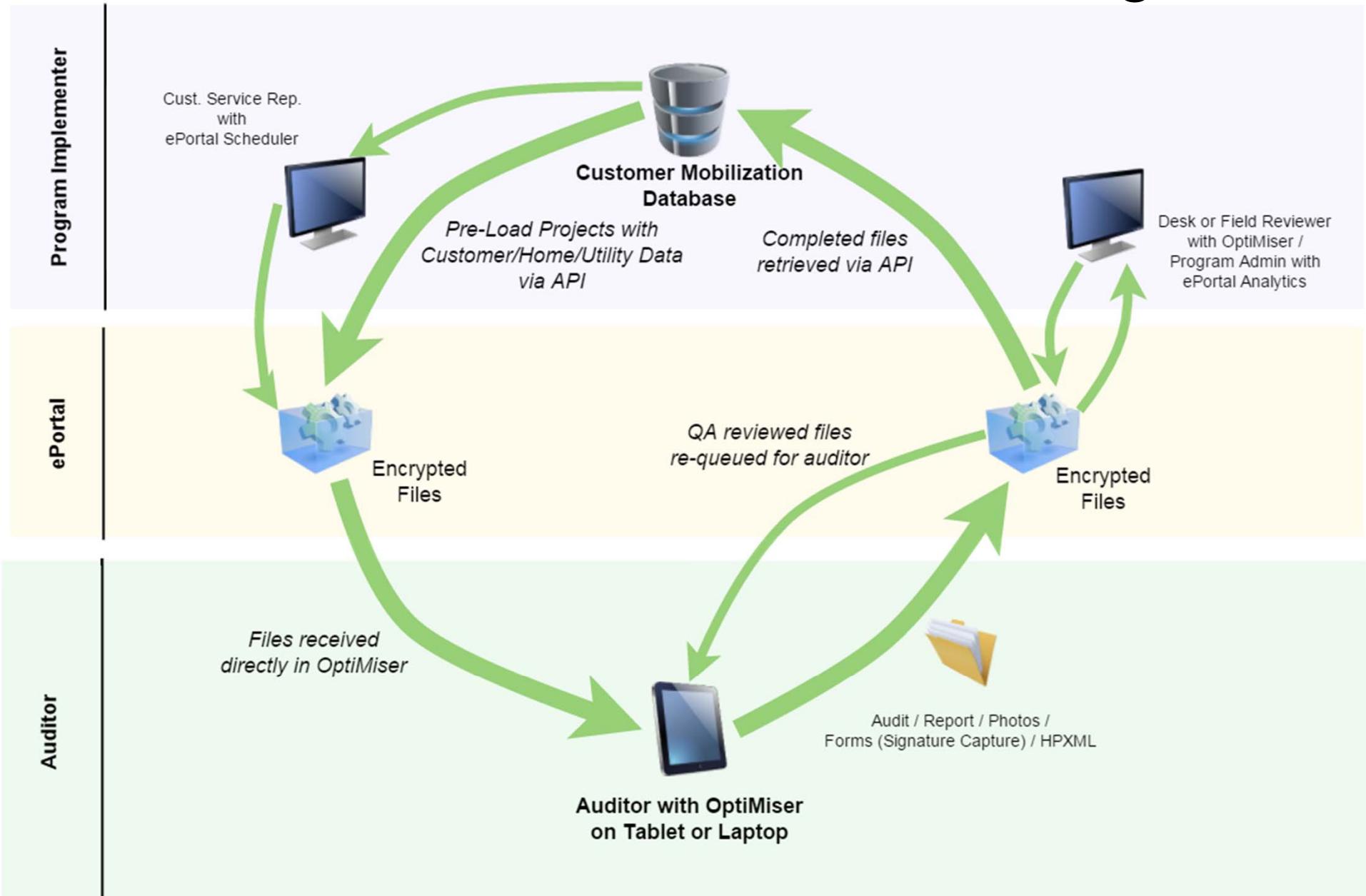
- Instantly incorporate calculators, lists, forms
- Built-in Excel-compatible spreadsheet emulator
- Quickly spec and build additional data collection screens – completely integrated with OptiMiser

# Home Energy Score

- HES reports with YOUR recommendations, not HES defaults!
- HE\_scores without any additional data inputs
- In *your* report
- Add *your* logo



# Field-to-backend data handling





SEARCH...

SEARCH

Sandbox: part

OPTIMISER ADMIN ▾ SETUP HELP &amp; TRAINING SUNSHINE ENERGY CO-OP ▾

DASHBOARD

PROJECTS

SCHEDULE

LEADS

ACCOUNTS

TASKS

MARKETING

PARTNERS

REPORTS

CHARTS

MESSAGES

EPORTAL

ADMIN TAB +



CHARTS

**PROJECTS****Project Total Savings (MBtu)**

Workflow

Completions

Buildings

Measures

**BUILDING**

Energy Use

EUI

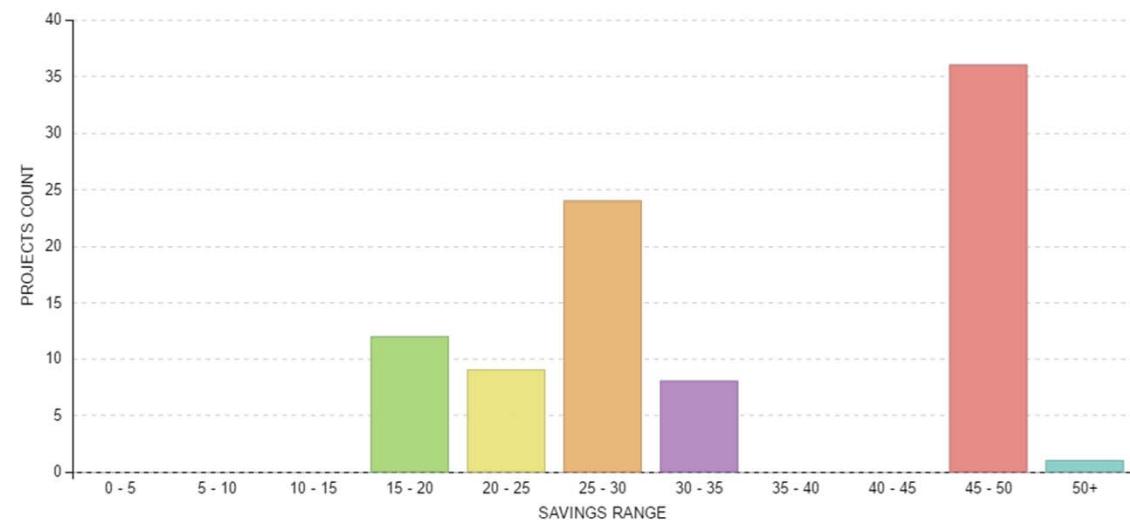
**SAVINGS**

By Project

By Measure

**MARKETING**

Leads



# Nexus

Building performance program management

# ASHRAE 1-3 Commercial Audits

- ASHRAE Level 1, 2 and 3 audits in the field
- Data collection, measure analysis, and reporting
- Eliminates hours of spreadsheet manipulation and report preparation.
- Targets a wide range of buildings, including:

office	multi-family
retail	public assembly
education	public order and safety
food sales/service	religious
health care (In/outpatient)	warehouse and storage
lodging	government
- Models a broad variety of ECMS:
  - operation and maintenance (O&M, or retro-commissioning)
  - low cost retrofit
  - investment grade retrofit and demand response measures.

# Integrated Quality Management

Originally piloted with implementation partner GoodCents in Energizing Indiana program.

# The Challenge

- Program requirements and “black box” file submission results in rejected files
  - added auditor or desk reviewer time**
- Insufficient feedback to auditors to correct rejection
  - added auditor time**
- Poor quality control necessitates more field reviews
  - added field reviewer time**
- Incomplete or incorrect data inputs results in compromised program data
  - added data handling time (or bad results)**
- Compromised program data leads to lost energy and demand savings during EM&V reviews
  - added time and expense and lost confidence**

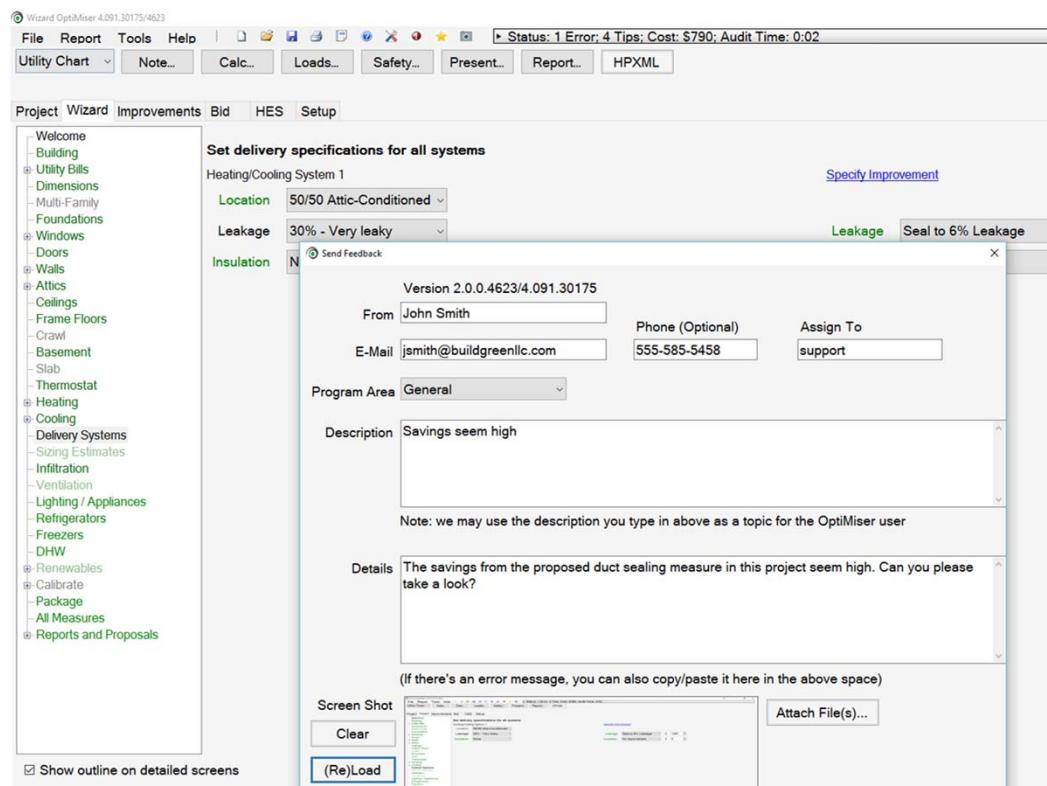


# The Solution

- Software automation to speed and verify data
  - Required Fields
  - Data Types
  - Allowable Entry Ranges
- Default values when practical and needed
- On-entry page notifications
- Post audit completion review
- Assurance of more accurate report generation
- Assurance of successful file submission
- Detailed, specific guidance on measure implementation
- Integration with legacy data

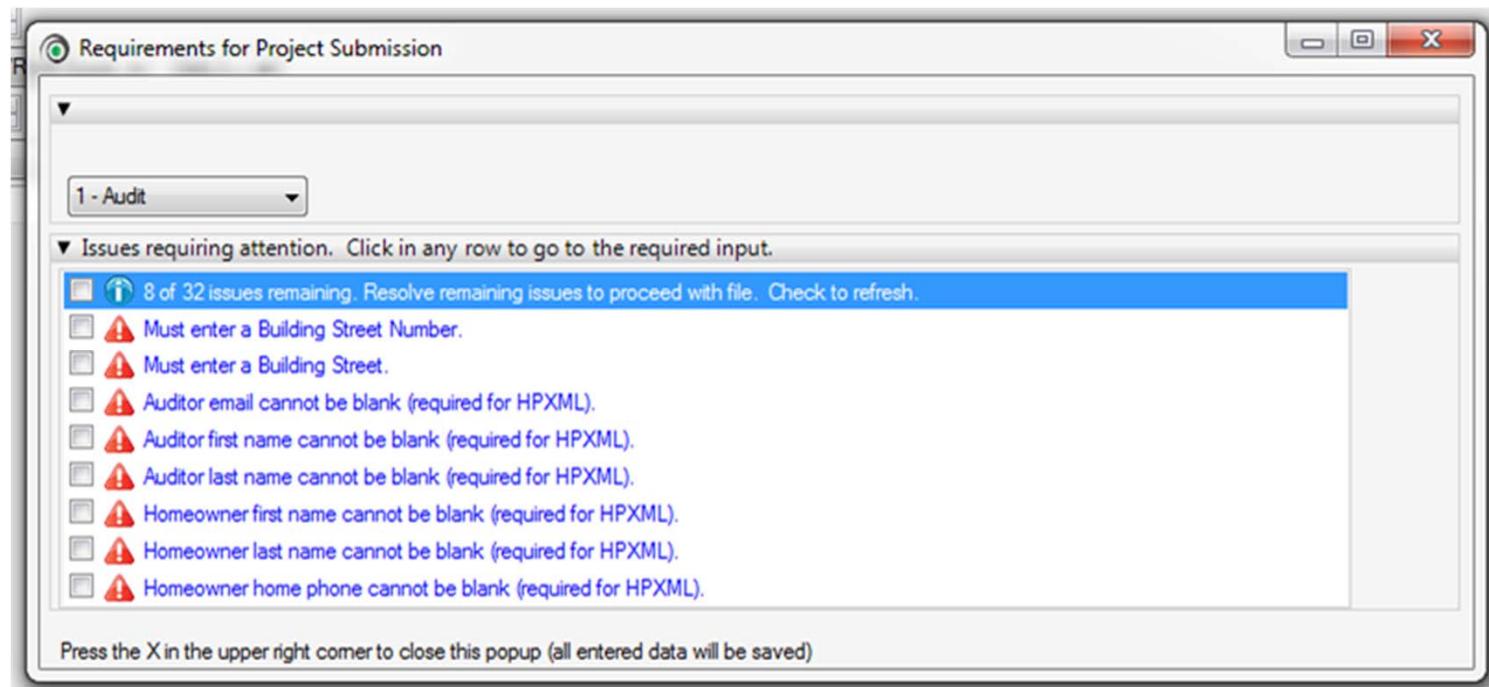
# Better Communication

- Sends complete status report to speed diagnosis
- Communicates directly to engineering and development team
- Encourages continuous learning and software improvements



# QC Messagelist

- Detailed real-time feedback
- Fix potential issues before you leave the site
- Incorporate reliable incentive and financing calculations



# Safety Assurance

Appliance testing to ensure safety of customer and auditor

▼ Heating System #1

Venting Condition	Natural draft	Zone	CAZ #1	Draft Range	-2.50
Spill WC	Draft WC	CO SS	Spill Nat	Draft Nat	SS Nat
Heater 1	0.0	0		0.0	0
Unable to Test	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Venting Notes					
Fuel Leak Test	Fixed?	<input type="checkbox"/>			
Leak Notes					

Heater Action  
Stop Work: Work may not proceed until the system is serviced and the problem is corrected.

Ambient condition testing and required plan of action

▼ CAZ #1

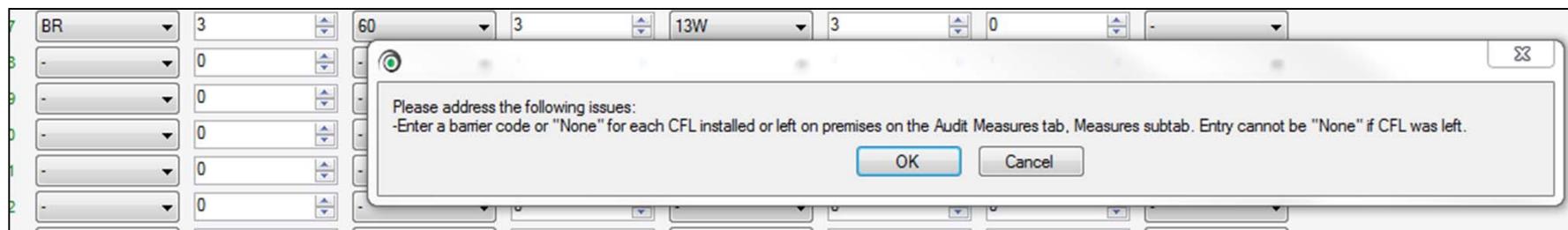
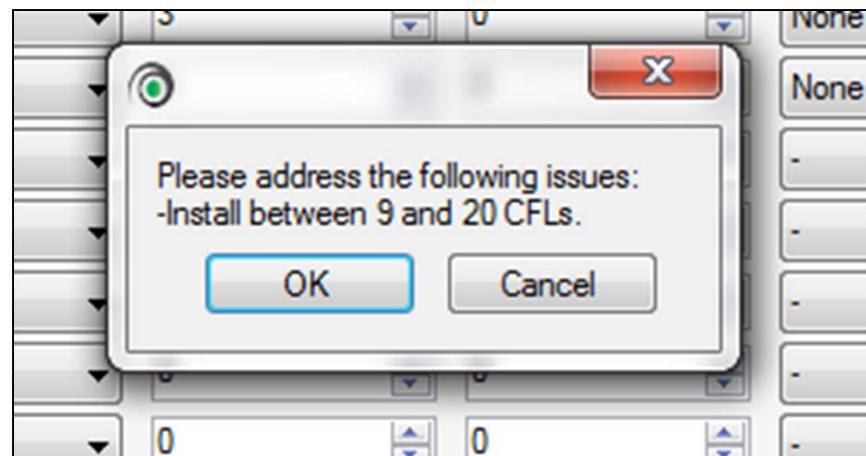
Separate Mech Rm?	<input type="checkbox"/>	Weather Stripping?	<input type="checkbox"/>	Cmb Air Dcts?	<input type="checkbox"/>
Baseline	0.3	Wrst Case	10.0		
Zone Notes					
Amb. CO	35				
CO Notes					

CAZ Results Pass

Amb. Action Abort inspection, disable appliance and have repaired before proceeding with additional diagnostics or inspections

# Data Integrity

- Validation of proper and allowable data entry
- Exception handling to explain variances



# Efficient Data Handling: Form Filling

The diagram illustrates a workflow for form filling. A green arrow points from a physical document at the top left to a digital form at the bottom right. A second green arrow points from the digital form to a signature capture interface at the bottom.

**Top Document (Physical Form):**

Home Energy Assessment  
Visit [www.energizingindiana.com](http://www.energizingindiana.com) or call 1-888-446-7750

**Middle Document (Digital Form):**

**WORK AUTHORIZATION**

Customer Name: Sally Smith

Property Address: 55 Maple Ave

Avon, IN 46123

Telephone: 555-468-5648

Alternate Telephone:

Email: ssmith@gmail.com

I am the  Owner, or  Tenant residing at the above described Property, and I am fully authorized to grant this authorization.

Please Note: Prior to scheduling a home energy assessment, tenants are encouraged to contact their landlord and secure permission for the assessment and the installation of energy efficiency measure.

By signing this Authorization, I give permission to GOODCENTS, conducting work as an independent contractor of the UTILITY, to enter the above noted Property for the purpose of performing a Home Energy Assessment. Based upon the observations made during the Assessment, GOODCENTS will install the following energy-saving home improvements (hereinafter, the "Work"):

- Compact Fluorescent Light bulbs
- Pipe Wrap Insulation
- Energy Efficient Faucet Aerators
- Energy efficient shower Head (s)

I understand that the specific items to be installed from the above list will be set forth in the Home Energy Assessment Report and I hereby authorize GOODCENTS to install, free of charge to me, the selected energy-saving home improvements, as recommended in the Report or by the Energy Advisor.

In consideration of the Assessment and any Work provided without charge to me, I agree to indemnify, hold harmless, release and waive any and all claims against INDIANA DSMCC, or any of its subsidiaries including the UTILITY, and GOODCENTS, which claims or actions arise from the Assessment or the Work.

I understand that actual energy savings may differ from those estimated on the Report due to variations in individual energy use habits, home characteristics, and any applied energy efficient measures.

**CUSTOMER SIGNATURE**

Date: 03 / 12 / 2015

Print Name: Sally Smith

**Bottom Document (Signature Capture):**

... Please Sign ...

Save Print Next Clear

**Text Box on Right:**

Automated form generation & signature capture

## Pre-Implementation

### **More effort + poor result**

- add desk review time
- add auditor time
- add field review time
- add data handling time and poor results
- add EM&V time, expense and lost confidence

## Post-implementation

### **Less effort + better result**

- nearly eliminated
- cut in half
- nearly eliminated
- flexible, automated and reliable
- no surprises, less effort, more confidence

# Presentation Highlights: OptiMiser

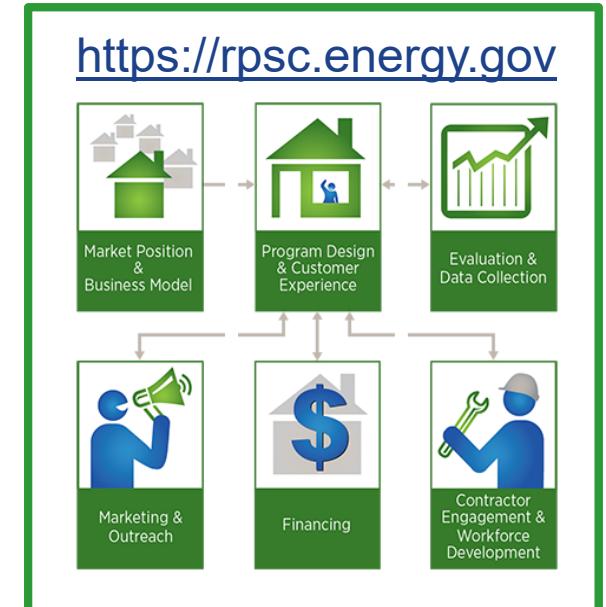
- OptiMiser leverages **energy bills** as the largest and most reliable source of information helping to **eliminate guess work** and minimize the impact of unknown data.
- OptiMiser runs on its own software engine and can be used every day **for very quick initial assessments to very detailed comprehensive projects.**
- Through the automated **utility bill calibration**, users can enter **data ranges when the exact information is unknown** and the tool will build an optimal model.
- By using **software automation**, OptiMiser has addressed the most common challenges with energy modeling, such as **accuracy or time use.**

# Related Resources in the Residential Program Solution Center

Explore resources related to energy modeling tools and best practices:

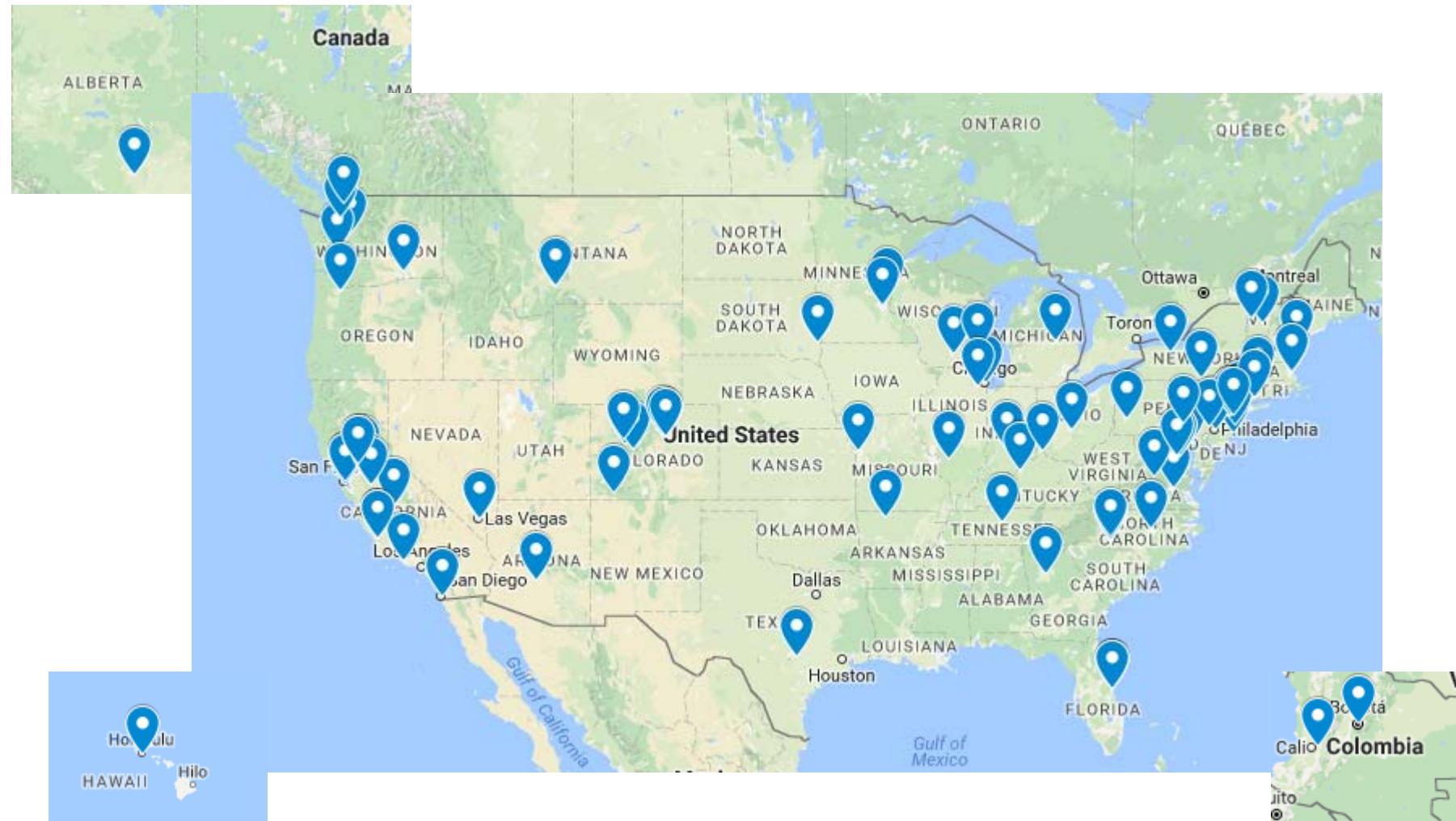
- Review your standards for the diagnostic and software tools used by contractors with help from the [Contractor Engagement & Workforce Development – Make Design Decisions](#) handbook.
- Explore the benefits and limitations of energy estimating methods at the individual upgrade level in the [Home Performance with ENERGY STAR Sponsor Guide](#).
- See [examples of programs](#) that offer participants multiple types of home energy assessments, including home energy modeling and diagnostic testing.
- Consider how to improve project level realization rates with insights from this recent [ACEEE report](#).

- While you're there, see the latest [Proven Practices](#) post on [Incentivizing Home Upgrade Actions](#).
- [\*\*Send us your ideas!\*\*](#) The Solution Center is continually updated to support residential energy efficiency programs.



# Addenda: Attendee Information and Poll Results

# Call Attendee Locations



# Call Attendees: Network Members

- American Council for an Energy-Efficient Economy (ACEEE)
- CLEAResult
- Center for Sustainable Energy
- Davis Energy Group
- District of Columbia Sustainable Energy Utility
- Efficient Windows Collaborative
- Energy Efficiency Specialists
- FSL Home Improvement
- Group14 Engineering Inc.
- International Center for Appropriate and Sustainable Technology (ICAST)
- Johnson Environmental
- Lifestyle Homes, Inc.
- Midwest Energy Efficiency Alliance (MEEA)
- North Carolina Building Performance Association
- Richmond Region Energy Alliance
- Southface
- The Insulation Man, LLC
- University of Central Florida
- Vermont Energy Investment Corporation (VEIC)

# Call Attendees: Non-Members (1 of 3)

- ACTION-Housing
- Association for Energy Affordability (AEA)
- Bay City Electric Light and Power BlocPower
- Bridging The Gap
- BSHM Architects, Inc.
- California Association of Building Energy Consultants (CABEC)
- Carolina Smart Homes
- City of Bloomington (IN)
- City of Highland (CA)
- CivicSpark
- Community Office for Resource Efficiency (CO)
- County of San Diego (CA)
- Craft3
- Commonwealth of Pennsylvania (CWOPA)
- Dow Corning
- DSB Energy Services LLC
- Energetics Incorporated
- Energy Analytics
- Energy Efficiency Solutions, LLC
- Energy Smart Colorado
- Fairfax County (VA)
- Franklin Energy Services
- Facility Strategies Group, LLC (FSG)
- Green Button Alliance

# Call Attendees: Non-Members (2 of 3)

- Green Compass Sustainability Consulting
- Greenergy Chicago, Inc
- Housing Authority of the County of San Bernardino (HACSB)
- HansenRE Marketing Services
- Hawaii Energy
- HDR CONSULTING LLC
- Healthy Building Research & ROCIS Initiative (Reducing Outdoor Contaminants in Indoor Spaces)
- Holy Cross Energy
- Home Office Training & Technology
- US Department of Housing and Urban Development
- Home Ventilating Institute (HVI)
- Johns Manville
- La Plata Electric Association (LPEA)
- Madison Lakeview LLC.
- Massachusetts Department of Energy Resources
- Mercy Housing
- MKthink
- North Arkansas Regional Medical Center (NARMC)
- National Housing Law Project

# Call Attendees: Non-Members (3 of 3)

- New Jersey Natural Gas
- National Renewable Energy Laboratory (NREL)
- Opportunity Council
- OptiMiser
- Pacific Northwest National Laboratory
- Parsec Energy Consulting
- People's Self Help Housing
- Pacific Gas and Electric Company (PG&E)
- POCH Colombia
- Pratt Center for Community Development
- Rethinking Power Management
- Schreiner Design
- SIM2
- Sustainable South Bronx
- Technician Community Development LLC
- Texas State University
- Therma-Stor LLC
- Universidad Autónoma de Occidente (Colombia)
- UIL Holdings Corporation
- University of Minnesota
- University of Pennsylvania
- Utility Cost Management LLC
- Washington State Department of Commerce

# Opening Poll #1

- Which of the following best describes your organization's experience with energy modeling tools and best practices?
  - Some experience/familiarity – **45%**
  - Limited experience/familiarity – **22%**
  - Very experienced/familiar – **20%**
  - No experience/familiarity – **11%**
  - Not applicable – **2%**



# Closing Poll

- After today's call, what will you do?
  - Seek out additional information on one or more of the ideas – **82%**
  - Make no changes to your current approach – **12%**
  - Consider implementing one or more of the ideas discussed – **3%**
  - Other (please explain) -**3%**

