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
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, or go to 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
See the Better Buildings Residential Network Program website to register
Best Practices:
Pacific Northwest National Laboratory
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
ENERGY STAR benchmarks the overall building performance against peers.

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.
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 an 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
1. Create a new building and enter basic building information

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

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

4. Score your building and receive your Asset Score Report
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

Four sections
- Score
- Upgrade Opportunities
- Structure and Systems
- Building Assets
Asset Score Preview

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

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

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![Graph showing potential improvement and current estimate]

Current Score 6.0

Potential Score 9.0

Estimated Savings 40%

1 Uses MORE Energy
2 3 4 5 6 7 8 9 10 Uses LESS Energy
1 Uses MORE Energy
2 3 4 5 6 7 8 9 10 Uses LESS Energy

High-Efficiency
Asset Score Preview

- 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
Asset Score Preview: Workflow

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
• 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.
As of August 2016...

- 952 Buildings scored
- 124M Square feet
- 44 States
- 1413 Registered users
Buildings in Asset Score Tool

Average energy savings identified range from 20-40%

ALF: Assisted Living Facility
CH: City Hall
CC: Community Center
MO: Medical office
MF: Multifamily
PS: Police Station
PO: Post office
SC: Senior Center
Example of Multifamily Building Model

BUILDING ENERGY ASSET SCORE
OVERALL BUILDING SCORE

Building Name: MidRise Apartment Example
Gross Floor Area: 34,048 ft²

ABOUT THE BUILDING SYSTEMS

<table>
<thead>
<tr>
<th>System</th>
<th>Ranking</th>
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<tbody>
<tr>
<td>Interior Lighting</td>
<td>Fair</td>
</tr>
<tr>
<td>Heating</td>
<td>Superior</td>
</tr>
<tr>
<td>Cooling</td>
<td>Good</td>
</tr>
<tr>
<td>Overall HVAC Systems</td>
<td>Superior</td>
</tr>
</tbody>
</table>

ABOUT THE BUILDING ENVELOPE

<table>
<thead>
<tr>
<th>Envelope Feature</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof U-Value, Non-Attic (Btu/hr·ft²)</td>
<td>Fair</td>
</tr>
<tr>
<td>Walls U-Value, Framed (Btu/hr·ft²)</td>
<td>Good</td>
</tr>
<tr>
<td>Windows U-Value (Btu/hr·ft²)</td>
<td>Good</td>
</tr>
<tr>
<td>Walls + Windows U-Value (Btu/hr·ft²)</td>
<td>Good</td>
</tr>
<tr>
<td>Window Solar Heat Gain Coefficient</td>
<td>Good</td>
</tr>
</tbody>
</table>

SOURCE ENERGY USE INTENSITY BY END USE

- Interior Lighting
- Heating
- Cooling
- Hot Water

Current Score: 6.0
Potential Score: 8.5
Estimated Savings: 34%

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 its structure, heating, cooling, ventilation, and hot water systems. The building's structure and systems are individually evaluated and ranked. The Upgrade Opportunities pages provide recommendations for how to improve the building's energy efficiency.
Thank You

- **Asset Score Website**

- **Asset Scoring Tool**
  [buildingenergyscore.energy.gov/](buildingenergyscore.energy.gov/)

- **Asset Score Email Box**
  [asset.score@ee.doe.gov](mailto:asset.score@ee.doe.gov)
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)
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)

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

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
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
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

www.optimiserenergy.com
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

www.optimiserenergy.com
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

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

www.optimiserenergy.com
Home Energy Score

- HES reports with YOUR recommendations, not HES defaults!
- HEScores without any additional data inputs
- In your report
- Add your logo
Field-to-backend data handling

Program Implementer
- Cust. Service Rep. with ePortal Scheduler
- Pre-Load Projects with Customer/Home/Utility Data via API
- Completed files retrieved via API

Customer Mobilization Database

Desk or Field Reviewer with OptiMiser / Program Admin with ePortal Analytics

ePortal
- Encrypted Files
- QA reviewed files re-queued for auditor

Auditor
- Files received directly in OptiMiser
- Auditor with OptiMiser on Tablet or Laptop
- Audit / Report / Photos / Forms (Signature Capture) / HPXML
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
  - retail
  - education
  - food sales/service
  - health care (In/outpatient)
  - lodging
  - multi-family
  - public assembly
  - public order and safety
  - religious
  - warehouse and storage
  - 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

www.optimiserenergy.com
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

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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

Ambient condition testing and required plan of action
Data Integrity

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

www.optimiserenergy.com
Efficient Data Handling: Form Filling

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**.
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 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
<table>
<thead>
<tr>
<th>Call Attendees: Non-Members (2 of 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Compass Sustainability Consulting</td>
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<tr>
<td>Greenergy Chicago, Inc</td>
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<td>Housing Authority of the County of San Bernardino (HACSB)</td>
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<td>HansenRE Marketing Services</td>
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<td>Hawaii Energy</td>
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<td>HDR CONSULTING LLC</td>
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<td>Healthy Building Research &amp; ROCIS Initiative (Reducing Outdoor Contaminants in Indoor Spaces)</td>
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<tr>
<td>Holy Cross Energy</td>
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<tr>
<td>Home Office Training &amp; Technology</td>
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<td>US Department of Housing and Urban Development</td>
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<td>Home Ventilating Institute (HVI)</td>
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<td>Johns Manville</td>
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<td>La Plata Electric Association (LPEA)</td>
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<td>Madison Lakeview LLC.</td>
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<td>Massachusetts Department of Energy Resources</td>
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<td>Mercy Housing</td>
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<td>MKthink</td>
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<td>North Arkansas Regional Medical Center (NARMC)</td>
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<td>National Housing Law Project</td>
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</tbody>
</table>
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%**