BPA Emerging Technologies for Energy Efficiency
Technology Focus Area:
Faster, Better, and Cheaper Research

Technology Background

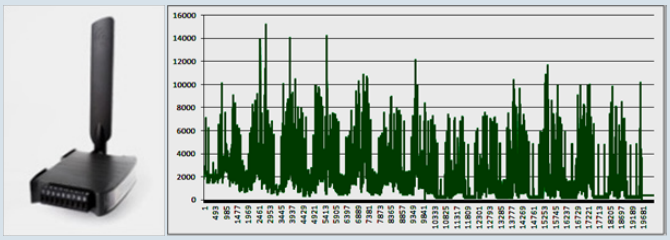
BPA is seeking innovative research methods to reduce the cost of evaluating new technologies for its energy conservation programs. In particular, BPA is focused on reducing the time and cost of field testing. High costs are borne for required instrumentation, data management, and specialized expertise. Traditional field trials that take 12 to 18 months to complete are also not in step with the rapid pace of innovation. Potential solutions include the following:

- Safe and low-cost sensors, data loggers, and communications equipment that can be installed by untrained building occupants
- Integrated solutions,from sensing to data analysis and presentation
- Innovative applications of public data, networks, and software services

Current Research Projects

Enhanced Tools for Residential Building Analysis in the Pacific Northwest
Timeline: 2014 – 2016
Collaborators: National Renewable Energy Laboratory (NREL), U.S. Department of Energy (US DOE) Buildings Technology Office, Ecotope

This project will develop and demonstrate tools for analysis of energy use in residential buildings, which are tailored for the Pacific Northwest. One tool will help the user identify cost-optimal packages of efficiency improvements for residences. Another will enable regional analysis by calibrating BEopt to results of a recent assessment of the Northwest residential building stock. Successful completion of this project will result in sophisticated and easy-to-use tools that can be used by conservation program staff at BPA to quickly identify least-cost efficiency measures for targeted residential markets.



Improvement of NILM Technology and Methods for Accuracy Testing
Timeline: 2014 – 2016
Collaborators: Pacific Northwest National Laboratory (PNNL), US DOE

Non-intrusive load monitoring (NILM) technology is targeted for reducing the cost and time requirements of measuring and verifying changes to the performance of energy-using systems in a building. Phase 1 of this project will improve and standardize current procedures for measuring the accuracy of NILM technology in disaggregating energy use by single loads from a single, premise-level meter. Phase 2 will include the development and prototyping of a sensor to more accurately distinguish the run times of large appliances, based on vibrations from motor operation.

Methods for Measuring the Efficiency of Smart Thermostats
Timeline: 2013 – 2015
Collaborators: Electric Power Research Institute

Traditional, 'gold-standard' methods for emerging technology assessment – such as randomized, controlled trials – are not well applied to a new generation of software-based controls and related services. BPA and EPRI are seeking to develop a unit of efficiency measurement for residential HVAC controls and methods for its evaluation, during operation, by analyzing data from networked thermostats. New learning for the industry and the public are intended to come about by addressing the project's key research questions, which have not

yet been answered through empirical research: How can the data from networked thermostats be used to evaluate the energy efficiency of these devices on a continual basis? What are appropriate evaluation methods today and how can they be adapted as this emerging technology matures?

Completed Project Reports

Reducing Cost of Technology Evaluation Using a Technology Performance Exchange
Timeline: 2012 – 2014
Collaborators: US DOE Buildings Technology Office, NREL

BPA has identified the cost of skilled engineering as a significant challenge in using current methods of field testing. To address these challenges, the U.S. Department of Energy and BPA funded the National Renewable Energy Laboratory to develop the Technology Performance Exchange (TPEx), a free,publicly accessible Web-based portal that facilitates the identification, storage, and sharing of transparent, foundational energy performance data. TPEx uses data entry forms to identify the intrinsic, technology-specific parameters necessary for a user to perform a credible energy analysis and includes a robust database to store and share these data. Performance maps for each product are automatically translated into building components, for drag-and-drop prediction and comparison of energy use in the Open Studio platform.

New M&V and Program Approaches for Smart, Connected Devices
Timeline: 2013 – 2014
Published in Proceedings of ACEEE Summer Study 2014

A new generation of smart and connected devices promises energy savings, but traditional participant/control group field trials taking 12 to 18 months are not in step with these rapidly evolving software-based products. This paper explores new approaches to measurement and verification using data from connected devices, including aggregating vendor's anonymous data sets, post/post analysis approaches, and baseline estimation techniques.

Results from analysis of field data from residential smart thermostats, digital lighting controls, and rooftop unit controllers are presented. Techniques and results for HVAC baseline emulation, survey-based lighting baselines, and thermostat metrics are presented. Issues explored include proprietary data, vendor-biased data, sampling protocols, and potential dramatic time and cost reduction

Integrated Daylighting and Energy Analysis Toolkit
Timeline: 2011 – 2013
Collaborators: NREL

The OpenStudio Platform supports integrated design for deep energy savings by providing a free,open source, user-friendly tool to create EnergyPlus building energy models early in the design process. The IDEAKit project added Radiance daylight modeling to OpenStudio. This project was conducted from 2011 to 2013.

For more information on this technology, reports, and collaboration opportunities, please visit our website.
www.bpa.gov/goto/E3T