



## TIP 318: Enhanced Residential Efficiency Analysis Tools for the Pacific Northwest

### Context

Predictions from energy analysis tools play an integral role in identifying and evaluating cost-effective energy efficiency for deep energy retrofits for existing homes and zero net energy solutions for residential new construction in the Pacific Northwest (PNW) region. Tools should be robust, accurate and flexible enough to evaluate innovative and emerging technologies in the context of whole-building simulations. Building simulations should be based on a suitable number of archetypes with characteristics representative of PNW homes, and aggregated results should be weighted by the number of archetype homes in different climates throughout the region.

The PNW currently uses a small number of prototype residential buildings to evaluate energy savings of efficiency measures. These buildings have continued to be used for historical reasons and were not specifically developed to represent the PNW housing stock. Without a suitable number of building archetypes weighted to reflect the number of homes in different climates throughout the region, aggregate energy savings estimates lack the comprehensiveness and granularity required for utility/regional programs.

### Description

EnergyPlus is a sophisticated whole-building energy simulation program that engineers, architects, and researchers use to model energy and water use in buildings. EnergyPlus models heating, cooling, lighting, ventilation, other energy flows, and water use. EnergyPlus includes many innovative simulation capabilities: time-steps less than an hour, modular systems and plant integrated with heat balance-based zone simulation, multi-zone air flow, thermal comfort, water use, natural ventilation, and photovoltaic systems. The BEopt tool has been developed by NREL in support of the U. S. Department of Energy Building America program goal to develop market-ready energy solutions for new and existing homes. The BEopt software utilizes the EnergyPlus simulation engine to provide capabilities to evaluate residential building designs and identify cost-optimal efficiency packages at various levels of whole-house energy savings along the path to zero net energy.

This project will deliver and demonstrate enhanced residential efficiency analysis tools tailored for the PNW including: 1) a residential building energy analysis tool based on BEopt/EnergyPlus, used to identify cost-optimal efficiency packages, and 2) a regional residential efficiency analysis tool driven by BEopt/EnergyPlus simulations/optimizations and calibrated to RBSA data, used to assess residential building energy conservation potential.

The tools and processes detailed above comprise a proven toolkit for identifying optimal combinations of energy efficiency technologies and operating strategies, in both design of new construction homes and retrofit packages for existing homes.

### Why It Matters

Successful completion of this project will result in sophisticated yet easy-to-use residential analysis tools that can be used to quickly identify least-cost efficiency measures/packages on the path to zero net energy for targeted residential markets. These tools, tailored for the PNW and built upon DOE's flagship open-source EnergyPlus simulation engine, leverage proven software platforms that have been used nationwide to provide robust, reproducible, and accurate analysis. The project will also make use of these tools to identify optimized, least-cost efficiency packages and to produce detailed regional efficiency potential maps given current technology performance characterization, costs, and utility rates. Public availability of these tools will allow adaptation of these analyses as the residential building landscape changes over time.

Compared to current practice, use of EnergyPlus will result in increased accuracy, transparency, leveraged funding/support, and more widespread adoption, and use of the regional tool will extend the granularity and accuracy of conservation potential assessments.

### Goals and Objectives

The objective of this project is to provide enhanced residential efficiency analysis tools tailored for the Pacific Northwest.

## Deliverables

The deliverables to BPA will be in the form of software packages and project files, technical documentation, and progress and financial status reports. A final project report prepared for BPA will summarize the software implementations and analyses developed during this project, as well as documentation of next steps for the project or potential follow-on projects.

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**Project Start Date:** October 1, 2014

**Project End Date:** September 30, 2016

### Funding

Total Project Cost: \$870,000

BPA Share: \$435,000

BPA FY2015 Budget: \$220,500

## Reports & References

## Links

### For More Information Contact:

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## Participating Organizations

National Renewable Energy Laboratory (NREL)  
U.S. Department of Energy – Buildings Technology Office  
Ecotope, Inc.

