Quantifying Measure-Level Energy Impact Uncertainty

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The Scope of the Assignment

Evaluations have long taken account of the statistical confidence associated with applying the impact results of a sample to the whole population. The estimate of the energy and demand savings at the individual measure level, however, is generally not assigned any uncertainty range. The overarching policy guidance for, and purpose of, EM&V is to enhance the reliability of savings estimates in state or utility energy efficiency portfolios, and as such, resources can be better directed through additional focus on uncertainty analysis.

The California Public Utilities Commission (CPUC) has required that measure level impact uncertainty be considered in the 2006-2008 evaluations. Calculation of impact uncertainty in the planning phase of an evaluation project informs choices about where to direct resources to most effectively minimize the uncertainty of the result. Reporting uncertainty on the final impact result helps to put the savings in context by providing a realistic picture of the range of actual savings that can be expected from the energy efficiency measure. Under this direction, energy savings uncertainty was explored within the evaluation of two programs as part of the CPUC contract.

Two Programs, Two Approaches

One program consisted of a wide variety of custom energy efficiency measures so the in-depth investigation focused on a few typical measures. Several types of error were examined including instrument error, sampling error, and model error. A combination of analytical and Monte Carlo approaches was used for the uncertainty propagation from the input parameters to the final savings result for each energy efficiency measure examined.

The second program included air-conditioning tune-up measures where savings are claimed for improving poorly performing units by correcting refrigerant charge and airflow issues. The program evaluators ran Monte Carlo simulations to explore engineering propagation of error of the various instrumentation packages required to assess superheat, sub cooling, and performance, informing the need and selection of improved instrumentation suites.

Implications

Enhancing the reliability of the energy savings estimates in an energy efficiency portfolio will require continued efforts to allocate all EM&V resources optimally. Ultimately, one goal of the professional EM&V community should be a framework that allows an optimization of the allocation of all EM&V resources to reduce savings uncertainty. The framework should also consider at what point the development of new sampling/analytical frameworks and instrumentation suites become feasible and/or required to address complex measures. Then, as policy changes to reflect changing attitudes towards market development and net savings versus gross savings issues, the proper use of EM&V approaches can be rationally adjusted.