NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Uniform Methods for Evaluation, Measurement and Verification of Savings from Energy-Efficiency Programs

Date — Date (Period of Performance, Arial 18pt Bold)

H. Haeri and T. Jayaweera
The Cadmus Group, Inc.
Portland, Oregon

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Subcontract Report
NREL/SR-xxxx-xxxxx
January 2012

Contract No. DE-AC36-

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NREL Technical Monitor: Name
Prepared under Subcontract No(s). XXX-X-XXXXX-XX

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Subcontract Report
NREL/SR-xxxx-xxxxx
January 2012

Contract No. DE-AC36-08GO28308

This publication received minimal editorial review at NREL.

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Cover Photos: (left to right) PIX 16416, PIX 17423, PIX 16560, PIX 17613, PIX 17436, PIX 17721

Printed on paper containing at least 50% wastepaper, including 10% post consumer waste.

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Acknowledgements

List of Acronyms and Abbreviations

Executive Summary

By DOE, describe the need for, necessity and the benefits of uniform protocols.

Describe project oversight.

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1 Introduction

Background

Brief history of energy-efficiency program evaluation, various early attempts at developing standardized methods and protocols at the national (EPRI, 1990 ORNL, 1991, NAESCO, IPMVP, NAPEE, etc.) and state (CA, Pacific NW, recent statewide protocols in NY, PA, MN, and others).

Objectives

This project builds on and extends these earlier efforts, drawing from the lessons from many evaluation studies of individual measures and programs completed since.

The uniform methods are prepared by evaluation and energy efficiency professionals with wide-ranging backgrounds that include utilities, non-profit regional entities, consulting firms and regulatory bodies.

Designed to conform to sound scientific methods and best practices,

Balances and explains the tradeoffs between accuracy with resource availability and the need for timeliness of the results,

The benefits are to enhance reliability of savings, create confidence about savings among regulators and resource planners, and mitigate the uncertainties about performance among program administrators.

Definitions of Savings

Define various savings terms – Ex ante, gross, evaluated gross, net.

(Insert Diagram)

Project Management and Oversight

Describe roles and responsibilities of SC, TAGs, NREL, and The Cadmus Group.

Organization of the Report

Describe overall organization, explaining how individual protocols relate to cross-cutting topical sections.

2 Residential Sector – Billing Analysis

Complete technical protocol, describing method(s) for calculation of savings and steps in verification for residential programs using statistical billing analysis.

3 Residential Sector – Energy Simulation Modeling

Complete technical protocol, describing method(s) for calculation of savings and steps in verification for programs requiring simulation modeling – if applicable. (THIS MAY NOT BE APPLICABLE IN RESIDENTIAL SECTOR, EXCEPT, POSSIBLY, NEW CONSTRUCTION.)

4 Residential-Sector Measures – Lighting

Complete technical protocol, describing method(s) for calculation of savings and steps in verification for residential lighting measures. (REPEAT FOR ALL OTHER MEASURES)

Measure Description

Measure Application and Delivery

Savings Calculations

Measurement and Verification Plan

Reference Sample Design, Survey and Metering Sections as applicable.

Net-to-Gross Analysis

Describe the relevance and importance of NTG and its components.
Discuss particular issues relevant to this measure.
Recommend appropriate method(s) for NTG analysis.

Reference the NTG Section for general methodology.
Reference Sample Design and Survey sections.

Other Evaluation Issues

Cross-Customer Class Sales

Cross-Service Area Sales (Leakage)

Reference Other Evaluation Issues chapter as applicable.

Program Evaluation Elements

Describe steps in implementation of the evaluation process and activities.

5 Commercial Sector – Billing Analysis

Complete technical protocol, describing method(s) for calculation of savings and steps in verification for commercial measures. (THIS MAY BE APPLICABLE ONLY TO SMALL COMMERCIAL SECOR OR NOT AT ALL.)

6 Commercial Sector – Energy Simulation Modeling

Complete technical protocol, describing method(s) for calculation of savings and steps in verification for programs requiring simulation modeling – if applicable. (THIS MAY APPLY ONLY TO COMMERCIAL NEW CONSTRUCTION.)

7 Commercial-Sector Measures – Lighting

Complete technical protocol, describing method(s) for calculation of savings and steps in verification for commercial lighting measures. (REPEAT FOR ALL OTHER MEASURES)

Measure Description

Measure Application and Delivery

Savings Calculations

Measurement and Verification Plan

Reference Sample Design, Survey and Metering Sections as applicable.

Net-to-Gross Analysis

Describe the relevance and importance of NTG and its components.
Discuss particular issues relevant to this measure.
Recommend appropriate method(s) for NTG analysis.

Reference the NTG Section for general methodology.
Reference Sample Design and Survey sections.

Other Evaluation Issues

Reference Other Evaluation Issues chapter as applicable.

Program Evaluation Elements

Describe steps in implementation of the evaluation process and activities.

8 Estimating Demand and Peak Load Impacts

Describe how to convert energy (kWh) savings into demand and peak capacity impacts.

Load shapes, conservation load factors, and coincidence factors.

9 Net-to-Gross Analysis

Describe the concept net savings and the elements of NTG.

Describe the use of NTG to calculate net savings.

Describe how NTG is incorporated into cost-effectiveness calculations (reference CA Standard Practice Manual).

Describe how NTG is applied retrospectively (for performance verification) and prospectively (program design enhancement, planning and forecasting).

10 Sample Design

Describe (briefly) sampling theory and its applications in EM&V of EE programs.
Describe statistical confidence and precision and trade-offs with cost.
Alternative methods for efficient sample design – stratification, etc.
Describe steps involved in sample development.

11 Data Development

Survey Design and Implementation

Purpose
Verification of installation, operating conditions, process evaluations, NTG, etc.

Instrument Design
Issues in design, response rate, response bias, etc.

Administration
Advantages, costs, tradeoffs among implementation methods such as telephone, mail, internet.

Metering

Purpose
Calculation of savings, validation of parameters, etc.

Unit of Measurement
Power, flow, pressure, temperature, etc.

Levels of Measurement
Equipment, end-use, circuit, process, facility, etc.

Levels of Resolution
Status, interval, etc.

Duration of Measurement
Instantaneous, short-term, long-term.

Equipment
General discussion of equipment (watt meters, pulse recorders, data loggers, etc.), communication (on-site recorders, cell phone, internet, etc.)

Data Capture, Storage, and Handling

12 Other Evaluation Issues

Introduction

Persistence of Savings

Rebound Effect

Leakage

13 Evaluation, Measurement, and Verification Planning

Describe steps in developing and implementing an evaluation plan. List evaluation activities. (POSSIBLY AN EXAMPLE)

14 References