There are multiple ways to calculate energy savings for the same energy efficiency measure or program.

– Lack of methodological consistency leads to difficulty comparing and understanding results.

– There is a general lack of transparency about the assumptions and details of savings calculations.
Technical Reference Manuals (TRMs) are often used to estimate savings.

Seventeen TRMs have been identified, covering 21 states and DC (as of Spring 2012).

Savings estimates for identical measures varied significantly with no clear explanation of the rationale.
Greater Consistency of Savings Calculations:

- Increases credibility of savings estimates
- Simplifies comparison of savings
- Helps utilities and program administrators manage regulatory risk
- Allows administrators to set data requirements early on
- Makes it easier and less costly for to quickly establish good EM&V practices

Addresses most common residential and commercial efficiency measures in incentive programs

Presents step-by-step calculations for determining gross savings

Includes additional sections to address cross-cutting evaluation requirements

Phase 1 Complete; Phase 2 underway
### Protocols for Efficiency Measures (Phase 1)

- Refrigerator recycling
- Commercial lighting
- Commercial lighting controls
- Residential lighting
- Residential furnaces and boilers
- Commercial unitary and split system air conditioning equipment
- Whole-building retrofit

### Cross-Cutting Protocols (Phase 1)

- Sample design
- Survey design
- Metering
- Calculation of peak impacts
- Other evaluation topics (including rebound and persistence of savings)
Phase 2 Measures

Measures Covered:

• Chillers (drafted)
• Commercial/non-residential new construction (drafted)
• Retro-commissioning (drafted)
• HVAC controls
• Adjustable Speed Drive Motors
• Data centers (IT component)
• Residential new construction
• Residential behavioral programs
• Compressed air systems

Cross-Cutting Measures:

• Net-to-Gross Ratio (NTG)
Current Steering Committee and Observers

States
- Nancy Seidman, Massachusetts Department of Environmental Protection
- Dub Taylor, Texas State Energy Conservation Office
- Doug Scott, Illinois Commerce Commission
- Julia Friedman, National Association of State Energy Officials
- Miles Keogh, National Association of Regulatory Utility Commissioners

Utilities
- Mike Brandt, Commonwealth Edison
- Mary Ann Ralls, National Rural Electric Cooperative Association
- Chuck Rea, MidAmerican Energy Company
- Gene Rodrigues, Southern California Edison
- Bill Newbold, Detroit Edison
- Linda Ecker, AEP Ohio

Other
- Tom Eckman, Regional Technical Forum
- Steve Kromer, Efficiency Valuation Organization
- Marty Kushler, American Council for an Energy-Efficient Economy
- Julie Michals, Northeast Energy Efficiency Partnerships
- Steve Schiller, on behalf of Lawrence Berkeley National Laboratory
- Rod Sobin, Alliance to Save Energy

Observers
- Steve Rosenstock, Edison Electric Institute
- Lisa Wood, Institute for Electric Efficiency
- Jason Erwin, Consortium for Energy Efficiency

Efficiency Service Providers/ESCO
- Donald Gilligan, National Association of Energy Service Companies
Protocols developed in collaboration with Evaluation, Measurement, and Verification (EM&V) industry and major energy efficiency stakeholders

Protocols developed in collaboration with energy efficiency program administrators, stakeholders, and EM&V consultants

- Including the major U.S. firms that do as many as 70% of energy efficiency evaluations

Industry review process allowed for input from large array of stakeholders

- 636 comments from 46 organizations
Public processes are simple

Expert completes draft >>> Cadmus reviews, edits, sends to TAG >>> TAG reviews, provides feedback >>> Expert addresses comments >>> Cadmus reviews, forwards to Steering Committee >>> NREL uploads document to Electronic Comment Tool (developed by PNNL) >>> "Stakeholder Review" opens for 4-6 weeks >>> Expert and TAG review comments, accept, accept with modification, or reject >>> Expert addresses comments, modifies draft >>> Commenters are notified of the disposition of their comments >>> Draft is "approved" by the TAG and Steering Committee, submitted for publication >>> Cheers!

~650 comments, 52 commenters, 46 organizations
Project Organization

- Funded by the U.S. Department of Energy
- Managed by the National Renewable Energy Lab
- Cadmus is the principal consultant
- Protocol authors are the experts as identified by their peers

Experts include:
- Navigant
- DNV KEMA
- Tetra Tech
- GDS Associates, Inc.
- Warren Energy Engineering
- Left Fork Energy
- Jacobson Energy Research
- BuildingMetrics, Inc.
- Apex Analytics
- Northwestern University
- Nexant
- Itron
- ADM
- SBW Consulting
- ADM Associates
- ICF Marbek
- Posterity Group
More Information

For more information visit:

eere.energy.gov/ump

Contact:

Michael.Li@ee.doe.gov
The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures

January 2012 — March 2013

Tina Jayaweera
Hossen Haeri
The Cadmus Group
Portland, Oregon

NREL Technical Monitor: Charles Kumik
Table of Contents

Acknowledgments

Chapter 1: Introduction

Chapter 2: Commercial and Industrial Lighting Evaluation Protocol

Chapter 3: Commercial and Industrial Lighting Controls Evaluation Protocol

Chapter 4: Small Commercial and Residential Unitary and Split System HVAC Cooling Equipment-Efficiency Upgrade Evaluation Protocol

Chapter 5: Residential Furnaces and Boilers Evaluation Protocol

Chapter 6: Residential Lighting Evaluation Protocol

Chapter 7: Refrigerator Recycling Evaluation Protocol

Chapter 8: Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol

Chapter 9: Metering Cross-Cutting Protocols

Chapter 10: Peak Demand and Time-Differentiated Energy Savings Cross-Cutting Protocols

Chapter 11: Sample Design Cross-Cutting Protocols
Chapter 6: Residential Lighting Evaluation Protocol
The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures

Scott Dimetrosky, Apex Analytics, LLC
Subcontract Report
NREL/SR-7A30-53827
April 2013
1 Measure Description

In recent years, residential lighting has represented a significant share of ratepayer-funded electricity energy efficiency savings. The majority of these savings have been achieved by promoting the purchase and installation of compact fluorescent lamps (CFLs), both standard “twister” bulbs and specialty CFLs such as reflectors, A-Lamps, globes, and dimmable lights. Some energy efficiency programs have also promoted ENERGY STAR lighting fixtures. More recently, programs are introducing solid-state light-emitting diode (LED) lamps.

The future of savings claims from residential lighting programs is uncertain, due to the provisions of the 2007 Energy Independence and Security Act (EISA). This legislation requires that most screw-based light bulbs become approximately 28% more energy-efficient during the period from 2012 through 2014, as measured by the efficacy in units of lumens per watt (W). EISA requirements take effect in phases, beginning with 100-W equivalents in 2012, 75-W equivalents in 2013, and 60- and 40-W equivalents in 2014. To add further uncertainty regarding the baseline, the federal spending bill approved in December 2011 eliminated enforcement of the EISA standards through at least September 2012.
2 Application Conditions of Protocol

Residential lighting measures are typically delivered by program administrators through four mechanisms:

- **Upstream Buy-Down/Mark-Down.** The most common approach to achieve residential lighting savings has been through “upstream” incentives to either manufacturers to buy down (or have retailers mark down) the cost of lights for consumers. This delivery mechanism offers the discount at the time of purchase (that is, at the point of sale) and thus does not require any application or paperwork from the end-use customer.

- **Direct Installation.** Many program administrators who offer residential audit programs also provide direct installation of CFLs at the time of the audit. In most programs, the audit is offered at either no cost or at a highly discounted cost to the customer, and there is usually no additional cost for the CFLs.

- **Giveaways.** A number of program administrators have provided CFLs free of charge to residential customers through the mail, at customer service offices, or at community, religious, or local government events. In some programs, the CFLs are mailed to customers only upon request. In other programs, the CFLs are distributed without prior customer request. The amount of customer information collected at the time of giveaway events varies, with some program administrators requiring full name and contact information and other program administrators not requiring any.

- **Coupons.** Some program administrators have relied on instant (point-of-sale) or mail-in coupons as the incentive mechanism for residential lighting products. These coupons typically require that customers fill out their name and contact information to obtain the product at the discounted price or to receive the rebate.

Although this Residential Lighting Evaluation Protocol applies to all of these delivery mechanisms, the strategies for collecting and analyzing the data necessary to calculate the savings tend to vary. Where necessary, this protocol highlights and provides more detail regarding specific differences. Also, program administrators may need to prioritize their evaluation resources on particular combinations of measures and delivery strategies based on criteria such as the contribution to savings and the assessed uncertainty of those savings estimates. (For example, program administrators may use data on those not leveraged and fewer.)
3 Savings Calculations

Gross energy first-year savings from residential lighting measures can be calculated through a number of different algorithms. The approach recommended is based on the following general algorithm:

\[ \text{kWh}_{\text{saved}} = \text{NUMMEAS} \times (\Delta W / 1,000) \times \text{HRS} \times \text{ISR} \times \text{INTEF} \]

where:

- \( \text{kWh}_{\text{saved}} \) = first-year electricity savings measured in kilowatt-hours
- NUMMEAS = number of measures sold or distributed through the program
- \( \Delta W \) = delta watts = baseline wattage minus efficient lighting product wattage
- HRS = annual operating hours
- ISR = in-service rate
- INTEF = cooling and heating interactive effects

The recommended techniques for estimating each of these parameters, based on either primary or secondary data, are described in this chapter.