



Energy Technologies Area

Lawrence Berkeley National Laboratory

Introduction to Technical Reference Manuals (TRMs) for Kentucky Energy Efficiency Programs

Presentation for:

Kentucky EM&V Stakeholder Meeting #2

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Frankfort, Kentucky



Introduction

LBNL is supported by the U.S. Department of Energy to conduct non-classified research, operated by the University of California

- ❑ Provides technical assistance to states—primarily state energy offices and utility regulatory commissions
- ❑ Assistance is independent and unbiased

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Topics

- ◆ Context/Background on EE EM&V Methods
- ◆ Introduction to TRMs
- ◆ TRM examples
- ◆ Setting Up TRMs and Lessons Learned
- ◆ EM&V and TRM Resources

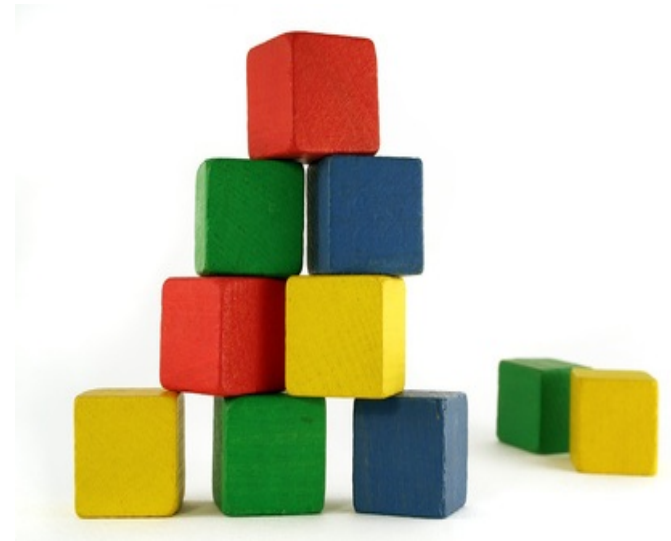
Intent is for informal presentation and discussion

Why talk about TRMs?

◆ Upside:

- ❑ Save money for consumers, utilities, state agencies and thus the public
 - EM&V activities cost less
- ❑ Create certainty (and control) for all involved with reliable savings values applicable to Kentucky markets
- ❑ Save time in the EM&V process

◆ Downside, it takes some coordination and effort up front



Context/Background

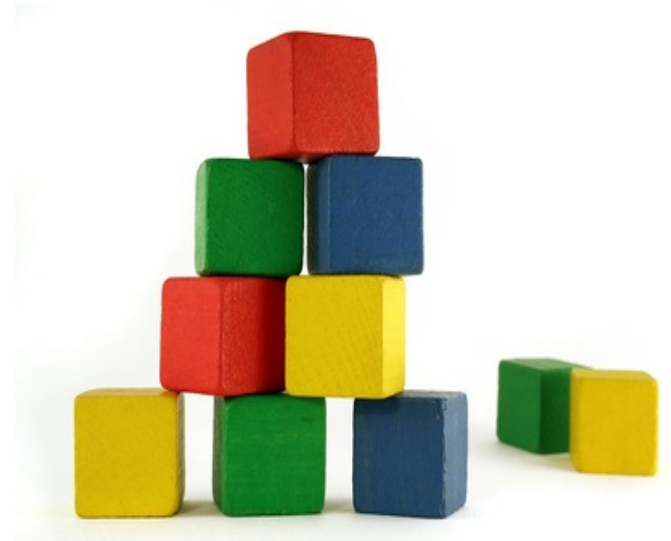
Approaches: Determining Gross Energy Savings

- ◆ **One or more measurement and verification (M&V)** options from the IPMVP (A, B, C and/or D) are used to determine the savings from a sample of projects. These savings are then applied to all of the projects in the program.
 - ❑ Typically applied to “calculated” or “custom” measures (e.g., commercial HVAC)
 - ❑ Tend to be project-by-project assessment of savings
 - ❑ Involve at least some measurements from site combined with analyses
- ◆ **Conduct Statistical analyses** of large volumes of metered energy usage data.
 - ❑ Typically applied to mass market, residential programs (e.g., weatherization program)
 - ❑ Uses utility bill data and often a control group
- ◆ **Apply deemed (stipulated, default) values or calculations** that are based on historical and verified data to applicable projects and/or measures
 - ❑ Typically applied to well defined, “prescriptive” or “standard” measures
 - ❑ Some verification activities involved
 - ❑ Where TRMs are applied

“Typical” Combination for Determining Gross Savings

- ◆ Prescriptive programs use deemed savings values for savings (e.g., residential CFLs, residential weather insulation, commercial ventilation motors, commercial building lighting)
- ◆ Custom programs use M&V:
 - ▣ Calculated ex-ante savings estimates and 100% site verification with spot measurements (e.g., commercial lighting, HVAC and controls measures)
 - ▣ Another set of custom programs use pre- and post-measurements on a census of projects (e.g., industrial process measures)
- ◆ Residential direct-install program uses large scale billing data analyses

Introduction to Technical Resource Manuals - TRMs



Deemed Savings and Algorithm Resource Database – AKA “TRM”

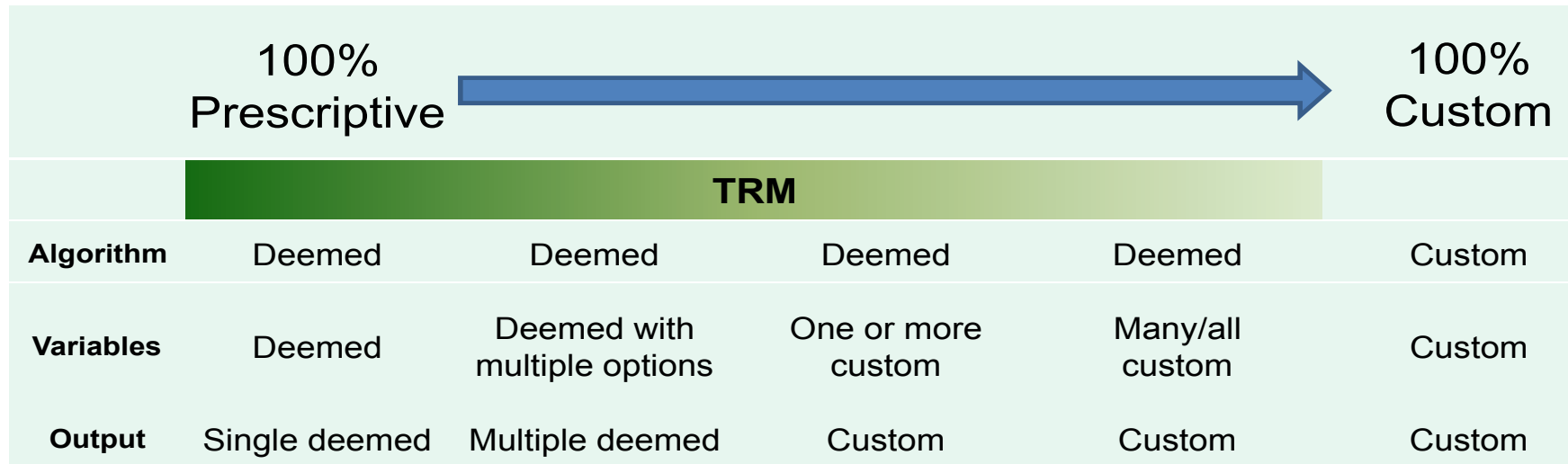
- ◆ Resource (document, database, website) that includes information used in program **planning**, **reporting** and **evaluating** of EE programs which can include:
 - ❑ Energy efficiency measures metrics – *deemed savings values (demand, energy)*
 - ❑ Engineering algorithms to calculate savings – *deemed savings calculation*
 - ❑ Parameters needed for calculating savings (e.g., typical operating hours, heating degree days)
 - ❑ Factors for applying to savings (e.g., *net-to-gross ratios*, measure lifetimes, project costs)
- ◆ Typically include documentation of:
 - ❑ Assumptions (e.g., baselines) used to prepare values
 - ❑ Calculations of values
 - ❑ What are **appropriate applications** for applying values and algorithms
- ◆ Common reference for utility program managers, implementers, evaluators, and regulators

Definitions

- ◆ **Deemed Savings Value:** *(Stipulated Savings Value, Unit Energy Savings)*. Estimate of energy or demand savings for installed EE measure 'per unit':
 - Examples:
 - kWh saved per year per 12 Watt LED
 - therms saved per linear foot of weather stripping
 - Used for well understood and documented EE measures
 - For example: energy-efficient appliances such as washing machines, computer equipment and refrigerators, and lighting retrofit projects with well-understood operating hours
 - Developed from reliable data sources and analytical methods
 - Are applicable to the situation being evaluated

- ◆ **Deemed Savings Calculation:** An agreed-to (stipulated) **engineering algorithm(s)** used to calculate the energy and/or demand savings associated with an installed EE measure(s).
 - Example: kWh saved per year = [(annual operating hours) x (kW_{pre} – kW_{post})]

Measure Spectrum



- Standardization
- Simple, Consistent Implementation
- Low Admin Cost



- “Accuracy”
- Complex, Varied Implementation
- High Admin Cost

◆ Graphic from VEIC

Deemed Savings

- ◆ They are used a lot!
- ◆ Probably the most common (by far) method used for utility EE programs

But, Must Be Used With Caution

- ◆ Have to be applied where appropriate – only!
- ◆ The use of deemed values in a savings calculation is an agreement to accept a stipulated value, irrespective of what actually “happens”
- ◆ When using deemed values, it is important to realize that technologies alone do not save energy - it is how they are used that saves energy

TRM Advantages

- ◆ Saves time and money while providing relative accuracy – calculate once, versus over and over again for each program (and project?), every year
 - **Allows evaluators to better allocate resources**
- ◆ Pre-vetted, pre-approved values – reduce regulatory risk and **provide certainty** for regulator, utility, implementer and customer in terms of incentive payments
 - **With values vetted for Kentucky**
- ◆ Maintains consistency
 - Planning and evaluation values will be calculated using the same methodology while allowing for utility specific inputs
 - Evaluation findings (e.g., billing analysis, metering, survey data) inform TRM updates allowing utilities to pool evaluation resources; the Uniform Methods Project can be a standard way to develop values:
<http://energy.gov/eere/about-us/ump-home>

TRM and Deemed Savings Cautions

◆ Can they be misused? Yes!

- ❑ Only as good as the data, analysis, and QC that goes into them (garbage in.....)
- ❑ Accurate on average
 - Should be - can be even better than case by case M&V)
 - But, accurate for each project and customer (probably not.....)

◆ Watch out for:

- ❑ Applying values only where they are applicable!
- ❑ Systematic biases
- ❑ Interactive and stacking effects (multiple measures in same facility)

◆ Best with transparency and documentation including a guide on how to use the data and algorithms

Applicability Conditions (concept)

Retail LED

- 10 hours per day
- Baseline = 60 Watts

Multi-Family Common Area LED

- 8 hours per day
- Baseline = 40 Watts

Point of Sale LED

- 2.5 hours per day
- Baseline = 40 Watts

Low Income Residential Direct Install

- 4 hours per day
- Baseline = 75 Watts

Residential New Construction

- 2.75 hours per day
- Baseline = 18 Watts

Bottom Line

◆ TRMs:

- ❑ Create greater savings certainty and consistency for savings values, and perhaps more accuracy
- ❑ Are widely assumed to reduce a state's EM&V costs
- ❑ Focus EM&V resources

◆ Statewide or regional TRMs are becoming essentially a standard practice – bit more on this later

◆ However,

- ❑ As with any tool need to be used correctly and with caution
- ❑ Require (a) agreement among stakeholders, (b) some startup research and costs, and (c) time to get going

TRM Formats

Can be in different formats

- ◆ **Online database**

- ◆ **Downloadable database (most common):**

- **Electronic Database** – often Excel worksheets but can be (should be....) more sophisticated database tools, provides lookup values for tracking system
- **PDF** – text format with common sections for each measure protocol; most common format for recent TRMs
- **Word** – text format, similar to PDFs

TRM Coverage and Administration: Geographic or Jurisdictional Options

◆ **Regional/Statewide**

- ❑ Used to specify the basis for determining savings values claimed by any program administrator (e.g., utility) in a region or state. Often developed through a multiple stakeholder process
- ❑ Administered by regional non-profit, state commission or agency, advisory committee, program administrators

◆ **Program Administrator (e.g., utility)**

- ❑ Used to specify the savings values claimed by a single utility. Often developed by that utility
- ❑ Administered by utility

Quick History of TRMs

◆ 1990s – The first databases of savings

- ❑ Northwest Power & Conservation Council's Regional Technical Forum (RTF) Unit Energy Savings (UES) Workbooks Database
- ❑ California Public Utility Commission (CPUC) Database for Energy Efficient Resources (DEER)

◆ 2000s – Continued work by the RTF and CPUC and new documents called Technical Reference Manuals

- ❑ More states started to develop these resources for the use of all utilities within the state

◆ Now

- ❑ More and more jurisdictions are adopting TRMs – about 20 state or regional TRMs
- ❑ Movement to create regional if not national standardization of resources
- ❑ U.S. DOE supporting efforts at standardization

A Few State Examples

◆ Arkansas TRM

- ❑ Compilation of deemed savings values for electric and gas energy efficiency measures being implemented by the Arkansas IOUs
- ❑ Provide common framework and set of reference points for conducting cost-effective DSM Program evaluations.
- ❑ Describe the types of information that must be collected, frequency for conducting evaluations, and the key metrics that must be reported
- ❑ Key definitions, recommendations regarding data capture and EM&V reporting formats.

◆ Energy Trust of Oregon TRM

- ❑ Primarily fully deemed values in the database developed in conjunction with analysis completed by Regional Technical Forum; some calculators
- ❑ Used for programs, and made specific to Oregon IOU territory
- ❑ Updated as needed with EM&V results

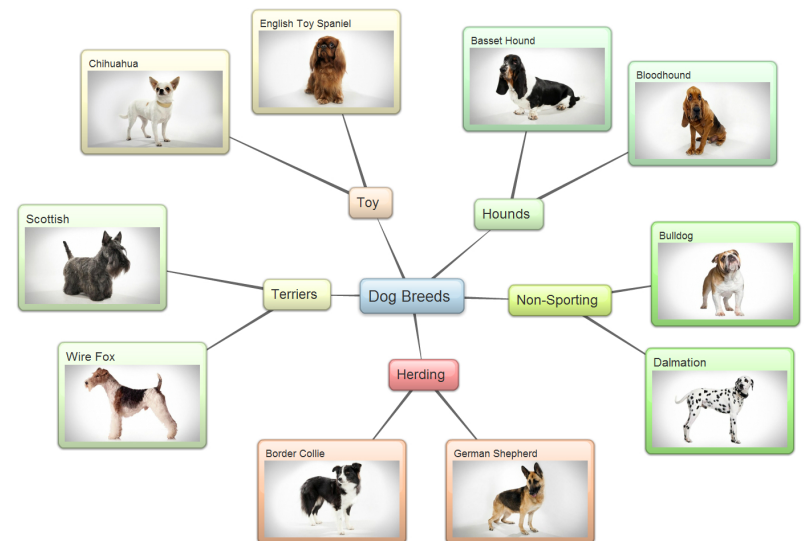
◆ Michigan Energy Measures Database

- ❑ Provide users with accurate information on potential technologies or measures that could be used in an energy efficiency programs
- ❑ Provide customized measures for Michigan specific weather and loads.
- ❑ Allow for consistent application of information across Michigan for energy efficiency planning and goal measurement.
- ❑ Allow for consistency of assumptions.
- ❑ Provide documentation for regulatory review and reconciliation processes.

◆ Pennsylvania TRM

- ❑ Primarily partially deemed algorithms with inputs based on look-up tables or customer-specific application data
- ❑ Used for program planners and claimed savings
- ❑ Updated annually

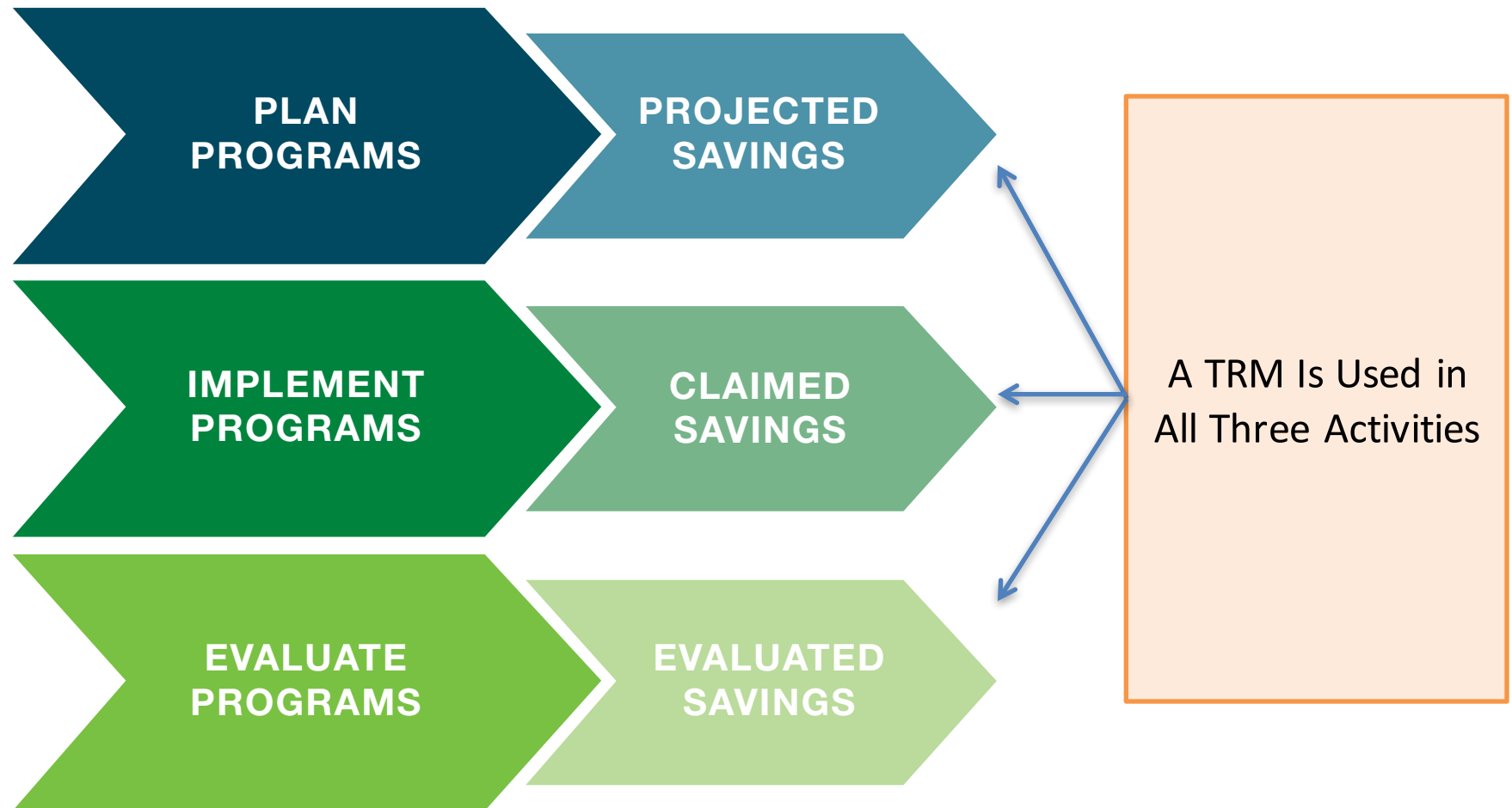
Lets run through some examples.....





Setting Up and Using TRMs and Lessons Learned

Planning, Implementing, and Evaluating Efficiency Programs

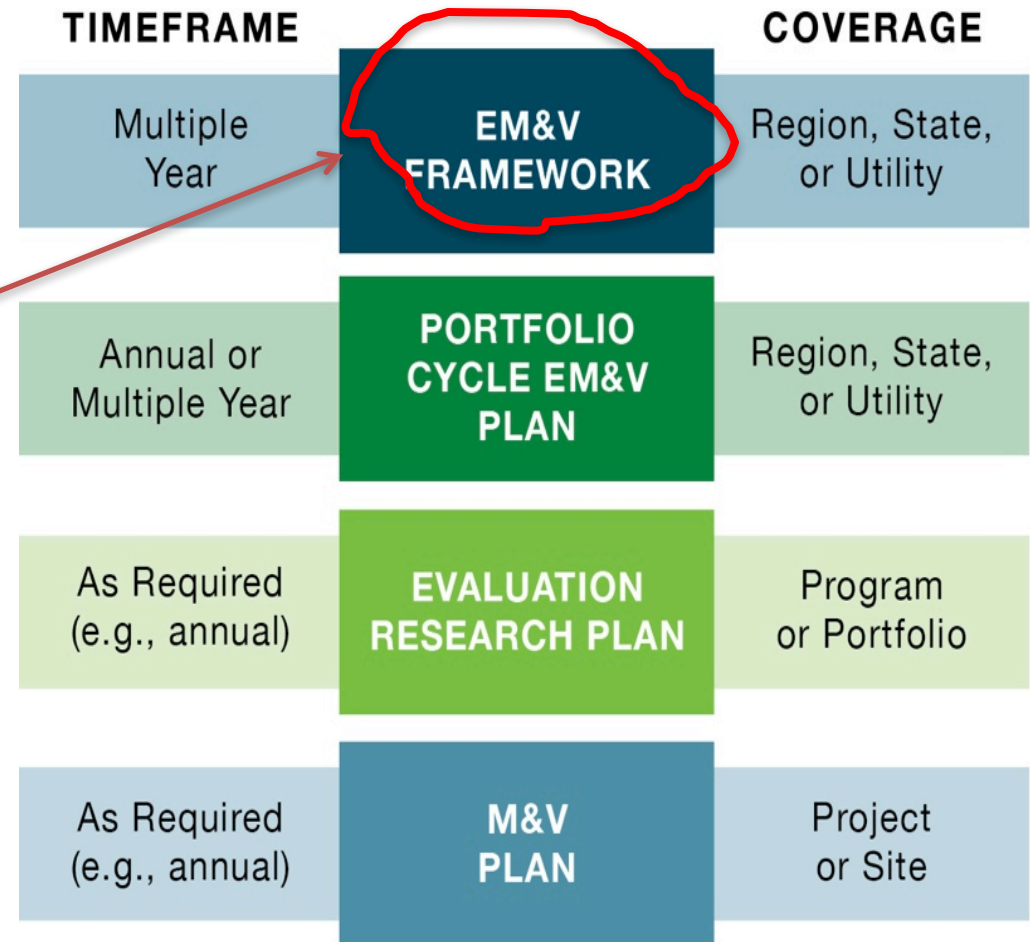


Structure for Defining Evaluation

- ◆ **EM&V Framework** – Primary document that lays out top level structure. *This is perhaps the principle document that all stakeholders can focus on and provide high level input. When used -*

- *This is where the TRM concept gets defined*

- ◆ **Portfolio (annual) Plans** – Indicates major evaluation activities that will be conducted during the evaluation cycle
- ◆ **Evaluation Research Plans** – Created for the major EM&V activities
- ◆ **Site Specific M&V Plans** – For custom project sites that are analyzed and inspected



How TRM Efforts Get Initiated


- ◆ Most are "ordered" or just agreed to by a Commission or perhaps an advisory board if there is a third-party EE administrator
- ◆ With these TRMs operating in about half the states, commissions, stakeholders, utilities, and/or group of implementers are asking and saying:
 - ❑ Why are we recalculating or re-justifying the same savings values over and over again?
 - ❑ Why does one of our utilities use "x" and another "y" for the savings for the same measure?
 - ❑ How can we increase certainty of savings throughout the process – i.e. how manage risk for utility customers and utilities?
 - ❑ How can we save time and money?
- ◆ The barriers are usually money and process:
 - ❑ Its almost certainly cheaper to do one for the state versus one per utility or implementer, but those costs are buried, versus a single larger line item
 - ❑ In some cases utilities and implementers do prefer that the Commission approves the TRM - to avoid second guessing, i.e. to provide certainty

Getting a TRM Process Started

1. **Research** (review other states' and regions TRM efforts)
2. **Set Objectives:**
 - a. Used for planning, reporting and/or in place of ex-post savings determination?
3. **Decide what information is needed:**
 - a. For example, gross and/or net savings values, cost data, effective useful life
 - b. Deemed saving values only or also calculation tools? Include work papers for custom measures?
4. **Answer some questions:**
 - a. Who's database? How is it reviewed? How is it approved?
 - b. Start from scratch or start with another state's system and modify for Kentucky? A regional effort?
 - c. Build large system (lots of EE measures) from beginning or start small (just high priority EE measures) and build up as data warrants?
 - d. What format – on-line, spreadsheet, pdf, etc.
 - e. Who develops, verifies, and maintains data?
 - f. What are criteria for “good” data and how rigorously it is verified and applied appropriately. How are baselines defined?
5. **Then set budgets and timeframes – and a framework and/or work plan**

Using TRM Data From Other States

- ◆ Many states use data from other states, but will document that is applicable to their own state (climate, market, baselines, operating hours, measure characteristics)
- ◆ Scoping study was conducted developing regional TRMs and included an assessment of savings values for 20 measures covering different fuels, sectors, end-uses in multiple TRMs, findings:
 - ❑ Savings estimates vary by order of magnitude across TRMs
 - ❑ Main drivers of variances are:
 - Differing baseline assumptions (e.g., hours of use, weather, prevailing codes)
 - Source of savings calculations (building simulation versus engineering algorithm)
 - Parameters included in algorithm (e.g., use of HVAC interaction factor for lighting)



Scoping Study to Evaluate Feasibility of National Databases for EM&V Documents and Measure Savings

Tina Jayaweera, Hossein Haeri, Allen Lee, Scott Bergen, Cynthia Kan, Aquila Velonis, Christy Gurin, Michael Visser, Andrew Grant, and Ashley Buckman

The Cadmus Group Inc. / Energy Services
720 SW Washington Street, Suite 400
Portland, OR 97205
503.467.7100

Evaluation, Measurement and Verification Working Group

June 2011

So How Much Does it Cost?

◆ It Depends!

◆ It depends on:

- **Timing** – how quick you want it and how often updated
- **Quality**
- **Scope**
 - How many EE measures
 - Primary or secondary research in state – or just update to another
 - Level of documentation
 - Format
 - Level of review

◆ Ball Park Cost Ranges – **It Depends!!**

◆ Development - \$50,000 - \$200,000

- Could it be less? ...perhaps; could it be more?oh yes

◆ Updates - \$10,000 to \$50,000 per cycle

- Mid-Atlantic TRM update is \$75,000 per year, balance larger scope and review process with very efficient/experienced team (this is also about what it cost for modifying it for for us in another state)

◆ Can be combined with:

- Scope of an evaluator
- Tracking and reporting systems

Updating

Process

- ◆ Typically done every one, two or three years
- ◆ Review and summarize other jurisdiction's TRM update processes for comparison and guidance
- ◆ Recommend an overarching strategy to update the TRM in a timely and appropriate manner, to best meet the needs of the organizations using it
- ◆ Interview stakeholders to identify needs and schedules relevant to the update process, commonalities that are mutually supportive of a single process and schedule, as well as any unique needs or situations that necessitate extra attention.
- ◆ Identify measures to be added or updated in the next round of TRM measure development

Lessons Learned

- ◆ Define update cycle that matches planning cycles (or planning and reporting if retroactive application)
 - Typically annual or every other year
 - Be realistic on time required to do updates
- ◆ Use savings verification and evaluation results to inform updates
- ◆ Develop process where old measures are systematically reviewed through annual update process
- ◆ Maintain a reference library to track:
 - Changes
 - Feedback
 - Error corrections
 - New information including new measure suggestions and references

Who Does Evaluation (and TRMs)

- ◆ Administration of the evaluation function:
 - 37% utility administration
 - 36% administration by the utility regulatory commission or a combination of the commission and utilities
 - 27% administration by some other government agency or third-party entity
- ◆ Most states (79%) rely on independent consultants/contractors to conduct the actual evaluations with 21% using utility and/or government agency staff

“A National Survey Of State Policies and Practices For the Evaluation Of Ratepayer-Funded Energy Efficiency Programs” Martin Kushler, Seth Nowak, and Patti Witte February 2012 Report Number U122. www.aceee.org

Lessons Learned – TRM Development Process

- ◆ Establish definitions for metrics (gross, net, incremental savings, lifetime, etc.) and measures
- ◆ Clearly define roles and responsibilities of different participants
- ◆ Define process for input and approval of TRM and updates
 - Strive for transparency, wide input and limited legal/regulatory hoops required to make changes
- ◆ Decide whether values are to be “expected values” or “conservative values” (remember EE savings are estimates)
- ◆ Provide some guidance on selection criteria for what measures go in the TRM
- ◆ Process guidance should make it clear what assumptions are used and for which purposes
- ◆ Decide how values are used – “looking back” or “going forward”

Looking Back or Going Forward?

- ❑ For the affected measures the per unit energy savings are based on the values found in the TRM – but which version for what purposes and when?
 - TRM values can and do change – mistakes found, better data, baselines change, etc.
- ❑ For example:
 - TRM updated in November 2013 and November 2014 and November 2015
 - Program plans submitted in August 2014 – used November 2013 TRM values
 - Program approved in December 2014 - with November 2013 TRM values
 - Program implemented in 2015 – which TRM version should be used for claimed savings?
 - Program evaluation completed in 2016 - which TRM version used for evaluated savings?
 - What's fair to utility? What's fair to the ratepayers? What's right for system planners?
- ❑ Points out two issues:
 - Should line up program planning, approvals with TRM updates – it would have been much better if the 2014 TRM update was done in summer of 2014 versus fall
 - Should decide in framework whether utilities get credit for savings based on *looking back or going forward* TRM versions
 - Common approach is using TRM values valid at time of program approval



EM&V and TRM Resources


EM&V and TRM Resources

- ◆ DOE/EPA SEE Action EM&V Resources website:
<http://www4.eere.energy.gov/seeaction/topic-category/evaluation-measurement-and-verification>
- ◆ U.S. DOE Uniform Methods Project website:
<http://energy.gov/eere/about-us/ump-home>
- ◆ TRM review and development scoping study:
http://www4.eere.energy.gov/seeaction/system/files/documents/emvscoping_databasefeasibility.pdf

SEE Action Impact Evaluation Guide

- ◆ Describes common **terminology, structures, and approaches** used for determining (evaluating):
 - energy and demand savings
 - avoided emissions
 - other non-energy benefits
- ◆ Does not recommend specific approaches - it provides:
 - context
 - planning guidance
 - discussion of issues

<http://www1.eere.energy.gov/seeaction/>



SEE Action
STATE & LOCAL ENERGY EFFICIENCY ACTION NETWORK

Energy-Efficiency Program Impact Evaluation Guide

An introduction to and summary of the practices, planning, and associated issues of documenting energy savings, demand savings, avoided emissions, and other non-energy benefits resulting from end-use energy-efficiency programs.

A RESOURCE OF THE STATE AND LOCAL ENERGY EFFICIENCY ACTION NETWORK

Discussion/Questions

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Kentucky EM&V Stakeholder Meeting
- LBNL Presentation by Steven Schiller
- March 2016

