STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

IN THE MATTER OF THE COMMISSION'S INVESTIGATION, PURSUANT TO IC § 8-1-2-58, INTO THE EFFECTIVENESS OF DEMAND SIDE MANAGEMENT ("DSM") PROGRAMS CURRENTLY UTILIZED IN THE STATE OF INDIANA, INCLUDING AN EXAMINATION OF ISSUES THAT COULD IMPROVE THE EFFECTIVENESS OF DEMAND SIDE MANAGEMENT PROGRAMS IN THE STATE, INCLUDING CONSIDERATION OF THE ESTABLISHMENT OF AN INDEPENDENT DSM ADMINISTRATOR MODEL ON A STATE-WIDE BASIS	)	CAUSE NO.: 42693 S-1
RESPONDENTS: ALL JURISDICTIONAL ELECTRIC AND GAS UTILITIES IN THE STATE OF INDIANA	)	

COMPLIANCE FILING

In compliance with the reporting requirements established in the Indiana Utility Regulatory Commission's December 9, 2009 Phase II Order, the Demand Side Management Coordination Committee's ("DSMCC") Evaluation, Management and Verification Subcommittee is filing the attached Indiana Evaluation Framework prepared for the DSMCC by the Indiana Statewide Core Program Evaluation Team (TecMarket Works, the Cadmus Group, Opinion Dynamics Corporation, Integral Analytics, Building Metrics, and Energy Efficient Homes Midwest). The DSMCC

accepted the attached Indiana Evaluation Framework by a vote of 6-0 with 2 abstentions.

Respectfully submitted on behalf of the Demand Side Management Coordination Committee,

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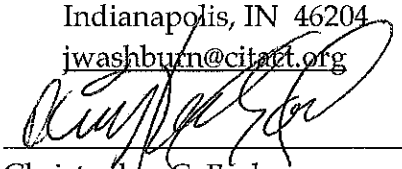

Christopher C. Earle

Indiana Evaluation Framework

Date: September 25 2012

Prepared for:

The Indiana Demand Side Management Coordination Committee

Submitted by

The Indiana Statewide Core Program Evaluation Team: TecMarket Works, The Cadmus Group, Opinion Dynamics Corporation, Integral Analytics, Building Metrics, and Energy Efficient Homes Midwest

with support from Vickie Benson and Maria Larson

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Introduction

This document establishes the Indiana statewide Core programs Evaluation, Measurement, and Verification (EM&V) Framework (Framework).

The purpose of this EM&V Framework is to:

- Develop an overall approach to the evaluation of statewide energy efficiency programs in Indiana;
- Standardize evaluation approaches for the assessment of energy efficiency programs in Indiana;
- Provide specific guidance on the evaluation of energy efficiency programs.

The primary purpose of the Framework is to provide a consistent platform from which evaluations can designed and implemented so that evaluation results are both reliable and comparable across programs, administrators, and energy providers. In order to accomplish this purpose this Framework is segregated into two chapters. The first chapter is the Evaluation Policy chapter. The Evaluation Policy chapter provides information pertaining to evaluation-related policies that impact when, how and for what reasons evaluations are conducted. The second chapter is an Evaluation Protocol chapter. The Evaluation Protocol chapter provides information specific to how evaluations are to be conducted.

Evaluation Administrators conducting evaluations of the statewide Core programs are required to design and implement evaluations that reflect the policy needs presented in the Evaluation Policy chapter and implement evaluations that follow the requirements presented in the Evaluation Protocol chapter. The Demand-Side Management Coordination Committee (DSMCC) Evaluation Measurement and Verification Subcommittee (Subcommittee) is the party responsible for ensuring all evaluation plans and their subsequent implementation are developed and conducted in alignment with this Framework.

The purpose of this EM&V Framework as specified in the Indiana Utility Regulatory Commission (IURC) Order 42693[1] is:

> To ensure a greater degree of statewide consistency in evaluation of DSM programs, the Energy Center recommends in its Phase II Report that the Commission develop a formal framework to guide future evaluation activities in Indiana. The goal of the framework would be to ensure that evaluation activities accomplish the following objectives:
>
> - **Accountability**: Including evaluation as a key component of program oversight functions;
> - **Effectiveness**: Ensuring that evaluation activities lead to better programs (*i.e.*, program implementers take action in response to evaluation findings);
> - **Independence**: Ensuring that evaluations are conducted by a third party with no involvement in program design or delivery;
> - **Consistency**: Developing mechanisms to ensure that similar programs are evaluated in the same way, using similar metrics to measure performance;

[1] IURC Order 42693, page 44.

- **Accuracy**: Conducting research to vet key inputs and assumptions used in program evaluation; and
- **Efficiency**: Allocating evaluation and research resources according to the areas of greatest savings and associated uncertainty/risk.

Evaluation Objectives

The goal of evaluation in Indiana is to provide the DSMCC and other interested parties with information on the effects of the programs implemented and to provide evidence that can be used to help guide future programs and service offerings. This will require flexibility in the evaluation approach so that resources are effectively spent to acquire study results that are reliable, comparable across programs, actionable and which can be used to improve the cost effectiveness of the statewide energy efficiency service portfolio.

Evaluation and Analysis Approach

Evaluations covered under this Framework include program-specific evaluation efforts, including:

Impact evaluation – quantifying the verified gross and net energy savings delivered by programs.

Process evaluation –assessing the way in which the programs are designed and implemented, the way they interact within the market, the levels of and drivers for participant satisfaction with the operations and offerings, and other investigative areas.

Market effects evaluation –assessing the ways in which energy efficiency programs impact the operations of energy service markets such that additional savings above and beyond those achieved through direct program services to participants are documented.

While written specifically to guide the design and implementation of program-specific energy impact or process evaluation as well as market effects evaluations, this Framework can also provide valuable guidance to the way crosscutting studies are designed and implemented. These types of studies can include the following efforts:

- Statewide potential studies that assess market baselines and future savings that may be expected for different technologies and customer markets over a specified time horizon.
- Analysis of technology or service gaps that can be met by energy efficiency programs
- Analysis of barriers to energy efficiency implementation and development of approaches to overcome those barriers through redesigned programs
- Meta-analysis studies that look at the energy efficiency efforts as a whole and assess accomplishments and identify opportunities at the state level.
- Action Plans that specify energy saving objectives and methods of achieving those objectives.

All evaluation or evaluation related studies, including crosscutting studies and their associated costs must be approved by the Subcommittee.

Key EM&V Resource Documents

There are four key EM&V resource documents that will provide the technical basis for planning and conducting evaluation efforts in Indiana, these include:

1. **Indiana EM&V Framework** – This document provides the overall structure and guidelines for EM&V of Core programs in Indiana. The guidance in the EM&V Framework will have precedence over guidelines or direction provided in supporting documents including those listed below.
2. **Indiana Technical Reference Manual (TRM)** –This document provides the deemed savings estimation approaches and calculation algorithms that should be used in the planning process for program measures in Indiana.
3. **Program-Specific EM&V Plans** – The EM&V Plans developed for the evaluation of the Core programs or for market effects analysis must be consistent with the guidelines outlined in this Framework and must present the evaluation approach to be used to assess the program's efforts, and the approved budget for those efforts.
4. **Industry Standard Protocols** – When not specified in this Framework the Evaluation Administrators and their subcontractors (if any) should follow industry standard protocols for best evaluation practice allowed within the resources available as approved by the Subcommittee. Protocols such as the California Evaluation Protocols[2], the Impact Evaluation Framework for Technology Deployment Programs[3], and other similar publications provide additional perspectives and recommendations for conducting program evaluations. In addition, organizations such as the International Energy Program Evaluation Conference (www.IEPEC.org) publish proceedings containing papers, panels, and presentations on evaluation policy, methods, results and applications that are useful for evaluation professionals. However, while these other documents may be useful for evaluation professionals, this document (the Indiana Evaluation Framework) supersedes all other evaluation protocols, guidelines, policies and publications and is the official evaluation guidance document for evaluations of Indiana's statewide core programs.

[2] California Energy Efficiency Evaluation Protocols: Technical, Methodological and Reporting Requirements for Evaluation Professionals, TecMarket Works, April 2006.
[3] Impact Evaluation Framework for Technology Deployment Programs, USDOE, EERE, July 2007.

Evaluation-Related Policy

This section of the Framework provides key provisions of several evaluation-related policies that are overseen by the Indiana DSMCC EM&V Subcommittee. The evaluation policies presented in this Framework are not intended to be comprehensive of all evaluation policy decisions affiliated with the evaluation efforts for Indiana's statewide Core Programs. The contents of the Framework are to convey the key evaluation policy aspects for which the Subcommittee has indicated are to be included in the Framework and communicated to stakeholders associated with the evaluation efforts. It is assumed that as the evaluation efforts are implemented in Indiana these Framework decisions will need to be adjusted by the Subcommittee via the Framework updating process.

All evaluation administrators and contractors conducting evaluations of Indiana's statewide Core Program should be familiar with the evaluation-related policy decisions presented in this document.

Updating the Framework

The Framework is a living document that will be updated periodically, on as needed basis by the Evaluation, Measurement and Verification (EM&V) Administrator or others as directed by the Subcommittee.

When the DSMCC or the DSMCC EM&V Subcommittee identifies a need to update the Framework the Subcommittee will undertake that effort or make arrangements for the Evaluation Administrator or other appropriate parties to undertake that effort. Issues regarding the need for an update to the Framework can be brought to the attention of the Subcommittee by any member of the DSMCC or the Subcommittee or by the Evaluation Administrator, the Third Party Administrator (TPA) or other program implementation contractors. Issues pertaining to the need for an update may also be brought to the Subcommittee by other interested parties. However, an update effort can only be undertaken at the direction of a majority vote of the Subcommittee. A formal change proposal must be developed by or at the direction of the Subcommittee or one of the Subcommittee members.

Updates will be conducted in a manner that ensures coordination with the TPA, the DSMCC, the EM&V Subcommittee and the Evaluation Administrator conducting evaluations for the Subcommittee. A coordinated approach will ensure that updates address all issues identified over the course of the year and that appropriate advice and consultation is received prior to a vote to adopt any change to the Framework. The updating process can be initiated at any time, but must be conducted to allow adequate discussion by impacted members of the DSMCC, the DSMCC EM&V Subcommittee and evaluation contactors conducting evaluations of the Core programs.

Updates to the Framework apply following a majority vote of the Subcommittee to accept a recommended change. If a change needs to start at a specific date or following a specific event, the Subcommittee may also vote to specify a start date for a change or identify an event trigger for a change to take effect. The proposal to update the Framework must include a proposal for how and when the change will take effect. The program cycle is defined by the Commission as the period of time over-which a set of program activities are approved and funded for implementation.

When an update to the Framework has taken place, a draft of the updated version will be submitted to the Subcommittee. The Subcommittee will be given ample time to review the draft. Following no less than a 2 week review process the Subcommittee will then vote to accept or reject the proposal. If the proposal passes by a majority vote of the Subcommittee members the revised Framework is accepted. Once accepted the Subcommittee will make arrangements for the updated Framework to be distributed to all DSMCC members and to impacted members of the DSMCC, the DSMCC EM&V Subcommittee and selected evaluation contactors conducting evaluations of the Core programs, and file any updates with the IURC if required.
All updates and changes to the Framework must be consistent with existing processes and procedures associated with the operations of the DSMCC. See Appendix D for change tracking documentation to be included in each update.

Documenting Framework Changes

Each version of the Framework, following acceptance of the first version, will include a *"Changes and Updates to the Framework"* Appendix. The appendix will list all changes made to the Framework, the date of the change acceptance by a majority vote of the Subcommittee, the change that was made and the reason for that change.

Updating the Indiana Technical Reference Manual

The Indiana Technical Reference Manual (TRM) serves as the primary source for establishing measure specific deemed energy savings values and the associated calculation approaches. The TRM is a program planning tool. It provides the approach for calculating estimated energy savings for future program initiatives.

Updating Process

Updates to the Indiana TRM will be initiated when Indiana impact evaluations have established sufficient evidence to suggest that a change to a specific TRM calculation is needed or when there is enough evidence within the energy efficiency program evaluation field to suggest that a change to the Indiana TRM is needed. As such, it is not recommended that a change be initiated unless the Evaluation Administrator and the Subcommittee have collectively decided that a change is necessary and the evidence is real (i.e., initiate an update only when a savings pattern or technology use condition is consistent).

Following the instructions of the Subcommittee, at the end of each program cycle (when reliability of the evaluation results are highest) the contactors should launch a comparative assessment of the estimated TRM estimated gross ex ante[4] impacts associated with the installed measures and the ex post evaluated energy impact results for those measures (when applicable) and assess if the savings levels are statistically different. If the savings are found to be statistically different, and the cause of that difference can be reasonably identified as being associated with typical installation and use conditions or a change in typical baseline conditions, the evaluation contactor should develop a new estimation approach and provide a change recommendation to the Subcommittee. A majority vote by the Subcommittee is required to accept the recommendation. Once accepted, that recommendation is forwarded to the DSMCC for adoption. The DSMCC can elect to accept or reject that recommendation. If the recommendation is accepted, the TRM is to be updated for each change approved by the DSMCC.

All updates and changes to the TRM must be consistent with existing processes and procedures associated with the operations of the DSMCC. See Appendix D for change tracking documentation to be included in each update.

Adding New Measures to the TRM

The energy impact Evaluation Administrator can recommend to the Subcommittee the addition of new measures to the TRM. Likewise the Subcommittee can instruct the Evaluation Administrator to include a new measure to the TRM if in the opinion of a majority vote of the Subcommittee a measure should be added. New measures can be added to the TRM at any time, subject to the Indiana TRM process set forth within the Indiana TRM.

[4] Gross ex ante: the projected expected gross savings for a program as estimated during the program planning and approval phase.

Guidance on Evaluation Budgeting and Budget Management

Targeting the Evaluation Budget at approximately 5% of the Portfolio Budget

The evaluation cost in Indiana should be set at a level not to exceed approximately 5% of the portfolio budget without approval by the Subcommittee for any given cycle. However, for any given program year within a cycle, evaluation budgets are more flexible (i.e., within reason these budgets may deviate from 5% of program projected costs as approved by the Subcommittee).

Regardless of the types of evaluation, the study budgets must be focused on achieving the most reliable results for the most important energy efficiency and demand response efforts. Careful allocation of evaluation resources must be achieved to provide the greatest value for the evaluation dollar. To help assure cost effective evaluation, the Subcommittee must approve all evaluation budgets proposed by the evaluation administrator.

Managing the Evaluation Budget to Increase Reliability and Reduce Error Risk

The evaluation budget must be managed to provide the most reliable evaluation results with the lowest probability of error. The Evaluation Administrator and members of the evaluation team and the Subcommittee will consider the following when developing and approving program-level EM&V approaches and budgets:

- The importance of the program's energy saving contribution to the portfolio. Programs that are expected to provide significant savings should be evaluated using more rigorous approaches than initiatives with lower savings expectations.
- Programs that spend larger portions of the portfolio budget should have a level of evaluation rigor that matches the importance of the program's total financial investment. Thus, larger or more complex programs may have evaluation budgets greater than 5%. However; this increased funding should be off-set by those programs that have evaluation budgets which are lower than 5%.
- Measures with higher level of uncertainty are likely to require higher allocation of budgets. Concentrating effort on measures of high uncertainty will reduce the overall portfolio risk.
- Sampling approaches, sample-size targets, and confidence limits should provide the highest level of accuracy achievable for the available budget. Large programs and programs that are important for reaching energy saving targets should have sampling approaches that reflect that importance. Low impact or smaller programs may have lower precision and confidence levels. However, the precision of the evaluation effort at the program level should be set at 90% confidence and 10% precision levels for a program-cycle[5] unless approved for different levels by the Subcommittee. The Evaluation Administrator is responsible for assessing the portfolio and recommending sampling methods and sizes that maximize accuracy and reliability and stay within the evaluation budget limits.

[5] Program cycle: the period of time over which a set of programs are approved for implementation and are subject to a 90/10 level independent evaluation assessment. This period is determined by the DSMCC and is based on a regulatory decision specifying that timeframe.

Monitoring the Evaluation Expenditures to Assure Reliable Results

During any given program cycle the expenditures must be monitored to make sure that evaluation resources are spent in a way that best reflects the need for reliable timely evaluation results. The Evaluation Administrator must monitor the individual program's progress and the expected level of gross savings and adjust the evaluation approaches as needed to best provide both reliable program-level and portfolio-level evaluation results. Program evaluation needs can change as program participation changes. The Evaluation Administrator and the evaluation team will work with the Subcommittee to adjust and refocus the evaluation efforts as needed. When changes to the evaluation approaches or the funding levels are identified, the Evaluation Administrator will provide recommendations for changes to the Subcommittee for review and approval.

Evaluation Management, Coordination, Communication & Progress Tracking

Progress reporting

It is important that the Subcommittee maintain an excellent understanding of the progress and focus of the evaluation activities as they progress. To accomplish this objective the Evaluation Administrator will provide monthly progress report detailing the status and progress of each program evaluation and crosscutting evaluation effort. The report will be e-mailed to the Chairperson of the Subcommittee and copied to all Subcommittee members. The Evaluation Administrator will also present the contents to the Subcommittee during one of its monthly meetings to be specified by the Subcommittee Chairperson. The presentation of the progress report will typically be delivered via electronic means to help control travel costs.

During the presentation of the progress report the Evaluation Administrator will address any issues or questions raised by the Subcommittee member or provide follow-up communications with the Subcommittee as required to address issues or questions raised by Subcommittee members.

Following the progress report presentation the Subcommittee Chairperson will provide the Evaluation Administrator with any comments regarding the progress report. Within two days of receipt of those comments, the Evaluation Administrator will provide a final progress report to the Subcommittee for transmission to the IURC.

Coordination with the DSMCC EM&V Subcommittee

The Evaluation Administrator reports to the DSMCC EM&V Subcommittee and is expected to maintain communications on an on-going basis. In addition, there will be situations in which Subcommittee members will need to contact the Evaluation Administrator in the conducting of the evaluation efforts. The evaluation contactor will maintain communications with the Subcommittee to assure that evaluation issues are handled in an efficient and cost effective manner. It is expected that these communications will be as needed and cover a wide range of evaluation issues.

In addition to the presentation of the monthly progress report, the Evaluation Administrator is expected to periodically attend Subcommittee meetings and provide presentations or issue-focused discussions as required by the Subcommittee.

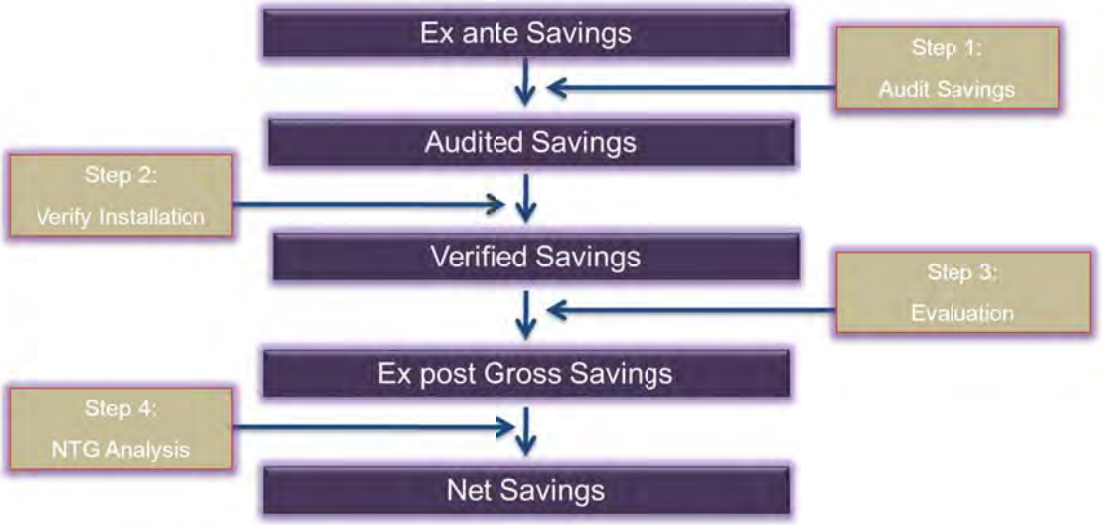
Progress tracking

The Evaluation Administrator is responsible for tracking the progress of the evaluation efforts and for maintaining oversight of the evaluation activities of the staff and subcontractors working under the direction of the Evaluation Administrator. The Evaluation Administrator is responsible for the quality and reliability of the evaluation efforts and is the primary director of the evaluation efforts and is responsible for assuring that studies are implemented in a way that is consistent with the evaluation plans and the available resources.

Policy on Gross and Net Savings and Application of Results

This section describes the typical steps taken in conducting impact evaluations of DSM programs. It also provides definition of different types of energy savings and proposes their appropriate use.

Figure 1 DSM Impact Evaluation Steps



Step 1: Auditing Savings

Validation of the Third Party Administrator will be performed by the evaluation team. The methodology involves the following steps:

1. Reviewing the program tracking databases.
2. Checking saving estimates and calculations against the best available information, (i.e. the Ohio[6] TRM and/or the adopted Indiana TRM.
3. Reviewing hardcopy program applications from a sample to verify consistency with data recorded in program tracking databases.
4. Adjust program tracking data as necessary to correct any errors, omissions identified in above.
5. Recalculate program savings based on the adjusted program tracking data.

Where custom measures are installed and not part of the TRM, engineering assumptions may be reviewed for a statistically representative sample of projects.
This step results in **Audited Deemed** savings.

[6] Ohio Draft Technical Reference Manual of August 6, 2010

Step 2: Verifying Installations

Step 2 confirms measures have been installed and are operating. This step uses a random sample of installations selected for detailed analysis. Typical methods for collecting necessary data include the following:

1) Telephone Surveys
2) Site Visits

This step may be adjusted to address issues such as:

- Measures rebated but never installed;
- Measures not meeting program qualifications;
- Measures installed but later removed; or
- Measures improperly installed.

Findings from this step produce **Verified Savings.**
Note: adjustments shown here impact the number of measures reported but do not adjust the TRM saving value.

Step 3: Performing Evaluation

At this stage, engineering analysis, building simulation modeling, billing analysis, metering analysis or other accepted statistical methods are used to determine ex post gross savings. Adjustments may include: changes to the baseline assumption; adjustments for weather; adjustments to occupancy levels; adjustments to decreased or increased production levels; and so on. This step does not need to occur annually for every program.
In all cases, the evaluator may use secondary or primary data to perform this step. Secondary data refer to using results from another, similar program, then making minor adjustments for local conditions and installation rates. An example might be using compact fluorescent lamps (CFL) installation rates from a similar utility to adjust the number of bulbs actually installed and saving energy. A significant body of knowledge, derived from evaluation of DSM programs over the last three decades, is readily accessible. Secondary data should always be explored as a cost-effective method for adjusting gross savings. Primary data involve collecting information the evaluation requires through surveying program participants, conducting site visits, or metering existing and installed equipment.
Note: findings reflected from this effort impact the ex post savings reported and serve as inputs for potential TRM adjustments over time from repetitive ex post studies, but do not adjust the TRM saving value directly (see updating the TRM section of this document).

Step 4: Applying NTG

"Net savings" refers to savings directly attributable to a program and represent the savings that are directly attributable to the program's efforts. Net savings are determined by adjusting the evaluated gross savings estimates to account for a variety of circumstances, including savings weighted[7] freerider[8] effects, spillover[9] effects and market[10] effects. Because market effects

[7] Freerider, spillover and market effects adjustments to the NTG ratio are to be weighted to reflect the level of savings associated with those effects compared to the level of savings that are achieved directly from the installed measures. Savings are weighted so that the adjustments to the net savings are based on the level of savings associated with the actions taken, thus small savings actions result in small adjustments where large savings actions result in larger adjustments, depending on the level of occurrence.

baseline evaluations are conducted once during a program cycle (instead of annually) or as determined by the Subcommittee, there are two types of net savings definitions in Indiana. The first definition applies to the savings reported in the *annual* evaluation reports due on April 1 of each year. This metric is call ***Participant Net Savings*** because it only includes the net savings associated with participants (includes freerider and participant spillover adjustments). The other net savings is called the ***Total Net Savings*** because it incorporates adjustments for freeridership, participant spillover and market effects[11].

The following equations are used to calculate the program's NTG ratio for the two types of net savings estimates:

Participant Net Savings

Annual Net-to-Gross Ratio = (1- freerider adjustment + participant spillover adjustment)

Total Net Savings

Net-to-Gross Ratio = (1- freerider adjustment + participant spillover adjustment + market effects adjustment)

For this Framework, three purposes of net savings are identified.

1. To understand the level of net savings achieved by the program and the portfolio to help determine which program to offer in the future.
2. For use in utility-specific calculations of lost revenues associated with the energy efficiency programs.
3. As a critical evaluation metric to be used for improving program design and implementation. Combined with process evaluations which assess program administration and operations and uncover processes that are ineffective or not well-conceived, the net savings metric assists program implementation toward performance improvements.

[8] Freeriders are those who would have taken exactly the same action (or made the same behavior change), installing a measure (or changing a behavior) at exactly the same energy efficiency result, at the same time as they took the program-incented action. Partial freeriders are those who would have taken exactly the same action, but the program expedited that change, or they would have taken a similar actions, but not at the same level of efficiency as the program-incented action, or they would have taken the same behavior change but at a later time than the program-encouraged behavior change.

[9] Savings produced as a result of the program's influence on the way participants use energy through technology purchase and use changes or through behavior changes induced or significantly influenced by the program or the portfolio.

[10] Savings produced as a result of the program's or portfolio's influence on the operations of the energy technology markets or changes to energy-related behaviors by customers.

[11] The process and timing of incorporating market effects savings into goal setting and accomplishment tracking will be determined in the future, but is not an established process at this time.

Determining the final market effects influenced total net-to-gross (NTG) ratio is not required every year (market effects are difficult to measure annually because of how rapidly markets change), but, at a minimum, it should be evaluated every three or four years or once a cycle.[12]

Uses of Various Saving Estimates

As the process above shows, different saving estimates will be produced at the various points in the EM&V process. These estimates serve different purposes as displayed in the table below:

Savings Estimate	Purpose
Ex ante (savings as projected by the TPA)	Goal setting
Audited Savings (checks for accuracy in tracking system)	Intermediate step only
Verified Savings (adjusts for confirmed installations)	Assessment of goal attainment
Net Savings (ex post evaluated program-induced savings)	Program design improvements Planning future programs Cost effectiveness analysis Calculations of lost revenues

Table 1 Uses of Various Saving Estimates

[12] The process for reconciliation of the added savings achieved via market effects (changes to the way the energy technology markets work) caused by the program are not finalized at this time. Once this process has been established by the DSMCC, this document will be updated to include that effort.

Benefit Cost Tests and Input Metrics To Tests

Overview of Benefit-Cost Assessment for DSM Programs

A variety of frameworks have historically been used to assess cost-effectiveness of energy efficiency initiatives.[13] In the late 1970s, the California Public Utility Commission (CPUC) implemented a least-cost planning strategy in which demand-side reductions in energy use were compared to supply additions. One result of this strategy was the Standard Practice Manual (SPM) that is now used in many other states for informing the benefit cost approach and for use as a starting platform from which non-California state-specific changes to the SPM approach are established.

The SPM established several tests that can be used to evaluate the cost-effectiveness of publicly funded energy efficiency initiatives. Most regulated energy efficiency programs use one or more versions of these tests, sometimes with variations unique to the requirements of a particular regulatory commission.

The Total Resource Cost (TRC) Test

This section addresses the total resource cost (TRC) test exclusively because this is the test currently established in Indiana for use with the statewide Core program evaluation. Further, the TRC test to be used for the Core programs is understood to be the "simple" TRC test. Some variations on the simple test are noted in the following subsections, but with the proviso that these variations are included for informational purposes and should not be construed as applying to benefit-cost (B/C) tests for the Indiana statewide Core programs. This test reflects the ratepayer's (both participants and nonparticipants) perspective.

The TRC test measures the net costs of a program as a resource option based on the total costs of the program, including both the participants' incremental costs and the utility's costs (including, administrative, marketing and operational costs[14]). The TRC B/C ratio is computed based on the present value of the program benefits (primarily avoided cost of generation) as well as the total program cost (measure total cost to the utility and utility program administration and operational costs).

The ratio is usually calculated on a life-cycle basis considering savings and costs that accrue over the lifetime of installed energy efficiency equipment, systems. When the ratio is 1.00 or greater, the program is considered cost-effective, with appropriate consideration of uncertainties in the TRC ratio calculation. This is the most commonly applied test.

[13]This discussion draws upon the National Action Plan for Energy Efficiency, (2007). *Model Energy Efficiency Program Impact Evaluation Guide.* Prepared by Steven R. Schiller, Schiller Consulting, Inc. (www.epa.gov/eeactionplan). Staff of TecMarket Works and Cadmus (Nick Hall, M. Sami Khawaja, and David Sumi) served on the Technical Group for preparation of this Guide, and are currently assisting with an update to the publication.

[14] Excludes participant incentives

For current application of the TRC in Indiana, the portfolio must be cost effective. However, individual measures within a program and a program do not need to be cost effective on their own, as long as the portfolio of approved programs is cost effective.

$$TRC\ Test = \frac{Avoided\ Costs^{*}}{Utility\ Costs + Participant's\ incremental\ Costs^{15}\ Net\ of\ Incentives}$$

Other Benefit-Cost Tests

Brief summaries are provided below.

- **Utility cost (UC) test.** The UC test measures the net costs of a program as a resource option based on the costs incurred by the administrator of the program. The benefits are the same as in the TRC test (energy and demand savings value), but the costs are defined more narrowly and do not include consumer costs.

  $$Utility\ Test = \frac{Avoided\ Costs^{*}}{Utility\ Costs}$$

- **Participant test.** The participant test assesses cost effectiveness from the participating consumer's perspective by calculating the quantifiable benefits and costs to the consumer of participating in a program. Since many consumers do not base their decision to participate entirely on quantifiable variables, this test is not necessarily a complete measure of all the benefits and costs a participant perceives.

  $$Participant\ Test = \frac{Lost\ Revenue + Incentives}{Participant\ Costs}$$

- **Societal test.** The societal test, a modified version of the TRC, adopts a societal rather than a utility service area perspective. The primary difference between the societal and TRC tests is that, to calculate life cycle costs and benefits, the societal test accounts for externalities (e.g., environmental and other non-energy benefits), excludes tax credit benefits, and uses a societal discount rate.

  $$Societal\ Test = \frac{Avoided\ Costs^{*} + Environmental + Other}{Utility\ Costs + Participant\ Costs\ Net\ of\ Incentives}$$

- **Ratepayer impact measure (RIM) test.** The RIM test only applies to utility programs. It measures what happens to consumer bills or rates due to changes in utility revenues

[15] *Note: Participant incremental cost net of incentives is the cost associated with what the participants spent on the energy efficiency project that they would not have spent without the program less the incentives provided by the program. The TRC is to include the participant's cost that are program-induced and not include costs that the participant would have incurred without the program.

and operating costs caused by the program. This test indicates the direction and magnitude of the expected impact on rates.

$$RIM\ Test = \frac{Avoided\ Costs^{*}}{Utility\ Costs + Lost\ Revenue}$$

TRC Test Inputs

The inputs required for the benefit-cost analysis of the Indiana TRC, and the suggested possible sources, are summarized in the following table.

Inputs – Basic TRC	Possible Sources	Notes
Net energy savings (direct and market effects)	Evaluation findings	
Measure life	Evaluation findings, Evaluation Framework, and/or utility-specific	Secondary sources
Discount rate	Utility-specific	
Avoided energy costs	Utility-specific	
Program operations costs	Third Party Administrator (TPA)	Work with TPA to assure appropriate accounting categories
Customer incremental costs, net of what they would have spent without the program (typically this is cost above and beyond that of the non-program induced change)	Third Party Administrator	Must be consistent across a program cycle
Load shapes	Application of shapes from Evaluation and secondary sources, by measure/sector	
Inputs – Expanded TRC	**Possible Sources**	**Notes**
Value of avoided carbon emissions (Not included in Indiana benefit cost tests)	Typically a policy-based cost or based on a traded value	Not to be included in the current Indiana TRC test
Avoided emissions and prices (NO_x, SO_x) (Not included in Indiana benefit cost tests)	Evaluation modeling of generation emissions	

Table 2 Benefit-Cost Analysis Inputs and Sources

The Indiana Core program portfolio is required to be cost effective based on the TRC test. That is, the cost to acquire energy efficiency resources needs to be equal to or less than the cost to acquire resources from new power supplies. However, individual programs are not required to be cost effective as long as the fit within a portfolio that is cost effective. This policy allows the development and testing of pilot programs or the launching of new programs or programs that

have higher start-up or operational costs, but which are expected to be cost effective once lower cost operations are achieved. It also allows the offering of programs that may not be cost effective but help provide a balanced set of energy efficiency services across all customer segments.

Contents of Evaluation Reports

Reporting Requirements for Impact, Process, and Market Effects Evaluations

All evaluated gross and net direct energy savings will be reported annually and for the program cycle as a whole, by program, by year, by utility. Savings will be reported in three ways, including 1.) ex ante gross, 2.) ex post gross, and 3.) ex post net savings. The reported results will include:

- Electric energy savings kilowatt hours (kWh).
- Electric demand savings (kW).
- Coincident Peak kilowatts (kW).
- Natural gas savings (therms) associated with Core program measures installed by the statewide TPA.
- And where specifically contracted, therm savings associated with gas measures installed via the Core programs (if any).

Associated with the direct energy savings is the reporting of the following metrics:

- Number of participants and location by participating utility as obtained from the Third Party Administrator database tracking system
- Estimated freerider and free driver percentages (used to calculate net savings)
- Hourly customer usage patterns (obtained for selected programs for which customer on-site metering is conducted)

Reporting of process evaluation results. Although the process evaluation efforts will be somewhat different for each program, to a certain extent these studies will follow a similar theme and approach associated with reporting the results of the approved evaluation's scope of effort. That is, the reporting of process evaluation results will depend on the researchable issues on which each evaluation will focus. For this reason we are not identifying the topics on which the evaluation effort will report, however each evaluation report will report the methodological approached used in the process evaluation, the researchable issues on which the evaluation focused, and the findings and recommendations associated with each issue. Findings and recommendations will be numbered so that they can be tracked and referenced and structured to guide program improvement effort. That is, evaluation recommendations should be detailed enough to be well understood and actionable by the TPA.

Reporting of results will focus on assessment of the following:

- Establishment of the Key Performance Indicators.
- Verification of robust program tracking databases.
- Assessment of participation processes.
- Assessment of market actor interactions/processes.
- Analysis of program design.
- Verification of program processes.

Reporting of market effects results. An initial market study will lead to the development of two reports: one on the residential market, and a second for the commercial market. The reports will be cross-cutting by describing the market baseline for multiple end-uses as well as overall market characteristics such as attitudes and barriers towards energy efficiency. Future market effects studies will report changes in the operations of the market and changes to key market change parameters that are caused by the program, and the energy savings associated with those market changes that are program-induced. Energy savings will be reported for the program cycle across the portfolio in the same formats that are required for ex post savings reports. These include:

- Electric energy savings kilowatt hours (kWh).
- Electric demand savings (kW).
- Coincident Peak kilowatts (kW).
- Natural gas savings (therms) associated with Core program electric measures installed by the statewide TPA.
- And where specifically contracted, therm savings associated with gas measures installed via the Core programs (if any).

Annual Reporting for Impact and Process Evaluation

The evaluation team must provide annual reports on process and impact evaluation with an end of cycle report that includes the last year and the accumulation of savings across the program cycle. The process activities to assess and inform program administration and delivery will be provided directly after the process evaluations are completed, rather than waiting for the April 1st required energy impact reporting date. This will allow faster process reporting feedback and help expedite program improvements. The focus of this process reporting will be identifying what is working well and also opportunities for improvements.

Impact reports should provide incremental and cumulative information for the annual status of EM&V activities, including the Core program's contributions to the annual savings goals and feedback for future Core program design. The reporting should provide impact evaluation results for each participating utility, by program and program year. Cost effectiveness calculations should also be reported as soon as the impact evaluations are finalized.

In addition to the reports provided to the Subcommittee, the evaluation team must also prepare for submission to the Subcommittee an annual Summary Report[16] intended for the general public. This report will provide summary information for the Core programs in a format suitable for non-technical readers.

Consistency Across Reporting Years

In order for reporting to be useful for the intended audiences across program years and cycles, and to support energy efficiency planning at the state level to guide policy and planning, it is essential that the evaluation research be reported in a comparable manner. This means that reports must be consistently structured so that reviewing and commenting on evaluation reports does not require substantial investments of time for stakeholders. Further, key messages should

[16] Per the Phase II Order 42693.

be communicated succinctly and executive summaries should be concise. The body of evaluation reports must be consistently organized across reports and years, and technical details supporting the work are preferably contained in appendices only.

Reporting Topics Specific to the First Program Cycle

Indiana Technical Reference Manual (TRM) Early reporting (2012) will document efforts to develop an Indiana-specific Technical Resources Manual (TRM), based on algorithms and data sources used in the Ohio TRM and other sources. The Indiana TRM will form the basis of the ex ante savings estimates used in the Core program evaluations after it is formally accepted by the Subcommittee and has been adopted by the DSMCC for use prospectively.

Market Effects Baseline As described above, findings from the market effects evaluation will focus on efforts to document market baselines for program measures for the purpose of estimating energy savings from program induced changes in energy equipment market operations.

Early Evaluation Results and Feedback

The Need for Early Reporting

There is a need for early feedback approaches for both impact and process evaluation so that the Third Party Administrator can, in consultation with the DSMCC, make prompt in-cycle changes to maximize energy impacts and customer satisfaction. This will also facilitate energy impacts goal attainment. Reporting will therefore include early results and/or feedback wherever possible. All early feedback reports, memorandums or other forms of feedback will be communicated to the Subcommittee and the TPA at the same time so that the Subcommittee can work with the TPA to resolve or take action on the finding as appropriate.

The overall objectives for Energizing Indiana include *demonstrating the feasibility* of initiating effective programs, and *meeting established energy savings goals* for Core programs[17]. Thus, the evaluation objectives require a team to develop credible data sources and measurement criteria for evaluating both quantitative energy savings and qualitative market change indicators for current and for future program design and evaluation needs.

The reporting function is critical to achieving this evaluation objective. In order for the Core program concepts to be effectively tested in the marketplace, it is imperative that the evaluation provide timely reporting of both quantitative and qualitative information. Two likely methods for early reporting are: (1) Interim reports ("as needed," to be determined by the EM&V contractor in consensus with the Subcommittee), and (2) roundtable discussions and/or oral presentations, providing periodic sharing of insights and suggested improvements to individual programs and the overall process of the statewide Energizing Indiana program.

Stakeholder Information Needs

The following table provides a list of suggested information needs for the key Energizing Indiana stakeholders, and also shows which evaluation activities will serve each of those needs. The needs are arranged across the top of the table, with evaluation activities down the left side. Where there is an "X" in the table, that activity provides content to the information need. The stakeholders who are associated with each information need are coded at the top of each column, as follows:[18]

CC = DSMCC (Demand Side Management Coordinating Committee
A = Third Party Administrator (TPA)
I = Implementer (TPA's as implementer or their subcontractors)
C = Commission (Indiana Utility Regulatory Commission)
OUCC = Office of Utility Consumer Counselor
P = Public
U = Utilities (Participating Utilities)

[17] Per the Phase II Order 42693.
[18] Stakeholder information needs indicated in the following table are provided for illustrative purposes and are not intended to be comprehensive. Actual information needs may be different than those indicated in the table.

Table 3. Matrix of Primary Information Needs and Evaluation Activities Serving those Needs

	Jobs	ROI	Constituent Impact (Incentives) Distribution	Public Perception	Energy Savings	Bill Impact	Rate Impact	Cost Effectiveness	Public Acceptance	Cost Allocation	Contract Goal Achievement	Market State (Iterative)	Customer Satisfaction	Customer Awareness	Program Impact	Utility Collaboration	Portfolio Impact	Territory Specific Savings	Program Collaboration	Value Perception
	C, CC, OUCC	*C, CC, OUCC*	*CC, OUCC, U*	*OUCC, U*	*C, CC, U*	*C, OUCC, U*	*C, OUCC*	*C, CC, OUCC*	*OUCC*	*CC, OUCC, U*	*A, I*	*A, I*	*A, I, OUCC, U*	*A, I, U*	*A, I*	*A, I OUCC U*	*A, CC, OUCC*	*U*	*U*	*P*
Tracking/database management			X		X													X		
Measurement of baseline estimation, calculation of baseline efficiencies			X		X						X							X		
Calculation of kWh savings, peak kW savings, therm savings, demand resource savings			X		X						X							X		
Annual evaluation reports		X	X		X						X				X		X	X		
Annual impact evaluation	X	X	X		X	X	X				X				X		X	X		
Load shape analysis							X													
Benefit-cost analysis		X						X		X										
Documentation of direct program effects	X	X	X			X	X								X		X	X		
Determination of economic impacts	X	X	X			X	X	X							X		X	X		
Determination of deemed savings/TRM					X															
Interviews and surveys with program staff at various levels, participants, non-participants, market			X	X		X			X				X	X		X		X	X	X

	Jobs	ROI	Constituent Impact (Incentives) Distribution	Public Perception	Energy Savings	Bill Impact	Rate Impact	Cost Effectiveness	Public Acceptance	Cost Allocation	Contract Goal Achievement	Market State (Iterative)	Customer Satisfaction	Customer Awareness	Program Impact	Utility Collaboration	Portfolio Impact	Territory Specific Savings	Program Collaboration	Value Perception
	C, CC, OUCC	***C, CC, OUCC***	***CC, OUCC, U***	***OUCC, U***	***C, CC, U***	***C, OUCC, U***	***C, OUCC***	***C, CC, OUCC***	***OUCC***	***CC, OUCC, U***	***A, I***	***A, I***	***A, I, OUCC, U***	***A, I, U***	***A, I***	***A, I OUCC U***	***A, CC, OUCC***	***U***	***U***	***P***
actors																				
Market Effects Baseline Research				X					X			X		X						
Review and analysis of deemed savings and cost values								X												
Review of program design										X	X					X			X	
Review of program operations documents for consistency with design and practicality											X									
Review of program participation levels relative to program costs		X						X												
Review of records on processing time and costs		X						X												
Development of a submission process to propose new protocols and modifications																X			X	
Analysis of policy implications	X																			

The Evaluation Planning and Reporting Cycle

Hiring the independent Evaluation Administrator

Consistent with the Phase II Order, (Order 42693) of December 9, 2009, the Subcommittee will hire an independent administrator to conduct evaluations and report results for the Core programs. Because program evaluations must be conducted on the evaluations that are specifically planned, designed and implemented under this order, the Evaluation Administrator must be hired in time to plan the evaluation efforts so that evaluation efforts are ready to be launched early in the program cycle. In addition, because there are measurements that need to occur before or very early in the program implementation cycle it is necessary to hire the Evaluation Administrator at the same time, or shortly after the hiring of the TPA. Both program design and evaluation planning efforts need to occur before the initial program cycle implementation date for each program cycle.

The evaluation planning cycle

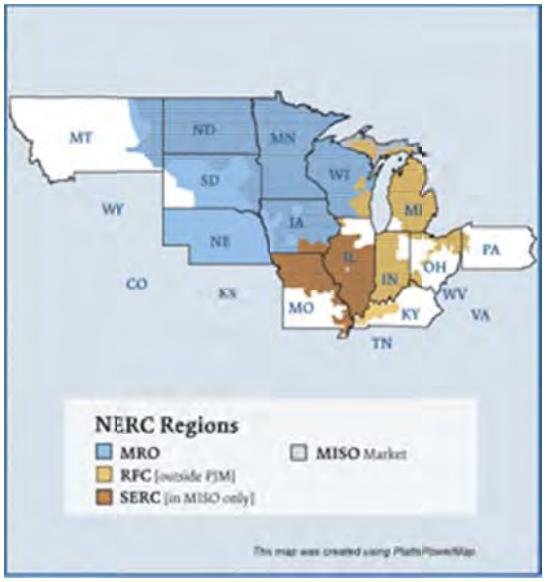
To have an effective evaluation approach evaluations must be carefully planned to cover a specific set of programmatic activities in order to provide the information needed for energy savings achievement reporting, efficiency policy decisions and to determine least cost energy supply strategies for Indiana. Evaluations need to be planned to match an approved program implementation cycle so that the evaluation findings match the decision periods for the offered programs. A two-year program cycle needs a two-year evaluation plan. A program cycle of four years needs a four-year evaluation plan. Evaluation planning needs to occur once each program cycle, with adjustments to the evaluation plans to match the changes made to the programs offered. Evaluation plans should be developed as soon as the programs plans are approved for implementation. Evaluation planning prior to program design approvals can result in inefficient use of evaluation resources as evaluation designs are developed for programs that may substantially change though the program design approval process. Evaluations that are planned after the programs are launched can miss the collection of critical pre-program baseline information and be launched too late to provide effective feedback needed to change program operations as evaluations identify need for programmatic change.

Evaluation plans should be developed and provided to the Subcommittee for review, ideally prior to the program launch and in time for the collection of pre-program baseline data.

The plans need to cover individual programs as well as any overarching or market focused evaluation initiatives. All program-specific plans should also have task-level timelines that indicate when the evaluation efforts will be conducted. All plans should have high-level budgets that reflect the program-specific evaluation costs and the costs associated with any crosscutting or market focused evaluation efforts. If needed, separate task level budgets can be requested by the Subcommittee to support the review of the evaluation plan, however detailed task level budgets will not be presented in the evaluation plans.

MISO & PJM Compliant Evaluations

Indiana electric power supply territories are located within the MISO and the PJM electric power markets as defined by the Federal Energy Regulatory Commission (FERC).



MISO Electric Region

PJM Electric Power Region

In selected cases program evaluation results may be provided to the regional power markets to support payment to the utilities for achieving reduced demand and energy within a market region. These power supply market operators (MISO/PJM) can provide incentives to energy efficiency providers that reduce the power supply needs associated their grid networks. In some cases the system operators have developed their own program or project evaluation requirements that must be followed in order for a utility to qualify for load reduction incentives. These studies are typically more rigorous than typical program-level evaluation in that they require a higher level of field verification, equipment monitoring and metering. If any of the Indiana Core program are considered to be system operator incentive qualified programs, and if utilities are contemplating submitting their energy savings to a system operator for incentives, those program evaluations conducted as part of the Core program evaluations will most likely need to be modified. In order to qualify for system reduction savings each utility must submit their system load reduction results separately to their system operator. The incremental added cost (if any) to comply with a system operator's evaluation requirements will be paid directly to the Evaluation Administrator by that utility to avoid any negative impact on the evaluations of the Core programs across the other utilities.

In most cases system supply operators need programs that provide significant load reduction during peak hours, however they also need programs that provide energy savings when there are supply constraints during off peak periods. Because the Core programs are designed to be primarily energy savings programs it is anticipated that none of the Core programs will be submitted for system operator incentive payments and, therefore, system operator required adjustments to the evaluation plans will not be needed.

Annual Updates to the Evaluation Plans

While the primary evaluation plan will be completed once per program cycle, annual modifications are expected. Programs that do not undergo any delivery changes are unlikely to

need evaluation plan modification. The Subcommittee will coordinate with the Evaluation Administrator to identify changes to the portfolio that might trigger an adjustment to the evaluation efforts. All changes to the evaluation plan must be approved by the Subcommittee.

Approving the Evaluation Plans

The Subcommittee will review proposed plans and if necessary request a presentation from the Evaluation Administrator. The Subcommittee can request any supporting or additional information to adequately review the evaluation plans. During that review process the Subcommittee may have the Evaluation Administrator change evaluation approaches, timelines or budgets to meet the evaluation needs for the Core programs.

Following the Subcommittee's review of the evaluation plan, a vote to accept the plans and approve them for implementation will be taken. If the plans are not approved, the Evaluation Administrator will alter them to meet the desired needs of the Subcommittee. However, it is critical to ensure independence of the Evaluation Administrator. The Subcommittee will not specify the evaluation approaches to be used in the study. The Evaluation Administrator shall design the evaluation efforts as independent evaluation contactors.

Timeline for Providing Evaluation Reports

Program evaluation reports shall be provided to the Subcommittee each year, following completion of the program year being evaluated. Crosscutting and market focused evaluation reports will be provided on a date to be specified by the Subcommittee, working in conjunction with the Evaluation Administrator to set that date. Typically, final program evaluation reports will be provided no later than 3 months following the end of the program year being evaluated (no later than April 1 for a typical program year and for the end of cycle periods as well). This means that draft evaluation reports must be delivered to the Subcommittee on or about March 1 of each year. This allows time for the program to close out its annual tracking systems and provide that information to the evaluation contactor, and also allows enough time for the evaluation contactor to conduct any remaining M&V and impact analysis on sites that are sampled late in the program year. It also allows a two-week period for the Subcommittee to review draft reports and provide comments to the Evaluation Administrator in time for preparation of the final report.

Benefit cost assessments require the inclusion of final energy impact results. Therefore the benefit cost assessments will be reported 30 days after the final energy impact reports are due. The benefit cost assessment will be provided in a benefit cost chapter added to the final energy impact and process report. The draft benefit cost report will be delivered May 1 of each year.

Final reports will be provided to the Subcommittee no later than 30 days following receipt of the Subcommittee's review comments on the draft reports.

Data Required to Support the Evaluation Effort

Information needed by the Evaluation Contactors

This section of the Framework discusses the types of information that the Evaluation Administrators will need to provide in support of the evaluation efforts. A detailed list of the type of information needed to conduct evaluations for different types of programs is provided in Appendix B. Each evaluation will need a somewhat different set of information from the TPA. There may be cases where the Evaluation Administrator may need to request additional information not listed in Appendix B. TPAs should establish their program tracking system to be able to rapidly provide the information requested by the evaluation contactor.

When requested information is to be provided to the Evaluation Contactor

One of the most common reasons that evaluations are not delivered on time is that the information needed to conduct the evaluation is not provided in a timely manner. For the purposes of conducting Indiana evaluations, The TPA is to provide the requested data within two weeks of receipt of the data request from the evaluation contactors. However this time period can be extended under special circumstances for up to two additional weeks. If the TPA cannot provide the requested data within two weeks, the TPA is to notify the DSMCC of the reason for the delay. If the TPA cannot provide the data, they are to inform the DSMCC of the reasons such data are not available. The type of data needed is outlined in the Appendix B to allow the administrators ample time to collect and maintain that data. The TPA will need to modify its operational procedures to collect the needed data and store them in a way that can be rapidly accessed and transferred to the Evaluation Administrator. It is the TPA's responsibility to establish and maintain program-tracking systems that are capable of supporting the evaluation efforts and of meeting the data needs requirements of the evaluation efforts.

Request for program information

All requests for data must be submitted in writing to the TPA and the Subcommittee at the same time so that all members of the Subcommittee are aware of the data request. Evaluation contactors are to only request data that are required to conduct the evaluations. The Evaluation Administrator will limit all data requests to information critical to the success of the evaluation. Evaluation data requests will need to plan for sample erosion due to a wide variety of conditions.

The TPA is not to limit, filter or influence the content of the information provided to the evaluation contactor. All measure-specific information provided must be reported by the TPA using the standard measure descriptions used during the program planning and approval process, or as modified and approved by the DSMCC.

Safe keeping and security of information received

All requested data that are obtained from the TPA will be securely maintained by the Evaluation Administrator and will be destroyed not sooner than one year and no later than 24 months following delivery of the evaluation reports. When longer term data storage and maintenance is required, the evaluation contactor will request approval of the Subcommittee.

Data Security

Definition of Data Security

This section of the Framework deals with data security and provides guidance on how utility, TPA and evaluation data will be transferred, stored and safeguarded. The guidance provided below represents the minimum level of data security requirements. However, each utility and TPA may have its own set of data security requirements that may be more restrictive and will take precedence over the guidance provided in the Framework. It is up to the Evaluation Administrator to understand each of the data security requirements of the participating utility companies and the TPA and comply with these requirements or arrange for alternative compliance agreements.

The evaluation database, including all incorporated EM&V data as well as customer data obtained from the program implementer and utilities must be in a secure electronic repository. It will contain all primary and secondary data collected and assembled along with all of the processing code used to data edit and transformation, including the database of evaluation results that will be used to supply all necessary inputs to evaluation reporting. To ensure data security, methods should be specified for auditing and analyzing the data in addition to the methods employed for identifying, measuring, recording, and transmitting required data in a secure manner.

Encryption Key Sharing

At the beginning of the project, it is considered best practice for all participating vendors to exchange public keys with each other. It is best if this exchange is done in-person, during a kick-off meeting, so that all parties can physically identify each other, however, public keys can be sent to participants via email if necessary. These keys will be included by each participant responsible for sending encrypted files so that only authorized people can decrypt the files.

Data Transfer Setup

A secure File Transport Protocol (SFTP) server is recommended as the most secure and efficient protocol for transferring data between utilities and the evaluation team. The hosting facility must be highly secure both physically and at the networking level. The SFTP site can be set up and managed by the evaluation team on one of these servers running a recommended application such as Serv-U FTP server.

It is suggested that security groups be created for each utility along with a home folder, which can only be modified by its corresponding utility and designated administrators. A designated user from each utility, with contact information provided, can then be added to a corresponding security group, thus inheriting the proper permissions to upload/download specific files.

Data Handling

Once data are transferred from a utility or TPA to the EM&V contractor's facility, it is the responsibility of the EM&V contractor to ensure that those data are handled in a secure manner. Here are some guidelines that should be followed:

1. Separate files containing personally identifiable information (PII) from files that do not contain this information. This will help in setting up a clear process for handling each type of data.

2. Files containing PII should be stored on device that is:
    a. secured physically (locked away from unauthorized personnel)
    b. secured at the network level (only authorized members of the evaluation team)
3. Files containing PII should be stored encrypted, when not in use.
4. Access to encrypted files should be documented and go through an approval process, where the evaluation project manager must approve all requests for access.
5. An example procedure of handling customer data would be as follows:
    a. Encrypted customer data are uploaded to the SFTP site.
    b. Files are deemed to contain PII, and downloaded to a secure location at the contractor's facility by a data administrator.
    c. A user from the project team needing access to these files requests access from the project manager.
    d. Project manager grants access and notifies a data administrator to decrypt the files and leave copies available for the requesting user for a limited period of time.
    e. Once the user is finished with the unencrypted files, they are expunged from the server.

Evaluation Protocols

This section of the Framework provides guidance from the DSMCC EM&V Subcommittee to the Evaluation Administrator and other evaluation professionals responsible for conducting evaluations of Indiana's Core programs so that evaluation-related definitions, approaches, and savings estimates can be comparable and reliable regardless of the evaluation contractors conducting those studies or the utility sponsoring the joint statewide programs. Evaluation contactors are required to understand and follow the evaluation provisions presented in this framework and design and conduct evaluations consistent with the provisions of this chapter of the Framework.

Evaluation Standards, Ethics and Expertise

Evaluation Standards and Ethics

There are a number of evaluation standards and ethics that apply to the Indiana evaluation efforts. These standards and ethical considerations guide all evaluation activities covered under this Framework:

Independence

The evaluation efforts for Indiana's core programs are to be independent of the core program design, approval and service delivery responsibilities. Evaluation contactors can provide support to the core program design process by providing evaluation research information, market condition or operations information, program related data, or information needed to support the program design effort, but are not to be responsible for developing program core program plans or involved with the submission of those plans for review and approval by the DSMCC. Evaluation contactors are to maintain an arms-length relationship with the core program design, approval and delivery process within the State of Indiana.

Evaluation efforts are to avoid not only conflicts of interest but also the appearance of conflicts of interests. The evaluators should be independent professionals who do not benefit, or appear to benefit, from the study's findings. The evaluations are also to be independent of the TPA, such that the Evaluation Administrator independently develops their study approaches, independently implements those approaches, and independently reports the results from the associated analysis. While evaluation plans, budgets, timelines and activities are to be approved by the Subcommittee prior to their implementation, the evaluation efforts will be planned and conducted by independent evaluation professionals. The core program evaluation team must not have or appear to have any conflicting relationships with the core program development, approval or implementation process.

Transparency

Each evaluation should have a detailed study plan that identifies how the evaluation is to be conducted, specifying the individual tasks within the study to be completed. The study plan should also specify how data will be collected, describe processes to assure objectivity and accuracy, and identify the analysis approach to be applied for each of the four types of evaluation metrics (jobs created, carbon saved, energy demand reduction and energy saved).

The evaluation effort is to be transparent. The methodological description of the study should be sufficiently detailed to allow the research design to be assessed for appropriateness by outside reviewers as required by the Subcommittee. The study design should be specific enough to allow other evaluation professionals to understand the approaches used at a sufficient level of detail. The study approach should be transparent to the extent that others can replicate the study approach and obtain similar results. The study plan should also specify how data will be collected, describe processes to assure objectivity and accuracy, and identify the analysis approach to be applied for each of the evaluation objectives. Proprietary or "black-box" analysis approaches that are not fully specified and disclosed to the Subcommittee and the Evaluation Administrator are not to be used.

Threats to Validity

The Evaluation Administrator should assess the various threats to validity for the study design and analytical approach and develop a study plan that minimizes those threats and reduces the associated

level of uncertainty. Both the evaluation plan and the study report should identify these threats and describe how the evaluation approach minimizes any impacts on the study findings.

Alternative Hypotheses

To the extent possible, the study design should be developed in a way that addresses alternative hypotheses regarding how observed effects may have occurred.

Best Practice Analysis

The study approach should, to the extent possible, use current best practice evaluation approaches that maximize the use of technical advancements and the most current analytical approaches consistent with the available evaluation budget and the study timeline requirements. Because the field of evaluation is constantly changing, it is not possible to define best practice approaches in a way that the definition can remain current. Likewise, the selection of best practice approaches is always limited by the available evaluation budget. It is up to the contractors conducting evaluations in Indiana to stay current within the field of energy program evaluation and recommend approaches that produce reliable results and which can be conducted within the available resources. Several guidance documents are available to help Evaluation Administrators select and apply best practice approaches. A sample of these guidance documents include:

- National Energy Action Plan Model Energy Efficiency Program Impact Evaluation Guide, Steven Schiller, USEPA November 2007
- International Performance Measurement and Verification Protocol, IPMVP Committee, March 2002
- National Energy Efficiency Evaluation measurement Verification Standard, Schiller, Goldman, Galawish, Lawrence Berkeley National Laboratory, April 2011
- Impact Evaluation Framework for Technology Deployment Programs, Reed, Jordan, E. Vine, USDOE, July 2007
- EERE Guide for Managing General Program Evaluation Studies, Barnes, Jordan, USDOE, 2006
- California Evaluation Framework, TecMarket Works Evaluation Team, TecMarket Works, June 2004
- California Evaluation Protocols, TecMarket Works Evaluation Team, TecMarket Works 2006

Likewise international energy program evaluation conferences (IEPEC.org) and energy efficiency industry conferences (AESP.org) present publish and discuss peer-reviewed research approaches that help evolve the field toward more reliable approaches.

Essentially, the use of best practice evaluation approaches means that the most reliable approaches that can be employed within the available evaluation budgets shall be used to estimate the energy impacts of the energy efficiency programs covered by this Framework.

Unbiased Assessment

The evaluation design, data collection efforts, analytical approach, and reporting of results should be objective and unbiased. Unsubstantiated claims or unsupported conclusions or personal points of view should be excluded from any evaluation reports or presentations. The study results should be based on objective data/information analysis. Study findings and recommendations should be

supported with data and analysis approaches that objectively and impartially assess the available information.

Attribution of Effects

The study should focus on identifying the outcomes of the projects and programs in question and identify where possible the gross and net effects that can be attributed to the program's efforts.

Conflict of Interest

Evaluation Administrators must disclose any real or perceived conflicts of interest that they might have. These conflicts of interest or perceived conflicts of interest should be identified as a component in the contractor selection process and contractors bidding on the evaluation efforts should present any real or perceived conflicts of interest in their proposals. Likewise, as evaluations evolve and as conditions change within the market, unreported conflicts of interest or potential conflicts of interests should also be brought to the attention of the Subcommittee during the course of the evaluation effort as appropriate as they are identified.

A conflict of interest would be reflected in but not necessarily limited to one or more of the following conditions:

1. Any member of the evaluation team or members of their immediate family are a part owner or stockholder or employed by any of the utilities sponsoring programs that are being evaluated by those contactors.
2. Any member of the evaluation team or members of their immediate family is an employee of any of the utilities sponsoring programs being evaluated.
3. Any member of the evaluation team or members of their immediate family is employed by an organization who offers energy efficiency program implementation services within the United States.
4. Any member of the evaluation team or members of their immediate family is employed by a company or organization owned by or controlled by another organization or company who offers energy efficiency program implementation services.
5. Any member of the evaluation team or members of their immediate family would be in a position to financially benefit from the results of the evaluation findings.

Sampling

All studies that rely on sampling approaches for collecting data to drive the impact analysis objectives should, to the extent possible, use procedures that minimize bias and maximize the sample's representativeness of the targeted population. Pending the availability of sufficient evaluation budgets, sampling approaches should be structured to be no less rigorous than a 90% level of confidence per utility, per program cycle, with a precision limit of ±10% for the key attributes on which the sample is being selected.

IPMVP Field Metering and Verification (M&V)[19] Efforts

Field measurements, when required for assessing equipment baselines and post-retrofit or post installation operations should be conducted using one of the four primary data collection protocols specified in the IPMVP (International Performance Measurement and Verification Protocol). This protocol describes options A, B, C, & D for both single project end use and whole building actions. The IPMVP requires that key performance indicators that drive the estimates of program impacts should be collected via on-site metering, monitoring and verification efforts. The protocol requires measurements to be collected that represent key savings calculation indicators. M&V plans should be developed for each study requiring on-site M&V activities. M&V sampling should be established to be representative of the types of projects and equipment use conditions that represent the largest portion of energy savings. Not all evaluations will require M&V field efforts.

Survey and Interviews

When surveys and interviews are used to collect data from which impacts are calculated, the questions should be objective, unbiased and non-leading. Closed-ended, scaled, or quantitative response questions should be structured to allow a full range of applicable responses. Open-ended questions should be single subject response questions that allow for a complete response. Complex questions that require a preamble to set a stage for a response consideration should be avoided to help assure that the response is objective and not guided toward a specific outcome.

On-site Staff Identification

When on-site (in customer's homes or business) or when in-field efforts (such as public-place data collection) are conducted in which members of the evaluation team come into contact with utility customers, members of the evaluation team will wear apparel approved by the Subcommittee that will identify them as Energize Indiana team members. Likewise each staff evaluation team member will display Subcommittee approved identification badges attached to their shirts. Vehicles used to conduct on-site visits will display the Energize Indiana logo prominently on the vehicle so that the vehicle can be identified as a program-related vehicle.

American Evaluation Association: Guiding Principles for Evaluators

The American Evaluation Association (AEA), the professional association for evaluators, works to ensure ethical work in the evaluations of programs, products, personnel, and policy. To proactively guide the work of professionals in everyday practice and to inform evaluation clients and the general public of expectations for ethical behavior, the Association developed a set of guiding principles that are incorporated into the Indiana Evaluation Framework. These principles include the following provisions:

A. Systematic Inquiry: *Evaluators conduct systematic, data-based inquiries about whatever is being evaluated.*
B. Competence: *Evaluators provide competent performance to stakeholders.*

[19] M&V refers to Metering and Verification associated with on-site field data collection efforts. The term (M&V) is used differently than the term EM&V in which the E stands for "Evaluation" or the analysis efforts that constitutes the analytical activities within the field of evaluation. Evaluation is the step in which evaluation-related data are analyzed to produce evaluation findings. IMPVP is an M&V effort associated with data collection and operational verification and in itself does not produce evaluation findings but provides the data on which evaluation findings are based.

C. Integrity/Honesty: *Evaluators ensure the honesty and integrity of the entire evaluation process.*

D. Respect for People: *Evaluators respect the security, dignity, and self-worth of the respondents, program participants, clients, and other stakeholders with whom they interact.*

E. Responsibilities for General and Public Welfare: *Evaluators articulate and take into account the diversity of interests and values that may be related to the general and public welfare.*

Appendix A: American Evaluation Association Guiding Principles provides a more detailed presentation of these principles.

Evaluation Expertise

The evaluation planning and implementation efforts should be directed, managed and implemented by members of the Evaluation Administrator's team who are trained, skilled and experienced in the specific areas of evaluation to which they are being used. Lead evaluation directors and managers should be experts with substantial experience in designing, managing, directing, and implementing evaluations, and reporting the results from those studies. Individuals assigned to the evaluation efforts should have the tools, skills and experience appropriate for the types of study and analysis approaches being used and the researchable issues being investigated. Inexperienced staff should be well supervised and their work reviewed for objectivity and accuracy before it is delivered to the Subcommittee.

Risk Mitigation and Reliability

Bias and precision

Bias arises when either the sampling design or the measurement approach leads to estimates that do not equal the true target value (e.g., average savings of population of CFL distributed). In other words, bias is a negative property to be avoided. A confidence interval is a range of values that is believed—with some stated level of confidence—to contain the true population quantity. The confidence level is the probability that the interval actually contains the target quantity. **Precision** provides convenient shorthand for expressing the interval believed to contain the estimator (e.g., if the estimate is 1,000 kWh, and the relative precision level is 10%, then the interval is 1,000 ±100 kWh. Stated another way, we are 90% confident that the true unobserved population value is between 900 and 1,100 kWh).

To illustrate four possible conditions relative to bias and precision, an image is often used of a target with different result patterns.

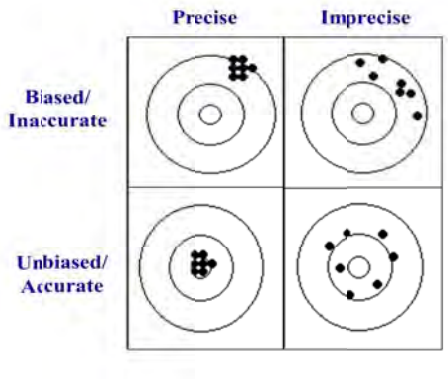


Figure 2 Bias and precision relationship

- *Unbiased and precise measurement*: results are tightly centered over the target bull's eye.
- *Unbiased and imprecise measurement*: results are very loosely arranged in a random pattern around the bull's eye, where the *average deviation*--high, low, left and right--is zero.
- *Biased and precise measurement*: results tightly clustered but systematically away from the bull's eye.
- *Biased and imprecise measurement*: results very loosely arranged in a pattern that is not centered on the bull's eye.

In real research, of course, the bull's eye is an unknown entity, for instance, the true value of energy savings for a measure. The bias of a measurement is typically assessed *on face value* and through past experience by how well it comes into contact with the thing being measured. Metering assures direct measurement of consumption and demand, so it normally has low bias, whereas an engineering review may be based on research conducted for a distant utility under conditions that diverge from the program in question, hence higher bias. Metering of one or even five installed measures, however, might not be a *precise* basis for assigning savings, insofar as

the amount of savings varies greatly from one installation to another. Paradoxically, then, a more biased measurement that is very precise might be more rigorous than a very imprecise but less biased measure. Rigor is the process of attempting to achieve unbiased and precise measurement.

Guidelines for assigning value to information

Where resources are limited—*i.e., in nearly every case*—overall validity and precision are optimized by a strategic allocation of effort. Importantly, not all programs need the same level of evaluation rigor. Evaluation budgets should be focused to achieve the most valid and reliable results where they matter most. Evaluation rigor should be matched to the importance of the information being gathered through the evaluation efforts. To achieve this balance the following evaluation rigor considerations are incorporated into the Evaluation Framework:

1. *Contribution to portfolio energy savings*
2. *Share of portfolio budget*
3. *Measure parameter uncertainty*
4. *Expanding programs*
5. *Specific program issues (slow launch, low enrollment, etc.)*

Mechanisms for achieving rigor

The primary mechanisms by which high levels of rigor are achieved in evaluations include higher sample sizes, frequency of measurement, and estimation methods. Reducing errors usually increases evaluation costs. Thus, research expenditures intended to improve statistical precision should be justified in terms of the value of improved information. Methods of measurement are quite varied but include the metering of equipment on site; on-site inspections without metering; telephone surveys of participants, non-participants, or trade allies; engineering analysis of program data; and review and analysis of secondary data sources. The precision of these methods must be weighed against their relative cost, to achieve an optimal allocation of resources. Likewise, the *number of measurements*, i.e., sample size, and hence the cost, must be balanced against the gains. General principles include:

1. Evaluation planning should focus the type and use of field measurement and verification efforts on those components of the portfolio that have the greatest risk of lowering the precision of the impact estimates.
2. Method selection should consider previous evaluations and the degree of change that has occurred so that as programs change over time, the evaluation focuses additional rigor on programs that have changed.
3. Sampling approaches, sample size targets and confidence limits should be considered so that the effort is focused on improved estimation accuracy or on improving the operations of the programs. For programs that are important components of the efforts should have sampling approaches that reflect that importance.

In addition to the above rigor considerations, at a minimum all statistical precision should match standards outlined in the Indiana TRM. Rigor achieved should also correspond to evaluation reporting criteria.

Common sampling approaches

The development of the sample requires understanding the necessary accuracy, determining the sample frame, and developing the suitable sampling methodology. Appropriate statistical techniques typically used in energy program evaluation include, but are not limited to:

- ***Simple random sampling:*** drawing randomly from an entire population. This is often, but not always, the most efficient form of sampling.
- ***Stratified sampling:*** drawing randomly from sub-groups within a population. This is used when the variance in a measure is unequally distributed across a population, such as when the size of savings varies by the size of sites and there is a broad distribution of sizes. Random sampling is done within size groupings.
- ***Ratio sampling:*** sampling to estimate the ratio between two values. This is done, for instance, to estimate a realization rate, where the sample captures both a claimed savings value and a verified savings value. This is not a sampling method, per se, but rather a special use of a sample that affects the sample size. Sampling to estimate a ratio can be more efficient than sampling to estimate a single parameter value.
- ***Nested sampling:*** drawing a sample from within another sample, such as when a site metering sample is drawn from a sample of site verifications.
- ***Systematic sampling:*** often used when a sampling frame is unavailable, such as in store intercept studies. Data is collected at a fixed interval with a random starting point.

90/10 Evaluation confidence and level of precision

Energy program evaluation is typically based on estimating energy impacts using a representative sample of program participants to determine how measures are installed and used. The results of these efforts are then used to estimate savings for the program. The Indiana Core program evaluations have a target confidence level of 90% with a relative precision of 10%. How this is applied will depend on several factors, including the need for participant surveys, contractor or trade ally interviews, participant phone verification, on-site verification, on-site metering or monitoring or other data collection approaches for which sampling is constructed. For Indiana evaluations, the evaluation effort should target sampling efforts at key energy estimation metrics to achieve a 90/10 objective. However, a 90/10 objective is not required for all evaluation efforts. The 90/10 standard can be lowered when is not considered beneficial for assessing the researchable issue on which an evaluation objective is based. This provision allows for lower levels of confidence and precision when a 90/10 level is not needed. As a result, a 90/10 objective may be appropriate for assessing the energy impacts of a program, but may not be needed to investigate an objective within the process evaluation. Likewise, a program may be small enough or have a low level of expected savings that the resources used to obtain a 90/10 objective may be better spent increasing the reliability of the findings of a larger program or focusing on a technology with one or more programs that provides larger savings. However before a 90/10 objective can be reduced the Subcommittee must approved that reduction.

This Framework does not specify how the 90/10 objective will be obtained, that is left to the professional discretion of the independent evaluation contactor to determine how best to deploy evaluation resources to achieve the highest level of reliability at the lowest level of estimation error risk at the portfolio level. However the Evaluation Administrator should structure their

sample at the 90/10 level per program, per utility, to the extent that this objective can be achieved within the available evaluation budget. At the time of the writing of this Framework there are six utilities[20] implementing five[21] statewide programs through a single TPA. Because the DSMCC has set the 90/10 objective at the program level and at the utility level, this means that a Core program evaluation is not a single evaluation effort as typically structured in other states, but is essentially six independent impact evaluations per program. At this time there are five statewide programs. This means that from a sampling perspective, 30 independent evaluations need to be conducted for the 5 Core programs (one per utility per program).

The evaluation efforts for Indiana's Core programs are expected to achieve utility-specific, program-specific estimates with a relative precision of approximately 10%, with a confidence level of 90% over the course of a multi-year program cycle. Thus, the energy impact estimates for a single year can be a lower level of precision, however, the final end-of-cycle evaluation reports which include all of the years of the program cycle, should be 90% confidence with a 10% level of precision per program per utility to the extent that the evaluation budget permits.

[20] Duke Energy, Vectren Energy, IP&L, I&M, NIPSCO and IMPA.

[21] Residential lighting, home energy audit, low-income weatherization, energy efficient schools, commercial and industrial program.

M&V Field Protocols[22]

This section of the Framework deals with measurement and verification (M&V) protocols, and principles relevant to applying M&V activities for evaluation of the Core programs. Engineering calculations, observation site visits, and metering are techniques that fit together as M&V activities and are used to varying degrees depending on the measure and program and site context. Topics include:

- Overview of M&V
- Selection of an M&V methodology
- Developing the site visit sample
- Quality assurance (QA/QC)
- Training

Overview of M&V

The following schematic provides an illustrative example of comprehensive M&V.

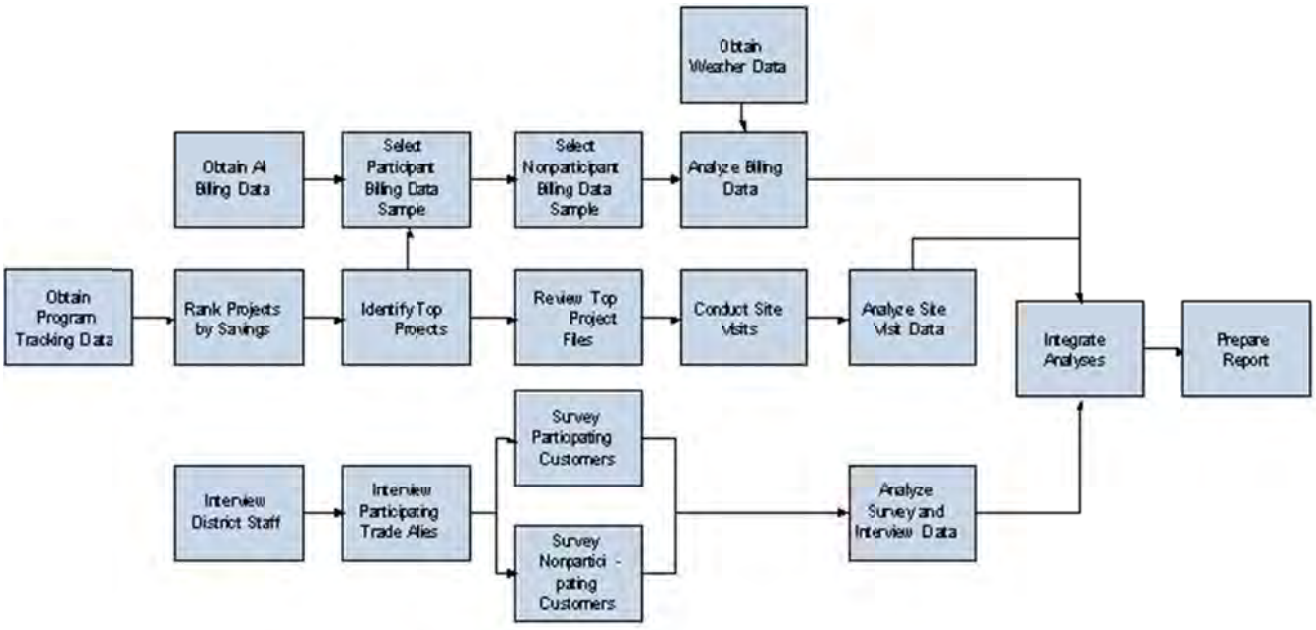


Figure 3 Comprehensive Monitoring and Verification

Evaluators generally conduct post-retrofit site visits and associated M&V to determine the savings realization rates associated with a sample of completed DSM projects.

[22] EM&V=Evaluation, Measurement and Verification. EM&V includes the analysis of the collected data (the E component of EM&V). M&V is a limited sub-set of EM&V and is strictly a measurement and equipment operations verification effort.

Selection of an M&V Methodology

The selection of an M&V methodology or analysis rigor for each sampled site will typically be based on several factors (measure complexity, magnitude of savings, etc.), and this will affect planning for site M&V unit costs accordingly. The following types of on-site verification activities are available to meet the evaluation goals, and will need to be adjusted based on actual site details:

- ***Verification:*** These sites include physical inspection and verification of the operating conditions of the systems under consideration.
- ***Verification with spot measurement:*** These sites involve physical inspection of the installation with spot measurement/reading of the current operating conditions.
- ***Verification with basic rigor:*** These sites will involve meeting–at a minimum–the standards of IPMVP Option A (Partially Measured Retrofit Isolation),[23] including the use of direct measurement.
- ***Verification with enhanced rigor:*** These sites will largely involve using IPMVP Option B (Retrofit Isolation)[24] level analysis.
- ***Phone Survey****:* Call to determine measure presence and operating characteristics.

Developing the Site Visit Sample

The primary sampling criteria will usually involve stratification of the program population into homogenous groups based on type (e.g., single family vs. multifamily, office vs. retail, etc.), the expected contribution to portfolio savings, and the uncertainty of input variables. Selecting a statistically valid sample is important to an evaluation such as the Indiana Core programs and requires a complex tradeoff between cost and accuracy.

Evaluators will normally develop the final sampling plan in the first phase of the project and will ensure that the statistical concepts and underlying sampling procedures are clearly explained.

Quality Assurance and Quality Control

Quality Assurance and quality control (QA/QC) procedures should be set at the inception of the evaluation process: meters should be tested in a metering lab before their use in the field; and nearly all measurements logged should be confirmed using an independent spot- measuring tool—both at installation and at removal—to check logging meter readings. Field staff members should remain on site until all readings are stable and in explainable or expected ranges. Best practice indicates that all metering points are photographed three times: before the meters are installed, with metering equipment, and after the meters are removed. This allows the evaluation team to confirm equipment nameplates and meter placements after they leave the field.

[23] Savings are determined by field measurement of the key performance parameter(s), which define the energy use of the affected system(s) and/or the success of the project. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter and the length of the reporting period.
[24] Savings are determined by field measurement of the energy use of the affected system. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period.

Training

To ensure consistency of data collection processes and analyses among all members of the evaluation site-visit team, the evaluation team's senior engineers will generally conduct a training session covering general technology, data collection topics, and project-specific forms and databases. All staff members must be trained in safety topics appropriate for their work and are to be provided with industry-standard safety gear.

Standards and Approaches for Survey Research

Survey research is a critical piece of the evaluator's toolkit. Nearly all evaluations require the collection or analysis of survey data. This section provides guidance on the design and fielding of structured surveys.

Principles of Question Wording and Order

A survey is a structured conversation. Like any conversation, word choice can impact understanding. People interpret the same word differently. Survey questions need to be specific, simple and direct; they should address one subject at a time, and need to be exhaustive and mutually exclusive. Questions that will be used in an algorithm to estimate an overall value need to be developed with the algorithm in mind. The algorithm needs to be developed before the survey is designed. The following parts of this section of the Framework provide guidance on survey construction to minimize data bias and improve evaluation reliability.

Closed-Ended Versus Open-Ended Questions

Surveys typically contain a combination of open- and closed-ended questions. Open-ended questions allow respondents to answer the question in their own words while close-ended questions require respondents to select their response from a provided list.

Close-ended questions are more common because they are easier to administer and analyze and less subject to interviewer effects. Open-ended questions can provide more rich and detailed responses than close-ended questions. However, open-ended questions take longer for respondents answer, require more skilled interviewers, and must be coded for analysis.

A common short-cut is to ask an open-ended question and have the interviewer "field-code" the response by fitting it into pre-defined categories that are not read to the respondent. This approach can reduce analysis time and survey costs, but it is not recommended in most cases. The interviewer becomes the coder and considerable training is typically required for each question to ensure that all interviewers are coding the open-ended responses correctly and consistently. If field-coded open-ended questions are used, long lists of response categories should be avoided as they are difficult for interviewers to manage and can introduce measurement error. Such questions should have no more than five response categories with responses that fall outside these categories typed out in full and recorded as an "other."

Questions that measure a numeric quantity, such as number of CFLs purchased or number of rooms in the house, can and should be asked as an open-ended question. Asking the respondent to fit numeric responses into close-ended category ranges is more likely to produce errors. If ranges are used, the categories should not overlap so that they are mutually exclusive.

Question Scales

Numeric rating scales are one of the most common question forms. An important decision is the number of scale points. For a scale to provide a reliable and valid measure of a concept, respondents must uniformly understand the meaning of the response categories. Scales with a small number of points are easier for respondents to understand so that respondents tend to interpret the categories in the same manner. The drawback of these scales is that they do not allow finer distinctions in attitudes and behaviors that most respondents are able to make. But

scales with too many categories can only provide this higher level of distinction if each point has a clear and distinct meaning. Long scales without clear meaning can create measurement error.

The optimal number of scale points to maximize reliability and validity of survey responses has been the subject of numerous studies. The general consensus is that scales with a moderate number of points – five or seven – tend to have greater reliability and validity than scales with fewer or more points.

Survey Development and Testing Techniques

Before survey fielding begins, evaluators should employ some form of testing of survey instrument to make sure respondents interpret the questions as intended and are not struggling with the answers.

During the survey development phase, designers could conduct focus groups or cognitive interviews in which the evaluator has the opportunity to talk with respondents to better understand how they interpret the questions. Focus groups and cognitive interviews are time intensive and costly techniques that most are not able to employ. A simple but often overlooked test is to read the survey aloud to someone who was not involved in its development. This exercise will often reveal awkward and confusing wording that can be easily improved.

Once a survey is final and ready for fielding, more formal testing should be conducted. Surveys should be pre-tested with a small number of actual respondents while the evaluator listens to the actual interviews as they are being conducted. Monitoring is one of the only ways a survey designer can hear the full interview from the respondent's perspective. The designer will hear if respondents struggle to understand questions, have difficulty providing an answer that fits the response options, if the interview is too long or repetitive and respondents become impatient compromising data quality.

Evaluators should closely examine the pre-test data to make sure the survey is programmed correctly and respondents are asked all appropriate questions.

All surveys must be reviewed and approved by Subcommittee before fielding begins.

Survey Fielding

Surveys should be fielded using best practices that are appropriate for the collection mode to ensure minimum bias. For telephone surveys, evaluators should employ call centers that train all new interviewers on proper telephone survey procedures and evaluate the quality of their work on a regular basis. Interviewers should also be trained on the specific survey before they begin calling respondents. The evaluator should explain the purpose of the survey and any unusual or complicated questions.

The survey field period should be long enough so that all sample telephone numbers are dialed numerous times at different times of day to maximize the chance of reaching all respondents. The call center should have procedures for recording the outcome of each call. Ideally, the call dispositions will be recorded in manner that allows the calculation of a response rate using standards set forth by the American Association for Public Opinion Research (AAPOR).

Because mail and Internet surveys are self-administered, evaluators need to pay careful attention to the visual appearance and design of these instruments to minimize respondent error. Evaluators should consider consulting an expert in the field of mail or internet survey design before crafting their field instruments. The field period of mail and Internet surveys should be long enough so that at least one reminder can be sent. The outcome of each email invitation or mailing should also be tracked in a manner to allow the calculation of an AAPOR response rate that is appropriate for internet and mail surveys.

Survey Methods Reporting

Evaluators should document the survey procedures and methods used so the results can be replicated or compared to other studies. All survey projects should retain:

1. Final survey instruments.
2. A sampling plan that includes a description of the population under study, the sampling frame, the source of the sampling frame, the method used for drawing a sample of respondents from the sampling frame. Any quotas used in fielding the survey should also be detailed.
3. Survey dispositions and response rates. Both should be tracked and calculated using AAPOR Standard Definitions.
4. A description of any survey weights and weight methods.
5. A topline that contains frequency results of all questions asked in the survey.
6. Final data files and computer code used for analysis.

Ethical Considerations

Evaluators have ethical responsibilities when conducting surveys with utility customers. For each survey, evaluators should inform customers of the sponsor of the survey and that their participation is voluntary. Customers who choose not to answer a question should be respected and not pushed to provide an answer. Any information, alone or in combination, that could identity a customer should be kept confidential unless the customer explicitly waives confidentiality. The Council of American Survey Research Organizations (CASRO) and AAPOR provide codes of standards and ethics. Evaluators must abide by one of these standards. The full CASRO standards can be found at: http://www.casro.org/codeofstandards.cfm. The AAPOR standards can be found at: http://www.aapor.org/AAPOR_Code_of_Ethics/4249.htm.

Energy Impact Baseline Approaches

Prescriptive Measure Baselines

The baseline for prescriptive measures will be one of the following:

- For early replacement scenario (i.e., replacing existing functioning equipment), the appropriate baseline is the efficiency level of the pre-existing operating equipment. This scenario has another baseline that starts when after the end of the remaining useful life (RUL), or when the existing equipment would have ceased to operate. The baseline at that moment is what the customer would have replaced the equipment with, i.e., current practice or code. (See Appendix C for detailed discussion of useful lives.)
- For replacement on failure scenario (i.e., the equipment is inoperable at the time of the participation in the program or the cost of the repairing an operating unit exceeds its value), the baseline is minimum applicable standard or minimum current practice. For applications in which there is no building code or appliance standard the baseline becomes the minimum efficiency level for equipment that is often installed in similar projects by non-participants. In these conditions the evaluation professional will need to make a judgment call about what is considered minimum efficiency for the range of equipment available in the market. The minimum efficiency equipment (typically called the inefficient choice) represents the lower levels of equipment efficiency available in the market.

Minimum Efficiency Typically Installed:

When baseline is either existing conditions or when set to minimum efficiency, or minimum efficiency level under a code or standards, free rider adjustments are needed to convert gross to net savings. However, it is also possible to set the baseline at a level that includes the influence of freeriders, thus eliminating the need for a freerider adjustment to the gross savings. In this baseline (Standard Market Practice, or SMP) approach, savings are estimated as the difference between the market standard practice baseline and the program induced high efficiency unit. When this approach is used it is assumed that the practice of establishing the market mean practice provides average per measure energy savings that will directly reflect the program's impact net of freeriders. This approach is used when there is a reasonable expectation that participants make decisions similar to those made by non-participants in the absence of the program.

Custom Measure Baselines

For custom program evaluations the baseline approach can be different for each installation. That is, the technologies as well as the technology configuration and use conditions can be different in each case. As a result, it is not advisable to establish a set of standard baseline approaches. Instead the Framework specifies how project-level baselines can be set, depending on the type of change induced by the program. The evaluation contactor must select the baseline approach appropriate for a set of sampled projects that best reflect the needs of the project and program-level evaluation.

Because there are several different ways that program managers and evaluation experts can define a custom baseline condition, significant differences in savings estimate can result. By defining baselines for various installation conditions, these approaches aim to reduce such differences.

Types of Custom Projects

There are typically four types of custom projects.

1. Measures that are not included in the Indiana Technical Reference Manual (TRM) and are unique to a specific non-typical process or application. They are typically not part of prescriptive programs because they do not conform to standard installation and use conditions.
2. Measures not included in the Indiana TRM but are promoted by one or more programs and can be considered a typical installation and therefore should be considered for inclusion in future updates to the Indiana TRM. Because they are not included in the Indiana TRM, custom baseline approaches are needed.
3. Measures that are in the Indiana TRM, but that are installed in a different environment or have a different use conditions than those assumed in the Indiana TRM.
4. Measures that are in the Indiana TRM, but that require simulation modeling or other advanced approaches in order to estimate interactive effects within a facility (if different than category 3 above).

Any one of these four types of custom measures can be mapped into three types (A-C below) of custom projects which require different considerations for estimating pre-program baseline conditions.

A. ***Building*** performance related projects (insulation, space heating, space cooling, domestic water heating, lighting etc.) and,
B. ***Process*** projects that are typically based on the activities that take place within a participant's facilities (paint drying, curing, baking, forming, cutting, stamping, molding, chilling, extruding, compressing, welding, etc.). Space heating and cooling projects are included in the building envelope definitional standard because the performance of these systems is dependent upon both the efficiency and operational conditions of the equipment and conditions of the facility's envelope.

While these two groups work well for many projects, there are also projects that substantially impact post program energy use across both of these groups.

C. ***Building and process*** projects where a change in one significantly impacts the energy use conditions of the other. For example when a facility installs a new high efficiency kiln for drying and forming that is more efficient and better insulated than the previous kiln such that the decreased energy used for baking pottery changes the load on the building's heating and cooling systems. The impacts on the building are the HVAC interactions resulting from the process change.

Within these three types of projects are other considerations for establishing baselines.

A. Building Projects

There are two types of building projects: 1) those that are not associated with a building code that is in force at the time of the program-induced change, and 2) those that are covered by a building code which limits the choices that can be considered for the project.

B. Process Projects

There are also two types of process projects: 1) those in which the levels of production (i.e., number of units produced annually) increase after installation and 2) those in which they do not increase. Both are further divided into: 1) those not covered by an applicable Federal or state standard, and 2) those covered by an applicable Federal or state standard.

C. Building and Process Projects

Some custom projects impact the energy use associated with the operations of the facility and the energy use of certain processes operating within that facility. For these types of projects, baselines must be established for both the facility and the process within the facility. Note that there are cases in which the installation of the installed measure interacts with the energy use of another existing measure (e.g., the installation of a custom lighting measure interacts with the energy use of the existing Heating, Ventilation and Air Conditioning (HVAC) system. In such cases, only the baseline for the installed measure (e.g., lighting) needs to be determined.

Custom Project Baseline Definitions

This section defines the baselines for two types of custom *building* projects and four types of custom *process* projects.

1. **Building or facility equipment not covered by a code:** Involves measures associated with the building or facility (envelope, non-deemed and non-process equipment) and measures not covered by a building code. If the program-induced change is an early (before end of life) replacement, the baseline is the pre-program in situ energy consumption. If the program-induced change is a normal replacement (replaced at the end of the effective useful life), the baseline is the energy consumption associated with current practice.
2. **Building or facility equipment that is covered by a code**: Involves measures associated with the building or facility (envelope and non-TRM and non-process equipment) and which are measures covered by a building code that limits the equipment choice. If the program-induced change is an early replacement, the baseline is the pre-program in situ energy consumption. If the program-induced change is a normal replacement, the baseline is the energy consumption associated with current building code.
3. **Process equipment *not covered* by an applicable Federal or state standard**: Involves measures associated with the process or operational activities occurring within the facility that are not covered by an applicable Federal or state standard. If the program-induced change is an early replacement, the baseline is the annual energy consumption of the pre-existing equipment at the post-program level of production. If the program-induced change is a normal replacement, the baseline is the annual energy consumption of equipment representing current practice at the post-installation level of production.

4. **Process equipment *covered* by an applicable Federal or state standard**: Involves measures associated with the process or operations occurring within the facility that are covered by an appliance of equipment standard which limits equipment and change options. If the program-induced change is an early replacement, baseline is the annual energy consumption of the pre-existing equipment at the post-program level of production. If the program-induced change is a normal replacement, the baseline is the annual energy consumption of equipment that meets the applicable standard at the post-installation level of production.

Note that for numbers three and four above, the issue of whether production increases is irrelevant since the basic assumption is that a given program is not the primary cause of a customer's decision to increase production. There are two reasons supporting this assumption. First, a decision to increase the level of production usually requires a firm to consider a very complex set of organizational and economic factors, only one of which may be the price of electricity and/or gas. Second, to assess whether the program was the primary cause of this decision would require a very complex and prohibitively expensive analysis designed to tease out the effect of the program from the multiple drivers of production changes such as the supply and demand for the firm's product within a national or global market.

In both numbers three and four, the baseline and the post-installation energy use assume the post-installation level of production. This results in greater savings than in the case in which the program is assumed to have caused the increase in the level of production. Both rules recognize that even though the level of production has increased in the post period thereby *increasing* consumption, the *efficiency of production* (kWh/unit) has improved, which has a positive impact on the economic efficiency of the firm and the gross state product.
Figure 4 below presents the various pathways to defining baselines in each of the types and sub-types discussed above. These definitions also apply to peak kW demand.

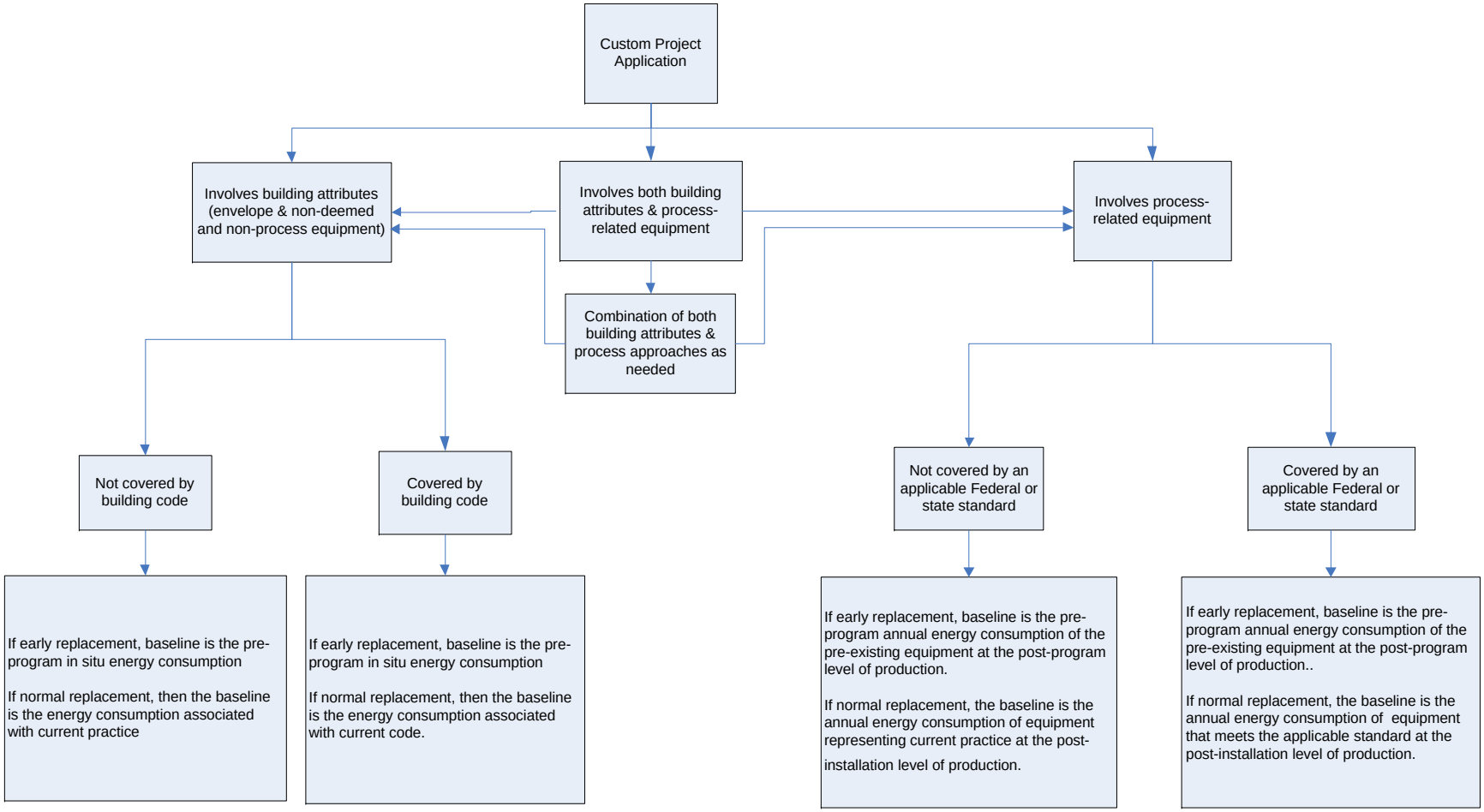
Defining "Current Practice" for Custom Program Baselines
In determining what constitutes a "*current practice*" in the absence of a building standard or an applicable Federal or state standard, the assessment needs to focus on what equipment choices and installation configurations would have normally been adopted in the absence of the program. (Note: The use of the term current practice should not be confused with the term standard market practice in which a net freerider baseline is defined.) This can be challenging for assessing projects with non-prescriptive measures or for which there is no common per-participant or industry practice which the participant would have followed or that are typical for non-participants. Establishing a *current practice* for a custom project will require some assessment of what each participant would have done in the absence of the program. It is essentially what would have been done without the program assessment. Thus when current per-participant or industry practice is set as the baseline, it is already set at what would have occurred, not as market current practice, but as the custom program participant's current practice. As a result, the impact results are already net of freeriders and no additional freerider adjustment is needed.

The assessments need to explore a variety of factors affecting what project would have been done in the absence of the program. Factors could include, among other:

- Procurement decision criteria for similar non-program covered equipment;
- The participant's traditional capital investment practices and how they impact equipment choice decisions;
- Past purchase trends for similar equipment;
- Customer self-reports of what they would have installed (if anything) had the program information and incentive not influenced the choice decision;
- Surveys of designers and/or vendors familiar with the process affected by the measure (e.g., interviews with wastewater treatment plant engineers to determine whether variable frequency drivers (VFDs) are common practice on wastewater aerators).

Because energy efficiency programs are designed to influence equipment decisions, one cannot assume that all participants follow what is typically purchased for a specific purpose or use. For many types of custom projects, there may be no typical industry practice. Likewise energy programs are designed to move both early adopters as much as late adopters.

Figure 4. Determining Baselines for Custom Projects under Various Installation Conditions



Effective Useful Life and Remaining Useful Life for Custom Measures
Since agreed upon effective useful lives (EULs) for general categories of custom projects are not available, case-by-case documentation for the proposed EUL for each custom project should be used in the impact evaluation. Documentation could include dates of installation of the existing equipment that would allow the calculation of its age or, absent such documentation, customer estimates of the age of the existing equipment for each custom project. In some cases, manufacturers' specifications for equipment comprising the custom application could also be used to estimate the EUL. Or, information on time-to-failure of similar equipment supporting similar applications (e.g., plastic extrusion) could be identified within a given industry.

With respect to remaining useful life (RUL), the situation is even more challenging. Information gathered from knowledgeable people at the site must be gathered to support an estimate of the RUL. For example, such questions as the following could be asked:

- At the time the equipment was replaced, about how many years were left in its useful life (without major repairs which may have led to replacement)?
- Which of the following best describes the condition of the existing equipment when it was replaced: fully functional, fully functioning but with significant problems, or non-functional?
- How long would the old equipment have met the technical and performance needs of the facility?

Custom Measure Early Replacement: When a technology is replaced earlier than what would have occurred without the program, the baseline condition is the energy use condition prior to the program-induced change for the remaining useful life of the replaced measure. Once the remaining useful life has expired, the baseline should be established using one of the three methods outlined above and applied to the remaining useful life. In some cases functional application impact calculation adjustments will need to be made by the evaluation contactor when they find that program-caused changes also impact the functions of equipment or processes that are different than the pre-condition.

Use of Control or Comparison Groups as Baselines
When the evaluation approach uses experimental or quasi-experimental evaluation approaches[25] the estimation of a pre-program baseline is not required. This is because the participant (test) group's energy use is statistically compared to the consumption of a matched non-participant group (control or comparison group). When random assignment is used to allocate sample points into both the participant and non-participant groups, the difference in consumption between the test and control group provide a net impact result that does not need to be adjusted or modified to provide results that are net of freeriders and participant spillover for that examination period. The same condition applies if quasi-experimental designs are used to establish the test and comparison groups. In both cases the baseline becomes the energy use of the test or comparison group. Experimental designs use random assignments into the two types of groups. Quasi-

[25] Experimental approaches randomly assign people to the participant and control group so that there is theoretically no difference between the two groups. Quasi-experimental approaches build a comparison group (instead of a control group) and statistically control for variable influences that impact the study's findings.

experimental designs use assignments other than random. Quasi-experimental designs are more challenging than experimental design, because differences between the groups that influence energy use need to be controlled statistically.

Net Energy Impact Attribution Approaches

Standard Market Practice approach

The standard market practice (SMP) approach is a way to set energy impact analysis baselines so that the baseline already incorporates the influence of freeriders. In this approach a freerider assessment is not needed because the use of a standard market practice baseline is already what the market is doing without the program's direct influence. The SMP baseline is typically set at the mean of the level of energy efficiency being installed across the market being targeted by the program.

Self-report participant approach

When the SMP approach is not considered to be optimal or appropriate and when experimental or quasi-experimental designs cannot be used, the evaluation should employ a self-reporting approach. This approach will be highly consistent across programs with in the Indiana Core Program portfolio, with a similar battery of self-report questions. The surveys and interview instruments ask a series of questions designed to specifically assess the influence of the program on the participant's decisions. The questions focus on information sources used for making purchase decisions, how the program information influenced the decision, and assessing how the incentive influenced the decision. Participants are also asked about additional actions taken due to the influence of the program, but for which an incentive was not requested or paid. The assessments include consideration for not just the incentives provided, but the information and educational aspects of the program. Net savings can be produced from the incentive, the information provided by a program or the education effects the program has on the purchase and use decision. Each, independently or together, can cause net impacts to be achieved by a program.

The battery of questions used for net analysis are be kept to a minimum and include only those questions that can reliably be used to estimate net effects. Burdening customers with unnecessary questions that have not been shown to improve the accuracy of an estimation calculation are be avoided. The development of a standard set of short, focused net-to-gross (NTG) questions will allow the evaluation team to assess freeriders and participant spillover, but will not allow for the addition of market effects.

Analysis of self-report data

The general analysis approach is to develop an algorithm, based on the direct attribution questions, that establishes an initial attribution factor. Responses to the direct attribution questions will be compared to the context and decision-making questions to identify inconsistencies. The analytical procedures for establishing attribution and for identifying and addressing inconsistencies should be established prior to analysis.

The Evaluation Administrator must develop a transparent, straightforward matrix approach to assign a score to participants, based on their objective responses to survey questions. Question response patterns are then assigned attribution scores, and the confidence and precision estimates are calculated on the distribution of these scores. The reporting of results should include a matrix (or flow diagram) showing the combinations of responses given to the attribution questions and

the percentage of customers (and percentage of the overall savings) that fall into each category. This allows stakeholders to fully understand how each question (and within each question, the response categories) affects the final result.

The Evaluation Administrator's method will also rely on the concept of partial freeridership (partial attribution). Experience has taught evaluation professionals that program participants do not fall neatly into freerider and non-freerider categories. For example, partial freeridership scores were assigned to participants with plans to install the measure; though, the program exerted some influence over their decision, other market characteristics beyond the program also proved influential. In addition, with partial freeridership, we could utilize "Don't Know" and "Refused" responses by classifying them as partial credit, rather than removing the entire respondent from the analysis. Evaluators then typically weight the respondent freeridership scores by the estimated savings of equipment installed, given the wide variation in nonresidential program participant energy savings.

Self-report spillover methodology

The concept of spillover refers to additional savings generated by program participants due to their program participation, but not captured by program records. Spillover occurs when participants choose to purchase energy-efficient measures or adopt energy-efficient practices because of a program, but they choose not to participate or are otherwise unable to participate in the program. As these customers are not "participants" for these additional actions, they do not typically appear in program records of the savings generated by spillover impacts. Thus, the energy efficiency programs' spillover effect serves as an additional impact, which can be added to the program's valid results, in contrast to the freeriders' impacts (which reduce net savings attributable to the program).

In the Indiana Core programs, the evaluations can measure spillover by asking a sample of participants purchasing and receiving a rebate for a particular measure if, due to the program, they installed another efficient measure or undertook other energy efficiency activity. Respondents are typically asked to rate, for example on a scale of 0 through 10, the relative influence of the Core program and rebate on their decision to pursue additional savings. They may also be asked to explain why they chose not to pursue a rebate for additional measures installed.

Participants are also asked for details regarding the baseline equipment the new energy-efficient equipment replaced. Once the measures and the estimated baseline measures are determined (as best as is feasible within constraints of the survey), detailed measure attributes obtained from the survey questions can be used to establish the most appropriate savings value to assign to that action taken. In cases where the Indiana TRM do not have applicable energy savings values, the evaluation team will rely on either other accepted values and/or engineering calculations by the evaluation team.

A spillover percentage per program is also calculated by dividing the sum of the additional spillover savings reported by respondents for a given program by total rebated gross savings achieved by all respondents in the program, as follows:

$$Spillover\ \% = \frac{\sum \text{Spillover Measure kWh Savings for All Survey Respondents}}{\sum \text{Program Measure kWh Savings for All Survey Respondents}}$$

Market effects - non-participant spillover

The evaluations should also assess the level of energy impacts associated with the program's/portfolio's impacts on how the market functions. Energy programs change the way products are selected and priced for sales in areas where energy efficiency programs are operated. These savings are then added to the portfolio's energy savings effects in a way that increases program level savings. In Indiana the Subcommittee has launched a series of market effects baseline studies that are replicated periodically. As these studies are completed the effects of the portfolio will be converted to kWh and kW impacts and added to the savings achieved directly by the program. The Evaluation Administrator will present the results of these studies to the DSMCC along with their recommended approach for allocating market effects savings to the programs that help produce those savings.

Use of Logic Models and Program Theories

Overview of Logic Models

A logic model serves as a graphic representation showing relationships between program inputs, outputs, and final desired outcomes. Program logic models offer a comprehensive way to identify and categorize the measurement of a program's progress toward the portfolio or program goals approved by the DSMCC. A well-designed logic model can help evaluation professionals design effective program evaluation plans because the logic model provides a roadmap for understanding logical relationships between program activities and final desired outcomes, and clarifies program design elements to ensure all operate properly for achieving a program's ultimate goals.

As seen in Figure 5 logic models can be used for planning as well as for evaluation purposes. Planning begins on the figure's right-hand side, including ultimate goals, outcomes needed for accomplishing final goals, and other planning elements. Evaluation starts on the figure's left-hand side, first checking program theory through examination of assumptions. The evaluation proceeds with a simple checklist of whether activities did or did not take place, and continues with more detailed evaluation activities to determine outcomes and goal achievements.

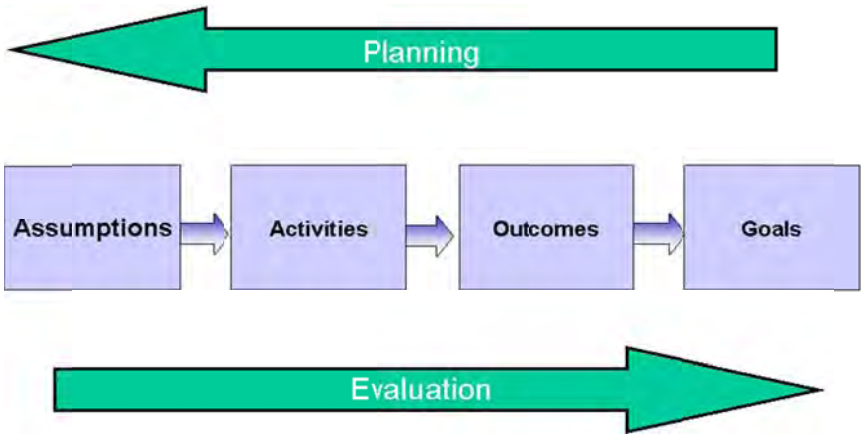


Figure 5 Logic Model Process

Often in an evaluation the initial logic models developed by the evaluators will serve as a guide for conducting evaluation research and discussions with program staff and implementers. Then revised and finalized logic models will also be an end product for the evaluation. Thus, the very process of building logic models can be used to establish consensus among stakeholders regarding program goals and methods for their achievement.

Value of Logic Models Across Broad Program Types

All evaluation efforts must, of course, be based on some model of what the program is trying to accomplish. However, use of program theories emphasizes the importance of a logic model spelling out in some detail the individual steps in the sequence of expected effects, their logical relationship to one another, and the causal mechanisms linking them. In the energy efficiency

field to date, logic models and program theories have proven particularly well adapted to evaluating the effectiveness of market transformation initiatives. This is largely because transforming a market tends to take a relatively long time to occur, involves a relatively large number of causal steps and mechanisms, and encompasses changing the behavior of multiple categories of market actors, all of which makes it particularly fruitful to focus on specifying and testing a detailed and articulated program theory.

In contrast, logic models tend to have somewhat less value for understanding direct resource acquisition programs. For these types of programs, flow diagrams depicting program processes are likely to be adequate for understanding what the program is trying to accomplish and how the activities are expected to achieve direct energy impacts with end-use customers.

Logic Models in Process Evaluations

Process evaluation activities can, and should, assess whether a program is being delivered in a manner that is consistent with the underlying program theory. Divergences between the program theory and the manner in which the program is actually being delivered do often occur. Often these divergences represent pragmatic improvements based on actual field experience. However, it is important that process evaluation activities assess whether this is the case, and whether changes in the underlying program theory, and the long-term plan for testing this theory, are needed. Process evaluations informed by "theory-based evaluation" (TBE) are more likely to help explain not only where breakdowns in observed versus hypothesized market activities occur but why they occur.

Appendices

Appendix A: American Evaluation Association Guiding Principles

A. Systematic Inquiry: *Evaluators conduct systematic, data-based inquiries about whatever is being evaluated.*
   1. Evaluators should adhere to the highest appropriate technical standards in conducting their work, whether that work is quantitative or qualitative in nature, so as to increase the accuracy and credibility of the evaluative information they produce.
   2. Evaluators should explore with the client the shortcomings and strengths both of the various evaluation questions it might be productive to ask, and the various approaches that might be used for answering those questions.
   3. When presenting their work, evaluators should communicate their methods and approaches accurately and in sufficient detail to allow others to understand, interpret, and critique their work. They should make clear the limitations of an evaluation and its results. Evaluators should discuss in a contextually appropriate way those values, assumptions, theories, methods, results, and analyses that significantly affect the interpretation of the evaluative findings. These statements apply to all aspects of the evaluation, from its initial conceptualization to the eventual use of findings.

B. Competence: *Evaluators provide competent performance to stakeholders.*
   1. Evaluators should possess (or, here and elsewhere as appropriate, ensure that the evaluation team possesses) the education, abilities, skills, and experience appropriate to undertake the tasks proposed in the evaluation.
   2. Evaluators should practice within the limits of their professional training and competence, and should decline to conduct evaluations that fall substantially outside those limits. When declining the commission or request is not feasible or appropriate, evaluators should make clear any significant limitations on the evaluation that might result. Evaluators should make every effort to gain the competence directly or through the assistance of others who possess the required expertise.
   3. Evaluators should continually seek to maintain and improve their competencies, in order to provide the highest level of performance in their evaluations. This continuing professional development might include formal coursework and workshops, self-study, evaluations of one's own practice, and working with other evaluators to learn from their skills and expertise.

C. Integrity/Honesty: *Evaluators ensure the honesty and integrity of the entire evaluation process.*
   1. Evaluators should negotiate honestly with clients and relevant stakeholders concerning the costs, tasks to be undertaken, limitations of methodology, scope of results likely to be obtained, and uses of data resulting from a specific evaluation. It is primarily the evaluator's responsibility to initiate discussion and clarification of these matters, not the client's.
   2. Evaluators should record all changes made in the originally negotiated project plans, and the reasons why the changes were made. If those changes would significantly affect the scope and likely results of the evaluation, the evaluator should inform the client and other

important stakeholders in a timely fashion (barring good reason to the contrary, before proceeding with further work) of the changes and their likely impact.

3. Evaluators should seek to determine, and where appropriate be explicit about, their own, their clients', and other stakeholders' interests concerning the conduct and outcomes of an evaluation (including financial, political, and career interests).
4. Evaluators should disclose any roles or relationships they have concerning whatever is being evaluated that might pose a significant conflict of interest with their role as an evaluator. Any such conflict should be mentioned in reports of the evaluation results.
5. Evaluators should not misrepresent their procedures, data, or findings. Within reasonable limits, they should attempt to prevent or correct any substantial misuses of their work by others.
6. If evaluators determine that certain procedures or activities seem likely to produce misleading evaluative information or conclusions, they have the responsibility to communicate their concerns, and the reasons for them, to the client (the one who funds or requests the evaluation). If discussions with the client do not resolve these concerns, so that a misleading evaluation is then implemented, the evaluator may legitimately decline to conduct the evaluation if that is feasible and appropriate. If not, the evaluator should consult colleagues or relevant stakeholders about other proper ways to proceed (options might include, but are not limited to, discussions at a higher level, a dissenting cover letter or appendix, or refusal to sign the final document).
7. Barring compelling reason to the contrary, evaluators should disclose all sources of financial support for an evaluation, and the source of the request for the evaluation.

D. Respect for People: *Evaluators respect the security, dignity, and self-worth of the respondents, program participants, clients, and other stakeholders with whom they interact.*

1. Where applicable, evaluators must abide by current professional ethics and standards regarding risks, harms, and burdens that might be engendered to those participating in the evaluation; regarding informed consent for participation in evaluation; and regarding informing participants about the scope and limits of confidentiality. Examples of such standards include federal regulations about protection of human subjects, or the ethical principles of such associations as the American Anthropological Association, the American Educational Research Association, or the American Psychological Association. Although this principle is not intended to extend the applicability of such ethics and standards beyond their current scope, evaluators should abide by them where it is feasible and desirable to do so.
2. Because justified negative or critical conclusions from an evaluation must be explicitly stated, evaluations sometimes produce results that harm client or stakeholder interests. Under this circumstance, evaluators should seek to maximize the benefits and reduce any unnecessary harm that might occur, provided this will not compromise the integrity of the evaluation findings. Evaluators should carefully judge when the benefits from doing the evaluation or in performing certain evaluation procedures should be foregone because of the risks or harms. Where possible, these issues should be anticipated during the negotiation of the evaluation.
3. Knowing that evaluations often will negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its results in a way that clearly respects the stakeholders' dignity and self-worth.

4. Where feasible, evaluators should attempt to foster the social equity of the evaluation, so that those who give to the evaluation can receive some benefits in return. For example, evaluators should seek to ensure that those who bear the burdens of contributing data and incurring any risks are doing so willingly, and that they have full knowledge of, and maximum feasible opportunity to obtain any benefits that may be produced from the evaluation. When it would not endanger the integrity of the evaluation, respondents or program participants should be informed if and how they can receive services to which they are otherwise entitled without participating in the evaluation.
5. Evaluators have the responsibility to identify and respect differences among participants, such as differences in their culture, religion, gender, disability, age, sexual orientation, and ethnicity, and to be mindful of potential implications of these differences when planning, conducting, analyzing, and reporting their evaluations.

E. Responsibilities for General and Public Welfare: *Evaluators articulate and take into account the diversity of interests and values that may be related to the general and public welfare.*

1. When planning and reporting evaluations, evaluators should consider including important perspectives and interests of the full range of stakeholders in the object being evaluated. Evaluators should carefully consider the justification when omitting important value perspectives or the views of important groups.
2. Evaluators should consider not only the immediate operations and outcomes of whatever is being evaluated, but also the broad assumptions, implications, and potential side effects of it.
3. Freedom of information is essential in a democracy. Hence, barring compelling reason to the contrary, evaluators should allow all relevant stakeholders to have access to evaluative information, and should actively disseminate that information to stakeholders if resources allow. If different evaluation results are communicated in forms that are tailored to the interests of different stakeholders, those communications should ensure that each stakeholder group is aware of the existence of the other communications. Communications that are tailored to a given stakeholder should always include all important results that may bear on interests of that stakeholder. In all cases, evaluators should strive to present results as clearly and simply as accuracy allows so that clients and other stakeholders can easily understand the evaluation process and results.
4. Evaluators should maintain a balance between client needs and other needs. Evaluators necessarily have a special relationship with the client who funds or requests the evaluation. By virtue of that relationship, evaluators must strive to meet legitimate client needs whenever it is feasible and appropriate to do so. However, that relationship can also place evaluators in difficult dilemmas when client interests conflict with other interests, or when client interests conflict with the obligation of evaluators for systematic inquiry, competence, integrity, and respect for people. In these cases, evaluators should explicitly identify and discuss the conflicts with the client and relevant stakeholders, resolve them when possible, determine whether continued work on the evaluation is advisable if the conflicts cannot be resolved, and make clear any significant limitations on the evaluation that might result if the conflict is not resolved.
5. Evaluators have obligations that encompass the public interest and good. These obligations are especially important when evaluators are supported by publicly generated funds; but clear threats to the public good should never be ignored in any evaluation. Because the public interest and good are rarely the same as the interests of any particular

group (including those of the client or funding agency), evaluators will usually have to go beyond an analysis of particular stakeholder interests when considering the welfare of society as a whole.

Appendix B. Data Needed for the Evaluation

This Appendix provides lists of the types of information evaluation contactors will need to support the evaluations of different types of programs. The following data should be readily available from the TPA.

Program Information

1. Full program descriptions, including operational or procedures manuals and activities descriptions and description of implementation territories;
2. Detailed descriptions of the tracking system and tracking system operations, including data dictionaries;
3. Program management and staff names, titles, work locations, phone numbers, fax numbers, email addresses;
4. Program theories and associated logic models if developed. If not developed a statement that they have not been developed with a projected date of delivery of the completed theories and logic models;
5. Market operations theories describing the operations of the markets in which the program operates and, if available, a description of how the program is to change the operations of the market;
6. A description of the size of the market targeted by the program, and a description of the baseline conditions at the measure/behavior level and a discussion of how the program is expected to change baseline measure/behavior conditions, if available;
7. A description of the pre-program technical potential at the measure/behavior level and a projection of the remaining technical potential at the end of the program cycle, if available; and
8. When the program relies on key market actors, trade allies and other stakeholders to deliver or support the program in order to reach the energy saving or outreach goals, the TPA should provide a listing, description of and contact information for these individuals/organizations.

Participant Data

For the purposes of this Framework a participant is defined as an individual or an organization that receives a program service or financial incentive. For most programs, participants are clearly defined in the program tracking systems. However, there are times when a participant is not clearly defined or is not easily identified. The DSMCC expects that the TPA will focus efforts on collecting participant information to the extent possible and practical for various types of programs or program services. Participants signing up for energy efficiency programs are generally easy to identify as they directly receive a service or a financial incentive. Participants in other programs, such as marketing and outreach programs can be harder to identify and report. This Framework does not act to require all programs to identify all participants. However when participant information is collected by the TPA or its subcontractor, much of this information will be of value to the evaluation efforts. It is the responsibility of the TPA to work with its

subcontractors to assure that when possible and practical the following information should be collected and maintained.

The following participant data should be available in electronic form with supporting database dictionaries to the evaluation teams on request.

Non-residential program data requests for end-user focused programs

1. Name of program(s) or program component(s);
2. Name of firms participating in program or program component;
3. Service turn on date;
4. Primary and secondary NAICS codes associated with the participants if available;
5. Extent to which customer is a repeat participant or a participant in other programs over the previous five years, if available or accessible;
6. Pre-participation measure and measure-use information, descriptions and conditions;
7. Address(es) of the participating firms or key participation decision makers;
8. Address(es) where program-related action is taken or for the services received;
9. Listing or description of actions taken or services received for each location by measure and end-use according to standard measure and end-use definitions established herein. These lists and descriptions should, to the extent possible, be standardized so that all database developers use the same term for the same measure;
10. Individual participation contact information for each location to include:
    a. First and last name;
    b. Address;
    c. Telephone number;
    d. Fax number (if collected); and
    e. Email address (if collected).
11. Dates of key action/activity/installation steps associated with program participation:
    a. Program enrollment date(s);
    b. Rebate or incentive payment date(s);
    c. Measure install dates;
    d. Date of training received; and
    e. Post-installation measure inspection dates.
12. Financial assistance amounts paid to participant by measure or action taken;
13. Project description information;
14. Estimated savings for actions taken;
15. Summary characteristics of building on which actions are taken or the operational environment in which measures are installed if collected;
16. Account and meter numbers and consumption histories from utility bills from all relevant meters for at least twelve months prior to program enrollment date and through to current period. Note: The Evaluation Administrator will work with the TPA and the Subcommittee to understand what metered data is available for which

types of customers and the formats and time intervals associated with the metered data;

17. Rate classification; and
18. The size and operational characteristics of the market in which the program is to operate including the number of covered technologies operating in the market and their expected normal failure, change-out or replacement rates.

Residential program data requests for end-user focused programs

1. Name of program(s) or program component(s) of the participation;
2. Type of building or structure associated with the participant or the participation;
3. Pre-participation measure and measure use information, descriptions and conditions;
4. Service turn on date;
5. Name of individual enrolling in the program or receiving service;
6. Address of the participant;
7. Extent to which customer is a repeat participant or a participant in other programs over the previous five years, if available or accessible;
8. Address where action is taken or for the services received;
9. Listing or description of actions taken or services received according to standard measure and end-use definitions;
10. Individual participation contact information to include:
    a. First and last name;
    b. Address;
    c. Telephone number;
    d. Fax number;(if available and collected); and
    e. Email address (if available and collected).
11. Dates of key action/activity/installation steps associated with program participation:
    a. Program enrollment date(s);
    b. Rebate or incentive payment date(s);
    c. Measure install dates;
    d. Date of training received; and
    e. Post-installation inspection dates.
12. Financial assistance amounts paid to participant by measure or action taken;
13. Project description information;
14. Estimated savings for actions taken;
15. Account numbers and meter numbers and consumption histories from utility bills for all relevant meters for at least twelve months prior to program enrollment date and through to current. Note: The Evaluation Administrator will work with the TPA and the Subcommittee to understand what metered data is available for which types of customers and the formats and time intervals associated with the metered data;
16. Rate classification; and

17. The size and operational characteristics of the market in which the program is to operate including the number of covered technologies operating in the market and their expected normal failure, change-out or replacement rates.

Non-participant or rejecter data for end-user focused programs

1. Description of program services offered to customer;
2. Date of offering or contact;
3. Method of contact;
4. Name of contact;
5. Address of contact;
6. Telephone number of contact (if known); and
7. Email of contact (if known).

Program data for mid-stream and upstream focused programs

1. Name of program(s) or program component(s);
2. Name of firms participating in program or program component;
3. Primary and secondary NAICS codes associated with the participants if available;
4. Extent to which customer is a repeat participant or a participant in other programs over the previous five years, if available or accessible;
5. Pre participation/measure and measure use information, descriptions and conditions;
6. Address of the participating firms or key participation decision makers;
7. Address(es) where action is taken or for the services received;
8. Listing or description of actions taken or services received for each location;
9. Individual participation contact information to include:
    a. First and last name (if known) and company name if applicable;
    b. Address;
    c. Telephone number;
    d. FAX number (if collected); and
    e. Email address (if collected).
10. Dates of key action/activity/installation steps associated with program participation:
    a. Program enrollment date(s);
    b. Rebate or incentive payment date(s);
    c. Date of training received; and
    d. Dates, numbers and types of material received.
11. Financial assistance amounts paid to participant by action taken;
12. End-user information as is made available to the program;
13. The size and operational characteristics of the market in which the program is to operate including the number of covered technologies operating in the market and their expected normal failure, change-out or replacement rates; and

14. Names and copies of previous evaluations and market research efforts used by the program to plan and structure program offerings and implementation efforts.

Program data for information, education and advertising-focused programs

1. Name of program(s) or program component(s);
2. Target population description, size, source of identifying information and lists of population members used in outreach activities. The size and operational characteristics of the market in which the program is to operate including the number of covered technologies operating in the market and their expected normal failure, change-out or replacement rates;
3. Contact information where individual participants are identified to include:
    a. First and last name of key contacts for each location (if known);
    b. Address of individual contacts;
    c. Telephone number of individual contacts;
    d. Fax number of individuals (if collected); and
    e. Email address of individuals (if collected).
4. Marketing materials by numbers, types and distribution;
5. Education or Media plan as appropriate;
6. Execution records for training held; information venues used; program participation agreements, commitments or other similar agreements; post-buy analysis; and other documentation of actual output;
7. Records for dates, number, location, target audience and attendance of events held, Web site hits, call-in numbers and rates, reach, frequency, gross rating points (GRPs), impressions, click through rate, composition, coverage, earned media, value of public service announcements, and other tracking and monitoring information the program maintains, as appropriate to the effort and for each wave, campaign and targeted effort. Include definitions and calculation methods for monitoring statistics used;
8. End-user information available to the program; and
9. Study names and copies of previous evaluations and market research efforts used by the program to plan and structure program offerings and implementation efforts.

Appendix C: Establishing Effective Useful Life Values and Remaining Useful Life

The Indiana Approach for Establishing EULs and RULs

The effective useful life (EUL) of an energy efficient measure is the average number of years over which a measure is expected to provide savings. The effective useful life is set is at the estimated point at which 50% of an installed technology type is expected to be remain installed and working in the participant's facilities. Measure lives can vary greatly. An air conditioner installed in a business can last 30 or more years if it is well maintained. In other facilities it may be removed after three years during a remodeling or major equipment up-grade activity. However, it is not uncommon to find measures still installed and performing well beyond their estimated useful life and in some cases for twice the estimated effective useful life. This is because the EUL is set at the *average* number of years the technology is expected to perform.

The remaining useful life (RUL) is the period of time over which the old technology being replaced is expected to have remained in place and functioning if the program would not have been offered to encourage the replacement of that old equipment with a new high efficiency model. The RUL used in evaluation is the expected average RUL across a type or category of technology. In some cases the participant's equipment has failed and is being would have been replaced regardless of the program, in other cases the program can induce a participant to replace the inefficient equipment years before the end of its life.

To establish the EUL and RUL of equipment offered in the Indiana Core Program portfolio the Evaluation Administrator will establish a set of EUL/RUL tables covering the type of equipment offered through the Core programs. The Evaluation Administrator will assess the measure life metric used in evaluation research from other jurisdictions and examine the EUL/RUL research available. From this review the Evaluation Administrator will establish as set of draft standard EUL/RUL tables presenting the recommended EUL/RUL to be used in Indiana's Core program evaluations and provide those to the Subcommittee for review and comment. Following discussions with the Subcommittee the Evaluation Administrator will finalize the tables and submit them to the Subcommittee for inclusion in the Framework. The Subcommittee will then vote to accept the tables or to ask for modifications. Once the Subcommittee votes to accept the recommended tables, they will then be incorporated into the Framework and used to estimate savings for all measures included in the Core Programs.

Updating the RUL and EUL tables

Periodically there will be a need to update, modify or expand the EUL/RUL tables. As EUL or RUL research is conducted and as more measures are added to the Core Programs the tables will need to be updated. The Subcommittee will initiate the up-dating process. The up-dating process will follow the process for formally adapting the original tables. That is, the recommended change will be brought to the attention of the Subcommittee and the Subcommittee will vote on that recommended change. The revised tables will be incorporated into an updated version of the Framework.

Part of the evaluation efforts of Core Programs will be to ask participants when they would have replaced the program incented technology in the absence of the program. As these data become available and are statistically stable, they will be used to modify the RUL part of the EUL/RUL tables.

Use of RUL and EUL in estimating energy impacts

The EUL/RUL tables establish the time period over which different energy impact baselines will be used to estimate energy savings. For the time period of the RUL the energy efficiency of the old unit being replaced will act as the energy impact baseline. The baseline for the rest of the EUL (EUL minus the RUL) will be established by the methods specified in this Framework for establishing baselines for the evaluation of energy efficiency programs.

All evaluations will use the EUL/RUL tables in there evaluations to estimate energy impacts. As EUL/RUL tables are updated, the changes will be used prospectively to assess the energy impacts for the next program cycle.

Use of RUL and EUL tables

<<Insert EUL/RUL tables here after they are developed>>

Appendix D: Changes and Updates to Framework and TRM

The following table presents the sequence of changes and updates that have made to the Framework or the TRM since their original acceptance. As the Subcommittee adopts a change to the Framework or the TRM each change will be documented by updating the following table, and included as an Appendix in the updated Framework or TRM.

Change #	Date of SC acceptance	Section of Framework/TRM	Summary of the change and reason for the change
1	xx/xx/20xx		
2			
3			
4			
5			
6			
7			
8			
9			
10			

Change # is the one-up number used to track each change.
Date of SC acceptance is the date on which the DSMCC EM&V Subcommittee voted to adopt the change.
Section of Framework/TRM is the title of the section of the Framework/TRM within which the change was made or the name of a new section that was added.
Summary of the change and reason for the change is a brief narrative summary of the change that was made and the reason for the change.