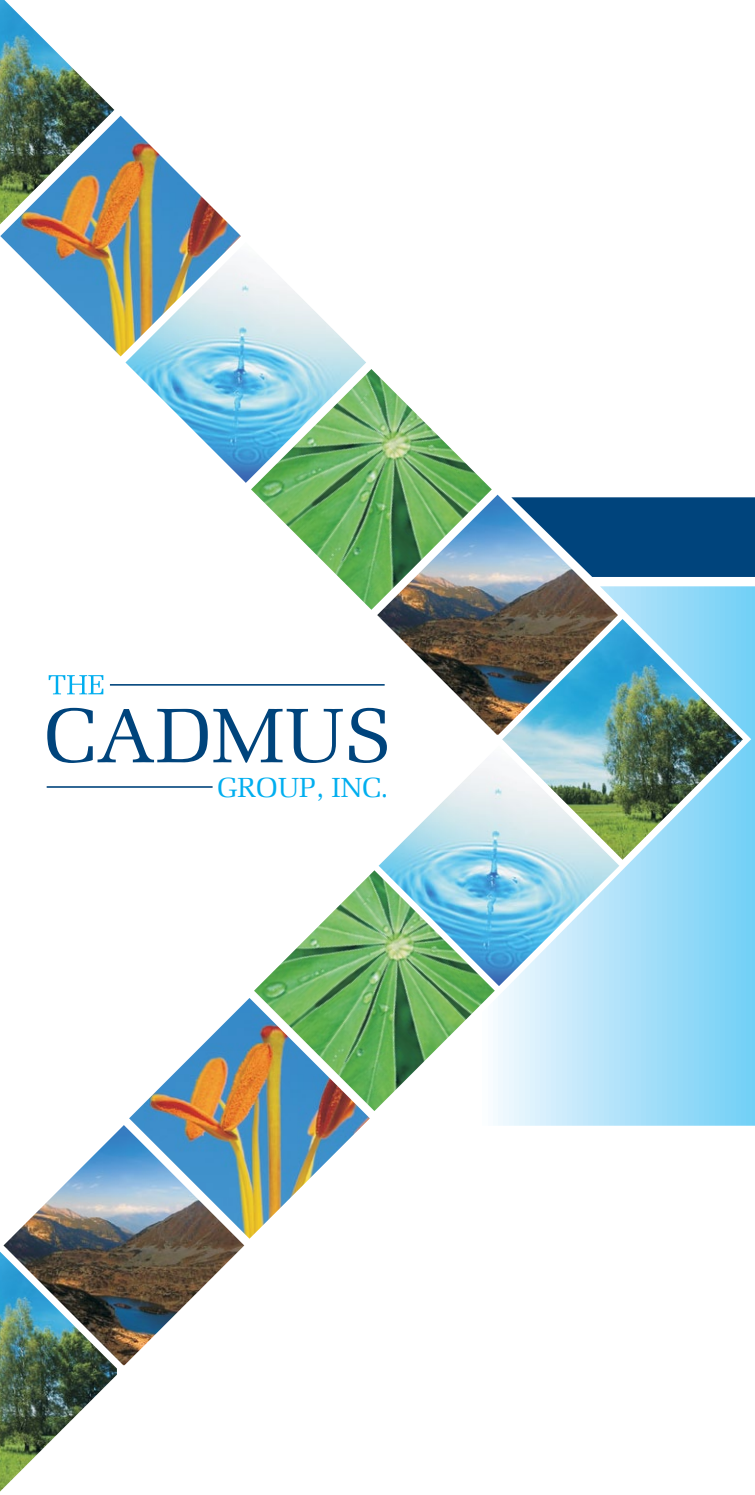

THE CADMUS GROUP, INC.

BPA ENERGY SMART INDUSTRIAL PROGRAM: EARLY EVALUATION REPORT

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1. Evaluability Overview and Approach

The Bonneville Power Administration (BPA) rolled out its newly designed Energy Smart Industrial Program (the program) on October 1, 2009. BPA retained the Cadmus Group, Inc. (Cadmus) to provide early evaluator involvement in the program's planning and implementation phases. Specifically, Cadmus' scope of service focused on six tasks:

1. Complete a document review.
2. Develop logic models.
3. Assess the proposed program tracking database.
4. Conduct an evaluability assessment.
5. Identify evaluation issues.
6. Provide ongoing implementation support.

An evaluability assessment is a structured process designed to assess whether a program's design and implementation provides the data necessary for future process and/or impact evaluations. Historically, evaluator involvement has been limited to providing feedback after a program has been active for some time; if evaluators find problems related to data gathering, tracking or monitoring, it can cause significant setbacks. In many cases, delayed identification of such problems has not only resulted in implementers' frustration, but have presented significant barriers to conducting evaluations. Given this, an evaluability assessment's two primary objectives are: to provide implementers with timely guidance on data required; and establish the appropriate format and frequency of data collection for a successful evaluation.

Methodology

Generally, early evaluation is based on a high-level review of program documents, application materials, and an examination of a program tracking database. It also typically involves interviews with program managers and implementers, and a comparison of information collected on application materials with data available in the database. The following activities were completed as part of the ESI Program early evaluation assessment:

- **Review of program documentation**. A review of available program documentation provided our team with a basic understanding of the program, and its objectives and goals, and provided a basis for developing logic models.
- **Interview program and implementation staff**. Informal interviews with program and implementation staff provided a more in-depth understanding of the program, implementation activities, and processes as well as expected outcomes. Based on information gathered in the first two steps, Cadmus developed draft logic models and linkage tables.
- **Review of logic models with program staff.** Cadmus developed four logic models: one for the overall ESI Program, and three for the Energy Management Pilot components (Energy Project Manager, Track and Tune, and High Performance Energy Management). Draft logic models and linkage tables were presented to BPA program, evaluation, and

planning staff through a workshop. Based on the feedback obtained during this workshop, we revised the logic models and finalized them with the ESI team.

- **Integrate logic model indicators**. Using the logic model and, specifically, the logic model indicators, Cadmus developed a list of data requirements specifying optimal data types and formats as well as data collection timing. In addition, Cadmus' review of the TrakSmart database was informed by whether the database contained the information needed to track the program's logic model indicators.
- **Review of the program database**. Cadmus conducted a preliminary review of the database structure, and sent comments to the BPA Industrial team. In addition, we reviewed a preliminary version of the TrakSmart database and provided comments
- **Develop detailed list of data needs.** Cadmus developed a detailed data request based on the logic model and previous evaluation experience with industrial programs. Data requirements are discussed in Section 3.
- **Review Measuring, Tracking, and Reporting (MT&R) approach.** Cadmus provided feedback on the implementation team's MT&R approach that the implementation contractor plans to apply in cases where savings cannot be captured through typical M&V approaches.

The results from the above activities are organized into the following sections of this document:

- Section 2: Document Review and Logic Models
- Section 3: Data Requirements and Database Review
- Section 4: MT&R Review
- Section 5: Evaluation Issues

2. Document Review and Logic Models

Overview

Cadmus reviewed two versions of the Program Delivery Manual[1] and BPA's Implementation Manual,[2] and conducted initial interviews with program management and other BPA staff involved in planning and implementation of the program.

Cadmus used information from the program documents and interviews to develop logic models for the overall program as well as for each of the three elements of the Energy Management Pilot included in the program. Appendix A provides logic models and corresponding linkage tables.

[1] Dated September 29, 2009.
[2] Dated October 1, 2009.

3. Data Requirements and Database Review

Overview

Cadmus reviewed TrakSmart, the primary ESI Program's project tracking database. As part of this review, we received "read only" access to the database, and attempted to generate a variety of reports reflecting what an evaluator would request while evaluating the program. The reports were prepared with the following aims:

- To track overall program progress in a manner consistent with the logic model indicators;
- To pull reports for determining survey and site visit samples; and
- To access site-specific data needed for M&V site visits.

During our analysis, we recognized database development was in progress; hence, some items noted in this report may eventually be addressed through ongoing database improvements. This section notes, however, all items currently an issue to ensure complete documentation of our findings. In addition, there were few projects in TrakSmart during our review; thus, our ability to generate certain reports and assess data quality was limited.

Cadmus sent initial comments to the ESI team to review and the ESI team responded to the identified database issues. In general, the TrakSmart structure is sufficient and the database is set up to collect key data required by evaluators. However, there are a few remaining database issues or items that need to be addressed on an ongoing basis. This section summarizes the outstanding database issues and provides an overview of evaluation data requirements.

Database Issues

Overall Data Quality

While Cadmus found that TrakSmart provides for the collection of key data, the actual use and population of the database is a separate issue. A database that provides for data entry, but has missing or inaccurate data is not useful to evaluators. Two potential data quality issues were noticed during our review of the database: completeness and consistency.

Data Completeness

Although we recognize TrakSmart is in development, it is important to note, for projects entered, some key data fields are not populated. We cannot stress the importance of thorough data-keeping from an evaluator's point-of-view. While implementers have intimate knowledge of projects and participants, evaluators have less familiarity with a program and need as much information as possible to understand project parameters and context. Key data include:

1. Customer information, such as SIC Code or type of facility.
2. Complete contact information for facility and facility personnel.
3. Participants' electric providers.
4. Project information (e.g. savings, measure description).

The ESI team noted that contact information is sometimes difficult to provide. For evaluation purposes, contact information is necessary. It is unlikely that implementation staff do not have

contact information for anyone at the participant site, as coordination must occur to complete the project and transfer the rebate. Thus, Cadmus sees no reason why contact name and phone number should not be obtainable.

Data Consistency

The ESI team provided naming conventions for unique site ids, facilities, and projects. The naming conventions are logical and appropriate. However, it appears they are not yet consistently applied in TrakSmart for all projects. It is important to ensure variables are entered in a consistent manner, particularly when drop down lists and validated fields cannot be employed.

Quality Control Process

The data quality issues can be easily addressed with a quality control review process similar to the process developed for MT&R. The ESI team provided an overview of various strategies they are employing to ensure correct and consistent use of the database such as the training of "super-users," who have in-depth knowledge of the database; though it appears there is no formal data QC process in place. The team should consider developing a more formal review process to address availability and consistency of data as well as responsibility for data corrections. For example, the engineer performing the QC engineering review could also check for data accuracy and completeness.

Cancelled or Withdrawn Participants and Projects

TrakSmart currently protects records by making it difficult for users to delete project entries. As such, the system does not allow data entry errors to be corrected. If a significant data entry error occurs, the project status is converted to "cancelled," and a new entry is populated with the correct information. Currently, users are including the word "Delete" into the title of their project to indicate entries that should be removed. A database administrator will delete these items quarterly. While this is an adequate short-term fix, Cadmus recommends a more consistent way to identify cancelled projects.

Not being able to identify cancelled projects is problematic, as an evaluator may want to survey participants that withdrew from the program or cancelled their project. In addition, an evaluator likely would summarize participation records and examine withdrawn participants for trends, but such end-users currently cannot be identified in TrakSmart. Note that the mix of error and cancelled records will result in extra time for the evaluation team to identify cancelled projects. If the evaluation team needs to survey withdrawn/cancelled projects as part of a process evaluation, this could result in contacting end users under the wrong context (i.e., the project was not cancelled). Based on anecdotal evidence, end users are generally unhappy when they are contacted with incorrect and missing information the utility should have on record.

Measures and End Uses

The ESI team has indicated that a majority of measures entered into TrakSmart will represent one measure, not a bundle of measures as indicated previously. The only case where multiple measures may be entered as a bundle is when multiple measures are integral for the savings calculation (e.g. refrigeration systems). As measures are entered as single entries, we recommend

the ESI team add an end use category to further categorize individual measures; this could be done through a drop down list to ensure consistency. Without end uses or consistent measure categorization, an evaluator will likely need to do a significant amount of manual work to bin the various projects and measures. Site visit and application review samples are often stratified by program, type of measure or end use, and magnitude of savings, thus, these data should be readily available.

Data Dictionary and Database Map

Currently, there is no data dictionary or database schema for TrakSmart. However, the ESI team has developed a TrakSmart "Wiki," that acts as a user guide for the tracking system, and the team has also appointed "super-users," who have been trained on the database and will facilitate knowledge transfer to other users. While these are useful strategies for program implementation, there are no tools for users other than implementers.

It is important to note not all database users will be "super-users" and a data dictionary or database schema would provide a consistent understanding of TrakSmart to infrequent users. A dictionary or schema would be very useful to third-parties requesting data (such as evaluators) and would provide an easy reference point for evaluation contractors or other parties submitting data requests, and act as a reference source to indicate where data are stored in the database. It is important to note that one of these items may be requested by an evaluator, or definitions may need to be developed for third-party data requests.

Utility Data

As discussed with ESI staff, utility specific information is tracked in a system outside TrakSmart. This approach is acceptable, though, the team should confirm the following data are tracked: engaged utilities, utility savings goals, elements of the ESI Program utilities have signed up, and ESIPs connected to a utility. From an evaluation perspective, such information is essential to determine whether the ESI Program is functioning properly and per program logic.

High-Level Evaluation Data Requirements

Appendix B provides an overview of typical data requirements for an evaluation. The table is organized into three columns:

- Data element required for an evaluation;
- Purpose of data element; and
- Assessment of data availability.

The far-right column provides a summary of additional information required for the evaluation process. In addition to high-level evaluation data requirements, we have provided a detailed data request in Appendix B, which is similar to the type of data an evaluator would require to sample projects and conduct M&V site visits.

4. MT&R Review

Overview

Cadmus reviewed the proposed MT&R (Measure, Track, and Report) Process as it is described in the MT&R Process Flow Chart Rev. 1.0 and the Process Outline for process logic and completeness and the evaluability of any resulting savings estimates. In general, the proposed Process will enable Cascade Energy Engineering to adequately measure, track, and report savings in industrial facilities and a third party to evaluate the estimated savings. Our review did, however, raise a number of questions regarding the proposed Process and result in a few suggestions for improvements.

Cascade reviewed and responded to The Cadmus Group's initial comments on the MT&R Process. Where applicable, Cascade updated the Process Flow Chart to provide detail and clarity to the process. Overall, Cadmus thought the ESI team addressed the comments in a thoughtful and complete manner. The improvements to the MT&R process will provide evaluators enough data and context to validate savings measured through the process.

This chapter provides a summary of the issues we noted, followed by Cascade's response addressing the noted issues.

MT&R Issues

Model Specification

Cadmus believes that the savings claims will be more reliable if the first step of the Process included the development of a conceptual energy use model that clearly identified the factors bearing on energy consumption. It is recommended that Cascade specify the theoretical influences by plant or process type for consistency among analyses. Such a model or theory should then guide data collection, model specification including the choice of explanatory variables, functional form, and estimation methods as well as data cleaning. Also, the theoretical model should also be specified in each MT&R report by plant or project.

Also, sections 4.3 and 4.6 of the MT&R Outline describe the selection of model specification. It says "Choose the curve, or combination of curves, that best characterizes the correlation pattern." Cadmus recommends that the model specification be guided a conceptual model based on economic and engineering principles that is developed at the beginning of the MT&R process. Basing the model specification on the correlation pattern alone can yield a model with high explanatory power but little logic.

ESI Team Response:

Section 1.1 in the Process Outline has been updated with a description of a base theoretical model as well as a requirement to match the physical process characteristics. Note: There currently are not enough models from which to establish separate base models for specific plant or project archetypes. These can be developed as more models are created, assuming they show repeatable characteristics.

Section 4.7 in the Process Outline has been added requiring the statistical model to reflect the physical characteristics of the process and conform to standard engineering and economics principles. A section in the MT&R report has also been added to document the rationale for the model in terms of these requirements.

Data Scrubbing

Cascade has included steps where "data scrubbing" will occur. In particular, Cascade will "Close any gaps where either energy usage variable or energy consumption data is missing or has been omitted due to special cause." Cadmus believes that this language is too vague and allows for too much freedom in treating missing or omitted data. It is recommended Cascade developed a more specific set of rules or protocols for how it will deal with suspect observations. There is a large literature in statistics and econometrics that deals with the issue of missing, censored, or wrongly measured observations that Cascade could consult. At a minimum, Cascade should very clearly document clearly all data cleaning steps in the MT&R report (to the level that they can be reproduced by an evaluator) and ideally test and comment on the sensitivity of the results to the steps.

ESI Team Response:

Additional data errors definitions have been added to section 3.3 in the Process Outline. Also, Section 3.5 in the Process Outline has been entirely rewritten to include specific rules and protocols on handling data errors. The Data Analysis section in the MT&R Report Template requires a full explanation for any data adjustments. In addition, ESI feels confident that the internal review process (Section 5.3) will provide a screening to make sure the data will not be "cleansed" in to favor a desired outcome. Third party evaluators will also have full access to original data in order to check the effects of any data corrections.

Exit Ramps

Details and protocols for acceptable actions at the MT&R flow chart "exit ramps" should be defined and consistent among projects. First, the options for the methods to be used as exit ramps should be defined to create consistent options across the program. For example, Section 5.4 indicates that "if model does not meet standards, a formal exception request can be submitted to the EPT Team." What would be the grounds for an exception? Why establish standards if they will not be adhered to? These protocols are also related to recommendations related to model specification. Defining the options at the exit ramp will help ensure consistent MT&R.

ESI Team Response:

Exit ramp is defined in Section 1.6 of the Process Outline. Alternative approaches must meet standards outlined in the IPMVP EVO 10000 - 1.2007. Sample alternative approaches are listed in section 1.6.

Additionally, to support consistency of approach, two sections have been added to the MT&R Report Template that require the analyst to document the reasons why MT&R is not suitable and to identify what alternate approach will be used and why.

Grounds for an exception would be just falling short of meeting one established criteria. For example if R2 were .71 (just below the .75 standard) and all the other criteria were well within the established ranges then an exception may be applied for. Additionally, if only 11 (of the required 12) data points were available, yet all of the correlation variables were very strong this would be another potential exception. This process allows the flexibility to apply judgment in using strongly correlated data sets that just barely miss the mark in one aspect. Any such exceptions would need to be documented in the MT&R report and approved by the EPT panel.

Baseline Specification

Section 2 describes the collection of baseline data and specifies criteria for determining the minimum length of the baseline period as a function of the number of coefficients in the model. What will Cascade do in situations in which the baseline period is too short, i.e., does not satisfy the minimum requirement? Section 4.1 also describes the determination of an appropriate baseline timeframe. The Outline indicates that "an ideal target timeframe is one year." However, what if a year does not satisfy the criteria for the minimum baseline period (2×number of coefficients as stated in Section 2)? Cascade should make sure there is not an inconsistency with other steps that discuss baseline timeframe.

ESI Team Response:

ESI plans to adhere to target guidelines outlined in the process, but realizes there may be situations, particularly where there is only monthly data, which may fall short of the standard for minimum number of data points. These situations will need to be dealt with individually with a number of optional responses including: Delay baseline establishment until enough data is available. Grant an exception (for fewer points) if the correlation is tight. Or, switch to daily data collection, either manual or install interval metering (if available), to quickly collect enough points to meet standards.

Multi-year Savings Estimation

The documentation should include a section about multi-year savings tracking, as the incremental impacts are essential for tracking the BPA program. For example, the documentation should address how baseline changes after year one will affect multi-year reporting.

ESI Team Response:

An entire new Section 8 in the Process Outline and Flow Chart has been added that outlines the steps for tracking savings and making any adjustments in years two through five. In addition a new report –"The MT&R Yearly Update Report Template" has been created to document any adjustments to the baseline or calculations and report the Cusum savings in years two through five.

Defining Approaches to Capital Projects

The documentation should more clearly address the methods that will be used to account for the savings for capital projects.

ESI Team Response:

Sections 7.4 and 8.9 in the Process Outline require project savings to be calculated based on standard methods as documented and approved in the PTR history and according to IPMVP protocol.

Model Diagnostics and Evaluation

Sections 4.5 and 5.1 describe criteria for assessing the fit of the model including R^2 and the coefficient of variation. How will the coefficient of variation be used in assessing the model? Also, Section 5.1 indicates a minimum correlation requirement of at least 0.75. While high explanatory power is desirable, this threshold seems arbitrary. Is there any theoretical justification for 0.75? Cadmus recommends that in addition to the R^2 statistic Cascade pay attention to and report the sign and statistical significance of the coefficients in the model.

ESI Team Response:

As a normalized measure of the dispersion of the model, the coefficient of variation is used to assess the "tightness of fit" of the data about the regression line or curve. The smaller the dispersion (as measured by the coefficient of variation), the more reliable the model is in measuring the energy savings determined by the difference the between the established baseline and future actual measurements.

For R^2 value, see IPMVP EVO 10000 - 1.2007, Appendix B, Pg 93 – "0.75 (for R_2) is often considered a reasonable indicator of a good casual relationship amongst the energy and independent variables." Also, see response to Transparency and Reporting. The MT&R Report will include the T-statistic for the coefficient of each independent variable included in the model.

CUSUM Approach

Section 6 describes the CUSUM Model and the estimation of energy savings. In the CUSUM framework, energy savings are estimated as the difference between actual consumption in the treatment period and the counterfactual energy consumption in the absence of program involvement. The counterfactual is generated using a regression of consumption on observable consumption drivers in the baseline period. Will the CUSUM model be able to control for impacts on energy consumption in the treatment period that are unrelated to the implementation of energy efficiency measures? If yes, how will the model control for such impacts?

An alternative approach would be to estimate savings in a regression of energy consumption on observable drivers that includes a variable for the implementation of energy efficiency measures and using observations in the baseline and treatment periods. Savings would be estimated using the regression coefficients for the energy efficiency interventions.

ESI Team Response:

An important exercise with CUSUM is observing changes in energy consumption and documenting an assignable cause (See Sections 6.5 and 8.2 in the Process Outline). The CUSUM, like a quality control chart, provides feedback that a significant shift or trend has taken place and allows the End User to search and associate a cause while "the trail is still hot". In our experience to data, in almost all cases a significant shift (up or down) can be explained with an assignable cause. IN SOME CASES these causes are NOT related to energy efficiency efforts, but rather to some other external or unrelated event. In these cases the cause and effect is still traceable, will be documented in the MT&R report and adjustments made if needed.

We recognize the value of pooled regression and plan on exploring further its application. However, we feel the CUSUM approach is more adapted to successfully achieving HPEM program goals. A key aspect is it's "user friendliness" making it more accessible for End Users

to understand and adopt into their own energy management practices.

Transparency and Reporting

MT&R must result in an estimate of savings that can be evaluated and replicated by a third party. The particular software tool that Cascade employs will probably not be important to the evaluator, but they may request the data and a complete description of model specifications and estimation methods.

Also, Cadmus recommends that the Energy Savings Analysis Report include summary statistics for energy consumption and observable drivers for the baseline and treatment periods. This will enable the evaluator to determine whether the estimated savings are plausible. In addition, Cadmus recommends that the Report provide more detailed regression output including estimated standard errors and t statistics, F statistics, and any other test statistics used to detect collinearity, heteroskedasticity, and autocorrelation.

ESI Team Response:

ESI plans on including in the MT&R report the table of statistics provided in the Excel statistical package which includes all of the "traditional regression statistics" including: standard errors, t and F statistics, plus others. ESI has also added a statistical test (see Sections 7.2 and 8.7 in the Process Outline) to compare energy consumption between the baseline and treatment periods to statistically verify the plausibility that energy savings have occurred.

In addition, ESI will make available to an evaluator the complete data set used to generate the model. An evaluator will be able to import this data into the statistical package of choice to conduct their own specific, specialized tests and analysis to compare with the MT&R results.

5. Evaluation Issues

In general, there are two parts of an energy efficiency program evaluation:

- Impact evaluation, which focuses on the actual energy impact of the program, and
- Process evaluation, which focuses on the program implementation.

The ESI Program will be subject to both impact and process evaluation. This chapter presents general evaluation objectives and common issues evaluators encounter when evaluating industrial programs. Impact and process evaluation issues are presented separately. We also provide suggestions for evaluation timing.

Impact Evaluation

The ESI Program impact evaluation's objective primarily is to answer the following question: Did BPA meet its industrial sector targets cost effectively? (In other words, did BPA attain the savings they have paid for?)

During an impact evaluation, the evaluation team will verify the savings estimates reported by program implementers and provide an adjusted value if corrections are made to the reported savings. Evaluation contractors verify savings through a variety of methods, including (but not limited to): documentation and application review, database review; site visits; and in situ metering. An evaluator would specifically report the following values:

- *Gross savings*: Total reported Program savings by BPA.
- *Verified Savings*: Total savings verified by an independent evaluator.
- *Realization Rate*: The ratio of verified to gross savings.

Savings verification activities vary by program components, and each of which have various impact evaluation issues. The following issues may affect the final verified program savings:

- **Documentation Quality.** Project records should be consistent and complete. Improper or incomplete documentation of measure details, operating assumptions, or savings calculations can lead an evaluator to discarding or lowering savings from projects.
- **Installation Verification.** An evaluator may verify an incented measure has been installed as claimed by program documentation (e.g., make, model, efficiency level), and the participant has not removed the measure after installation.
- **Installation Quality.** An evaluator may also verify an incented measure has been installed properly and to specifications of deemed measure requirements or custom measure assumptions.
- **Savings Calculation Errors.** Incorrect assumptions for measure savings calculations or MT&R model specification may affect validated savings. Ideally, these errors are corrected during the implementer's QC process. In the event of calculation errors, an evaluator would adjust savings to be in accordance with the correct assumptions.

- **Incorrect Baseline Specification**. As with calculation errors, mistakes in baseline specification may result in evaluator adjustments to project savings. This could apply to MT&R projects as well as other custom calculations. Baseline specifications should have some consistency among similar project types, and should be clearly defined in the project records.
- **Bad Data or Lack of Data.** Missing or incorrect data affect an evaluator's ability to verify project savings. Erring or missing data can be due to implementer error, though some participants may experience data limitations due to equipment age or facility configurations. These limitations and the assumptions arising from them must be clearly documented for evaluators.
- **Measure life.** Incorrect measure life assumptions may affect expected outcomes of CE tests.
- **Measure persistence.** Measure persistence is less well-documented for O&M or behavioral changes than for capital measures. Assumptions regarding measure persistence, if applicable, need to be substantiated and well-documented.
- **Double Counting.** For participants utilizing MT&R for measure savings, in addition to other custom or deemed savings projects, saving may be overestimated due to double counting. The MT&R approach should provide a reliable method of removing savings from other projects from the overall estimate.
- **Implementation Timeframe.** The timeframe in which an end user installs measures or implements projects must fall within the program year or period. Measures installed prior to the program's start or after the program period's end (even if an application was submitted) may be excluded from verified savings estimates as they cannot be directly attributed to that program period.

Table 1 lists of typical impact evaluation issues and how they apply to each program component.

Table 1. Savings Verification Issues by Program Component

	Deemed	Custom Capital	Energy Project Manager	Track & Tune	HPEM
Documentation quality	✓	✓	✓	✓	✓
Installation verification	✓	✓			
Installation quality	✓	✓			
Calculation errors	✓	✓	✓	✓	✓
Baseline Specification (Incorrect Assumptions)		✓	✓	✓	✓
Bad data	✓	✓	✓	✓	✓
Measure Life		✓			
Measure Persistence		✓	✓	✓	✓
Double Counting	✓	✓	✓	✓	✓
Implementation Timeframe	✓	✓	✓	✓	✓

Impact Evaluation Indicators

Based on logic models Cadmus developed with the ESI team, Table 2 shows key indicators an evaluation contractor would likely use to inform an impact evaluation. The impact evaluation entirely relies on the program's ability to clearly document and track projects, savings, savings estimates, implementation rates, and incentives. While evaluator activities confirm project sample details, program data are the primary source of this information.

Table 2. Key Impact Evaluation Indicators

Impact Evaluation Indicator	Data Source	
	Program Tracking	Evaluator Activities
Cost per kWh scoped	✓	
Realization rates by M&V project, type, and TSP and non-TSP	✓	✓
Number of participant utilities	✓	✓
Number and type of projects per utility	✓	✓
Percent of participant utility industrial goal achieved	✓	✓
Number of projects and savings by participant utility	✓	✓
Number of project leads	✓	
Number of EM projects implemented	✓	✓
Number of projects implemented	✓	
Number of measures implemented	✓	
kWh savings, overall and by program element	✓	✓
Estimated and measured savings estimates	✓	✓
Number of projects verified by type	✓	✓
Number of projects financed with incentives	✓	
Amount of incentives paid by type of project (custom, deemed, EPM, T&T, HPEM)	✓	
Final cost of project and percent covered by incentive	✓	
Number of plants participating in each energy management component	✓	✓
Number of plants that achieve contract goals	✓	✓
Capital and O&M savings at participant plants	✓	✓
Long term energy management plans and savings goals	✓	✓
Number of O&M/behavioral projects that achieve savings and receive incentive payments	✓	✓
Energy intensity information and calculations by plant and project.	✓	

Impact Evaluation Timing

Impact evaluations typically occur after the first program year. As the ESI Program started last fall, and the Energy Management Pilot is just beginning, we recommend that impact evaluation start in the spring, to evaluate the energy savings impact in the ESI Program's first full year.

Process Evaluation

Process evaluations, at their most basic level, help determine what does or does not work for a program. Process evaluation results provide context to help program managers interpret observed program outcomes (for example, they may reveal why a program did not achieve expected market penetration). These results are informed through:

- Documenting program processes, and comparing program logic and process maps to actual implementation.
- Determining whether the right data are tracked properly and in the right format.
- Identifying operational issues and customers' (both utility and end user) responses early in implementation, so necessary improvements can be made quickly.
- Identify market barriers, and examine how successfully the program addresses these market barriers.

The ESI Program faces market barriers at two levels: utility customers and end users. The program emphasizes relationships with utilities, and a program goal is to reduce administrative burdens on utility customers. These issues and relationships would be explored as part of a process evaluation. Specific observations may include identifying participant utility characteristics and understanding the industrial energy-efficiency activities outside the program.

With regard to end-user barriers, the process evaluation would examine characteristics of participants (which project types, why some do a great deal and others undertake only minor projects); and nonparticipants (to identify systematic trends). Success at the end-user level is dependent on the relationship between BPA and implementation contractors. Thus, process evaluation activities would examine the effectiveness of coordination and communication among ESI staff, EERs, and implementation contractors, and between implementers and utilities.

Process Evaluation Indicators

Based on the logic models Cadmus developed with the ESI team, shows key indicators likely used by an evaluation contractor to inform the process evaluation.

Table 3. Key Process Evaluation Indicators

	Data Source	
	Program Tracking	Evaluator Activities
Number of utilities using ESI marketing materials	✓	
Number of leads provided by non-BPA or utility partners	✓	
Regional partners' awareness of ESI program		✓
Number of trade allies participating in SI and TAN	✓	
Percent end users and trade allies aware of ESI offerings (participating utility service territory only)	✓	
Number of participant utilities	✓	
Number and type of projects per utility	✓	
Number of ESIPs	✓	
Utility satisfaction with program		✓
Number of utilities offering each energy management component	✓	
Issues identified during M&V process	✓	✓
Number of applications with significant problems / deviations in savings noted	✓	✓
Number of project leads compared to projects implemented	✓	
Consistency and completeness of record keeping	✓	✓
Level of participant's energy efficiency awareness and knowledge		✓
Time required for COTR approval	✓	✓
Months needed to turn project lead into a completed project	✓	✓
Repeat customers or vendors (number of projects per customer/vendor)	✓	
Number of satisfied utility participants		✓

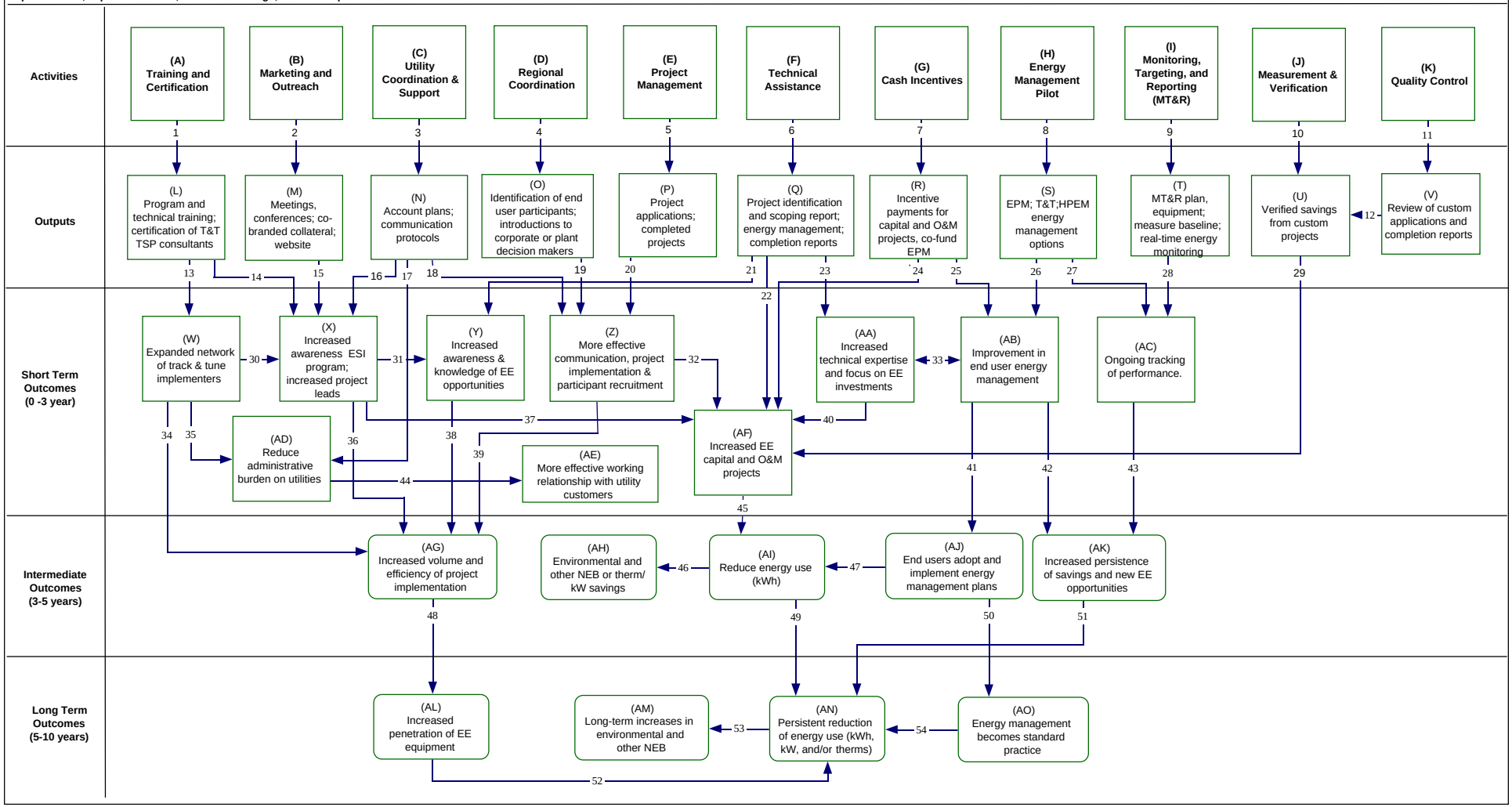
Process Evaluation Timing

Involving an evaluator early in the implementation process is ideal as the evaluation can work in concurrence with the program and provide timely and relevant feedback during each program year. Cadmus recommends establishing an evaluation contractor by Fall 2010 to provide feedback, beginning with the program's first year of implementation (2010).

Appendix A: Logic Models

Logic Model for BPA Energy Smart Industrial Program

Inputs: Funds, experienced staff, market knowledge, network of partners.



Linkage Table for BPA Energy Smart Industrial Sector Logic Model

Link #	Impact	Program Theory	Potential Indicators
1	Trade allies, utility partners, end users, and Technical Service Proposal (TSP) consultants have increased awareness of Energy Smart Industrial (ESI) Program and gain specific technical skills (by end use, O&M, energy management related). Certification of Track & Tune) T&T consultants will result in pool of TSP consultants able and willing to offer T&T services in a consistent manner.	Trained trade allies and utility partners increase the technical capabilities and program awareness, and ensure consistent implementation of the ESI program. This addresses knowledge, skill and awareness barriers. Training activities will also occur at the end user level, and will help increase ESI program awareness and technical capability.	- Number of trainings conducted by type - Number of TSPs certified to provide T&T services
2	Increased awareness and use of co branding promotes the program to end users.	End-users and trade allies learn about ESI program offerings through 1-on-1 contact with ESI staff; this addresses information barriers. Marketing collateral distributed at conferences and meetings (e.g. NWFPA, utility conferences) increases awareness of the Program and EE offerings. Providing co-branded marketing materials will reduce marketing burden on utilities, optimize messaging consistency and provide assistance to utilities in promoting ESI participation to end-users.	- Number of utilities using ESI marketing materials - Percentage of surveyed customers reporting Program awareness - Number of marketing collateral pieces developed
3	BPA communicates effectively with participant utilities and their customers.	Account plans will facilitate coordination between BPA and each utility resulting in: 1. a more coordinated approach of end-users, 2. reduction in confusion at the end-user level, 3. optimized project implementation due to shared understanding of end-user account plans, and 4. optimized communication with end users which reduces contact fatigue and potential for confusion among end users. Specification of communication protocols will result in effective communication between all parties and develop effective working relationships between utilities and BPA staff.	- Number of participant utilities Number and type of projects per utility - Number of account plans
4	Coordination with regional partners (NWFPA, ETO, NEEA, etc) generates	Close coordination with other market actors helps leverage industry knowledge, experiences, and knowledge about end-	- Number of trainings collaboratively offered

Link #	Impact	Program Theory	Potential Indicators
	potential leads, offers introduction at end user sites and facilitates information sharing.	users to identify projects and likely participants. In addition, regional coordination will prevent two organizations from pursuing the same end user for EE projects. Regional partners, such as the DOE and WSU, offer trainings that can be used by ESI Program participants. Leveraging existing relationships with trade associations can provide potential leads and introductions at targeted end-user sites.	- Number of end-user sites for which BPA coordinates with other agencies - Number of leads provided by non-BPA or utility partners - Regional partners' awareness of ESI program
5	Projects are managed efficiently with Program resources (e.g. ESIPs). Utilities have access to pertinent information via web-based project management tools. Utility participants are relieved of much of administrate burden related to participating in BPA programs.	Dedicated and knowledgeable project managers assigned to each participant utility will ensure effective communication between BPA and all stakeholders, identify and address potential problems, provide assistance to utilities, trade allies, and end-users in administrative tasks, and ensure consistent communication and flow of information regarding BPA programs and offerings. BPA develops and uses effective project management tools to share information and provide key stakeholders with needed access to data.	- Number of ESIPs - Consistency and completeness of record keeping - Use patterns of project management tools
6	Technical assistance improves end users' ability to identify and complete projects.	Lack of familiarity with or lack of resources for energy efficiency is a barrier to project implementation. By providing technical assistance through ESIPs and knowledgeable TSP consultants, end users can receive help in identifying and completing capital and O&M projects, or implementing comprehensive energy management strategies on site.	- Number of participants that receive assistance - Number of outreach efforts to provide technical assistance - Number of TSP participants - Level of TSP workload - TSP level of satisfaction - Cost per kWh scoped - Conversion of TSP to CPP
7	End users decide to implement capital or O&M projects. Incentives address financial barrier and lack of resources.	Up-front cost is a barrier to investing in energy-efficiency. Providing financial incentives tied to energy savings increases the ability to make energy-efficiency investments by directly reducing end-user's cost share of investment.	- Number of projects financed with incentives - Amount of incentives paid by type of project (custom, deemed, EPM, T&T, HPEM) - Final cost of project and percent covered by incentive
8	End users participate in one or more components of Energy management pilot	Staff time and energy efficiency knowledge are barriers to managing energy on a day-to-day basis at an industrial plant.	- Number of utilities offering each energy management component

Link #	Impact	Program Theory	Potential Indicators
	(energy project manager (EPM), track and tune (T&T), and high performance energy management (HPEM)).	Providing funding for an in-house energy manager or for technical assistance to identify low cost, no cost improvements, provides additional resources dedicated toward energy management, increased awareness within a plant, and more projects and energy savings. T&T and HPEM offerings will help identify and demonstrate opportunities for energy management practices to manage energy in a sustainable way.	- Number of plants participating in each energy management component - Number of plants that achieve contract goals - Capital and O&M savings at participant plants - Long term energy management plans and savings goals
9	Track, monitor and establish credible savings estimates by developing Monitoring, Targeting, and Reporting (MT&R) plans, installing monitoring equipment, establishing credible baselines at the plant or end-use levels.	MT&R helps monitor and control a facility's system or sub-systems, and will be employed for energy management projects. Ongoing tracking of energy use and production increases awareness of energy use, and facilitates savings quantification from energy management. Improving end user measurement and tracking will help increase the overall awareness of energy use and its link to production. Rigorous process of developing MT&R savings will produce defensible estimates of savings related to O&M and behavioral changes.	- Number of MT&R plans - Number of sites with sub metering equipment installed - Number of O&M/behavioral projects monitored through MT&R - Number of O&M/behavioral projects that achieve savings and receive incentive payments - Energy intensity information and calculations by plant and project. - Number of sites
10	Credible and verified savings estimates related to all capital projects.	A formal M&V process for capital and some O&M projects ensures energy savings and corresponding incentives are accurate.	- Number of projects verified by type - Estimated and measured savings estimates - Issues identified during M&V process
11	Project information and savings calculations are reviewed to ensure accuracy	The quality control process requires that an engineer independent of a particular project review savings calculation and completion reports to everything has been completed and calculated correctly.	- # of applications with significant problems / deviations in savings noted
12	Savings are verified	The independent engineer review is part of the savings verification process. The review of completions reports and applications provides quality assurance for program projects and savings calculations.	- # of applications with significant problems / deviations in savings noted
13, 14	Training activities expand the number of program implementer and consultants, as	Training of industry partners creates an infrastructure for the program and extends the reach of the ESI program.	- Percent end users and trade allies aware of ESI offerings (participating

Link #	Impact	Program Theory	Potential Indicators
	well as increase the awareness of ESI Program offerings and Program leads.	Trained ESI representatives then promote the program among potential participants and overall Program awareness increases. This expanded network also leads to more project leads.	utility service territory only) - Number of projects (capital & O&M) resulting at sites participating in training - Number of project leads - Number of trained certified TSP consultants - Number of TSPs completing energy management projects
15	Increased knowledge of ESI offerings due to marketing collateral, website, conference attendance and industry networking.	Informational barriers are addressed as ESI representatives reach out to the industrial customers in BPA territory through conferences, meetings, and marketing collateral. Interested utilities can leverage BPA marketing materials on ESI Program.	- Percent end users and trade allies aware of ESI offerings (participating utility service territory only) - Number of utilities using ESIP and ESI marketing materials - Number of trade allies participating in SI and TAN
16-18	Efficient coordination increases program awareness, project leads, and project implementation.	Account plans, in which utilities and BPA specify the responsibilities and communication protocols, promote clarity and efficiency in generating project leads and recruiting end users. The account plans are also designed to reduce the administrative burden on utilities. Result in increased awareness of ESI program offerings, increased number of project leads, increased number of implemented projects, and effective communication among key stake holders.	- Number of projects and savings by participant utility - Number of projects and savings by end use site - Percent of participant utility industrial goal achieved
19	Participant recruitment is streamlined and properly targeted.	Targeting specific end users and plants, as identified through coordinating with regional partners will increase the efficiency of ESI participant recruitment and help prioritize efforts and resources.	- Number of project leads from regional partners - Number of meetings regarding target customers/sectors - Number of projects and savings by end user site

Link #	Impact	Program Theory	Potential Indicators
20	Effective and streamlined day-to-day management of all program aspects and reduction in administrative burden on participant utilities and end users.	One-on-one contact with dedicated project managers (ESIP) ensure effective communication between BPA and all stakeholders, identify and address potential problems, provide assistance to utilities, trade allies, and end-users in administrative tasks, and ensure consistent communication and flow of information regarding BPA programs and offerings. ESIPs use project management tools to share information and provide key stakeholders with needed access to data.	- Number of utility customers per ESIP - Time elapsed from account plan to project completion - Number of steps for completed projects - - Time required for COTR approval - Time required for selecting/contracting TSPs -
21	End users have a heightened awareness of and focus on energy efficiency opportunities.	Provision of targeted and end-use specific technical assistance will provide end use customers with decision quality information regarding EE opportunities and their costs.	- Level of participant's EE awareness and knowledge
22, 23	End users are able to implement projects and explore EE on their own.	Technical assistance—with project identification or energy management opportunities—provides end users and trade allies with key technical skills and tools that will lead to implementation of more capital and O&M projects. These activities also help increase the end user's technical expertise.	- Number of end user and trade ally initiated projects
24, 25	Incentive payments reduce end user's share of project costs.	The cash assistance improves end users' ability to invest in EE. In the case of energy management measures, the incentives motivate facilities to save energy through active energy management.	- Number of projects financed with incentives - Amount of incentives paid by type of project (custom, deemed, EPM, T&T, HPEM) - Final cost of project and percent covered by incentive
26, 27	Participation in energy management pilot provides end use customers with skills, knowledge, and tools to implement O&M projects and make long-term behavioral changes in how energy is managed at the end use level.	Promoting goal oriented energy management program options increases the end users' ability to implement energy management effectively and promotes on-going tracking of energy use.	- Number of participants with an energy plan - Number of plants regularly tracking energy use intensity - List of KPIs tracked as part of plan
28	The use of monitoring equipment and corresponding information increases	Lack of pertinent and useful data and feedback is often a barrier for understanding and measuring the impact of O&M	- Number of plants regularly tracking energy use intensity

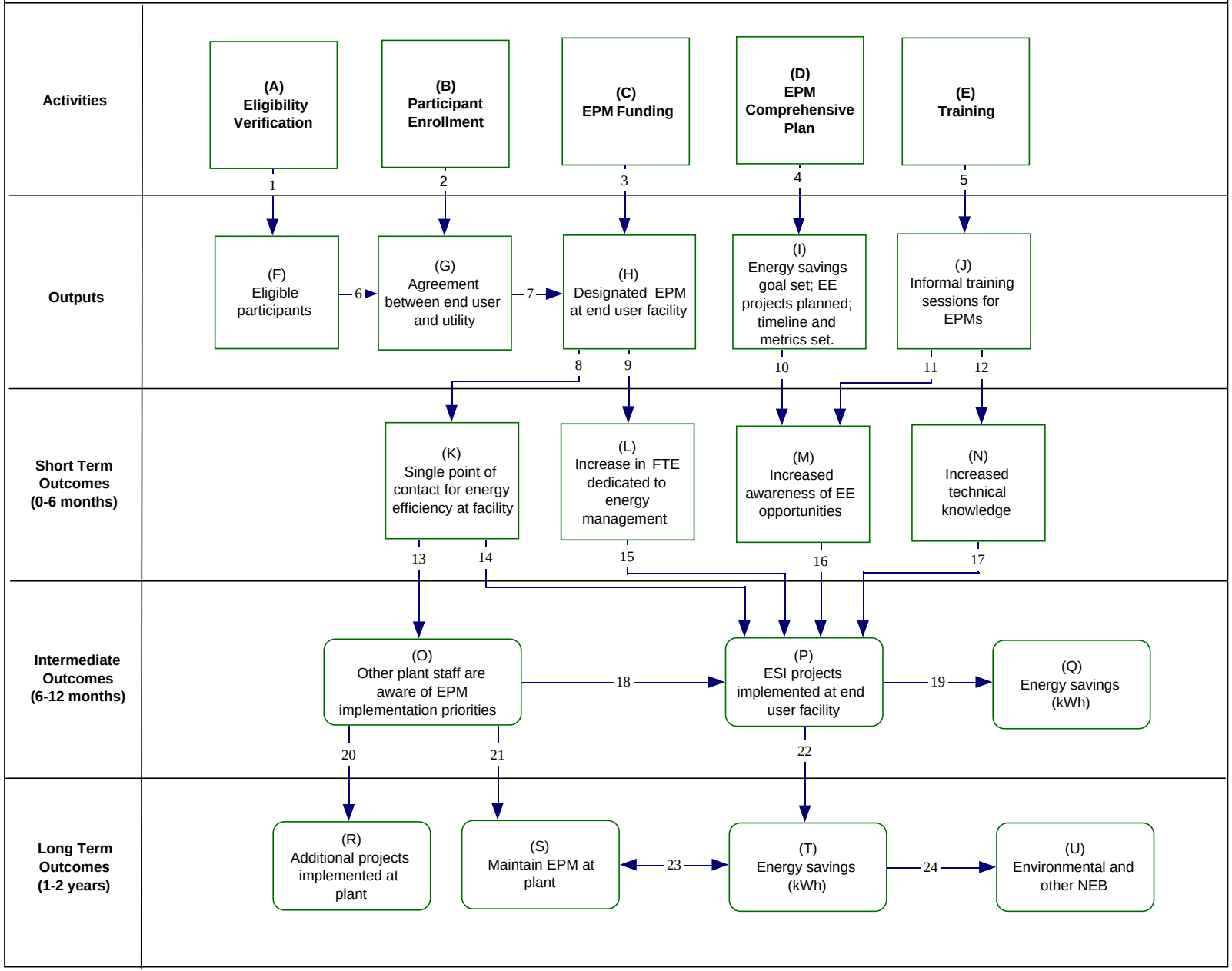
Link #	Impact	Program Theory	Potential Indicators
	awareness of energy usage and promotes the tracking of performance.	projects or behavioral changes. By installing additional equipment or promoting consistent tracking of energy intensity data, the end user can examine the data to make adjustments to processes.	- List of KPIs tracked as part of plan
29	Proof of real savings estimates.	Consistent and rigorous M&V of projects (using traditional and M&V light approach) provides credible estimates of achieved savings. Confirmation of real savings will increase interest by end users and utilities in making investments in energy efficiency.	- Number of projects with M&V - Number of projects with M&V light - Realization rates by M&V project, type, and TSP and non-TSP
30	Increased program awareness and leads.	A sufficiently large network of T&T providers will increase awareness of ESI programs through TSP providers providing services as well as reaching out to customers to promote the services on their own. This in turn is expected to lead to increased project leads. The network also provides the infrastructure for program implementation.	- Number of implementers in the program - Number of certified T&T providers - Projects by T&T provider - The number of leads generated by T&T providers - Percent of survey respondents who know of the program
31	Increased knowledge of EE opportunities.	Promotion of ESI programs by T&T providers will result in increased program awareness.	- Number of certified T&T providers - Projects by T&T provider - The number of leads generated by T&T providers
32	More implemented projects.	Better communication and recruitment results in the implementation of more projects.	- Number of projects - Number of agreements signed
33	Increase in technical expertise and knowledge and improvements in energy management create a feedback loop.	As end users gain more technical knowledge, their ability to manage energy increases. Likewise, as an end user improves energy management through participation in the Energy Management Pilot, their knowledge of what works and doesn't work for energy efficiency improves. Mutual reinforcement loops are developed.	- Types of technical assistance provided by site - Types of energy management services provided by site
34, 35	The infrastructure of a network of implementers fosters increased volume of project implementation and reduces administrative burden on utilities.	Increased program awareness and project leads results in more projects and shorter implementation timelines. Additional implementers and TSP consultants provide resources that utility partners do not need to come up with on their own.	- Utility satisfaction with program - Number of projects - Months needed to turn project lead into a completed project
36-	Increasing awareness addresses the	Increased awareness of ESI Program and EE opportunities	- Number of projects implemented

Link #	Impact	Program Theory	Potential Indicators
38	information barrier.	results in more projects in the short term and more projects and shorter implementation times in the medium term.	
39	Communication and efficiency encourages more projects to be implemented.	Effective communication and a greater number of recruits results in more projects and shorter implementation times.	- Number of projects implemented
40	Increasing technical expertise addresses the information barrier.	Increased technical expertise may lead to additional energy efficiency projects.	- Number of projects implemented - kWh savings
41	End user implementation of energy management plans.	Improved end user energy management results in users adopting and implementing energy management plans.	- Number of end user energy management plans (EPM or HPEM)
42	Persistent energy savings and end user interest in pursuing EE opportunities.	Improved end user energy management results in persistent energy savings and additional EE opportunities.	- kWh savings - Repeat customers or vendors (number of projects per customer/vendor)
43	Persistent energy savings and end user interest in pursuing EE opportunities.	Tracking of performance results in longer term savings and additional EE opportunities.	- Persistent energy management savings (kWh savings)
44	Providing a program with reduced administrative burden improves BPA's reputation and rapport with utilities.	Reducing the administrative burden on utilities ideally leads to more effecting working relationships with utility partners.	- Number of utilities participating in the Program - Number of satisfied utility participants
45	Project implementation results in energy savings.	Increased projects lead to an overall reduction in energy use in the industrial sector.	- Number of EE projects implemented - kWh savings
46	Environmental and other energy benefits.	Reducing energy usage provides environmental and other non-energy benefits (NEBs).	- kW and Therm savings - Reduction in CO_2 emissions
47	Reduced energy use.	The adoption and implementation of energy management plans results in reduced energy use.	- kWh savings
48	Increased penetration of EE equipment.	Implementing projects increases the penetration of EE equipment.	- Number of projects implemented - Number of measures implemented
49	Persistent energy use reduction.	Energy management practices become normal operating behavior resulting in long term reductions in energy use.	- Sustained kWh savings
50	The use of energy management plans is standard practice across the industry.	The use of energy management plans becomes normal operating behavior.	- Number of energy management plans (EPM and HPEM)
51	Persistent reduction of energy use.	As savings persist, end users identify new energy savings opportunities and implement them.	- kWh savings
52	More EE equipment leads to persistent energy use reduction.	Increasing the number of measures implanted increases long term energy use reduction.	- kWh savings
53	Increased environmental and other non energy benefits.	Persistent energy use reduction leads to long term increases in environmental and other non energy benefits.	- kW and Therm savings - Reduction in CO2 emissions

Link #	Impact	Program Theory	Potential Indicators
54	Persistent reduction of energy use.	When energy management becomes standard practice energy savings persist into the long term.	- kWh savings for (EPM, T&T and HPEM)

Logic Model for BPA Energy Smart Industrial Program: Energy Project Manager

Inputs: Funds, experienced staff, market knowledge, network of partners.
Assumptions: Marketing and Outreach, Project Management, and Coordination are addressed at the sector level, refer to sector program logic model



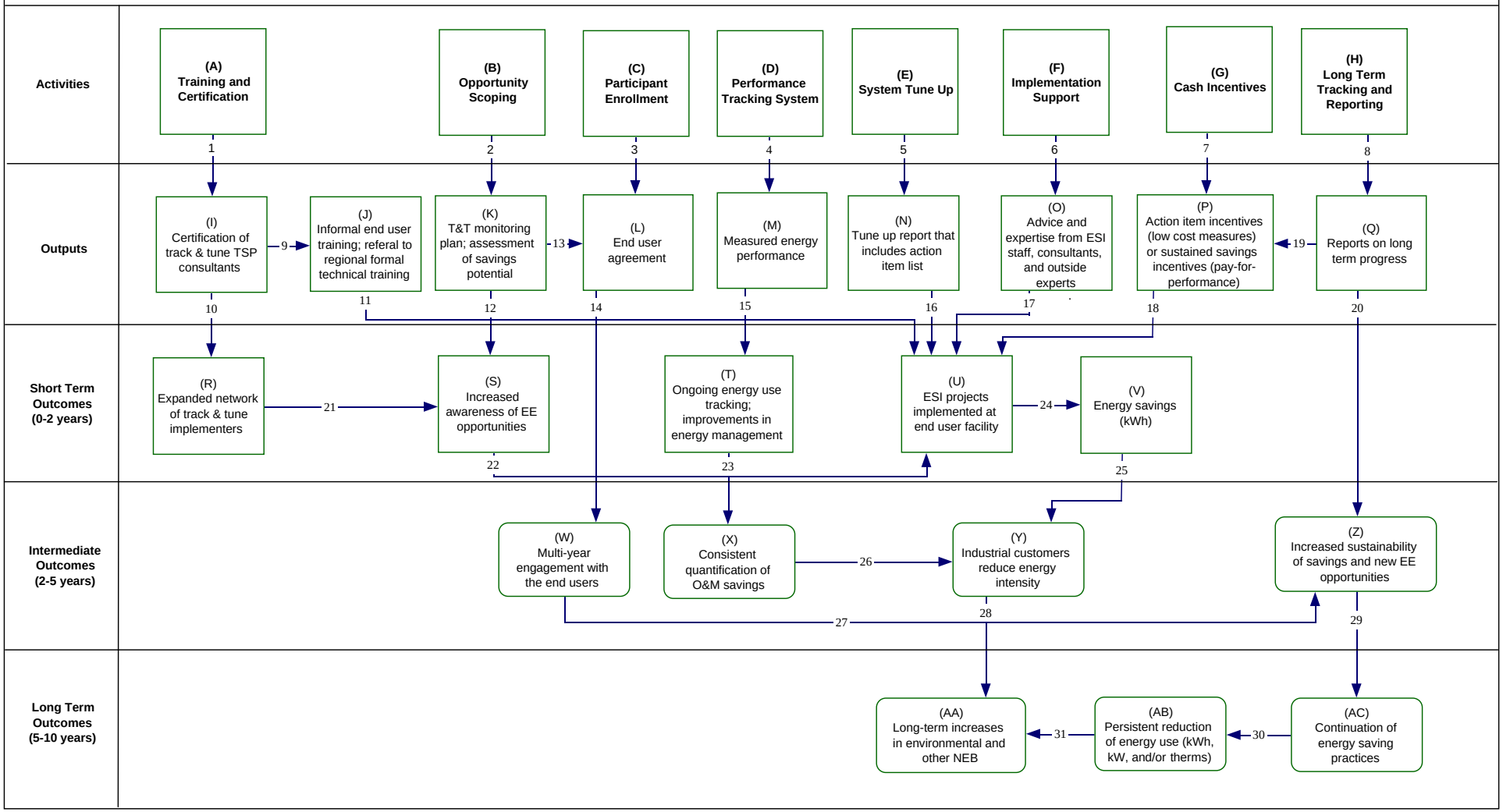
Link #	Impact	Program Theory	Potential Indicators
1	Potential end user sites are screened and eligible participants identified.	ESI and utility staff identify and determine eligibility of potential participants using criteria such as minimum savings goals, access to sufficient capital, and sufficient technical staff to implement Track & Tune projects. Providing co-funding for EPMs meeting these criteria ensures projects with credible and verifiable savings will be implemented.	- Number of utilities offering EPM component - Number of potential end use sites screened - Number of eligible participants - Potential savings by site
2	Eligible end users are enrolled for EPM Co-funding	As part of account planning, utilities will discuss and potentially enroll eligible end users for EPM co-funding by executing a formal EPM agreement.	- Number of EPM agreements
3	End users designate/hire EPM	Lack of funding and technical personnel dedicated to energy management is one of the key barriers to implementing energy efficiency at industrial sites. Providing funding for one or more EPMs per site will fully or partially offset the costs associated with an EPM resulting in end use facility being willing/able to dedicate existing or new staff to energy management and implementing goals laid out in EPM comprehensive plan.	- Number of EPM agreements - Number of EPMs funded by site - Savings goals by site
4	Detailed specification and formal agreement regarding annual savings goals, EPM costs, summary of planned EE projects and associated costs, project timelines, metrics for each end use site.	Joint development of a detailed plan specifying what the end user site will do how, when, and with what expected results sets clear expectations for all parties. Payment triggers and timelines are clearly defined, providing predictability and clarity of resource availability for the end user.	- Number of EPM Comprehensive plans - Annual savings goals by site - EPM costs by site - List of planned projects by site (incl. costs & expected savings) - Project timelines - Metrics - Number of EPMs funded by site - Actual dates of payments to end users
5	EPMs have necessary skills and training to effectively manage energy projects and achievement of savings goals	End users have full authority to select EPMs. ESIPs and other ESI staff will provide informal training as part of their ongoing engagement with EPM.	- Number of EPMs by site - Number of formal trainings attended by EPMs after date of EPM agreement
6	Eligible end users sign 1-year EPM agreement with utilities and secure ESI program approval.	Execution of formal agreement between eligible end users and their utility form a shared understanding of expectations, requirements and payments as well as release initial funds. One year term provides flexibility if interest persists beyond one year.	- Number of EPM agreements by utility - Potential savings by locations - Number of EPM agreements extended beyond one year

Link #	Impact	Program Theory	Potential Indicators
7	Signature of EPM agreement triggers $25,000 in startup funding for EPM as well as ongoing funds.	End users have sufficient financial resources to dedicate or hire EPM staff and begin implementation of EPM comprehensive plan.	- Number of EPMs funded at site - % FTE of EPM dedicated to energy management -
8	Effective communications with internal and external audiences.	EPM functions as single point of contact at end use facility resulting in efficient and reliable communications inside the facility as well as with utility, ESI and other outside staff. EPM will be knowledgeable of opportunities and priorities as well as available resources provided through ESI. ESI (via ESIP) will have up to date information on progress and issues in real time.	- Number of projects and savings implemented
9	Increase in FTE dedicated to energy savings at end use site.	Co-funding of EPM increases FTE dedicated to energy savings and implementing EPM Comprehensive plan.	- Increased energy savings and implementation rate relative to historic delivery - Number of EPMs per site
10	EPM (and end use management) is aware of energy efficiency opportunities	As end users set goals and action items, they increase their awareness of energy efficiency opportunities. ESI staff assistance during this process will help facilitate knowledge transfer.	- Number of proposed projects by type - Expected savings by project
11	EPM has strong command of energy efficiency key concepts and is aware of specific EE opportunities at the site levels	Informal training of EPMs will ensure they understand key EE concepts and have strong awareness of specific opportunities at the site.	- Number of informal training sessions provided by type (T&T, HPEM, etc)
12	EPM has necessary technical knowledge and skills to implement EPM Comprehensive Plan	Informal training will ensure EPMs have the necessary technical knowledge and skills to effectively oversee and manage implementation of ESI projects.	- Number of informal training sessions provided by type (T&T, HPEM, etc)
13	Other plant (management and non-management) staff are aware and supportive of plant commitments under EPM comprehensive plan	EPM informs and engages other plant (operations and management) staff of opportunities and priorities plant commitments under EPM Comprehensive plan.	
14 - 18	Planned ESI projects are implemented	Focused attention and close communications of EPM with internal and external staff, and increased energy awareness ensures projects are implemented in a timely manner.	- Number of projects implemented by type - Savings by projects and type - Percent of savings from comprehensive plan that are achieved
19	Energy savings	Implemented T&T and custom projects result in booked energy	- kWh savings by project

Link #	Impact	Program Theory	Potential Indicators
		savings.	
20	Additional projects implemented at site	As awareness among staff increase, the site will continue to implement energy efficiency projects.	- Additional projects
21	Facility maintains EPM	Meeting goals of EPM comprehensive plan will qualify facility for ongoing or renewal of funding. Energy savings from implemented projects clearly demonstrate the benefit from having a dedicated EPM resource resulting in sites maintaining EPM position with or without ESI funding.	- Number of participants meeting implementation milestones - Number of EPM participants that have funding suspended - Number of sites self funding EPM position after conclusion of ESI program
22	Long-term energy savings	Implemented projects will result in expected/longer-term energy savings	kWh savings by project
23	Long-term energy savings	Maintaining an EPM at the plant will results in long-term or ongoing energy savings.	kWh savings by project
24	Environmental and other NEB are achieved at the plant level as well as outside	Implementation of energy efficiency projects will result in environmental benefits as well as non energy benefits.	kW and therm savings productivity, safety, and maintenance benefits CO2 emissions reductions

Logic Model for BPA Energy Smart Industrial Program: Track and Tune

Inputs: Funds, experienced staff, market knowledge, network of partners.
Assumptions: Marketing and Outreach, Project Management, and Coordination are addressed at the sector level, refer to sector program logic model



Link #	Impact	Program Theory	Potential Indicators
1	Facilities enlisted in T&T component and savings identified. End users and TSP consultants gain specific technical skills for energy management and have increased awareness of the ESI Program.	TSP Consultants will be trained and certified to deliver the T&T component of the ESI Program to ensure consistent and effective delivery of the T&T technical services. Informal trainings offered through TSP consultants and regional partners will help increase the energy efficiency capability of end users.	- Number of trainings conducted - Number of certified T&T consultants
2	End user has clear understanding of energy savings potential by identifying possible energy efficiency opportunities and ways to track energy	Opportunity scoping helps end users identify the low-cost/no-cost energy efficiency opportunities at their plant as well as assists them with a monitoring plan to measure and track future energy efficiency projects.	- Number of scopings
3	Participation in T&T increases	As part of account planning, utilities will discuss and potentially enroll eligible end users for T&T through an official agreement; contract length for T&T is 5 years. Program services, end user commitments, schedules, and potential incentives are outlined in the agreement.	- Number of participants - Number and types of tracking systems installed
4	Performance tracking systems are installed at end user plants, enabling them to calculate a baseline and future energy savings	End user and MT&R staff are able to track and measure the effects of implementing action items and O&M measures.	- Length of time to set up tracking system at facility
5	End users have specific list of action items of low-cost or no-cost energy upgrades that can be done quickly	A tune up assesses how a system is operating and provides a final tune-up report that contains a list of action items, a summary of the facility and system operations, a savings estimate for the action items, and supporting documentation. This report helps the end user determine which energy efficiency actions to implement.	- kWh saving estimates - Number of final tune up reports - Cost estimates per site
6	End users have access to knowledgeable Program staff to complete projects and increase their technical knowledge	TSP consultants or outside experts will provide project implementation assistance to end users as necessary. This will help end users implement projects suggested in the system tune up in the event they do not have enough internal knowledge to complete the projects.	- Number of action items implemented - Number of action items ESI staff assisted on
7	End users implement low cost or O&M projects and incentives	Up-front cost is a barrier to investing in energy-efficiency. T&T financial incentives will make it easier for facilities to implement	- Incentives paid - $/kWh of incentives

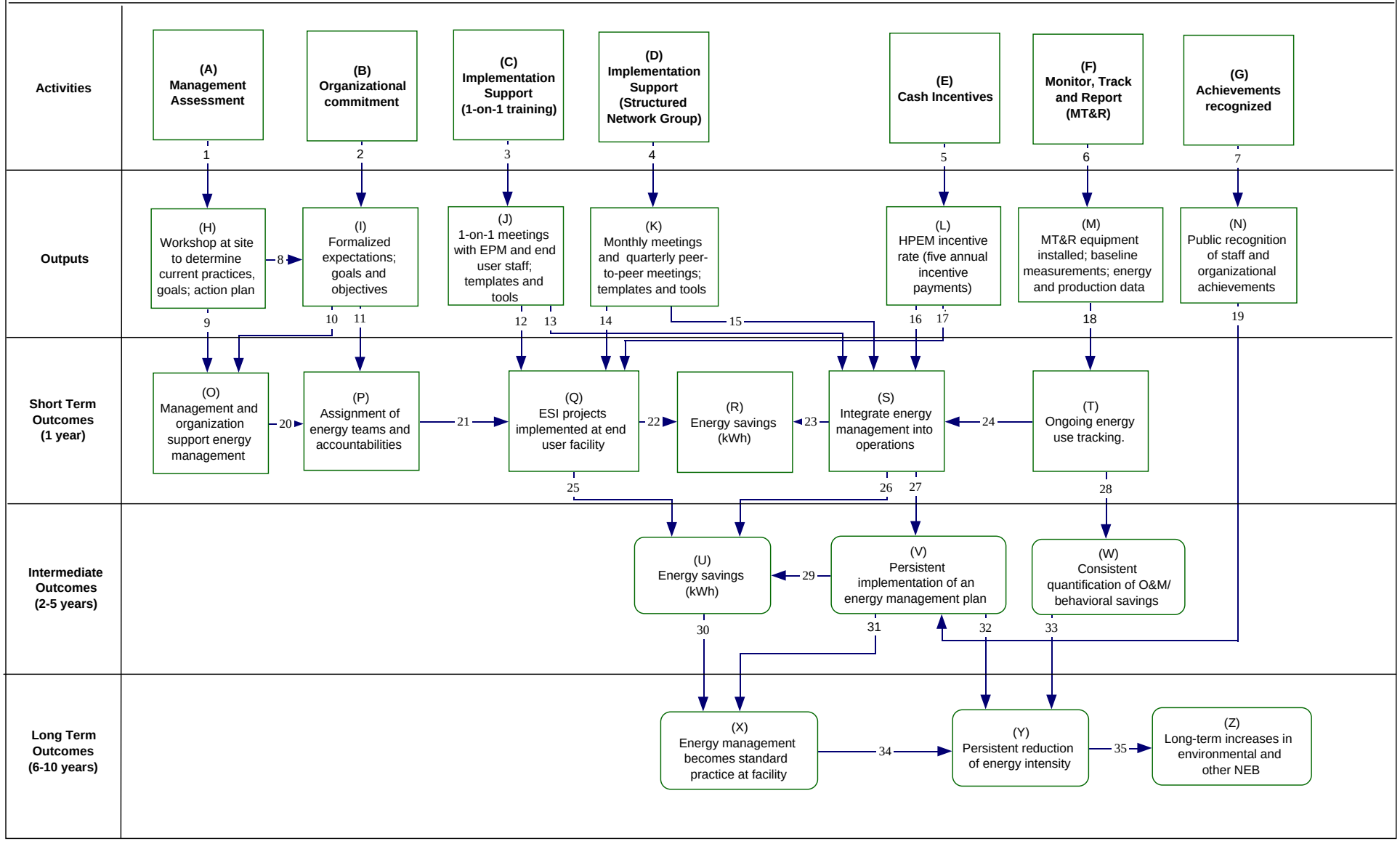
Link #	Impact	Program Theory	Potential Indicators
	address financial barrier and lack of resources	energy savings and create attractive ROIs for end user. For T&T specifically, the cash incentives will lead to completion of action items (identified in scoping activities) or sustained savings payment projects.	- Percent of action items implemented - Number of track and tune projects - Final cost of project and percent covered by incentive
8	End users and MT&R staff observe and measure long term energy savings from T&T projects and O&M adjustments	Long term tracking and reporting facilitates the measurement of long term or ongoing energy savings which is a goal of the program	- Number of 5-year reports generated - Average length of engagement
9	End users increase knowledge from informal or regional formal training	End users will receive informal training from certified TSPs. If applicable, the end user may be referred to formal training events offered by regional partners.	- Trainings attended - Participant EE awareness as a result of participating in ESI program
10	The number of T&T program implementers and consultants increases	Providing training and certification to TSP providers to be able o provide T&T technical services will expand the network of T&T providers to provide the necessary services to end users participating in the ESI program. More TSP providers being trained to offer T&T services will also extends the reach of the ESI program as T&T providers provide their new services to their established customer base.	- Number of certified T&T consultants - Number of leads provided by T&T consultants
11	Projects are implemented	Increased awareness of energy efficiency among end users will ultimately lead to more projects implemented.	- Types of training attended / informal training received - Types of end-use projects completed
12	End user's awareness of EE opportunities increases	The opportunity scoping gives end users the information necessary to identify and make changes that save energy and monitor the impact of those changes. This activity familiarizes end users with energy management opportunities and concepts, and increases their awareness of EE opportunities.	- Awareness of energy efficiency opportunities among participants
13	End users enrolled in T&T component of ESI Program	Once ESI implementers assist end users identify energy efficiency projects during the scoping, the end users will sign official T&T participation agreements. Execution of formal agreement between eligible end users and their utility form a shared understanding of expectations, requirements and payments.	- Number of agreements
14	Multi-year engagement with the end user that leads to sustained savings	The participant agreements engage end users for five years. The long term working partnership will help provide sustained savings over time.	- Percent participants that remain engaged for five years - Average length of engagement
15	End user and MT&R staff tracks energy use on an ongoing basis,	Savings realization relies on a comparison of baseline energy usage to future usage after measure installation or implementation has	- Number of baseline measurements - Number of completion reports

Link #	Impact	Program Theory	Potential Indicators
	calculates energy savings, and improves energy management	occurred—a performance tracking system will enable end users to calculate savings. In addition, active energy management requires adequate monitoring and data feedback.	- Installation of energy monitoring technology - Upload of data onto tracking system
16	T&T upgrades or O&M changes are implemented	The system tune up report provides the end user with specific EE action items and O&M changes. Having a detailed action plan will greatly increase the chances of the projects being implemented.	- Number of EE action items implemented - Ratio of actual to projected savings
17	T&T upgrades or O&M changes are implemented	The expertise provided by the ESI implementers helps end users complete T&T projects.	- Number of EE action items implemented
18	T&T upgrades or O&M changes are implemented	Incentives for the T&T measures will motivate participants to complete upgrades or pursue longer term, sustained savings payment measures.	- Number of EE action items implemented
19	Sustained savings payment projects implemented and incented	Long term reporting allows ESI staff and end users to quantify savings from sustained EE efforts. This leads to additional incentives for the end user.	- Number of "sustained savings payment" measures incented
20	Sustainable energy savings	Reports on long-term progress maintain the end users' focus on energy management and EE opportunities. It also enables ESI staff and end users to measure energy savings over time.	- kWh savings - Number of sustained savings reports
21	Increased awareness of EE opportunities among end users	The expanded network of T&T trained consultants expands the infrastructure and reach of the ESI Program. ESI implementers are able to pass their knowledge and EE awareness onto end users.	
22	T&T action items or O&M changes are implemented	Increased EE awareness will lead to more projects implemented at end user facilities.	- kWh savings
23	Consistent quantification of O&M savings	Ongoing energy user tracking and an overall improvement in energy management hones the end users ability to calculate savings from O&M changes. As multiple projects are implemented across the ESI program, the implementers will be able to provide consistent estimates of O&M energy savings.	- kWh savings from O&M measures - O&M savings calculation methodology
24	Energy savings from T&T projects	T&T project implementation leads to low/no-cost energy savings.	- kWh savings
25	Overall reduction in industrial customer energy intensity	Energy savings will create a longer term reduction in the energy intensity among industrial customers.	- Reduction in energy intensity
26	Overall reduction in industrial customer energy intensity	Consistent quantification of O&M savings provides industrial customers with the appropriate tools to measure real energy reductions from O&M changes. Over the long-term, this will help industrial customers reduce their energy intensity.	- Reduction in energy intensity - Reduction in energy intensity due to O&M changes
27	Sustainable energy savings	The multi-year engagement with the customers, an integral	- Savings in years 2 to 6 of participation

Link #	Impact	Program Theory	Potential Indicators
		requirement of the program, will allow ESI implementers to help end users sustain energy savings over time.	- Persistence of O&M measures (length of time implemented/incented)
28	Long term non-energy benefits	A reduction in energy intensity will provide the end users with non-energy benefits such as decreased operating costs and improved productivity. From a societal perspective, decreased energy intensity provides environmental benefits such as lower carbon emissions.	- CO2 emissions associated with reduction in energy intensity - kW and therm savings
29	Continuation of energy savings practices	Continued savings and EE opportunities will help end users continue the energy saving practices in their facility	- kWh savings
30	Persistent reduction of energy use	Continued energy saving practices will help end users reduce energy use over the long term	- kWh savings
31	Long term non-energy benefits	Persistent energy savings will provide the end users with non-energy benefits such as decreased operating costs and improved productivity. From a societal perspective, decreased energy intensity provides environmental benefits such as lower carbon emissions.	- CO2 emissions associated with reduction in energy intensity - kW and therm savings

Logic Model for BPA Energy Smart Industrial Program: High Performance Energy Management

Inputs: Funds, experienced staff, market knowledge, network of partners.
Assumptions: Marketing and Outreach, Project Management, and Coordination are addressed at the sector level, refer to sector program logic model



Link #	Impact	Program Theory	Potential Indicators
1	Management at end user site completes assessment of current energy management practices	Completing assessment of current energy management practices with plant management staff will result in documentation of current energy management practices, management awareness and buy-in of energy management in general and ESI program offerings and HPEM in particular.	- Number of assessments - Number of letters of intent
2	Management staff at end user site formally commits to implementing HPEM	End use site management formally documents commitment to implement HPEM through a letter of intent, which outlines what the ESI program can provide and what is expected of the end user. This letter helps formalize end user goals and assign accountabilities to end user staff.	- Number of letters of intent
3	Large, process-heavy end users receive 1-on-1 training and mentoring from dedicated HPEM trainers providing them necessary information and flexibility needed to implement HPEM at their facility	The HPEM component offers two implementation avenues, one of which is 1-on-1 training for larger industrial customers. ESI staff will provide 1-on-1 coaching for end user staff to help guide them through a comprehensive energy management strategy. ESI staff (HPEM trainer) will provide end users with templates and tools to assist with employee awareness campaigns, energy policies, and other related activities.	- Participant feedback on topics covered in 1-on-1 training - Self-reported increase in knowledge due to participation
4	Attendance of monthly structured and facilitated meetings (Structured Network Group) and quarterly energy champion meetings provides participants with necessary information, guidance and peer support to successfully implement HPEM at their facilities over 12 months	The HPEM component offers two implementation avenues, one of which is a Structured Network Group that bring non-competing firms together in a peer-to-peer network to guide them through the a comprehensive energy management strategy. ESI staff will participate in monthly meetings with the energy champions. ESI staff (HPEM trainer) will provide end users with templates and tools to assist with employee awareness campaigns, energy policies, and other related activities.	- Number and type of participants attending Structured Network Groups - Participant feedback on usefulness of meetings
5	Offer of annual incentive payments enhances end user motivation to dedicate time and resources to implementation of ESI projects in general and HPEM in particular	Up-front cost is a barrier to investing in energy-efficiency. Providing financial incentives tied to energy savings increases the ability to make energy-efficiency investments by directly reducing end-user's cost share of investment. For HPEM specifically, the cash incentives will lead to completion of more complex projects or behavioral changes. End users may also complete projects that qualify for EPM funding, and T&T and custom project incentives as part of their energy management action plan.	- Site savings goal, documented in participant agreement - -Actual incentives (capital, T&T, and HPEM) paid by year - -Savings underlying HPEM payments by year
6	End users, ESI and utility staff are able to track, monitor and establish credible savings	MT&R helps monitor and control a facility's system or sub-systems, and will be employed for energy management projects. Ongoing tracking of energy use and production increases	- Number of behavioral projects monitored through MT&R - Energy intensity information and

Link #	Impact	Program Theory	Potential Indicators
	estimates	awareness of energy use, and facilitates savings quantification from energy management. Improving end user measurement and tracking will help increase the overall awareness of energy use and its link to production. Rigorous process of developing MT&R savings will produce defensible estimates of savings related to O&M and behavioral changes.	calculations by plant. - Number of sites
7	End user management is aware of impact of energy management and plant energy management staff are publicly recognized for their efforts	It is important for end user management and staff to see the benefits of energy management and feel successful with the process. Thus, public recognition of these achievements is important to continued energy management. The form of recognition will be tailored to each organization's preference.	- Number of end use facilities completing goals
8	Site sets goals and formal energy savings objectives	A workshop at the site to determine current practices and an action plan leads to more formalized expectations at a participant site.	- Energy savings goals
9	Management staff understands benefit of implementing HPEM and supports its implementation	Having end user management participate in workshop raises management's awareness and interest in energy management and provides management with detailed action plan and expected results. Clear understanding of the benefits as well as a defined path to improvements results in management supporting HPEM and ESI project implementation at the site.	- Number of letters of intent
10, 11	Management at end user organization supports energy management and dedicates staff and resources to address energy efficiency	Formalizing expectations with the end user organization builds their commitment to energy management and clarifies ESI program requirements. In addition, it initiates the assignment of energy teams, energy champions, and staff accountabilities related to energy management.	- Number of letters of intent - Goals by facility - Dedicated EPM (yes/no)
12	ESI projects are implemented, particularly complex, process oriented energy management projects	Providing Program support through meetings, templates, and tools will help end users complete various ESI projects at their facility. These projects could encompass custom projects, T&T, or more complex, process oriented projects that are incented through HPEM participation.	- Number of projects implemented by type - kWh savings measured
13	Energy management is integrated into day-to-day operations at end user facility	Providing Program support through meetings, templates, and tools also helps the end user incorporate energy management into the day-to-day operations at their plant.	- Number and frequency of energy team meetings - Number of projects implemented by type - kWh savings measured
14	ESI projects are implemented,	Providing Program support through meeting, templates, tools and	- Number and frequency of energy

Link #	Impact	Program Theory	Potential Indicators
	particularly complex, process oriented energy management projects	the peer network will help end users complete various ESI projects at their facility. These projects could encompass custom projects, T&T, or more complex, process oriented projects that are incented through HPEM participation.	team meetings - Number of projects implemented by type - kWh savings measured
15	Energy management is integrated into day-to-day operations at end user facility	Providing Program support through meetings, templates, and tools also helps the end user incorporate energy management into the day-to-day operations at their plant.	- Number and frequency of energy team meetings - Number of projects implemented by type - kWh savings measured
16	Energy management is integrated into day-to-day operations at end user facility	The cash incentives provided by the Program will provide end users with the incentive and resource to integrate a comprehensive energy management strategy into day-to-day operations at their plan.	- Number and frequency of energy team meetings - Number of projects implemented by type - kWh savings measured
17	ESI projects are implemented, particularly complex, process oriented energy management projects	The cash assistance improves end users' ability to invest in energy efficiency projects. These projects could encompass custom projects, T&T, or more complex, process oriented projects that are incented through HPEM participation.	- Number of projects implemented by type - kWh savings measured
18	The use of monitoring equipment and corresponding information increases awareness of energy usage and promotes the tracking of performance.	Lack of immediate data and feedback is often a barrier for understanding and measuring the impact of O&M projects or behavioral changes. By installing additional equipment or promoting consistent tracking of energy intensity data, the end user can examine the data to make adjustments to processes.	- Number of plants regularly tracking energy use intensity - List of KPIs tracked as part of plan, if applicable
19	Long term implementation of an energy management plan at end user facility	Recognition of staff and organizational achievements reinforces the value of energy management. Highlighting the energy savings, projects, and corresponding cost savings will help maintain management support of energy management over the long-term.	- Number of projects implemented by type, by year - Savings by projects and type, by year
20	Staff/resources at end user facility are allocated to energy management	Once internal support of energy management has been achieved, end user management is more likely to dedicate staff to address energy issues through an internal energy team and other individual responsibilities (e.g. energy champion).	- Number and frequency of energy team meetings - EPM dedicated (yes/no)
21	ESI projects are implemented, particularly complex, process oriented energy management projects	Dedicating staff to energy management leads to more energy efficiency projects at the end user facility.	- Number of projects implemented by type - Savings by projects and type
22	Short-term energy savings	Increased projects lead to energy savings in the short term.	- Number of EE projects implemented

Link #	Impact	Program Theory	Potential Indicators
			- kWh savings
23	Short-term energy savings	Integration of energy management into day-to-day operations leads to energy savings.	- Number of EE projects implemented - kWh savings
24	Energy management is integrated into day-to-day operations at end user facility	As mentioned previously, lack of immediate data and feedback is often a barrier for understanding and measuring the impact of O&M projects or behavioral changes. Ongoing monitoring provides end users with the necessary data and feedback to integrate energy management into operations and monitor the results.	- Number and frequency of energy team meetings - Number of projects implemented by type - Savings by projects and type
25	Intermediate term energy savings	Increased projects lead to energy savings over a sustained period.	- kWh savings
26	Intermediate term energy savings	Integration of energy management into day-to-day operations leads to energy savings over a sustained period.	- kWh savings
27	Long term implementation of an energy management plan at end user facility	Integrating energy management into day-to-day operations will lead to implementation of an energy management plan long-term.	- Number of projects implemented by type, by year - Savings by projects and type, by year
28	Consistent quantification of O&M/behavioral savings	Ongoing energy tracking allows end users to develop reliable, consistent ways to estimate savings from O&M or behavioral changes.	- kWh savings by type of project
29	Energy savings	Persistent implantation of an energy management plan results in energy savings.	- Number of EE projects implemented - kWh savings
30, 31	Energy management becomes standard practice at end user facility	As energy savings are realized as a result of persistent implementation of an energy management plan, the end user will have will tangible evidence for plant staff and management that energy management is effective and worthwhile. Long-term, the end user will make energy management a standard practice.	
32, 33	Persistent reduction in energy intensity	Persistent implementation of an energy management plan and quantification of O&M and behavioral savings will lead to a long-term reduction in energy intensity at the end user facility.	- % reduction in energy intensity
34	Persistent reduction in energy intensity	As energy management becomes a standard practice, the end user will realize a persistent reduction in energy intensity.	- % reduction in energy intensity
35	Long term non-energy benefits	Persistent energy savings will provide the end users with non-energy benefits such as decreased operating costs and improved productivity. From a societal perspective, decreased energy intensity provides environmental benefits such as lower carbon emissions.	- CO_2 emissions associated with reduction in energy intensity - kW, kWh and Therm savings

Appendix B: Data Requirements for Evaluation

Data Elements Required for Evaluation	Purpose of Data Element for Evaluation	Availability of Data Element for this Evaluation
1. Implementer and Subcontractor Contact Information A. Project roles	Tracking responsibilities; Provides appropriate contacts for information.	This program is run by six BPA staff and multiple third-party implementation team members (Cascade Energy Engineering, Strategic Energy Group, and Evergreen Consulting.) The BPA staff members are listed by name, Web addresses are listed for the third-party implementers. **Additional Information Required** 1. List of staff or organizational chart of implementation team (BPA and Cascade team. 2. Contact information (phone number and email) for each team member.
2. Program Theory and Indicators A. A description of how and why the program is supposed to achieve the desired results. B. Clearly stated indicators of success	Provide evaluators with a clear understanding of the intended workings of the program and the targeted success indicators in the short, medium, and long-term. Develop an evaluation plan appropriate to capture and track the right data at the correct granularity and interval. Develop list of evaluation objectives and detailed data request. What innovative features are being tested that require specific evaluation focus?	Cadmus developed logic models (sector level as well as individual models for elements of Energy Management Pilot) and corresponding indicators in close coordination with the implementation team. Models and linkage tables including indicators will be available for the evaluation. Appendix A provides a complete list of indicators listed in the logic models.

Data Elements Required for Evaluation	Purpose of Data Element for Evaluation	Availability of Data Element for this Evaluation
3. Target Market and Participants A. A specific description of the target market and applicable sub-target markets B. Information regarding targeting strategy	Identify potential and targeted participants (utilities, end-users, trade allies). Identify likely nonparticipants.	The program is just starting and utilities are in the process of joining. The plan provides basic information on targeting strategy. Target markets are defined for each program in broad terms: 1. BPA utility customers with industrial load a. Start with largest and expand b. Start with the utilities that already have an industrial efficiency program. 2. End users 3. TSP consultants 4. Regional Stakeholders (Efficiency programs, Trade ally sectors, and Trade associations) **Additional Information Required** 1. Detailed participant contact information (TrakSmart) 2. List of targeted utilities, contact name & contact information (Location?) 3. List of participant utilities (Location?) a) Utility contact and contact information b) ESIP assignments and contact information c) Utility and account plans d) Communication preferences by utility 4. Information regarding non-participants, if available a list of targeted but unresponsive end-users
4. Marketing plan A. Approach and schedules for marketing the program, consistent with the program theory. B. Marketing materials	Assess effectiveness of marketing approach in general and marketing materials in particular	A high-level marketing plan was provided. The approach focuses on face-to-face, one-on-one recruiting efforts. Guidelines for developing the marketing material were identified. Stakeholders have been identified as audiences for the program *(Section 8.6)* 1. Efficiency programs, 2. Trade ally sectors, 3. Trade associations

Data Elements Required for Evaluation	Purpose of Data Element for Evaluation	Availability of Data Element for this Evaluation
5. Trade allies A. Will Trade allies be used in the program delivery? B. What types are used? C. Are they identified as participant and nonparticipant trade allies in the tracking database	Assess effectiveness of trade allies as part of program delivery.	Trade allies are an integral part of the Program, and BPA developed an approach to incorporate the trade allies through the Northwest Trade Ally Network (TAN) as well as the existing TSP network. The TAN network is provided by Evergreen Consulting. The TAN: 1. Helps lighting trade allies participate in utility programs 2. Offers training and industry news 3. Provides forms and resources. Several program elements rely on a network of existing TSP consultants to provide vital services through the program. The T&T element of the program also requires several TSP consultants being trained and certified to provide T&T services. **Additional Information Required** 1. List of participant trade allies (TAN, TSP) including key contact and contact information (phone, email) 2. Copies of typical agreements/contracts/guidelines and rules applying to participating trade allies 3. List of targeted nonparticipant trade allies, reasons for non-participation, if available, and contact information. 4. List of TSP providers being trained & certified to provide T&T services. 5. Training and certification materials for T&T service providers
6. Tracking databases A. As-found values for parameters used to estimate ex-ante savings. B. Name, address, and account number of participant. C. Pre-retrofit or baseline. D. Program assumptions tracked on a site-specific or site/location specific level (e.g., hours of	Primary data source for impact evaluation, and to a lesser extend process.	Program and project information is kept in different databases including PTR, TrakSmart, and the TSP portal. **Additional Information Required** 1. Data mapping showing what data are stored in which database 2. Unique identifiers allowing for association of records in different databases. 3. Existing or proposed data diagram (showing tables and relational design of the data storage elements) dictionary and for each database 4. Information on data entry processes and responsibilities

Data Elements Required for Evaluation	Purpose of Data Element for Evaluation	Availability of Data Element for this Evaluation
operation). E. Specific locations of measures. (Can the installed measures be found?) F. Measures installed or activity completed. G. Estimated outcomes (savings), if appropriate. H. Referrals to other programs. I. Installation date and in-service date, if different.		See Section 3 for more details.
7. Program forms and agreements A. Participation, installation, and other forms. B. Customer contact forms. C. Baseline monitoring requirements and results.	Check that the data collected is captured properly (in granularity, frequency). These data will be used in conducting a database validity check. Much of the data collected and documented in the various forms and agreements represent important sources of data for impact and process evaluation tasks.	Evaluators may check documentation against the database to assess whether data is being accurately transferred to the data tracking system. **Additional Information Required** 1. Examples of all forms used to capture key information on different program elements as they become available. 2. Information regarding intended use and target audience for these documents
8. Nonparticipant contact information A. Direct marketing list B. Utility target market customer list	Collecting information from non-participants (utilities, end-users, trade allies) is necessary to gather information regarding barriers and determining net program effects. Also instrumental to inform ongoing feedback regarding potential opportunities for program adjustments and tweaks.	Some utilities have been contacted regarding the Program but it is too early to state that there are refusals. **Additional Information Required** 1. List of targeted non-participants (utilities, trade allies, end-users)

Data Elements Required for Evaluation	Purpose of Data Element for Evaluation	Availability of Data Element for this Evaluation
9. Savings assumptions A. Documented savings assumptions B. Assumptions source specified C. Baseline parameters recorded	To be able to properly assess the savings resulting from the program implementation efforts.	Savings assumptions come from the RTF Deemed Savings Calculators and/or deemed measure lists are available. Custom projects for large applications will follow BPA's normal M&V protocol. Small Industrial applications will follow M&V light. **Additional Information Required** 1. Copies of all calculators used 2. Savings assumptions for custom projects 3. Information on baseline assumptions/data, if applicable 4. Detailed description of BPA's M&V protocol (regular and M&V light) 5. Detailed MT&R reports and baseline assumptions, once available

Detailed Site Visit Data Requirements

SECTION 1: Site Visit Details

- Evaluator Name
- Facility Contact Person
- Facility Contact Title
- Facility Contact Telephone Number
- Facility Contact E-mail
- Facility Physical Address

SECTION 2: Facility Information

- Company Name
- Utility Name
- Level of Utility Involvement
- Sector
- Number of Employees
- Product Manufactured
- Production Process
- Production Trends
- Metering in Place

SECTION 3: Energy Usage Information

- Actual Annual kWh
- Actual Annual Therms
- Actual Annual Operating Hours
- Energy Use as Percentage:
    - Compressed Air
    - Refrigeration
    - Motors
    - Steam
    - Other
- Fuel Type as Percentage
    - Electric
    - Gas
    - Other

SECTION 5: Measure Details

- Measure Name
- Measure Description
- Measure Documentation (including equipment type and cost details)
- Measure Type (O&M or Capital)
- Estimated Energy Savings

THE CADMUS GROUP, INC.