

Evaluation Work Plan: FINAL

Energy Efficiency and Conservation Block Grant

February 9, 2012



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1. Executive Summary

1.1 Program Description

The EECBG Program, authorized in Title V, Subtitle E of the Energy Independence and Security Act (EISA) and signed into law on December 19, 2007, was funded for the first time by the American Recovery and Reinvestment Act of 2009 (ARRA). The Funding Opportunity Announcement (FOA) for Formula Grants was issued on June 25, 2009 and closed on June 25, 2010. Over \$2.7 billion was distributed through Formula Grants to about 2,350 cities, counties, states, territories and Native American tribes. This funding represents a Department of Energy priority to increase energy efficiency activities and renewable energy installations across the country while decreasing overall energy use and associated greenhouse gas emissions, increasing jobs and stimulating the economy.

The Program was designed to enable grant recipients to create and implement strategies to:

- Reduce fossil fuel emissions
- Reduce total energy use
- Improve energy efficiency in the building and transportation sectors.

Recipients were encouraged and given the flexibility to develop new and innovative approaches across these three focus areas that would yield long-term sustainable impacts. Grants could be used in any of 14 eligible Activity areas referred to in this document (also known as Broad Program Areas, or BPAs). All funds were required to be committed within 18 months of award and fully expended within 36 months. The six BPAs shown in Table 1-1 account for 80% of all EECBG funding; the evaluation will focus on these six areas exclusively.

Table 1-1: BPAs Receiving Top 80% of Funding¹

Top 6 Broad Program Areas
Energy Efficiency Retrofits
Financial Incentives
Buildings and Facilities
Onsite Renewables
Lighting
Energy Efficiency and Conservation
Strategy

1.2 Evaluation Objectives

The EECBG evaluation presents a complex challenge. Evaluators must understand the overall objectives of the EECBG Program, the variations on the objectives present within each grant, (and in the case of State grants, their sub-grants), and the variety of unique projects (referred to as “Activities”) carried out under a grant. Much of the funding is directed to projects resulting in direct energy impacts. Other components are structured to achieve market development and transformation goals, and still others provide a platform to increase overall awareness and aid in state and local long-term planning efforts.

The evaluation of the EECBG Program is intended to “*document the Program’s principal achievements and provide valuable information for policy makers and program managers to help inform future energy efficiency and renewable energy efforts*”.² This will require a combination of qualitative and quantitative approaches designed to effectively communicate both the direct energy impacts and the features that enabled success for grantees.

Employing data collected from existing EECBG databases and in-depth interviews with DOE project officers, grantees, and other primary stakeholders, KEMA will answer the three key research questions of this evaluation:

¹ Based on review of data as of December 18, 2011; this order may change once the full dataset of grants and sub-grants is reviewed.

² As stated in the April 2011 EECBG Evaluation Plan original solicitation documents.

- 1) What is the **total** lifetime magnitude of energy and cost savings and other key outcomes achieved in those BPAs that cumulatively account for approximately 80% of total Formula Grant expenditures in the 2009-2011 program years?
- 2) What is the lifetime magnitude of outcomes achieved by **each** of the most heavily-funded BPAs within the EECBG portfolio?
- 3) What are the **key performance factors** influencing the magnitude of EECBG outcomes?

These questions will be answered based on evaluating a sample of 350 grants/activities from a pool of 2,338 direct grants and over 5,000 sub-grants. The following six BPAs account for approximately 80% of grant expenditures:

- Energy Efficiency Retrofits
- Financial Incentives
- Buildings and Facilities
- Onsite Renewables
- Lighting
- Energy Efficiency and Conservation Strategy

The evaluation will assess the following metrics:

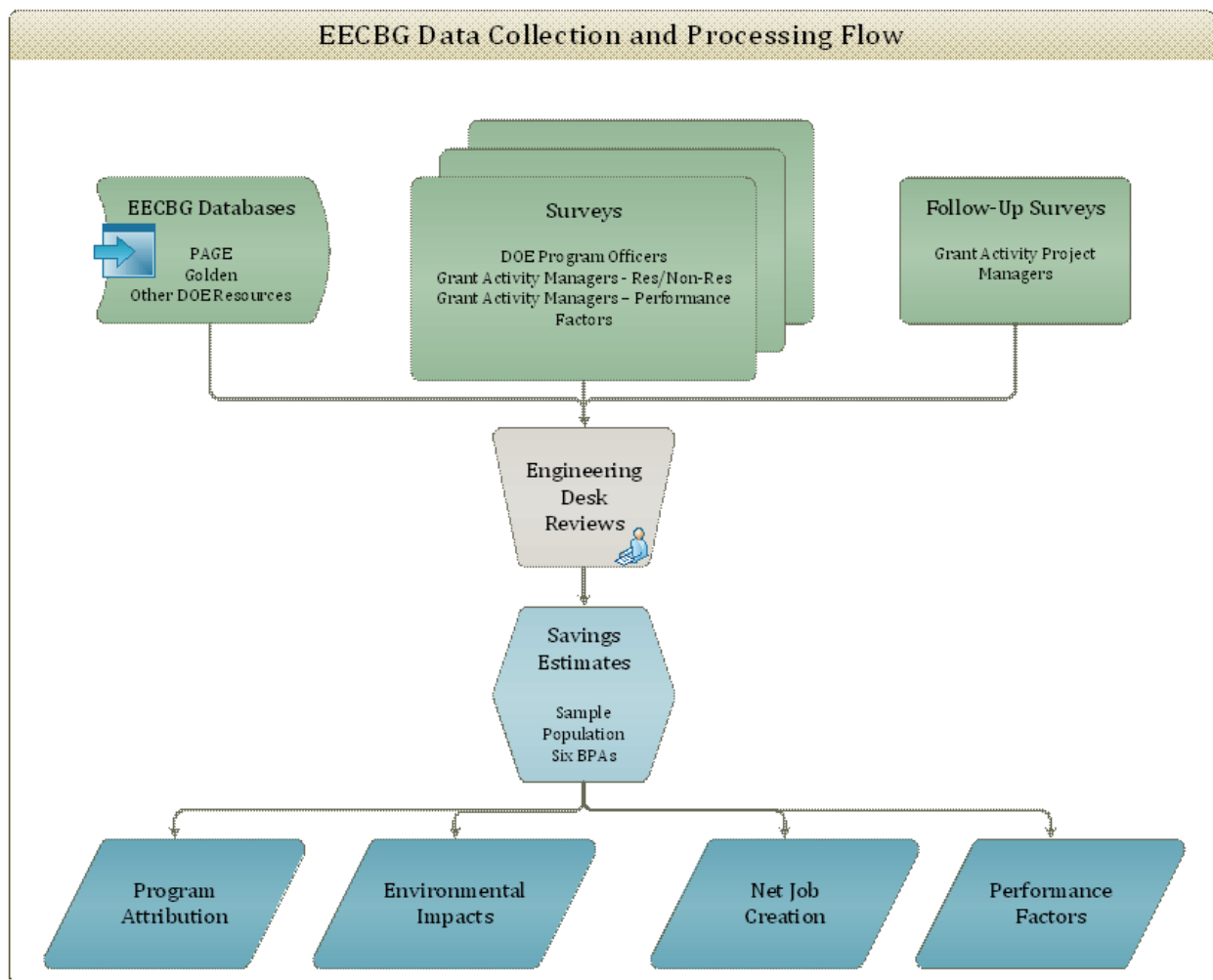
- Energy savings
- Reduction in energy costs
- Net job creation and productivity impacts
- Impact on air quality and fossil fuel emissions
- Use of federal, state and local government resources, private sector investment and non-profit organizations services to increase program benefits

1.3 Evaluation Approach

The EECBG Program will be evaluated between August 2011 and December 2012 (16 months). The implementation of the grants/sub-grants included in the study began in 2009 and may continue through mid-2012, with approximately 20% of the grants having been completed at the time the RFP was issued in early May 2011. Grants at all stages of completion are eligible for sampling.

The study will include two key analyses: 1) calculate outcomes attributable to EECBG funding, and 2) identify performance factors. The latter investigation is more exploratory in nature and will yield important information for understanding “whether and to what extent the organizational and operational [and other] factors examined influenced the achievement of key outcomes” (Evaluation Plan, RFP p.11). The following figure summarizes the various components of the EECBG Evaluation Study.

Figure 1-1: EECBG Evaluation Approach



The key components in the evaluation include:

- **Characterize the full set of EECBG program activities in terms of BPAs and measures of size.** In terms of the evaluation, the principal objectives of this step are to:

-
- Develop the sample frame from which the individual program activities to be evaluated will be selected and analyzed.
 - Develop the information needed to expand the results from the sampled program activities to estimate total impacts for the BPA groups
 - Gather information on the level and quality of available program documentation, which will be used to make final determinations of evaluation approaches to be taken in regard to specific BPAs.
 - **Develop the sample of individual program activities for evaluation.** The KEMA team will select a sample of at least 350 individual program activities from the total pool of grants and sub-grants listed in the DOE database.
 - **Assess the “evaluability” of the sampled individual program activities.** The Evaluation Team will develop a set of criteria for determining whether a program Activity that is selected into the sample has adequate information concerning energy savings actions taken to render a reasonable estimate of outcomes. The steps include the following:
 - a. *Confirm progress in implementation.*
 - b. *Confirm quality and availability of program records.*
 - c. *Eliminate non-energy-producing Activities, such as grants or sub-grants used for administrative support, through the survey.*
 - **Conduct engineering desk reviews to estimate energy impacts of the selected Activities.** Each Activity selected in the sample will be assigned to a project engineer for conducting an engineering desk review of all available data associated with the grant and Activity.

For each selected individual Activity, we will quantify the energy savings. The savings estimates will be based upon data and information from the following sources:

- Activity data and documentation including grant applications and quarterly reports from the PAGE database
- Other databases including data maintained by DOE’s Golden, Colorado office

-
- Telephone surveys with DOE Program Officers
 - Telephone surveys with grantee or sub-grantee project managers
 - Follow-up telephone interviews with grantee or sub-grantee project managers who are directly involved and most knowledgeable of the activity to provide additional unique Activity information to obtain information and data required for the analysis that is not available from either the various DOE databases or surveys
 - Information from state websites regarding the EECBG programs and, as available and of good quality, the results of state- level evaluations of EECBG projects.

These data will be combined with documented input assumptions and applied to standard engineering formulae to estimate savings for all or a sample of participants.³

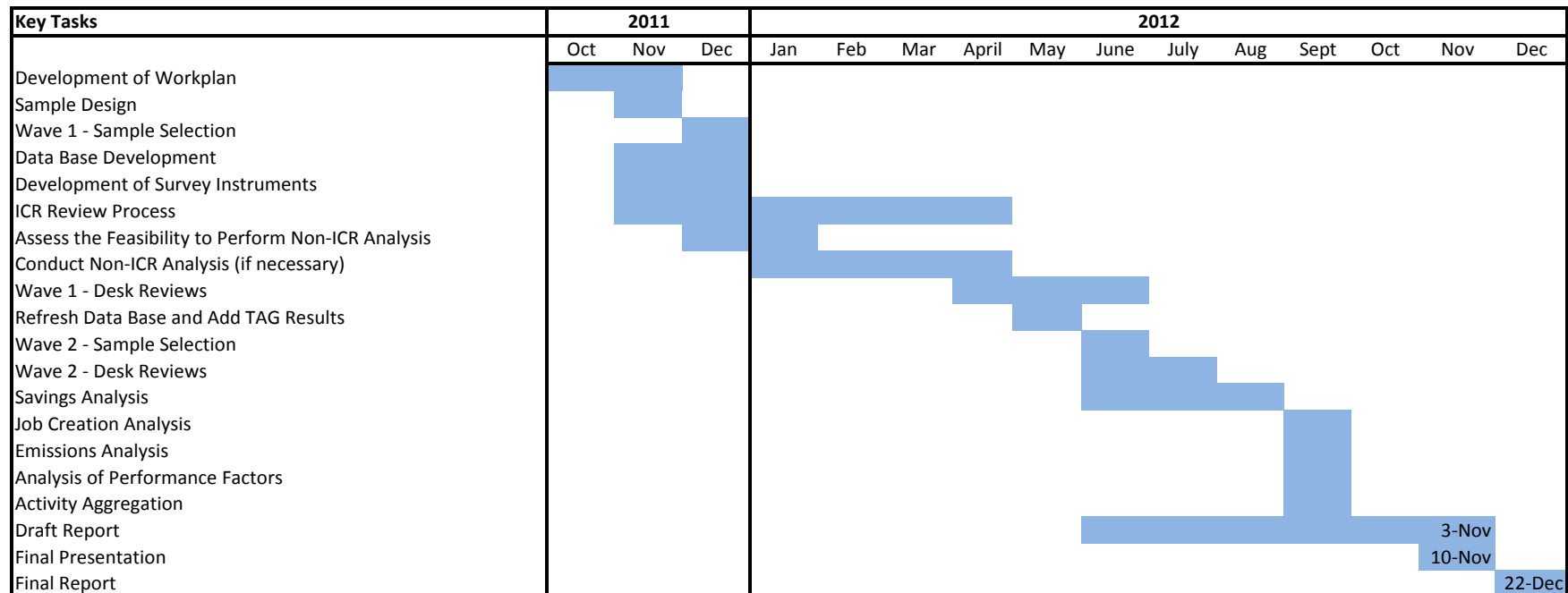
- **Attribute estimated energy impacts to the individual program activities.** For each selected Activity, KEMA will carry out an analysis to assess the portion of estimated energy impacts that were attributable to the EECBG program activities in the sample and other influences such as general developments in the market or the activities of other organizations offering similar kinds of programs or services. Attribution of effects will be assessed separately for each individual programmatic Activity studied and be based on information collected from grantee decision makers and other sources.
- **Estimate energy cost savings.** For the selected Activity KEMA will calculate value of annual energy savings and demand reductions at the current energy costs over effective useful life of the Activity.
- **Estimate effects of individual activities on carbon emissions.** We will use estimates of annual and lifetime energy savings attributable to the program as inputs to a model that estimates carbon emissions reductions based on the carbon content of fossil fuels and electricity consumption avoided.

³ These approaches are commonly referred to as engineering-based assessment or statistically-adjusted engineering assessment.

-
- **Estimate effects of individual activities on employment.** The energy savings estimates will be combined with other program information, such as matching funds contributed, participant expenditures for labor and materials, and direct program expenditure as inputs into a regional economic model to estimate net employment impacts.

Once the individual Activity evaluations are completed and reviewed for accuracy and completeness, the effort will shift to aggregation of sample results by BPA, projection to the national level, and interpretation of findings. KEMA and its subcontractors will expand the sample results to the top-funded BPAs using the relationship between verified metrics for the sample activities and information on measures of size (funding).

1.4 Project Timeline



2. Introduction

This document presents the Work Plan for the EECBG Evaluation and will serve as a reference over the next several months as the plan is implemented.

As the work proceeds, possible new information could cause the evaluation approach to be adjusted. If this situation occurs, rather than revise this document we will issue an Addendum to the Plan, explaining any alterations, which have been approved by ORNL, to the approach outlined herein. Overall, the methods and approaches presented in this document should provide adequate flexibility to allow for minor adjustments without sacrificing the reliability of the evaluation findings. More significant project risks and mitigating strategies were considered by the team and sponsors early in the project and are outlined in Appendix A.

2.1 Program Description

The EECBG Program, authorized in Title V, Subtitle E of the Energy Independence and Security Act (EISA) and signed into law on December 19, 2007, was funded for the first time by the American Recovery and Reinvestment Act of 2009 (ARRA). The Funding Opportunity Announcement (FOA) for Formula Grants was issued on June 25, 2009 and closed on June 25, 2010. Over \$2.7 billion was distributed through Formula Grants to about 2,350 cities, counties, states, territories and Native American tribes. This funding represents a Department of Energy priority to increase energy efficiency activities and renewable energy installations across the country while decreasing overall energy use and associated greenhouse gas emissions, increasing jobs and stimulating the economy.

The Program was designed to enable grant recipients to create and implement strategies to:

- Reduce fossil fuel emissions
- Reduce total energy use
- Improve energy efficiency in the building and transportation sectors.

Recipients were encouraged and given the flexibility to develop new and innovative approaches across these three focus areas that would yield long-term sustainable impacts. Grants could be used in any of 14 eligible Activity areas referred to in this document (also known as Broad Program Areas, or BPAs). All funds were required to be committed within 18 months of award and fully expended within 36 months. The six BPAs shown in Table 2-1 account for 80% of all EECBG funding; the evaluation will focus on these six areas exclusively.

Table 2-1: BPAs Receiving Top 80% of Funding⁴

Top 6 Broad Program Areas
Energy Efficiency Retrofits
Financial Incentives
Buildings and Facilities
Onsite Renewables
Lighting
Energy Efficiency and Conservation Strategy

2.2 Evaluation Objectives

The EECBG evaluation presents a complex challenge. Evaluators must understand the overall objectives of the EECBG Program, the variations on the objectives present within each grant, (and in the case of State grants, their sub-grants), and the variety of unique projects (referred to as “Activities”) carried out under a grant. Much of the funding is directed to projects resulting in direct energy impacts. Other components are structured to achieve market development and transformation goals, and still others provide a platform to increase overall awareness and aid in state and local long-term planning efforts.

The evaluation of the EECBG Program is intended to “*document the Program’s principal achievements and provide valuable information for policy makers and program managers to help inform future energy efficiency and renewable energy efforts*”.⁵ This will require a combination of qualitative and quantitative approaches designed to effectively communicate both the direct energy impacts and the features that enabled success for grantees.

Employing data collected from existing EECBG databases and in-depth interviews with DOE Program Officers, grantees, and other primary stakeholders, KEMA will answer the three key research questions of this evaluation:

⁴ Based on review of data as of December 18, 2011; this order may change once the full dataset of grants and sub-grants is reviewed.

⁵ As stated in the April 2011 EECBG Evaluation Plan original solicitation documents.

- 1) What is the **total** lifetime magnitude of energy and cost savings and other key outcomes achieved in those BPAs that cumulatively account for approximately 80% of total Formula Grant expenditures in the 2009-2011 program years?
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These questions will be answered based on evaluating a sample of 350 grants/activities from a pool of 2,338 direct grants and over 5,000 sub-grants. The following six BPAs account for approximately 80% of grant expenditures:

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- Financial Incentives
- Buildings and Facilities
- Onsite Renewables
- Lighting
- Energy Efficiency and Conservation Strategy

The evaluation will assess the following metrics:

- Energy savings
- Reduction in energy costs
- Net job creation and productivity impacts
- Impact on air quality and fossil fuel emissions
- Use of federal, state and local government resources, private sector investment and non-profit organizations' services to increase program benefits

2.3 Evaluation Approach

The EECBG Program will be evaluated between August 2011 and December 2012 (16 months). The implementation of the grants/sub-grants included in the study began in 2009 and may continue through mid-2012, with approximately 20% of the grants having been completed at the time the RFP was issued. Grants at all stages of completion are eligible for sampling.

The study will include two key analyses: 1) calculate outcomes attributable to EECBG funding, and 2) identify .key factors that influence the magnitude of the outcomes achieved. The latter investigation is more exploratory in nature and will yield important information for understanding

“whether and to what extent the organizational and operational [and other] factors examined influenced the achievement of key outcomes.” (Evaluation Plan, RFP p.11)

The key components in the evaluation include:

- **Characterize the full set of EECBG program activities in terms of BPAs and measures of size.** In terms of the evaluation, the principal objectives of this step are to:
 - Develop the sample frame from which the individual program activities to be evaluated will be selected, analyzed, and the results for the individual program activities will be expanded to the full program
 - Provide input data to support sample design, including the definition of metric activities and the allocation of sample resources to the final set of sample activities
 - Develop the information needed to expand the results from the sampled program activities to estimate total impacts for the BPA groups
 - Gather information on the level and quality of available program documentation, which will be used to make final determinations of evaluation approaches to be taken in regard to specific BPAs.
- **Develop the sample of individual program activities for evaluation.** The KEMA team will select a sample of at least 350 individual program activities from the total pool of grants and sub-grants listed in the DOE database. See Section 4 for a description of the objectives, methods, and preliminary design of the sample selection process. Once an Activity is selected into the sample, the KEMA team will deploy the evaluation in the following steps.
- **Assess the “evaluability” of the sampled individual program activities.** The Evaluation Team will develop a set of criteria for determining whether a program Activity that is selected into the sample has adequate information concerning energy savings actions taken to render a reasonable estimate of outcomes. The steps include the following:
 - a. *Confirm progress in implementation.* In order to be included in the impact analysis, the selected program Activity must be either completed or far enough along in the implementation process to provide an accurate characterization of the Activity. For example, a municipal street lighting Activity may be only 10% completed, but all

of the lighting equipment has been purchased and awaiting installation; thus, it would be included in the analysis. In contrast, the installation of a custom energy management system Activity, where the final operating specifications and characteristics are still in flux, would be excluded from the analysis.

b. Confirm quality and availability of program records. KEMA will review the Activity data from the Performance and Accountability for Grants in Energy (PAGE) data and any supplemental data provided by the DOE's Golden Colorado office for completeness and quality.⁶ If such significant data elements are missing or appear to be erroneous and cannot be reconstructed within schedule and budget constraints, then the program Activity will be removed from the sample and a substitute selected.

c. Eliminate non-energy-producing Activities through the survey. The third step of assessing evaluability occurs during the survey of grantee or sub-grantee project managers in cases where it is discovered that no actions were taken that result in energy savings.

- **Conduct engineering desk reviews of sampled grants to estimate energy impacts of the selected Activities.** Each Activity selected in the sample will be assigned to a project engineer for conducting an engineering desk review of all available data associated with the grant and Activity.

For each selected individual Activity, we will quantify the energy savings. The savings estimates will be based upon data and information from the following sources:

- Activity data and documentation including grant applications and quarterly reports from the PAGE database
- Other databases including data maintained by DOE's Golden, Colorado office
- Telephone surveys with DOE Program Officers
- Telephone surveys with grantee or sub-grantee project managers

⁶ DOE's Golden office is in the process of integrating its data into the PAGE database. If the integration process is not completed by the time the saving analysis is conducted, the KEMA team may need to obtain program Activity data directly from the Golden office.

-
- Follow-up telephone interviews with grantee or sub-grantee project managers who are directly involved and most knowledgeable of the activity to provide additional unique Activity information to obtain information and data required for the analysis that is not available from either the various DOE databases or surveys⁷
 - Information from state websites regarding the EECBG programs and, as available and of good quality, the results of state level evaluations of EECBG projects.

These data will be combined with documented input assumptions and applied to standard engineering formulae to estimate savings for all or a sample of participants.⁸

- **Attribute estimated energy impacts to the individual program activities.** For each selected Activity, KEMA will carry out an analysis to assess the portion of estimated energy impacts that were attributable to the EECBG program activities in the sample and other influences, such as general developments in the market or the activities of other organizations offering similar kinds of programs or services. Attribution of effects will be assessed separately for each individual programmatic Activity studied and will be based on information collected from grantee decision makers and other sources.

See Section 8 for more discussion of our approach to determining attribution.

- **Estimate effects of individual activities on carbon emissions.** We will use estimates of annual and lifetime energy savings attributable to the program as inputs to a model that estimates carbon emissions reductions based on the carbon content of fossil fuels and electricity consumption avoided. See Section 9 for a description of this analysis.
- **Estimate effects of individual activities on employment.** The energy savings estimates will be combined with other program information, such as matching funds contributed, participant expenditures for labor and materials, and direct program

⁷ Each information requested from grantee and sub-grantee project managers will be specific to the individual Activity and will differ from Activity to Activity and will not require an OMB approved survey instrument..

⁸ These approaches are commonly referred to as engineering-based assessment or statistically-adjusted engineering assessment.

expenditure as inputs into a regional economic model to estimate employment impacts. See Section 10 for a description of these analyses.

Once the individual Activity evaluations have been completed and reviewed for accuracy and completeness, the effort will shift to aggregation of sample results by BPA, projection to the national level, and interpretation of findings. KEMA and its subcontractors will expand the sample results to the top-funded BPAs, using the relationship between verified metrics for the sample activities and information on measures of size (funding).

2.4 Work Plan Structure

The remainder of the Work Plan discusses the approach to the EECBG evaluation in detail.

- Section 3 reviews the Data Collection approach including a list of existing data sources plus plans for augmenting what is available through PAGE and other available databases with surveys.
- Section 4 presents preliminary results of our review of PAGE data, and the subsequent Sampling Plan for selection of the 350 grant Activities to be studied.
- Section 5 shares the objectives and steps to be taken in the Review of EECBG Databases.
- Section 6 discusses implementation of the three surveys that constitute the primary new information to be used in the analysis.
- Section 7 presents the plans for estimating the primary impacts of the projects and how these impacts will be aggregated to arrive at BPA level results.
- Section 8 discusses the approach to assessing attribution of the impacts to EECBG.
- Section 9 presents the approach to determining carbon reductions that will result from the energy savings impacts.
- Section 10 addresses the analysis of employment effects due to EECBG grant Activity.
- Section 11 is a discussion of the planned analysis of organizational/operational factors influencing project outcomes.
- Section 12 lays out the reporting structure and schedule for the project.
- Section 13 is the management and organizational plan for the EECBG evaluation.

3. Data Collection

The evaluation of the EECBG program will be based upon information obtained from three key data sources:

- PAGE and other DOE and OMB databases and Activity documentation and records reported by grantees and sub-grantees
- Telephone surveys with DOE Program Officers and with grantee/sub-grantee project managers including:

Survey #1: Program Officers Survey - In-depth interviews with DOE Program Officers, State and Regional Coordinators

Survey #2: Grant Activity Manager Survey (GAMS) - Telephone surveys with Grant Activity Project Managers who are closest to the activities conducted under each Grant Activity sampled, with two versions of the instrument as follows:

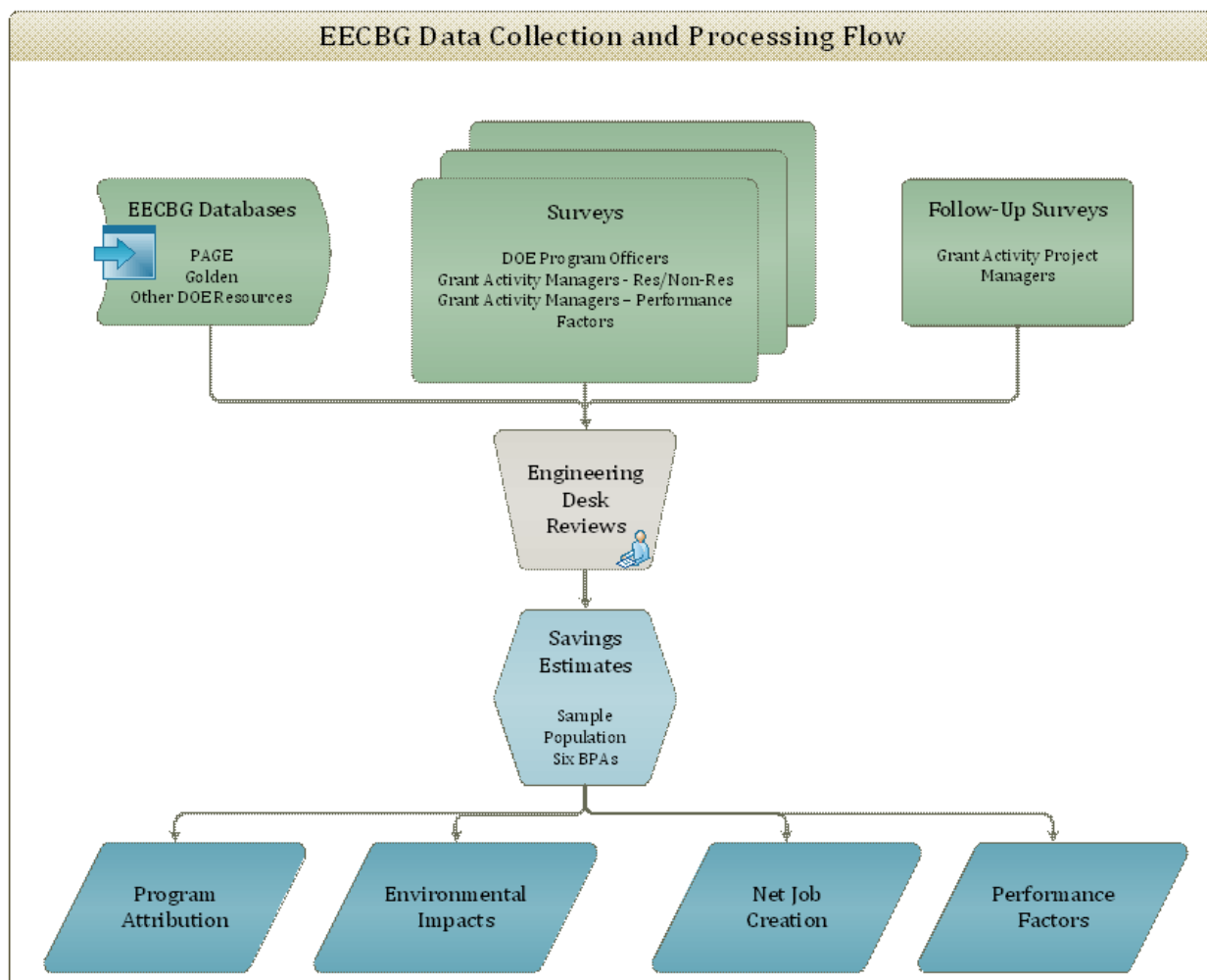
- a) Survey #2A – Residential Grant Activity Manager Survey (ResGAMS)
- b) Survey #2B – Non-Residential Grant Activity Manager Survey (Non-ResGAMS)

Survey #3: Performance Factors Survey - Telephone surveys with Grant Managers of the sampled Activities

- Follow-up in-depth interviews with grantee/sub-grantee project managers to obtain additional activity specific information required for the evaluation that was not provided in the program databases or in the telephone surveys.

Figure 3-1 shows the relationship between these three primary data sources and key analytical components of the evaluation.

Figure 3-1: EECBG Data Collection Processing Flow



The following section describes each data collection Activity and how the three activities will form the basis for evaluating the EECBG program.

The additional sources of information that may be used, as available, are data from program evaluations that may be undertaken by states or grantees. As this is not a reporting requirement for grantees, we do not anticipate that all sampled jurisdictions will have an evaluation performed. Further, we cannot say at this point what the quality or comprehensiveness of the evaluations will be. Even so, the project team will identify and review any evaluations that are available at the time of the analysis to consider whether any of the information contained therein might be useful to this effort.

3.1 Reporting Data and Activity Documentation

The evaluation will incorporate an in-depth review of the data that grantees and sub-grantees are required to report to the Office of Management and Budget (OMB) and DOE⁹ on a quarterly basis. The type of information will include the following:

Quarterly reporting to OMB (federalreporting.gov) - Required of grantees, may be delegated to sub-grantees

- Total amount of ARRA funds received from DOE
- Amount of ARRA funds expended or obligated to projects or activities
- Detailed list of all projects or activities
- Information on subcontracts or sub-grants awarded by Prime Recipient

Quarterly reporting to DOE (PAGE) – Required of all EECBG Grantees

- All Prime Recipients are required to report quarterly through PAGE
 - Allocations >\$2M required to report a subset of the quarterly data on a monthly basis into PAGE (Performance Accountability for Grants in Energy). Reporting may be delegated to sub-recipients.
- Two additional reports
 - Federal Financial Report (SF-425)
 - Performance Report (at the level of Activity)
 - Activity Status
 - Activity Milestones
 - Financial Metrics
 - Progress Metrics
- Three categories of metrics
 - Jobs/Hours Worked

⁹ DOE EECBG Program Notice Effective April 21, 2010, formula grant reporting guidance.

- Standard Program Metrics – outlay and obligation of funds, amount of Activity completed

Grant Reporting and Analysis Software System (GRASS) – Compliance and monitoring data provided by EECBG DOE Program Officers

- Inputs based on information grantees submit to PAGE and on findings from monitoring desk reviews/visits
- Primarily compliance and procedural in nature
- Narrative component can provide insight into project/program accomplishments, challenges and keys to success

Grant Close-Out Tagging Process – Final data requirements collected via interview with grant recipients when grants are concluded.

DOE's Golden, Colorado office is responsible for grant close-out activities. As part of this process, they have developed a "Tagging Process" whereby more detailed information on actual activities and actions taken are being collected in recognition that this is the last time that information may be captured on what was accomplished. The developers of the process shared their data collection form with KEMA and ORNL and enabled us to provide comments and suggestions for evaluation purposes.

It is the intent of DOE to have the results of the Tagging Process incorporated into PAGE and appended to each grant/data file upon project close out.¹⁰ A pilot test of the process is being undertaken in the first quarter of CY2012, with the full process implemented following the pilot. KEMA will verify whether the Activities selected for the sample have the additional tagging data available for use in the evaluation.

The data will consist of various elements including:

- Post-grant verification of BPAs and Activity level categorization
- Confirmation and more detail concerning any buildings treated

¹⁰ DOE is expected to complete this process in early 2012. However, if tagging process is completed after the engineering desk review process has begun or if the comprehensiveness of the data is not sufficient, this information will not be included in this study.

-
- Confirmation and more detail concerning end-uses of energy that were addressed
 - Confirmation and more detail concerning specific measures installed
 - Collection of additional detail on building characteristics

3.2 Survey Instruments

3.2.1 Objectives

The scope of this project involves a combination of careful reviews of grant status reports and applications plus three primary survey data collection activities:

Survey #1: Program Officers Survey - In-depth interviews with DOE Program Officers, State and Regional Coordinators

Survey #2: Grant Activity Manager Survey (GAMS) - Telephone surveys with Grant Activity Project Managers who are closest to the activities conducted under each Grant Activity sampled, with two versions of the instrument as follows:

- Survey #2A – Residential Grant Activity Manager Survey (ResGAMS)
- Survey #2B – Non-Residential Grant Activity Manager Survey (Non-ResGAMS)

Survey #3: Performance Factors Survey - Telephone surveys with Grant Program Managers of the sampled Activities

Grant Program Managers (Survey #3) are state employees who oversee the distribution and administration of the EECBG grants. Grant Activity Managers (Survey #2) are state or local employees who have been directly involved in the implementation of a specific Activity. For some Activities, the Grant Program Manager may also serve as the Grant Activity Manager.

The objective of the interviews and surveys, shown in Table 3-1, are to assemble critical data necessary for answering the three key research questions in this study.

Table 3-1: List of Surveys and Their Objectives

Survey	Objectives
Survey #1: DOE Program Officers, State and Regional Coordinators (Program Officer Survey)	a) Identify the best person to respond to Survey #2 regarding building and measure-level data b) Obtain their perspective on the sampled grant activities under their jurisdiction c) Collect data regarding possible key Performance Factors
Survey #2: Grant Activity Project Managers (GAMS) – 2 versions: Survey #2A: <u>Residential</u> Grant Activity Project Managers Survey #2B: <u>Non-Residential</u> Grant Activity Project Managers	a) Confirm proper categorization of the sampled Activity b) Verify data from PAGE and other sources as to the project description and what energy saving actions were taken c) Gather additional detail regarding buildings treated, equipment and measures installed, persistence of measures, changes in operations and building and measure characteristics to enable calculation of energy savings
Survey #3: Grant Program Managers (Performance Factor Survey)	a) Collect data regarding possible key Performance Factors

3.2.1.1 Discussion of Data Collection Approach

The data collection approach followed by KEMA is to conduct in-depth telephone interviews with DOE Program Officers, State and Regional Coordinators, and telephone surveys with Grant Program Managers and Grant Activity Project Managers.

The in-depth interviews (Survey #1 – Program Officer Survey) will be guided by an interview protocol with a series of broad questions regarding the relative performance of EECBG grants within their portfolio, and a series of questions specific to the sampled grant Activities within their jurisdiction. Critical to these interviews is the identification or confirmation of one individual who has the most knowledge about the specific Activity(ies) selected for evaluation. DOE Program Officers/State and Regional Coordinators who manage grant portfolios where no Grant Activities are sampled will only be asked the broader series of questions regarding grant performance in general.

Telephone surveys of Grant Activity Managers (Survey #2A and #2B) will then be employed to confirm information collected from the PAGE database and other program data sources (as

described in Section 3.1) and obtain more detailed information necessary for the calculation of energy savings. It is recognized that in many cases the PAGE database may not contain sufficient detailed measure data; and therefore, these surveys are designed to obtain an understanding of the Activity from the Program Officer's perspective and to obtain contact information for the Grant Activity Project Manager.

KEMA will conduct the three surveys described above in sequence, starting with DOE Program Officers, and the State and Regional Coordinators (Survey #1). Once the review of the EECBG databases and Program Officer Surveys have been completed, a customized survey instrument will be created from the broad survey instruments described above (Survey #2A and #2B) for each of the 350 Activities, populating the first section of the survey with basic information such as Grant Broad Program Area designation, a Grant Activity description (the basis of sample selection), grant amount, and contact information for the individual being interviewed. The Grant Activity Manager surveys will then be scheduled by the KEMA team and are anticipated to take approximately one hour to complete, with the expectation that simpler activities (treated one building or several facilities with one type of measure, etc.) will take less time than more complex activities.

Finally, telephone surveys of Grant Managers (Survey #3) will then be employed to collect data to help determine what factors influence the performance of a grant or Activity.

3.2.1.2 Benefits and Resource Efficiency

There are several efficiencies built into the data collection process. First, the survey instruments are designed into modules or sections where respondents may skip entire groups of questions that do not apply to their situations. The survey instruments themselves are quite long because they must take into account all potential situations and scenarios. In executing the surveys, however, respondents will only be asked questions that apply to their sampled Activity. The vast majority of interviews will involve only a small subset of the overall survey sections. For example, it would be a rare situation that any one interviewee would be subject to the entire set of questions in Survey #2. (That would mean that a facility was treated with measures in all categories including an on-site renewable energy system.)

A second efficiency built into the Work Plan is that there will be extensive reviews of the EECBG databases, which will populate, when possible, much of the survey data in Survey #2 up front. Accordingly, a large part of the telephone survey will consist of verifying information that KEMA already obtained from the PAGE data set and documentation for the Activity.

A third efficiency results from the planned implementation of the surveys, in that the person conducting the review of EECBG databases will also conduct the DOE Program Officer calls, and to the extent possible populate the survey instrument with data, review the results of the GAMS telephone survey instrument (Survey #2), and conduct any follow-up calls necessary to clarifying the information collected. By having one person follow the investigation for a Grant Activity from start to finish, KEMA seeks not only a more cohesive and efficient process, but a better quality result and product. It is understood that the primary data collection source rests with the technical staff of the grantees doing the projects in their facilities and that all other data will be used only when it can be considered complete and equally reliable enough that grantee interviews with technical teams are not required.

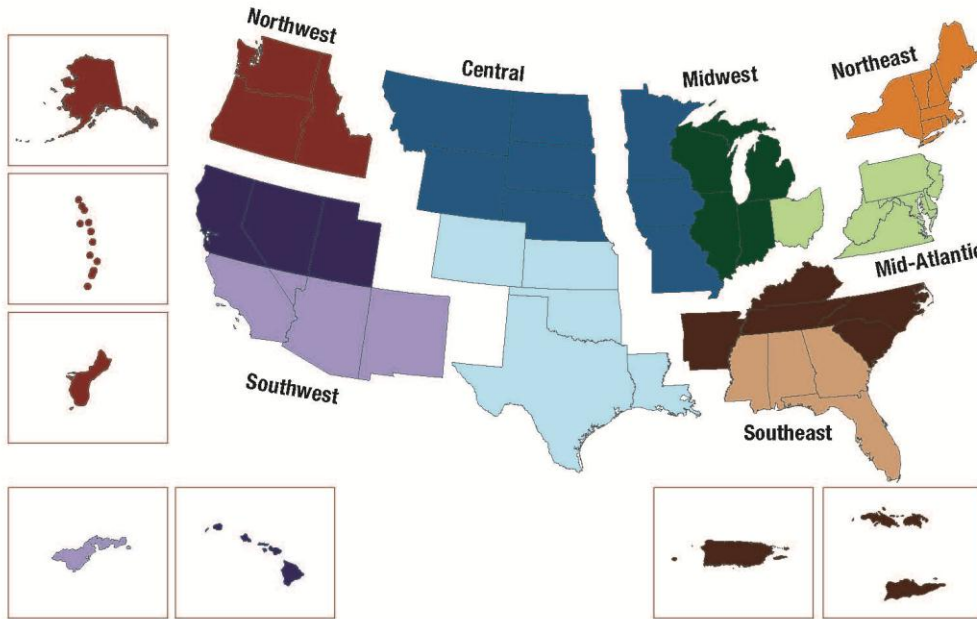
3.2.2 Survey #1 – DOE Program Officers, Regional and State Coordinators

DOE Program Officers located in the 50 states and 5 territories are responsible for overseeing a portfolio of EECBG grants within their geographical jurisdictions. A second tier of oversight for EECBG grants is provided by DOE Regional and State Coordinators. Through DOE's Technical Assistance Network, there are State and Regional Coordinators who engage with all grantees (SEP, EECBG) on a regular basis. While they are responsible for coordinating technical assistance needs through a network of subject-matter expert teams, they engage with all grantees in their area on many levels. Some coordinators have a deep understanding of grantee programs, program/project players, obstacles, and successes. They provide regional peer-to-peer opportunities for grantees to learn from one another and in general "keep their finger on the pulse" of grantee activities.

Seventeen regional coordinators located around the country, as shown in Figure 3-2, provide assistance to EECBG grantees regarding a range of subjects. KEMA will include these individuals in the Program Officer Survey sample.

Figure 3-2: EECBG/SEP TTA Regional Coordinators

EECBG/SEP TTA Regional Coordinators



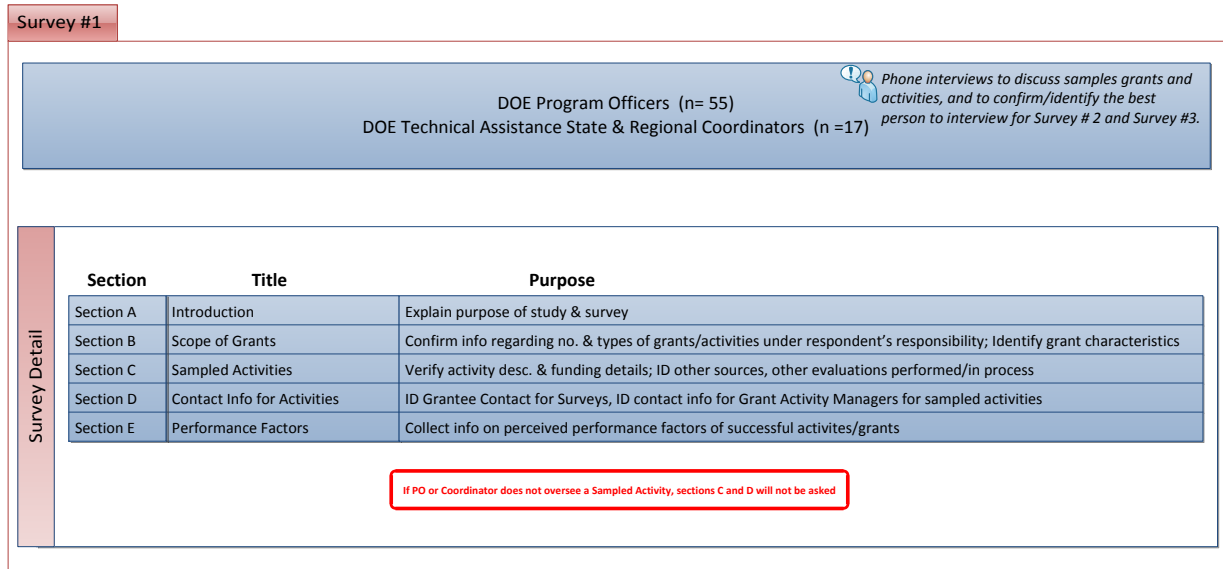
State Regional Coordinators

Northeast	Chuck Guinn, straguinn@aol.com 518-478-0748
Mid-Atlantic	Chuck Clinton, cclinton@naseo.org 703-299-8800 x19
Southeast	Brian Henderson, bhenderson@naseo.org 518-469-7497
Midwest	Jeff Pillon, jpillon@naseo.org 517-580-7626
Central	Jim Ploger, jploger@naseo.org 785-383-2557
Northwest	Bill Nesmith, wnesmith@naseo.org 503-580-4499
Southwest	Jim Anwood, jarwood@naseo.org 602-468-1702

Local Regional Coordinators

Northeast	Marianne Graham, MGraham@icfi.com 603-291-0071
Mid-Atlantic	Leigh-Golding DeSantis, LDeSantis@icfi.com 202-862-1202
Southeast 1	Marylou Einfalt, MEinfalt@icfi.com 919-246-4903
Southeast 2	Mitch Brown, MitchBrown@icfi.com 404-861-7227
Midwest	Therese Dorau, TDorau@icfi.com 202-862-2686
North Central	Zach Abrams, ZAbrams@icfi.com 646-334-1174
South Central	Micah Brill, MBrill@icfi.com 202-862-1177
Northwest	Karen Tsai, KTsai@icfi.com 415-677-7165
West	Liz Grubin, LGrubin@icfi.com 415-677-7114
Southwest	Aaron Burdick, ABurdick@icfi.com 818-325-3158

Figure 3-3: Structure, Purpose and Sequence of Survey Modules for Survey #1 Program Officer Survey



There is only one core instrument under Survey #1. Those respondents overseeing sampled Activities will be administered the full survey, Sections A – E. Others who do not have sampled Activities will only be asked Sections A, B and E.

3.2.3 Survey #2 — Local Grant Activity Manager Survey (GAMS)

This survey is the heart of the evaluation in that it is used to verify self-reported data on the specific activities sampled for energy savings calculations. It is also the critical source of data beyond that which is found in PAGE or the other data sources identified since it collects information directly from grantee and sub-grantee that are directly involved in the Activity. Figure 3-4 outlines the sequence and content of Survey #2.

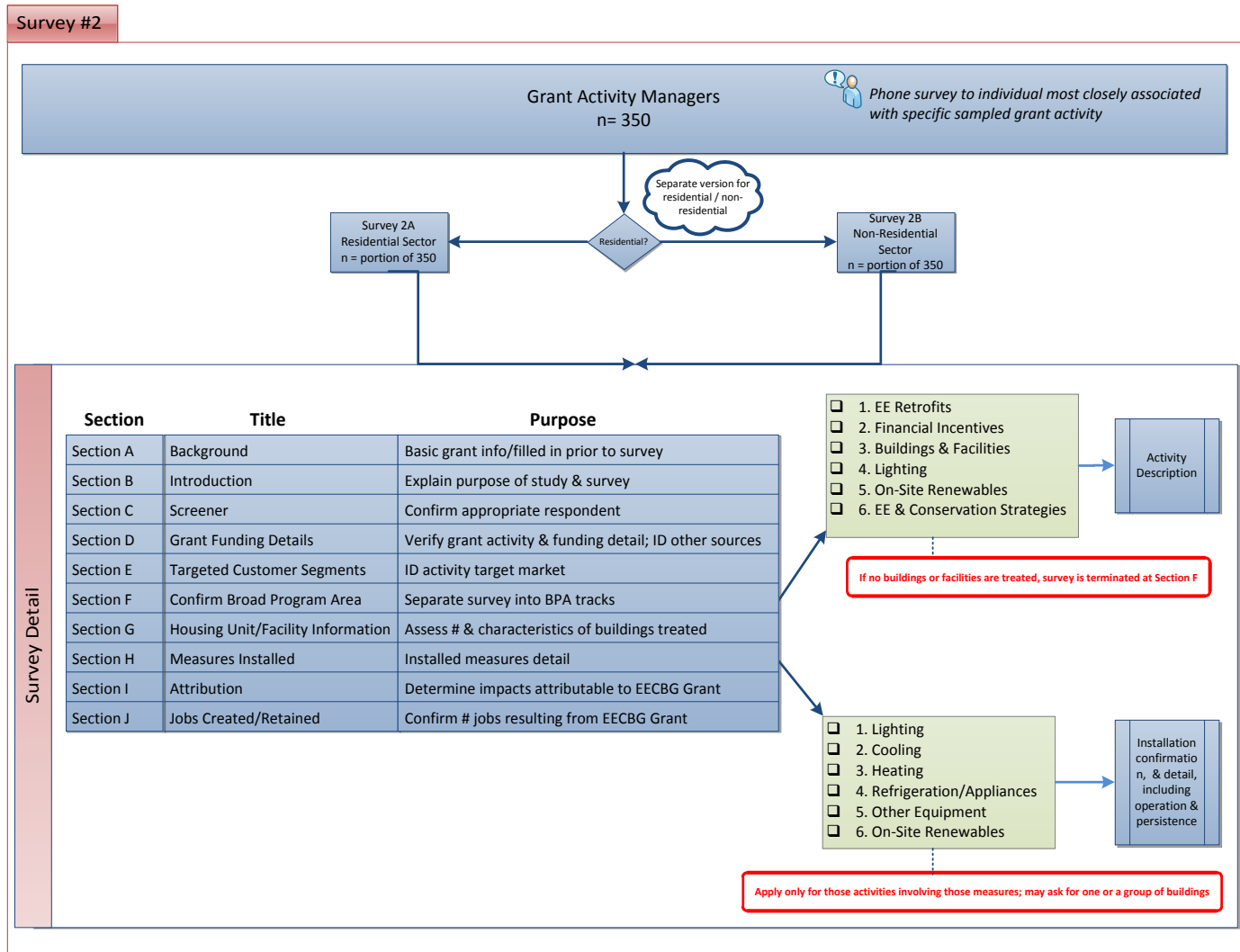
Survey 2 consists of two versions:

- **Survey 2A: Residential GAMS** – Survey questions for Grant Activities targeted to residential end users of energy, residential buildings, and residential appliances and measures.
- **Survey 2B: Non-Residential GAMS** – Survey questions for non-residential Grant Activities including those focused toward municipal buildings, commercial or business establishments, industrial end user facilities, and the equipment and systems they contain.

Both survey instruments follow the same general format with the content of the questions tailored to relate to residential or non-residential buildings. The primary objective of this survey is to collect detailed technical information required to calculate savings estimates. The surveys address the following topics:

- Introduction and screening for correct respondent
- Confirmation of Broad Program Area categorization
- Respondent's role in the Activity
- Building and firmographic characteristics
- Verification of inventory by end use and measure
- Attribution

Figure 3-4: Structure, Purpose and Sequence of Survey Modules for Survey #2 Grant Activity Project Manager Survey



The Residential and Non-Residential GAMS will be administered to those individuals identified in Survey #1 as being the most knowledgeable about each respective sampled Activity. In some cases, it may be the Grant Program Manager who is also closest to the Activity within the grant; whereas in others, particularly those with multiple activities carried out under one Grant, it is more likely that another individual was responsible for carrying out the actual project(s) under that Activity. We will begin by verifying the name of the contact person listed in PAGE for each Activity with the DOE Program Officer in Survey #1; if they have a more appropriate person, we will collect their name, position and contact information.

The survey will start by verifying that we have the correct person on the phone, and that adequate time is set aside for the interview. It is important to identify the person most knowledgeable about the Activity. If the initial contact person is not the appropriate contact, the interviewer will ask for the contact information for the appropriate person. All calls will be scheduled ahead of time to allow the respondent to prepare for the discussion and set aside the time necessary to complete the survey (estimated at up to one and a half hours for particularly complex activities, to a minimum of 40 minutes for those activities involving limited buildings and measures).

3.2.3.1 Verification of Measures and Actions

As shown in Figure 3-4, the BPA categories of Energy Efficiency Retrofits (1), Lighting (4) and On-Site Renewables (5) activities are likely to most directly involve actual installations of measures in buildings, because of the nature of the category. Thus, we anticipate being able to proceed relatively quickly to energy savings related questions in Sections F, G and H. For the other BPA categories, a sequence of questions unique to each category must be posed before one can determine whether buildings or facilities are actually treated (directly or indirectly), what types and how many, whether any information is available on those buildings/treatments, and whether the respondent has the knowledge to be able to provide that information. If it is discovered that no actual energy savings actions were taken for an Activity selected in the sample, the survey will be concluded at that point. The selected Activity will be replaced with another Activity. The sampling methodology and replacement protocols are discussed in Section 4.

Two examples of possible outcomes for these categories are provided:

Example 1: Financial Incentive Program Activity (F2) - An Activity selected into the sample under the Financial Incentive Program BPA may be determined to consist of a loan program for small businesses to replace lighting systems. The survey will therefore probe what types of

non-residential buildings were targeted (small business), how many actual small business facilities were treated using loans given out under the Activity, how many lighting measures were installed in those facilities and what types. More information will be sought regarding what kinds of equipment were replaced, hours of use data for the facilities, and other information necessary for developing an estimate of energy savings. It should be noted that some of this information will be collected as part of Survey #2, and some may require a follow-up interview, as described below in section 4.2.4.

Example 2: Energy Efficiency and Conservation Strategy Program Activity (F6) – An Activity selected under this BPA has a greater chance of not resulting in specific treatments made to a building or facility, due to the nature of the activities described under this category. Most often activities under this BPA consist of indirect energy savings projects, such as development of a Community Sustainability Plan or other policy, communications and educational projects. Some jurisdictions may have information about specific buildings treated or actions taken as a direct or indirect result of such activities. The Survey in Section F6 will seek to determine whether any buildings were actually treated, how many, what types, and with what treatments. If no buildings are known to have been treated (or other energy savings actions taken), then the survey will be terminated after Section F, the respondent thanked and the call ended.

3.2.3.2 Attribution Questions

Following the customized questions from sections F, G and H above, all respondents will be guided to Section I for a series of questions related to attribution. These questions are based upon industry-standard methods of probing for the extent to which the specific intervention – in this case, the funding from the EECBG grant – influenced the actions taken. In the case of many EECBG activities, it is likely that other funding sources were tapped to complete the project; whereas in others, the entire project may have been paid for exclusively with EECBG grant dollars. Beyond the question of funding, attribution questions also deal with the decision-making process. Was the project planned prior to the seeking of funding from EECBG? Would it have gone forward without EECBG funding?

The results of these questions will feed the analysis of attribution by applying a factor to the energy savings reductions achieved. If the EECBG grant is the primary source of influence, then the energy savings and demand reduction impacts will not be adjusted downward. If, however, the EECBG grant was only one factor in the decision to proceed with the project, or if the project had multiple funding sources, then the energy savings reductions will have to be adjusted to account for the various influences on project outcomes.

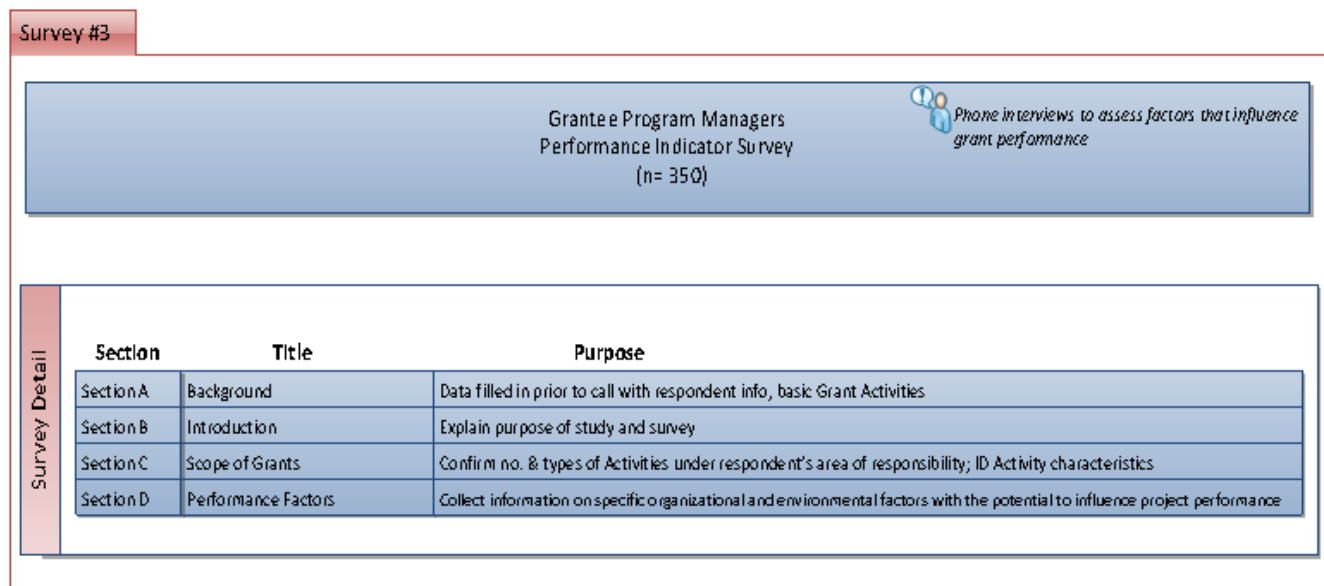
Section 8 of this Work Plan explains the approach to assigning attribution in more detail.

3.2.4 Survey #3 – Performance Factors Survey

The third survey involves collection of data related to the performance of grants and activities to help determine what factors influence the performance of a grant or Activity. Section 11 of this Work Plan describes KEMA’s strategy for this analysis in detail. For this survey, KEMA envisions a brief introductory section followed by verification/collection of data on the characteristics of the Activity sampled in Section C. This will be followed by questions related to the various factors that may influence the performance of the grant/sub-grant activities, such as number of staff devoted to the project, the number of times that the grantee took advantage of available Technical Assistance, etc. Other questions in this section may relate to the understanding and perceptions of the Grant Program Manager regarding qualitative factors (enthusiasm of the Activity Manager, history of the jurisdiction in conducting previous projects, or the general economic health of the jurisdiction receiving the grant, etc.)

Figure 3-5 illustrates the sequence and content of Survey #3.

Figure 3-5: Structure, Purpose and Sequence of Survey Modules for Survey #3 Performance Indicators Survey



In order to capture the same information from various perspectives, some of the questions posed to Grant Program Managers in Survey #3 will also, as appropriate, be asked of DOE Program Officers, Regional and State Coordinators, and Grant Activity Managers as part of Surveys 1 and 2.

3.3 Follow-up Interviews with Grantee and Sub-grantee Activity Project Managers

After the GAMS surveys are completed, the data for each Activity will be reviewed to determine whether there are any remaining gaps in the data needed for calculating energy savings, or clarifications required to the responses provided. It is important to recognize that the primary purpose of the GAMS surveys is to elicit the information necessary to conduct the savings analysis. However, it is expected that some Activity information will be unique to the specific Activity and will not be feasible to collect using the GAMS surveys. In those instances, the desk reviewers will construct a customized set of questions to address the gaps, and make a follow up call to the Grant Activity Project Manager. Given the diversity in Activities and the preliminary review of the DOE databases, it is expected that follow-up interviews will be required for the majority of the 350 sampled Activities.

In addition, it may be determined during the calls for Survey #2 that another individual is needed to address some section of the Survey #2 questionnaire. If that is the case, then the survey can be terminated, or a section skipped, for follow up with the other individual in order to collect the best information possible.

4. Program Data Characteristics and Sample Design

This chapter summarizes the initial analysis of the PAGE database and describes the proposed sample design and framework, with some details based on the initial analysis of the PAGE data base.

To describe the sampling approach, we discuss the following:

1. Definition of the sampling frame: what are the units or elements that can be selected for the sample? How are these units defined and identified? Which units are included in the study and which are excluded?
2. How will the sample be stratified?
3. How will the sample points be allocated to the stratification cells?
4. Staging: how will the sample be staged over time?

4.1 Sampling Frame

4.1.1 Structure and Sampling Units

4.1.1.1 Overview

This study will be conducted by selecting a random sample of EECBG-funded Activities for evaluation, and estimating the full program savings based on the evaluation results for this sample. To develop the sample, it is first necessary to define what the units or elements are that can be selected for evaluation. The list of all the units or elements that can be selected, and that in turn are formally represented by the study, is the sampling frame. For this study, the units or elements in the sampling frame are “Activities.”

The RFP specified that a sample of “Activities” will be selected for evaluation. An “Activity” is an initiative conducted under a single grant or sub-grant to a particular agency. The Activity may be an individual energy efficiency project at a particular facility, a group of energy efficiency projects at one or more facilities, or broader initiatives or programs not identified with specific facilities or projects.

A record in the PAGE database is identified by its “Activity Worksheet Unique ID.” A single grant may have multiple Activity Worksheet Unique IDs. As described above, some at least 60% of grants to states and territories are further distributed in sub-grants. Sub-grant detail is not provided in PAGE. However, a single sub-grant also may have multiple initiatives within it, that can be considered to be separate “Activities,” but that are not identifiable within PAGE.

The sampling frame to be constructed therefore will include two types of Activities

1. Grant-level Activity IDs: An Activity Worksheet Unique ID in PAGE that does not involve sub-grants
2. Sub-grant-level Activity IDs: A sub-grant or component of a sub-grant.

To construct the sample frame, it will therefore be necessary to compile information on activities within sub-grants similar to that available in PAGE for non-sub-grantee Activity Worksheet Unique IDs. The Golden program office has indicated they will provide this sub-grant-level information during the first quarter of CY2012.

4.1.1.2 Further discussion

EECBG grants are given to three types of entities: local government agencies, tribes, and state/territorial agencies. Most of the state/territorial grants are distributed to other agencies via sub-grants. Thus, local government agencies can receive EECBG funding either via a direct grant from DOE, or via a sub-grant from the state/territorial agency that received the DOE grant. The state/territorial grants represent a small fraction of the total number of DOE grants (55 out of 1696) but account for over a quarter of the total funding, most of it disbursed to other agencies.

As described in the RFP, “Activities’ are the basic building blocks of the [EECBG] Program and refer to specific actions taken by individual grant recipients.” Thus, the Activity will be the common ultimate unit of selection for the sample. As described in the RFP and in KEMA’s proposal, a total of 350 Activities will be selected.

However, for the state/territorial grants that are distributed as sub-grants, the specific actions ultimately taken are not listed within the grant information in the PAGE data base, but only in more detailed information expected to be available for each sub-grant.

For each DOE grant, the PAGE database lists the individual efforts funded by the grant, the Activity type, description, contact information, and associated funding amount. For each effort within a grant, there is a record in the database identified by an Activity Worksheet Unique ID.

For the direct grants to local governments and tribes, the Project Descriptions indicate fairly specific actions, such as efficiency improvements to specific facilities or infrastructure, a particular educational program, or a particular planning process. For the state/territorial grants, the Project Descriptions describe sub-grant processes or assistance programs to be implemented with the funds. Specific actions, improvements, or programs are not reported in PAGE. However, we would like to conduct evaluations, and to select units to be evaluated, at this granular level of specific actions, improvements, or programs. We do not want to select an entire state grant for evaluation. Rather, we want to develop the more fine-grained detail on Activities within the sub-grants, and draw a sample of these Activities.

The DOE Office in Golden, CO, which administers the state/territorial grants and other large grants (\$2 million or more), committed to compiling a database of specific activities within each sub-grant. This database will provide details for each specific Activity similar to that available for direct grants in PAGE. We anticipate that this database will be available by the end of the first quarter of CY2012.

We therefore propose to define the sampling unit for the selection of 350 activities as an Activity, defined as one of the following:

- An Activity corresponding to an Activity Worksheet Unique Id in PAGE, for grants not redistributed as sub-grants.
- A specific, uniquely identifiable Activity defined within sub-grants based on additional data for state/territorial grants re-distributed as sub-grants.

In the latter case, there may be multiple Activities within a single Activity Worksheet Unique Id in PAGE.

Table 4-1 indicates the distribution of grants and activities based on the recent PAGE data as of December 18, 2011. The highlighted values for number of sub-grants, number of Activities within the sub-grants, and corresponding average budget per Activity for sub-grantees are approximations at this point. These approximations are based on the rough estimates in the RFP of the numbers of sub-grants.

Table 4-1: Structure of grant and sub-grant recipients and activities for the 6 BPAs

Grant Recipient	Number Grants	Number Sub-grants	# of Activities	Budget \$B	Budget to Grants \$B	% of Budget	Average Budget per Grant (\$M)	Average Budget per Activity (\$1000)	# Sample Points Allocated Prop'l to Budget
Local Government	1696	4.3	6000	1.88	1.60	70%	1.1	313	244
Tribes	587	4.4	700	0.055	0.05	2%	0.1	79	7
States	55	5400	10000	0.767	0.65	28%	13.9	77	99
Total	2338		16700	2.702	2.3	100%	1.2	162	350

There are approximately 200 Activity Worksheet Unique Ids in PAGE corresponding to state/territorial grants, totaling over \$750 million dollars. Thus, the average spending per PAGE unique Id is about \$3.5 million for these grants, compared with about \$300,000 for the local government grants. It will therefore be more effective to sample the state/territorial grants at the finer level corresponding to specific activities within the sub-grants, rather than treating an entire grant-level Activity, corresponding to a state program or sub-grant making function, as a unit for selection. This is the reason we propose to define Activities within sub-grants as the unit of selection for these types of grants.

An initial indication of a likely sample distribution is given in the final column of the table. This column indicates the number of sample points that would go to each grantee type if the 350 sample points are allocated proportional to total budget. The final sample allocation will take a number of other factors into account, as described below.

4.1.2 Frame Restrictions

4.1.2.1 BPAs Included

The RFP specifies that the focus of this evaluation will be on the six largest BPAs, which together account for over 80 percent of the total program funding. Table 4-2 below indicates the budget and number of Activity Worksheet Unique IDs in PAGE by BPA as of December 18, 2011. Based on these data, the six largest BPAs are the same as those indicated in the RFP. Together, these account for about \$2.3 billion, or 84 percent of the program budget.

Table 4-2: Budget and Activity Count by BPA per PAGE – 12/18/2011

BPA	BUDGET	UNIQUE ACTIVITIES
Energy Efficiency Retrofits	\$ 1,061,789,136	2489
Financial Incentive Program	\$ 498,676,898	361
Buildings and Facilities	\$ 265,774,085	781
Lighting	\$ 196,714,002	631
Onsite Renewable Technology	\$ 169,129,015	454
Energy Efficiency and Conservation Strategy	\$ 129,680,034	771
Transportation	\$ 117,174,520	528
Other	\$ 77,257,567	77
Technical Consultant Services	\$ 67,992,028	526
Residential and Commercial Buildings and Audits	\$ 64,102,333	442
Material Conservation Program	\$ 32,003,942	160
Energy Distribution	\$ 30,787,364	69
Reduction/Capture of Methane/Greenhouse Gases	\$ 29,968,657	42
Codes and Inspections	\$ 18,347,452	111
Grand Total	\$ 2,759,397,032	7442
Total of Top 6	\$ 2,321,763,170	5487
Top 6 as % of Total	84%	74%

As noted above, the Activities within sub-grants are not identifiable from PAGE. There is a BPA defined for each grant-level Activity. Ad hoc review of some of the Project Descriptions for state/territorial grants indicates that the Activities under the corresponding sub-grants, once that detail is available, will likely be consistent with this grant-level BPA, at least in many cases. However, when we review the specific activities within the sub-grants, we may find that some of the Activities belong to a different BPA than the one indicated for the grant in PAGE. Thus, the distribution of spending by BPA and possibly even the identity of the six largest BPAs may shift after the Activities within sub-grants are identified.

Another consideration in defining what is included in the sampling frame is the nature of the activities under BPA #1, “Energy Efficiency and Conservation Strategy,” particularly for the state/territory grants. The Energy Efficiency and Conservation Strategy BPA differs from the other BPAs offered in the EECBG program. As a condition for participation in EECBG, potential grantees/sub-grantees were required to develop an energy efficiency and conservation strategy plan for their municipality or tribe. Some strategies developed in this BPA did not necessarily translate to direct energy savings but rather identified other EECBG BPAs or other energy

efficiency programs (e.g., State Energy Programs, utility sponsored energy efficiency programs, etc) that should be pursued to achieve direct energy savings. Therefore, for Activities in which energy efficiency measures were installed, will be included in the analysis of for BPA #1. Activities with no direct energy savings that are related to program administration, such as hiring an energy efficiency coordinator or costs for administering an energy efficiency program, will be excluded from the analysis. However, Activities such as training and education programs that may not have direct energy but rather indirectly lead to activities (e.g., building retrofits) that produce energy savings, will be included in the analysis of BPA #1.

Another restriction for consideration is project completeness. We plan to evaluate projects that are not necessarily complete at the time of selection or evaluation. However, it will be important to give credit for savings only to projects that are likely to be completed. The RFP specifies that the activity “must be far enough along so that its essential characteristics and operating environment can be well understood.” This specification does not require that the project be complete or nearly complete, but that it is sufficiently under way so that it is fully defined and unlikely to be abandoned. Final determination of likelihood of completion will be part of the evaluation of the selected activities.

4.2 Sampling in Waves

The RFP specifies that the sample will be stratified by expected time of completion, with evaluations first conducted for the more complete activities, moving to the next group only when the Activities in that group are sufficiently complete. Given the current timing of the sample selection, we propose to consider a maximum of two waves. Thus, we will stratify Activities into Early and Late, based on the time that Activity first reached a stage of being sufficiently complete to be evaluated.

Activities sufficiently complete as of the first sample pull (Early stratum) can be selected at that time, or at the second pull. Activities sufficiently complete only as of the second sample pull (Late stratum) can only be selected at that time. For this reason, we will err on the side of under-allocating sample to the first pull, because we can add sample points to the Early stratum in the second pull if needed. If we over-allocate to the first pull initially, we will not have enough sample points left to give an appropriate proportional allocation to the Late stratum in the second pull.

Thus, if we sample in two waves, we will first identify all Activities that are sufficiently complete for evaluation as of a specified cut-off date. This is the Early stratum. For the first wave, we will select a sample of Activities from the Early stratum. The Late stratum will include all Activities

that were not sufficiently complete as of the Early cut-off date, but are sufficiently complete by the time of the late cut-off date. For the second wave, we will select a sample from the Late stratum, as well as selecting additional cases from the Early stratum.

It is anticipated that the sub-grantee detailed data will be available in PAGE at the end of the first quarter of CY2012. Therefore it may be that the initial sampling wave will include only DOE direct grantees rather than state grantees. We will design our sampling allocations across the two waves to ensure that sub-grantees and larger projects (if applicable) are sufficiently represented in the second sampling wave.

In general, larger projects take longer to plan and complete. For this reason, it is common in many programs to find that earlier completed projects tend to be smaller than those completed later. If this pattern holds for this program as well, we may find that the Early stratum involves mostly smaller projects, and that most of the larger ones are in the Late stratum. For this reason, it is particularly important not to over-allocate sample to the first wave, which will include Activities only from the Early stratum.

4.3 Stratification

The RFP suggests stratifying the sample by BPA and within BPA by subcategories appropriate to each BPA, such as technology type. However, the only subcategory information available in PAGE is the Metric Activity. Each Activity Worksheet Unique ID in PAGE has a Broad Program Activity (BPA), as well as one or more Metric Activities. The Metric Activity is an activity category. The list of possible Metric Activities is the same as the list of possible BPAs. Thus, the Metric Activity can be viewed as a “secondary” BPA. In some cases the Metric Activity is the same as the BPA.

We will stratify Activities by state and sub-grantee BPA and Unique Activity Identification Code, as defined by DOE. The table below4-3 indicates initial allocations to the cells defined by BPA and Metric Activity, with allocation proportional to proposed EECBG budget.



Table 4-3: Initial Proportional to Size Allocation by BPA and Metric Activity

BPA/Metric Activity	Proposed EECBG Budget Total	% of Frame		Number of Unique Activities	Proportional to Budget Sample Allocation	Rounded Allocations
		Budget	% of BPA Budget			
Energy Efficiency Retrofits	\$ 1,061,789,136	46%	100%	2489	160.1	160
Building Retrofits	\$ 933,713,211	40%	88%	2209	140.8	141
Loans and Grants	\$ 33,346,225	1%	3%	18	5.0	5
Government, School, Institutional Procurement	\$ 32,812,418	1%	3%	111	4.9	5
Other	\$ 30,442,438	1%	3%	36	4.6	5
Industrial Process Efficiency	\$ 12,300,181	1%	1%	36	1.9	2
Building Energy Audits	\$ 6,427,561	0%	1%	20	1.0	1
Transportation	\$ 5,447,741	0%	1%	15	0.8	1
Clean Energy Policy	\$ 2,046,352	0%	0%	5	0.3	0
Financial Incentives and Rebates	\$ 1,879,535	0%	0%	6	0.3	0
Energy Efficiency Rating and Labeling	\$ 975,395	0%	0%	10	0.1	0
Renewable Energy Market Development	\$ 845,871	0%	0%	7	0.1	0
Building Codes and Standards	\$ 711,046	0%	0%	5	0.1	0
Workshops, Training, and Education	\$ 656,791	0%	0%	9	0.1	0
Technical Assistance	\$ 184,371	0%	0%	2	0.0	0
Financial Incentive Program	\$ 498,676,898	21%	100%	361	75.2	75
Loans and Grants	\$ 354,321,895	15%	71%	216	53.4	53
Financial Incentives and Rebates	\$ 78,312,410	3%	16%	113	11.8	12
Other	\$ 48,244,813	2%	10%	6	7.3	7
Building Retrofits	\$ 14,395,309	1%	3%	15	2.2	2
Clean Energy Policy	\$ 1,878,355	0%	0%	2	0.3	0
Technical Assistance	\$ 995,706	0%	0%	3	0.2	0
Building Energy Audits	\$ 473,823	0%	0%	3	0.1	0
Workshops, Training, and Education	\$ 54,587	0%	0%	3	0.0	0
Buildings and Facilities	\$ 265,774,085	11%	100%	781	40.1	40
Building Retrofits	\$ 135,209,795	6%	51%	265	20.4	20
Workshops, Training, and Education	\$ 27,863,302	1%	10%	209	4.2	4
Loans and Grants	\$ 25,175,392	1%	9%	11	3.8	4
Other	\$ 19,632,059	1%	7%	42	3.0	3
Building Energy Audits	\$ 16,036,481	1%	6%	72	2.4	2
Government, School, Institutional Procurement	\$ 9,767,926	0%	4%	52	1.5	1
Financial Incentives and Rebates	\$ 6,907,033	0%	3%	8	1.0	1
Clean Energy Policy	\$ 6,709,643	0%	3%	41	1.0	1
Industrial Process Efficiency	\$ 6,662,915	0%	3%	12	1.0	1
Renewable Energy Market Development	\$ 3,867,872	0%	1%	16	0.6	1
Technical Assistance	\$ 3,528,852	0%	1%	30	0.5	1
Energy Efficiency Rating and Labeling	\$ 2,279,856	0%	1%	9	0.3	0
Transportation	\$ 1,094,734	0%	0%	4	0.2	0
Building Codes and Standards	\$ 1,038,224	0%	0%	10	0.2	0
Lighting	\$ 196,714,002	8%	100%	631	29.7	30
Transportation	\$ 103,591,905	4%	53%	258	15.6	16
Government, School, Institutional Procurement	\$ 58,304,290	3%	30%	222	8.8	9
Building Retrofits	\$ 20,038,186	1%	10%	96	3.0	3
Other	\$ 9,609,295	0%	5%	28	1.4	1
Energy Efficiency Rating and Labeling	\$ 2,299,250	0%	1%	9	0.3	0
Industrial Process Efficiency	\$ 1,001,461	0%	1%	2	0.2	0
Renewable Energy Market Development	\$ 641,732	0%	0%	6	0.1	0
Loans and Grants	\$ 483,000	0%	0%	3	0.1	0
Clean Energy Policy	\$ 436,484	0%	0%	3	0.1	0
Building Codes and Standards	\$ 163,400	0%	0%	1	0.0	0
Workshops, Training, and Education	\$ 100,000	0%	0%	1	0.0	0
Technical Assistance	\$ 25,000	0%	0%	1	0.0	0
Financial Incentives and Rebates	\$ 20,000	0%	0%	1	0.0	0
Onsite Renewable Technology	\$ 169,129,015	7%	100%	454	25.5	25
Renewable Energy Market Development	\$ 151,875,786	7%	90%	381	22.9	23
Other	\$ 6,552,460	0%	4%	13	1.0	1
Clean Energy Policy	\$ 3,810,200	0%	2%	14	0.6	1
Government, School, Institutional Procurement	\$ 3,094,562	0%	2%	10	0.5	0
Building Retrofits	\$ 2,779,030	0%	2%	24	0.4	0
Industrial Process Efficiency	\$ 386,692	0%	0%	2	0.1	0
Building Energy Audits	\$ 238,100	0%	0%	2	0.0	0
Technical Assistance	\$ 133,672	0%	0%	3	0.0	0
Transportation	\$ 116,520	0%	0%	2	0.0	0
Loans and Grants	\$ 92,600	0%	0%	1	0.0	0
Workshops, Training, and Education	\$ 49,393	0%	0%	2	0.0	0
Energy Efficiency and Conservation Strategy	\$ 129,680,034	6%	100%	771	19.5	20
Loans and Grants	\$ 41,615,130	2%	32%	12	6.3	6
Clean Energy Policy	\$ 32,825,616	1%	25%	413	4.9	5
Other	\$ 30,728,530	1%	24%	130	4.6	5
Technical Assistance	\$ 10,237,762	0%	8%	111	1.5	2
Building Retrofits	\$ 4,881,777	0%	4%	26	0.7	1
Workshops, Training, and Education	\$ 4,032,576	0%	3%	34	0.6	1
Building Energy Audits	\$ 2,461,577	0%	2%	26	0.4	0
Transportation	\$ 1,402,700	0%	1%	4	0.2	0
Government, School, Institutional Procurement	\$ 758,691	0%	1%	5	0.1	0
Building Codes and Standards	\$ 368,210	0%	0%	2	0.1	0
Energy Efficiency Rating and Labeling	\$ 208,588	0%	0%	2	0.0	0
Renewable Energy Market Development	\$ 158,876	0%	0%	6	0.0	0
Grand Total	\$ 2,321,763,170	100%	600%	5487	350	

As the table indicates, some BPA-Metric Activity cells have less than one sample point allocated; each such cell contains less than 0.15 percent of the proposed EECSBG budget. Based on current PAGE information, these small cells *combined* represent less than 1 percent of the total frame. We recommend either collapsing these small cells (combining them with other cells) or excluding them from the sampling frame. Collapsing cells with small allocations (say 1 to 3 sample points) might also make sense.

A possible additional stratification variable is percent complete (as of the time the sample is defined for each wave). Based on the percent complete, we may stratify into the following categories such as:

- Complete or substantially complete
- Partly complete
- Substantially incomplete
- Not started

Activities that are not started or are insufficiently complete as of the time of sampling will be excluded. Other dimensions that will be considered for stratification include size (proposed budget), state, and grantee type. As described below, our proposed allocation and selection procedures will ensure that the sample is allocated approximately proportional to size, and is distributed across states and grantee types.

4.4 Allocation

Our general approach is to allocate samples proportional to size, with proposed EECSBG budget as the basic measure of size (MOS). Ideally, we would sample proportional to expected savings, but that information is unavailable.

To give greater emphasis to certain types of activities, an adjusted measure of size can be used that weights activities or cells with certain characteristics higher. For example, if we want to include partly complete activities at half the sampling rate, we would create a modified measure of size equal to proposed budget for substantially complete and complete activities, equal to half the proposed budget for partly complete activities, and equal to zero for substantially incomplete and incomplete activities.

We would then allocate sample proportional to this modified MOS. That is, we calculate the total MOS by summing the MOS over all Activities in the sampling frame. For each sampling

cell, we determine what percentage of the total MOS is in that sampling cell. This is the percentage of sample points allocated to that sampling cell.

The total sample of 350 implies that one Activity will be selected for approximately every 0.3 percent of the total MOS. That is, a cell with 1 percent of the total MOS will get an allocation of 3 sample points. A cell with 10 percent of the total MOS will have an allocation of 35 sample points. The allocation procedure we will use follows these general principles, with some refinements, as described below.

The first allocation step is to identify the “certainty” activities. These are the activities that by themselves would get an allocation of at least one unit based on their size. Certainty activities are identified in two rounds, as follows.

1. The initial certainty threshold is the total measure of size divided by total sample size. Using the total proposed budget for the 6 included BPAs with no re-weighting, this ratio gives 1 selection for each \$21M of budget. All Activities with proposed budget above this certainty threshold are included in the sample with certainty. Also, if a grant and sub-grant that has multiple Activities with a budget above the certainty threshold, each Activity above the threshold will be in sample with certainty. Therefore, it is possible that multiple Activities within a grant or sub-grant will be included in the sample.
2. Recalculate a “2nd pass” certainty threshold as the remaining measure of size divided by the remaining sample count. All Activities with measure of size above this second pass certainty threshold are included with certainty.

After the largest activities are pulled out in the certainty sample, the remaining sample is allocated to the remaining Activities proportional to size. This allocation will be done across the entire sample frame resulting with a BPA that having a high initial allocation due to a few very large Activities would have a smaller final allocation after the certainty Activities are pulled out.

Figure 4-1 below illustrates how the certainty allocation falls out for the current PAGE data, without identifying the Activities within the sub-grants. That is, in this illustration, each state/territory Worksheet Activity Unique ID that is a sub-grant distribution process is included as a single, very large Unique Activity. Most of these would end up as certainty selections. The column “sum of certainty allocation” indicates the total probability proportion to size (pps) allocation that would in principle go to the large activities. However, we allow each Activity to be selected only once. Thus, while the total size-based allocation to the certainty activities would

be 82, there are only 41 such activities. The rest of the allocation to these activities is included in the BPA remainder allocations.

Figure 4-1: Certainty Allocations¹¹

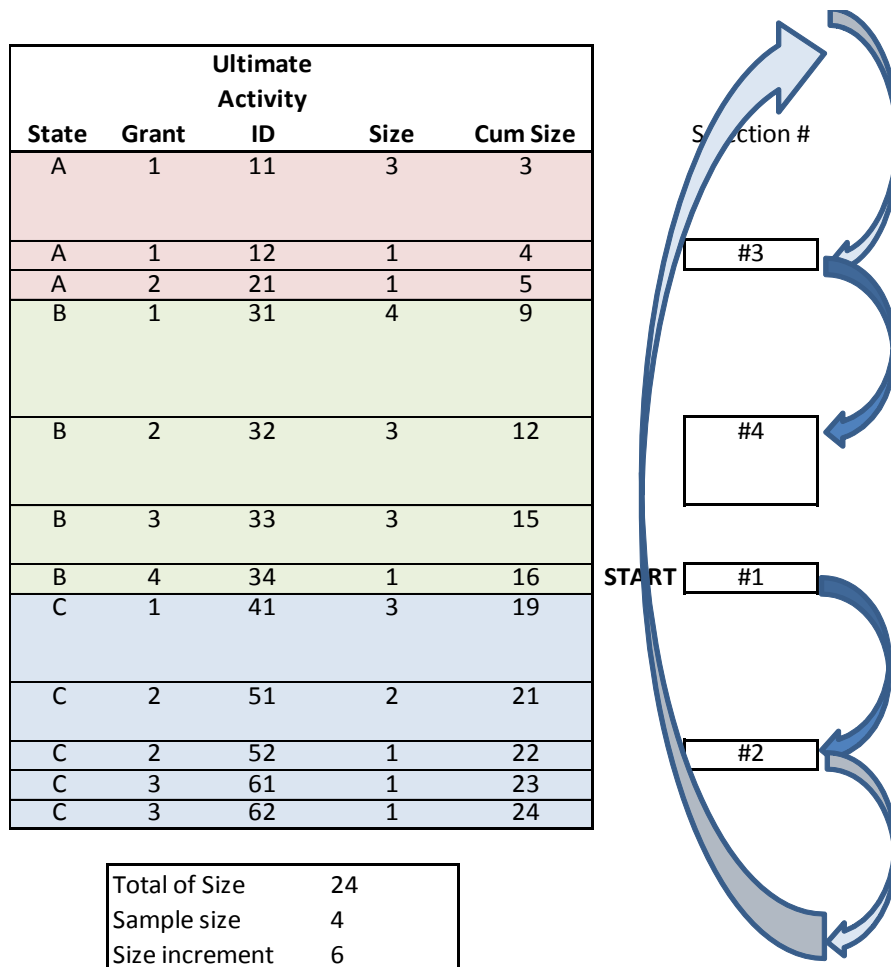
BPA	Sum of Proposed EECBG Budget	Count of Activity Worksheet Unique ID	Sum of sample points allocated	Sum of certainty allocation	Sum of # certainty activities
Local Government and Tribes Grants					
Energy Efficiency Retrofits	\$ 938,150,531	2461	141.4	18.4	10
Financial Incentive Program	\$ 236,945,115	325	35.7	13.2	6
Buildings and Facilities	\$ 235,731,704	764	35.5	5.1	3
Lighting	\$ 189,150,145	624	28.5	1.1	1
Onsite Renewable Technology	\$ 159,693,424	447	24.1	0.0	0
Energy Efficiency and Conservation Strategy	\$ 75,839,369	752	11.4	0.0	0
State Grants					
Financial Incentive Program	\$ 261,731,783	36	39.5	29.4	11
Energy Efficiency Retrofits	\$ 123,638,605	28	18.6	7.4	5
Energy Efficiency and Conservation Strategy	\$ 53,840,665	19	8.1	5.2	3
Buildings and Facilities	\$ 30,042,381	17	4.5	2.5	2
Onsite Renewable Technology	\$ 9,435,591	7	1.4	0.0	0
Lighting	\$ 7,563,857	7	1.1	0.0	0
Grand Total	\$ 2,321,763,170	5487	350.0	82.4	41

With the identification of sub-grant Activities within the state/territory grant-level activities, these very large activities will be broken up into smaller pieces. As a result, there can be multiple selections of Activities within a single state/territory grant Activity. This process will provide a better allocation of resources.

The allocation of the non-certainty sample will use a form of systematic proportional to size sampling based on Chromy's method. The procedure is illustrated in the figure below, for a simplified example with a total measure of size equal to 24, a sample size of 4, and each unit having a size or 1, 2, 3, or 4.

¹¹ Currently, we have only an approximate indicator for distinguishing grants to states for distribution to sub-grantees. KEMA anticipates obtaining a more definitive indicator from DOE.

Figure 4-2: Illustration of Systematic Proportional Sampling



Sort the Activities by BPA, State, and Grant number (or other factors we want to distribute the sample over systematically).

1. Beginning at the top of the sorted list, calculate the cumulative MOS for each Activity in the list.
2. Calculate the selection size increment as the total remainder MOS divided by the total remainder sample size.
3. Select a random start point between 1 and the total MOS. The first selection is the first Activity in the list whose cumulative size is greater than that random start point. This is the Activity the random start point “lands in.”

4. The next Activity selected is the one that is “hit” by adding the selection size increment (from Step 2) to the previous selection point. That is, the cumulative measure of size for the next selection point is the previous selection point’s cumulative measure of size plus the selection size increment. If this cumulative measure of size value is greater than the total measure of size, wrap the count around to the beginning. The corresponding selection is the first Activity on the list with cumulative measure of size greater than this.
5. Repeat step 4 until all selections are made.

This procedure ensures that an individual state or grant will be allocated selections within +/- 1 of its proportional allocation. In fact, the number of selections will be the (possibly non-integer) expected number rounded either up or down.

For example, in the illustration, the sample size is 4, and the total measure of size is 24. The sampling increment is therefore $24/4 = 6$. The sampling rate is 1 unit for every cumulative size measure of 6, or $1/6$ of a selection per size unit. State A has a total size of 5, so its expected number of selections is $5/6$. In the example, state A has 1 selection. State A cannot have more than 1 selection because the increment of 6 units cannot fit within State A. Once State A has been hit once, the next increment will go beyond State A. State A could end up with 0 selections, if the selection increments hit just before and just after it. Therefore, the possible number of selections for State A is 0 or 1.

State C on the other hand has a total size of 8. In the illustration it was selected once. However, with an increment of 6, State C could have been hit twice. State C has to be hit at least once, because its size is bigger than the selection increment. The expected number of selections for State C is $8/6 = 1.3$. The possible number of selections for State C is 1 or 2.

To control the sample size by BPA exactly, we will apply this method separately for each BPA. Within BPA, we can sort by Metric Activity, State, Grant, and Grantee type. We plan to sort first by State and Grant, so that each of these will have allocations within +/- 1 of their expected number within the BPA. However, there may randomly be over- or under-allocation to Metric Activity or Grantee Type within the BPA.

4.5 Oversampling

The sample drawn will be greater than the target of 350 completes, to allow for cases where it is not possible to evaluate a selected Activity due to lack of available or cooperative respondents, or other data limitations. We will work with DOE to make every practical effort to secure a response for the primary selections before moving to a substitute. We will provide explicit rules for how substitutes will be chosen.

5. Review of EECBG Databases

5.1 Creation of Review Packages

Each sampled grant Activity will have several background documents associated with it, including:

- Grant application
- Quarterly reports, with data incorporated into PAGE
- Reports to OMB, with data incorporated in OMB database
- Status reports to State and Regional offices, with data incorporated into GRASS

A set of Activities will be assigned to individual reviewers, with associated hard copy reports plus links to the various data sources for each grant. The combined information constitutes a grant review package.

5.2 Review Procedure

The initial review will occur prior to the administration of the surveys. This phase will proceed as follows:

1. Review all material associated with the selected Activity to determine what project(s) was performed, what types of buildings or facilities was involved and other aspects of the Activity.
2. Determine what portion of the grant the selected Activity represents, and obtain a general description of the other grant components.
3. Prepare a Case Study description of the Activity that will serve as the background “story” of the Activity.
4. Create an individual database of information concerning the specific Activity by extracting key data elements from PAGE, GRASS, OMB and any other sources of data on specific actions taken to save energy in buildings or facilities. Carefully provide

source notations as to the origination of each data point for future verification.¹² Note that a template/format will be developed for the Activity-Level Evaluation Data File for each BPA to ensure specificity for evaluation of that program type, comprehensiveness and consistency across Activities within each BPA.

5. Populate the survey instruments as follows using information collected from the reviews of the various EECBG databases.
 - a. Survey 1: DOE Program Officers, Regional and State Coordinators:
 - i. Name and contact info for the respondent
 - ii. Survey appointment date and time
 - iii. Interviewer name
 - iv. Grant title and recipient
 - v. Activity BPA category
 - vi. Activity description
 - vii. Grant amount
 - viii. Activity amount or budget
 - ix. Status of the Activity and Grant (descriptive and % complete)
 - x. Notes concerning any special issues or questions that have arisen from prior research and review of the EECBG databases
 - b. Survey 2: Grant Activity Manager Survey
 - i. Items i-ix listed in Survey 1
 - ii. Insert data from PAGE into each verification question in survey instrument
 - iii. For those questions that cannot be populated from PAGE, indicate whether the value is missing or of questionable quality
 - c. Survey 3: Performance Factor Survey
 - i. Items i-ix listed in Survey 1

¹² For example, insert a comment in each cell using Excel comment feature, or create a separate field for source notes within the database.

5.3 Post-Survey Review

After the new data are collected from the three surveys, the person conducting the will enter the survey data into the Activity-Level Evaluation Data File and update all Activity information. This phase will proceed with the following three final steps required before analysis:

1. Review for completeness and potential accuracy of information for assessing energy savings and other outcomes for the Activity.
2. Identify any questions or inconsistencies or remaining gaps in the available Activity Data.
3. If such gaps or questions remain, schedule a follow-up call with the respondent to fill gaps and address issues (See Section 6.0).

6. Survey Implementation

6.1 Population of Surveys with Data from Review of EECBG Databases

The review of the EECBG databases will culminate in having each assigned reviewer populate the appropriate Grant Activity Manager Survey (Survey #2A or #2B) with data concerning the specific Activity sampled. The purpose of this is to create a customized survey for each sampled Activity so that information can be quickly verified or collected while on the telephone.

The other two surveys – Survey 1 and 3 – will similarly be prepared with the contact person’s name, phone number, grant amount, BPA and Activity description so that the telephone interviewer can refer back to the specific projects undertaken during the call.

Figure 6-1: Survey Instrument Summary

EECBG Survey Instrument Summary		
Survey #1	Survey #2	Survey #3
<p>Target: DOE Project Officers; DOE Technical Assistance State and Regional Coordinators</p> <p>Purpose: Gain understanding of grant details, project activity, and performance. Identify Grantee Contact for further surveys.</p>	<p>Target: Grant Managers (Program Activity Level)</p> <p>Purpose: Obtain Program area and Activity level detail.</p>	<p>Target: Grant Managers (Program Level)</p> <p>Purpose: Identify factors with the potential to influence performance.</p>

6.2 Survey Training

KEMA will conduct training on the survey instruments with all team members who are conducting the calls. The survey instruments will be tested for timing and logic of the skip

patterns. A survey dictionary will be developed to assist the interviewers with technical terms and provide definitions for respondents who may have questions.

6.3 Conduct Survey #1 – DOE Program Officers Interviews

Senior KEMA team members will conduct the interviews with DOE Program DOE Program Officers, State and Regional Coordinators. We will employ professionals who have experience in conducting process evaluation interviews and have the technical capability to probe issues that may arise during the discussion. A key factor in these interviews will be the identification of the best person at the Activity Level of the grant selected to participate in the Grant Activity Manager Survey.

To schedule the calls, KEMA may request a cover letter email be sent by DOE introducing KEMA and the purpose of the calls so that full cooperation can be encouraged. We will schedule the calls at the respondent's convenience in anticipation of a 30 to 40 minute contact.

6.4 Conduct Survey # 2 – Local Grantee Grant Activity Manager Survey

These surveys will be performed by trained CATI telephone interview staff experienced in conducting energy efficiency program related studies. Each will undergo extensive training on the instrument so that they fully understand the skip patterns and response choices involved with each question. The survey instrument is very detailed with response choices, which will enable non-engineers to conduct this phase of the research in an efficient and cost-effective manner.

Once the surveys are concluded, the individual engineering staff (desk reviewer) will review each of the results for comprehensiveness and adequacy of data for the purpose of estimating energy savings.

6.5 Conduct Survey #3 – Performance Factors Survey

The Performance Factors Survey will be conducted by trained CATI staff using a programmed instrument. At the same time, there will be ample opportunities for open-ended questions so that any unanticipated factors and/or issues can be captured through the conversations.

6.6 Follow-Up Calls

Follow-up calls will be conducted by the engineers conducting the desk reviews, as these individuals possess the engineering knowledge of the technologies and building science that will enable them to probe for any gaps in the data. These follow-up calls will be made when needed to fill out the information necessary, and will focus upon detailed information unique to the specific Activity.

6.7 Prepare Survey Results Database

Responses from Survey #1 will be entered into a spreadsheet database for analysis. This approach will be used due to the more conversational nature of these calls, their shorter duration and the small sample size involved (55 DOE Program Officers and 17 regional and state support staff).

Responses from Survey #2 will be captured electronically during the telephone interview, with no manual data entry involved. We anticipate using a Computer Aided Telephone Interview (CATI) system that will automatically store responses to questions into a database for later analysis. Due to the complexity of the survey instrument and the potential need to cycle back to sections for addressing multiple buildings and/or multiple measures, a CATI system is most appropriate. This system also provides for frequent status reporting on the survey disposition so that KEMA can include weekly reports on survey status while calls are in the field. The desk reviewers responsible for evaluating each Activity will download the relevant data from the survey results into their Activity –Level Data File.

Responses from Survey #3 will also be captured via the CATI system, so that the data can be appended to responses from each of the 350 sampled grants. As above, the desk reviewers responsible for each Activity will download the relevant data from the survey results into their Activity –Level Data File.

7. Estimation of Energy Savings

This section provides guidelines for estimating the energy impacts for the program activities to be evaluated. The energy impacts referred to in this section correspond in concept to “gross savings” as that term is commonly used in evaluation of rate payer-funded energy efficiency programs. Evaluation team members charged with managing each of the sample program Activity evaluations (the Lead Evaluators) will prepare detailed evaluation plans that take into account each sample program activities’ actual operations, scale, organization, roster of services provided, and level of documentation.

7.1 Introduction

The evaluation of the EECBG program will be based upon the integration of data from each key data source, as described in Chapter 2. While the DOE databases, particularly PAGE, may provide information and data for the specific Activity, it is the GAMS surveys together with the follow-up calls, that will provide the data required for the central part of the evaluation. The review of Activity data must be conducted by individuals with training in building and technology sciences, who have the capacity to determine the engineering logic of the information provided, and whether adequate data exist to be able to develop a reasonable estimate of energy savings.

To that aim, the evaluation team has assigned a team of engineers with experience in impact evaluation to research a portfolio or set of Grant Activities from “cradle to grave”- from the application paperwork through to the grant close-out information being collected by DOE (see discussion of Grant Close-Out Tagging Process in Section 3.0). Having each Activity researched by one person will provide continuity through the study tasks and will result in a higher quality of insights based on the accumulated knowledge of that individual concerning that Activity. The reporting will consist of a Case Study description of the grant and Activity, along with results of the data collection and final energy savings results – all performed by the same individual closest to the information.

Quality control will be exercised by cross-reviewing within the team by equally (if not more) experienced engineering and impact evaluation Subject Matter Experts. Each desk reviewer will be responsible for defending their information, their conclusions and their recommendations concerning each of the Activities in their portfolio.

7.2 Groupings of Programs for Energy Impact Assessment Planning

The energy impact analysis will focus on six BPAs:

- Energy Efficiency Retrofits
- Financial Incentives Programs
- Building and Facilities
- Lighting
- On-site Renewable Technology
- Energy Efficiency and Conservation Strategy

The six BPAs can be grouped by type of Activity performed in the program, which will permit the application of common and consistent impact analyses on like measures. Specifically, for the purposes of energy impact analysis, the six BPAs can be categorized into three basic groups of program activities.

- 1. Building Retrofit and Equipment Replacement.** For this group, the basic energy savings mechanism involves the implementation of energy-savings capital projects or the installation of energy-efficient equipment in existing residential, commercial, and industrial facilities. Estimation of energy savings generally requires the following steps:
 - a. Review and validation of program records to ensure that they capture and characterize accurately the capital improvements or efficient equipment installations supported by the program. The data sources for this analysis will include the PAGE data base, DOE's Golden data base and GRASS.
 - b. Verification of the measure installation and operation. The data collected through the grant Activity survey will provide verification of the installation and operation of measures installed in the Activity.
 - c. Expansion of sample findings to the population of projects, usually through the application of ratio estimation.

BPAs included: Energy Efficiency Retrofits, Financial Incentives Programs, Building and Facilities and Lighting

2. On-Site Renewable Technology. For this group, the energy savings mechanism involves the production and delivery of energy using renewable technologies that would otherwise have been produced by conventional fuels including: petroleum products, natural gas, nuclear power, or coal. The types of technologies in this BPA are uniquely different than the retrofit and replacement of equipment and should be analyzed as a separate group. However, while the type of data collected for on-site renewable technologies (e.g., capacity, generation patterns, etc.) is different, the estimation of energy savings will use an approach similar to the analysis of savings from building retrofits:

- a. Review and validation of program records to ensure that they capture and characterize accurately the renewable energy equipment installations made with program support and verification of installation and operation.
- b. Expansion of sample findings to the population of projects, usually through the application of ratio estimation, with appropriate segmentation by renewable energy system type and size.

BPA included: On-site Renewable Technology

3. Energy Efficiency and Conservation Strategy. The Energy Efficiency and Conservation Strategy BPA is distinct from the other BPAs offered in the EECBG program. As a condition for participation in EECBG, potential grantees/sub-grantees were required to develop an Energy Efficiency and Conservation Strategy plan for their state/territory, municipality or tribe. The objective of the plan was to ensure that recipients developed a forward-looking framework to identify and capture energy saving opportunities and associated benefits such as job growth and environmental benefits. Some strategies developed in this BPA do not necessarily translate to direct energy savings but rather identified other EECBG BPAs or other energy efficiency programs (e.g., State Energy Programs, utility sponsored energy efficiency programs, etc) that should be pursued to achieve direct energy savings. Therefore, the energy impact analysis approach for this BPA differs from the other two program groupings described above. Specifically, the diversity of Activity types in this BPA will require a two-prong approach.

- *Direct energy savings.* For activities in this BPA in which energy efficiency measures were installed (direct energy savings), the energy impact analysis will follow the process described above for the Building Retrofit and Equipment Replacement

grantees/sub-grantees or the On-site Renewable Technology category, as appropriate.

- *No direct energy savings.* For activities in this BPA with no direct energy savings that are related to program administration, such as hiring an energy efficiency coordinator or costs for administering an energy efficiency program, the activity will be excluded from the energy impact analysis. However, for training and education programs in this BPA, with no direct energy savings, the activity will be included the analysis. .

BPA included: Energy efficiency and Conservation Strategy

7.3 Evaluation Plans: Building Retrofit and Equipment Replacement

7.3.1 Introduction

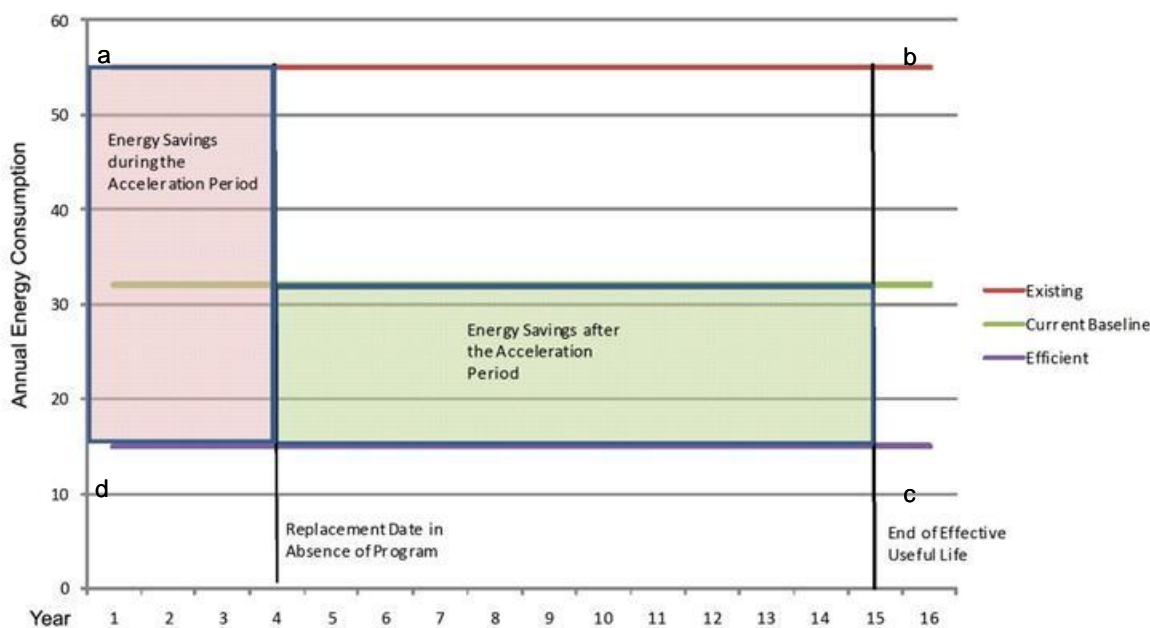
Based on the review of the EECBG PAGE database and information gained from work on state-level EECBG Program Activity evaluations, we have determined that many of the program activities in the Building Retrofit and Equipment Replacement group are retrofit projects involving the early replacement of functioning equipment and building systems with energy efficient models.

Lifetime energy savings is one of the key evaluation metrics for this evaluation. In order to estimate savings from a retrofit project fairly and accurately, it is necessary to determine or to provide clear and reasonable assumptions regarding how long the facility owner would have kept the pre-existing equipment in place in the absence of program assistance to replace it. The example depicted in Figure 7-1 illustrates the importance of this methodological issue. The solid horizontal lines show the annual energy consumption for a large, durable piece of equipment, such as a chiller, at three levels of efficiency: the equipment in place, the current standard or baseline efficiency for new equipment, and the most efficient equipment available. Assume the program participant installs a new chiller with the highest available efficiency, and that the program induced him to do so four years before he would have in the absence of the program. We refer to the period between the program-induced improvements and the (hypothetical) date when they would otherwise have occurred as the “acceleration period.”

During the acceleration period, energy savings would be represented by the shaded area labeled “Energy Savings during the Acceleration Period”. After year four, the relevant efficiency

improvement is represented by the distance between the “Current Baseline” and “Efficient” annual consumption levels. So, from year four to the end of the equipment’s useful life, the total savings are represented by the shaded area labeled “Energy Savings after the Acceleration Period.” If we had simply projected the savings during the acceleration period to the entire useful life, lifetime energy savings would be much greater, as represented by the rectangle bounded by points a, b, c, and d.

Figure 7-1: Representation of Energy Savings from Retrofit



In assessing the length of the acceleration and post-installation periods for individual projects or groups of projects, we will take the following into consideration:

- Studies of persistence of measures in the field undertaken for public benefits program sponsors
- Databases of measurement performance such as California’s *Database of Energy Efficiency Resources* (DEER) and Technical Resource Manuals that were developed for other program sponsors
- Knowledge of the facility management and investment practices of key owner segments. For example, in our own practice we often find that government agencies, operating under budget constraints, retain major heating, mechanical, lighting, and control systems

in place well beyond their rated useful lives. Conversely, in retail and office space, lighting systems are replaced frequently with changes in occupancy and mechanical system adjusted to accommodate occupancy needs.

Surveys and follow-up telephone interviews with grantee and sub-grantee project managers will be used to assess the extent to which program assistance accelerated replacement of the equipment in question.

7.3.2 Development of the Savings Calculation Tool (SCT)

We will undertake evaluations of 350 program activities. In order to ensure consistency of evaluation methods across each Activity, transparency of procedures, replicability of results, and an auditable trail for quality control, we will develop a Savings Calculation Tool (SCT) that will be used by all Lead Evaluators.

For all evaluations of the activities included in the building retrofit and replacement measures, it will be necessary to develop engineering-based (TRM type) estimates of savings for the diverse sample of activities. The quality of these estimates will be equivalent to the reliability provided by *ex ante* projections of savings typical of energy efficiency Technical Reference Manuals such as the New York TRM. The program activities in the Building Retrofit and Equipment Replacement category support a broad range of measures in the full spectrum of residential and non-residential end-uses. Moreover, they operate in a wide variety of climate zones and in states characterized by large variations in baseline efficiency, as shaped by levels of code adoption and customary building practice. We know from preliminary work that the PAGE tracking database for EECBG programs may vary in terms of content and level of detail for some activities. For example, PAGE may contain information on square footage of the space associated with the measures implemented in the Activity but may have no other measures of scale, such as counts of units installed. Other entries contain information on project cost, but no other measures of size. Our engineering calculations will need to make the best use of survey data that verify and supplement the PAGE data and follow-up interviews with grant and sub-grantee Activity project managers. We will develop procedures and tools to maintain as much consistency and transparency as possible in the savings analysis.

As mentioned above, we will develop for ORNL/DOE an SCT to meet these needs. The SCT will be developed in Microsoft Access or Excel and a separate copy populated with local data for each Activity evaluation. We will, to the extent possible, leverage the work undertaken to develop the SCT for the National Evaluation of the State Evaluation Program (SEP) currently being performed by KEMA. We will exploit opportunities to mirror the structure of the SEP SCT

for activities that are similar between the two programs. For activities that are unique to the EECEBG program, we will expand the SCT to incorporate the modeling parameters required to conduct the energy savings calculations.

We anticipate that the EECEBG SCT will consist of the following components.:

- Savings Algorithm Library. This portion of the tool will contain savings calculation algorithms for the full range of common energy savings measures in the building segments. For weather-sensitive measures such as HVAC improvements, the algorithms will include formulae and procedures for taking local weather conditions into account, including specification of the local weather data required. These algorithms will be based on similar work contained in Technical Resource Manuals, as well as our own engineering experience. The sources of all algorithms will be fully documented in this portion of the tool.
- Input parameter assumption library. This portion of the tool will contain input parameter assumptions used in the algorithms. For some, these will be engineering constants, such as the conversion of motor horsepower to kW or efficiency curves used to estimate savings from VFDs. Others, such as coincidence factors, hours of use for lighting, and heating and cooling degree days will need to be localized to regions, states, or climate zones as appropriate. Finally, this library will contain the “acceleration period” matrices discussed above.
- Input parameter estimates. This portion of the tool will contain the input parameter estimates actually used in the evaluation of a given Activity. These will be estimated through verification activities (e.g., telephone surveys with the grant/sub-grantee project managers) of the Activity together with the input parameter assumption library.
- Tracking database file. The tracking database will be copied, moved, or data entered into a flat file in the SCT for use in developing *ex ante* estimates of savings at the individual Activity level of aggregation.
- Ex ante savings file. This portion of the tool will contain the results of the *ex ante* savings calculations at the lowest level of aggregation supported by the input data. From these results, we should be able to calculate statistics such as savings per project or per unit of various measures that can be used to test the plausibility of estimates and to assess the accuracy of the input data.

-
- Verification data file. This portion of the tool will contain the cleaned raw data from the data collection on the verification sample that was done by telephone.
 - Verified savings file. This file will contain the results of the estimations of verified savings for each sample site. To the extent possible the calculations of verified savings will be stored with the individual site records on this file. For instances in which the calculations are too complex or customized, this file will contain references to work papers and free-standing spreadsheet files.
 - Ratio estimation and sample expansion file. Where ratio estimation is used, this sheet will contain the output of calculations which KEMA generally implements in a statistical package such as SAS. This sheet will also contain the calculations by which the sample data are expanded to the population.
 - Energy savings summary file. This sheet will contain the principal results of the savings analysis, including average annual energy savings, lifetime energy savings, and average peak demand reductions. This sheet may also contain areas for calculations that are driven by energy savings estimates, such as energy cost savings and emission reductions.
 - Cost benefit inputs file. This file will contain the inputs needed for cost benefit analysis and other economic characterizations of the program, including program expenditures, developed in consultation with ORNL/DOE.

Once the tool is created, the Lead Evaluator for the Activity evaluation will be responsible for populating it. We will store the current versions of each tool on a central server where senior evaluation managers can access them for quality control checks and to verify progress.

7.3.3 Energy Impacts Assessment Approach

The impact analysis will be comprised of the following sub-tasks:

- Assessment of evaluability
- Verification data collection and analysis
- Calculation of energy savings estimates
- Expansion of sample results to the population of participants.

7.3.3.1 Assessment of Evaluability

The objectives of this task are to determine whether it will be possible to evaluate the sampled Activity. The Lead Evaluator for the Activity will be responsible for collecting information on the criteria listed below and for submitting to the KEMA Project Manager an evaluability assessment within two weeks of initiation of the Activity analysis. The criteria to be applied in assessing evaluability of sampled activities in this group will include the following:

- Progress in Activity implementation. In order to be considered for evaluation, the program Activity needs meet the following implementation milestones:
 - Received and approved applications and completed contract agreements for loans or grants (or other applicable incentives) from eligible participants
 - The Activity is currently active, and is not at risk of cancellation or movement of significant funding to a different BPA
 - Documentation and reporting data are sufficient to conduct the evaluation
- Quality and availability of program records. At a minimum, evaluation will require an indicator of the kinds of services and/or incentives received. The Lead Evaluator will make an assessment as to whether:
 - All or nearly all of the Activity data are included in PAGE, other EECSBG-related databases or available on paper in the grantee or sub-grantee file. Such information would include types of measures installed, end-uses addressed, quantity, efficiency rating, and installed capacity of equipment installed, project costs, and savings estimates developed by other organizations.
 - The Lead Evaluator will assess the quality and completeness of the data fields to determine if they provide what is required by the Savings Calculation Tool (SCT) to develop consistent *ex ante* estimates of savings for each Activity. For larger and more complex projects, review of the project files may be required to ensure that *ex ante* estimates are reasonable. We anticipate needing to supplement tracking system data with information gained from paper files and questioning of program staff in some cases.

Deliverables. The deliverable for this task will be a memorandum summarizing the Lead Evaluator's findings in regard to the criteria listed above and a recommendation regarding the retention of the Activity in the evaluation sample.

7.3.3.2 Measurement and Verification Data Collection and Analysis

The objectives of this task are to develop verified estimates of energy savings for all the Building Retrofit and Equipment Replacement activities selected for the evaluation. The measurement and verification of savings will be accomplished through telephone verification interviews. Telephone verification interviews with grant/sub-grantee project managers will validate or update information on the type, quantity, and capacity of equipment measures installed with program support.

After completing the review of the Activity data and documentation and the verification data, the next step will be to calculate the energy savings. The key components of this task include:

- Determine the appropriate baseline conditions
 - Normal pre-EECBG baseline: The energy savings for retrofits is based on either the pre-existing conditions or on a minimally code compliant replacement that has not been influenced by EECBG.
 - Dual baseline: In the case where the existing equipment was not ready for replacement but was replaced to improve energy efficiency, the remaining useful life of the equipment is considered. The first baseline, the early replacement baseline, uses the energy consumption of the preexisting equipment for the remaining useful life. The second baseline, the normal replacement pre-EECBG baseline, applies after the remaining useful life of the equipment until the estimated end of the measure life.
- Perform engineering calculations to determine the gross savings achieved. The gross site savings will be calculated by taking the difference between energy usage for the measure-treated usage and the appropriate pre-EECBG baseline. The engineer combines data from the following sources to estimate savings: participant survey interviews, including hours of operation, seasonal patterns of use, control schemes; equipment specifications and invoices; engineering best practices and reference data.

Deliverables. The deliverables for this task will be as follows:

- Verification data file populated with data collected through telephone interviews for each sample project.

- Verified savings file populated with the verified savings estimate for each sample site. This file will also contain references to algorithms and assumptions used from the libraries included in the Savings Calculation Tool, and to external spreadsheets that contain the savings calculations for more complex measures.
- Work papers consisting of savings calculation spreadsheets and scans of paper records, such as manufacturers' cut sheets used in developing savings estimates for complex measures.

7.3.3.3 Expansion of sample savings estimates

The final step will be to expand the findings of verified savings for the sample of Building Retrofit and Equipment Replacement activities to the BPA levels. The data analyses performed for all sampled Activities will produce a set of savings estimates that are adjusted to reflect the actual quantity, efficiency features, operating environment, and operating patterns of the measures installed. We will use ratio estimation techniques to process these Activity-specific estimates of savings, per dollar, along with information on expenditures for the entire population into an estimate of adjusted gross savings for each of the six BPAs included in the EECBG evaluation.

The calculation of the adjustment factors for preliminary savings estimates uses appropriate weights corresponding to the sampling rate within each stratum. The extrapolation of Activity savings to BPA level will be based upon the following calculation:

$$\text{BPA Level Savings} = \sum (\text{sampling weight for stratum}_i) \times \sum (\text{savings for project}_i \text{ in stratum}_i / \text{grant expenditure for project}_i)$$

Deliverables. The deliverables for this task include:

- Ratio estimation and sample expansion file populated with the results of the sample expansion calculations, which will include total energy savings for the Activity and for the BPA. These findings may be used to help refine savings parameters used in the Savings Calculator.
- Energy savings summary file. This sheet will contain the principal results of the savings analysis, including average annual energy savings, lifetime energy savings, and average peak demand reductions.

7.4 On-site Renewable Technology Program

7.4.1 Introduction

The On-site Renewable Technology Program focuses on the development of customer-sited equipment. The energy impact assessments will be based on estimation of renewable energy generation and capacity for a sample of installations, and expansion of those estimates to the relevant population of installations using various statistical approaches. The savings for all selected activities will be verified via remote methods, including telephone interviews with project principals and review of project specifications and energy production records, to the extent those are available.

7.4.2 Assessment of Evaluability

The objectives of this task are to determine whether it will be possible to evaluate the sampled Activity. The Lead Evaluator for the Activity will be responsible for collecting information on the criteria listed below and for submitting to the KEMA Project Manager an evaluability assessment within two weeks of initiation of the Activity analysis. The criteria to be applied in assessing evaluability of sampled activities in this group will include the following:

- Progress in Activity implementation. In order to be considered for evaluation, the program Activity needs to meet the following implementation milestones:
 - Received and approved applications, and completed contract agreements for loans or grants (or other applicable incentives) from eligible participants. The Activity is currently active, and is not at risk of cancellation or movement of significant funding to a different BPA
 - Documentation and reporting data are sufficient to conduct the evaluation
- Quality and availability of program records. At a minimum, evaluation will require some indicator of the kinds of services and/or incentives received. The Lead Evaluator will make an assessment as to whether:
 - All or nearly all of the Activity data are included in PAGE, other EECBG-related databases or available on paper in the grantee or sub-grantee file. Such information would include types of measures installed, end-uses addressed, quantity, efficiency rating, and installed capacity of equipment installed, project costs, and savings estimates developed by other organizations.

- The Lead Evaluator will assess the quality and completeness of the data fields to determine if they provide what is required by the Savings Calculation Tool (SCT) to develop consistent *ex ante* estimates of savings for each Activity. For larger and more complex projects, review of the project files may be required to ensure that *ex ante* estimates are reasonable. We anticipate needing to supplement tracking system data with information gained from paper files and questioning of program staff in many cases.

7.4.3 Verification Data Collection and Analysis

The objective of this task is to develop verified estimates of renewable energy generated for on-site renewable activities selected for the evaluation. Verification information will be collected only through remote activities, including file review and interviews with project owners and operators.

7.4.4 Expansion of Sample Savings Estimates to the Population of Activities

The sample expansion procedures to be used in the evaluation of the activities in this group are the same as those described above in Section 7.3.3.3 for the Building Retrofit and Equipment Replacement group.

7.5 Energy Efficiency and Conservation Strategy

7.5.1 Assessment of Evaluability

The criteria to be applied in assessing evaluability of the activities in the Energy Efficiency and Conservation Strategy BPA will include the following:

- Progress in Activity implementation. In order to be considered for evaluation, the program Activity needs to have met the following implementation milestones:
 - The development of the energy efficiency and conservation strategy is either currently active or completed, and is not at risk of cancellation or movement of significant funding to a different BPA.
 - Documentation and reporting data are sufficient to conduct the evaluation.

-
- Quality and availability of program records. At a minimum, an indicator of the kinds of activities resulting from the strategy (e.g., recommended energy efficiency activities to pursue, creation of an energy efficiency office/manager). The Lead Evaluator will make an assessment as to whether:
 - A sufficient level of Activity data are included in PAGE, other EECBG-related data bases or available on paper in the grantee or sub-grantee file to allow savings to be calculated. Such information could include types of measures installed, end-uses addressed, quantity, efficiency rating, and installed capacity of equipment installed, project costs, and savings estimates developed by other organizations.
 - The Lead Evaluator will assess the quality and completeness of the data fields to determine the extent required by the Savings Calculation Tool (SCT) to develop consistent *ex ante* estimates of savings for each Activity where energy efficiency activities are implemented as part of this BPA. For larger and more complex projects, review of the project files may be required to ensure that *ex ante* estimates are reasonable. We anticipate needing to supplement tracking system data with information gained from paper files and questioning of program staff in some cases.

7.5.2 Estimation of Energy Impacts

For the selected activities where energy efficiency measures or on-site renewable technologies are installed, the methodology for calculating energy savings will follow the corresponding methodologies described above in Section 7.3.3.3.

7.5.3 Expansion of Sample Savings Estimates to the Population of Activities

The sample expansion procedures to be used in the evaluation of the activities in this group are the same as those described for the Building Retrofit and Equipment Replacement group.

8. Attribution Approach

EECBG projects may have been heavily influenced by existing SEP initiatives, governmental, utility or other local funding sources. Consistent decoupling of the net effects of SEP or other funding sources and influences and EECBG will be a very important methodological consideration for this evaluation effort. Standard practice for assigning attribution involves consideration of three factors:

- The proportion of funding from EECBG (e.g., does EECBG comprise the majority source of funds used for the Activity?)
- The timing of the Activity (e.g., was the Activity already planned, but accelerated because of EECBG?)
- The extent of the Activity (e.g., did the EECBG funding make it possible to “do more” or make even more efficient choices” than had originally been planned?)

These factors are typical of free-ridership and net-to-gross analysis, but are applied here to qualitatively assess attribution since the scope of the project does not involve consideration of a control group or other standard practices more commonly used for a utility program evaluation.

8.1 Source of Attribution Data

The survey instruments will query grant recipients in the sample regarding the amounts, proportion of total and sources of other non-EECBG funding sources. Then, KEMA plans to deploy the following three-step process to meet this challenge in the context of evaluations of individual projects.

1. **Definition.** The first step of determining attribution of savings impacts to EECBG will be to define qualitatively, as based on the information that may be included in the PAGE data, the overall sources of funding and other influences on each sampled Activity.
2. **Validation.** The second step will be to validate the components of influence, and if used, the program theory and logic models, with results of the structured interviews with Grant and Activity Managers and DOE Program Officers.

3. **Quantification.** The final step in the process will be to quantify the portion of measured outcomes attributable to subject Activity using techniques that have long been associated with energy program evaluation, consisting of an analysis of self-reports of program effects from the sample of the target population.

8.2 Attribution Analysis

The “bottom line” of attributable energy savings will, of necessity, be developed on a slightly more subjective basis than standard utility program evaluation, where concepts such as free-ridership and spill-over are better measured. In this case, PAGE data and the impressions and opinions of respondents at three levels – DOE Program Officers, the Grant Manager and the Activity Manager – are the sources of the data for making a determination. Trends in the data and results will be reviewed and examined to help construct any patterns of behavior that may inform future program designs.

8.3 Determination of EECBG Attribution

Once the range and scope of incremental effects have been defined, we will employ a combination of techniques, culminating in a Delphi process to review the information, confirm and quantify the magnitude of the net effects of the set of EECBG projects within each BPA. Evaluators of energy efficiency programs have used various types of analytical approaches to assess and quantify net program effects on adoption of energy efficiency measures and practices. In this case, we will employ a combination of techniques of historical tracing/case study development and structured expert judging.

- **Historical Tracing/Case Study Development.** In this case, we will employ a combination of techniques of historical tracing/case study development and structured expert judging. This approach relies on an assessment of self-reports of program effects by targeted market actors and typically involves surveying samples of actual and/or potential program participants to elicit their assessment of the program’s influence on their decisions to adopt energy efficiency measures or practices (in this case, Grant Activity Managers). The questions can be structured to probe the effect of the program on the timing, extent, and features of the projects in question, as well as the relative importance of the program versus other decision factors. The responses will then be processed to develop an attribution score using a transparent algorithm.

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- **Structured expert judging.** Structured expert judgment studies assemble panels of individuals with close working knowledge (in this case DOE Program Officers, Regional and State Coordinators) of the technology, infrastructure systems, markets, and political environments addressed by a given energy efficiency program to estimate impacts with and without the program in place. Structured expert judgment processes employ a variety of specific techniques to ensure that the participating experts specify and take into account key assumptions about the specific mechanisms by which the programs achieve their effects. The Delphi process is the most widely known of this family of methods.

We will develop attribution scoring algorithms from the collected and secondary data to estimate net savings impacts. The final determination of attribution – what portion of the estimated savings can reasonably be attributed to the existence of and funding received from the EECBG Program - will be determined using a Delphi process with the engineers closest to the Activities being studied, plus a panel of Subject Matter Experts comprised of senior team members. The adjustments will be reviewed within each BPA grouping, and an average attribution level – or realization rate – determined by BPA and for the EECBG program overall.

9. Conduct Carbon Emissions Reduction Analysis

9.1 Assessment of Carbon Impacts

The assessment of gross carbon dioxide (CO₂) savings will be done for each broad program category and for the individual indicator activities. Annualized CO₂ reductions achieved as a result of EECBG-funded efforts will be calculated and reported for each year over the effective useful lifetime (EUL) of the measures evaluated. When the consumption of energy from fossil fuel resources is reduced, the CO₂ emissions that would have resulted from burning those fuels are avoided. Likewise, when renewable energy is used as an alternative to fossil fuels, the CO₂ emissions associated with the replaced fuels are avoided.

In this study, the carbon emissions avoided from EECBG-funded energy efficiency and renewable energy activities will be reported nationally and for each state. The assessment of gross CO₂ savings will be done for each BPA and for the individual activities. Annualized CO₂ reductions achieved as a result of EECBG-funded efforts will be calculated and reported for each year over the effective useful lifetime (EUL) of the measures evaluated.

The approach to be taken is consistent with recommendations contained in the Model Energy Efficiency Program Impact Evaluation Guide¹³ (“the Guide”). As noted in the Guide: “The methods for determining avoided emissions values for displaced generation range from fairly straightforward to highly complex. They include both spreadsheet-based calculations and dynamic modeling approaches with varying degrees of transparency, rigor, and cost. Evaluators can decide which method best meets their needs, given evaluation objectives and available resources and data quality requirements.”

For this study, the basic approach selected employs the use of emission factors as follows:

$$\text{avoided emissions}_t = (\text{net energy savings})_t \times (\text{emission factor})_t$$

The emission factor is expressed as mass per unit of energy (e.g., pounds of CO₂ per MWh), and represents the characteristics of the emission sources displaced by reduced generation from conventional sources of electricity and non-electrical loads including natural gas, fuel oil and propane.

¹³ National Action Plan for Energy Efficiency (2007). *Model Energy Efficiency Program Impact Evaluation Guide*. Prepared by Steven R. Schiller, Schiller Consulting, Inc. <www.epa.gov/eeactionplan>

Non-base load emissions rates from the US Environmental Protection Agency's (EPA) Emissions & Generation Resource Integrated Database (eGRID)¹⁴ will be used to quantify avoided emissions. Non-base load emission rates have been developed to estimate the emissions from marginal generation units, which are those most likely to be displaced by energy efficiency and/or renewable energy programs and projects. The non-base load emission metric is recommended by EPA for this purpose,¹⁵ and is appropriate to the level of analysis called for in the EECBG evaluation.

¹⁴ eGRID2010, the most recent version will be used for this analysis.

¹⁵ E.H. Pechan & Associates, Inc., "The Emissions & Generation Resource Integrated Database for 2010 (eGRID2010) Technical Support Document," Prepared for the U.S. Environmental Protection Agency, Office of Atmospheric Programs, Clean Air Markets Division, Washington, DC, December 2010.

10. Conduct Employment Analysis

10.1 Broad Parameters of Jobs Assessment

The measurement of net annual job impacts will occur at the state-level for each BPA. Those BPAs containing several heterogeneous program activities will require job impact estimation for each of those activities.

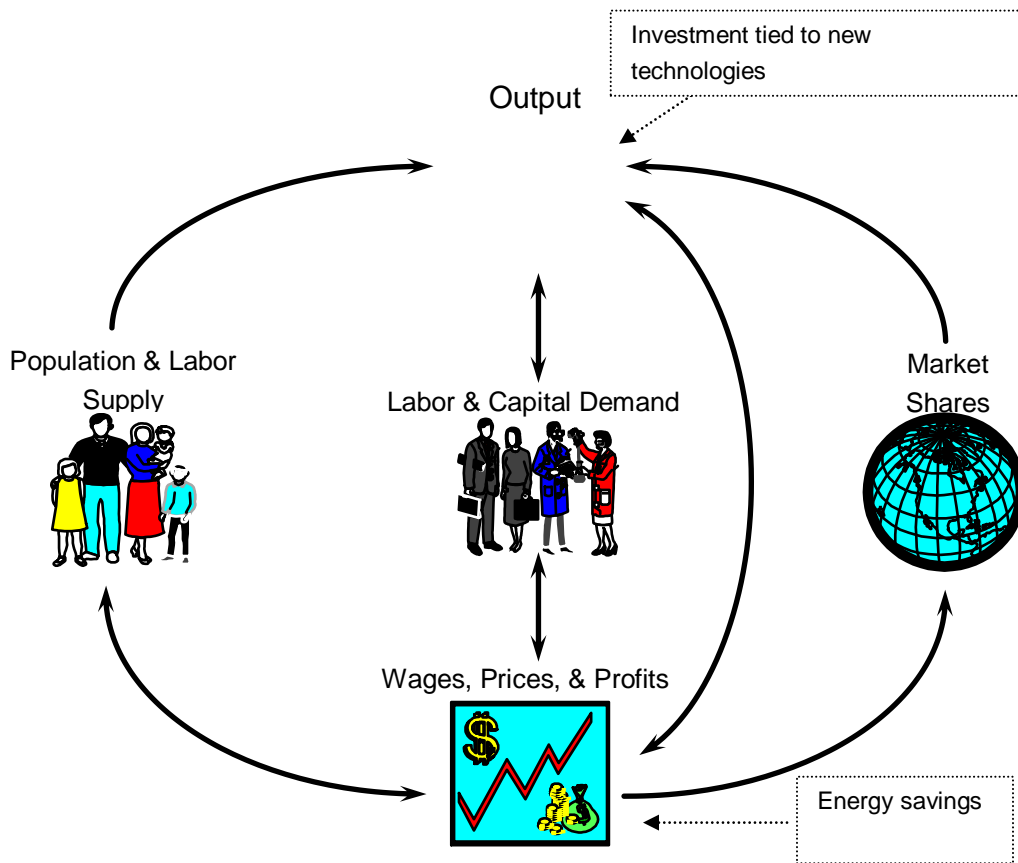
10.2 Economic Impact Model for identifying Job Impacts

Our proposed approach includes a 51-region (state) REMI Policy Insight simulation model. Information describing the short-term and long-term project-related effects will be introduced into this economic model to identify the annual projection of job impacts. This analysis system has been applied to numerous energy and environmental policy/program analyses. A brief overview of the REMI model capabilities follows below.

REMI is chosen over other models because it has the relevant economic levers and feedbacks to handle the types of effects expected to flow from such project spending and energy saving (generating) technology adoption. The model is a computable, general equilibrium (CGE) simulation forecasting system of industry-level Activity for 23 different industries (approximating three-digit NAICS definitions of business Activity) through the year 2050. It is well-specified through its internal logic or equation set, such that feedbacks among economic stakeholders (households, businesses and public agency budgets) are captured when more energy-efficiency and renewable generation investments take place. The feedback mechanisms capture both the increases and decreases in spending, demand and employment that result from an increase in spending occurring in a single or multiple industries both within and across geographic regions. Figure 10-1 portrays the basic concept of what the REMI model captures for a region's economic impacts (a region can be a county/state or any combination of county building blocks). There are five major blocks to a region's economy (e.g. Output, Labor & Capital Supply, etc.); each block contains numerous equations, and the arrows depict the feedback between different components of an economy. In a multi-state model (of 51 regions), one can envision 51 economies, such as in Figure 10-1, which will also exhibit feedback between other states (inter-regional) for labor flows (commuters) and trade in manufactured goods and in services. Unique to the REMI model, among the class of competing regional economic impact frameworks available, is the linkage to the market shares block. Policies or investments that change the underlying cost-of-doing-business for an industry in region k will affect that industry's relative

competitiveness (relative to the U.S. average for that industry) and its ability to retain/gain sales within its own region, elsewhere in the multi-region marketplace, elsewhere in the U.S. and for non-U.S. trade.

Figure 10-1: REMI Economic Forecasting Model – Basic Structure and Linkages



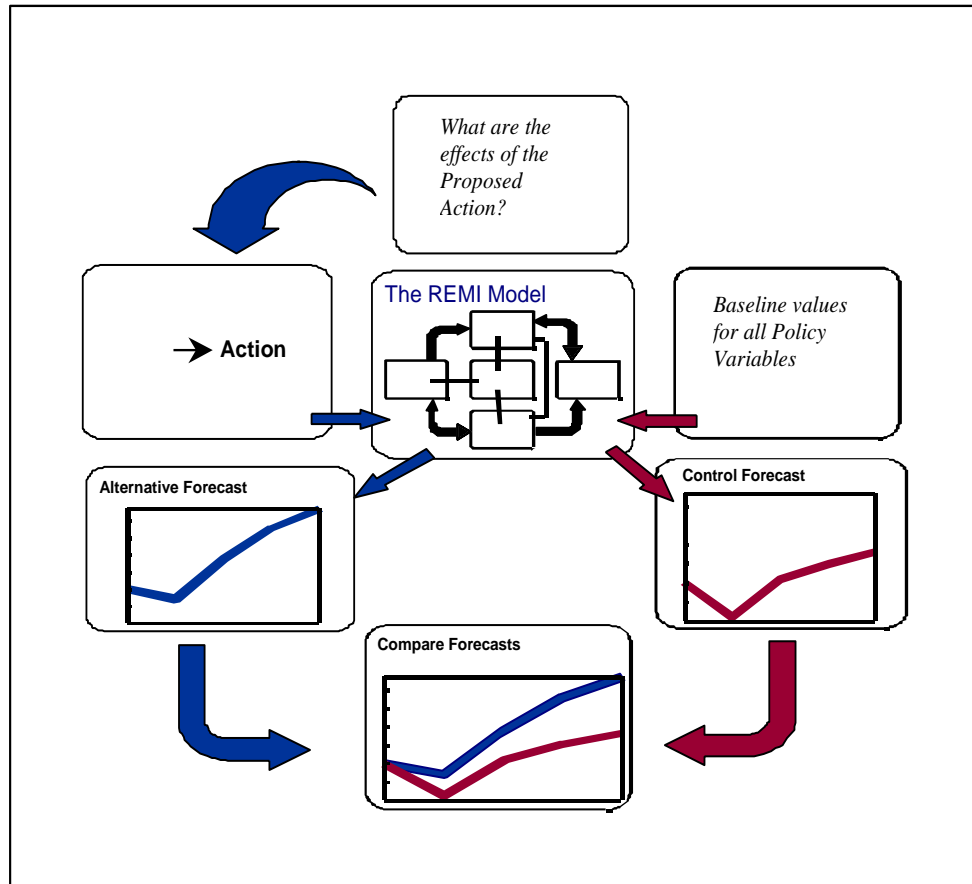
The REMI model identifies estimates of job impacts (and numerous other economic and demographic metrics) by comparing the base case¹⁶ annual forecast using the above structure/feedbacks to the annual forecast when energy-related savings/costs or new dollars of investment are proposed through the *alternative* forecast. *Total* economic impacts result from the *direct* economic effects of EECBG project investment. The *total* impact equals the *direct*

¹⁶ The regionally-calibrated software model is delivered with a *standard Regional Control* forecast out to 2050. This analysis has assumed that forecast is a sufficient long-term representation of the base case economies.

plus *non-direct* impacts. Non-direct impacts are sometimes referred to as *ripple effect* in an economy. It is the presence of a comprehensive region-specific set of *multiplier effects* in the REMI economic simulation model that create additional economic responses once the *direct* effects have been introduced. Two economic mechanisms follow as a result of the direct program effects: *changes in consumer demand* (often labeled '*induced*' effects) and *changes in intermediate demand or Business to Business "B2B"* (often labeled '*indirect*' effects). The REMI model reports a *total* impact concept reflecting the increases and decreases that occur across industry sectors and regions, and though it does not report separate *induced* and *indirect* contributions, both are accounted for, and we can segment these post-analysis.

The *total* economic impacts (stated in terms of net jobs for this study objective) are expressed as a *difference* relative to jobs in year t without the program. Figure 10-2 portrays this relationship.

Figure 10-2: Identifying Economic Impacts in the REMI Framework



10.3 Translating EECBG Project Direct Effects into Economic Events

The REMI model will translate the ways in which EECBG dollars affect various segments through relevant *direct effects* that exert an influence on the local economy. Relevant direct effects include those to specific energy customer segments (e.g. change in price, consumption or both), a region’s economic self-sufficiency (by replacing imported purchases of energy generating feed stocks/ energy driven components with more *locally* provided energy conserving devices/services), and the incremental cost to energy customers and/or government

to achieve these goals. These *direct effects*, expressed as data inputs, will be developed as part of the data collection activities described in Section 3. In Figure 10-3 below, the left portion of the diagram portrays the set of direct effects that are possible with a broad range of energy-related investments/objectives. The major categories of direct effects associated with energy policies/investments and their potential to initiate macroeconomic responses are described below:

- Program operations (administrative) spending— dollars spent to operate the state’s EECBG program and to incentivize to business and household to invest
- Household and business savings— dollar savings to businesses and households (resulting from reductions in energy consumed and (potentially) electric demand), realized as a result of the EECBG funded project
- Household and business cost— additional household and business expenditures associated with the incremental cost of purchasing energy-efficient equipment/customer-sited RE systems (generally the total cost of new equipment minus incentives paid by the program and net of what would otherwise have been spent anyway). They may also include a ratepayer effect (a benefit in the case of lower rates/avoided costs or a negative if higher rates result.)
- Other spending shifts— shifts in patterns of spending and business sales among sectors of the state’s economy affecting the flow of dollars into, out of, and within the state. Included here are “*import substitution*” effects, new O&M spending requirements for new technology facilities/systems, as well as potential contraction for the power generating sector in light of energy-efficiency project uptake.

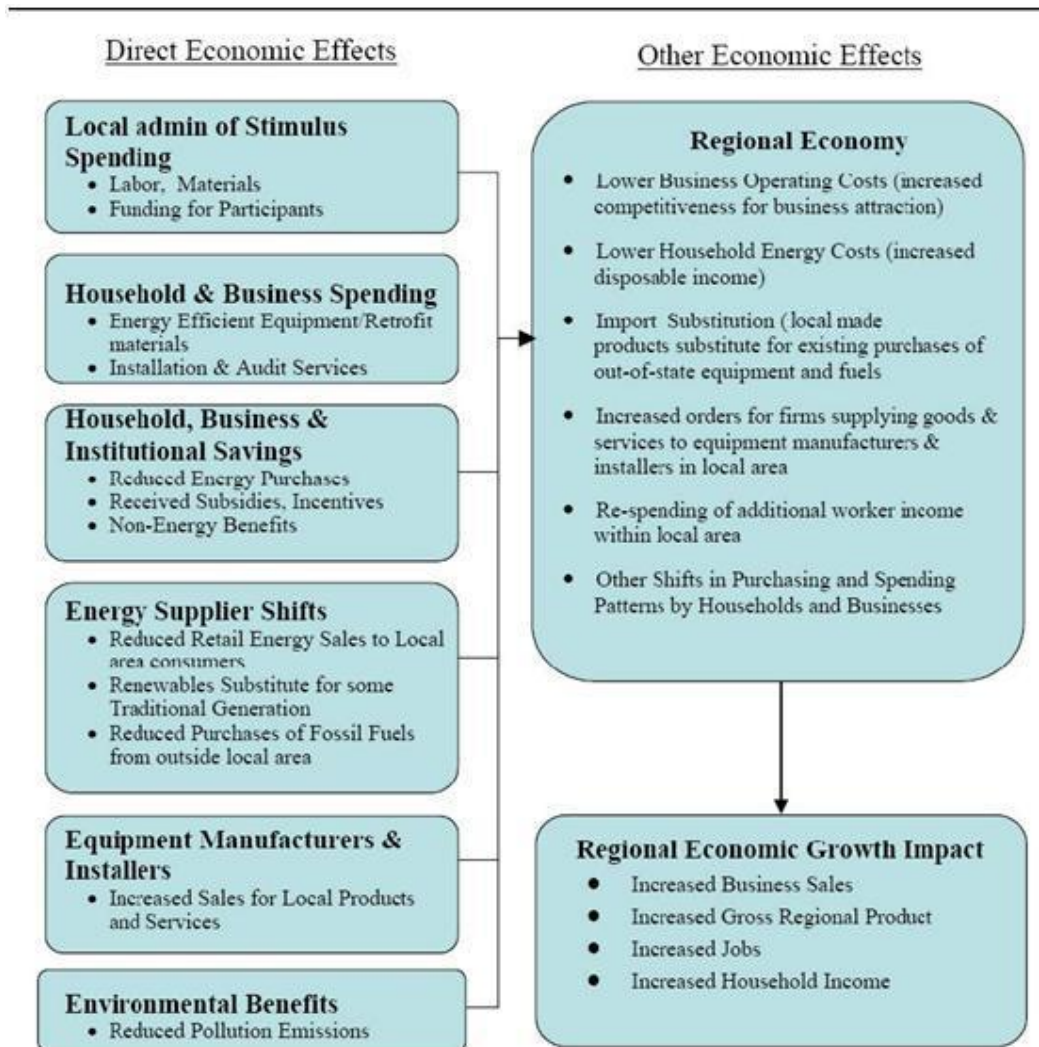
The “*mapping*” or translation of the above categories of direct effects into the economic impact model is depicted in the upper right portion of Figure 10-3. This entails careful delineation of instances when a new pattern of local demands arising from some or all energy customer segments represents opportunities for greater reliance on “within region” sales, or none at all. The latter signals a continued import requirement albeit for an energy-efficient device instead of imported coal or petroleum feed stocks. Installation and other contractor services are more likely to be locally provided. Net savings to participating households and businesses (after paying off equipment investment cost differentials) have a clear pathway into the economic impact model and subsequent net job impacts. While employment in the industries directly affected by influx of demand and funding from the EECBG program, other industries such as fossil fuel sectors

may see reductions in demand for their products which may result in a reduction in employment in that sector.

Figure 10-3: REEM Framework for Energy Impact Analysis

[Renewable Energy Efficiency Mapping]

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10.4 Presentation of Job Impacts

The key outputs of the macroeconomic modeling exercise will be presented to show the state-level job impact process at the BPA or program Activity level. From the model's outputs, we will be able to do the following:

-
- Distinguish the *time-phase* of impacts, e.g. short-term activities, long-term persistent changes
 - Distinguish the *direct* net jobs from the *indirect* and *induced* net job impacts
 - Use the results from attribution analyses by BPA above to estimate the attributable net job impacts associated with total project investment/implementation
 - Perform aggregations to harness BPA/ state-level/national level net job impacts from EECBG projects by each program year to be evaluated

11. Conduct Analysis of Organizational/Operational Factors Influencing Outcomes

A unique feature of this evaluation will be the performance of a statistical analysis of factors that can affect program performance. The objective of the statistical analysis will be to identify key factors that are significantly related to Activity outcomes. An understanding of the factors related to successful performance can be helpful to public policy makers, program managers, and other parties interested in the adoption and effective utilization of energy efficiency and renewable energy technologies.

11.1 Incorporation of Other Data

The first step in identifying key factors influencing performance will be an examination of past studies exploring the relationships between various organizational and operational factors and outcomes achieved by energy efficiency and renewable energy activities. A source of information will be published proceedings from energy efficiency, renewable energy, and evaluation conferences. Two key proceedings that will be examined are those associated with the annual American Council for an Energy-Efficiency Economy (ACEEE) Summer Study and the biannual International Energy Program Evaluation Conference (IEPEC). Other proceedings will also be examined, as relevant.

Several major online evaluation databases will also be searched. The best known of these are the California Measurement Advisory Council (CALMAC) Searchable Database; the Consortium for Energy Efficiency (CEE) Market Assessment and Program Evaluation (MAPE) Clearinghouse; and the New York State Energy Research and Development Authority (NYSERDA) library of New York Energy \$mart quarterly and annual evaluation reports.

Other reports and journal articles documenting state, utility, and university studies could provide useful information and those will be examined as well.

11.2 Regression Modeling

The objective of the task is to identify the characteristics of the program and implementation of the grant or sub-grant that influenced the performance of a specific grant or sub-grant. The analysis for this task will be based on a statistical regression model. A regression framework will allow identification of key organizational and operational characteristics that explain the

relative level of savings per grant dollar with statistical rigor and quantify the relationship between those characteristics and grant performance.

The factors for the regression analysis will be based on the findings from the above-described literature review and the experience of ORNL advisors and senior KEMA evaluation staff regarding performance-affecting factors from previous evaluations. An initial meeting with the project team was held to develop a preliminary list of variables for consideration. It is important to conceptualize this early in the project so that data collection instruments will capture the necessary information to feed the model. The precise nature of key variables will be determined for each sampled Activity through the review of Activity records and direct interviews with the involved parties (project manager, grant manager). The data for this analysis will also come from outside sources, such as the US Census.

Key variables could include design, implementation, operational, technical assistance, market, and psychosocial factors. Table 11-1 below lists some examples of factors to be examined in this study within six potential categories of influence.

Table 11-1: Example Factors Influencing EECBG Outcomes

Category of Factors	Example Factors	Example Definitions
Design Factors	Use of best practice features; identification of an appropriate baseline; consideration of market potential; approach to market segment being served; etc.	<u>Number of best practice features:</u> numeric; <u>Articulation of baseline:</u> yes or no (1 or 0)
Implementation Factors	Presence of a champion/strong leadership; staffing resources; prior experience; use of vendors; marketing types; marketing schedule; incentive amounts and types; measure types; educational features; customer service features (e.g., presence of 800 number or other tech support); continuity of staff; type of staff (temporary, part-time, full-time); etc.	<u>Presence of champion:</u> yes or no (1 or 0); <u>Number of staff:</u> numeric; <u>Marketing schedule:</u> 3=frequent, 2=fairly frequent, 1=minimal, 0=none
Operational Factors	Data processing approach; frequency of reporting; presence of follow-up or customer satisfaction feature; structure of back office (one location, multiple locations); target budget vs. actual budget; etc.	<u>Data processing approach:</u> 2=web-based data entry by implementers, 1>manual emailing of spreadsheets or other format for data entry by program managers, 0=no use of forms or tables, simply text, email or verbal status reports
Technical Assistance Factors	Training features for internal implementation staff; training of trade allies; certification requirements; source of training; etc.	<u>Training features:</u> 2=strong training program, good frequency and locations (accessible), 1=good training, not as frequent and/or accessible; 0=no training
Market Factors	Target population; number of segments targeted; unemployment rate; educational levels of target market; number of competing programs; accessibility of measures; etc.	<u>Unemployment rate:</u> use state values or municipal if known/available
Psychosocial Factors	Alignment of messaging with audience; type of message; customization to different segments within the market (non-English speaking groups, low income); etc.	<u>Alignment of message:</u> 1=good alignment, 0=poor alignment

Each Activity will be weighted to reflect its relative share of overall EECBG funding. Statistical analyses can be performed for each BPA separately as well as for the combined set of programs areas under study.

11.3 Other Statistical Analysis Approaches

The types of statistical analyses used will include at minimum a regression analysis, as discussed above. Other applicable statistical analyses, such as a correlation analysis, will be determined through the literature review, discussed with ORNL/DOE, and used as appropriate.

12. Reporting and Presentation

12.1 Interim Reports

During the EECBG project, we will provide ORNL and its advisors with memos summarizing our interim findings. Specifically, we will provide summary memos upon completion of the following key tasks:

- Sample Design and Selection
- Energy Savings Analysis

KEMA will meet with the ORNL team either in-person or by telephone to discuss the results and solicit comments. Following that interaction, KEMA will revise the interim memos as needed.

12.2 Draft and Final Reports and Presentation

Upon completion of the study, we will provide ORNL with a draft report for comment. KEMA will incorporate ORNL's comments and prepare a revised draft report for distribution for peer review by an independent panel of evaluation experts and key stakeholders including DOE. We will present the results during an in-person meeting with DOE, ORNL and the Peer Review Panel. Comments and direction received during and following the presentation will be incorporated into the final written report.

13. Project Management and Administration

The national evaluation of EECBG is a complex study that necessitates a structured and disciplined project management approach. The management fundamentals employed are based on the Project Management Body of Knowledge (PMBOK), as published by the Project Management Institute (PMI). Due to the magnitude of this project, the evaluation team includes four key resources that provide overall management and administrative support: 1.) Principle in Charge (PIC), 2.) Project Manager, 3) .Deputy Project Manager, and 4) Project Coordinator. The Project Manager reports directly to the PIC. This system allows for tight project control and the benefit of experienced oversight via the PIC who can help predict and address project risks and issues while guiding the project to success. The Deputy Project Manager, a PMI certified Project Management Professional (PMP), coordinates and manages the daily operations and activities with the support of the Project Coordinator.

13.1 Description of Project Management Tools

KEMA adopts industry best practices into its standard project planning and management approach, refining processes that address budget management, client communication, risk management, schedule adherence, scope supervision, personnel guidance, and quality assurance/control to name a few. The suite of tools with which KEMA manages includes both commercial as well as proprietary systems:

MS Project - Project schedule, resource management, sub contractor management, team communication

SharePoint - Communication, collaboration, file share, resource management

KEMA Project Tracker 1.0 - Budget management, resource management, forecasting

KEMA RAM – Internal resource management, Resource Allocation Management (RAM)

Oracle - Resource management

Risk Memo - Risk identification and mitigation strategies

Weekly Status Updates – Client / team communication

13.2 Schedule

KEMA is managing and tracking the evaluation schedule and resources in MS Project. Appendix B provides a Gantt chart showing the major tasks along with their durations and associated interdependencies. Upon approval of the final Work Plan, the major tasks shown in the schedule will be broken down into multiple subtasks to allow for more accurate and tighter project control.

13.3 Budget Allocation and Expected Spend Rate

KEMA's Project Manager will track project time and expenses on a weekly basis, using reports from individual consultants and standard work-in-progress (WIP) reports from KEMA's Oracle reporting systems. The results of the project budget expenditures will be tracked and reported in our progress reports (including % spent vs. % project time elapsed), including any mitigating actions required to conform to estimates. In addition, each monthly status report will provide a three-month projection of the expected spend rate for the project. By employing Microsoft Project in conjunction with our internal project reporting systems, KEMA will utilize available Earned Value Management (EVM) techniques and internal budget tracking tools to measure the project's status.

13.4 Project Team and Responsibilities

The KEMA Team is composed of highly experienced, nationally-recognized individuals who have management responsibility for the project, supported by a set of subject matter experts assigned to Broad Program Areas and analytical components consistent with their expertise.

The Senior KEMA Management Team will consist of the following individuals:

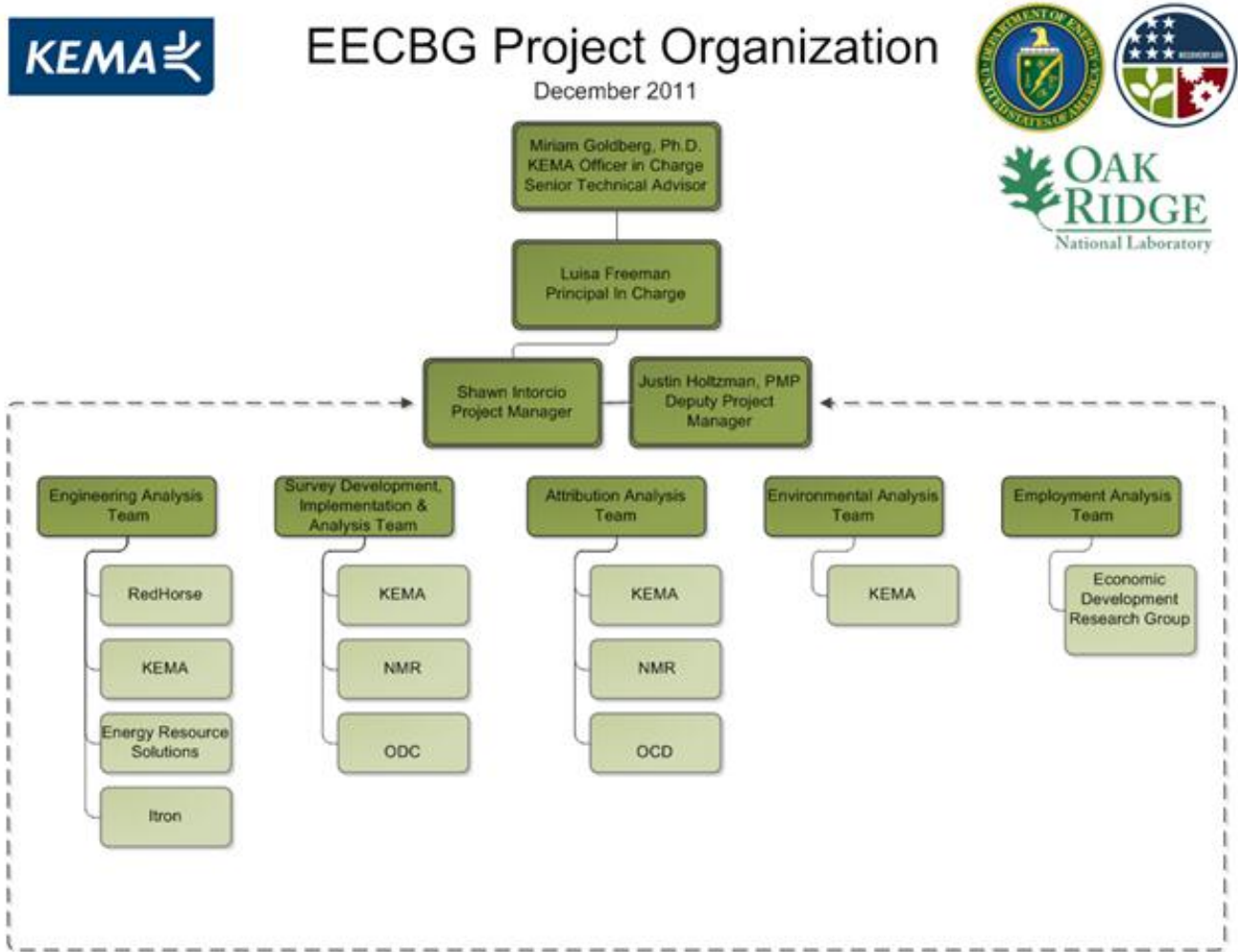
- **Miriam Goldberg, PhD, Officer in Charge and Senior Technical Advisor.** As the official liaison to KEMA's top management, Dr. Goldberg will ensure that DOE/ORNL are completely satisfied with the quality of our work and dedication of our staff and subcontractors. Dr. Goldberg will lead the sample design and statistical analysis for the project.
- **Luisa M. Freeman, MSc., Principal-in-Charge,** will oversee the management and execution of the project and will be responsible for quality assurance. Ms. Freeman will lead the survey design and implementation.

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- **Shawn Intorcio, Project Manager**, will be responsible for the day-to-day management and oversight of the technical work under this contract.
 - **Justin Holtzman, Deputy Project Manager, PMP**, will assist Ms. Intorcio in the execution of the project and will be responsible for maintaining the data necessary for ensuring the project is on track and within budget.

This project will coordinate closely with work proceeding under the National SEP Evaluation. KEMA leaders for that project, **Kathleen Gaffney** and **Tim Pettit**, will communicate regularly about the two projects so that any cost efficiencies can be identified, and that technical solutions might be shared as appropriate.

13.4.1 Project Organization Chart

Figure 13-1: Project Organization Chart



A. Appendix A – Risk Management Memo

To: Colleen Rizey, Martin Schweitzer, Rick Schmoyer, Joel Eisenberg - ORNL
Date: November 30, 2011
From: Luisa Freeman and the KEMA Evaluation Team
Subject: EECBG Evaluation Budget/Quality Risk Mitigation Strategies - Final
Copy to: Nick Hall, TecMarket Works

This memorandum summarizes the EECBG Team's risk mitigation strategies that were discussed on October 19, 2011 at the KEMA Fairfax offices. The strategies below reflect comments received from ORNL and its advisors regarding:

- Quickly identifying risks
- Promptly facilitating the appropriate mitigation strategy
- Ensuring that all identified risks are managed in such a manner that no reduction in rigor level or quality of methods or results occurs.

Further, by identifying and addressing these potential risks, the team will be able to better manage the project budget. Comments received on this memo will be addressed and a final strategy produced to serve as an action plan if any of the identified risks materialize.

Identified Risk	Mitigation Strategies
<p>RISK 1. (Administrative Risk) Delays in completion of the ICR process may result in a delay to the project such that it cannot be completed within the current schedule.</p>	<ol style="list-style-type: none"> 1. KEMA will allocate the resources necessary to complete the ICR package in a timely manner. 2. KEMA will request an Emergency ICR in addition to the standard ICR. 3. KEMA will submit the survey instrument(s) to OMB at the same time as issuing the 30-Day Public Notice in anticipation of limited to no comments. 4. KEMA will identify tasks that can proceed while awaiting ICR approval. 5. KEMA will reserve remaining project resources until after ICR approval is obtained.

Identified Risk	Mitigation Strategies
<p>RISK 2. (Administrative Risk) DOE may elect to postpone the completion date for some grants, thus potentially limiting the number of grants available for sampling within the necessary timeframe.</p>	<ol style="list-style-type: none"> 1. KEMA will draw the sample from activities across both grants and sub-grants. Those activities that are completed by the time of ICR approval will be kept in the sample. 2. For incomplete activities, we will determine whether enough information is available from the desk review to estimate energy savings.
<p>RISK 3. (Administrative Risk) Subcontractor availability may be compromised due to need to stop work until ICR process is approved.</p>	<ol style="list-style-type: none"> 1. KEMA may elect to proceed with desk reviews during the ICR review process, maintaining the original schedule. 2. KEMA will shift work to other subcontractors and/or KEMA staff to accomplish the tasks on time and within budget. 3. KEMA has duplicate skill sets to allow for this contingency.
<p>RISK 4. (Data Availability/Adequacy Risk) A lack of data on EECBG State sub-grants may result in higher costs for creating a sampling frame.</p>	<ol style="list-style-type: none"> 1. KEMA will pursue sub-grant data from DOE Golden office to determine its potential usefulness for categorization of sub-grants. 2. KEMA will leverage the grant close-out tagging process to identify sub-areas and activities at a level necessary for evaluation purposes. 3. KEMA will explore the extent to which DOE can incorporate State sub-grant data into PAGE, thus eliminating the need to devote project time and resources to the creation of a separate State sub-grant database. 4. The sampling procedure used will identify the state sub-grants for which additional detail will be needed, eliminating the need to gather detailed information for sub-grants made by <i>all</i> the states.
<p>RISK 5. (Data Adequacy Risk) Anticipated project-level data are not available to support energy savings calculation (“evaluability”).</p>	<ol style="list-style-type: none"> 1. The sample will include substitutes, in addition to the primary sample, to achieve the targeted number of completed evaluations by program area. 2. KEMA will obtain data that will allow the evaluability of each primary sample Activity to be determined using identified protocols, before moving to a substitute. 3. To limit the need for such a substitution, extra effort will be devoted to assuring evaluability of the certainty selections.

Identified Risk	Mitigation Strategies
<p>RISK 6. (Data Availability Risk) Attribution estimates could be compromised if data and planning assumptions are not available.</p>	<ol style="list-style-type: none"> 1. KEMA will devote adequate project resources toward identifying the best person for each project to discuss attribution issues. 2. KEMA will make use of other resources such as studies being conducted when there is overlap so EECBG evaluation funding might be leveraged. Examples include an ongoing study at LBL, and State EECBG evaluations being conducted independently. 3. The tagging process will be used to capture other funding sources leveraged at a time when such knowledge should be current and up-to-date. 4. KEMA will work with ORNL/DOE to establish level of effort ceiling per Activity after which the KEMA team will move to a simpler alternative means of assigning attribution for that Activity. 5. In consultation with ORNL/DOE, KEMA will specify the alternative “last resort” means of assigning attribution. This method will be used only for cases where the planned attribution analysis is not possible. 6. KEMA will apply alternatives such as establishing a range and using the midpoint, borrowing findings from similar PAs, or some combination of these.
<p>RISK 7. (Methodology Risk) Multiple calls may be needed to identify the appropriate individuals to interview for each sampled Activity.</p>	<ol style="list-style-type: none"> 1. KEMA will have DOE Project Officers review the contact list that is developed to avoid “false starts.” 2. KEMA will use the tagging process at project closure to identify the best contacts for on-going projects. 3. KEMA will devote adequate resources to make sure we identify the best person from each project to respond to evaluation questions.
<p>RISK 8. (Methodology Risk) If engineering estimates of energy savings are not done efficiently and accurately in a reasonable amount of time, costs will escalate and the quality of the study will be at risk.</p>	<ol style="list-style-type: none"> 1. The desk review process will identify the specific level of detail required for each Activity in order to estimate energy savings. 2. A calculation tool can be developed and employed once sample points are known (quantities and other variables to be inserted later). 3. KEMA will leverage the Savings Calculation Tool developed under SEP for appropriate activities.

Identified Risk	Mitigation Strategies
<p>RISK 9. (Methodology Risk) The range of savings and non-savings related activities among some grants may compromise the ability to extrapolate findings from individual activities to Broad Program Areas.</p>	<ol style="list-style-type: none"> 1. KEMA will make every reasonable attempt within the budget to develop a rich database for the sampled projects from which to estimate impacts and success factors. 2. An approach for extrapolating savings from activities to Broad Program Areas will take into account the possibility that some grants may have high percentages of non-savings dollars. 3. KEMA will make use of people experienced in sample expansion to determine a rigorous approach to extrapolation. 4. KEMA will outline the process for aggregating Activity results to sub-areas, Broad Program Areas, and cumulative levels in the Work Plan.

B. Appendix B– Project Schedule

