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METHODOLOGY FOR RECALCULATING AND VERIFYING SAVINGS ACHIEVED BY THE SUPER ESPC PROGRAM

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Engineering Science and Technology Division

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1. INTRODUCTION

This report describes an evaluation of the cost and energy savings achieved by the Super ESPC program that will be performed by Oak Ridge National Laboratory (ORNL) with the support and guidance of the U.S. Department of Energy's (DOE's) Federal Energy Management Program (FEMP).

1.1 BACKGROUND

Energy savings performance contracts (ESPCs) allow federal agencies to implement energy conservation projects at their facilities without up-front capital costs and without the need for special appropriations to pay for the improvements. An ESPC is a partnership between the customer (a government organization) and an energy services company (ESCO). The ESCO conducts a detailed energy survey and identifies improvements that will save energy and reduce energy and energy-related costs at the facility. The ESCO designs and constructs a project that meets the agency's needs, and arranges financing to pay for it. The ESCO guarantees that the installed energy conservation measures (ECMs) will generate cost savings sufficient to pay for the project over the term of the contract. The agency uses the guaranteed cost savings to make payments to the ESCO over the life of the contract. The ESCO in turn uses these payments to pay the financing for the project and to fund any performance-period services (such as equipment maintenance and repair) provided for in the contract. At least once per year, the ESCO provides a measurement and verification (M&V) report to the agency containing observations, measurements, and analysis intended to show whether the cost savings guaranteed by the contract have been delivered during the year.

Currently the most widely used vehicles to implement ESPC projects in the federal government are DOE FEMP's Super ESPCs. Super ESPCs are indefinite-delivery, indefinite-quantity (IDIQ) contracts established by FEMP to make ESPCs as practical and cost-effective a tool as possible for agencies to use. These "umbrella" contracts were competitively awarded to ESCOs who demonstrated their capabilities to provide energy services to federal customers. The general terms and conditions are established in the IDIQ contracts, and agencies implement projects by awarding delivery orders to the Super ESPC ESCOs. Using IDIQ contracts, agencies can implement Super ESPC projects in far less time than it takes to develop stand-alone ESPC projects.

The entire United States, the District of Columbia, and all U.S. territories are covered by Regional (general-purpose) Super ESPCs. Technology-Specific Super ESPCs can be used for federal facilities worldwide and emphasize four advanced technologies: ground source heat pumps, biomass and alternative methane fuels, photovoltaics, and solar thermal concentrating systems.

Since 1998, more than $700 million worth of energy improvements have been installed at federal agency sites using the Super ESPCs.

1.2 EVALUATION OBJECTIVES

The principal objective of the upcoming evaluation that is described in this report is to compare predicted and guaranteed Super ESPC cost and energy savings with the verified savings. ESCOs guarantee a certain amount of cost savings to be delivered by their ESPC projects, based on their estimates (or predictions) of energy savings that the project will deliver. There is always a difference between predicted and guaranteed savings amounts, because ESCOs virtually never guarantee 100 percent of predicted savings. This evaluation will compare predicted as well as guaranteed cost savings to the verified cost savings. Energy savings are not formally guaranteed in the contracts, but they form the basis for the guaranteed cost savings, and the predicted energy savings will also be compared to verified energy savings. In addition, this evaluation will identify and examine the key factors accounting for any observed differences between predicted and verified energy and cost savings.

The ratio of verified to predicted savings (typically expressed as a percentage) is often called the "realization rate." This ratio illustrates how close a particular project comes to achieving the magnitude of savings that it is expected to produce. ORNL and a number of other research institutions have studied the realization rates achieved by a variety of programs over many years. Some studies that have used this concept are Nadel and Keating (1991); Barakat and Chamberlin (1995); Brown and Mihlmeister (1995); Gettings et al. (1998); Kumar et al. (2002); and Schweitzer and Tonn (2005). Shonder and Hughes (2005, 2006) performed a detailed analysis of utility bills to calculate verified savings from an ESPC project at Fort Polk, LA, and Shonder and Florita (2003) performed a similar analysis for a UESC project at Camp Lejeune, NC. A recent presentation by Shonder (2005a) reviewed the findings from case studies comparing verified savings to savings reported by the ESCO in the annual M&V report at Carlisle Barracks in Carlisle, PA, and for theWyatt/Green Federal Building in Portland, OR.

The evaluation employs a sampling technique. The findings from this sample will permit the development of adjustment factors that can be applied to savings for all current contracts and thereby address the extent to which the program as a whole pays for itself from cost savings. For valid practical reasons, the M&V methods that are the basis for the savings estimates that ESCOs calculate and report in their annual M&V reports employ "simplifying assumptions." Findings of this evaluation will also be employed to validate or improve the "simplifying assumptions" (e.g., energy cost escalation rates; percentage of estimated savings that should be guaranteed) to use in new contracts to ensure that the savings reported by ESCOs in the annual M&V reports in the future are as representative as possible of the verified savings achieved. Lastly, the evaluation team will attempt to identify new M&V methods that provide the savings assurance needed but have the potential to reduce cycle time, M&V costs, and risk.

1.3 SCOPE OF REPORT

The remainder of this report provides additional information on the Super ESPC program and the methods this evaluation will use to measure the program's energy and cost savings. Chapter 2 provides a brief description of the Super ESPC program encompassing its history, current operations, and the issues motivating the prospective evaluation described in this report. Chapter 3 presents an overview of the evaluation design that will be employed, touching on the key components, the evaluation questions addressed, and the sample selection process. In Chapter 4, the data collection and analysis approaches to be used in the evaluation will be discussed in detail. Finally, the schedule for this research endeavor is laid out in Chapter 5.

2. DESCRIPTION OF SUPER ESPC PROGRAM

2.1 HISTORY

The use of ESPCs by the U.S. federal government was authorized in the 1986 amendments to the National Energy Conservation Policy Act of 1978, which was further amended by the Energy Policy Act of 1992. DOE was charged with developing rules for federal use of ESPCs and in 1995 issued its rule-making as 10 CFR Part 436. DOE delegated the responsibility for implementing a federal ESPC program to FEMP.

FEMP integrated an Alternative Financing Program into its activities, published model ESPC solicitations, and began helping agencies implement financed energy projects. However, the process of awarding stand-alone ESPCs for individual agency sites—a new and unfamiliar procurement practice in the federal sector—proved cumbersome and time-consuming. To streamline the process and make ESPCs a more practical option, FEMP competitively awarded umbrella-type IDIQ contracts, “Super ESPCs,” to a number of ESCOs in 1997–1998. The Air Force and Army also have IDIQ ESPCs in place. The Super ESPCs establish the general scope of work, terms, and conditions for fixed-price performance-based energy-savings projects. Projects are implemented by issuing delivery orders under the Super ESPCs.

Executive Order 13123, issued in 1999, directed federal agencies to maximize their use of ESPCs and other alternative financing contracting mechanisms to reduce energy use and cost in their facilities and operations. Since that time about $743 million worth of conservation measures has been installed at federal facilities using Super ESPCs, with expected energy and energy-related cost savings of nearly $1.8 billion. With the Energy Policy Act of 2005 calling for the energy intensity of standard federal buildings to be reduced by 2 percent per year from 2006 through 2015—and declining budgets for energy conservation projects funded through Congressional appropriations—ESPCs are expected to play an even more important role in the future.

2.2 CURRENT OPERATIONS

Legislation authorizing the federal government to enter into ESPC contracts contained a sunset provision that had been extended to October 1, 2003, when authority lapsed for a 14-month period. Up to that time, federal agencies had used the various ESPC vehicles to install more than $1.8 billion in energy conservation equipment at their sites, with about one-third of that amount awarded through the Super ESPC program. In late November 2004 ESPC authority was extended for two years in the Defense Authorization Act, and the Energy Policy Act of 2005 extended authority to 2016. A few modifications to existing ESPC projects occurred during the lapse, but no new ESPC projects were awarded with the exception of a few by Air Force, based on a legal counsel ruling unique among agencies. Since the lapse, all of the federal ESPC programs have had difficulty returning to pre-lapse levels of project activity and investment. As of July 2006, about $69 million in ESPC project investment has been awarded under the Super ESPC program since federal ESPC authority was reinstated.

2.3 PROGRAM ISSUES MOTIVATING THIS EVALUATION

The planned evaluation of energy and cost savings in Super ESPC projects is part of FEMP's longstanding quality assurance and improvement program, as well as a response to concerns of oversight organizations.

The use of ESPCs by agencies of the federal government has been audited several times by various oversight organizations. In 2002, the U.S. Army Audit Agency (2002) examined five projects implemented under the Army's own ESPC umbrella contract or as site-specific Army ESPCs. In 2003, the U.S. Air Force audited eight projects awarded under its own umbrella contract. Two major audits by the Government Accountability Office (GAO), in 2004 and 2005, (GAO 2004, GAO 2005) examined a broad cross section of projects awarded under various ESPC umbrella contracts, including DOE's Super ESPCs. These audits all share, to one degree or another, questions about whether guaranteed savings are covering costs in ESPC projects, as required by legislation.

These questions arise primarily from a lack of savings documentation for the projects that were audited, and GAO in particular recommended that FEMP should obtain more data and use it to provide definitive answers.

ESPCs are implemented at the site level, and site personnel generally receive the annual reports that document M&V of savings. Site personnel are best suited to review these reports because they are most familiar with the performance of the conservation measures themselves and with the ESCO's performance of any required performance-period services during the contract term. However, due to the decentralized nature of the process, there has up to this time been no central repository for annual M&V reports, which makes it difficult for auditors to collect the documentation they need to perform program-wide audits. For the planned evaluation, DOE-FEMP has made considerable effort to gather every annual M&V report that has been produced on each and every project awarded under the Super ESPC umbrella contracts. This collection will form the basis for the planned evaluation and will become the foundation for a central repository that will collect and catalog annual M&V reports as they are produced.

3. EVALUATION DESIGN

3.1 DESCRIPTION OF 3-TIER NESTED APPROACH

The evaluation described in this report will utilize a three-tier nested design (Fig. 1), with increasingly intensive and rigorous methods being applied to smaller and smaller samples.

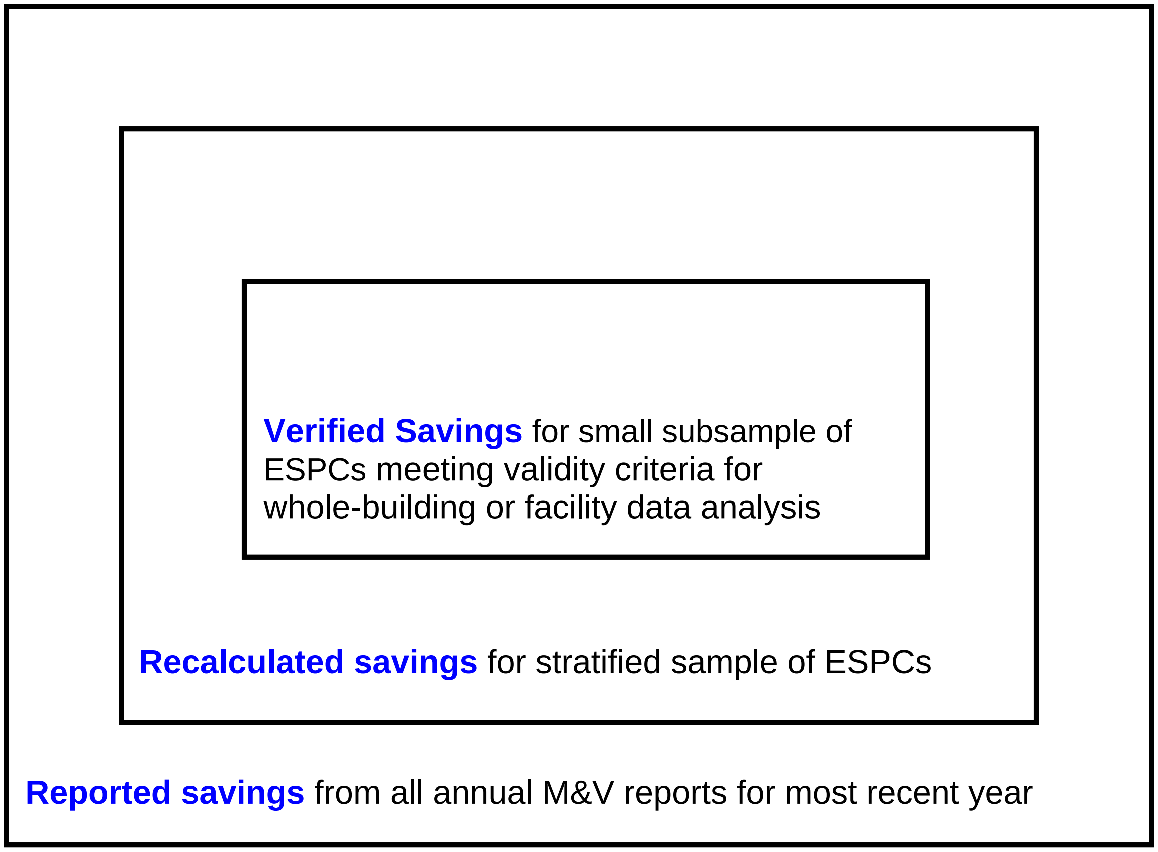

Fig.1. Graphic representation of nested evaluation design.

In the first tier of the evaluation, the latest annual M&V report in the designated performance period will be reviewed for each ongoing Super ESPC project. This includes all active Super ESPC projects for which the relevant improvements were completed and accepted by the government by spring of 2005.[1] For each project included in the evaluation population, the energy and cost savings documented by the ESCO in the annual report will be recorded. The ESCO-reported savings will be compared to the guaranteed cost savings and to the predicted (or "estimated") energy savings on which those guarantees are based. Estimated energy savings are shown in the financial schedules of the delivery order contract.

[1] Spring of 2005 was chosen as the cut-off date because that allows at least one full year of performance, for which an annual M&V report can be produced, before the initiation of data collection for this study.

Tier 2 of the evaluation will focus on 25 Super ESPC projects selected using a stratified sampling process (see section 3.3). For those 25 projects, savings for the most recent annual report will be recalculated employing the approach specified in the M&V plan included in the delivery order contract and, to the extent possible, using improved data in place of previously used values for key factors that influence energy consumption and costs. The Tier 2 approach will consist of verifying all the math from the earlier calculations, verifying to the extent possible the savings associated with reduced energy-related operations and maintenance (O&M) and repair and replacement (R&R) expenses, substituting measured values for some stipulated savings and, where possible, using measured values for key parameters. As shown below, a number of previous studies bear out the importance of revisiting the above-mentioned factors.

A pair of recent studies by Nexant (2002, 2004) found that O&M savings make up a substantial portion of total projected savings but often are not subject to formal M&V. Schiller Associates (2000) found the same lack of formal M&V for O&M savings and characterized it as a source of considerable risk. On the topic of using stipulated savings values, the literature shows that to be an extremely common approach (e.g., Nexant 2005) and indicates that stipulated values are sometimes established without adequate baseline or post-retrofit measurement (Schiller 2000). Unfortunately, the acceptance of stipulated values without proper measurement can introduce substantial uncertainty into the savings calculations (Kumar et. al 2002). Several common "simplifying assumptions" establishing the values for key parameters during project development, such as the percentage of "estimated" savings for measures that is guaranteed, hours of operation of measures, and utility escalation rates, have explained differences between ESCO-reported savings and verified savings during the performance period (e.g., Krieg and Deng 2005; Shonder and Hughes 2005).

The Tier 3 analysis will be conducted for a much smaller subsample that meets validity criteria for whole-building or whole-facility data analysis. This effort will measure verified energy and cost savings under real-world conditions for a set of three to five Super ESPC projects. Recent publications have discussed the findings from this type of evaluation at Fort Polk, Louisiana (Shonder and Hughes 2005, Shonder and Hughes 2006) and Camp Lejeune in North Carolina (Shonder and Florita 2003), and a recent ORNL presentation **(**Shonder 2005b) gave an overview on the use of this type of analysis to verify the savings achieved by ESPC projects.

The findings from each tier of the upcoming evaluation will be used in conjunction with the findings from the other two tiers to optimize the value of this evaluation. Specifically, the Tier 3 data will be used to corroborate the Tier 2 findings and, if necessary, suggest appropriate adjustments to the Tier 2 numbers. This approach of using intensive case studies to corroborate and flesh out the findings from less-intensive studies of larger, statistically valid samples of subjects is frequently used in the evaluation field (e.g., Berry, Brown, Wright, and White 1991; U.S. Nuclear Regulatory Commission 1996). In turn, the adjustment factors produced through the Tier 2 and 3 analyses will be applied to the reported savings documented in Tier 1 to estimate total verified savings from all implemented projects.

3.2 KEY EVALUATION QUESTIONS

Typically, a set of questions is established to guide an evaluation of this type. Those questions document what the evaluation is intended to reveal about the topic or topics of interest. In the case of this evaluation, four key questions will be addressed. They are:

1. What percentage of the cost savings guaranteed by Super ESPCs is verified?
2. What percentage of the energy savings originally predicted for Super ESPCs is verified?
3. What adjustment factors can be applied to the cost savings guaranteed in existing contracts, the predicted energy savings associated with those cost numbers, and the cost and energy savings reported in annual M&V reports to make them better approximate verified savings achieved under contracted[2] conditions and also under real-world conditions?
4. Are the "simplifying assumptions" commonly used valid or in need of improvement, and what new M&V methods and assumptions can be used for new contracts so that reported savings more reliably approximate verified savings without negatively impacting cycle time, M&V costs, and risk?

3.3 SAMPLE SELECTION

3.3.1. Sampling Frame and Stratification

The population of ESPC projects eligible for inclusion in the sample, referred to in this document as the "sampling frame," consists of 117 projects. These are all of the Super ESPC projects that are currently in the performance period, and for which at least one annual M&V report has been produced. Several categories were used to ensure representation of all important strata in the sample. Table 1 shows the distribution of ESPC projects by census region and by whether or not they were subject to the contract "consistency" modifications made to all the Super ESPC umbrella contracts after August 2001. The Super ESPC IDIQ contracts were awarded in a series beginning in 1998, and improvements resulting from lessons learned while establishing the earlier contracts were incorporated into the later Super ESPCs. The modifications made to the Super ESPCs after August 2001 eliminated the differences between the regional contacts, making them all consistent across the program. The standardization and uniformity of the contracts and project documents, especially the financial schedules, was intended to improve quality assurance and administration of Super ESPC projects.

Although sample size objectives were not formulated explicitly for the individual strata, an overall sample size was determined (see next section) and then allocated to the strata. A complete list of all 117 projects in the sampling frame is presented in Appendix A.

[2] The term "contracted conditions" refers to the simplifying assumptions agreed on in the contract for key parameters that are used to calculate cost savings (such as utility tariffs and escalation rates, weather conditions, and O&M/R&R cost savings). Such agreements leave the agency bearing many of the same risks they have when direct-funding projects. Only selected risks that the ESCO can control, such as equipment performance, are generally transferred to the ESCO in ESPCs.

Table 1 also shows, for each census region and consistency modification stratum, minimum and maximum project sizes as measured in guaranteed cost savings (GCS) over term in 2006 dollars. The variation in ESPC project sizes is enormous. Overall, the largest ESPC project has a GCS of $97,064,073, which is 300 times as large as the smallest GCS ($322,774). Because large projects have much greater potential than small projects to affect net savings for the entire population, project size was also used as a basis for sampling. However, rather than stratifying by project size, projects were selected using probability-proportional-to-size (PPS) sampling.

Table 1. Number and Size of ESPC Projects by Census Region and Consistency Modification Status

Census region	Consistency modification status (before/after)	Number of projects	Minimum project size, *GCS over term (2006 dollars)	Maximum project size, GCS over term (2006 dollars)
Northeast	Before	4	2,223,597	12,991,259
Northeast	After	10	1,737,994	41,527,208
Midwest	Before	9	467,024	11,101,277
Midwest	After	11	1,032,875	15,865,971
South	Before	19	1,185,391	37,900,401
South	After	24	1,056,631	97,064,073
West	Before	20	322,774	12,615,820
West	After	20	1,599,832	16,098,606
All Regions	**Either**	**117**	**322,774**	**97,064,073**

***GCS = guaranteed cost savings**

3.3.2. Sample Size

In choosing a size for the sample, our goal was to be able to estimate recalculated whole-project cost savings as a proportion of guaranteed savings to within 5 percent of the mean value for that parameter for the entire population of Super ESPCs at a 90 percent confidence level.

Although they lead to a more efficient sampling design, stratification and PPS sampling complicate the problem of reckoning a necessary sample size. Therefore several simplifying assumptions were made to reckon an overall sample size. As an approximation, the sample size was determined for a design with simple random (as opposed to PPS) sampling and without any stratification. This sample size should exceed the sample size necessary for the stratified and PPS-sampled design. As an additional approximation for reckoning sample size, it was assumed that verified savings for individual projects would be within a certain distance of the guaranteed savings and that a specific confidence interval was desired. Calculations were performed using a variety of assumptions (e.g., verified savings as a percentage of guaranteed savings being uniformly distributed between 80 and 120 percent; verified savings as a percentage of guaranteed savings being binomially distributed at 90 percent and 110 percent) and with both 0.9 and 0.95 confidence levels. The most relevant results are shown in Table 2, indicating that a sample size of 25 is adequate to provide accurate results under a variety of conditions.

Table 2. Required Sample Sizes to Ensure that Tolerated Error is Not Exceeded

Tolerated error (percentage points)	Required sample size (n) [assuming uniform distribution between 80 and 120 percent of mean and 0.90 confidence level]	Required sample size (n) [assuming binomial distribution at 90 and 110 percent of mean and 0.95 confidence level]
3	40	43
4	23	24
5	15	16
6	10	11
8	6	6

3.3.3. Sample Selection Procedure for Tier 2 Evaluation

A sample of 25 ESPC projects stratified by census region and consistency modification status (before/after) was selected with the SAS Surveyselect procedure (SAS 2004). The sample was allocated to the various strata approximately in proportion to the total GCS over term (2006 dollars) for the strata. The allocation and sampling were in *approximate* proportion to the GCS because (1) GCS is continuous and so the proportions are generally not integers, and (2) the Hanurav-Vijayan algorithm used in the SAS Surveyselect procedure imposed certain constraints on the PPS sampling.[3] Because of the constraints, strict PPS sampling could not be used. Instead, in determining selection probabilities, a bound of $30 million on GSC over term was set on the project size. This bound was imposed *only* for determining selection probabilities, it did not constrain the size of projects selected to below $30 million, and it will not affect any variable used in the analysis.

Given the conditions discussed above, the 25 sampled projects were allocated among the various possible combinations of census region and consistency modification status as shown in Table 3. Minimum and maximum project size for the projects that were actually selected are shown in the last two columns of that table.

As this report will be made public before the commencement of Level 2 and Level 3 activities, we do not disclose which particular projects are included in the sample. However, Figure 2 compares the composition of the selected sample by census region and consistency modification status to the composition of the entire population. Given sampling variation, the

[3]See http://support.sas.com/faq/037/FAQ03719.html for further explanation of the constraints in the Hanurav-Vijayan algorithm.

sample distribution appears to provide a good approximation of the distribution in key strata found for the entire population.

Table 3. Frequencies of ESPC Projects Sampled

Census region	Consistency modification status (before/after)	Number of projects sampled	Minimum project size actually sampled (2006 dollars)	Maximum project size actually sampled (2006 dollars)
Northeast	Before	1	3,905,058	3,905,058
Northeast	After	3	8,452,119	41,527,208
Midwest	Before	1	11,101,277	11,101,277
Midwest	After	2	13,055,513	15,865,971
South	Before	4	3,154,260	22,152,019
South	After	8	11,419,404	97,064,073
West	Before	2	1,812,340	12,615,820
West	After	4	6,386,896	7,981,918
All Regions	**Either**	**25**	**1,812,340**	**97,064,073**

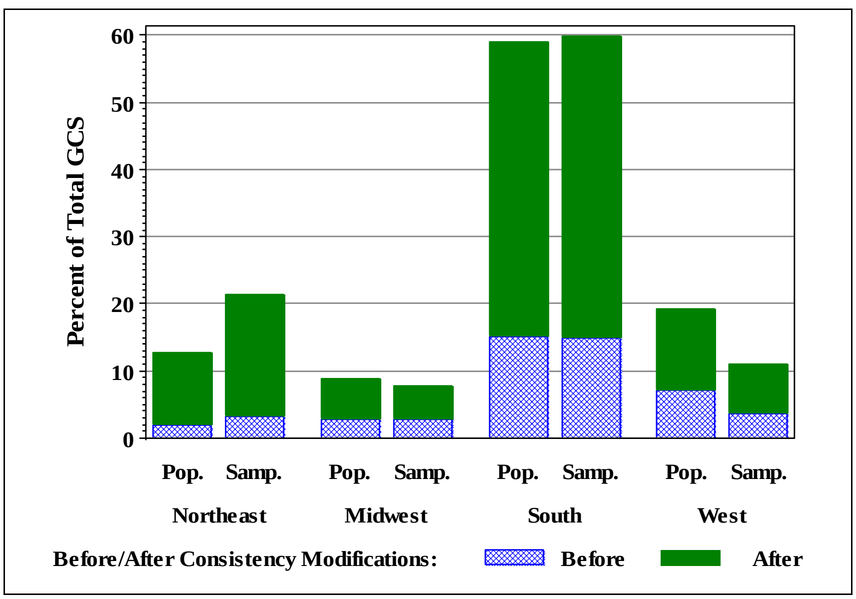

Figure 2. Composition of the ESPC population and sample by census region and consistency modification status.

3.3.4. Sample Selection Procedure for Tier 3 Evaluation

For the Tier 3 whole-building analysis, a subsample of 3 to 5 projects will be selected from the larger Tier 2 sample. Verification of a project's savings based on analysis of pre- and post-project whole-building or facility data is not always possible; therefore, sampled projects must meet validity criteria. To the extent possible, the subsample meeting the validity criteria will also provide a good mix by geographic area. It would be ideal to select some cases where the ratio of recalculated to guaranteed savings (as revealed in the Tier 2 evaluation) is close to 100 percent and some where the ratio is substantially different than that; however, we may not have sufficient data early enough in the life of the project to do that.

If there are not enough projects in the Tier 2 sample that are suitable for whole-building analysis, additional sites for Tier 3 analysis will be selected and then added to the Tier 2 sample. It should be noted that a larger sub-sample might yield more statistically representative results, but the anecdotal information produced by these cases is expected to be very useful. The Tier 3 evaluation allows estimation of true verified savings from data sources entirely independent of the project's contracted M&V plan.

4. DATA COLLECTION AND ANALYSIS

4.1 TIER 1 EVALUATION METHODS

In this first part of the evaluation, annual M&V reports will be collected for all Super ESPC projects in the designated performance period, which begins with the inception of the Super ESPC program and includes all projects for which the relevant improvements were operating and accepted by the Government by spring of 2005. The reported energy and cost savings will be documented for each project for each year of its existence. In addition, guaranteed cost savings and the associated energy savings predictions will be documented for each project. For the most recent annual M&V reports for each project, reported cost savings will be calculated as a percentage of guaranteed cost savings. For the same projects, reported energy savings will be calculated as a percentage of the predicted energy savings on which the cost savings guarantees are based. Prior experience with annual M&V reports prepared to satisfy ESPC requirements suggests that the savings reported by the ESCOs in these reports will rarely, if ever, be less than guaranteed savings (Nexant 2004; Stetz 2005).

The Tier 1 analysis will not examine the M&V methods used to estimate savings, nor will any attempt be made to verify the reported savings. At this point in the evaluation, the major task is to document reported savings for *all* Super ESPC projects during the designated performance period and see how they compare to the original predictions and guarantees.

4.2 TIER 2 EVALUATION METHODS

In Tier 2, savings will be recalculated for the sample of 25 projects discussed in Section 3.3, using the most recent annual M&V report available for each sampled project. Several different sets of calculations will be performed, each one going a little further toward capturing real-world energy and cost savings. Each approach is discussed separately below.

4.2.1. Initial Recalculation of Energy and Energy Cost Savings, Using Approach Described in M&V Plan

For each ESPC examined, savings will be calculated using the approach documented in the M&V plan. The calculations will be made for each type (broadly categorized) of ECM and for all ECMs combined. This will permit the determination of the ratio of recalculated cost savings to both guaranteed and reported cost savings for the entire project. And recalculated energy savings will be compared to reported energy savings project-wide as well as to the predicted energy savings on which cost savings guarantees are based. For individual ECMs, recalculated savings will be compared to reported savings and, if the information is available, to predicted savings. Any discrepancies between recalculated savings and reported savings uncovered by this first part of the Tier 2 analysis would be due to math errors or instances in which the M&V plan was not meticulously followed by the ESCO when calculating reported savings for the annual M&V report.

During this stage of the Tier 2 evaluation, the following tasks will be performed for each Super ESPC project in the sample:

1. Obtain the M&V plan from the Final Proposal.
2. Perform an in-depth review of the latest annual M&V report to identify and document:
   a. guaranteed and reported energy cost savings for the entire project;
   b. predicted and reported energy savings for the entire project;
   c. predicted and reported energy and energy cost savings for each ECM;
   d. whether all activities (measurements, inspections, etc.) called for in the M&V Plan were carried out;
   e. whether the formulas contained in the M&V plan were used correctly to calculate energy savings;
   f. whether the correct utility and escalation rates were used; and
   g. whether the reported energy cost savings were calculated correctly.
3. Use the M&V plan and the information available in the annual M&V report to recalculate reported energy savings and energy cost savings for each ECM and for the entire project.
4. For each individual ECM, determine the ratios of recalculated energy savings to both predicted and reported energy savings.
5. For each individual ECM, determine the ratios of recalculated energy cost savings to both guaranteed and reported energy cost savings.

6. For each Super ESPC project as a whole, determine the ratios of recalculated energy savings to both predicted and reported energy savings.

7. For each Super ESPC project as a whole, determine the ratios of recalculated energy cost savings to both guaranteed and reported energy cost savings.

The information gained from the effort described above will be used to determine the extent to which the additional actions outlined below can be performed for each of the sample projects. The nature of the ECMs installed, the amount of data available, and the expected amount of time required will be considered in determining the scope of effort for each Super ESPC project in the sample.

4.2.2. Calculation of Operations and Maintenance (O&M) and Repair and Replacement (R&R) Savings.

Savings estimates for each project can be improved by checking the numbers contained in the annual M&V reports on cost savings from energy-related operations and maintenance (O&M) and repair and replacement (R&R) expenses. Those savings are often very large and are typically stipulated in the contract and not reviewed for the annual M&V report. To the extent possible, data will be collected on pre- and post-retrofit O&M and R&R expenses to estimate the value of the savings. Using the data collected for all 25 projects, the mean value and 90 percent confidence interval for O&M/R&R cost savings as a proportion of guaranteed and reported O&M/R&R cost savings will be determined for whole projects. At a minimum this activity will identify the kinds of baseline cost documentation and annual cost record keeping the program should strive to implement in the future. What is appropriate for the latter is a function of O&M/R&R responsibility allocation between the agency and ESCO during the performance period.

The following tasks will be performed during this stage of the Tier 2 evaluation:

1. For each Super ESPC in the sample, identify the specific source(s) of the contracted O&M/R&R savings described in the Final Proposal.

2. For each Super ESPC, calculate the proportion of *total* guaranteed cost savings that come from O&M and R&R savings.

3. Extract the pre-retrofit O&M/R&R baseline expenses documented in the M&V plan. If no documentation exists, attempt to collect data on pre-retrofit O&M/R&R expenses incurred at each project site through interviews with staff at the project site and review of relevant site financial records.

4. Collect data on post-retrofit O&M/R&R expenses incurred at each project site through the same methods described for step 3, with the exception that the source of any existing documentation would be the annual M&V report rather than the M&V plan.

5. For each Super ESPC, calculate the value of O&M/R&R savings (step 3 minus step 4) for individual ECMs and entire projects.

6. For each Super ESPC, determine the ratio of recalculated O&M/R&R cost savings to both predicted and reported O&M/R&R cost savings for individual ECMs. In cases

where these savings are stipulated, the predicted and reported values are the same and equal to the stipulated values.

7. For each Super ESPC, determine the ratio of recalculated O&M/R&R cost savings to both guaranteed and reported O&M/R&R cost savings for the whole project. In cases where these savings are stipulated, the guaranteed and reported values are the same and equal to the stipulated values.

8. For the entire sample, calculate the mean value and 90 percent confidence interval for recalculated whole-project O&M/R&R cost savings as a proportion of *guaranteed* O&M/R&R savings and for recalculated whole-project O&M/R&R savings as a proportion of *reported* O&M/R&R savings[4]. In cases where these savings are stipulated, the guaranteed and reported values are the same and equal to the stipulated values.

9. For the entire sample, calculate the mean value and 90 percent confidence interval for individual ECMs (to the extent that data are available) for recalculated O&M/R&R cost savings as a proportion of *predicted* O&M/R&R savings and for recalculated O&M/R&R savings as a proportion of *reported* O&M/R&R savings.

4.2.3. Recalculation of Energy and Energy Cost Savings, Substituting Measured Values for Stipulated Savings

At this stage of the Tier 2 evaluation, the analysis will be taken a step further by identifying instances in which M&V Option A[5] was used without first performing appropriate pre- and/or post-retrofit measurements of equipment capacity, equipment performance, or other factors to establish values that were stipulated in the contract. Although pre-retrofit performance cannot be measured at this time, it is possible that such data were collected during the detailed energy survey and can be examined, or that equipment and conditions approximating pre-retrofit circumstances are available elsewhere at the project site and can be observed. In those cases where cost-effective opportunities present themselves, pre- and post-retrofit data will be obtained and used to adjust the stipulated values. Energy and energy cost savings will then be recalculated using these *new* stipulated numbers. This will provide a more accurate estimate of savings under contracted conditions. Using the data from all the ESPCs studied, the mean value for recalculated energy cost savings as a proportion of both reported and guaranteed energy cost savings can be computed for the entire sample, along with the 90 percent confidence interval. Similarly, the mean value and confidence interval for recalculated energy savings as a proportion of both reported and predicted energy savings can be generated. For individual ECMs, recalculated energy cost savings and energy savings can be compared to reported and predicted savings, to

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[4] These calculations will use *total* sample-wide values for recalculated savings, guaranteed savings, and reported savings. This will automatically give more weight to the bigger projects than to the smaller ones. The SAS Surveymeans procedure will be used to account for the way the sample was stratified and the probability sampling approach that was used.

[5] With M&V Option A, "stipulations" are allowed. A stipulation in an ESPC M&V plan is an agreement between the ESCO and agency to accept a defined value or functional form of a specific factor to be used in determining the baseline and/or post-installation energy consumption, which will be used to calculate the guaranteed cost savings, and by definition the reported cost savings is the same. If related requirements are met (i.e., satisfactory commissioning results and annual verification of equipment performance and that maintenance is being done), the guarantee is considered to be met.

the extent that data are available. For each ECM, the mean value and 90 percent confidence interval for the above-mentioned proportions will be calculated.

The following tasks will be performed:

1. For each Super ESPC in the sample, identify any instances in which M&V Option A was used without first performing pre- and post-retrofit measurements to establish the performance of the ECM(s).
2. For the ECMs identified in step 1, where feasible and cost-effective, obtain data on pre-retrofit performance from the detailed energy survey that was performed during the project development phase or from the examination of equipment elsewhere on the project site that approximates pre-retrofit conditions.
3. For each Super ESPC, make measurements of actual post-retrofit performance, as feasible.
4. Using the data collected in steps 2 and 3, recalculate energy savings for each Super ESPC for the ECM(s) in question.
5. For each Super ESPC, recalculate energy cost savings for each relevant ECM using the utility rates and other simplifying assumptions specified in the contract.
6. Recalculate whole-project energy and energy cost savings using the new ECM-level savings numbers in place of the original stipulated values. This represents recalculated energy and energy cost savings under the contracted parameters.
7. Compute recalculated whole-project energy savings as a proportion of both predicted and reported whole-project energy savings for each Super ESPC in the sample.
8. For the entire sample, compute the mean value and 90 percent confidence interval for recalculated whole-project energy savings as a proportion of predicted energy savings and for recalculated whole-project energy savings as a proportion of reported energy cost savings[6].
9. Compute recalculated whole-project energy cost savings as a proportion of both guaranteed and reported whole-project energy cost savings for each Super ESPC in the sample.
10. For the entire sample, compute the mean value and 90 percent confidence interval for recalculated whole-project energy cost savings as a proportion of guaranteed energy cost savings and for recalculated whole-project energy cost savings as a proportion of reported energy cost savings.
11. Compute recalculated energy savings and energy cost savings as a proportion of both predicted and reported energy savings and energy cost savings for individual ECMs for each Super ESPC, to the extent that data are available.

[6] These calculations, and all others that generate means and confidence intervals, will use *total* sample-wide values for the variables involved and will employ the SAS Surveymeans procedure to account for the sample stratification and probability sampling approach that was used.

12. For the entire sample, compute the mean value and 90 percent confidence interval for each of the following for individual ECMs (to the extent that data are available): recalculated energy savings as a proportion of predicted energy savings; recalculated energy savings as a proportion of reported energy savings; recalculated energy cost savings as a proportion of predicted energy cost savings; and recalculated energy cost savings as a proportion of reported energy cost savings.

4.2.4. Recalculation of Energy and Energy Cost Savings, Using Real-World Values for Key Parameters

At this point, savings will be recalculated using real-world values for key parameters that influence savings calculations, to the extent possible. This will involve consideration of actual utility tariffs and the position of the ESPC savings at the margin of energy use within the tariff structure, weather conditions, operating hours and equipment schedules, and plug loads during the reporting period. By sequentially calculating savings using one real-world parameter value at a time, it will be possible to identify which factors account for the largest discrepancies between reported and recalculated savings. In order to focus on how changes in parameter values – by themselves – affect savings estimates, the stipulated performance values for individual ECMs used in the original contracts will be employed here. Once again, findings from all 25 ESPCs will be used to calculate the mean value and 90 percent confidence interval for recalculated savings as a proportion of guaranteed, predicted, and reported savings. This will be done for whole projects and for individual ECMs, where possible.

The following tasks will be performed:

1. As feasible, obtain actual values in effect over the reporting period for each Super ESPC for the key parameters that influence energy and energy cost savings calculations:
   a. utility tariffs and the position of the ESPC savings at the margin of energy use within the tariff structure,
   b. weather conditions,
   c. operating hours/equipment schedules, and
   d. plug load.

2. For each Super ESPC, recalculate energy savings and energy cost savings for individual ECMs according to the approach documented in the M&V plan, using one real-world parameter value at a time.

3. For each Super ESPC, use the findings from step 2 to identify which factors account for the largest discrepancies between recalculated energy savings and predicted energy savings, between recalculated energy savings and reported energy savings, between recalculated energy cost savings and predicted energy cost savings, and between recalculated energy cost savings and reported energy cost savings for individual ECMs.

4. For all 25 Super ESPC projects combined, identify which factors account for the largest discrepancies between recalculated energy savings and predicted energy savings, between recalculated energy savings and reported energy savings, between recalculated energy cost savings and predicted energy cost savings, and between recalculated energy cost savings and reported energy cost savings for individual ECMs.

5. For each Super ESPC, recalculate energy savings and energy cost savings for the entire project with the new ECM-level savings numbers generated in Step 2, using the savings associated with one real-world parameter value at a time.
6. For each Super ESPC, use the findings from step 5 to identify which factors account for the largest discrepancies between recalculated energy savings and predicted energy savings, between recalculated energy savings and reported energy savings, between recalculated energy cost savings and guaranteed energy cost savings, and between recalculated energy cost savings and reported energy cost savings for the entire project.
7. For all 25 Super ESPC projects combined, identify which factors account for the largest discrepancies between recalculated energy savings and predicted energy savings, between recalculated energy savings and reported energy savings, between recalculated energy cost savings and guaranteed energy cost savings, and between recalculated energy cost savings and reported energy cost savings for whole projects.
8. For the entire sample of 25 Super ESPCs, compute the mean value and 90 percent confidence interval for recalculated whole-project energy savings as a proportion of predicted energy savings and for recalculated whole-project energy savings as a proportion of reported energy savings.
9. For the entire sample, compute the mean value and 90 percent confidence interval for recalculated whole-project energy cost savings as a proportion of guaranteed energy cost savings and for recalculated whole-project energy cost savings as a proportion of reported energy cost savings.
10. For the entire sample, compute the mean value and 90 percent confidence interval for each of the following for individual ECMs, as feasible: recalculated energy savings as a proportion of predicted energy savings; recalculated energy savings as a proportion of reported energy savings; recalculated energy cost savings as a proportion of predicted energy cost savings; and recalculated energy cost savings as a proportion of reported energy cost savings.

4.2.5. Final Tier 2 Calculations and Comparisons

The results of the individual calculations carried out in the previous stages of the Tier 2 evaluation will be combined to produce adjustment factors that can be used to revise and improve the savings numbers for all projects that are documented in Tier 1. Those adjustment factors will show: (1) mean recalculated whole-project energy savings as a percentage of predicted energy savings; (2) mean recalculated whole-project energy savings as a percentage of reported energy savings; (3) mean recalculated whole-project cost savings as a percentage of guaranteed cost savings; and (4) mean recalculated whole-project cost savings as a percentage of reported cost savings. The data collected in this evaluation will allow the generation of one set of adjustment factors that approximate savings under contracted conditions and another set that approximate savings under the real-world conditions observed during the designated performance period. Those adjustment factors, once they are fine-tuned to reflect additional findings from the Tier 3 evaluation, can be applied to the reported savings for projects included in the Tier 1 evaluation to approximate recalculated program-wide savings for all current Super ESPC projects under contracted and real-world conditions for the most recent year.

The following tasks will be performed in this final phase of the Tier 2 evaluation:

1. For each Super ESPC, use findings from previous stages of the Tier 2 evaluation to recalculate energy and energy cost savings that incorporate recalculated O&M/R&R savings numbers (Section 4.2.2) and substitute recalculated savings for stipulated ones (Section 4.2.3). This will be done for individual ECMs (where data are available) and for entire projects.

2. Use the savings numbers calculated in step 1 to compute each of the following for individual ECMs for the entire sample: (1) mean[7] recalculated energy savings as a percentage of predicted energy savings; (2) mean recalculated energy savings as a percentage of reported energy savings; (3) mean recalculated cost savings as a percentage of predicted cost savings; and (4) mean recalculated cost savings as a percentage of reported cost savings. This makes up a set of adjustment factors that approximate savings under *contracted conditions*.

3. Use the savings numbers calculated in step 1 to compute each of the following for whole projects (i.e., all ECMs performed by a Super ESPC) for the entire sample: (1) mean recalculated energy savings as a percentage of predicted energy savings; (2) mean recalculated energy savings as a percentage of reported energy savings; (3) mean recalculated cost savings as a percentage of guaranteed cost savings; and (4) mean recalculated cost savings as a percentage of reported cost savings. Again, these adjustment factors approximate savings under *contracted conditions*, but for whole projects rather than for individual ECMs.

4. For each Super ESPC, use findings from previous stages of the Tier 2 evaluation to recalculate energy and energy cost savings that incorporate recalculated O&M/R&R savings numbers (Section 4.2.2), substitute recalculated savings for stipulated ones (Section 4.2.3), and use real-world values for key parameters (Section 4.2.4). This will be done for individual ECMs (where data are available) and for entire projects.

5. Use the savings numbers calculated in step 4 to compute each of the following for individual ECMs for the entire sample: (1) mean recalculated energy savings as a percentage of predicted energy savings; (2) mean recalculated energy savings as a percentage of reported energy savings; (3) mean recalculated cost savings as a percentage of predicted cost savings; and (4) mean recalculated cost savings as a percentage of reported cost savings. This makes up a set of adjustment factors that approximate savings under *real-world conditions*.

6. Use the savings numbers calculated in step 4 to compute each of the following for whole projects for the entire sample: (1) mean recalculated energy savings as a percentage of predicted energy savings; (2) mean recalculated energy savings as a percentage of reported energy savings; (3) mean recalculated cost savings as a percentage of guaranteed cost savings; and (4) mean recalculated cost savings as a percentage of reported cost savings. Again, these adjustment factors approximate savings under *real-world conditions*, but for whole projects rather than for individual ECMs.

[7] Wherever means are calculated, the 90 percent confidence interval will be calculated also.

4.3 TIER 3 EVALUATION METHODS

For three to five of the Super ESPC projects examined in Tier 2, an analysis will be performed using pre- and post-retrofit whole-building or facility data in order to determine the verified savings that were achieved following installation of the ECMs. Unlike the Tier 2 evaluation, which addresses savings for individual ECMs and whole projects, this analysis focuses on savings achieved at the entire building or facility level, using actual metered energy use interval data (e.g., utility billing records, the site's sub-metered data, etc.) as the primary data source. The Tier 3 analysis can only be performed on projects meeting validity criteria for whole-building or facility data analysis. If it turns out that there are not three to five projects from Tier 2 that also meet the Tier 3 validity criteria, a few additional projects will be selected for Tier 3 and then added to Tier 2.

The Tier 3 analysis will start by measuring the project-level savings achieved under real-world conditions. Information on energy consumption, energy costs, and local daily high, low, and mean temperature will be collected for two distinct periods: a multi-month period before the ECMs were installed and a similar period after the retrofit was completed. A regression analysis will be performed using the energy use and temperature data as inputs, and the resulting regression equations will give expressions for energy use as a function of weather in the pre- and post-retrofit periods. The post-retrofit regression equation will then be subtracted from the pre-retrofit equation to give an expression for energy savings as a function of temperature. Temperature data from the period covering the most recent annual reporting period will be used as input to the savings regression to determine verified energy savings for the period covered by the annual report.

If the selected Tier 3 projects include electrical demand savings, a similar procedure will be used to correlate pre- and post-retrofit peak electrical demand with extreme (high or low depending on season) temperatures. The post-retrofit regression equation will be subtracted from the pre-retrofit equation to give an expression for demand savings as a function of temperature. Temperature data from the period covering the most recent annual reporting period will be used as input to the savings regressions, to determine verified demand savings for the period covered by the annual report.

The regression equations developed for energy and demand will also be used to determine verified energy cost savings for the period covered by the most recent annual report. The energy and demand savings – as predicted by the regression equations -- will be added to the actual energy and demand for each month in the analysis period, to determine the energy and demand that would have occurred in the absence of the ESPC project. These monthly values will be plugged into the currently applicable tariff to determine the energy cost that would have occurred each month, in the absence of the project. The actual monthly cost will then be subtracted from the "no project" monthly cost to determine the verified cost savings.

The same regression equations described above can be employed to determine verified savings under contracted conditions by feeding weather data for a Typical Meteorological Year into both the pre- and post-retrofit regression equations. The costs of purchasing this energy will then be calculated by applying the contracted utility tariff and energy escalation rate to the normalized energy consumption figures.

The Tier 3 findings for real-world and contracted conditions will be compared to the savings found for the same sites by the Tier 2 analysis under contracted and real-world conditions. Major discrepancies will be investigated and, if possible, explained through contact with the facility's engineers. If additional explanatory information is required, site surveys and short-term measurements will also be conducted.

4.4. SYNTHESIS OF FINDINGS FROM TIER 1-3 STUDIES

As noted in Section 4.3, any major discrepancies between the savings calculated in the Tier 2 and Tier 3 studies will be investigated and explained. Those findings will be used to fine-tune the adjustment factors developed in the Tier 2 evaluation. While Tier 3 focuses on whole-building savings, it is possible that the examination of differences between Tier 2 and Tier 3 findings could provide insights regarding the savings estimates for individual ECMs as well as for entire facilities.

The finalized adjustment factors resulting from this effort can be applied to the savings numbers reported for existing ESPCs to yield improved estimates of project-generated savings. One adjustment factor can be used to make the savings numbers calculated with current methods and assumptions better approximate savings under contracted conditions, while another adjustment factor can be used to approximate savings under real-world conditions. Those factors will be applied to the reported savings from the Tier 1 review to estimate total savings from all implemented projects combined for the most recent year for which data are available. The mean value and 90 percent confidence interval will be computed for total whole-project energy and cost savings under contracted parameters as well as for total energy and cost savings until real-world conditions.

The adjusted savings numbers for all Super ESPC projects described above will be used to calculate the ratio of mean whole-project energy and cost savings under contracted parameters to mean energy and cost savings under real-world conditions. For each ratio (one for energy and one for costs), the mean value and the 90 percent confidence interval will be computed. Where availability of data allow, the ratio of mean energy and cost savings under contracted parameters to mean energy and cost savings under real-world conditions will also be calculated for individual ECMs that are commonly used in Super ESPC projects.

In addition to enabling reported savings for existing contracts to be adjusted and improved, the findings from this evaluation can also suggest new methods and improved simplifying assumptions to be used in new contracts. Both the whole-project results and findings about individual ECMs will be useful in this endeavor. The use of new simplifying assumptions (e.g., energy cost escalation rates, percentage of estimated savings that should be guaranteed) is expected to result in contractor-reported savings that are better approximations of real-world verified savings, both for entire projects and individual ECMs.

Finally, the findings from this evaluation can be used to alert ESCOs and government agencies to data that should routinely be tracked during ESPC operations to allow savings to be more easily and accurately estimated.

5. SCHEDULE

The period for performing this evaluation will cover the remainder of FY 2006, all of FY 2007, and the first two months of FY 2008. Key tasks and the expected completion date for each one are listed below.

1. Finalize collection of Annual M&V reports for all projects in performance period .... **September 1, 2006**
2. For each Super ESPC in the designated performance period, calculate reported cost savings as a percentage of guaranteed cost savings and reported energy savings as a percentage of predicted energy savings, using data from the most recent annual M&V report .... **September 15, 2006**
3. Select three to five projects from the Tier 2 sample to examine in the Tier 3 evaluation ....**October 2, 2006**
4. For the 25 Tier 2 projects, perform initial recalculation of energy savings, energy cost savings, and O&M/R&R cost savings for each ECM and for entire projects, using the procedures, savings numbers, and parameter values documented in the contract M&V plan plan..**November 27, 2006**
5. Recalculate the value of O&M/R&R savings for the 25 Tier 2 projects....... **January 26, 2007**
6. For the 25 Tier 2 projects, recalculate savings using upgraded savings values for selected ECMs for which savings were stipulated in the M&V plan .... **April 27, 2007**
7. Finish collecting data for Tier 3 evaluation .... **June 1, 2007**
8. Recalculate savings for the 25 Tier 2 projects using real-world values in effect during the performance period for key parameters .... **June 29, 2007**
9. Develop adjustment factors that show how recalculated savings compare to guaranteed, predicted, and reported savings under both contracted parameters and real-world conditions ... . **July 27, 2007**
10. Complete Tier 3 analysis to determine verified whole-project savings for three to five Super ESPC projects under real-world conditions and contracted parameters.......... **August 10, 2007**
11. Investigate and explain any major discrepancies between the Tier 2 and Tier 3 evaluation findings .... **September 14, 2007**
12. Finalize adjustment factors that show verified savings as a percentage of guaranteed, predicted, and reported savings... **September 28, 2007**

13. Use finalized adjustment factors to estimate total savings from all projects combined for the most recent year for which data are available...**October 5, 2007**

14. Develop improved simplifying assumptions to be used in new contracts......**October 19, 2007**

15. Prepare draft report documenting evaluation findings...............................**November 30, 2007**

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APPENDIX — COMPLETE SAMPLING FRAME

Table A.1. Complete Sampling Frame

Project name(in FEMP Central data base)	Date awarded	Consistency modification status (before/ after)	Census region	Total guaranteed cost savings over term (2006 dollars)
Fort Monmouth, NJ	30SEP03	After	Northeast	41,527,208
MMA Kings	25SEP03	After	Northeast	21,665,081
VA Medical Center [3 sites 1 MA & 2 CT]	05SEP01	After	Northeast	15,771,772
Carlisle Barracks	17JUL02	After	Northeast	13,847,024
JFK/FDR Library	17OCT02	After	Northeast	8,452,119
Ft. Hamilton	16NOV01	After	Northeast	6,537,875
Fort Drum	22SEP03	After	Northeast	4,182,349
Northern Buildings Bundle	20NOV02	After	Northeast	4,077,583
Nix Courthouse and Customs House	26JUN03	After	Northeast	2,150,520
FAA New England	12JUN03	After	Northeast	1,737,994
U.S. Merchant Marine Academy	31AUG01	Before	Northeast	12,991,259
USCG Support Center	01SEP99	Before	Northeast	3,905,058
VA Medical Center [Providence]	02MAR01	Before	Northeast	2,605,019
Leo O'Brien Federal Building	08JUN00	Before	Northeast	2,223,597
Rock Island	06FEB02	After	Midwest	15,865,971
VA Medical Center (VISN 23) Phase II	21AUG03	After	Midwest	13,055,513

Project name(in FEMP Central data base)	Date awarded	Consistency modification status (before/ after)	Census region	Total guaranteed cost savings over term (2006 dollars)
VA Medical Center (VISN 23)	12DEC02	After	Midwest	10,058,736
Haskell Indian Nations University, Riverside Indian School	14SEP01	After	Midwest	7,278,156
North Central States Courthouse, 2 Fed. Bldgs.	22APR02	After	Midwest	4,824,969
Iron Mountain	21AUG03	After	Midwest	4,636,986
Argonne National Lab	30SEP03	After	Midwest	3,369,064
GSA Bannister	30SEP03	After	Midwest	3,290,430
GSA Michigan	25SEP03	After	Midwest	3,222,137
Kansas City Regional Office - Wichita, Topeka, KS sites	06SEP02	After	Midwest	1,122,704
Bundle - LA, TX, NM, OK, KS	27AUG03	After	Midwest	1,032,875
National Animal Disease Center, Agricultural Research Services	16DEC99	Before	Midwest	11,101,277
IHS - Aberdeen Area Office	01AUG01	Before	Midwest	5,472,004
Denney Federal Building/Courthouse, Lincoln, Nebraska (Kansas City GSA Office)	25JUL00	Before	Midwest	4,889,313
Marine Corps Support Activities Center - Richards-Gebaur Memorial Airport	01FEB01	Before	Midwest	2,449,447
Glenn Research Center at Lewis Field	05AUG99	Before	Midwest	2,046,390
National Imagery & Mapping Agency	05JUN00	Before	Midwest	1,875,706
Des Moines Federal Bldg	24MAY01	Before	Midwest	1,864,442
Des Moines VA Medical Center (VISN 14)	08AUG01	Before	Midwest	1,115,948
Eisenhower Museum and Library	26MAR99	Before	Midwest	467,024
Marine Base Quantico	30SEP02	After	South	97,064,073

Project name(in FEMP Central data base)	Date awarded	Consistency modification status (before/ after)	Census region	Total guaranteed cost savings over term (2006 dollars)
GSA - FDA White Oak	12JUL02	After	South	79,599,293
Little Creek NAB	25AUG03	After	South	42,413,677
Fort Jackson	18SEP01	After	South	36,915,975
Marine Corps Albany	03SEP03	After	South	26,664,358
Federal Bureau of Investigation	29SEP03	After	South	26,537,381
VA Medical Center (VISN 7)	19MAY03	After	South	22,649,794
MCAS Beaufort	30SEP03	After	South	21,234,189
Beltsville Agricultural Research Center (BARC) and the US National Arboretum	24SEP03	After	South	20,793,462
GSA - Suitland, MD	30SEP03	After	South	16,629,686
Oceana Naval Air Station/Little Creek Naval Amphib. Base	24DEC02	After	South	15,478,791
Beaufort MCAS	28SEP01	After	South	13,336,660
Aberdeen Proving Grounds	18SEP01	After	South	12,750,909
National Institutes of Health	25JUN03	After	South	11,419,404
Ft. Hood	29SEP03	After	South	9,345,945
National Institute of Standards and Technology (NIST)	26NOV02	After	South	8,219,396
Courthouse and New Construction - Gulfport	28SEP01	After	South	7,367,126
Albuquerque & El Paso Projects - Ft. Worth Office, TX	04DEC02	After	South	4,317,820
National Capitol Region - HOTD	12JUL02	After	South	3,474,615
Job Corps various sites	26SEP03	After	South	3,465,189

Project name(in FEMP Central data base)	Date awarded	Consistency modification status (before/ after)	Census region	Total guaranteed cost savings over term (2006 dollars)
Camp LeJeune	07NOV02	After	South	3,323,977
Boggs Federal Building and Courthouse	03MAR03	After	South	2,653,264
Houston GSA Buildings (Ft. Worth GSA Office)	15APR03	After	South	1,451,920
Projects in TX, LA, AR - Dallas/Ft. Worth Office	28JUN02	After	South	1,056,631
Johnson Space Center	01FEB99	Before	South	37,900,401
Fort Gordon, Fort Jackson & Fort Stewart Medical Commands	30SEP00	Before	South	22,152,019
Atlanta - Richard Russell & Summit	30SEP99	Before	South	17,417,518
VA Medical Center (VISN 17)[San Antonio/Kerrville]	13JUL01	Before	South	15,853,477
Oak Ridge National Laboratory	06AUG99	Before	South	12,136,178
Pantex Plant	01JUN00	Before	South	9,272,507
National Risk Management Research Laboratory	27SEP00	Before	South	7,261,317
Patuxent River Naval Air Station	28SEP00	Before	South	6,278,105
Y-12	26MAR01	Before	South	6,170,647
Austin Project - Ft.Worth Office, TX	29DEC99	Before	South	6,140,694
National Gallery of Art	02NOV00	Before	South	4,862,731
Raleigh NC - Bundled Sites	29SEP00	Before	South	4,515,377
Columbia, SC - 11 sites in TN and SC	22NOV00	Before	South	3,261,119
Memphis, TN Customer Service Center and 8 bldgs in 4 states	23JAN01	Before	South	3,154,260
Gary Job Corps Center	22DEC99	Before	South	2,937,402

Project name(in FEMP Central data base)	**Date awarded**	**Consistency modification status (before/ after)**	**Census region**	**Total guaranteed cost savings over term (2006 dollars)**
Fox Army Health Center	30SEP00	Before	South	2,832,627
DOA/USDA/ARS: Beltsville, MD	27JAN00	Before	South	1,681,813
Project in South Texas Sites - Ft. Worth Office	04MAY00	Before	South	1,583,663
Center for Disease Control	31MAY01	Before	South	1,185,391
VA Medical Center (VISN 22)[San Diego]	30SEP03	After	West	16,098,606
NAVSTA San Diego CA Bldg 85	30SEP03	After	West	16,079,799
Hill AFB BAMF Project	30SEP03	After	West	13,746,484
SW Region, DO #2	26SEP01	After	West	10,924,811
Victorville	29SEP03	After	West	8,531,341
Sub Base Bangor, DO#2	27SEP01	After	West	7,981,918
Ft. Lewis/Yakima Firing Range	28JUN02	After	West	7,937,179
Marine Corps Air Station [Miramar CA]	26SEP01	After	West	7,329,069
MCAS Camp Pendleton	26SEP03	After	West	6,472,090
Hill AFB Regional	30SEP03	After	West	6,386,896
VA Medical Center - Fresno (VISN 21)	21AUG03	After	West	5,789,052
VA Medical Center San Francisco (VISN 21, DO #2)	21AUG03	After	West	5,709,344
Ames Research Center DO#2	28MAR02	After	West	4,212,307
Denver Federal Center #2	10SEP01	After	West	3,882,506
Denver Downtown Buildings	22AUG02	After	West	2,917,205

Project name(in FEMP Central data base)	Date awarded	Consistency modification status (before/ after)	Census region	Total guaranteed cost savings over term (2006 dollars)
Federal Courthouse Seattle	27NOV01	After	West	2,666,801
Reagan Library	21MAR02	After	West	2,362,356
Denver/Salt Lake City ARTCCs	30AUG02	After	West	2,173,568
Naval Air Station - Fallon	26SEP01	After	West	2,127,856
North Las Vegas	30NOV01	After	West	1,599,832
VA Medical Center (VISN 19)[Salt Lake City]	31JAN00	Before	West	12,615,820
San Francisco VAMC (VISN 21, DO #1)	28SEP98	Before	West	11,490,427
Southwest Indian Polytechnic Inst.	20APR01	Before	West	6,901,590
Integrated Support Command, Kodiak, AK, DO#2	30JUL99	Before	West	5,973,939
Sherman Indian High School	29JUN00	Before	West	5,321,220
VA Medical Center (VISN 19)[Denver]	16MAY01	Before	West	5,143,111
Ames Research Center DO#1	21AUG00	Before	West	4,534,413
SW Region, DO #1	01MAR01	Before	West	3,922,261
Pt. Mugu	12AUG99	Before	West	3,330,500
Denver Federal Center	29JUN00	Before	West	3,233,767
Defense Manpower Data Center	21JUL99	Before	West	3,196,296
Def Lang/Presidio and Annex	23DEC99	Before	West	3,017,115
Idaho Eng Lab/Lockheed	22JAN01	Before	West	1,812,340
Integrated Support Command, Alameda, CA	19APR99	Before	West	1,615,774

Project name(in FEMP Central data base)	Date awarded	Consistency modification status (before/ after)	Census region	Total guaranteed cost savings over term (2006 dollars)
Wyatt-Green Fed Bldg.	21FEB01	Before	West	1,533,304
VA Medical Center (VISN 19)[Grand Junction]	28MAY99	Before	West	1,459,072
FDA Building - Bothell	23SEP98	Before	West	1,335,200
ARTCC, Seattle, WA	29JUL98	Before	West	771,693
Corvallis Forestry Lab	28SEP98	Before	West	749,361
Job Corps Centers	08OCT99	Before	West	322,774