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EVALUATION OF AMERENUE'S COMMERCIAL ENERGY AUDIT AND ENERGY EFFICIENCY IMPROVEMENT REBATE PROGRAM

Prepared for

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TABLE OF CONTENTS

Executive Summary

The Commercial Energy Audit and Energy Efficiency Improvement Rebate Program is designed to encourage more effective utilization of electric energy through energy efficiency improvements in the building shell or though the replacement of inefficient electrical equipment with efficient electrical equipment. AmerenUE provides a rebate for a portion of the costs of an energy audit and related upgrades that improve the efficient use of electricity. (A detailed description is provided in Section II.)

This program was run as a pilot program between 2003 and 2006. Program accomplishments during the pilot period include:

- 42 applications with 31 of 42 projects completed: 29 high-efficiency lighting or lighting controls; 5 HVAC improvements or HVAC controls; 1 installation of variable speed drives (VSD) and chillers[1]
- Over $131,000 in rebates provided to customers, with 71% of program budget committed
- Additional non-energy benefits reported by participants, including brighter and cleaner lighting
- Self-reported estimates by participants of over 5,724 MWh in annual energy savings from program supported projects, with verification of nearly 1,000 MWh.

These program accomplishments are described further in Section III.

The amount of funding available to participants during this pilot was small (i.e., a maximum of $5,000 per customer). For participants, these funds increased communications and overall satisfaction with AmerenUE; but while appreciated by customers, for *most* customers, the small amount of funding from the AmerenUE program does not appear to increase the efficiency level of the projects—there were, however, a few participants who said that it did help justify the measures and/or speed up the timing of the upgrades.

During the pilot period, this program was undersubscribed, and most notably, did not result in the energy savings that could have been achieved with the available program funding since only 71% of the available budget was used or committed. Notably, it was also administered at a low cost by AmerenUE (and with AmerenUE kicking in for the cost of the administrative efforts). As such, program tracking was kept to a minimum. This approach is understandable given the low level of funding for the projects; however, the lack of project documentation does not allow for an impact analysis to be conducted. The evaluation team was unable to verify program savings or report on the cost effectiveness of this program.

We did, however, examine impacts for seven of the 31 projects completed through this program. These projects appear to be cost effective. (See Sections IV and VII.)

[1] This is according to the program spreadsheet although our review of the final rebate applications indicates that at least one project (an HVAC project) is mislabeled as a lighting project in the program spreadsheet.

Based on the findings from our evaluation efforts, AmerenUE and the Collaborative should consider the following process recommendations for future commercial programs:

- Increase marketing efforts to promote program awareness and increase future participation
- Change the rebate structure to support additional projects and encourage projects that would not otherwise be done, and review size requirements
- Require an ROI of over three years to reduce freeridership
- Reexamine the role of the audits
- Consider a more formal pre-application notification process that limits the reservation of funds, and a stated policy for extension of deadlines
- Increase administrative oversight and program tracking efforts
- Collect additional data to allow for an impact analysis (details included in Section V)
- Verify documentation, installation and persistence of measures
- Conduct future evaluation efforts closer to project implementation

While the pilot was valuable—allowing AmerenUE to gain experience with a commercial program, before rolling out a larger program—AmerenUE should revisit the project design and ensure that all necessary information is being tracked. Addition information on each of the recommendations listed above is provided in Section V.

I. Introduction and Methodology

The Commercial Energy Audit and Energy Efficiency Improvement Rebate Program is designed to encourage more effective utilization of electric energy through energy efficiency improvements in the building shell or though the replacement of inefficient electrical equipment with efficient electrical equipment. AmerenUE provides a rebate for a portion of the costs of an energy audit and related upgrades that improve the efficient use of electricity.

This pilot program started on October 1, 2003 and allowed participation of up to 25 companies per funding cycle with rebates of up to $5,000 per company. Two rounds of program funding occurred between October 2003 and December 2006, for a total budget of $250,000.

This evaluation report is based on (1) our review of the participant tracking spreadsheet and available applications or other hard copy documentation, (2) our review of program materials (i.e., a short program description and the program application forms), (3) in-depth interviews with the AmerenUE program administrator and program stakeholders, and (4) telephone interviews with program participants. In all, we interviewed 13 program participants representing a total of 20 individual projects, of which 18 had been completed at the time of our interviews.[2]

We attempted to reach all customers listed in the participant database. Table 1 below presents the interview status of all 42 projects that had some contact information listed in the program spreadsheet.

Table 1: Interviews Status

	Number of Customers	Number of Projects
Completed interview[a]	13	20
Could not identify correct telephone number	5	8
Did not return call after multiple attempts to contact	12	12
Dropped from program	2	2
Total	32	42

a. Three of the interviewees did not have sufficient time to complete the entire interview and only provided high-level feedback about the program.

Because of the small number of participants in this program, we would need to speak with approximately 70% of the customers in the database (22 of the 32 customers) to present quantitative findings with 90% confidence ± 10% error. Thus, our findings below should be considered to be qualitative findings.

[2] Three of the interviewees did not have sufficient time to complete the entire interview and only provided high-level feedback about the program. Most of the impact and process findings in Sections IV and V below are therefore based on the responses of ten program participants, of which eight had completed their projects.

II. Program Description

The Commercial Energy Audit and Energy Efficiency Improvement Rebate Program is an incentive program designed to encourage customers to replace inefficient energy consumption equipment or otherwise improve the energy efficiency of commercial facilities. The program started on October 1, 2003 and was run as a pilot program through the end of 2006.
During this pilot program, there were two rounds of funding. Each round of funding allowed for 25 projects with a maximum rebate amount of $5,000 per project. The maximum program funding was $125,000 per year, for a total program budget of $250,000.

Energy-efficient measures eligible for rebates include high-efficiency lighting, space and water heating equipment, central air conditioning, and other measures. The target market is small commercial companies in Missouri that are served by AmerenUE. The design documents indicate that larger companies would not benefit as much from this program because it has a relative small rebate (up to $5,000 per customer), but they are still eligible to participate. Individual residential homes and manufacturing facilities are not eligible to participate in the program.

Prospective program participants completed the Customer Enrollment Application, which requests general information about the applicant and their business, e.g., contact information, building type and structure, and prior energy conservation projects. Applications were screened to determine that the customer was an AmerenUE Missouri customer, and that there were still openings in the program. No information on anticipated energy savings measures was collected in the enrollment application (although estimated savings is usually provided on the final rebate application), and savings and ROI were not required.

According to the program materials, the program consists of three main components – an initial energy audit, a follow-up energy audit, and implementation of energy audit recommendations – although participants do not need to complete all three components to receive a rebate. These three program components are described below.

Initial Energy Audit: The initial audit is a high-level walk-through and audit of all the systems listed under AmerenUE's standard energy audit.[3] Although the audit step is required to be in the program, there is no required forms to fill out unless the customer is requesting reimbursement. (Notably, only one participant received a rebate for the initial audit according to the program tracking spreadsheet.) Auditors usually submitted some form of paperwork (at times an invoice, other times a more detailed audit report.) According to the design documents, the initial audit is intended to identify potential cost-effective improvements and energy savings measures but the extent of this audit is not specified. AmerenUE makes available a list of approved Energy Auditor (EA) firms, but participants are not required to use a contractor from this list. The program provides a rebate of 50% of the cost of the initial energy audit, up to $500. In many cases, however, the contractors do not separately charge for the audit if they are also hired to implement the energy saving measures.

[3] This includes general building construction, heating and cooling systems, water heating system, refrigeration equipment, indoor and outdoor lighting, cooking equipment, office equipment, laundry equipment, hot tubs, spas, and swimming pools, elevators and escalators, interval usage data, and operations and maintenance procedures.

Follow-up Energy Audit: The follow-up audit is a detailed on-site audit of the systems identified as areas of potential energy savings during the initial audit. In this audit, which is not required to receive the implementation rebate, the auditor calculates specific energy savings from potential measures as well as the predicted potential total energy savings and the associated Return on Investments (ROI). Recommendations of energy saving measures are outlined in a report for the customer. According to the design document, AmerenUE would then review the recommendations to verify applicability to the program. After the follow-up energy audit is performed, the remaining 50% of the initial audit cost, up to another $500, is credited to the customer. It should be noted that none of the projects enrolled in the pilot program had a follow-up audit performed (so the follow-up audit component is by design, not in practice).

Implementation of Energy Audit Recommendations: The customer has 18 months from the application date to complete some or all audit recommendations. Once energy efficiency measures have been implemented, the customer completes the two-page "Application for Commercial Energy Audit & Energy Efficiency Rebate Program" which asks for the date complete, the annual kWh savings, the associated costs and ROI (estimated by the contractor) and submits this form to AmerenUE with documentation of project completion (generally an invoice). The AmerenUE program administrator verifies that the customer has the correct paperwork and then sends the application to AmerenUE's accounting department to offer the customer a rebate of 33% of the costs of the upgrades, up to a total of $5,000 (minus the previous audit credits, if any). Interactions between the customer and the program administrator are minimal. While the current pilot program does not require a specific ROI for participation, it is anticipated that future program revisions will require an ROI of greater than three years.
AmerenUE conducted minimal proactive promotional campaigns for this program given the minimal funds available during the pilot period. According to the program materials, promotional activities included:

- Press release at the beginning of the program.
- Description of the program on the Products and Services page in the Your Business section of www.ameren.com.[4]
- Description of the program to customers who could benefit from this program during routine discussions in the field and call center, and to customers requesting information about the program.

[4] This is believed to have been short and brief since the program was only available to 25 customers each round. No large scale marketing was done. Design documents indicate that messages would be available on the Ameren bills, but this was never done due to the limited availability of funding.

III. Program Accomplishments

Based on our findings, program accomplishments during the pilot period include:

- 42 applications with 31 of 42 projects completed: 29 high-efficiency lighting or lighting controls; 5 HVAC improvements or HVAC controls; 1 installation of variable speed drives (VSD) and chillers[5]
- Over $131,000 in rebates provided to customers, with 71% of program budget committed
- Non-energy benefits including brighter and cleaner lighting
- Self-reported estimates by contractors of over 5,724 MWh in annual energy savings from program supported projects, with nearly 1,000 MWhs verified through evaluation efforts.

These accomplishments are described in more detail below.

Thirty-One of 42 Projects Completed

Since the inception of the pilot program in October 2003, 42 individual projects have been initiated (of 50 possible spots) and 31 projects have been completed. In the first year, the program allowed for the same customer to submit multiple projects, so in all, these 31 projects were completed by 21 customers. (Note that this was changed in subsequent years so that each customer could only receive one rebate.)

Table 2 below presents a summary of the projects for the two funding cycles, 2003 and 2004, and for the overall program to-date.[6]

Table 2: Summary of Projects

	Round 1	Round 2	Total
Application Date	10/27/03 to 10/06/05	10/06/05 to 06/26/06	10/27/03 to 06/26/06
Date Implementation Completed	12/13/03 to 03/29/06	10/30/05 to 09/30/06	12/13/03 to 09/30/06
Number Initiated	25	17	42
(Unique Customers)	(15)	(17)	(32)
Number Completed as of March 2007	23	8	31
(Unique Customers)	(13)	(8)	(21)
Projects Started But Not Completed	-	9	9
Projects Dropped	1	1	2
Percent Completed	92%	47%	74%

The majority of the 31 completed projects are lighting projects, with a few other types, including HVAC, VSD, and chiller projects. All completed projects had an initial audit but only one was funded through the program; none had a follow-up audit.

[5] This is according to the program spreadsheet although our review of the final rebate applications indicates that at least one project (an HVAC project) is mislabeled as a lighting project in the program spreadsheet.
[6] The tables in this section include program information as of March 2007.

Table 3: Completed Projects Including Various Measures

Measures	Round 1	Round 2	Total
Total Number of Completed Projects	**23**	**8**	**31**
By Measure (some projects had multiple measures)			
Lighting / Lighting Controls[a]	22	7	29
HVAC / HVAC Controls	4	1	5
VSDs	-	1	1
Chillers	-	1	1
Initial Energy Audit	23	8	31
Initial Energy Audit Funded Through the Program	-	1	-
Follow-Up Energy Audit	-	-	-

a. Lighting controls include occupancy sensors; HVAC controls include DDC Controls, programmable T-stats, and thermostat controls for ceiling fans.

During in-depth interviews, three customers indicated that the AmerenUE program affected the timing of their project (moving it up), or that the program affected the efficiency level. Three others said that they "might or might not" have done the project without the AmerenUE funding. Many customers, however, (7 of 13) reported that while very satisfied with the program, they would have made the changes anyway. In all, four of 13 interviewees indicated that the incentive was very important in their decision to install the upgrade.

Over $131,000 In Rebates Given, With 71% of Budget Committed

AmerenUE provided a total of $131,000 in rebates, representing about 53% of the program budget, with an average rebate amount of $4,528 per project. In addition, up to $45,000 in additional rebates are earmarked for the nine projects that have been started but not completed (as of March 2007). If these rebates are given out in full, program rebates would total $176,000, or 71% of the program budget. Only one of the 31 completed projects requested a rebate for audit costs.

Total implementation costs for the completed projects by participants have totaled almost $5 million;[7] thus the AmerenUE rebates represent only 2.6% of the total funds for these projects (or 8% of total funds after removing one outlier). According to customers, the average ROI period, before the rebate, was 4.5 years, with 11 completed projects having an ROI of three years or less and 18 completed projects having an ROI of greater than three years.[8]

[7] Note that one project with a recorded implementation cost of $3.3 million accounts for 66% of total project costs.
[8] Note that two of the completed projects were missing ROI information in the database.

Table 4: Summary of Program Rebates and Funding

	Round 1	Round 2	Total
Total Rebates Available	$125,000	$125,000	$250,000
Rebates Provided	$109,309	$22,000	$131,309
Percent Rebates Used	87%	18%	53%
Average Rebate Amount	$4,753	$3,667	$4,528
Total Implementation Cost	$4,732,674	$223,232	$4,955,906
Average ROI	4.7	3.1	4.5
Number with ROI ≤ 3 years	7	4	11
Number with ROI > 3 years	16	2	18

Non-energy Benefits Including Brighter Cleaner Lighting

Through in-depth interviews with 13 participants, several participants indicated that the program-supported lighting improved the conditions of those in the space. Respondents (including the National Guard) frequently mentioned brighter, cleaner lighting as one non-energy benefit from the AmerenUE supported projects.

Over 5,724 MWhs in Annual Energy Savings from Program Supported Projects

While documentation was not available to conduct an impact assessment for this program (see detailed write-up below), participants were asked to provide estimates of annual kWh savings on the final rebate applications. The AmerenUE program spreadsheet estimates that the 31 completed projects account for annual energy savings of over 5,724 MWh. Nearly 1,000 MWhs of this was verified through our analysis. (See Section VII.) This program has the ability to result in a large amount of energy savings for AmerenUE and the Collaborative—more than nearly every other program in the portfolio besides the residential lighting program.

IV. Impacts

Over the pilot period, this program was administered in-house, at a low cost. As such, program tracking was kept to a minimum (as were administrative costs). This approach is understandable given the low level of funding for the projects; however, the lack of project documentation did not allow for an impact analysis to be conducted. Thus, we are unable to report total program savings or the cost effectiveness of this program.

We did, however, examine impacts for seven of the 31 projects that were supported with program funds (see table below). This included five lighting projects and two HVAC projects. Savings for the lighting projects ranged from 73,000 kWh to 258,000 kWh, while savings from the two HVAC projects were 44,192 and 275,000 kWh. Only one of the HVAC projects resulted in gas savings. (See table below.)

The total savings from these seven projects was approximately 1,000 MWh, and all seven were determined to be cost-effective. (See Section VII.) While we did not have enough information to extrapolate to the program as a whole (given the wide range of projects), these seven projects represent 23% of all completed projects.

Table 5: Savings from Seven Projects

	Project Type	Electricity Savings (kWh)	Gas Savings (therms)	Demand Reduction (KW)
Missouri Lutheran Synod—St. Louis	HVAC	275,949	--	70
WalMart—Ferguson	Lighting	258,546	-490	47.4
WalMart—Caruthersville	Lighting	148,477	-304	29.3
WalMart—Owensville	Lighting	108,354	-248	23.7
St. Anthony's—St. Louis	Lighting	74,460	--	20.4
Clean Uniform—O'Fallon	Lighting	73,251	--	23.5
Capitol Plaza Hotel--Jefferson	HVAC	42,192	1,044	24.7
TOTAL FOR 7 PROJECTS		981,229 kWh		

Through in-depth interviews with 13 participants, we also found that all measures are still installed (i.e., in-service rate appears to be 100%). Three of 13 participants indicated that the project resulted in increases in the use of the equipment (i.e., snapback). No spillover was reported by those interviewed.

Recommendations for data tracking, to allow for future impact evaluations, are provided in the process findings section below.

V. Process Findings and Recommendations

The Commercial Energy Audit and Energy Efficiency Improvement Rebate Program was undersubscribed during the pilot period, and most notably, did not result in the energy savings that could have been achieved with the available program funding since only 71% of the budget was used or committed during the pilot period.

Overall, however, there was a high level of satisfaction among the customers who enrolled in the pilot program. The interviewed participants found both the application and the rebate process to be very easy and thought that AmerenUE provided all the program information they needed. Some also mentioned that the AmerenUE program contact was helpful in guiding them through the process. None of the interviewed participants indicated having any problems with either the application or rebate process. Several interviewees indicated that the application process was "very easy" and that the AmerenUE contact person had been very helpful. One participant mentioned that the online application process was helpful. Participants were also highly satisfied with the new products they installed. The pilot Commercial Energy Audit and Energy Efficiency Improvement Rebate Program was clearly very popular with the interviewed program participants, and interviewees had very little criticism about any aspects of the program.

Based on our process related findings, AmerenUE and the Collaborative should consider the following recommendations for future programs:

- **Increase marketing efforts to promote program awareness and increase future participation**

  As mentioned above, this program was undersubscribed. During the pilot period, the program enrolled 42 of 50 possible projects. So far, proactive promotional campaigns for this program have been kept to a minimum, partially because the program was still in its pilot phase and was only available to Ameren's Missouri customers. The limited approach to marketing might have contributed to the under-subscription to the program in its second round of funding (only 17 of 25 potential projects were initiated).

  Going forward, we recommend increasing marketing efforts to encourage more participation in this program (assuming that the program grows). Because this program currently targets small commercial customers (who most likely do not have account representatives), AmerenUE should consider proactively reaching out to targeted customers, either on a one-on-one basis or through a contractor network. Notably, through in-depth interviews, participants in the pilot program reported learning about the program through a variety of sources, including contractors, Ameren's website, and by directly contacting AmerenUE to inquire about available incentives.
  We also recommend searching for a way to expand the program to Illinois customers if at all possible.

- **Consider changing the rebate structure to support additional projects and encourage projects that would not otherwise be done, and review size requirements**

  Interviewed participants were generally satisfied with the level of program incentives. For many (7 of 13), however, their satisfaction appears to be, in part, because they would

have implemented the program anyway, so the rebate was viewed as a bonus on top of the already expected energy savings.[9]

Only one interviewee, an energy auditor speaking on behalf of one customer, indicated that the rebate amounts should be much larger. This participant stated, "*because [the rebate] was a set amount... it didn't really incentivize them to do a much larger piece.*"

Although only one of the participants that we spoke with mentioned increasing the rebate levels, AmerenUE may want to consider changing the rebate structure to help encourage additional energy efficiency upgrades. For example, removing the maximum funding level and/or providing rebate amounts that adjust based on total square footage may help to increase the number of participants and the number of energy efficiency projects that would not have otherwise occurred. Changing the rebate structure to offer assistance to customers considering larger projects, or with longer ROIs, can help increase participation in the future. However, this decision should be made in the context of understanding the size of participating customers. According to the program design, this program is intended for small customers; however, of 33 applications that were submitted with sq. footage information, 12 were for small spaces (<25,000 sq feet), 14 were for medium sized spaces (25,001 to 100,000 sq. ft), and seven were for larger spaces over 100,000 square feet (with the largest being for a 767,000 square foot space). If many of the current participants are large customers, it may be that the incentives are right for smaller customers, and that the size requirements should be reviewed.

Twenty of the 29 customers with available rebate information used the full $5,000 rebate. For these 20 customers, the average as well as the median rebate amount was 15% of implementation cost. There were, however, nine customers who used less than $5,000 because their rebate was capped at 33% of implementation costs.

Based on the participants interviews that we conducted, there doesn't appear to be any spillover as a result of the program since the funding was so limited that for many participants it did not have a huge affect on decisionmaking.

- **Require an ROI of over three years**

Based on our research, we support AmerenUE's planned program modification to restrict participation to projects with an estimated ROI of more than three years. Of the 29 projects that had estimated ROIs, 11 had an ROI of less than three years and 18 had an ROI of more than three years. Many participants indicated that they would have implemented the project without the rebate because the energy savings alone were worth the additional capital outlays. By restricting participation to projects with estimated ROIs of more than three years, program funds could be better targeted to energy saving measures that would not be implemented without the program.

[9] Seven of the 10 interviewees who completed the entire interview indicated that they definitely or probably would have done the project even without the rebate; only three indicated that they might or might not have done the project without the rebate. However, an additional three interviewees indicated that the project definitely or probably would not have been done to the same level of efficiency. Four of 13 interviewees indicated that the incentive was very important in their decision to install the upgrade.

- **Reconsider the role of the audit**

  The program currently consists of three program components – two of which are energy audits. Only one participant, however, appears to have used the funding for an initial audit (although all included an initial audit date in the program database.) Moreover, there were not stated requirements for the audits, and the documentation (and nature) of these audits varied widely. It is unclear whether this initial audit is just a formality. Participants did not indicate much value in an audit. Moreover, the follow-up audit was not used at all. This may be due to the limited amount of funding (i.e., all funds were necessary for the measures). AmerenUE should consider why the program currently includes the promotion of energy audits, (i.e., are they just for the sake of getting an audit done or is the goal to increase energy savings from these audits), and then determine whether they are serving their intended purpose. If the audit component is kept, AmerenUE may want to consider setting priorities and detailing the calculation that are required to be done (as well as what factors should go into these calculations, for example, how to calculate ROI and whether savings from accompanying maintenance efforts should also be included).

- **Consider a more formal pre-application notification process that limits the reservation of funds and a stated policy for extension of deadlines**

  The program spreadsheet demonstrates that projects stretched out over a long period of time. During the 2003 funding period (Round 1 of funding), program applications were accepted from 10/27/03 until 10/06/05 – almost a two-year period. The enrollment time for the 2004 funding period (Round 2) was considerably shorter – 10/06/05 through 06/26/06, but only 17 of 25 potential projects were enrolled. As a result of the long enrollment period, nine projects still have not been completed, one from the first period and eight from the second period.

  All of the program spaces were also not filled. It appears that initial enrollment might have been slowed down by an informal reservation policy where AmerenUE reserved program funds based on an initial indication of interest from customers. In some cases, customers did not submit an application until 2005 after expressing initial interest in 2003. Because of the limited effort on oversight, the program administrator was also not able to follow-up with customers as much as would be necessary to understand whether the projects are going to be completed or not. (That is, some dropped out at various stages after the initial contact with AmerenUE, leading to an undersubscription since the program administrator thought that all of the spaces were filled.)

  A pre-application notification process is common in similar programs. However, due to the limited effort to promote this program, it appears that the reservation of funds ultimately led to reduced savings for this program. For future programs, AmerenUE should consider a more formal pre-application notification process that limits the reservation of funds and provides a deadline in the event that a formal application is not submitted.

The program also includes two official deadlines: A 60-day deadline to conduct the initial audit after submitting the application, and an 18-month deadline to implement the energy saving measures.[10]

All interviewees considered the program schedule and deadlines reasonable. Except for one interviewee, who admitted to having gotten a very late start, none of the interviewees had any problems meeting the 18-month implementation schedule. The interviewee with the late start had not contacted AmerenUE about an extension to the 18-month deadline. We recommend formalizing a policy for providing extensions to the program deadlines, if such a policy does not already exist. This would provide additional clarity and certainty for program participants.

- **Increase administrative oversight and program tracking efforts**

In its pilot form, the program costs are minimal because the program is implemented by AmerenUE and the majority of their efforts are spent "just tracking" a limited number of projects. If this program grows, however, AmerenUE should consider additional staff (or outsourcing this effort) to increase marketing, oversight, and verification of the projects, as well as program tracking.

Currently, program tracking is limited to an application form, inconsistent documentation of the initial audit report, a final rebate application, and various forms of implementation documentation including project descriptions and hard copies of contractor invoices. Key information is compiled in a one-page Excel spreadsheet, and other information was inconsistently available in hard-copy from AmerenUE.

As the program grows, we recommend formalizing the program tracking process. For example, we recommend developing a final rebate application form that would require the customer to provide all the information of interest. This should include the size of the facility, number of units installed, what was replaced, name and contact information for both the participants and the contractor, and whether the contractor is approved by AmerenUE.

In addition, we suggest modifying the Excel tracking spreadsheet. Our key observations with respect to the spreadsheet include:

- Some of the described projects do not match applications
- Contact information is not always correct and does not always match final rebate applications
- Many projects are missing either kWh savings or monetary savings due to the project
- A lot of the projects that have kWh savings and monetary savings list the same value for both.
- It is not clear how the ROI is derived:
    - For some projects, ROI equals Implementation Cost/Annual Savings

[10] The requirement to complete the initial audit within 60 days of application is gleaned from the in-depth interview with the program administrator, who indicated that participants who do not meet this deadline are dropped from the program. We did not see this requirement in any other program information and recommend formalizing this policy, if it has not already been done.

- For some projects, ROI is a hard-entered (undocumented) value
- For some projects, ROI is linked to a file we do not have
- For one project (2004, #11), it is linked to a blank cell in the spreadsheet
- Some ROIs are expressed as ranges

- Two projects (2004, #14 and #15) were completed but the database has no rebate amounts.
- 2004 project #15 is also missing implementation date and cost, savings, and ROI.
- Several projects (4) list an "unknown" auditor.
- The annual totals for 2003 (row 31) omit projects #24 and #25.

The project tracking spreadsheet should be amended to include key information from the application (such as the size of the facility and business type), as well as details on what supporting hard copy information has been turned in by the customer (or alternatively, this information should be kept as electronic files.)

We also recommend tracking contact information for both customers and auditors. Six of the 42 initiated projects only list an energy auditor as a contact person. In our interviews, we encountered limitations with respect to the type of information auditors had available. Going forward, we recommend tracking contact information for both the customer and the contractor. This will facilitate any future follow-up and/or information collection.

➢ **Collect additional data to allow for impact analysis**

There was a wide range of supporting documentation for the projects completed by the customers who participated in the Commercial Audit Program. Some of the documentation, such as the lighting project documentation for the Wal-Mart stores was complete and very detailed, but in many cases there was either no documentation associated with a project, or the documentation was incomplete. In order to complete an impact evaluation on a project, it is essential to review engineering calculations or building simulation model information that includes model inputs and which clearly state which variables in the calculation are assumed and which were either measured or based on nameplate information. Ideally, the information would include a spreadsheet in which calculations are contained within the cells, but alternately, a text document that details the calculations completed would also be adequate. Specific minimum information requirements based on end use is described below.

Lighting Projects

- Quantities of existing fixtures
- Specifications of existing fixtures, including number of bulbs per fixture, and fixture wattage
- Assumed or measured operating hours for the existing fixtures
- Baseline annual energy use and peak demand
- Quantities of replacement fixtures
- Specifications of replacement fixtures, including number of bulbs per fixture, and fixture wattage
- Assumed or measured operating hours for the replacement fixtures

- Proposed annual energy use and peak demand
- Annual energy savings and peak demand reduction
- Model numbers of existing and replacement bulb types would also ideally be included
- Detailed invoice matching the quantities and specifications used in the calculations

HVAC or Motor Projects

- Quantities of existing equipment
- Specifications of existing equipment, including model number, age, capacity, estimated efficiency, and part-loading assumptions
- Assumed or measured operating hours for the existing fixtures, which may include equivalent full load heating or cooling hours, hourly bin data, etc.
- Baseline annual energy use and peak demand
- Quantities of replacement equipment
- Specifications of replacement equipment, including model number, capacity, and estimated efficiency, and part-loading assumptions
- Assumed or measured operating hours for the replacement fixtures
- Proposed annual energy use and peak demand
- Annual energy savings and peak demand reduction
- Detailed invoice matching the quantities and specifications used in the calculations

➢ **Verify documentation, installation and persistence of measures**

Currently, there does not appear to be any verification of measure installations, and very limited efforts are made to review or question project documentation. Moreover, contractors are not required to be AmerenUE approved contractors. As this program grows, additional efforts should be made to verify the installation of funded measures and the savings from these measures. Generally, this role is conducted by the program administrator or third party evaluator.

➢ **Conduct evaluation effort closer to project implementation**

Several of the respondents to our survey indicated that they could not remember the details of the project, while other project contacts listed in the database were no longer at the company, or could not be tracked down because of outdated contact information. As such, we recommend that future process evaluation efforts be conducted during the program cycle to help gather immediate feedback to guide the program and ensure that all necessary data is collected.

Overall, the current program design documents do not appear to match the overall process for what is occurring. While the pilot was valuable by allowing AmerenUE to gain experience with a commercial program, before rolling out a larger program, AmerenUE should revisit the project design and ensure that all necessary information is being tracked.

VI. Firmographics and Other Detailed Information from Evaluation

Key firm/facility characteristics of the 10 program participants who completed the entire in-depth interview:

- Eight of ten facilities use natural gas as their primary fuel.
- Nine of the ten interviewees have less than 300 employees at the upgraded location; three have less than 50.
- Seven of ten facilities are between 10 and 30 years of age.
- One of ten facilities renovated less than 25,000 square feet of space; four facilities renovated 100,000 square feet or more.

Additional information was not available in the program spreadsheet.

VII. Detailed Impact and Cost-Effectiveness Analyses

This section includes our detailed analyses on seven of the 31 projects completed through AmerenUE's Commercial Energy Audit and Energy Efficiency Improvement Program.

Wal-Mart – Caruthersville, MO

The Wal-Mart in Caruthersville, MO completed a lighting retrofit project in March 2004, primarily involving replacement of eight-foot, two-lamp, T12 fixtures (123 Watts per fixture) with four-foot, two-lamp, high ballast factor T8 fixtures (79 Watts per fixture). The project sponsor was American Light, and engineering calculations were presumably completed by American Light.

Gross Savings Calculation

The calculations were thorough and detailed, listing existing and replacement fixture types by the area of the store. 5,054 annual operating hours were assumed for the light fixtures. This is reasonable given the 7 AM to 10 PM operating hours for the store. Part of the calculation estimated interactive cooling savings resulting from the lower wattage fixtures. This also appears to be reasonable, however no supporting calculations were provided. In order to check the interactive cooling savings claimed, we assumed that 30% of lighting wattage affected the occupied space of the store and a rooftop unit cooling efficiency of 1.2 KW/ton. Approximate cooling hours of 2,620 hours were derived from the savings and peak reduction provided by the contractor, and these appear to be reasonable for a large building in this climate. Total annual savings claimed by the contractor were 148,477 KWh and a peak demand reduction of 29.3 KW, resulting in annual cost savings of $8,949. It is likely that there would be a slight heating penalty because of the reduced wattage of the light fixtures, but this was not factored into the contractor's savings analysis. In order to estimate heating penalty, we assumed that 30% of the lighting wattage affected the space as heat load, a heating efficiency of 90%, and 1,000 hours of heating, assuming that significant internal heat generation is typical in large buildings. As a result, we estimated an additional annual heating requirement of 303 Therms of natural gas as a result of the fixture retrofit. These results are summarized in Section VII Table D-1 below.

Section VII Table D-1: Wal-Mart Caruthersville, MO

Measure type	Peak KW reduction	Annual electric savings (KWh)	Annual gas savings (Therms)	Total annual savings ($)
Claimed Lighting	26.6	141,477	0	$8,523
Claimed interactive cooling	2.7	7,074	0	$ 426
Claimed interactive heating	0	0	0	0
Total claimed savings	29.3	148,551	0	$8,949
Adjusted Lighting	26.6	141,477	0	$8,523
Adjusted interactive cooling	2.7	7,074	0	$ 426
Adjusted interactive heating	0	0	-303	-$ 242
Total adjusted savings	29.3	148,477	-303	$8,707

Net Realized Savings

No information on free-ridership or spillover exists for the project, so it is assumed that the project would not have happened with out the program, and net realized savings are therefore assumed to be the same as the adjusted gross savings above: Annual energy impact of 148,477 KWh and -304 Therms of gas, and a peak demand reduction of 29.3 KW.

Cost Effectiveness

Section VII Table D-2 shows the cost effectiveness of the Caruthersville Wal-Mart project. FEMP UPV Discount Factors for commercial electricity and natural gas for Census Region 2 (Including Missouri) were used for the benefit/cost analysis. The Department of Energy currently uses a 3% discount rate in determining discount factors. An expected life of 7.0 years for lighting measures was assumed, so an effective life of 7.0 years was used in determining the appropriate commercial discount factors.

Section VII Table D-2: Caruthersville Wal-Mart Cost Effectiveness

Program Cost	First Year Program Savings	Effective Life of Recommendations	Lifetime Savings	Lifetime Benefit/Cost Ratio
$32,218	$8,707	7.0	$52,378	1.6

Wal-Mart – Owensville, MO

The Wal-Mart in Owensville, MO completed a lighting retrofit project in March 2004, primarily involving replacement of eight-foot, two-lamp, T12 fixtures (123 Watts per fixture) with four-foot, two-lamp, high ballast factor T8 fixtures (79 Watts per fixture). The project sponsor was American Light, and engineering calculations were presumably completed by American Light.

Gross Savings Calculation

The calculations were thorough and detailed, listing existing and replacement fixture types by the area of the store. 5,054 annual operating hours were assumed for the light fixtures. This is reasonable given the 7 AM to 10 PM operating hours for the store. Part of the calculation estimated interactive cooling savings resulting from the lower wattage fixtures. This also appears to be reasonable, however no supporting calculations were provided. In order to check the interactive cooling savings claimed, we assumed that 30% of lighting wattage affected the occupied space of the store and a rooftop unit cooling efficiency of 1.2 KW/ton. Approximate cooling hours of 2,620 hours were derived from the savings and peak reduction provided by the contractor, and these appear to be reasonable for a large building in this climate. Total annual savings claimed by the contractor were 108,354 KWh and a peak demand reduction of 21.6 KW, resulting in annual cost savings of $8,949. It is likely that there would be a slight heating penalty because of the reduced wattage of the light fixtures, but this was not factored into the contractor's savings analysis. In order to estimate heating penalty, we assumed that 30% of the lighting wattage affected the space as heat load, a heating efficiency of 90%, and 1,000 hours of heating, assuming that significant internal heat generation is typical in large buildings. As a result, we estimated an additional annual heating requirement of 246 Therms of natural gas as a result of the fixture retrofit. These results are summarized in Section VII Table D-3 below.

Section VII Table D-3: Wal-Mart Owensville, MO

Measure type	Peak KW reduction	Annual electric savings (KWh)	Annual gas savings (Therms)	Total annual savings ($)
Claimed Lighting	21.6	103,194	0	$6,192
Claimed interactive cooling	2.1	5,160	0	$ 310
Claimed interactive heating	0	0	0	0
Total claimed savings	23.7	108,354	0	$6,502
Adjusted Lighting	21.6	103,194	0	$6,192
Adjusted interactive cooling	2.1	5,160	0	$ 310
Adjusted interactive heating	0	0	-246	-$ 197
Total adjusted savings	23.7	108,354	-246	$6,305

Net Realized Savings

No information on free-ridership or spillover exists for the project, so it is assumed that the project would not have happened with out the program, and net realized savings are therefore assumed to be the same as the adjusted gross savings above: Annual energy impact of 108,354 KWh and -246 Therms of gas, and a peak demand reduction of 23.7 KW.

Cost Effectiveness

Section VII Table D-4 shows the cost effectiveness of the Owensville Wal-Mart project. FEMP UPV Discount Factors for commercial electricity and natural gas for Census Region 2 (Including Missouri) were used for the benefit/cost analysis. The Department of Energy currently uses a 3% discount rate in determining discount factors. An expected life of 7.0 years for lighting measures was assumed, so an effective life of 7.0 years was used in determining the appropriate commercial discount factors.

Section VII Table D-4: Owensville Wal-Mart Cost Effectiveness

Program Cost	First Year Program Savings	Effective Life of Recommendations	Lifetime Savings	Lifetime Benefit/Cost Ratio
$23,407	$6,305	7.0	$37,941	1.6

Wal-Mart – Ferguson, MO

The Wal-Mart in Ferguson, MO completed a lighting retrofit project in March 2004, primarily involving replacement of eight-foot, two-lamp, T12 fixtures (123 Watts per fixture) with four-foot, two-lamp, high ballast factor T8 fixtures (79 Watts per fixture). The project sponsor was American Light, and engineering calculations were presumably completed by American Light.

Gross Savings Calculation

The calculations were thorough and detailed, listing existing and replacement fixture types by the area of the store. 5,054 annual operating hours were assumed for the light fixtures. This is reasonable given the 7 AM to 10 PM operating hours for the store. Part of the calculation estimated interactive cooling savings resulting from the lower wattage fixtures. This also appears to be reasonable, however no supporting calculations were provided. In order to check the interactive cooling savings claimed, we assumed that 30% of lighting wattage affected the occupied space of the store and a rooftop unit cooling efficiency of 1.2 KW/ton. Approximate

cooling hours of 2,620 hours were derived from the savings and peak reduction provided by the contractor, and these appear to be reasonable for a large building in this climate. Total annual savings claimed by the contractor were 258,546 KWh and a peak demand reduction of 47.4 KW, resulting in annual cost savings of $15,504. It is likely that there would be a slight heating penalty because of the reduced wattage of the light fixtures, but this was not factored into the contractor's savings analysis. In order to estimate heating penalty, we assumed that 30% of the lighting wattage affected the space as heat load, a heating efficiency of 90%, and 1,000 hours of heating, assuming that significant internal heat generation is typical in large buildings. As a result, we estimated an additional annual heating requirement of 490 Therms of natural gas as a result of the fixture retrofit. These results are summarized in Section VII Table D-5 below.

Section VII Table D-5: Wal-Mart Ferguson, MO

Measure type	Peak KW reduction	Annual electric savings (KWh)	Annual gas savings (Therms)	Total annual savings ($)
Claimed Lighting	43.1	246,234	0	$14,766
Claimed interactive cooling	4.3	12,312	0	$ 738
Claimed interactive heating	0	0	0	0
Total claimed savings	47.4	258,546	0	$15,504
Adjusted Lighting	43.1	246,234	0	$14,766
Adjusted interactive cooling	4.3	12,312	0	$ 738
Adjusted interactive heating	0	0	-490	-$ 392
Total adjusted savings	47.4	258,546	-490	$15,112

Net Realized Savings

No information on free-ridership or spillover exists for the project, so it is assumed that the project would not have happened with out the program, and net realized savings are therefore assumed to be the same as the adjusted gross savings above: Annual energy impact of 258,546 KWh and -490 Therms of gas, and a peak demand reduction of 47.4 KW.

Cost Effectiveness

Section VII Table D-6 shows the cost effectiveness of the Ferguson Wal-Mart project. FEMP UPV Discount Factors for commercial electricity and natural gas for Census Region 2 (Including Missouri) were used for the benefit/cost analysis. The Department of Energy currently uses a 3% discount rate in determining discount factors. An expected life of 7.0 years for lighting measures was assumed, so an effective life of 7.0 years was used in determining the appropriate commercial discount factors.

Section VII Table D-6: Ferguson Wal-Mart Cost Effectiveness

Program Cost	First Year Program Savings	Effective Life of Recommendations	Lifetime Savings	Lifetime Benefit/Cost Ratio
$48,063	$15,112	7.0	$90,905	1.9

Clean Uniform Company – O'Fallon, Missouri

Clean Uniform Company in O'Fallon, MO completed a lighting retrofit project in 2006, involving replacement of various fixtures with T8 lighting systems. The project sponsor was Budget Lighting Inc, and engineering calculations were presumably completed by Budget Lighting Inc.

Gross Savings Calculation

The calculations were thorough and detailed, listing existing and replacement fixture types by the area of the store. 3,120 annual operating hours were assumed for the light fixtures. This is reasonable given a ten hour operating time for the store, six days a week. The results are summarized in Section VII Table D-7 below.

Section VII Table D-7: Clean Uniform Co. – O'Fallon, MO

Measure type	Peak KW reduction	Annual electric savings (KWh)	Total annual savings ($)
Claimed Lighting	23.5	73,251	$9,377
Adjusted Lighting	23.5	73,251	$9,377
Total adjusted savings	23.5	73,251	$9,377

Net Realized Savings

No information on free-ridership or spillover exists for the project, so it is assumed that the project would not have happened with out the program, and net realized savings are therefore assumed to be the same as the adjusted gross savings above: Annual energy impact of 73,251 KWh and a peak demand reduction of 23.5 KW.

Cost Effectiveness

Section VII Table D-8 shows the cost effectiveness of the Clean Uniform Company project. FEMP UPV Discount Factors for commercial electricity in Census Region 2 (Including Missouri) were used for the benefit/cost analysis. The Department of Energy currently uses a 3% discount rate in determining discount factors. An expected life of 7.0 years for lighting measures was assumed, so an effective life of 7.0 years was used in determining the appropriate commercial discount factors.

Budget Lighting Inc used a 2% annual increase rate and 20 year life of the lighting to determine the lifetime savings. The higher life of the lights is what caused their lifetime savings values to be considerably high.

Section VII Table D-8: Clean Uniform Company Cost Effectiveness

	Program Cost	First Year Program Savings	Effective Life of Recommendations	Lifetime Savings	Lifetime Benefit/Cost Ratio
Claimed	$16,130	$5,860	20.0	$103,299	N/A
Adjusted	$16,130	$5,860	7.0	$35,161	2.2

Capitol Plaza Hotel – Jefferson City, Missouri

Capitol Plaza Hotel in Jefferson City, MO, completed a kitchen remodeling project and HVAC replacement in February 2006. The HVAC replacement included installing four new Armstrong rooftop units. No information on the chiller refurbishing was provided and there was insufficient data on the kitchen upgrade so no savings calculations could be done by ODC/GDS.

Gross Savings Calculation

Calculations for the Capitol Plaza Hotel energy savings were not available, but an engineering calculation based on estimated efficiencies for the existing and new units and weather data for St. Louis indicated that the savings for the main rooftop unit project were reasonable. The annual cost savings were reported for electric and natural gas savings, only. The results are summarized in Section VII Table D-9 below.

Section VII Table D-9: Capitol Plaza Hotel – Jefferson City, MO

Measure type	Peak KW Reduction	Annual Electric Savings (KWh)	Annual Natural Gas Savings (therms)	Total Annual Savings ($)
Claimed HVAC	N/A	N/A	N/A	$3,500
Adjusted HVAC	24.7	42,192	1,044	$3,576

Net Realized Savings

No information on free-ridership or spillover exists for the project, so it is assumed that the project would not have happened with out the program, and net realized savings are therefore assumed to be the same as the adjusted gross savings above: Annual energy impact of 42,192 KWh, 1,044 therms and a peak demand reduction of 24.7 KW.

Cost Effectiveness

Section VII Table D-10 shows the cost effectiveness of the Capitol Plaza Hotel project. FEMP UPV Discount Factors for commercial electricity in Census Region 2 (Including Missouri) were used for the benefit/cost analysis. The Department of Energy currently uses a 3% discount rate in determining discount factors. An expected life of 15.0 years for the rooftop units was assumed, so an effective life of 15.0 years was used in determining the appropriate commercial discount factors.

Section VII Table D-10: Capitol Plaza Hotel Cost Effectiveness

	Program Cost	First Year Program Savings	Effective Life of Recommendations	Lifetime Savings	Lifetime Benefit/Cost Ratio
Claimed	$57,000	$3,500	N/A	N/A	N/A
Adjusted	$57,000	$3,576	15.0	$20,848	0.4

Missouri Lutheran Synod – St. Louis, MO

The Missouri Lutheran Synod in St. Louis, MO completed an air handling unit upgrade and chiller replacement in July 2006. The air handling unit upgrade consisted of adding a variable frequency drive to the 125 HP motor, while the chiller replacement involved replacement of two older 130 ton units with two high efficiency 130 ton units of IPLV of 13. The project sponsor was Automation Solutions Group, who completed a building simulation for the two different measures.

Gross Savings Calculation

The simulation results were thorough and detailed, listing existing and replacement building energy use for both the VFD project and the chiller replacement, however very little information was provided on the inputs to the building simulation model. In an attempt to verify claimed savings we completed engineering calculations based on reasonable assumptions for equipment efficiencies, operating hours for the air handling unit, average speed of the air handling unit fan motor after retrofit, and weather data for St. Louis. Based on this, we believe the savings generated by the simulation model to be reasonable estimates of project savings. Total annual savings claimed by the contractor were 275,949 KWh and a peak demand reduction of 70 KW, resulting in annual cost savings of $16,557. These results are summarized in Section VII Table D-11 below.

Section VII Table D-11: Missouri Lutheran Synod

Measure type	Peak KW reduction	Annual electric savings (KWh)	Annual gas savings (Therms)	Total annual savings ($)
Claimed VFD savings	10	124,594	0	$ 7,476
Claimed chiller replacement	60	151,355	0	$ 9,081
Total claimed savings	70	275,949	0	$16,557
Adjusted VFD savings	10	124,594	0	$ 7,476
Adjusted chiller replacement	60	151,355	0	$ 9,081
Total adjusted savings	70	275,949	0	$16,557

Net Realized Savings

No information on free-ridership or spillover exists for the project, so it is assumed that the project would not have happened with out the program, and net realized savings are therefore assumed to be the same as the adjusted gross savings above: Annual energy impact of 275,949 KWh and a peak demand reduction of 70 KW.

Cost Effectiveness

Section VII Table D-12 shows the cost effectiveness of the Ferguson Wal-Mart project. FEMP UPV Discount Factors for commercial electricity and natural gas for Census Region 2 (Including Missouri) were used for the benefit/cost analysis. The Department of Energy currently uses a 3% discount rate in determining discount factors. An expected life of 20.0 years for lighting measures was assumed, so an effective life of 20.0 years was used in determining the appropriate residential discount factors.

Section VII Table D-12: Cost Effectiveness

Program Cost	First Year Program Savings	Effective Life of Recommendations	Lifetime Savings	Lifetime Benefit/Cost Ratio
$147,412	$16,557	20.0	$238,751	1.6

St. Anthony's – St. Louis, Missouri

Saint Anthony's hospital in St. Louis, MO, completed an outdoor lighting retrofit project in 2005, involving the replacement of four 250 watt mercury vapor lights with one 400 watt metal halide.

Gross Savings Calculation

There were no calculations provided for Saint Anthony's, only initial cost and annual energy cost of the old system and new system. Thirty sets of outdoor lights were assumed to have been replaced. Since there were four mercury vapor lights to every one metal halide lights, a total of 120 mercury vapors were replaced with 30 metal halides. 3,650 annual operating hours were assumed for the light fixtures based on the outside lights running for an average of ten hours each night. These results are summarized in Section VII Table D-13 below.

Section VII Table D-13: St. Anthony's Medical Center St. Louis, MO

Measure type	Peak KW reduction	Annual electric savings (KWh)	Total annual savings ($)
Claimed Lighting	N/A	N/A	$5,008
Adjusted Lighting	20.4	74,460	$4,468

Net Realized Savings

No information on free-ridership or spillover exists for the project, so it is assumed that the project would not have happened with out the program, and net realized savings are therefore assumed to be the same as the adjusted gross savings above: Annual energy impact of 74,460 KWh and a peak demand reduction of 20.4 KW.

Cost Effectiveness

Section VII Table D-14 shows the cost effectiveness of Saint Anthony's outdoor lighting upgrade. FEMP UPV Discount Factors for commercial electricity and natural gas for Census Region 2 (Including Missouri) were used for the benefit/cost analysis. The Department of Energy currently uses a 3% discount rate in determining discount factors. An expected life of 7.0 years for lighting measures was assumed, so an effective life of 7.0 years was used in determining the appropriate commercial discount factors.

Section VII Table D-14: Saint Anthony's Cost Effectiveness

Program Cost	First Year Program Savings	Effective Life of Recommendations	Lifetime Savings	Lifetime Benefit/Cost Ratio
$15,960	$4,468	7.0	$26,806	1.7

OPINION DYNAMICS
CORPORATION

EVALUATION OF AMERENUE'S BUILDER OPERATOR CERTIFICATION PROGRAM

Prepared for

AMERENUE

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GDS ASSOCIATES

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TABLE OF CONTENTS

Executive Summary

AmerenUE along with the Midwest Energy Efficiency Alliance (MEEA) and the Missouri Department of Natural Resources' Energy Center (Energy Center) began offering a Building Operator Certification (BOC) program in 2005. BOC is a competency-based training and certification program for operations and maintenance staff working in commercial, institutional, or industrial buildings. BOC achieves energy savings by training individuals directly responsible for the maintenance of energy-using building equipment and day-to-day building operations. (Further details on the program can be found in Section II.)

Based on the findings from this evaluation, program accomplishments between October 2003 and December 2006 include:

- Five training sessions completed (and additional classes starting)
- 65 AmerenUE customers representing 41 unique companies trained[1]
- Numerous projects started and/or completed as a result of the training
- Savings of 2,975 MWh and 12,444 MMBtus
- Program effects that expand beyond the companies represented in the trainings

These program accomplishments are described in Section III.

Overall, this program is valuable and does lead to cost-effective savings (see Section IV). Savings from this program were much higher than the online energy analysis or refrigerator recycling programs, but lower than the commercial rebate and residential lighting programs. Savings from this program could easily be increased by increasing the number of training participants.

For upcoming trainings, we recommend that AmerenUE and the Collaborative consider the following:

- Consistently collect information such as square footage in registration forms
- Track how participants learn about the program to determine what marketing and outreach methods are working, and use key account reps and other AmerenUE interactions to promote the course
- Consistently survey participants to gather feedback and make mid-course corrections
- Aim for approximately 20 participants per class
- Make classes more affordable for students
- Review the materials and ensure that they are cutting edge to the industry, and applicable to Missouri
- Seek ways to help increase recognition and understanding of the BOC course.

Details on each of these recommendations is provided in Section V.

[1] 81 total but 16 in one class were from Columbia Power & Light. These 81 customers represented a total of 53 unique companies.

I. Introduction and Methodology

AmerenUE along with the Midwest Energy Efficiency Alliance (MEEA) and the Missouri Department of Natural Resources' Energy Center (Energy Center) began offering a Building Operator Certification (BOC) program in 2005. BOC is a competency-based training and certification program for operations and maintenance staff working in commercial, institutional, or industrial buildings. BOC achieves energy savings by training individuals directly responsible for the maintenance of energy-using building equipment and day-to-day building operations.

This report provides the findings from a process and impact evaluation of AmerenUE's BOC program, led by Opinion Dynamics in partnership with GDS and Associates. This evaluation is based on (1) our review of the program spreadsheet, (2) our review of program materials (i.e., a short program description, the program application form and Ameren's website), (3) in-depth interview with the AmerenUE program administrator, David Harrison of Department of Natural Resources (DNR) Energy Center, (4) telephone in-depth interviews with 23 program participants and (5) our review of DNR's post-training hard-copy survey results from 31 program participants, administered on the final day of class.

ODC interviewed 23 of 81[2] program participants that completed one of the five BOC Level 1 Trainings offered by AmerenUE. These participants completed one of the first three training sessions offered. The first two started in October, 2005 and ended in April, 2006 while the third started in May, 2006 and ended in November, 2006. We did not interview participants in the fourth and fifth sessions (October, 2006 and finished in April, 2007) because they would not have had time to implement measures or practices learned through the course work.

As described above, our findings also draw on surveys conducted post-training. Thirty-one participants had filled out the hard-copy survey administered on the final day of class. While the ODC interviews were conducted with participants that had completed trainings and had time to use the methods and concepts taught in the training session, the MEEA surveys were used to gather participant feedback on the value of the course materials and to determine if participants had used or applied the methods or concepts taught in the courses. Both surveys represent qualitative results due to the limited number of interviews.

[2] Notably, only 65 of the 81 were in AmerenUE territory.

II. Program Description

The BOC program is designed to help businesses, industry, schools, hospitals, and government facilities operate buildings more safely, efficiently, and effectively. Certification is earned by attending courses and completing assignments. There are two levels of BOC training, BOC Level 1 (100 level courses) and BOC level 2 (200 level courses). BOC Level 1 training sessions consists of seven courses and covers topics related to energy transfer, air movement, heating systems and maintenance, motors, cooling, ventilation and control systems, lighting, electrical safety, environmental health and safety and indoor air quality.

Table 1: BOC Level 1 Courses

Course Name
BOC 101: Building Systems Overview
BOC 102: Energy Conservation Techniques
BOC 103: HVAC Systems and Controls
BOC 104: Efficient Lighting Fundamentals
BOC 105: Environmental Health and Safety Regulations
BOC 106: Indoor Air Quality
BOC 107: Facility Electrical Systems

AmerenUE has only offered Level 1 courses so far. At the time of writing this report, BOC Level 2 courses were scheduled to begin in May 2007.

Participants who pass an exam at the end each course and complete all coursework are eligible for certification. Certification must be renewed each year by completing at least five hours of additional training per year.

DNR Energy Center is the program administrator for the Missouri program. They are responsible for setting up the training series, securing classrooms, times and class structure. They are also responsible for finding instructors to teach the courses. DNR receives a list of qualified instructors from MEEA. They review the list for qualified instructors for each course and then send an email bid to the instructors. There is a variety of instructors from different companies who teach the courses. MEEA provides prepackaged education materials to DNR to distribute to the instructors. The materials for the training were licensed from the Northwest Energy Efficiency Council (NEEC).

Marketing is done by MEEA, the DNR Energy Center and AmerenUE. MEEA maintains www.boccentral.org and develops marketing materials for use in the Midwest such as articles and advertisements for trade journals and case studies. MEEA is also the liaison with NEEC for the national marketing plan. DNR Energy Center identifies stakeholders and prospective partners and prepares and distributes written materials to promote BOC, news releases, placement of articles in professional publications. AmerenUE promotes BOC to its customers though company publications.

The total program budget for AmerenUE's program is $538,324. Total expenses through mid 2007 for the BOC program are $263,000.

Table 2: Program Budget for 2005-2007

	2005	2006	2007	Three Year Budget
BOC License	$ 11,340	$ 5,670	$ 5,670	$ 22,680
Program Administration, MEEA	$ 49,525	$ 49,640	$ 33,590	$132,755
Program Administration, Missouri Energy Center	$ 45,640	$ 34,715	$ 34,755	$115,110
Purchase of Services	$ 31,180	$ 38,720	$ 63,130	$133,030
BOC Training Materials	$ 10,950	$ 14,125	$ 23,775	$ 48,850
BOC Instructional Expense	$ 6,720	$ 27,450	$ 51,729	$ 85,899
Total Program Budget	**$155,355**	**$170,320**	**$212,649**	**$538,324**

Using these funds, program design documents indicate that the program seeks to train approximately 60 building operators per year, or a total of 150 participants over the three year period.

Table 3: Participation Goals for 2005-2007

	2005	2006	2007
Number of BOC training series launched	2	3	3
Number of participants per series	15	20	20
Total number of participants	30	60	60

III. Program Accomplishments

Program accomplishments in 2005 and 2006 include:

- Five training sessions completed (and additional classes starting)
- 65 AmerenUE customers representing 41 unique companies trained[3]
- Numerous projects started and/or completed as a result of the training
- Savings of 2,975 MWh and 12,444 MMBtus
- Program effects that expand beyond the companies represented in the trainings

These accomplishments are described below.

Five Training Sessions Completed

In the first two years of the program, five trainings were started or completed. The locations and start dates of these trainings include are shown in the table below. As such, AmerenUE achieved their goal of conducting five trainings within the first two years of the program. Additional trainings are being started in 2007, including the first Level II BOC course.

65 AmerenUE Customers Trained

In the first two years, the program trained 65 individuals within AmerenUE's territory, and an additional 16 individuals in the Columbia area.

Table 4: Participation 2005-2006

Locations	Session Start Date	Total number of AmerenUE participants
Jefferson City	10/5/05	10
St. Louis	10/26/05	28
St. Louis	05/16/06	10
St. Charles	10/11/06	15
Columbia	11/18/06	2
	TOTAL	**65**

These 65 customers represent 41 unique companies.[4]

Based on our in-depth interviews with participants in the first three sessions, buildings operated by participants average 1,157,000 sq feet, much more than anticipated prior to training. The median is 500,000 sq feet. Both the average and median are significantly higher AmerenUE's current estimate of 200,000 sq ft. The unique facilities factor is 0.63 (41 unique companies/65 individuals) compared to the current estimate of 0.71.

[3] 81 total but 16 in one class were from Columbia Power & Light. These 81 customers represented a total of 53 unique companies.

[4] These numbers include two AmerenUE employees.

Table 5: Building Information

Sq Ft	Number of Buildings	Building Use
3,600,000	33	Education; this is a school district
3,000,000	6	offices, patient areas
3,000,000	8	Patient Care/Medical Research
3,000,000	40	Educational purposes
2,200,000	10	Office complex
2,000,000	26	Offices and research
1,800,000	12	Government Offices
750,000	40	University - residential, classroom, lab, offices
750,000	1	Hotel
567,000	1	Shopping mall
500,000	4-5 all connected into one	Umbrella organization for United Van Lines, Mayflower, etc. Building house all departments involved in operations
450,000	25	Highway patrol headquarters
433,000	4	Financial/Banking
376,000	7	library, 2 major academic buildings, athletics building, reserve building not used for much and a dormitory
275,000	1	Hotel
240,000	1	Dining, Athletic and Hotel Rooms
200,000	1	Apartments and a hotel
162,000	3	Main- Non profit plant research laboratory
66,000	1	Engineering Co. Contracting
50,000	1	Mostly meetings, ballroom activities, several restaurants, pro shop, restrooms, locker rooms, showers
43,000	1	Hospital
40,000	3	Office space
No idea		Would include all state buildings in MO (thus included as over 500,000 when calculating median)

Participants are Starting or Have Completed Numerous Projects

Of the 23 participants interviewed, 18 have completed or plan to complete lighting projects and nine have completed or plan to complete HVAC projects. Overall, projects range from switching to energy efficient lighting and installing motion sensors, to upgrading motors and using new variable speed drive (VSD) motors for air handling units (AHU).

Program has saved 2,975 MWh and 12,444 MMBtus

The BOC program appears to be cost effective, as described in the impacts section below. Applying the average savings per square foot to all program participants along with the average square feet of the facilities and the unique facilities factor savings were determined to be 2,975 MWh and 12,444 MMBtus. (The impact and cost effectiveness analysis is described in detail in Section IV.)

Program Effects that Expand Beyond the Companies Represented in the Trainings

Some participants have left the job they held when they attended training while others with whom we spoke with were leaving shortly. As these participants move to other jobs, they bring their knowledge with them the reach of the BOC program increases.

IV. Impacts and Cost-Effectiveness

We calculated the impacts for this program based on a survey of twenty participants in the BOC program. All participants attended the BOC courses in either October 2005, or May 2006, thus all had at least six months to implement projects after completing the course. Our survey asked participants questions ranging from the total square footage of their facilities to the types of projects that they completed based on knowledge gained from the BOC training. Projects ranged from switching to energy efficient lighting and installing motion sensors, to upgrading motors and using new variable speed drive (VSD) motors for air handling units (AHU). Using the responses given in the survey, we determined savings calculations based on energy efficient lighting, motion sensors, motor upgrades, air handling unit upgrades, and rooftop unit upgrades being installed.

Some participants needed to be called multiple times for more details on their completed projects. For lighting projects, clarification was needed on the type of fixture that was replaced (eg; four lamp, T12 lighting being replaced with five lamp, T5 lighting) as well as how many fixtures were replaced. The number of motion sensors and an average of how many light fixtures each sensor controlled was asked to participants. Replacing AHU motors required the evaluation team to find the size of the supply air (cubic feet per minute), motor size (horsepower), and if it has a variable speed drive. Also, information on the old motor was needed, such as age and horsepower. Any rooftop units that were replaced, the old EER rating and the new EER rating along with the cooling size (tons) and heating size (Btuh) were required.

Energy Efficient Lighting and Occupancy Sensors

For lighting, if the original fixtures were unidentified, a four lamp T12 fixture was assumed to have been replaced. The hours lighting was in use was estimated by the hours of operation provided by participants on the survey. Using the wattage data for each fixture, wattage of the bulbs and electronic ballast, kilowatt-hour savings were calculated using the equation below:

Compact Fluorescent Lamp Savings Calculation

kWh = watts saved * (hrs of operation per day * 365 days)

The motion or occupancy sensor savings were calculated using the assumption that they were installed with the new lighting. This makes sense because only the participants who reported installing efficient lighting reported also installing occupancy sensors. That means all wattages are based on the same energy efficient lighting values from above. An estimation of running time was determined by the hours of operation of each facility. Savings were calculated using a 25% reduction in running time in all but one case where a participant mentioned reducing running time by 35%. From the new running time, kilowatt-hour savings were calculated using the same equation above.

Motor and AHU Upgrades

We calculated the energy savings from upgrading motors based on the horsepower, previous efficiency, new motor efficiency and if the motor has variable speed drive (VSD). The horsepower, efficiency and an assumed loading of 75% are used to calculate the kilowatts used

to run the motor. We assumed a running time of 6,000 hours annually to calculate the annual energy use of the motor in kilowatt-hours. Based on the new efficiency and VSD capability, we then calculated energy savings.

Finally, to calculate savings from updated air handling units, we calculated the motor savings as described above. The energy use of the old motor is input to a spreadsheet that contains AHU and regional weather data. The spreadsheet allows for weather data, internal and external temperatures, and heating and cooling to be used in energy calculations. This determines the current annual use of the AHU. On a second spreadsheet, new motor with VSD energy use is input and the natural gas and electric annual savings are calculated.

Total Savings

Table 6 shows the savings calculated from each measure for the 20 participants who completed the survey. These savings were then divided by the square footage for an average savings of 0.063 kWh/sq ft., and 0.00263 MMBtu/sq ft.

Table 6: Energy Savings from BOC Program Survey Based on 20 Participants

Measure		Savings		
		kWh	MMBtu	$
Motors	1	20,034	0	$ 1,160
	2	151,886	0	$ 8,794
	3	5,876	0	$ 340
AHU's	1	42,448	327	$ 5,957
	2	-6,933	916	$ 9,386
	3	75,056	552	$ 10,250
Lighting	Total Lighting (all respondents combined)	256,604	0	$ 14,857
OCC	Occupancy Sensors (all respondents combined)	150,087	0	$ 8,690
Rooftop	Rooftop Units (all respondents combined)	604,613	3,640	$ 73,919
TOTAL		**1,299,672**	**5,435**	**$ 133,353**

Table 7: Calculated Energy Savings per Square Foot

Square Footage	kWh / sf	MMBtu / sf	$ / sf
20,695,000	0.063	0.000263	$ 0.0064

Total energy savings for the program was then calculated by first summing the kWh and MMBtus saved and dividing by the total square footage of the buildings operated by program participants that completed the survey. This provided an estimate of savings per square foot of the BOC program. Next, using the number of classes and participants in each the 2005 and 2006 years, along with the average square footage and unique facilities factor of participating locations (as calculated by our participant survey), we calculated total kilowatt-hour and MMBtu savings per BOC class year. An electric rate of $0.0579/kWh and a gas rate of $10.69/MMBTU were provided by AmerenUE for their commercial users. Using these rates, we calculated the cost savings for the 2005 and 2006 BOC program years.

Table 8: BOC Program Totals

	Total Students	Unique Facilities Factor	Facility Avg sf	kWh / sf	kWh	$ / kWh	MMBtu / sf	MMBtu	$ / MMBtu	Total $
2005	38	0.63	1,157,000	0.063	1,739,505	$0.058	0.000263	7,275	$10.69	$178,483
2006	27	0.63	1,157,000	0.063	1,235,964	$0.058	0.000263	5,169	$10.69	$126,817
TOTAL	65				2,975,469			12,444		$305,300

NEEP estimated a 0.60 kilowatt-hour per square foot savings and a 0.001950 MMBTU per square foot savings for the BOC program. As explained above, ODC/GDS calculates 0.063 kilowatt-hour per square foot savings and 0.000263 MMBTU per square foot savings. NEEP's values for both electric and natural gas savings per square foot are respectfully 9.52 and 7.42 times higher than ODC/GDS's calculations. It is unclear in the BOCfinalreportdelivered.pdf file where NEEP's savings per square foot values came, so it is difficult to determine why the values are so different between NEEP and ODC/GDS. The total program savings calculated by NEEP will be higher partly because they have a unique facilities factor larger than ODC/GDS (0.71) and because of the high value of savings per square foot.

Cost-Effectiveness

The program costs have totaled $263,000 for a total savings of 2,975,469 kWh and 12,444 MMBtu for years 2005 and 2006. Paybacks for these years range from 0.8 to 0.9 years. Also, the benefit-cost ratio varies between 11.1 and 12.4.

Benefits are calculated using $0.0579/kWh and $10.69/MMBTU rates, which was provided by AmerenUE as standard rates charged to their commercial customers. The discount factor was provided by the *Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis - April 2006* report from the US Department of Commerce to the US Department of Energy (http://www1.eere.energy.gov/femp/pdfs/ashb06.pdf). In the report, table Ba-2 uses a 3% rate of inflation and has discount factors adjusted for the Missouri area. Light bulbs were estimated to last for eight years while motors were estimated at fifteen years. Referencing the commercial, electric column and looking to eight years of life, a discount factor of 6.75 was discovered for lighting savings. Motors received a discount factor of 10.00 for natural gas and 11.51 for electric from the respective commercial columns referencing fifteen years. Using the discounted factors, the discounted savings and the benefit-cost ratios were calculated.

Table 9: Benefit-Cost Ratios

	2005	2006
Cost	$160,500	$ 102,500
Benefit	$ 178,295	$ 126,819
Payback	0.9	0.8
Discounted Savings	$ 1,785,013	$ 1,269,657
Benefit Cost Ratio	11.1	12.4

Detailed spreadsheets on the savings and life cycle costs analyses were provided to AmerenUE along with this report.

V. Process Findings and Recommendations

All but one of the 23 participants we interviewed were satisfied with the training they received. Participants liked talking to other people in their fields and learning what they were doing. They also liked the presentation of information and found the instructors knowledgeable. Participants found the lighting, HVAC and energy conservation courses the most valuable.[5] One participant stated, "It was good information for the purposes of facilities operations for energy savings, bringing awareness of the systems in the building, how different systems from HVAC to electrical operate in the buildings." Another said, "the instructor took time to answer peoples questions, homework was important, projects required were about your facility and that was really beneficial."

Many (19 of 23) of those who were interviewed are very interested in completing the BOC Level II training with 10 already signed up or planning to sign up for the Fall course.

- **Consistently collect information such as square footage in registration forms**

  Square footage of the buildings that participants control is an important input to determine the savings from the BOC program. This information should be collected in a consistent manner and used to update savings estimates on a regular basis. MEEA has indicated that they started to do this as of January 2007, and the program should confirm that this information has been collected for all participants in the first BOC course offered in 2007 (starting in May 2007). In addition, AmerenUE and the Collaborative should also consider using the application process to ask for building type or use, hours of operation and other key data to help the program understand both who it is attracting, and the overall impacts of the course.

- **Track how participants learn about the program to determine what marketing and outreach methods are working, and use key account reps and other AmerenUE interactions to promote the course**

  While the program trained 65 AmerenUE customers in the sessions that began in 2005 and 2006 it fell short of its goal of 90 participants during this timeperiod. AmerenUE key account reps and other AmerenUE interactions could help to increase enrollment in the course.

  Most of the participants found out about the BOC program from their employer, DNR or AmerenUE.[6] Others mentioned they heard of the program through fliers or mailings, Facility Operator & Service Provider Association (FOSOP) and IFMA.

  When asked for suggestions on getting more building operators to attend the courses respondents suggested:
  - Mass mailing
  - IFMA or BOMA
  - Go to trade schools and target graduates through the newsletter

[5] Based on MEEA End of Training Evaluation
[6] Based on MEEA End of Training Evaluations

- Advertising
- Use existing databases such as people that subscribe to different technical facility type magazines.
- Word of mouth
- Advertise in local supply houses

As part of the enrollment form a questions should be asked to find out how the trainee learned about the program. Responses should be used to track which marketing and outreach efforts are working the best.

➢ **Consistently survey participants to gather feedback and make mid-course corrections**

End of training evaluation surveys are important for providing feedback on the course materials and instructors. An end-of-course and an end-of-training survey were provided with the course packet. We suggest continuing to distribute the end-of-training survey to all students at the end of each training session, and reconsidering the use of the end-of-course survey which was formerly handed out at the end of each of the eight courses that make up the training. The results from these surveys can be used to guide instructors and enhance courses.[7]

➢ **Aim for approximately 20 participants per class**

One training session has 28 participants while two others had only ten participants. While having ten students per class provides for a lot of interaction. The revenue and impacts from such a small number are less than ideal. However, feedback from the DNR Energy Center administrator indicates that 28 was too many to manage. The DNR Energy Center suggests approximately 20 participants per class because it alleviates some of the financial burden and it is a good class size to manage and teach.

➢ **Make classes more affordable for students**

AmerenUE's BOC courses currently cost $2,300 and AmerenUE pays half for its customers to attend so the cost for the participant is brought down to $1,150. Notably, however, neighboring utilities such as Columbia Water & Power offers the same BOC course for $1,150 and will reimburse the participant half the cost if they become certified so that the cost to the customer is only about $575. AmerenUE's course is also more expensive that a BOC course offered in Arizona, which is offered at approximately $1,200 with a financial incentive from the utility of $600 to bring the cost to approximately $600 to the customer. Our survey did not explore issues around program costs, but AmerenUE and the Collaborative may want to reexamine the program costs to see if they can bring down the course cost in order to increase the number of students per class. (Or similarly, by increasing the number of students per class through additional marketing efforts, AmerenUE may be able to bring down course costs.)

7 We received some end of training evaluation surveys that MEEA conducted to use as part of our research. We received three surveys for the first three training sessions. The surveys were not consistent in the questions asked and it does not appear that all participants completed the surveys.

- **Review the materials and ensure that they are cutting edge to the industry, and applicable to Missouri**

  Currently the course content is based on materials from NEEC. NEEC provides MEEA a package that contains student manuals, PowerPoint presentations and tests. MEEA gives this to DNR for use in each course. Instructors use the prepackaged educational portion to teach the classes. These materials are based on a different geographic location and the instructors (along with MEEA) have attempted to update and customize these materials for the Missouri climate and building codes and make sure they are up to date. Prior to future trainings, AmerenUE and the Collaborative should consider reviewing the materials and ensuring that they are cutting edge to the industry in order to ensure that they are offering customers a valuable service through the trainings. Notably, some other areas of the country have built their own courses from the ground up, which offers a more local flavor to the course, and allows the instructors to be more invested in keeping the materials up to date.

- **Seek ways to help increase recognition and understanding of the BOC course**

  BOC name recognition in Missouri is low, according to program administrators. Additional marketing, promotion, and education about BOC can help increase the recognized value of the course, and ultimately increase both participation and savings from the course. AmerenUE and the Collaborative should seek ways to help increase recognition and understanding of the BOC course.

In addition, respondents to our survey had a few suggestions for improving the BOC program. Suggestions included: have a web log where people dealing with some of the same problems can interact; visit locations that have implemented some of the things talked about in the courses; more emphasis on the LEED program; more displays in each class; and more hands on.