

2012 Evaluation of EnergySaveOhio Commercial and Industrial Energy Efficiency Incentive Programs

Evaluation Report

Prepared for the FirstEnergy Ohio Companies:

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The Toledo Edison Company*

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1. Executive Summary

During 2012, the Ohio Operating companies The Cleveland Electric Illuminating Company (CEI), Ohio Edison (OE), and The Toledo Edison (TE) (collectively “Companies”), implemented commercial and industrial programs. These programs (collectively “C/I Equipment Programs”) include the following:

- Large Enterprise Equipment Program
- Small Enterprise Equipment Program
- Motors and Drives Program
- Government Lighting Program

The main features of the approach used for the evaluation are as follows:

- Data for the study were collected through review of program materials, on-site inspections, end-use metering, and interviews with the Companies’ staff members, program implementation contractor staff members, and participating customers and contractors. Based on data provided by the Companies’ and their program implementation contractor, a sample design was developed for on-site data collection. Samples were drawn that provide savings estimates for each program providing energy savings estimation with $\pm 10\%$ statistical precision at the 90% confidence level. Table 1-1 shows the total sample sizes for different types of data collection employed for this study for the C/I Equipment Programs.
- On-site visits were used to collect data for savings impact calculations, to verify measure installation, and to determine measure operating parameters. Facility staff were interviewed to determine the operating hours of installed systems and to locate any additional benefits or shortcomings with the installed systems. For many of the sites, energy efficient equipment was monitored in order to obtain accurate information on equipment operating characteristics. The 127 projects, for which on-site measurements and verification data were collected, account for approximately 56% of the Large Enterprise Equipment Program’s ex ante kWh savings, 21% of the Small Enterprise Equipment Program’s ex ante kWh savings, 95.91% of the Motors and Drives Program’s ex ante kWh savings, and 33% of the Government Lighting Program’s ex ante kWh savings.
- Customer surveys provided the information for process evaluation. A total of 321 customer decision makers who completed 327 surveys for Small and Large Enterprise Equipment were interviewed, and 71 trade allies were interviewed. Additionally, relevant Company and implementation contractor staff members were interviewed to provide information for the process evaluation.

Table 1-1 Sample Sizes for Data Collection Efforts

<i>Type of Data Collected</i>	<i>Large Enterprise</i>	<i>Small Enterprise</i>	<i>Motors and Drives</i>	<i>Government Lighting</i>	<i>Total</i>
Project On-Site Measurement and Verification	51	60	9	7	127
Customer Decision Maker Survey	67	260	0	0	327
Trade Ally Survey	71				71

Gross savings were estimated using proven techniques, including industry standard engineering calculations and verification of computer simulations developed by program contractors to determine energy savings. The realized energy savings for each program are summarized in Table 1-2.

Table 1-2 Gross Savings by Program

<i>Program</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Realization Rate</i>	<i>Ex Ante Peak kW Savings</i>	<i>Ex Post Peak kW Savings</i>	<i>Realization Rate</i>
Large Enterprise	93,218,469	96,593,825	104%	11,460	13,497	118%
Small Enterprise	115,436,084	105,367,329	91%	21,464	22,877	107%
Motors & Drives	13,845,460 <u>7,117,483</u>	6,544,372 <u>6,634,855</u>	47%-93%	1,529 <u>1,418</u>	403-404	26%-29%
Government Lighting	1,092,169	1,069,080	98%	125	122	98%
Total	223,592,181 <u>216,864,204</u>	209,574,607 <u>209,665,090</u>	94%-97%	34,577 <u>34,466</u>	36,899 <u>36,900</u>	107%

The realized energy savings of the 2012 Large Enterprise Equipment Program from the three service territories are summarized in Table 1-3. For the entire program, the realized gross energy savings totaled 96,593,825 kWh. The gross realization rate for the program is 104%.

Table 1-3 Summary of Annualized kWh Savings for Large Enterprise Equipment Program

<i>Operating Company</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Realization Rate</i>
CEI	22,866,952	25,141,027	110%
OE	53,497,996	54,764,404	102%
TE	16,853,521	16,688,394	99%
Total Companies	93,218,469	96,593,825	104%

The realized gross peak kW reductions of the 2012 Large Enterprise Equipment Program from the three service territories are summarized in Table 1-4. The achieved gross peak demand savings for the program are 13,497.40 kW. The gross realization rate for the program is 118%

Table 1-7 Summary of Annualized Peak kW Savings for Small Enterprise Equipment Program

<i>Operating Company</i>	<i>Ex Ante Peak kW Savings</i>	<i>Ex Post Peak kW Savings</i>	<i>Realization Rate</i>
CEI	10,603.14	11,040.50	104%
OE	8,505.52	9,323.51	110%
TE	2,355.57	2,512.80	107%
Total Companies	21,464.23	22,876.81	107%

The accrued savings during the remaining months in 2012, after the date of implementation for a measure under the Small Enterprise Equipment Program, is referred to as first year pro rata savings. The first year pro rata ex post kWh savings for the Small Enterprise Equipment Program is summarized in Table 1-8. For the first year pro rata, the realized gross energy savings totaled 65,996,641 kWh.

Table 1-8 Summary of First Year kWh Pro Rata Savings for Small Enterprise Equipment Program

<i>Operating Company</i>	<i>First Year Ex Post Pro Rata kWh Savings</i>
CEI	29,099,387
OE	29,767,137
TE	7,130,118
Total Companies	65,996,641

The realized energy savings of the 2012 Motors and Drives Program from the three service territories are summarized in Table 1-1. For the entire program, the realized gross energy savings totaled ~~6,544,372~~6,634,855 kWh. The gross realization rate for the program is ~~47~~93%.

Table 1-9 Summary of Annualized kWh Savings for Motors and Drives Program

<i>Operating Company</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Realization Rate</i>
CEI	735,251	526,177	72%
OE	5,454,324	5,345,533	98%
TE	7,655,885 <u>927,908</u>	672,662 <u>763,145</u>	9%-82%
Total Companies	13,845,460 <u>7,117,483</u>	6,544,372 <u>6,634,855</u>	47%-93%

The realized gross peak kW reductions of the 2012 Motors and Drives Program from the three service territories are summarized in Table 1-10. The achieved gross peak demand savings for the program are ~~402.88~~403.76 kW. The gross realization rate for the program is ~~26~~28%.

Table 1-10 Summary of Annualized Peak kW Savings for Motors and Drives Program

<i>Operating Company</i>	<i>Ex Ante Peak kW Savings</i>	<i>Ex Post Peak kW Savings</i>	<i>Realization Rate</i>
CEI	179.12	82.97	46%
OE	1,093.00	241.18	22%
TE	256.49 <u>145.82</u>	78.73 <u>79.61</u>	31% <u>55%</u>
Total Companies	1,528.62 <u>1,417.94</u>	402.88 <u>403.76</u>	26% <u>28%</u>

After the date of implementation for a measure under the Motors and Drives Program, the number of months remaining in 2012 for which annual savings could be attributed is referred to as first year pro rata savings. The first year pro rata ex post kWh savings for the Motors and Drives Program is summarized in Table 1-11. For the first year pro rata, the realized gross energy savings totaled ~~3,286,513~~ 3,365,441 kWh.

Table 1-11 Summary of First Year Pro Rata kWh Savings for Motors and Drives Program

<i>Operating Company</i>	<i>First Year Ex Post Pro Rata kWh Savings</i>
CEI	517,606
OE	2,145,902
TE	623,005 <u>701,933</u>
Total Companies	3,286,513 <u>3,365,441</u>

The realized energy savings of the 2012 Government Lighting Program from the three service territories are summarized in Table 1-12. For the entire program, the realized gross energy savings totaled 1,069,080 kWh. The gross realization rate for the program is 98%.

Table 1-12 Summary of Annualized kWh Savings for Government Lighting Program

<i>Operating Company</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Realization Rate</i>
CEI	134,960	134,887	100%
OE	957,208	934,193	98%
TE	-	-	-
Total Companies	1,092,169	1,069,080	98%

The realized gross peak kW reductions of the 2012 Government Lighting Program from the three service territories are summarized in Table 1-13. The achieved gross peak demand savings for the program are 122.05 kW. The gross realization rate for the program is 98%

Table 1-13 Summary of Annualized Peak kW Savings for Government Lighting Program

<i>Operating Company</i>	<i>Ex Ante Peak kW Savings</i>	<i>Ex Post Peak kW Savings</i>	<i>Realization Rate</i>
CEI	15.41	15.40	100%
OE	109.27	106.66	98%

However, there were some aspects of the program that trade allies felt could be improved. They were displeased with the length of time required to receive the incentive payments, a lack of communication about the program, and the effort required for the application process.

Survey findings indicate that the program has improved its operations during the 2012 program year. However, some issues remain and the following recommendations may provide strategic advantage during future program operations:

- **Streamline Participation Process:** Although improvements have been made, trade allies and customers continued to express dissatisfaction with the application process and with the length of time for payment of the incentives in particular. Additional steps taken to decrease the time required to process incentives would likely lead to increased customer satisfaction.
- **Continue to Foster Greater Trust among Trade Allies and Customers:** Trade ally satisfaction with the program increased during the 2012 program year. Continued consistency in program offerings and steady improvements in operations will continue to improve both trade ally and customers satisfaction.
- **Savings Calculations for Motor and Drives Projects:** The overall realization rate for Motors and Drives Program projects was 47.93%. ADM staff noted that the project documentation did not include the calculations used to estimate ex ante savings for many of the completed projects. Without calculations it was difficult to determine specifically why the realization rate was low for the projects completed. It is recommended that calculations used to estimate savings from motor and drive projects are included in the project documentation. Providing calculations for savings estimates will allow engineering staff to identify why realization rates are low to improve the estimation of ex ante savings.

Incentives were available to customers through motor distributors as a rebate per unit replaced on a first come first serve basis and were limited to the Company's motor upgrade budget.

To have been eligible to participate in the Motors and Drives Program, a customer must have met the following criteria:

- Motor(s) must operate a minimum of 2,000 hours annually.
- Projects must be a "one-for-one" replacement of a motor with a new, NEMA Premium® motor. The sizes (hp) of the existing and new motors may vary, but the project must involve replacing a quantity of motors for the same quantity of new motors. For new construction, the baseline motor should be a code-compliant option that is less efficient than the NEMA Premium® motor that is being installed.
- Project does not involve a change in annual run hours.
- Project includes the installation of a new NEMA Premium® motor of up to 200hp.
- The motor upgrade program's individual incentives per motor start at \$25 for a 1HP.
- The variable-speed drive incentive is \$35 per horsepower (up to 500hp) of the motor being used.
- Variable Frequency Drives (VFDs) incentives were available only for the installation of a new VFD on applications where no existing speed control existed on applications controlling a maximum of 500 hp.

Standard motor and drive measures include equipment for which the program uses "deemed" or "partially deemed" protocols with stipulated algorithms and assumptions to estimate measure gross energy savings and peak load reductions. The measures were evaluated on an implementation-by-implementation basis, using site-specific data and algorithms tailored to the nature of the EEM and its implementation.

Measures were targeted at customers that have purchased motor or drive equipment which will result in energy efficiency and/or peak demand reductions. Incentives for custom measures require a payback between one and seven years.

Any projects with incentive amounts totaling \$3,000 or more required pre-approval before equipment was purchased and installed. Projects with total incentives which were less than \$3,000 only needed to submit an application and implement the project. Once applications were approved, they were sent to the Companies for approval as the last step in the implementation process.

For the Motors and Drives Program, there is only one category of equipment; there were 16 projects in the program which were expected to provide savings of ~~13,845,460~~ 7,117,483 kWh.

Figure 3-3 shows the Motors and Drives Program's ex post kWh savings by the date of application submission.

4. Methodology

ADM's evaluation of the 2012 C/I Equipment Programs consisted of both an impact evaluation and a process evaluation. The impact evaluation methodology is described in section 4.1 and the process evaluation methodology is described in section 4.2 of this chapter.

4.1 Impact Methodology

The methodology used for estimating gross savings is described in this section.

4.1.1 Sampling Plans - C/I Equipment Programs

Data used to estimate the gross savings achieved through the Large Enterprise Equipment Program were collected for samples of projects completed during the 2012 program year. Data provided by the implementation contractor showed that during 2012, there were 225 projects for the program, which were expected to provide savings of 93,218,469 kWh annually.

Data used to estimate the gross savings achieved through the Small Enterprise Equipment Program were collected for samples of projects completed during the 2012 program year. Data provided by the implementation contractor showed that during 2012, there were 1,471 projects for the program, which were expected to provide savings of 115,436,084 kWh annually.

Data used to estimate the gross savings achieved through the Motors and Drives Program were collected for samples of projects completed during the 2012 program year. Data provided by the implementation contractor showed that during 2012, there were 16 projects for the program, which were expected to provide savings of ~~13,845,460~~7,117,483 kWh annually.

Data used to estimate the gross savings achieved through the Government Lighting Program were collected for samples of projects completed during the 2012 program year. Data provided by the implementation contractor showed that during 2012, there were 63 projects for the program, which were expected to provide savings of 1,092,169 kWh annually.

For ~~both~~all programs, inspection of data on kWh savings for individual projects provided by implementation contractor indicated that the distribution of savings was generally positively skewed, with a relatively small number of projects accounting for a high percentage of the estimated savings. Estimation of savings for each program is based on a ratio estimation procedure, which allows precision/confidence requirements to be met with a smaller sample size. ADM selected a sample with a sufficient number of projects to estimate the total achieved savings with 10% precision at 90% confidence. For the Large Enterprise Equipment Program sample, the actual precision is $\pm 7\%$. For the Small Enterprise Equipment Program sample, the actual precision is $\pm 8\%$. For the

Motors and Drives Program sample, the actual precision is $\pm 38\%$. For the Government Lighting Program sample, the actual precision is $\pm 5\%$.

Sampling for the collection of program M&V data accounted for the M&V effort occurring in real time during program implementation. Completed projects accumulate over time as the program is implemented, and sample selection was thus spread over the entire program year. ADM used a near real-time process whereby a portion of the sample was selected periodically as projects in the program were completed. The timing of sample selection was contingent upon the timing of the completion of projects during the program year.

Table 4-1 shows the number of projects and expected energy savings of the sampled projects by stratum for the Large Enterprise Equipment Program. Table 4-2 shows the number of projects and expected energy savings of the sampled projects by stratum for the Small Enterprise Equipment Program. Table 4-3 shows the number of projects and expected energy savings of the sampled projects by stratum for the Motors and Drives Program. Table 4-4 shows the number of projects and expected energy savings of the sampled projects by stratum for the Government Lighting Program

Table 4-1 Population Statistics Used for Sample Design for Large Enterprise Equipment Program

	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Stratum 5	Totals
Strata boundaries (kWh)	< 52310	52310 - 131599	131600 - 261669	261670 - 709649	> 709650	
Number of projects	51	44	32	57	41	225
Total kWh savings	1,101,004	3,962,587	5,663,995	24,430,291	58,060,592	93,218,469
Average kWh Savings	21,588	90,059	177,000	428,602	1,416,112	414,304
Standard deviation of kWh savings	14,872	25,670	33,347	127,861	732,353	589,705
Coefficient of variation	0.69	0.29	0.19	0.30	0.52	1.42
Final design sample	4	4	5	4	34	51

Table 4-2 Population Statistics Used for Sample Design for Small Enterprise Equipment Program

	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Stratum 5	Totals
Strata boundaries (kWh) Savings	< 21020	21020 - 80419	80420 - 231049	231050 - 501419	> 501420	
Number of projects	558	521	272	95	25	1471
Total kWh savings	5,421,044	23,143,851	36,928,881	29,499,958	20,442,349	115,436,084
Average kWh Savings	9,715	44,422	135,768	310,526	817,694	78,475
Standard deviation of kWh savings	6,184	16,868	41,939	67,290	325,694	134,339
Coefficient of variation	0.64	0.38	0.31	0.22	0.40	1.71
Final design sample	9	13	8	6	24	60

Table 4-3 Population Statistics Used for Sample Design for Motors and Drives Program

	Stratum 1	Stratum 2	Stratum 3	Totals
Strata boundaries (kWh) Savings	< 22710 440390	22710 - 96829 140390 - 66969	> 96830 66970	
Number of projects	6	6	4	16
Total kWh savings	325,348	1,093,579 1,346,087	5,698,556 12,204,025	7,117,483 13,845,460
Average kWh Savings	54,225	182,263 219,348	1,424,639 3,051,006	444,843 5,341
Standard deviation of kWh savings	36,250	125,329 98,784	1,535,324 3,524,493	906,493 439,975
Coefficient of variation	0.67	0.69 0.45	1.08 0.44	2.04 0.66
Final design sample	2	3	4	9

Table 4-4 Population Statistics Used for Sample Design for Government Lighting Program

	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Totals
Strata boundaries (kWh) Savings	< 13100	13100 - 17469	17470 - 265279	> 265280	
Number of projects	24	25	13	1	63
Total kWh savings	218,373	375,084	233,435	265,277	1,092,169
Average kWh Savings	9,099	15,003	17,957	265,277	17,336
Standard deviation of kWh savings	1,441	696	1,426	N/A	31,960
Coefficient of variation	0.16	0.05	0.08	N/A	1.84
Final design sample	2	1	3	1	7

As shown in Table 4-5, the Large Enterprise Equipment Program sample projects account for approximately 56% of the expected kWh savings. As shown in Table 4-6, the Small Enterprise Equipment Program sample projects account for approximately 21% of the expected kWh savings. As shown in Table 4-7, the Motors and Drives Program sample projects account for approximately 95% of the expected kWh savings. As shown in Table 4-8, the Government Lighting Program sample projects account for approximately 33% of the expected kWh savings.

Table 4-5 Expected kWh Savings for Sampled Projects by Stratum for Large Enterprise Equipment Program

Stratum	Ex Ante kWh Savings (Population)	Ex Ante kWh Savings (Sample)	Percent of Ex Ante Peak kWh Savings in Sample
5	58,060,592	48,518,216	84%
4	24,430,291	2,196,783	9%
3	5,663,995	837,923	15%
2	3,962,587	491,876	12%
1	1,101,004	105,817	10%
Total	93,218,469	52,150,615	56%

Table 4-6 Expected kWh Savings for Sampled Projects by Stratum for Small Enterprise Equipment Program

Stratum	Ex Ante kWh Savings (Population)	Ex Ante kWh Savings (Sample)	Percent of Ex Ante Peak kWh Savings in Sample
5	20,442,349	19,782,781	97%
4	29,499,958	2,204,268	7%
3	36,928,881	1,433,085	4%
2	23,143,851	952,630	4%
1	5,421,044	97,689	2%
Total	115,436,084	24,470,453	21%

Table 4-7 Expected kWh Savings for Sampled Projects by Stratum for Motors and Drives Program

Stratum	Ex Ante kWh Savings (Population)	Ex Ante kWh Savings (Sample)	Percent of Ex Ante Peak kWh Savings in Sample
3	12,204,025 5,698,556	12,204,025 5,698,556	100%
2	1,316,087 1,093,579	865,483 642,975	66 59%
1	325,348	114,985	35%
Total	13,845,460 7,117,483	13,181,494 6,456,516	95 91%

Table 4-8 Expected kWh Savings for Sampled Projects by Stratum for Government Lighting Equipment Program

Stratum	Ex Ante kWh Savings (Population)	Ex Ante kWh Savings (Sample)	Percent of Ex Ante Peak kWh Savings in Sample
4	265,277	265,277	100%
3	233,435	58,740	25%
2	375,084	16,232	4%
1	218,373	20,528	9%
Total	1,092,169	360,776	33%

As shown in Table 4-9, the Large Enterprise Equipment Program sample projects account for approximately 52% of the expected peak kW savings. As shown in Table 4-10, the Small Enterprise Equipment Program sample projects account for approximately 17% of the expected peak kW savings. As shown in Table 4-11, the Motors and Drives Program sample projects account for approximately ~~95~~ 94% of the expected peak kW savings. As shown in Table 4-12, the Motors and Drives Program sample projects account for approximately 33% of the expected peak kW savings.

Table 4-9 Expected Peak Demand kW Savings for Sampled Projects by Stratum for Large Enterprise Equipment Program

Stratum	Ex Ante Peak kW Savings (Population)	Ex Ante Peak kW Savings (Sample)	Percent of Ex Ante Peak kW Savings in Sample
5	6,632	5,603	84%
4	3,342	179	5%
3	723	154	21%
2	532	39	7%
1	231	25	11%
Total	11,460	6,000	52%

Table 4-10 Expected Peak Demand kW Savings for Sampled Projects by Stratum for Small Enterprise Equipment Program

Stratum	Ex Ante Peak kW Savings (Population)	Ex Ante Peak kW Savings (Sample)	Percent of Ex Ante Peak kW Savings in Sample
5	2,881.91	2,791.83	97%
4	5,098.78	362.35	7%
3	6,899.99	231.18	3%
2	5,140.63	201.48	4%
1	1,442.92	23.76	2%
Total	21,464.23	3,610.60	17%

Table 4-11 Expected Peak Demand kW Savings for Sampled Projects by Stratum for Motors and Drives Program

Stratum	Ex Ante Peak kW Savings (Population)	Ex Ante Peak kW Savings (Sample)	Percent of Ex Ante Peak kW Savings in Sample
3	1,262.50 <u>1,158.63</u>	1,262.50 <u>1,158.63</u>	100%
2	190.53 <u>197.34</u>	153.15 <u>159.95</u>	84.80 %
1	68.78	27.30	40%
Total	1,528.62 <u>1,417.94</u>	1,449.75 <u>1,339.08</u>	95.94 %

Table 4-12 Expected Peak Demand kW Savings for Sampled Projects by Stratum for Government Lighting Program

Stratum	Ex Ante Peak kW Savings (Population)	Ex Ante Peak kW Savings (Sample)	Percent of Ex Ante Peak kW Savings in Sample
4	30.28	30.28	100%

5. Detailed Evaluation Findings

This chapter reports ADM's impact evaluation findings and process evaluation findings for the Large Enterprise Equipment Program, the Small Enterprise Equipment Program, the Motors and Drives Program, and the Government Lighting Program during the 2012 program year.

5.1 Impact Evaluation Findings

This section provides the results of gross savings for the Large Enterprise Equipment Program, the Small Enterprise Equipment Program, the Motors and Drives Equipment Program, and the Government Lighting Program during the 2012 program year. Table 5-1 summarizes the gross savings for each program.

Table 5-1 Gross Savings by Program

	Ex Ante kWh Savings	Ex Post kWh Savings	Realization Rate	Ex Ante Peak kW Savings	Ex Post Peak kW Savings	Realization Rate
Large Enterprise	93,218,469	96,593,825	104%	11,460	13,497	118%
Small Enterprise	115,436,084	105,367,329	91%	21,464	22,877	107%
Motors & Drives	7,117,483 13,845,660	6,634,855 6,544,372	47 93%	1,418 1,529	403 404	26 28%
Government Lighting	1,092,169	1,069,080	98%	125	122	98%
Total	216,864,204 223,592,184	209,665,090 209,574,607	94 97%	34,466 34,577	36,899 900	107%

5.1.1 Gross Savings

To estimate gross kWh savings and peak kW reductions for the Large Enterprise Equipment Program, data were collected and analyzed for samples of ~~51~~2 incentive projects. To estimate gross kWh savings and peak kW reductions for the Small Enterprise Equipment Program, data were collected and analyzed for samples of 60 incentive projects. To estimate gross kWh savings and peak kW reductions for the Motors and Drives Program, data were collected and analyzed for samples of 9 incentive projects. To estimate gross kWh savings and peak kW reductions for the Government Lighting Program, data were collected and analyzed for samples of 7 incentive projects.

The data were analyzed using the methods described in section 4.1 to estimate project energy savings and peak kW reductions and to determine realization rates for both programs. The results of that analysis are reported in this section.

5.1.2 Realized Gross kWh Savings

The gross kWh savings of the 2012 Large Enterprise Equipment Program are summarized by sampling stratum in Table 5-2. Overall, the achieved gross savings of 96,593,825 kWh were equal to 104% of the expected savings.

The gross kWh savings of the 2012 Small Enterprise Equipment Program are summarized by sampling stratum in Table 5-3. Overall, the achieved gross savings of 105,367,329 kWh were equal to 91% of the expected savings.

The gross kWh savings of the 2012 Motors and Drives Program are summarized by sampling stratum in Table 5-4. Overall, the achieved gross savings of 6,544,372,634,855 kWh were equal to 4793% of the expected savings.

The gross kWh savings of the 2012 Government Lighting Program are summarized by sampling stratum in Table 5-5. Overall, the achieved gross savings of 1,069,080 kWh were equal to 98% of the expected savings.

Table 5-2 Expected and Gross Realized kWh Savings for Large Enterprise Equipment Program by Sample Stratum

Stratum	Ex Ante kWh Savings	Ex Post kWh Savings	Realization Rate
5	58,060,592	55,911,504	96%
4	24,430,291	31,184,594	128%
3	5,663,995	5,385,846	95%
2	3,962,587	3,039,523	77%
1	1,101,004	1,072,359	97%
Total	93,218,469	96,593,825	104%

Table 5-3 Expected and Gross Realized kWh Savings for Small Enterprise Equipment Program by Sample Stratum

Stratum	Ex Ante kWh Savings	Ex Post kWh Savings	Realization Rate
5	20,442,349	17,654,438	86%
4	29,499,958	28,092,136	95%
3	36,928,881	35,245,946	95%
2	23,143,851	20,071,302	87%
1	5,421,044	4,303,508	79%
Total	115,436,084	105,367,329	91%

Table 5-4 Expected and Gross Realized kWh Savings for Motors and Drives Program by Sample Stratum

Stratum	Ex Ante kWh Savings	Ex Post kWh Savings	Realization Rate
3	5,698,556 42,204,025	5,577,309	4698 %
2	4,316,087 1,093,579	763,666 854,149	5878 %
1	325,348	203,397	63%
Total	7,117,483	6,634,855	4793 %

<i>Stratum</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Realization Rate</i>
	13,845,460	6,544,372	

Table 5-5 Expected and Gross Realized kWh Savings for Government Lighting Program by Sample Stratum

<i>Stratum</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Realization Rate</i>
4	265,277	242,922	92%
3	233,435	234,804	101%
2	375,084	370,001	99%
1	218,373	221,353	101%
Total	1,092,169	1,069,080	98%

Table 5-6 shows the expected and realized energy savings by project for the Large Enterprise Equipment Program. Table 5-7 shows the expected and realized energy savings by project for the Small Enterprise Equipment Program. Table 5-8 shows the expected and realized energy savings by project for the Motors and Drives Program. Table 5-9 shows the expected and realized energy savings by project for the Government Lighting Program.

Table 5-6 Expected and Gross Realized kWh Savings for Large Enterprise Equipment Program by Project

<i>Project ID</i>	<i>Expected kWh Savings</i>	<i>Realized Gross kWh Savings</i>	<i>Project Gross Realization Rate</i>
OH-CI8519	1,478,199	1,086,187	73%
OH-CI29442	2,116,156	2,774,909	131%
OH-NSLB5727	750,560	1,075,533	143%
OH-NSLB7368	894,781	917,249	103%
OH-NSLB8512	1,440,726	945,993	66%
OH-NSLB14276	733,773	674,141	92%
OH-NSLB18198	1,046,145	823,397	79%
OH-NSLB29411	1,311,942	1,163,558	89%
OH-CI17329	813,868	746,062	92%
OH-CI19169	1,495,317	1,349,390	90%
OH-CI31153	929,682	795,999	86%
OH-CI31154	929,682	795,999	86%
OH-NSLB4527	2,003,135	1,581,607	79%
OH-NSLB12164	3,726,271	2,687,890	72%
OH-NSLB8574	901,692	905,962	100%
OH-NSLB12114	709,653	654,760	92%
OH-NSLB13933	1,233,304	607,301	49%
OH-NSLB13900	1,304,106	738,604	57%
OH-NSLB13603	1,661,492	1,425,305	86%
OH-NSLB13012	1,549,726	1,248,426	81%
OH-NSLB13723	1,087,170	949,019	87%
OH-NSLB13938	779,014	738,191	95%

<i>Project ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Realization Rate</i>
OH-NSLB15920	76,391	29,466	39%
OH-NSLB25063	78,306	58,515	75%
OH-NSLB28819	21,936	26,265	120%
OH-NSLB13833	18,506	16,137	87%
OH-NSLB33886	15,494	14,312	92%
OH-SLB31539	3,309	5,525	167%
OH-SLB16607	2,647	3,170	120%
OH-NSLB14510	5,310	3,106	58%
OH-NSLB16925	20,861	10,839	52%
OH-NSLB28476	9,353	10,502	112%
OH-NSLB16545	19,798	11,260	57%
OH-NSLB31433	2,412	2,700	112%
Non-Sample Projects	90,965,630	83,911,947	92%
Total	115,436,084	105,367,329	91%

Table 5-8 Expected and Gross Realized kWh Savings for Motors and Drives Program by Project

<i>Project ID</i>	<i>Expected kWh Savings</i>	<i>Realized Gross kWh Savings</i>	<i>Project Gross Realization Rate</i>
OH-MD8166	3,104,065	3,369,597	109%
OH-MD16417	2,350,259	1,975,936	84%
OH-MD16367	96,825 4,921,476	66,966	469%
OH-MD16369	147,407 1,828,226	164,810	9112%
OH-MD12235	390,095	312,841	80%
OH-MD18968	230,171	141,451	61%
OH-MD16378	245,217 22,709	47,909	20211%
OH-MD4826	19,119	32,735	171%
OH-MD4827	95,867	39,150	41%
Non-Sample Projects	660,967	392,977 483,460	5973%
Total	7,117,483 13,845,460	6,634,855 6,544,372	4793%

Table 5-9 Expected and Gross Realized kWh Savings for Government Lighting Program by Project

<i>Project ID</i>	<i>Expected kWh Savings</i>	<i>Realized Gross kWh Savings</i>	<i>Project Gross Realization Rate</i>
OH-TS20095	265,277	242,922	92%
OH-TS19096	18,707	18,680	100%
OH-TS19100	17,470	17,657	101%
OH-TS19126	22,563	22,747	101%

Facility Type	Ex Ante kWh Savings				Ex Post kWh Savings				Percent of Total Ex Post kWh Savings	Realization Rate
	CEI	OE	TE	Total Companies	CEI	OE	TE	Total Companies		
Warehouse	2,938,916	8,094,367	1,805,998	12,839,281	2,729,494	7,381,139	1,589,566	11,700,199	11%	91%
Retail	4,871,983	5,559,781	1,365,942	11,797,706	4,421,366	5,004,511	1,205,365	10,631,242	10%	90%
Office	5,540,004	4,936,633	898,285	11,374,922	4,760,981	4,800,749	816,154	10,377,884	10%	91%
K-12 Education	4,280,503	1,723,335	665,714	6,669,553	3,800,647	1,557,671	590,909	5,949,227	6%	89%
Hospital	2,064,570	3,759,645	469,666	6,293,881	1,461,339	3,088,892	448,262	4,998,493	5%	79%
Grocery	3,543,739	1,507,466	266,357	5,317,562	3,310,634	1,392,145	226,423	4,929,202	5%	93%
Food Service	271,974	1,410,330	412,584	2,094,888	233,823	1,301,734	362,252	1,897,808	2%	91%
University	377,724	19,183	-	396,907	354,509	15,228	-	369,738	0%	93%
Multi-Family Common Areas	291,250	-	56,013	347,263	254,140	-	44,466	298,607	0%	86%
Community College	-	75,742	176,175	251,917	-	57,474	168,146	225,620	0%	90%
Medical Clinic	33,593	129,610	4,255	167,458	28,286	111,125	3,378	142,789	0%	85%
Lodging	30,303	76,844	-	107,147	26,280	66,642	-	92,922	0%	87%
Total	55,644,456	47,123,119	12,559,206	115,326,780	50,208,339	43,773,299	11,385,692	105,367,329	100%	91%

Table 5-12 Realized Gross kWh Savings by Facility Type for Motors and Drives Program

Facility Type	Ex Ante kWh Savings				Ex Post kWh Savings				Percent of Total Ex Post kWh Savings	Realization Rate
	CEI	OE	TE	Total Companies	CEI	OE	TE	Total Companies		
Manufacturing	620,266	3,104,065	-	3,724,331	454,292	3,369,597	-	3,823,889	58%	103%
Hospital	-	2,350,259	-	2,350,259	-	1,975,936	-	1,975,936	30%	84%
Other	19,119	-	431,538 7,159,516	450,657 7,178,634	32,735	-	382,586	415,321	6%	692%
Retail	-	-	340,212	340,212	-	-	197,409 265,725	197,409 265,725	34%	5878%
University	95,867	-	156,158	252,025	39,150	-	92,667 114,834	134,817 153,984	2%	5261%
Total	735,251	5,454,324	927,908 7,655,885	7,117,483 13,845,460	526,177	5,345,533	672,662 763,145	6,634,855 6,544,372	100%	4793%

5.1.3 Realized Gross Peak kW Savings

The realized gross peak kW reductions of the 2012 Large Enterprise Equipment Program are shown in Table 5-13. The achieved gross peak demand savings for the program are 13,497.40 kW.

The realized gross peak kW reductions of the 2012 Small Enterprise Equipment Program are shown in Table 5-14. The achieved gross peak demand savings for the program are 22,876.81 kW.

The realized gross peak kW reductions of the 2012 Motors and Drives Program are shown in Table 5-15. The achieved gross peak demand savings for the program are ~~402,883.76~~ kW.

The realized gross peak kW reductions of the 2012 Government Lighting Program are shown in Table 5-16. The achieved gross peak demand savings for the program are 122.05 kW.

Table 5-13 Expected and Gross Realized Peak kW Savings for Large Enterprise Equipment Program

Stratum	Ex Ante Peak kW Savings	Ex Post Peak kW Savings	Realization Rate
5	6,631.93	7,214.87	109%
4	3,342.17	4,892.00	146%
3	722.74	888.17	123%
2	531.89	213.06	40%
1	230.84	289.30	125%
Total	11,459.57	13,497.40	118%

Table 5-14 Expected and Gross Realized Peak kW Savings for Small Enterprise Equipment Program

Stratum	Ex Ante Peak kW Savings	Ex Post Peak kW Savings	Realization Rate
5	2,881.91	3,245.01	113%
4	5,098.78	4,900.38	96%
3	6,899.99	7,891.20	114%
2	5,140.63	5,397.56	105%
1	1,442.92	1,442.66	100%
Total	21,464.23	22,876.81	107%

Table 5-15 Expected and Gross Realized Peak kW Savings for Motors and Drives Program

Stratum	Ex Ante Peak kW Savings	Ex Post Peak kW Savings	Realization Rate
3	1,158.63 4,262.50	269.18	24 23%
2	197.34 190.53	404.32 105.20	53 55%
1	68.78	29.38	43%
Total	1,417.94 4,528.62	402.88 403.76	26 28%

Table 5-16 Expected and Gross Realized Peak kW Savings for Government Lighting Program

Stratum	Ex Ante Peak kW Savings	Ex Post Peak kW Savings	Realization Rate
4	30.28	27.73	92%
3	26.65	26.82	101%
2	42.82	42.29	99%
1	24.93	25.21	101%
Total	124.68	122.05	98%

5.1.4 Discussion of Gross Savings Analysis

The project realization rates were reviewed to assess whether there were factors that were causing systematic differences in the realization rates. An analysis was conducted to determine whether realization rates for projects differed systematically by

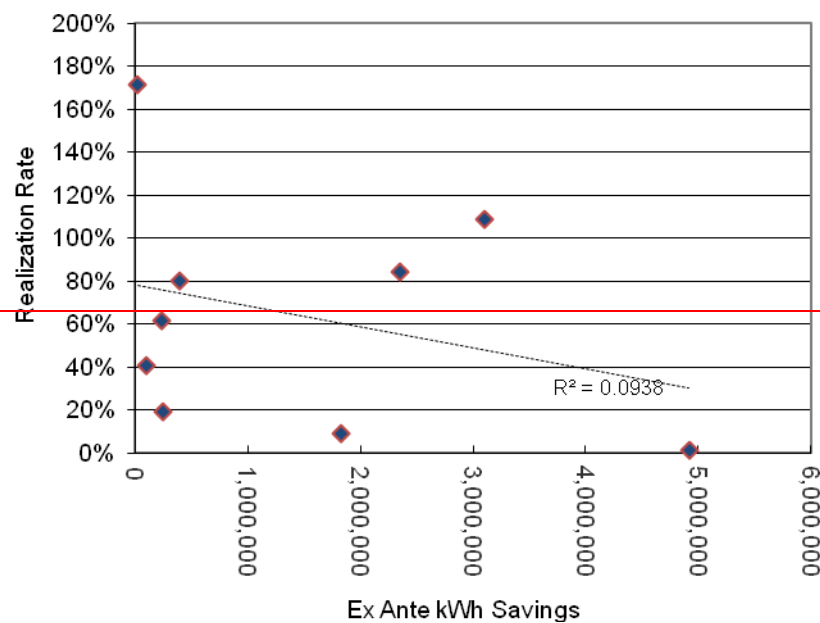
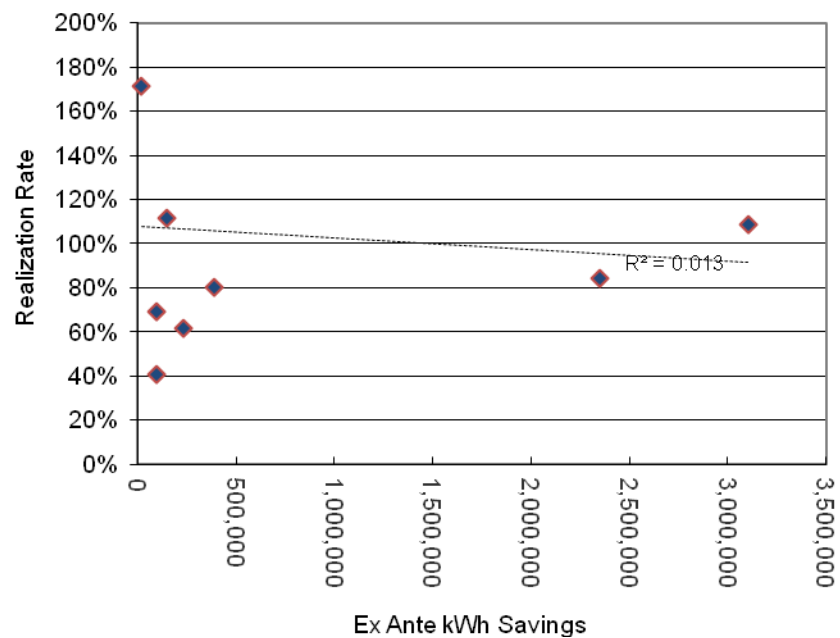
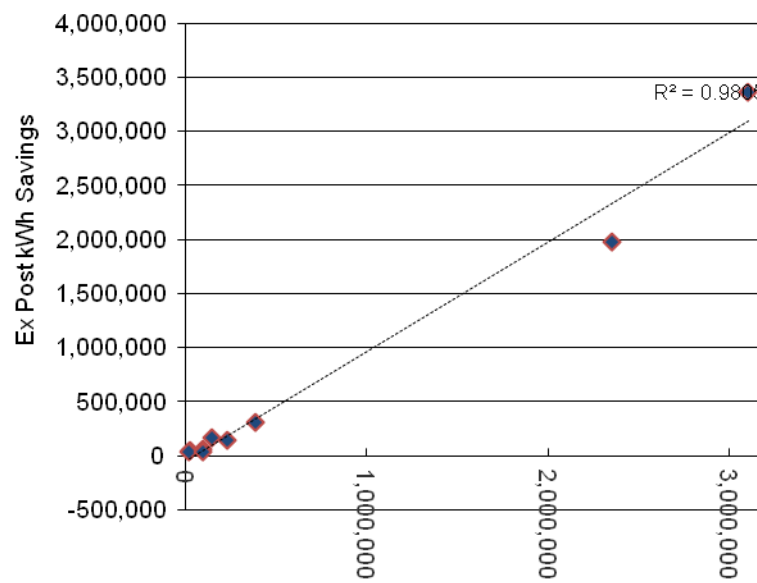
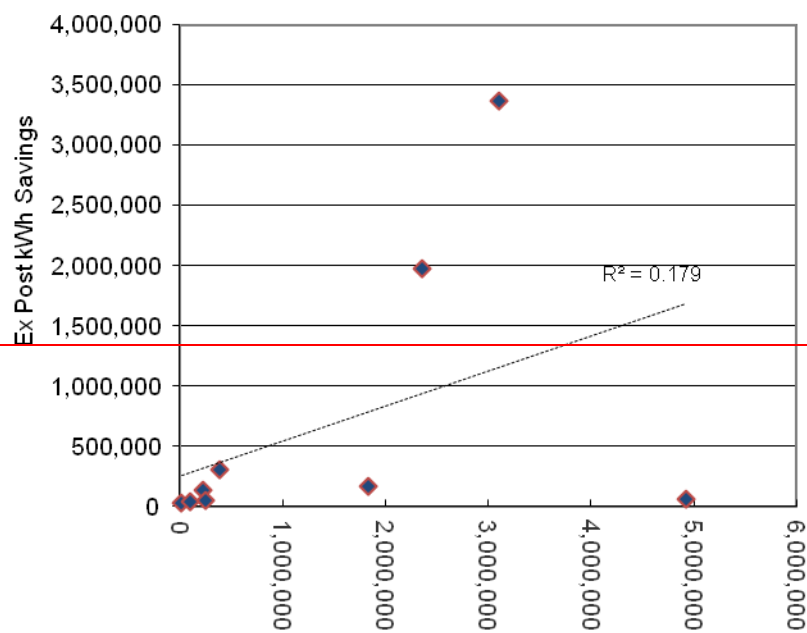


Figure 5-5 Sample Project Realization Rate versus Expected kWh Savings for Motors and Drives Program



Ex Ante kWh Savings



Ex Ante kWh Savings

Figure 5-6 Sample Project Realized kWh Savings versus Expected kWh Savings for Motors and Drives Program

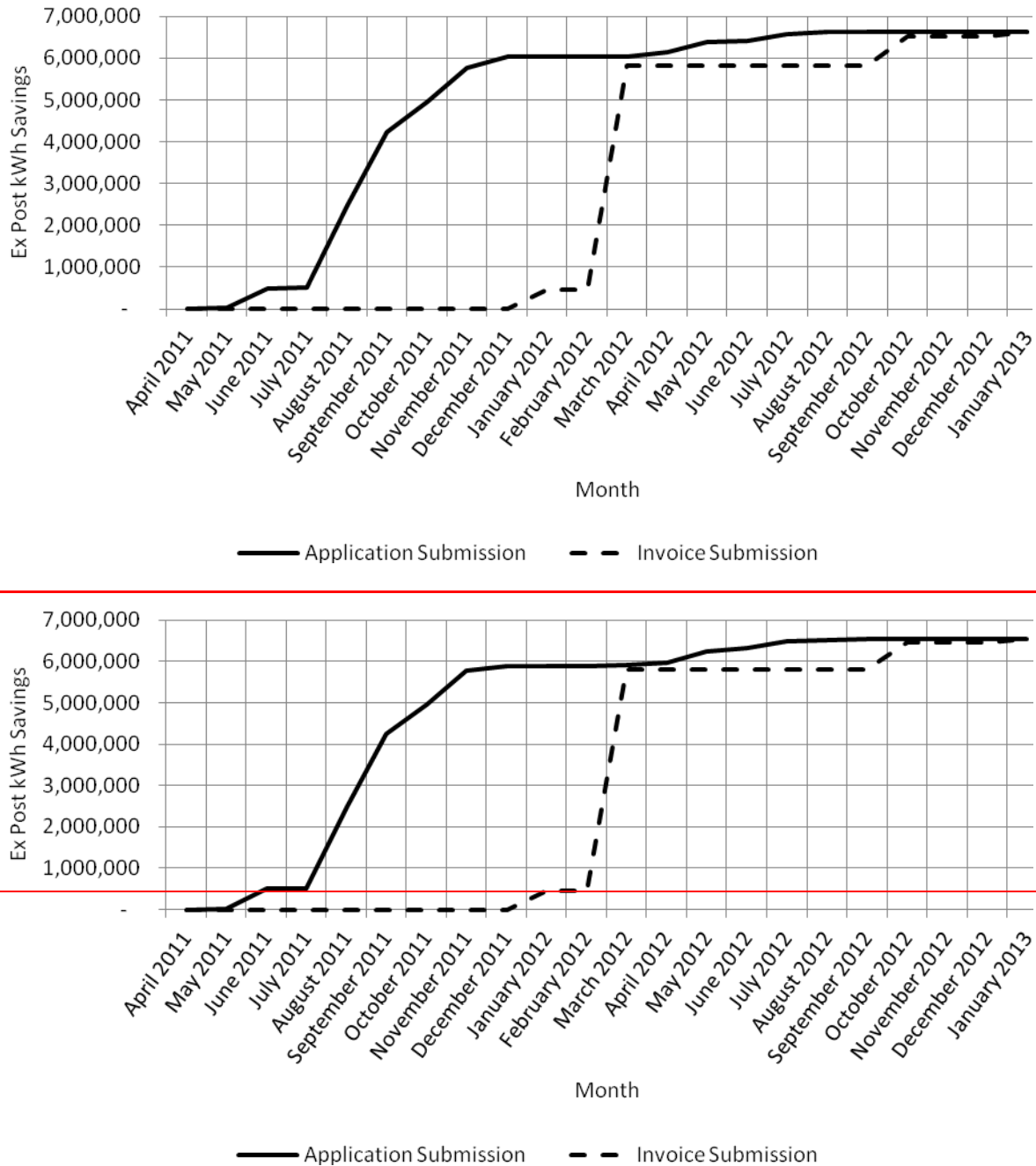


Figure 5-11 Cumulative Savings Associated with Application and Invoice Submissions by Month during 2012 for Motors and Drives Program

<i>Equipment Type</i>	<i>Number of Applications</i>	<i>Average</i>	<i>Median</i>	<i>Range</i>
Standard Lighting	184	\$867	\$535	\$10 - \$3,000
HVAC	12	\$588	\$400	\$250 - \$1,500
Refrigeration and Food Service	1	\$250	\$250	\$250 - \$250
Specialty Equipment	1	\$250	\$250	\$250 - \$250
Custom	48	\$11,505	\$5,655	\$441 - \$98,025
Motors and Drives	13	\$1,736	\$1,395	\$70 - \$5,075
All Equipment Types	1471	\$4,830	\$2,135	\$10 - \$208,896

Table 5-21 Motors and Drives Program Incentive Characteristics by Equipment Type

<i>Equipment Type</i>	<i>Number of Applications</i>	<i>Average</i>	<i>Median</i>	<i>Range</i>
Motors and Drives	16	\$10,044 <u>\$6,317</u>	\$2,349 <u>\$2,105</u>	\$1,050 - \$41,796 <u>\$950 - \$37,500</u>

Table 5-22 Government Lighting Program Incentive Characteristics by Equipment Type

<i>Equipment Type</i>	<i>Number of Applications</i>	<i>Average</i>	<i>Median</i>	<i>Range</i>
Traffic Signal	63	\$647	\$470	\$200 - \$13,565

Customer survey responses also support the importance of high payback measures among participants. As shown in Table 5-23 and Table 5-24, the majority of customers reported using simple payback to evaluate the implementation of efficiency measures and as displayed in Figure 5-13, participants required relatively short periods with less than one-third of respondents indicating that their required payback period exceeded three years.

Table 5-23 Financial Methods to Evaluate Energy Efficiency Improvements, Large Enterprise Equipment Programs

	<i>Response</i>	<i>(n=67)</i>	<i>Percent of Respondents</i>	<i>Percent of Ex Post kWh Savings</i>
Which financial methods does your organization typically use to evaluate energy efficiency improvements for this facility?	Initial Cost	30	45%	28%
	Simple payback	49	73%	82%
	Internal rate of return	24	36%	31%
	Life cycle cost	24	36%	18%
	None of these	0	0%	0%
	Don't know	1	1%	4%

Table 5-24 Financial Methods to Evaluate Energy Efficiency Improvements, Small Enterprise Equipment Programs

of the program activity. These findings suggest that the program activity is being generated by a different mix of facility types.



Figure 5-14 Projects by Facility Type, Large (Left Side) and Small (Right Side) Enterprise Equipment Program

- **Savings Calculations for Motor and Drives Projects:** The overall realization rate for Motors and Drives Program projects was ~~47~~93%. ADM staff noted that the project documentation did not include the calculations used to estimate ex ante savings for many of the completed projects. Without calculations it was difficult to determine specifically why the realization rate was low for the projects completed. It is recommended that calculations used to estimate savings from motor and drive projects are included in the project documentation. Providing calculations for savings estimates will allow engineering staff to identify why realization rates are low to improve the estimation of ex ante savings.

Appendix A: Required Savings Tables

This appendix contains annualized gross kWh savings, first year gross kWh savings, and peak demand savings for the Large Enterprise Equipment Program, the Small Enterprise Equipment Program, the Motors and Drives Program, and the Government Lighting Program.

Table A-1 Gross Savings by Program

<i>Program</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Realization Rate</i>	<i>Ex Ante Peak kW Savings</i>	<i>Ex Post Peak kW Savings</i>	<i>Realization Rate</i>
Large Enterprise	93,218,469	96,593,825	104%	11,460	13,497	118%
Small Enterprise	115,436,084	105,367,329	91%	21,464	22,877	107%
Motors & Drives	7,117,483 43,845,460	6,634,855 6,544,372	4793%	1,418 4,529	403,404	2628%
Government	1,092,169	1,069,080	98%	125	122	98%
Total	216,864,204 223,592,184	209,665,090 209,574,607	9497%	34,577,466	36,899,900	107%

Table A-2 Summary of Annualized kWh Savings for Large Enterprise Equipment Program

<i>Operating Company</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Realization Rate</i>
CEI	22,866,952	25,141,027	110%
OE	53,497,996	54,764,404	102%
TE	16,853,521	16,688,394	99%
Total Companies	93,218,469	96,593,825	104%

Table A-3 Summary of Annualized Peak kW Savings for Large Enterprise Equipment Program

<i>Operating Company</i>	<i>Ex Ante Peak kW Savings</i>	<i>Ex Post Peak kW Savings</i>	<i>Realization Rate</i>
CEI	2,715.30	3,526.04	130%
OE	6,698.34	7,758.56	116%
TE	2,045.92	2,212.80	108%
Total Companies	11,459.57	13,497.40	118%

Table A-4 Summary of First Year Pro Rata kWh Savings for Large Enterprise Equipment Program

<i>Operating Company</i>	<i>First Year Ex Post Pro Rata kWh Savings</i>
CEI	15,344,743
OE	29,348,992
TE	12,151,016

Table A-9 Summary of Lifetime kWh Savings for Small Enterprise Equipment Program

Operating Company	Lifetime Ex Post kWh Savings
CEI	753,125,085
OE	656,599,485
TE	170,785,380
Total Companies	1,580,509,950

Table A-10 Summary of Annualized kWh Savings for Motors and Drives Program

Operating Company	Ex Ante kWh Savings	Ex Post kWh Savings	Realization Rate
CEI	735,251	526,177	72%
OE	5,454,324	5,345,533	98%
TE	927,908 7,655,885	763,145 672,662	982%
Total Companies	7,117,483 13,845,460	6,634,855 6,544,372	4793%

Table A-11 Summary of Annualized Peak kW Savings for Motors and Drives Program

Operating Company	Ex Ante Peak kW Savings	Ex Post Peak kW Savings	Realization Rate
CEI	179.12	82.97	46%
OE	1,093.00	241.18	22%
TE	145.82 256.49	79.61 78.73	3455%
Total Companies	1,417.94 1,528.62	403.76 402.88	2628%

Table A-12 Summary of First Year Pro Rata kWh Savings for Motors and Drives Program

Operating Company	First Year Ex Post Pro Rata kWh Savings
CEI	517,606
OE	2,145,902
TE	623,005 701,933
Total Companies	3,286,513 3,365,441

Table A-13 Summary of Lifetime kWh Savings for Motors and Drives Program

Operating Company	Lifetime Ex Post kWh Savings
CEI	4,830,305
OE	49,071,993
TE	7,005,671

<i>Operating Company</i>	<i>Lifetime Ex Post kWh Savings</i>
	6,175,037
Total Companies	60,907,969 60,077,335

Table A-14 Summary of Annualized kWh Savings for Government Lighting Program

<i>Operating Company</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Realization Rate</i>
CEI	134,960	134,887	100%
OE	957,208	934,193	98%
TE	-	-	-
Total Companies	1,092,169	1,069,080	98%

Table A-15 Summary of Annualized Peak kW Savings for Government Lighting Program

<i>Operating Company</i>	<i>Ex Ante Peak kW Savings</i>	<i>Ex Post Peak kW Savings</i>	<i>Realization Rate</i>
CEI	15.41	15.40	100%
OE	109.27	106.66	98%
TE	-	-	-
Total Companies	124.68	122.05	98%

Table A-16 Summary of First Year Pro Rata kWh Savings for Government Lighting Program

<i>Operating Company</i>	<i>First Year Ex Post Pro Rata kWh Savings</i>
CEI	53,585
OE	708,000
TE	-
Total Companies	761,585

Table A-17 Summary of Lifetime kWh Savings for Government Lighting Program

<i>Operating Company</i>	<i>Lifetime Ex Post kWh Savings</i>
CEI	2,023,305
OE	14,012,895
TE	-
Total Companies	16,036,200