

Evaluation of Illinois Energy Now Public Sector Retro-Commissioning Program

June 2012 through May 2013

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Executive Summary

This report presents the results of the impact and process evaluations of the Public Sector Retro-Commissioning Program that the Illinois Department of Commerce and Economic Development (DCEO) offers to public sector entities in Illinois. This report presents evaluation results for activity during electric program year five and natural gas program year two (EPY5/GPY2), the period from June 2012 through May 2013.

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

- Data for the study were collected through review of program materials, as well as interviews with program implementation staff members, participants, and retro-commissioning service providers. Based on data provided by DCEO and its program implementation partner, a sample design was developed for on-site data collection. Samples were drawn for both the electricity and natural gas components that provide savings estimates with $\pm 10\%$ precision at the 90% confidence level for each component.
- An analytical desk review was performed to verify gross savings estimates.

The realized gross energy savings of the Retro-Commissioning Program during the period June 2012 through May 2013 are summarized in Table ES-1. During this period, realized gross energy savings totaled 11,442,146 kWh. The gross realization rate for the program is 94%. During this period, realized net energy savings also totaled 10,633,225 kWh. The net-to-gross ratio for the program is 93%.

Table ES-1 Summary of Gross kWh Savings for Retro-Commissioning Program

Utility	Expected kWh Savings	Realized Gross kWh Savings	Gross Realization Rate	Realized Net kWh Savings	Net to Gross Ratio
Ameren	1,097,597	1,714,495	156%	1,593,286	93%
ComEd	11,045,292	9,727,651	88%	9,039,939	93%
Total	12,142,889	11,442,146	94%	10,633,225	93%

The realized gross peak kW reductions of the Retro-Commissioning Program during the period June 2012 through May 2013 are summarized in Table ES-2. The achieved gross peak demand savings for the program are 1,515.07 kW. The achieved net peak demand savings for the program are also 1,515.07 kW.

Table ES-2 Summary of Gross Peak kW Savings for Retro-Commissioning Program

Utility	Realized Gross Peak kW	Realized Net Peak kW
Ameren	90.12	90.12
ComEd	1,424.95	1,424.95
Total	1,515.07	1,515.07

The realized gross therms reductions of the Retro-Commissioning Program during the period June 2012 through May 2013 are summarized in Table ES-3. The achieved gross therms savings

for the program are 870,039 therms. The achieved net therm savings for the program are 792,788.

Table ES-3 Summary of Gross Therm Savings for Retro-Commissioning Program

<i>Utility</i>	<i>Expected Therm Savings</i>	<i>Realized Gross Therm Savings</i>	<i>Gross Realization Rate</i>	<i>Realized Net Therm Savings</i>	<i>Net to Gross Ratio</i>
Ameren	51,896	75,794	146%	69,065	91%
Nicor	346,831	313,507	90%	285,671	91%
North Shore	137,440	145,113	106%	132,229	91%
Peoples	430,851	335,624	78%	305,824	91%
Total	967,018	870,039	90%	792,788	91%

Since its initial launch, the Retro-Commissioning Program has continued to develop and improve the efficiency of public sector buildings in Illinois. Program participants and service providers are generally satisfied with the program and program staff members have implemented ways to improve operations.

The following presents a selection of key evaluation findings:

- **High Level of Program Activity:** Program staff reported that the program year was successful. The number of completed projects more than doubled from the prior year, and expected electric savings were nearly twice the expected savings from the prior year. Additionally, EPY5/GPY2 marks the first year that the program realized natural gas savings from studies initiated during natural gas program year one.
- **Continued Demand for the Retro-Commissioning Program:** Program staff indicated that there was significant demand for the program and noted that there are more public entities interested in completing retro-commissioning project than can be funded with the current program budget. Furthermore, service providers indicated that demand for retro-commissioning was either remaining steady or growing as awareness of the potential energy savings increases.
- **Barriers to Program Participation:** Despite the demand for the program, service providers noted some barriers to participation. Service providers indicated that the \$10,000 commitment can prevent some organizations from participating in the program. This spending requirement may be particularly problematic for decision makers who have little knowledge of the potential energy benefits from retro-commissioning. Another barrier noted by service providers is that the facility staff members who are aware of energy inefficiencies at their facilities are often not the same individuals with the authority to commit the organization to participating in the program.

Participant survey responses indicated that public sector facilities typically have one or two individuals that make decisions about energy efficiency improvements. A key factor for the successful promotion of the program by service providers is that their facility contacts are the

individuals with the authority to commit the facility. Service providers noted that not having the correct contact can be a barrier to program participation.

Other barriers to program participation noted by service providers include a lack of facility staff resources to dedicate to the project, and resistance to allowing outsiders into the facility to complete the study.

- **Spending Commitment may Effectively Limit Investments in Efficiency for Some Participants:** One of the strengths of the program for gaining participation is that participants receive the retro-commissioning services in exchange for a relatively modest commitment to spend \$10,000 on energy efficiency improvements identified through the study. This incentive design likely appeals to public sector entities that often cite limited energy efficiency improvement budgets as a barrier to implementation. However, some service providers noted that for some participants, the \$10,000 spending requirement effectively acts as a cap on the facility's expenditures. That is, although considerably more than \$10,000 worth of efficiency improvements may be identified in a study, some participants are only interested in spending as much as is required by the program. Participation data supports this observation as a number of projects saw a relatively small share of the recommended savings implemented. Studies of larger scope for which only a small share of the recommended improvements are implemented create inefficiencies for the program. In these cases, the scope of the retro-commissioning study, and consequently its cost, may be disproportionate to the amount participants' are intending to spend on the improvements.
- **Program Marketing is Adequate Given Current Program Budget:** The program has seen sufficient activity to commit all of the program's budget, and funds from supplementary requests, to retro-commissioning projects. The ability to fully utilize its budget suggests that the program marketing is sufficient given its current level of funding.

However, additional attention to program marketing will likely be needed should the program expand. In particular, the level of promotion by service providers may not be sufficient to drive additional program activity. Approximately half of the interviewed service providers indicated that they did not expend much effort in promoting the program. Additionally, most surveyed participants heard of the program from a source other than the service providers. Although the program is promoted by program staff, service providers are critical to the promotion of the program and some may not be fully engaged in this effort.
- **Service Providers Noted Few Program Administration Problems:** Service providers were generally satisfied with the retro-commissioning program and noted few problems with how the program is administered. Service providers noted that the approval process was quick in comparison to other retro-commissioning programs they had worked with and that the reporting requirements are similar to other programs, although they are more structured. Service providers also stated that program staff is knowledgeable and responsive to inquiries. Service providers who were new to the program stated that the training provided on program structure and operation was useful.

However, service providers did provide some suggestions for improving the administration of the program. Some of these suggestions included focusing on reporting content rather than format and keeping reporting requirements consistent over time. However, the suggestions regarding changes to the reporting content likely reflect program staff's attempts to streamline and improve the program. Additionally, some service providers indicated a preference to receive compensation earlier in the process because of the large amount of preparatory work that occurs before the first invoice can be submitted. Program staff recently instituted a change that allows service providers to submit monthly invoices for projects. This change went into effect during EPY6/GPY3.

- **Participants Satisfied with the Program and the Participation Process:** From the participant perspective, the program appears to be operating well. All of the participant survey respondents indicated that they were very satisfied with the program overall. Additionally, all of the respondents were very satisfied with the professionalism of the service providers. Few participants noted problems with the participation process. However, a few issues were noted regarding contractors' implementation of the recommended measures. These included contractors' reluctance to implement one of the recommended measures and contractors failing to install some of the equipment detailed in the selected recommendations. Overall, these comments were the exception rather than the rule and do not suggest systematic problems with the program.

Overall the Retro-Commissioning Program is operating effectively and delivering energy savings for the DCEO. However, the following recommendations may serve to further improve the program processes and capacity to deliver cost-effective savings.

- **Consider Balancing Spending Requirement with Savings Potential and Study Scope:** The relatively low participant spending requirement likely facilitates participation in the program. However, in some instances, large savings identified in the studies may be unrealized because participants are only required to spend \$10,000. In order to generate additional value from the studies, program staff should consider varying the spending commitment by a factor such as the facility size or its energy use intensity. Alternatively, program staff may consider offering prospective participants varying levels of financial commitments which would be tied to the scope of the retro-commissioning study. For example, the total allowed cost of the retro-commissioning will be set at one level for participants who commit to spending \$10,000, while the retro-commissioning study budget will be higher for participants who commit to spending \$50,000.
- **Consider offering Retro-Commissioning Training to Service Providers:** Some service providers noted interest in additional training on completing retro-commissioning studies. Given the depth of SEDAC's expertise, program staff may consider offering training on special topics related to identifying energy savings in retro-commissioning studies, or hosting events where service providers can meet and discuss best practices. Prior to offering any training, it is recommended that the program staff perform a thorough analysis of service providers' specific training needs. This will assist in developing a tailored training that will be useful to service providers.

- **Provide Additional Information on Savings Potential:** Some service providers noted that the \$10,000 spending commitment may prevent some of their prospective customers from participating because they have to commit to the spending requirement before knowing what their energy savings will be. Although the program has a brochure that identifies the typical savings for a retro-commissioning project, program staff may consider providing information about the savings that are typically realized for a \$10,000 investment. Additionally, as more facilities complete retro-commissioning studies, it may be possible for the program to develop more tailored materials that provide estimated savings by facility type, size, energy use intensity, or other factors. This additional information may help reduce potential participants' uncertainty about agreeing to the \$10,000 commitment.
- **Potential for Expanded Scope of Program:** Given program staff and service provider observations about the level of demand for this program, there is potential for generating additional savings through the Retro-Commissioning Program. However, such a change in program scope would have to be considered in the context of several factors including the need for greater promotional efforts from service providers, the potential for greater efficiencies in the achievement of savings as previously discussed, and the ability of the retro-commissioning program to deliver energy savings that are at least as cost effective as what could be achieved through other programs in DCEO's portfolio.

1. Introduction

This report presents the results of the impact and process evaluations of the Public Sector Retro-Commissioning Program that DCEO offers to public sector entities in Illinois. The report presents results of the program for activity during electric program year five and natural gas program year 2 (EPY5/GPY2), the period from June 2012 through May 2013.

1.1 Description of Program

The Retro-Commissioning Program offered by DCEO was designed to help public sector entities identify and implement energy saving projects through the completion of retro-commissioning studies. The program funds the full cost of the retro-commissioning studies in exchange for a commitment from participants to implement at least \$10,000 worth of energy efficiency improvements.

During EPY5/GPY2 the period June 2012 through May 2013, there were 34 retro-commissioning incentive projects in the program which were expected to provide savings of 12,142,889 kWh and 976,018 therms.

1.2 Overview of Evaluation Approach

The overall objective for the impact evaluation of the Retro-Commissioning Program was to determine the gross and net energy savings and peak demand (kW) reductions resulting from program projects implemented during EPY5/GPY2.

The approach for the impact evaluation had the following main features.

- Available documentation (e.g., audit reports, invoices, savings calculation work papers, etc.) was reviewed for projects, with particular attention given to the calculation procedures and documentation for savings estimates.
- Gross savings were verified via analytical desk review.
- A participant survey was conducted from a sample of program participants to gather information on their decision making, their likes and dislikes of the program, and factors determining net-to-gross savings ratios for the program.

1.3 Organization of Report

This report on the impact and process evaluation of the Retro-Commissioning Program for the period June 2012 through May 2013 is organized as follows:

- Chapter 2 presents and discusses the analytical methods and results of estimating gross savings for measures implemented under the program.
- Chapter 3 presents and discusses the analytical methods and results of estimating program net savings.

- Chapter 4 presents and discusses the analytical methods and results of the process evaluation of the program.
- Chapter 5 presents evaluation conclusions and recommendations for the program.
- Appendix A provides a copy of the questionnaire used for the survey of participant decision makers.
- Appendix B presents the results from the survey of participant decision makers.
- Appendix C provides a copy of the questionnaire used for the survey of retro-commissioning service providers.

2. Estimation of Gross Savings

This chapter addresses the estimation of gross kWh, peak kW and therm reductions resulting from measures installed in facilities of participants that obtained incentives under the Retro-Commissioning Program during electric program year five and natural gas program year two (EPY5/GPY2), the period June 2012 through May 2013. Section 2.1 describes the methodology used for calculating gross savings. Section 2.2 presents the results from the calculation of gross savings.

2.1 Methodology for Estimating Gross Savings

2.1.1 Review of Documentation

The DCEO's program implementation partner provided documentation pertaining to the projects completed during EPY5/GPY2.

For each project, the available documentation (e.g., audit reports, savings calculation work papers, etc.) for each rebated measure was reviewed, with particular attention given to the calculation procedures and documentation for savings estimates. Documentation that was reviewed for all projects included program forms, data bases, reports, billing system data, weather data, and any other potentially useful data. Each application was reviewed to determine whether the following types of information had been provided:

- Documentation for the energy efficiency improvements, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information
- Information about the savings calculation methodology, including (1) what methodology was used, (2) specifications of assumptions and sources for these specifications, and (3) correctness of calculations

2.1.2 Sampling Plan

Data used to estimate the gross savings achieved through the Public Sector Retro-Commissioning Program were collected for samples of projects completed during the period June 2012 through May 2013.

Data provided by the program implementer showed that during the period June 2012 through May 2013, there were 34 RCx projects, which were expected to provide savings of 12,142,889 kWh and 967,018 therms. Inspection of expected kWh and therm savings for individual projects provided 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 component is based on a ratio estimation procedure, which allows precision/confidence requirements to be met with a smaller sample size. For both electricity and natural gas the actual precision is $\pm 10.0\%$ at 90% confidence.

Table 2-1 shows the number of projects and expected savings for the electric savings sample by stratum. Table 2-2 shows the number of projects and expected savings for the natural gas savings sample by stratum.

Table 2-1 Population Statistics Used for Sample Design for kWh and kW Savings Components

	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Totals</i>
Strata boundaries (kWh)	<20,000	20,000-70,000	>70,000	
Number of projects	19	10	5	34
Total kWh savings	2,064,478	3,963,552	6,114,859	12,142,889
Average kWh Savings	108,657	396,355	1,222,972	357,144
Standard deviation of kWh savings	61,572	150,434	918,892	510,086
Coefficient of variation	0.567	0.380	0.751	1.428237635
Final design sample	6	5	5	16

Table 2-2 Population Statistics Used for Sample Design for Therm Savings Component

	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Totals</i>
Strata boundaries (Therms)	<20,000	23,800-70,000	>70,000	
Number of projects	17	7	3	27
Total Therm savings	168,347	263,289	535,382	967,018
Average Therm Savings	9,903	37,613	178,461	35,815
Standard deviation of Therms savings	7,953	13,263	147,700	67,419
Coefficient of variation	0.803	0.353	0.828	1.882397551
Final design sample	6	5	3	14

As shown in Table 2-3, the sample projects account for approximately 72% the expected kWh savings, while, as shown in Table 2-4, the sample projects account for approximately 87% of standard incentive expected therm savings.

Table 2-3 Expected Savings for kWh and kW Incentives Sampled Projects by Stratum

<i>Stratum</i>	<i>Sample Expected Savings</i>	<i>Total Expected Savings</i>	<i>Percent of Ex Ante kWh Savings in Sample</i>
3	6,114,859	6,114,859	100%
2	2,016,693	3,963,552	51%
1	565,926	2,064,478	27%
Total	8,697,478	12,142,889	72%

Table 2-4 Expected Savings for Therm Incentives Sampled Projects by Stratum

<i>Stratum</i>	<i>Sample Expected Savings</i>	<i>Total Expected Savings</i>	<i>Percent of Ex Ante Therm Savings in Sample</i>
3	535,382	535,382	100%
2	229,205	263,289	87%
1	81,044	168,347	48%
Total	845,631	967,018	87%

2.1.3 Analytical Desk Review

If there was uncertainty regarding a project, or apparently incomplete project documentation, ADM staff contacted the implementation contractor to seek further information.

Evaluation staff reviewed the energy savings algorithms to verify that the assumptions were reasonable and the algorithm was correct for assigning ex ante gross kWh, kW and therm savings per measure.

2.1.4 Procedures for Estimating Savings from Measures Installed through Retro-Commissioning Projects

Savings estimation was based on ex ante estimates of gross savings (as reported in the project documentation and program tracking system) and the ex post gross savings were developed through ADM's analysis.

Energy savings realization rates¹ were calculated for each sampled project. Projects with relatively high or low realization rates were further analyzed to determine the reasons for the discrepancy between expected and realized energy savings.

2.2 Results of Gross Savings Estimation

To estimate gross kWh savings, peak kW and therm reductions of the program, data were collected and analyzed for the sample electric savings sample of 16 projects and the natural gas savings sample of 14 projects. The data were analyzed using the methods described in Section 2.1 to estimate project energy savings, peak kW reductions and therm reductions, and to determine realization rates for the program. The results of that analysis are reported in this section.

¹ The savings realization rate for a project is calculated as the ratio of the achieved savings for the project to the expected savings (as determined through the project application procedure and recorded in the tracking system for the program).

2.2.1 Realized Gross kWh Savings

The gross kWh savings of the Retro-Commissioning Program during the period June 2012 through May 2013 are summarized in Table 2-5. Overall, the achieved gross savings of 11,442,146 kWh were equal to 94% of the expected savings.

Table 2-5 Expected and Gross Realized kWh Savings for Retro-Commissioning Program

<i>Utility</i>	<i>Expected kWh Savings</i>	<i>Realized Gross kWh Savings</i>	<i>Gross Realization Rate</i>
Ameren	1,097,597	1,714,495	156%
ComEd	11,045,292	9,727,651	88%
Total	12,142,889	11,442,146	94%

2.2.2 Realized Gross Peak kW Savings

The realized gross peak kW reductions of the Retro-Commissioning Program during the period June 2012 through May 2013 are shown in Table 2-6. The achieved gross peak demand savings for the program are 1,515.07 kW which are 244% of expected savings.

Table 2-6 Expected and Gross Realized Peak kW Savings for Retro-Commissioning Program

<i>Utility</i>	<i>Expected kW Savings</i>	<i>Realized Gross kW Savings</i>	<i>Gross Realization Rate</i>
Ameren	37.00	90.12	244%
ComEd	585.00	1,424.95	244%
Total	622.00	1,515.07	244%

2.2.3 Realized Gross Therm Savings

The realized gross therm reductions of the Retro-Commissioning Program during the period June 2012 through May 2013 are shown in Table 2-7. The achieved gross savings for the program are 870,039 therms, which are 90% of expected savings.

Table 2-7 Expected and Gross Realized Therm Savings for Retro-Commissioning Program

<i>Utility</i>	<i>Expected Therm Savings</i>	<i>Realized Gross Therm Savings</i>	<i>Gross Realization Rate</i>
Ameren	51,896	75,794	146%
Nicor	346,831	313,507	90%
North Shore	137,440	145,113	106%
Peoples	430,851	335,624	78%
Total	967,018	870,039	90%

2.2.4 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.

Table 2-8 below displays explanations for differences between project level ex ante and ex post gross savings calculations.

Table 2-8 Project-Level Gross Realized Savings Analysis Results

Project	Measure	Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Ante kW	Ex Post kW	Realization Rate	Ex Ante therms	Ex Post therms	Realization Rate	Analysis Notes
Project 1	Day light controls	184,262	116,708	63%	21.00	3.39	16%	(2,075)	-	0%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
	Demand controlled ventilation	56,694	78,844	139%	6.00	2.86	48%	10,260	-	0%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
	Fan schedules	379,928	400,347	105%	-	56.32	-	8,601	46,908	545%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
	Lighting schedule controls	72,087	89,510	124%	-	-	0%	(812)	-	0%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
	Operational checklist	99,099	40,470	41%	11.00	0.15	1%	17,101	-	0%	Several aspects of the savings for this measure are included in the other AHU measures and was double counted by the implementer
	Outside air temperature controls	46,093	-	0%	5.00	-	0%	17,101	-	0%	This measure is considered maintenance
	Supply air temperature reset	62,660	94,631	151%	-	4.13	-	9,266	335	4%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.

<i>Project</i>	<i>Measure</i>	<i>Ex Ante kWh</i>	<i>Ex Post kWh</i>	<i>Realization Rate</i>	<i>Ex Ante kW</i>	<i>Ex Post kW</i>	<i>Realization Rate</i>	<i>Ex Ante therms</i>	<i>Ex Post therms</i>	<i>Realization Rate</i>	<i>Analysis Notes</i>
Project 2	AHU scheduling and optimum start	101,946	121,539	119%	-	47.53	-	1,672	-	0%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
	BAS network, misc. repair	29,210	-	0%	-	-	-	2,267	-	0%	Savings for this measure are included in the other measures as the implemented control strategies will not operate properly if there are communication errors within the BAS.
	Facility vacation scheduling	130,000	91,840	71%	-	12.85	-	1,008	2,935	291%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
	Outdoor air damper schedule (make sure they close completely)	972	-	0%	-	-	-	9,586	-	0%	Savings for this measure are included in the other AHU measures and was double counted by the implementer.
	Unoccupied classroom temperature setback	20,548	46,570	227%	-	10.93	-	1,876	2,498	133%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
	Unoccupied classroom ventilation turn off	58,840	25,698	44%	7.00	6.26	89%	12,206	17,862	146%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
Project 3	Chilled water/discharge air temperature reset, duct static pressure reduction	106,440	98,451	92%	-	16.70	-	4,840	3,007	62%	The ex-ante doesn't account for interactive effects.

<i>Project</i>	<i>Measure</i>	<i>Ex Ante kWh</i>	<i>Ex Post kWh</i>	<i>Realization Rate</i>	<i>Ex Ante kW</i>	<i>Ex Post kW</i>	<i>Realization Rate</i>	<i>Ex Ante therms</i>	<i>Ex Post therms</i>	<i>Realization Rate</i>	<i>Analysis Notes</i>
	Implement enthalpy control of economizers	41,795	1,271	3%	-	0.18	-	-	88	-	Ex-Ante calculations assume no economizer as baseline. The baseline is a functional economizer with OA temp control. The savings are the result of dual enthalpy controls.
	Install occupancy sensors in storage rooms	17,820	14,134	79%	-	6.63	-	-	(226)	-	Ex-Ante calculations assume 6 hours per day reduction; whereas, the ex-post uses the TRM approach of 41% reduction of the actual hours. This approach comes to 3.8 hours. The ex-ante also doesn't account for interactive effects.
	Low flow shower head installation	20,171	20,111	100%	-	0.20	-	-	-	-	
	Unoccupied outdoor air damper control	-	4,367		-	-	-	2,935	-	0%	Savings are zero because the HVAC system is off during unoccupied periods.
Project 4	Boiler pump VFD enabled/schedule change	3,950	3,721	94%	15.00	-	0%	4,000	-	0%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
	Lighting schedule controls	52,170	33,545	64%	20.00	-	0%	4,080	-	0%	Therm savings are zero because reducing lighting will put larger load on heating system.
	Minimize VAV reheat (reset supply air temp and static pressure)	31,800	41,252	130%	-		0%	2,759		0%	Reducing OA quantity measure already implements strategy to limit CO2 levels through reducing OA, no interaction factor was considered in the Ex Ante analysis.
	New fan schedule	68,984	69,834	101%	-	-	-	-	15,710	-	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.

<i>Project</i>	<i>Measure</i>	<i>Ex Ante kWh</i>	<i>Ex Post kWh</i>	<i>Realization Rate</i>	<i>Ex Ante kW</i>	<i>Ex Post kW</i>	<i>Realization Rate</i>	<i>Ex Ante therms</i>	<i>Ex Post therms</i>	<i>Realization Rate</i>	<i>Analysis Notes</i>
	Reduce outside air quantity (10%)	15,900	19,822	125%	-	1.93	-	(445)	3,930	-883%	Therm savings include VAV reheat reduction through interaction effects.
Project 5	Chilled water temperature reset	15,861	27,501	173%	15.00	5.03	34%	4,000	-	0%	There should be no therm savings for this site as the building is all electric as there is no natural gas equipment on site.
	fix OA air dampers	694,499	608,365	88%	-	6.32	-	(445)	-	0%	There should be no therm savings for this site as the building is all electric as there is no natural gas equipment on site.
	Occupied cooling temperature setpoint reset	35,937	43,708	122%	20.00	6.44	32%	4,080	-	0%	There should be no therm savings for this site as the building is all electric as there is no natural gas equipment on site.
Project 6	Demand controlled ventilation (Auditorium)	-	7,199	-	-	14.28	-	5,101	1,768	35%	Ex-ante calculations used average indoor, outdoor, and operating hours where Ex-post used TMY3 weather data and a simulated model.
	Demand controlled ventilation (Cafeteria)	10,486	72,310	690%	-	14.28	-	8,875	6,122	69%	Ex-ante assumptions not included however verbiage suggests overestimation of cafeteria occupancy throughout the day.
	Mixed air temperature reset and hot deck temperature reduction	-	6,268	-	-	0.35	-	9,936	1,973	20%	Savings are zero because the HVAC system is off during unoccupied periods.
	Static pressure control reset	14,427	19,173	133%	-	0.83	-	-	-	-	Ex-post used average static pressure reset based off screen shots of AHU static pressures.
Project 7	Demand controlled ventilation	-	51,766	-	-	12.09	-	2,508	40,623	1620%	Savings are zero because the HVAC system is off during unoccupied periods.
	Demand controlled ventilation (Auditorium)	-	6,390	-	-	0.34	-	3,502	2,035	58%	Savings are zero because the HVAC system is off during unoccupied periods.
	Recommission heat recovery unit	40,814	4,695	11.5%	-	2.16	0%	5,388	37	0.69%	Ex-ante analysis assumptions were not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the

<i>Project</i>	<i>Measure</i>	<i>Ex Ante kWh</i>	<i>Ex Post kWh</i>	<i>Realization Rate</i>	<i>Ex Ante kW</i>	<i>Ex Post kW</i>	<i>Realization Rate</i>	<i>Ex Ante therms</i>	<i>Ex Post therms</i>	<i>Realization Rate</i>	<i>Analysis Notes</i>
											discrepancy between the Ex-ante and Ex-post analysis.
Project 8	HTC fan powered box schedule	134,241	109,709	82%	-	-	-	-	26,259	-	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
Project 9	Enable economizer	1,213,298	30,485	3%	-	0.02	-	(12,881)	10,282	-80%	Prevents heating above 45F and cooling below 55F. RCx Plan states that the savings were based upon the following equation: $1.08 \times \text{CFM} \times (\text{DAT}_{\text{proposed}} - \text{DAT}_{\text{current}})$. This methodology assumes a change in the discharge air temperature which is an incorrect approach for calculating the savings for limiting heating and cooling availability.
	Expand economizer range	279,348	181,724	65%	-	54.07	-	-	119	-	Raised the economizer limit of the VAV systems from 55F to 70F. Ex-ante calculations used $1.08 \times \text{CFM} \times \text{DT}$ to calculate savings assuming a Chiller COP of 6.1. Did not provide the assumed OSA provided by the Economizer, therefore ex-ante analysis cannot be fully vetted.

<i>Project</i>	<i>Measure</i>	<i>Ex Ante kWh</i>	<i>Ex Post kWh</i>	<i>Realization Rate</i>	<i>Ex Ante kW</i>	<i>Ex Post kW</i>	<i>Realization Rate</i>	<i>Ex Ante therms</i>	<i>Ex Post therms</i>	<i>Realization Rate</i>	<i>Analysis Notes</i>
	Hot and cold deck temperature reset	936,455	1,113,316	119%	-	355.73	-	273,615	23,443	9%	Measure allows the Hot and Cold decks of the Multi-Zone air handlers to reset based on OSA. kWh savings was within reason for this measure, however the heating load seemed to be over predicted by a factor of 10. Airports have a high internal load due to the number of people, therefore it is expected that a majority of the savings would come from cold deck reset.
	Optimize bag room fan control	428,888	827,730	193%	78.00	71.85	92%	74,824	77,779	104%	Baggage AHU operation is now based upon OSA as opposed to 24/7 operation. Temperature bin analysis was utilized for the analysis assuming a boiler efficiency of 80% and desired supply T of 55F. Volumetric flow rates were based on details provided in the RCx report.
	Supply air temperature reset	-	291,526	-	-	(13.48)	-	12,266	1,918	16%	Savings are zero because the HVAC system is off during unoccupied periods.
Project 10	Discharge air temperature reset	25,486	50,321	197%	-	1.36	-	20,299	43,137	213%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
	Outside air damper position reset	24,040	17,855	84%	-	45.45	-	43,165	44,999	109%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.

Project	Measure	Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Ante kW	Ex Post kW	Realization Rate	Ex Ante therms	Ex Post therms	Realization Rate	Analysis Notes
	Replace chilled water control valves	173,018	-	0%	-	-	-	(113)	-	0%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
Project 11	Supply air temperature reset	57,615	41,080	71%	-	70.18	-	47,812	10,636	22%	Actual reset not known by site, common reset was used in the model.
Project 12	Advanced HVAC shutdown on Fridays	66,653	87,242	131%	-	-	-	8,444	6,489	77%	Actual shutdown may not be consistent every Friday due to activities requiring fan usage. No calculations given, all three measures were calculated together.
	Isolate unoccupied wings during weekends	412,487	80,372	19%	-	-	-	36,438	4,964	14%	Actual shutdown may not be consistent every Friday due to activities requiring fan usage. No calculations given, all three measures were calculated together.
	Optimize schedules	72,685	147,253	203%	-	4.51	-	4,502	1,160	26%	Actual schedule optimization is not consistent due to changing classes and activities. An average schedule was used for modeling.
Project 13	All Measures	409,914	387,798	94%	-	4.00	-	15,754	22,213	140%	Ex-ante analysis was not provided for this measure. This prohibits ADM from fully vetting the provided analysis and determining the discrepancy between the Ex-ante and Ex-post analysis.
Project 14	Adjust AHU runtime schedule	344,921	271,972	79%	-	99.24	-	11,603	53,561	462%	Ex-Ante calculations use assumed heating/cooling hours and delta t
	Mixed air temperature reset and hot deck temperature reduction	-	6,491	-	-	0.15	-	2,466	1,651	67%	Savings are zero because the HVAC system is off during unoccupied periods.
	Static pressure control reset	14,792	16,888	114%	-	0.64	-	-	(58)	-	
Project 15	Activate holiday schedule	31,900	90,872	285%	-	-	-	4,092	10,490	256%	Holiday schedule savings energy on both HVAC equipment and lightings

<i>Project</i>	<i>Measure</i>	<i>Ex Ante kWh</i>	<i>Ex Post kWh</i>	<i>Realization Rate</i>	<i>Ex Ante kW</i>	<i>Ex Post kW</i>	<i>Realization Rate</i>	<i>Ex Ante therms</i>	<i>Ex Post therms</i>	<i>Realization Rate</i>	<i>Analysis Notes</i>
	Optimize equipment scheduling	241,774	257,153	106%	-	-	-	29,615	127,862	432%	Baseline schedule runs everything on weekend where the optimized schedule don't run HVAC system on Saturday and Sunday.
	Repair hot and cold water valves	21,096	-	0%	7.00	-	0%	8,345	-	0%	This measure is a valid measure but not enough information is given to calculate the savings. Only one air handler unit was given as an example of the problem and even so, the project does provide what HVAC system is doing.
Project 16	Activate holiday schedule	38,911	93,231	240%	-	-	-	3,406	11,731	344%	Higher realization rate because the facility did not have holiday schedule and lighting and equipment ran during holidays.
	Optimize equipment scheduling	513,106	142,563	28%	3.00	-	0%	72,989	65,413	90%	Lower realization rate because the facility already had some schedule and the new "optimized" schedule isn't aggressive enough to save as much as it claimed.
Project 17	Demand controlled ventilation	3,074	534	17%	10.00	15.00	150%	14,345	8,258	58%	DCV was installed on place where BMS turns HVAC system ON or OFF as it is needed.

3. Estimation of Net Savings

This chapter reports the results from estimating the net impacts of the Retro-Commissioning Program during June 2012 through May 2013, where net savings represents the portion of gross savings achieved by program participants that can be attributed to the effects of the program.

3.1 Procedures Used To Estimate Net Savings

Net savings are defined as the portion of gross savings that can be attributed to the effects of the program. Net savings may be less than gross savings as a result of free ridership. Free riders of a program are defined as those participants that would have implemented the same energy efficiency measures and achieved the observed energy changes, even in the absence of the program.

In general, net savings can be considered to be gross savings less the impact of free ridership. That is, because the energy savings realized by free riders are not induced by the program, these savings should not be included in the estimates of the program's actual (net) impacts. Without an adjustment for free ridership, some savings that would have occurred naturally would be incorrectly attributed to the program.

ADM performed a net savings analysis to estimate the impacts of the energy efficiency measures attributable to the Retro-Commissioning Program that were net of free ridership. Information collected from a sample of program participants through a participant survey was used to estimate the extent of free ridership. Appendix A provides a copy of the survey instrument, and Appendix B presents tabulated responses for each survey question.

Based on a review of this information, the preponderance of evidence regarding free ridership inclinations was used to assess the likelihood of participant free ridership and in turn estimate net savings.

Several criteria were used for determining what portion, if any, of a participant's gross savings for a particular project should be attributed to free ridership. The first criterion was based on the response to the question: "Would your organization have been financially able to retro-commission the facility without the assistance from the Retro-Commissioning Program?" If a participant answered "No" to this question, a free ridership score of 0 was assigned to the project. That is, if a participant required assistance from the program in the form of a no-cost retro-commissioning service, then that participant was not considered to be a free rider.

For decision makers that indicated that they were able to undertake implemented energy efficiency projects without financial assistance from the program, three factors were analyzed to determine what percentage of savings may be attributed to free ridership. The three factors are:

- Plans and intentions of participant to perform the retro-commissioning without support from the program;

- Influence that the program had on the decision to perform the retro-commissioning; and
- A participant's previous experience with retro-commissioning.

For each of these factors, rules were applied to develop binary variables indicating whether or not a participant's behavior showed free ridership. These rules made use of answers to questions on the decision maker survey questionnaire. A copy of the questionnaire is provided in Appendix A.

The first factor required determining if a participant stated that his or her intention was to perform the retro-commissioning even without the program. The answers to a combination of several questions were used with a set of rules to determine whether a participant's behavior is indicative of free ridership. Two binary variables were constructed to account for participant plans and intentions: one, based on a more restrictive set of criteria that may describe a high likelihood of free ridership, and a second, based on a less restrictive set of criteria that may describe a relatively lower likelihood of free ridership.

The first, more restrictive criteria indicating participant plans and intentions that likely signify free ridership are as follows:

- The respondent answered "yes" to the following two questions: "Did you have plans to have this facility retro-commissioned before participating in the Retro-Commissioning Program?" and "Would you have gone ahead with this retro-commissioning even if you had not participated in the program?"
- The respondent answered "definitely would have" to the following question: "If the retro-commissioning service had not been provided at no cost through the program, how likely is it that you would have had the facility retro-commissioned anyway?"
- The respondent answered "no" in response to the following question: "How did the availability of information and the service incentive provided through the Retro-Commissioning Program affect the timing of the retro-commissioning project? Did you retro-commission the facility earlier than you otherwise would have without the program?"

The second, less restrictive criteria indicating participant plans and intentions that likely signify free ridership are as follows:

- The respondent answered "yes" to the following two questions: "Did you have plans to have this facility retro-commissioned before participating in the Retro-Commissioning Program?" and "Would you have gone ahead with this retro-commissioning even if you had not participated in the program?"
- Either the respondent answered "definitely would have" or "probably would have" to the following question: "If the retro-commissioning service had not been provided at no cost through the program, how likely is it that you would have had the facility retro-commissioned anyway?"

- Either the respondent answered “no” in response to the following question: “How did the availability of information and the service incentive provided through the Retro-Commissioning Program affect the timing of the retro-commissioning project? Did you retro-commission the facility earlier than you otherwise would have without the program?” or the respondent indicated that that while program information and financial incentives did affect the timing of project implementation, in the absence of the program they would have implemented the project within the next two years.

The second factor required determining if a participant reported that a recommendation from a Retro-Commissioning Program representative or past experience with the program was influential in the decision to implement the project.

The criterion indicating that program influence may signify a lower likelihood of free ridership is that either of the following conditions is true:

- The respondent answered “very important” to the following question: “How important was previous experience with the programs in making your decision to retro-commission the facility?”
- The respondent answered “yes” to the following question: “Did a Retro-Commissioning Program or other DCEO representative recommend that you retro-commission the facility?” and “probably would not have” or “definitely would not have” to the question: “If the Public Sector Retro-commissioning Program or other DCEO representative had not recommended that you retro-commission the facility, how likely is it that you would have done it anyway?”

The third factor required determining if a participant in the program indicated that he or she had previously implemented an energy efficiency measure similar to one that they implemented under the program without an energy efficiency program incentive during the last three years. A participant indicating that he or she had implemented a similar measure is considered to have a likelihood of free ridership.

The criteria indicating that previous experience may signify a higher likelihood of free ridership are as follows:

- The respondent answered “yes” to the following question: “Before participating in the Retro-Commissioning Program, had you completed similar retro-commissioning projects?”
- The respondent answered “yes” to the following question: “Has your organization completed any energy efficiency projects in the last three years for which you did not apply for a financial incentive through an energy efficiency program?”

The four sets of rules just described were used to construct four different indicator variables that address free ridership behavior. For each participant, a free ridership value was assigned based on the combination these variables. With the four indicator variables, there were 12 applicable combinations for assigning free ridership scores for each respondent, depending on the combination of answers to the questions creating the indicator variables. Table 3-1 shows these values.

Table 3-1 Free Ridership Scores for Combinations of Indicator Variable Responses

<i>Indicator Variables</i>				<i>Free Ridership Score</i>
<i>Had Plans and Intentions to Perform Retro-Commissioning without RCx Program? (Definition 1)</i>	<i>Had Plans and Intentions to Perform Retro-Commissioning without RCx Program? (Definition 2)</i>	<i>RCx Program had Influence on Decision to Perform Retro-Commissioning?</i>	<i>Had Previous Experience with Measure?</i>	
Y	N/A	Y	Y	100%
Y	N/A	N	N	100%
Y	N/A	N	Y	100%
Y	N/A	Y	N	67%
N	Y	N	Y	67%
N	N	N	Y	33%
N	Y	N	N	33%
N	Y	Y	Y	33%
N	Y	Y	N	0%
N	N	N	N	0%
N	N	Y	N	0%
N	N	Y	Y	0%

3.2 Results of Net Savings Estimation

The procedures described in the preceding section were used to estimate free ridership rates and net-to-gross ratios for the Retro-Commissioning Program for the period June 2012 through May 2013.

3.2.1 Realized Net kWh Savings

The data used to assign free ridership scores were collected through a participant survey of twelve participant decision makers for retro-commissioning projects completed during the period June 2012 through May 2013. The survey respondents were associated with projects that represented 56% of the natural gas savings and 59% of the electric savings. Individual free ridership rates were estimated for each respondent.

As discussed in Section 3.1, the first criteria used to determine what proportion of energy savings from a project should be assigned to free ridership was whether or not the participant was financially able to undertake the project without financial assistance from the Retro-Commissioning Program. If a decision maker respondent answered “No” to the question of “Would your organization have been financially able to retro-commission the facility without the assistance from the Retro-Commissioning Program?” a free ridership score of 0 was assigned to the project. That is, if a participant required financial assistance from the Retro-Commissioning Program to undertake a project, then that participant was determined not to be a free rider.

Under this criterion, the other free ridership scoring criteria were applied only to projects for participants who answered “Yes” to the question: “Would your organization have been financially able to retro-commission the facility without the assistance from the Retro-Commissioning Program?”

Table 3-2 shows the percentage of survey respondents who relayed the following: The participant had plans and intentions to perform the retro-commissioning without the assistance of the program (under two alternative definitions as described in the preceding section), the program influenced the participant's decision to perform the retro-commissioning, or that the participant previously performed retro-commissioning without a program incentive during the last three years. Percentages reported are averages weighted by project gross realized savings.

Table 3-2 Weighted Average Indicator Variable Values

<i>Savings Type</i>	<i>Had Financial Ability</i>	<i>Had Plans and Intentions to Perform Retro-Commissioning without RCx Program (Definition 1)</i>	<i>Had Plans and Intentions to Perform Retro-Commissioning without RCx Program (Definition 2)</i>	<i>RCx Program had Influence on Decision to Perform Retro-Commissioning</i>	<i>Had Previous Experience with Measure</i>
kWh	41%	0%	14%	15%	27%
Therm	36%	0%	18%	15%	31%

Table 3-3 shows percentages of total realized gross kWh savings that are associated with different combinations of free ridership indicator variable values. Fifty-nine percent of the savings is associated with respondents who indicated that they were financially unable to implement the project in the absence of the program incentive.

Table 3-3 Estimated Free ridership for kWh Savings from Projects

<i>Had Plans and Intentions to Retro-Commission Facility without Program (Definition 1)</i>	<i>Had Plans and Intentions to Retro-Commission Facility without Program (Definition 2)</i>	<i>Program had Influence on Decision to Retro-Commission Facility</i>	<i>Had Previous Experience with Measure</i>	<i>Percentage of Total Realized Gross kWh Savings</i>	<i>Free Ridership Score</i>
N	N	N	Y	8.5%	33.0%
N	Y	N	N	13.0%	33.0%
N	N	N	N	7.0%	0.0%
N	N	Y	Y	12.5%	0.0%
Required program incentive to implement measures.				59.1%	0.0%
Total				100.0%	7.1%

Table 3-4 shows percentages of total realized gross therm savings that are associated with different combinations of free ridership indicator variable values. Sixty-four percent of the savings is associated with respondents who indicated that they were financially unable to implement the project in the absence of the program incentive.

Table 3-4 Estimated Free ridership for Therm Savings from Projects

<i>Had Plans and Intentions to Retro-Commission Facility without Program (Definition 1)</i>	<i>Had Plans and Intentions to Retro-Commission Facility without Program (Definition 2)</i>	<i>Program had Influence on Decision to Retro-Commission Facility</i>	<i>Had Previous Experience with Measure</i>	<i>Percentage of Total Realized Gross Therm Savings</i>	<i>Free Ridership Score</i>
N	N	N	Y	11.9%	33.0%
N	Y	N	N	15.0%	33.0%
N	N	N	N	0.4%	0.0%
N	N	Y	Y	9.1%	0.0%
Required program incentive to implement measures.				63.7%	0.0%
Total				100.0%	13.3%

The realized energy savings of the Retro-Commissioning Program during the period June 2012 through May 2013 are summarized in Table 3-5. During this period, realized net energy savings totaled 10,316,359 kWh. The net to gross ratio is 90%.

Table 3-5 Summary of kWh Savings from Projects

<i>Utility</i>	<i>Expected kWh Savings</i>	<i>Realized Gross kWh Savings</i>	<i>Realized Net kWh Savings</i>	<i>Net to Gross Ratio</i>
Ameren	1,097,597	1,714,495	1,593,286	93%
ComEd	11,045,292	9,727,651	9,039,939	93%
Total	12,142,889	11,442,146	10,633,225	93%

The realized energy savings of the Retro-Commissioning Program during the period June 2012 through May 2013 are summarized in Table 3-5. During this period, realized net energy savings totaled 673,523 therms. The net to gross ratio is 87%.

Table 3-6 Summary of Therm Savings from Projects

<i>Utility</i>	<i>Expected Therm Savings</i>	<i>Realized Gross Therm Savings</i>	<i>Realized Net Therm Savings</i>	<i>Net to Gross Ratio</i>
Ameren	51,896	75,794	69,065	91%
Nicor	346,831	313,507	285,671	91%
North Shore	49,384	145,113	132,229	91%
Peoples	430,851	335,624	305,824	91%
Total	878,962	870,039	792,788	91%

3.2.2 Realized Net Peak kW Savings

The realized net peak kW reductions of the Retro-Commissioning Program during the period June 2012 through May 2013 are summarized by utility Table 3-7. The achieved net peak demand savings are 1,151.07 kW. The net to gross ratio is 100%.

Table 3-7 Summary of Peak kW Savings from Projects

<i>Utility</i>	<i>Realized Net kW</i>
Ameren	90.12
ComEd	1,424.95
Total	1,515.07

4. Process Evaluation

This chapter presents the results of the process evaluation for the Public Sector Retro-Commissioning Program (Retro-Commissioning Program) during electric program year five and natural gas program year two (EPY5/GPY2). The process evaluation focuses on the effectiveness of program policies and organization, as well as the program delivery framework. The purpose of the process evaluation is to assess the design and recent results of the program in order to determine how effectively it is achieving its intended outcomes. This evaluation is based upon analysis of program structure, interviews with program staff and service providers, surveys of program participants, and a review of program tracking data.

The chapter begins with a discussion of the overall progress of the program, followed by an examination of certain issues that are critical to the future success of the program. This chapter also presents strategic planning and process recommendations and highlights key findings from participant and service provider interviews. The information in this chapter provides insight into service provider and participant decision making behaviors and identifies any key issues that may be addressed for future program years.

4.1 Evaluation Objectives

The purpose of the process evaluation is to examine program operations and results throughout the program year. This assessment allows evaluators to identify potential program improvements that are intended to increase program efficiency or effectiveness in terms of participation and satisfaction levels. This process evaluation was designed to document the operations and delivery of the Retro-Commissioning Program during the EPY5/GPY2.

Key research questions to be addressed by this evaluation of EPY5/GPY2 activity include:

- Is the Retro-Commissioning Program effectively reaching participants and meeting their energy efficiency needs?
- Is the program incentive appropriately structured to encourage participants to make energy efficiency improvements?
- Do service providers find the program to be operating effectively?
- Did the Retro-Commissioning Program reduce barriers to energy efficiency project implementation?

During the evaluation, data and information from numerous sources are analyzed to achieve research objectives. Insight into the participant experience with the Retro-Commissioning Program is developed from a telephone survey of program participants. The market perspective is developed through in-depth interviews with service providers that engage in marketing, consultation, and implementation efforts for the program. The program operations perspective is developed through interviews with program staff from DCEO's implementation partner, SEDAC / 360 Energy.

4.2 Summary of Primary Data Collection

Multiple sources of information informed the process evaluation of the Retro-Commissioning Program.

- **Participant Surveys:** Data collected through participant surveys serve as the foundation for understanding the participant perspective. The participant surveys provide feedback and insight regarding participant experiences with the Retro-Commissioning Program. Respondents report on their satisfaction with the program, detail their motivations and the factors affecting their decision making process, and provide recommendations related to improving the program.
- **Service Provider Interviews:** Information collected through interviews with service providers is used to analyze the program from the market perspective. The objective of the interviews is to gain insight into the application and project implementation process and to develop a sense of program satisfaction levels. Service providers report on their experiences with participants, program marketing, and provide opinions of how the program could be improved.
- **Interviews with Implementation Partner Staff Members:** Interviews with program implementation staff members provide information regarding program progress and observations regarding service providers and participants. Staff members report on recent program changes and future plans to improve program operational efficiency.

4.3 Summary of Conclusions and Recommendations

Since its initial launch, the Retro-Commissioning Program has continued to develop and improve the efficiency of public sector buildings in Illinois. Program participants and service providers are generally satisfied with the program, and staff has made efforts to implement operational improvements.

The following presents a selection of key evaluation findings:

- **High Level of Program Activity:** Program staff reported that the program year was successful. The number of completed projects more than doubled from the prior year, and expected electric savings were nearly twice the expected savings from the prior year. Additionally, EPY5/GPY2 marks the first year that the program realized natural gas savings from studies initiated during natural gas program year one.
- **Continued Demand for the Retro-Commissioning Program:** Program staff indicated that there was significant demand for the program and noted that there are more public entities interested in completing retro-commissioning project than can be funded with the current program budget. Furthermore, service providers indicated that demand for retro-commissioning was either remaining steady or growing as awareness of the potential energy savings increases.

- **Barriers to Program Participation:** Despite the demand for the program, service providers noted some barriers to participation. Service providers indicated that the \$10,000 commitment can prevent some organizations from participating in the program. This spending requirement may be particularly problematic for decision makers who have little knowledge of the potential energy benefits from retro-commissioning. Another barrier noted by service providers is that the facility staff members who are aware of energy inefficiencies at their facilities are often not the same individuals with the authority to commit the organization to participating in the program.

Participant survey responses indicated that public sector facilities typically have one or two individuals that make decisions about energy efficiency improvements. A key factor for the successful promotion of the program by service providers is that their facility contacts are the individuals with the authority to commit the facility. Service providers noted that not having the correct contact can be a barrier to program participation.

Other barriers to program participation noted by service providers include a lack of facility staff resources to dedicate to the project, and resistance to allowing outsiders into the facility to complete the study.

- **Spending Commitment may Effectively Limit Investments in Efficiency for Some Participants:** One of the strengths of the program for gaining participation is that participants receive the retro-commissioning services in exchange for a relatively modest commitment to spend \$10,000 on energy efficiency improvements identified through the study. This incentive design likely appeals to public sector entities that often cite limited energy efficiency improvement budgets as a barrier to implementation. However, some service providers noted that for some participants, the \$10,000 spending requirement effectively acts as a cap on the facility's expenditures. That is, although considerably more than \$10,000 worth of efficiency improvements may be identified in a study, some participants are only interested in spending as much as is required by the program. Participation data supports this observation as a number of projects saw a relatively small share of the recommended savings implemented. Studies of larger scope for which only a small share of the recommended improvements are implemented create inefficiencies for the program. In these cases, the scope of the retro-commissioning study, and consequently its cost, may be disproportionate to the amount participants' are intending to spend on the improvements.
- **Program Marketing is Adequate Given Current Program Budget:** The program has seen sufficient activity to commit all of the program's budget, and funds from supplementary requests, to retro-commissioning projects. The ability to fully utilize its budget suggests that the program marketing is sufficient given its current level of funding.

However, additional attention to program marketing will likely be needed should the program expand. In particular, the level of promotion by service providers may not be sufficient to drive additional program activity. Approximately half of the interviewed service providers indicated that they did not expend much effort in promoting the program. Additionally, most surveyed participants heard of the program from a source other than the

service providers. Although the program is promoted by program staff, service providers are critical to the promotion of the program and some may not be fully engaged in this effort.

- **Service Providers Noted Few Program Administration Problems:** Service providers were generally satisfied with the retro-commissioning program and noted few problems with how the program is administered. Service providers noted that the approval process was quick in comparison to other retro-commissioning programs they had worked with and that the reporting requirements are similar to other programs, although they are more structured. Service providers also stated that program staff is knowledgeable and responsive to inquiries. Service providers who were new to the program stated that the training provided on program structure and operation was useful.

However, service providers did provide some suggestions for improving the administration of the program. Some of these suggestions included focusing on reporting content rather than format and keeping reporting requirements consistent over time. However, the suggestions regarding changes to the reporting content likely reflect program staff's attempts to streamline and improve the program. Additionally, some service providers indicated a preference to receive compensation earlier in the process because of the large amount of preparatory work that occurs before the first invoice can be submitted. Program staff recently instituted a change that allows service providers to submit monthly invoices for projects. This change went into effect during EPY6/GPY3.

- **Participants Satisfied with the Program and the Participation Process:** From the participant perspective, the program appears to be operating well. All of the participant survey respondents indicated that they were very satisfied with the program overall. Additionally, all of the respondents were very satisfied with the professionalism of the service providers. Few participants noted problems with the participation process. However, a few issues were noted regarding contractors' implementation of the recommended measures. These included contractors' reluctance to implement one of the recommended measures and contractors failing to install some of the equipment detailed in the selected recommendations. Overall, these comments were the exception rather than the rule and do not suggest systematic problems with the program.

Overall the Retro-Commissioning Program is operating effectively and delivering energy savings for the DCEO. However, the following recommendations may serve to further improve the program processes and capacity to deliver cost-effective savings.

- **Consider Balancing Spending Requirement with Savings Potential and Study Scope:** The relatively low participant spending requirement likely facilitates participation in the program. However, in some instances, large savings identified in the studies may be unrealized because participants are only required to spend \$10,000. In order to generate additional value from the studies, program staff should consider varying the spending commitment by a factor such as the facility size or its energy use intensity. Alternatively, program staff may consider offering prospective participants varying levels of financial commitments which would be tied to the scope of the retro-commissioning study. For example, the total allowed cost of the retro-commissioning will be set at one level for

participants who commit to spending \$10,000, while the retro-commissioning study budget will be higher for participants who commit to spending \$50,000.

- **Consider offering Retro-Commissioning Training to Service Providers:** Some service providers noted interest in additional training on completing retro-commissioning studies. Given the depth of SEDAC's expertise, program staff may consider offering training on special topics related to identifying energy savings in retro-commissioning studies, or hosting events where service providers can meet and discuss best practices. Prior to offering any training, it is recommended that the program staff perform a thorough analysis of service providers' specific training needs. This will assist in developing a tailored training that will be useful to service providers.
- **Provide Additional Information on Savings Potential:** Some service providers noted that the \$10,000 spending commitment may prevent some of their prospective customers from participating because they have to commit to the spending requirement before knowing what their energy savings will be. Although the program has a brochure that identifies the typical savings for a retro-commissioning project, program staff may consider providing information about the savings that are typically realized for a \$10,000 investment. Additionally, as more facilities complete retro-commissioning studies, it may be possible for the program to develop more tailored materials that provide estimated savings by facility type, size, energy use intensity, or other factors. This additional information may help reduce potential participants' uncertainty about agreeing to the \$10,000 commitment.
- **Potential for Expanded Scope of Program:** Given program staff and service provider observations about the level of demand for this program, there is potential for generating additional savings through the Retro-Commissioning Program. However, such a change in program scope would have to be considered in the context of several factors including the need for greater promotional efforts from service providers, the potential for greater efficiencies in the achievement of savings as previously discussed, and the ability of the retro-commissioning program to deliver energy savings that are at least as cost effective as what could be achieved through other programs in DCEO's portfolio.

4.4 Program Overview

The Retro-Commissioning Program is operated through the Smart Energy Design Assistance Center (SEDAC) and managed by the 360 Energy Group (360 Energy).

4.4.1 Program Incentive Strategy

The Retro-Commissioning Program offers a service incentive which fully funds the cost of the retro-commissioning study. In exchange for receiving this service, the participant agrees to implement \$10,000 worth of energy saving measures with a payback of 18 months or less. The program does not provide incentives to the participant to implement the measures.

In comparison, the retro-commissioning program offered by Ameren Illinois to its private sector customers covers 70-80% of the cost of the study and offers \$0.02 per kWh saved and \$0.40 per therms saved. Retro-Commissioning Program staff stated that due to budget constraints and a lack of familiarity with retro-commissioning, public sector entities would be unlikely to complete retro-commissioning studies if there was an upfront cost.

4.4.2 Project Eligibility Requirements

The Retro-Commissioning Program is available to public sector entities that receive electrical service from Ameren Illinois or ComEd. Natural gas saving measures may also be included in projects for public sector entities that receive natural gas from Ameren Illinois, Nicor, North Shore, or Peoples Gas.

To be eligible for the service incentive, buildings should have 150,000 square feet of conditioned space and be at least 5 years old. However, newer and smaller buildings with an energy use profile suggesting a large potential for savings are also eligible for inclusion. Buildings must also have a functioning building automation system to which the participants will grant access.

In addition to the eligibility requirements, buildings with certain characteristics are given preference for selection. These characteristics are:

- Buildings with automation systems that include direct digital controls;
- Strong commitment by the facility owner to implement recommended measures and to be actively involved in the study;
- No planned major system renovations or retrofits; and
- Accessible and up to date building documentation and records.

4.4.3 Retro-Commissioning Project Process

There are four stages in completing a retro-commissioning project: the application phase; planning, investigation, and recommendation phase; the implementation phase; and the verification phase.

- **Application Phase:** Application to the Retro-Commissioning Program begins with the prospective participant completing a notice of interest. If the interested party has already selected an eligible service provider to complete the study, the service provider may assist with the submission of the notice of interest. The purpose of the notice of interest is to screen the facility for eligibility and potential energy savings. Additionally, facility staff members are screened for commitment to the project and willingness and ability to invest the required \$10,000 in measures. If the project is deemed eligible for the program, a potential service provider completes a brief preliminary walkthrough to assess the site for potential energy savings. The purpose of the walkthrough is to identify electric and natural gas measures to target. Additional service provider responsibilities during this phase include submitting a scope of work that identifies potential energy saving measures, setting targets for savings,

and assisting the participant with completion of the program application. Within two weeks after the application and scope of work have been submitted, program staff members determine whether the project is approved for the program.

The application phase should take approximately three to four weeks.

- **Planning, Investigation, and Recommendation (PIR) Phase:** The PIR phase is composed of several activities related to completing the retro-commissioning study. This phase is initiated with a kick-off meeting that provides an overview of the project including the initial measures to be investigated and the process. During this phase, the service provider works with facility staff to complete the study. The service provider may identify additional measures that were not identified in the initial scoping during the application phase. Completion of the study involves collection of additional data on energy use, how the facility is utilized, parameters related to equipment use, maintenance procedures and problems, equipment operational procedures and conditions, and comfort problems. Measurement and verification procedures are also established during the study phase. A key component of developing measurement and verification procedures in the PIR phase is to establish baseline conditions to estimate and verify the energy savings resulting from measure implementation. During the PIR phase, program participants solicit quotes from vendors and contractors for the implementation of the identified measures.

The PIR phase should take approximately three to five months.

- **Implementation Phase:** During the implementation phase the participant implements the measures selected from the recommended measures. Participant facility engineers and operations staff, and potentially their contractors, implement the measures with the guidance of the service provider. During this phase, the service provider may help with the preparation of the scope of work for the measures, assist the implementation team, and direct participants to resources provided through the program or DCEO for identifying contractors and vendors. The program prohibits service providers from directly implementing the measures in order to ensure a measure of independence when the service provider verifies savings, as well as to protect the state from liability if a measure is incorrectly implemented. Service providers are also prohibited from selling materials, recommending contractors or specific name brands for equipment, or preparing bid documents.

The costs of implementing the recommendations are to be based on reasonable market costs as determined by the implementation team. In addition to assisting with the implementation of the measures, service providers are responsible for updating the measure selection form if modifications occur and for collecting proof of installation such as invoices and work orders.

The implementation phase should take approximately two to ten months.

- **Verification Phase:** The final phase of the retro-commissioning project is the verification of measure installation. During this phase, service providers evaluate trends in energy consumption, visit the site to verify that measures have been implemented correctly, and prepare the verification report and verified participant selection form. These materials

summarize the measures implemented; the demand, electric, and natural gas savings; the total cost savings; the facility cost savings; and the implementation cost. Additionally, the form indicates the value of any DCEO incentives available for these measures and whether or not the participant intends to apply for these incentives. Measures for which incentives are obtained cannot count toward the \$10,000 spending requirement.

The verification phase should take approximately three weeks to two months.

4.4.4 Service Providers

The Retro-Commissioning Program utilizes pre-qualified service providers to complete the retro-commissioning studies. In order to become pre-qualified, applicants must demonstrate experience completing retro-commissioning studies with an emphasis on energy efficiency. Applicants must also be pre-qualified as RCx Service Providers for the Smart Energy Design Assistance Program. To receive this qualification, applicants submit a proposal that includes a statement of qualifications, a curriculum vitae, professional references, bill rates, and experience completing green and sustainable design projects. Applications are reviewed by SEDAC staff.

Table 4-1 summarizes service providers' key tasks and deliverables for each phase of the retro-commissioning project.

Table 4-1 Service Provider Deliverables and Key Tasks

<i>Phase</i>	<i>Service Provider Deliverables and Key Tasks</i>
Application	Submit Scope of Work Assist participant with the Application Assist with Notice of Interest (if already selected for potential project)
Planning, Investigation, and Recommendation	Submit Project Status Reports Submit Draft and Final Retro-Commissioning Plan Submit Initial Participant Selection Form
Implementation	Provide permitted assistance to participant Update the Participant Selection Form (if applicable) Collect proof of measure implementation such as invoices and work orders
Verification	Submit Draft and Final Verification Report Submit Verified Participant Selection Form

Retro-commissioning projects require 18 to 24 months to complete. Due to the extended nature of the process, the program subdivides the project budget into two, one-year budgets. During the year, service providers can submit invoices for work once various project milestones are complete. This process allows service providers to receive payment at various points of the project based on work completed. The Project Year 1 invoicing milestones are as follows:

- Progress reports can be submitted requesting up to 50% of the first project year budget, dependent on time and materials costs.
- Up to 85% of the project year one budget can be invoiced once a draft plan and the participant's selection of measures form have been submitted, dependent on time and materials costs.
- After approval of plan, invoices for the remaining project budget can be submitted.

The Project Year 2 invoicing milestones are:

- Up to 85% of the second project year budget can be submitted once the draft verification report and form is submitted, dependent on time and materials costs.
- Once the final report is approved, service providers can submit invoices for 100% of the project year budget.

4.4.5 Quality Control and Verification Procedures

The Retro-Commissioning Program has a number of policies and procedures to manage the quality of the projects, and the accuracy of the estimated savings. As an initial check to maintain project quality, the program only permits prequalified service providers who have been screened by the program. Service providers are screened based on past experience with retro-commissioning and identifying efficiency improvements in buildings. Additionally, staff provides service providers with a manual that outlines project requirements and the service provider's role. The program also limits the number of projects that a service provider can work on at one time, in part to ensure that they have sufficient resources for completing the projects.

Additional aspects of the program that are designed to ensure project quality and savings verification include the following:

- Projects are monitored for progress through milestone points for adherence to time schedules and budget utilization.
- Each retro-commissioning project team includes a SEDAC engineer who reviews the measures identified by the study and the estimated savings.
- Standardize reporting templates that promote consistency in the information provided by service providers.
- Checklists to ensure that service providers identify all potential measures in a facility.
- A list of data the facility survey should collect for typical building systems and equipment types.

After measures are implemented, service providers verify the measure implementation and provide documentation of proof of implementation in the form of invoices and work orders. Service providers submit a verification report that documents verification procedures and results.

4.5 Review of Program Materials

ADM reviewed program materials that were provided by program staff and are used to support service providers and program processes. Specifically, the following documents were reviewed:

- Service Provider Manual
- Sample Participant Measure Selection Form
- Sample Measure Verification Form
- Sample RCx Plan
- Sample Verification Report

The service provider manual is a comprehensive document that details how the program operates, the service providers' role, the project timeline and project milestones, and program reporting requirements. This information is conveyed through a description of each phase of the project process. The manual utilizes figures, tables and bulleted lists to succinctly convey information to service providers. The appendix contains bulleted lists of information to be gathered while performing studies and sample versions of a scope of work and project invoicing.

The participant measure selection form and measure verification form are spreadsheets that summarize the measures selected by the participant and the measures that the participant implemented. These forms contain basic information on the energy savings, measure costs, and energy cost savings. Although these forms may facilitate administrative processes, they do not contain measure details that would enable the review of energy and cost savings calculations. For this information, the project team refers to the RCx plan and verification report.

The sample RCx plan and verification reports are templates for service providers to use for reporting the study methods and findings. These sample reports likely promote consistency in reporting and aid the project team's review of the study and verification results. The reports may also reduce service providers' workloads to some degree by providing the report structure and suggested language.

4.6 Retro-Commissioning Program Participant Profile

Table 4-2 displays a summary of the average and total recommended and verified savings. The total recommended therm savings was 1,753,481 and the total verified therm savings was 967,018. The total recommended kWh savings was 856,058, while the total verified kWh savings was 12,142,889. On average, the verified savings implemented by participants represented 55% of the recommended therm savings and 41% of the recommended kWh savings.

Table 4-2 Average and Total Recommended and Verified Energy Savings by Fuel Type

<i>Fuel Type</i>	<i>Average Recommended Energy Savings</i>	<i>Average Verified Energy Savings</i>	<i>Total Recommended Energy Savings</i>	<i>Total Verified Energy Savings</i>
Therms	51,573	28,442	1,753,481	967,018
kWh	856,058	357,144	29,105,986	12,142,889

As shown in Table 4-3, the average annual cost savings for the verified savings projects implemented by participants was \$43,067. In total, participants in the program realized an estimated annual cost savings of \$1,464,291.

Table 4-3 Average and Total Recommended and Verified Cost Savings

<i>Average Recommended Cost Savings</i>	<i>Average Verified Cost Savings</i>	<i>Total Recommended Cost Savings</i>	<i>Total Verified Cost Savings</i>
\$94,938	\$43,067	\$3,227,881	\$1,464,291

The largest facility with verified savings during the program year realized more than a third of the verified natural gas savings and nearly a quarter of the verified electric savings. Smaller facilities accounted for a somewhat disproportionately smaller share of verified savings.

Table 4-4 Distribution of Projects and Energy Savings by Facility Size

<i>Facility Size (ft²)</i>	<i>Count</i>	<i>Percent of Total Projects</i>	<i>Percent of Total Verified Natural Gas Savings (Therms)</i>	<i>Percent of Total Verified Electric Savings (kWh)</i>
200,000 or Less	10	29%	14%	20%
200,001 - 500,000	18	53%	40%	45%
500,001-1,000,000	5	15%	11%	11%
More than 1,000,000	1	3%	36%	24%

As shown in Table 4-5, the average verified investment in implementing the recommended measures was not strongly related building size.

Table 4-5 Verified Investment by Facility Size

<i>Facility Size (ft²)</i>	<i>Count</i>	<i>Average Verified Investment</i>
Less than 200,001	10	\$16,596
200,001 - 500,000	18	\$22,244
500,001-1,000,000	5	\$25,636
More than 1,000,000	1	\$13,880

Figure 4-1 displays the relationship between the recommended energy savings and the verified energy savings (in therms). Not surprisingly, verified savings were less than recommended

savings for most participants, although in a few cases, participants realized larger verified savings than what was recommended. There were several sites with relatively small verified savings as compared to what was recommended.

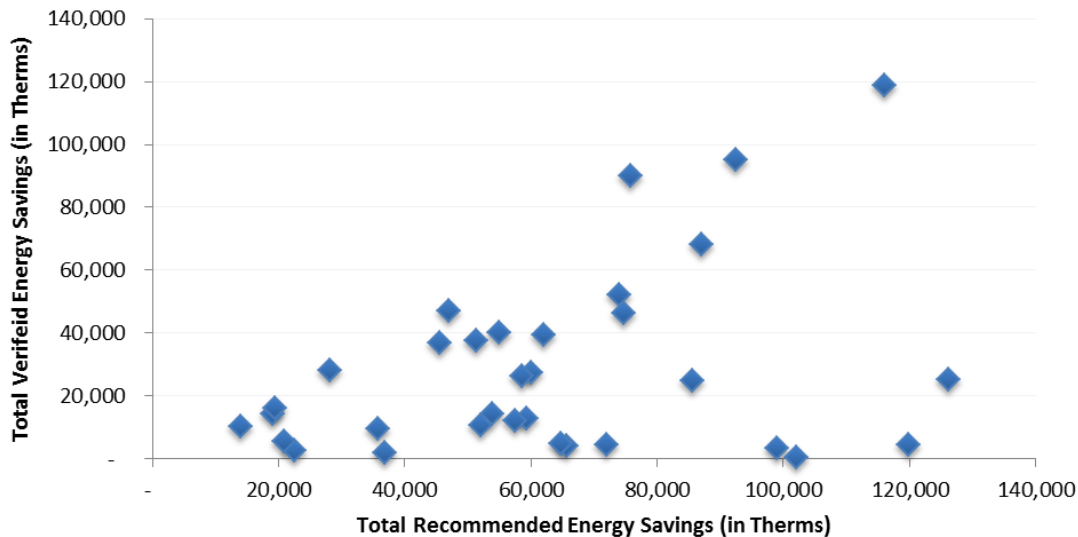


Figure 4-1 Relationship between Recommended and Verified Savings

One of the eligibility criteria for the program is that buildings should have a minimum of 150,000 square feet of conditioned space. However, exceptions to this criterion may be made if a prospective site has a high potential for energy savings. Figure 4-2 displays the relationship between recommended and verified savings and building size. Although larger buildings have larger recommended and verified savings in general, the relationship is not a strong one. This suggests that other factors such as energy use intensity may be more determinative of the energy savings than building size. This finding supports the program policy of making exceptions to the building size requirement.

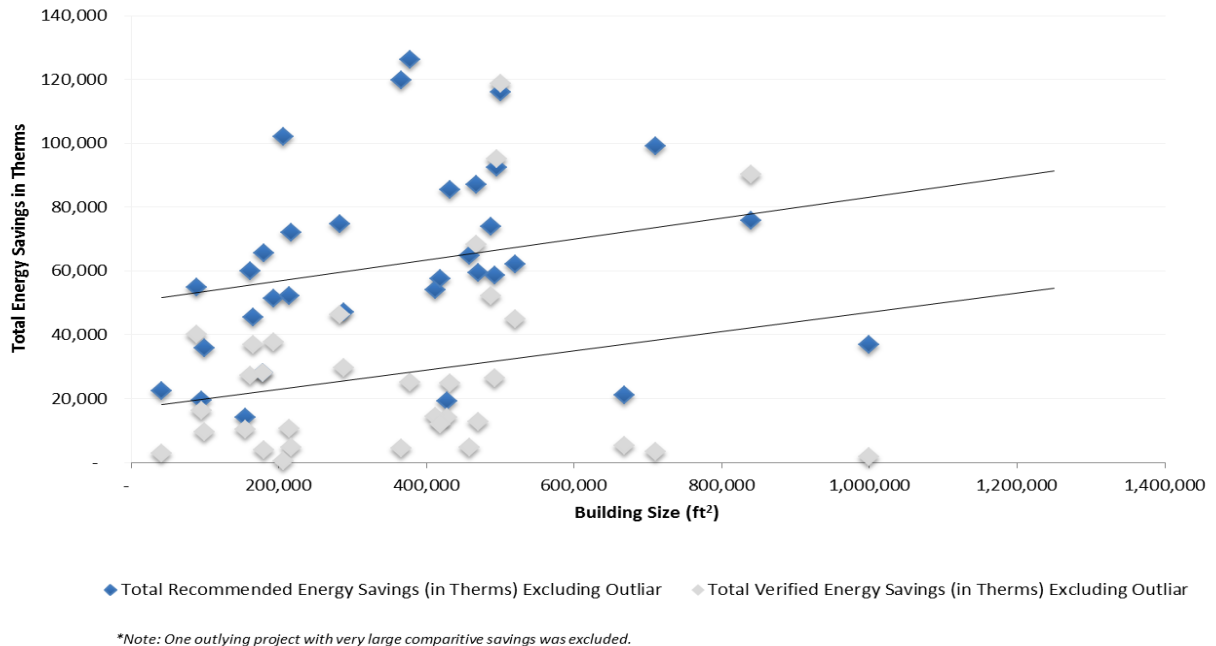


Figure 4-2 Relationship between Recommended and Verified Savings and Building Size

4.7 Participant Outcomes

A telephone survey was conducted to collect data about participant decision-making, preferences, and opinions of the Retro-Commissioning Program. The program offered the retro-commissioning service at no cost in exchange for an agreement by the participant to implement \$10,000 of energy efficiency improvements. In total, twelve participants who implemented a project under the program responded to the survey.

Information in this section is intended to characterize participant decision making behaviors and identify notable trends within participant responses. Some of the comments and issues raised by participants are anecdotal in nature, and may reflect individual participant opinions. The Conclusions and Recommendations section of the Process Evaluation chapter provides an overall distillation of key findings from the process evaluation activities that were performed for the Retro-Commissioning Program.

It is important to note that, while the survey results discussed below are used as inputs for the calculation of estimated free ridership, participant responses to individual survey items do not, in isolation from additional factors, infer specific levels of free-ridership. Chapter 3 details the methodology used to estimate free ridership based on survey response data, while this chapter provides a qualitative discussion of participant responses.

4.7.1 How Participants Learn About the Program

Table 4-6 displays the participant responses regarding how they learned about the program. The percentages shown are percentages of survey respondents. Participants heard of the program in a wide variety of ways. The most frequently mentioned sources for learning about the program,

each mentioned by 25% of the respondents, were from the DCEO website and friends or colleagues. Other less frequently mentioned sources for learning about the program, each mentioned by two respondents, were DCEO and SEDAC representatives. A single participant learned of the program from each of the following: architects, engineers, or energy consultants and from attending conferences, workshops or seminars.

Table 4-6 How Participant Decision Makers Learned about the Program

	<i>Response</i>	<i>Percent of Respondents (n=12)</i>
How did you learn of the Public Sector Retro-Commissioning Program?	The DCEO website	25%
	Friends or colleagues	25%
	A DCEO representative mentioned it	17%
	From a representative of Smart Energy Design Assistance Center (SEDAC) or a SEDAC Service Provider	17%
	An architect, engineer, or energy consultant	8%
	Attended a conference, workshop or seminar	8%
	Past experience with the program	8%
	Other	8%

* Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

As shown in Table 4-7, all of the respondents learned about the program before planning to retro-commission the facility.

Table 4-7 When Participant Decision Makers Learned about the Program

	<i>Response</i>	<i>Percent of Respondents (n=12)</i>
When did you learn of the Retro-Commissioning Program?	Before planning to retro-commission the facility	100%
	While planning to retro-commission the facility	-
	Once a retro-commissioning plan was established but before it was implemented	-
	After the retro-commissioning was completed	-
	Some other time	-
	Don't know	-

4.7.2 Factors Affecting Participation

Participants were asked about the influence of the Retro-Commissioning Program on their decision to retro-commission the facility. Although as previously indicated, all of the respondents indicated that they heard about program before planning to retro-commission the facility, thirty-three percent of the respondents reported that they had plans to retro-commission

the facility before hearing of the program. These seemingly contradictory responses may be due to different interpretations of the two questions. Participants may have interpreted the statement “before planning to retro commission the facility” as referring to immediate intentions, whereas by indicating that they had plans before hearing of the program, participants may have been referring to more general plans rather than an intention to act immediately. In support of this interpretation, all participants who stated that they had plans before hearing of the program reported that they had these plans for at least six months and half indicated that they had the plans for at least two years.

Of the four respondents who had retro-commissioning plans before hearing of the program, all stated that they would have completed the retro-commissioning even if they had not participated in the program. However, other responses may indicate that the program was influential in participants’ decision making processes. For example, the program may have still influenced the timing of the retro-commissioning study or the participants’ prior experience with the program may have influenced the decision. Consequently, these responses do not, in isolation, designate a specific level of free-ridership. Responses to individual survey items may be used to characterize certain aspects of a decision maker’s program perspective or implementation behavior, but it is necessary to analyze the full set of a respondent’s survey responses in order to estimate an accurate and reliable net-to-gross percentage. In addition to gauging participants’ preexisting plans and intentions, it is important to consider how the program affected factors such as the timing and overall efficiency level of the project. Chapter 3 outlines the full net-to-gross estimation methodology that is applied to survey results for this evaluation.

In order to further understand participants’ motivation for participating in the program, participants were asked whether the retro-commissioning was recommended to them by a representative of the program or the DCEO or by its partner SEDAC. Seventeen percent of respondents reported that a DCEO representative recommended the retro-commissioning project for their facility. These individuals also reported that they probably would have not conducted retro-commissioning projects at their facility if not for this recommendation. Additionally, 33% of respondents indicated that a SEDAC representative or SEDAC service provider recommended the retro-commissioning. Of these four respondents, one reported that they probably still would have conducted the retro-commissioning project at their facility if not for the recommendation. Three individuals reported that they probably would not have completed such projects. These findings emphasize the importance of non-monetary program influences on participant decision making. While the availability of the service incentives may be a key factor to influencing participants to undertake retro-commissioning projects, information about the service and the potential energy savings likely motivate participation as well.

4.7.3 Energy Efficiency Attitudes, Behaviors, and Decision Making

Respondents were asked about the importance of past experience with energy efficient equipment or practices and advice or recommendations from DCEO or its partners in their decisions to implement energy efficiency projects. Their responses are shown in Table 4-8. Fifty-eight percent of respondents considered advice or recommendations from DCEO to be “very

important” to their decision making and 58% also considered past experience with energy efficient equipment or practices to be very important.

Table 4-8 Factors Influencing the Decision to Participate

<i>Energy Efficiency Decision Making Factor</i>	<i>Very Important</i>	<i>Somewhat Important</i>	<i>Only Slightly Important</i>	<i>Not Important at All</i>	<i>Don't Know</i>	<i>n</i>
Past experience with energy efficient equipment or practices	58%	25%	17%	-	-	12
Advice and/or recommendations received from DCEO or its partners (SEDAC or SEDAC Service Providers)	58%	33%	8%	-	-	12

Participant survey respondents were asked what kinds of energy efficiency policies and procedures their organizations have in place. As shown in Table 4-9, 67% of respondents stated that their organizations had policies that incorporate energy efficiency in operations and procurement. Another 67% indicated that they had a staff member responsible for energy and energy efficiency. Other frequently mentioned policies and procedures respondents' organizations had in place were the active training of staff (50%) and an energy management plan (42%). One respondent stated that their organization did not have policies or resources for energy efficiency improvements.

Table 4-9 Participant Energy Efficiency Policies and Activities

	<i>Response</i>	<i>Percent of Respondents (n=12)</i>
Which of the following policies or resources does your organization have in place regarding energy efficiency improvements at this facility?	Policies that incorporate energy efficiency in operations and procurement	67%
	A staff member responsible for energy and energy efficiency	67%
	Active training of staff	50%
	An energy management plan	42%
	Do not have policies or procedures for energy efficiency improvements	8%
	Other	8%
	Don't know	-

**Since respondents were able to select more than one response, the sum of the percentages in the table above exceeds 100%.*

Respondents who indicated that they had an energy management plan were asked whether the plan included goals for energy savings. Five respondents stated that their plans included energy savings goals. The most frequently cited goal was to reduce energy consumption by 10 to 15% over one to two years. One participant reported that their goal was to improve the organization's EnergyStar score annually.

Program participants were asked about their prior experience with paying for energy efficiency improvements. As shown in Table 4-10, most participants reported that they had implemented energy efficiency improvements in the last three years. More specifically, 75% of respondents stated that they previously purchased energy efficient equipment for which they did not receive an incentive. When asked why they had not applied for incentives, three of these respondents stated that they did not have time to complete paperwork for the incentive application. One respondent reported that they did not know about incentives until after the efficiency improvements were completed. Another respondent indicated that they did not know whether improvements qualified for incentives and one stated that the incentive was insufficient. Additionally, 17% of participants indicated that they had previously made energy efficiency improvements and applied for an incentive. The remaining participant had not previously made energy efficiency improvements. Overall, these responses indicate an inclination by respondents to implement efficiency improvements without financial assistance. However, in nearly half of these cases, participants indicated that they did not apply for incentives because the effort was not worth the incentive, i.e., they stated the incentive was insufficient or that it required too much paperwork. This suggests that these past improvements may have been minor, with participants assuming that the available incentives would not be large enough to justify the application effort.

Table 4-10 Incentives for Previous Equipment Purchased

	<i>Response</i>	<i>Percent of Responses (n=12)</i>
Has your organization paid for any energy efficiency improvements in the last three years for which you did not apply for a service or financial incentive through an energy efficiency program?	Yes, paid for energy efficiency projects but did not apply for incentive.	75%
	No efficiency improvements were paid for by the organization.	-
	No, an incentive was applied for.	17%
	Don't know	8%

4.7.4 Barriers to Energy Efficiency Improvements and Purchasing Processes

The literature regarding public sector decision making and procurement of energy efficient equipment identifies a number of barriers to energy efficiency improvements in the public sector. These barriers include a lack of consideration of energy costs when making purchasing decisions, least-cost purchasing rules preventing purchase of higher cost energy efficient equipment, the perception that high efficiency equipment is a luxury item, risk aversion generated by low cost purchasing requirements and transparency of decision making, and a lack of technical expertise.² Some of these barriers were identified by participants in the Retro-Commissioning Program, as shown in Table 4-11.

Eighty-three percent of respondents cited that the most frequently mentioned barrier was insufficient funding to make the improvements. The second most cited barrier to energy efficiency improvements was that current equipment was too new to be replaced with more efficient equipment (58%). Other barriers to energy efficiency improvements included incentive program time requirements (25%) and approval processes that are too slow or make purchasing

² Barnes, P. and Wisniewski, E. J. (2000). *Making it happen: Incorporating energy efficiency into government purchasing*. American Council for an Energy-Efficient Economy Summer Study Proceedings.

Harris, J., Brown, M., Deakin, J., Jurovics, S. Khan, A., et al. (2004). *Energy-efficient purchasing by state and local government: Triggering a landslide down the slippery slope to market transformation*. American Council for an Energy-Efficient Economy Summer Study Proceedings.

Kunkle, R., Lutzenhizer, L. and Dethman, L. (2000). *Influencing the purchase of energy-efficient products in public organizations: It's not as easy it looks*. American Council for an Energy-Efficient Economy Summer Study Proceedings.

Rose, A., Stimmel, J., Oyhenart, J., and Ahrens, A. (2008). *Breaking down silos: Bridging the communications and knowledge gap between departments to implement energy efficiency in the public sector*. American Council for an Energy-Efficient Economy Summer Study Proceedings.

difficult (25%). One respondent cited another barrier to making energy efficiency improvements—not having adequate staffing to install the new equipment.

Table 4-11 Barriers to Making Energy Efficiency Improvements

	<i>Response</i>	<i>Percent of Respondents* (n=12)</i>
What barriers does your organization face in making energy efficiency improvements?	Insufficient funding for improvements	83%
	Current equipment is too new to be replaced with more efficient equipment	58%
	Incentive program time requirements	25%
	Approval processes that are slow or make purchasing difficult	25%
	Lack of information on energy efficient equipment and practices	8%
	Schedules that dictate when equipment is to be maintained regardless of efficiency levels	-
	Other	8%
	Don't know	-

**Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.*

Respondents were asked how their organizations make decisions about energy efficiency improvements. As shown in Table 4-12, 50% of respondents stated that decisions are made by one or two key people. Other methods for making decisions included decision-making by a group or committee (33%) and decision making based on staff recommendations to a decision maker (17%). These responses suggest that the majority of respondent's organizations have centralized decision processes that involve only one or two key people.

Table 4-12 Decision Maker Characteristics

	<i>Response</i>	<i>Percent of Respondents (n=12)</i>
How does your organization decide to make energy efficiency improvements for this facility? Is the decision:	Made by one or two key people	50%
	Made by a group or committee	33%
	Based on staff recommendations to a decision maker	17%
	Made in some other way	-
	Don't know	-

4.7.5 Where Decision Makers Get Their Information

Respondents were asked whom they rely on for information about energy efficient equipment, materials, and design features. Respondents were able to provide multiple responses and the percentages shown in Table 4-13 are percentages of respondents.

Program participants reported using a wide variety of sources for information about energy efficiency projects. The most commonly mentioned source was equipment vendors or building contractors, cited by forty-two percent of respondents. Architects, engineers, or energy consultants and trade journals or magazines were each cited by 25% of respondents. Trade associations or business groups, the DCEO website, and friends or colleagues were each cited by 17% of the respondents. Other cited sources of information included: DCEO representatives, SEDAC, a utility representatives, and brochures or advertisements. Fifty-eight percent of respondents reported using other sources for information about energy efficiency, including Internet resources for energy efficiency, information provided through the ENERGY STARTM program, the U.S. Department of Energy, the American Society of Heating and Refrigeration Engineers, and various government, university, and vendor websites.

Table 4-13 Who Respondents Rely on for Information

	<i>Response</i>	<i>Percent of Respondents (n=12)</i>
What are the main sources your organization relies on for information about energy efficient equipment, materials, practices, and design features?	Equipment vendors or building contractors	42%
	Architects, engineers, or energy consultants	25%
	Trade journals or magazines	25%
	Trade associations or business groups you belong to	17%
	The DCEO website	17%
	Friends and colleagues	17%
	A DCEO representative	8%
	The Smart Energy Design Assistance Center (SEDAC) and SEDAC RCx service providers	8%
	A utility representative	8%
	Brochures or advertisements	8%
	The Energy Resource Center (ERC)	-
	Other	58%
	Don't know	8%

**Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.*

4.7.6 Financial Methods Used by Decision Makers

Table 4-14 displays the financial methods that respondents indicated using to review efficiency projects. Fifty-eight percent of respondents reported that they use life cycle cost to evaluate energy efficiency improvements. These seven respondents indicated that they normally apply a 3-10% discount rate when determining life cycle costs. An equal percentage of respondents reported that they use an initial cost (50%) and simple payback (50%) to evaluate efficiency improvements. The six participants that reported using a simple payback period were asked what

payback length of time they normally require in order to proceed with an energy efficient project. Participants cited required payback periods ranging from 2 to 10 years. Twenty-five percent of the respondents reported that they use an internal rate of return to evaluate energy efficiency improvements for their facility, and cited expected rates of return ranging from approximately 1.5 to 5 years.

Table 4-14 Methods Used to Evaluate Efficiency Improvements

	<i>Response</i>	<i>Percent of Respondents (n=12)</i>
Which financial methods does your organization typically use to evaluate energy efficiency improvements for this facility?	Life cycle cost	58%
	Initial Cost	50%
	Simple payback	50%
	Internal rate of return	25%
	None of these	-
	Don't know	-

4.7.7 Participant Satisfaction with the Program

Respondents rated their levels of satisfaction with selected aspects of the program on a scale ranging from very dissatisfied to very satisfied. As seen in Table 4-15, participants were generally satisfied with the program. Survey respondents were most satisfied with the service provider's level of professionalism and the overall program experience. Specifically, 100% of participants were very satisfied with the service provider's level of professionalism and 100% of participants were very satisfied with the overall program experience. The areas with relatively lower satisfaction ratings were the information provided by the retro-commissioning service provider and the information provided by Smart Energy Design Assistance Center (SEDAC). However, 75% of survey respondents were very satisfied with these aspects of the program.

Table 4-15 Decision Maker Satisfaction with Selected Aspects of Program Experience

<i>Element of Program Experience</i>	<i>Very Satisfied</i>	<i>Somewhat Satisfied</i>	<i>Neither Satisfied nor Dissatisfied</i>	<i>Somewhat Dissatisfied</i>	<i>Very Dissatisfied</i>	<i>Don't Know / Not Applicable</i>	<i>n</i>
Energy efficiency of the facility since the retro-commissioning	42%	50%	-	-	-	8%	12
Savings on your monthly bill	42%	50%	-	-	-	8%	12
Effort required for the application process	50%	25%	17%	-	-	8%	12
Information provided by the retro-commissioning service provider	75%	17%	-	8%	-	-	12
Retro-commissioning service provider's level of professionalism	100%	-	-	-	-	-	12
Quality of the work conducted by the contractor implementing the measures	25%	50%	8%	-	-	17%	12
Information provided by DCEO	67%	25%	-	-	-	8%	12
Information provided by Smart Energy Design Assistance Center (SEDAC)	75%	17%	-	8%	-	-	12
Overall program experience	100%	-	-	-	-	-	12

In addition to satisfaction levels, respondents were also asked whether or not the energy efficiency improvements implemented through the Retro-Commissioning Program had met their expectations. As shown in Table 4-16, more than half of respondents (58%) indicated that the energy efficiency measure had met their expectations, while 17% stated that it had exceeded their expectations. Twenty-five percent of participants stated that their expectations were mostly met and were then asked why their expectations were not fully met. One respondent described the recommendations as being somewhat difficult to understand due to extremely technical language. One respondent encountered difficulty in balancing the temperature of the building so that there were no hot and cold spots. Another respondent stated that they would have liked more input from their service provider, the group that was conducting retro-commissioning with SEDAC.

Table 4-16 Energy Efficiency Improvements Satisfaction of Participant Expectations

	<i>Response</i>	<i>Percent of Respondents (n=12)</i>
Did the energy efficiency improvements implemented through your participation in the retro-commissioning meet your expectations?	My expectations were exceeded	17%
	My expectations were met	58%
	My expectations were mostly met	25%
	My expectations were not met	-
	Don't know	-

4.7.8 Installation and Incentives

As displayed in Table 4-17, 92% survey respondents did not experience any problems with the application process for the Retro-Commissioning Program. One participant reported experiencing problems with the application process. This individual explained that the paperwork was laborious and time-consuming.

Table 4-17 Experience with the Application Process

	<i>Response</i>	<i>Percent of Respondents (n=12)</i>
Did you have any problems with the application process?		
	Yes	8%
	No	92%
	Don't know	-

Participant experience with project implementation is summarized in Table 4-18. Seventy-five percent of the respondents stated that the implementation went smoothly, while three participants indicated that it was a mostly smooth process.

Table 4-18 Experience with Project Implementation

<i>Question</i>	<i>Yes</i>	<i>For the most part</i>	<i>No</i>	<i>Don't know</i>	<i>n</i>
Did the retro-commissioning project go smoothly?	75%	25%	-	-	12
Do you feel the retro-commissioning service provider did a good job of identifying efficiency improvements?	92%	-	8%	-	12
For those measures implemented by a contractor, do you feel you got a quality implementation?	56%	44%	-	-	9

These three participants were asked to describe the ways in which the process did not go smoothly. One respondent stated it was difficult to achieve substantial savings with a \$10,000

commitment from the city. The same respondent also stated that the timeframe was problematic—that there was not enough time to evaluate the retro-commissioning project correctly. Another respondent asserted that it was difficult to coordinate contractors. The final respondent described the difficulties in acquiring internal funding for the measures.

Nearly all participants stated that the retro-commissioning service provider did a good job identifying energy efficiency improvements. The one respondent who stated that the service provider mostly did a good job explained that they would have liked the service provider to spend more time identifying measures in addition to the measure information that the respondent had provided.

Of the participants who had their retro-commissioning measures implemented by a contractor, fifty-six percent stated that the contractor implementing the measures provided a quality installation. Forty-four percent indicated that they received a quality installation for the most part and were asked in what ways they did not receive a quality installation. One respondent explained that they hired an HVAC vendor to implement one of the recommended measures but that the vendor was hesitant in doing so. Another respondent explained that their contractor did not install as many motion sensors as were in the agreement; they were overlooked.

Overall, program participants reported few problems with the participation process. There were a few reports of problems that occurred during the process, but these appeared to be anecdotal instances rather than reflections of a systematic issue with program delivery.

4.7.9 Verifications

Participants were asked if the measures implemented through the program had been verified by a representative of SEDAC or a SEDAC service provider. As displayed in Table 4-19, although 58% of the survey respondents indicated that the measures had been verified, the program requires that verification inspections are conducted for all projects. It is possible that the remaining respondents did not recall the verification visit, or that the visit was conducted when this respondent was away from the facility. Twenty-nine participants reported that changes were made as a result of the verification inspections. One respondent explained that there were some programming changes to ensure that schedules were set appropriately.

Table 4-19 Measure Verifications

<i>Question</i>	<i>Percent of Respondents Saying Yes</i>	<i>n</i>
Have the measures you implemented through the retro-commissioning program been verified by a representative of SEDAC or a SEDAC Service Provider?	58%	12
Were any changes made to the measures as a result of this verification?	29%	7

4.7.10 Additional Energy Efficiency Projects

As displayed in Table 4-20, four participants reported implementing additional efficiency measures similar to those implemented through the program. Additionally, one participant indicated that they implemented measures that were not similar to the measures implemented through the program. One of these respondents elaborated and indicated that the measures implemented included variable frequency drives, LED lighting and ECM motors.

Although these responses suggest that participation in the program is encouraging participants to adopt additional energy efficiency measures, these responses, in isolation, do not suggest a specific level of spillover attributable to the program.

Table 4-20 Additional Energy Efficiency Projects

<i>Question</i>	<i>Percent of Respondents Saying Yes</i>	<i>n</i>
Since participating in the Public Sector Energy Efficiency Program, have you implemented any additional energy measures similar to those you implemented through the program that you did not apply or receive an incentive for?	33%	12
Since participating in the Public Sector Energy Efficiency Program, have you implemented any additional energy efficiency equipment that was not similar to those you implemented through the program that you did not apply or receive an incentive for?	8%	7

4.7.11 Participant Recommendations and Overall Impressions

Survey respondents were provided an opportunity to make additional comments about the program or provide recommendations for program improvements. One respondent stated that the DCEO needs to better market all of the programs that they offer. This respondent explained that had it not been for their sustainability department, they would not have known about DCEO's Retro-Commissioning Program.

Another participant recommended increasing the \$10,000 minimum given that it is difficult to obtain a substantial set of measures for that amount. This participant also stated that the time frame should be extended past 12 months to capture more data.

The remaining participants noted that the DCEO Retro-Commissioning Program is an excellent opportunity to save energy and increase awareness of energy related projects at facilities. Respondents stated that the program helps organizations identify energy savings. One respondent reported that they were impressed with working with the DCEO staff. The staff was described as extremely helpful and not bureaucratic in nature.

Respondents indicated that they hope the program and associated incentives will continue to be offered. Some even recommended the Retro-Commissioning Program to other facility managers due to the positive experience they had with the program.

4.8 Service Provider Outcomes

Six telephone interviews were completed with service providers who provide retro-commissioning services to public sector entities under the auspices of DCEO's Retro-Commissioning Program. The interviews were completed in late July and early August from a list of service providers developed from the documentation for projects completed during the June 2012 to May 2013 program year. The service providers were asked questions about:

- Non-DCEO retro-commissioning experience;
- How they learned of the DCEO Retro-Commissioning Program and any training they may have participated in;
- Prior relationships with Retro-Commissioning Program participants;
- The level of program awareness among participants and barriers to their participation;
- Their interactions with program staff;
- The demand for retro-commissioning services;
- Promotion efforts by service providers and assessment of program marketing; and
- Program satisfaction and suggestions for improvement.

4.8.1 Non-DCEO Retro-Commissioning Experience

Retro-commissioning service providers' experience in providing services to the public sector was generally limited or non-existent prior to establishment of the Retro-Commissioning Program. No more than 30% of a company's retro-commissioning work (range 5% to 30%) was reported to be public sector work, with a similar percentage derived from private retro-commissioning work.

I had one project in a federal building that was a combination retro-commissioning/commissioning. It wasn't a structured program such as this, more of a one off contract we had with GSA, who hired us to perform what they were calling re-commissioning but really it was more of what we define as retro-commissioning. I would say the public sector is probably 20%. I would say about 25%, maybe a little higher like 40% [is private retro-commissioning work.]

Not [a lot of] retro-commissioning in public sector, no. 5% maybe is public. I think the retro-commissioning work for us is maybe 10 or 13% total. On the private side, we have a lot of existing clients we do design work for so we went through. Not this past program year that just ended, but the year before, we did 14 retro-commissioning projects on the private side. But this year we only had about two.

Respondents also participated in Ameren Energy's and ComEd's retro-commissioning programs for private sector buildings. Their experience with the utility programs appeared to be more extensive than their experience with DCEO's public sector program, in that many more projects have been completed for private buildings than have been completed for public sector buildings. This experience gave respondents a vantage point from which to compare the public and private programs.

Respondents indicated that project approval seemed quicker within DCEO's Retro-Commissioning Program than within the utility programs. Reporting requirements were comparable, but DCEO's format was more structured. DCEO paid 100% of the survey fee, but the utilities pay only a portion of the fee and expect the private entity to also pay. Requirements for being a service provider appeared to be similar for both the private and public programs. The utilities appeared to require more rigorous documentation of how recommendations were implemented and the savings that were achieved.

I think that the incentive is lower on the DCEO side. I don't think our fees tend to be as big. There's more scrutiny involved in our process on the ComEd side, so I think that is subsidized by the additional fee. The Ameren is very similar to the DCEO Retro-Commissioning Program in terms of level of verification required, as well as the amount of paperwork. The ComEd is definitely arduous. The additional paperwork and trend data that's required on ComEd is not required for DCEO.

From our perspective, the DCEO Retro-Commissioning Program is fully funded for the study, the Ameren program, at this point, is now funding at 70% level but they turn around and provide more I think incentive money for short-term savings options. Ameren pays 70% of the program but they also will offer some implementation help. Under DCEO's program, the owner has to spend \$10,000 and anything with less than a year payback, they don't get any support.

In general, respondents liked DCEO's Retro-Commissioning Program and in fact, one respondent indicated that they would prefer to see the utility programs operated like the DCEO program because the utility programs do not currently offer sufficient leeway to identify ways to save energy.

I much favor the one through DCEO. Through the ComEd program, I am very cranked down. They try to focus me on certain things to the exclusion of other things. As a professional engineer I favor not having my hands tied behind my back, not being cranked down so much, having the freedom to roam pretty much wherever the project takes me to find solutions.

4.8.2 Service Provider Awareness, Participation, and Training

Respondents first learned about the DCEO Retro-Commissioning Program in one of two ways – either directly from the DCEO or its implementation partner, the 360 Energy Group, or indirectly from ComEd.

I've been with the 360 Energy Group for several years. I learned of it through them.

We are a provider for the private program as well, the ComEd program. I believe we heard about that program through one of our contacts at ComEd saying there was a retro-commissioning program for public buildings.

The service providers reported that the Retro-Commissioning Program provided an opportunity to speak with potential customers, to demonstrate the value of their services, and to build a stronger relationship with the participants. Additionally, some service providers noted that the completing project through the program was professionally rewarding. These service providers noted that the retro-commissioning process involves identifying and solving problems. Improving the energy efficiency of a building presented challenges that they were ready and able to meet, and the service providers also liked seeing their recommendations implemented.

There are financial benefits. Personally I like the program style, I like that it's a 9- or 12-month commitment. You get to be on site, you're working directly with the client, the owner, and the engineers. Unlike a study where you submit a report that may end up on a shelf that doesn't necessarily get implemented, you really get to work with them and see the changes directly happen. I think that's a really nice benefit.

We kind of treat it as a door opener to get in and hold onto that client for future work, whether its energy or construction or whatever it is. To be an energy consultant with them long term. We've had pretty good success in doing that.

What our focus was to begin with, we already had this focus before the programs were set up, so it's a natural fit. Secondly, it certainly helps generate work. Fairly easy program to sell.

Participation in training provided by DCEO was limited to training about the workings of the Retro-Commissioning Program. This was especially useful and necessary when a provider first started with the Retro-Commissioning Program and when changes were made to the Retro-Commissioning Program. The available training was much less useful for providers who are experienced with the Retro-Commissioning Program. The service providers expressed interest in having technical training that focuses particularly on what to look for during the study.

Online – a couple of online webinars, basically an overview of the program. I think it happens each year. Most of it is also provided in written form which we read through. It helped but a lot of the information we already read about. Moderately helpful but we didn't need it to participate in the program.

Yes. Seems to be more about how the program works. I'd say mixed. Most of the training I participated in seemed more for the clients, to bring them up to speed. From our standpoint, it wasn't that useful to us. We already know the majority of that. Seems to be focused less on training about specific issues, how to make a boiler more efficient, or some of those things.

No, I have not. Initial training while we are doing the job, we have already talked to people. There had to be, for the formal training, there had to be something for the higher people. I would say that somehow we have not gotten to the point or seen interest for the training.

4.8.3 Interaction with Program Staff

Interaction with program staff was described as frequent and ongoing throughout the life of a project. Updates and reports were submitted at intervals, and there were frequent questions that had to be answered. Most of the contact was with 360 Energy Group staff rather than with SEDAC or DCEO staff members. Program staff members were described as knowledgeable, helpful, and responsive.

Almost all of our interaction is through 360 Energy. They administer the program, and I would say at least my communication is 100% through 360 Energy. If we are in the middle of a project, we're talking to 360 at least once a week. If it's the end of the program year, it's more like once a day, which the program year ends on May 31 every year. May is a busy month where we're in constant communication. Other than that, once a week if we have a project going on. Responsive? Absolutely!

They have a company called 360 that manages that. People that work directly with DCEO, very minimal if any. SEDAC, who is kind of under DCEO, that manages some of the incentives, we have some contact with them. And then 360, who manages retro-commissioning, we have a lot of contact with them. It's usually getting the project started, kicked off, putting our scopes together, requirements of the program. And then there are usually weekly or monthly interactions with the status updates of the project once they get going.

I have most interaction with 360. I have very little interaction with SEDAC. Normally it will be to submit the application for retro-commissioning and question and answer about some item to be filled in. Follow-up on the application. I will always go to 360. They have dedicated individuals who are responsible. I go to them. They are quite helpful.

4.8.4 Demand for the Retro-Commissioning Services

Perceptions about the level of demand for retro-commissioning services varied. The demand was either described as steady or growing slowly. Such variation could result from one or more of several factors such as difficulty qualifying for the Retro-Commissioning Program, limited space in the Retro-Commissioning Program, resources that individual service providers have to undertake projects, and a lack of awareness of the Retro-Commissioning Program or the benefits of retro-commissioning.

Under the program, it seems to be fairly steady. I would say steady to growing. I think the whole concept of making buildings more energy efficient is growing just overall, nationwide, worldwide I guess.

I think that the commissioning is a real thing, it saves you real money when it comes to energy. So the people are realizing slowly and slowly and I think demand is part of need. With

the need, the demand can be created. There's a need for retro-commissioning, part it this way, the demand will be a function of if you can convince people. I would say that there's a potential demand, but there's definitely a need.

4.8.5 Program Provides Opportunity to Develop Customer Relationships

For some of those interviewed, retro-commissioning provided an opportunity to extend services to existing customers. For others, retro-commissioning was the first service provided to the client by the service provider. Service providers recognized that providing retro-commissioning services lends itself to creating ongoing customer relationships.

About 25 years ago I had done similar work with [two schools], and it saved them quite a bit of money. And then 25 years later, I get the call back.

We actually provided four energy studies for [a college]. When we got involved with them for the energy studies, we said hey in addition to that, there's this retro-commissioning program that is available, are you interested? They said yes and that's how we got involved. That's how the retro-commissioning program got started at [a college].

We did a project for [a high school] and we had never worked with them in the past. We approached them with the retro-commissioning option as our first project work with them. We are hoping to build a relationship there, using that as a door opener.

4.8.6 Participant Awareness of Efficiency Issues and Barriers to Participation

Service providers were asked about participants' awareness of equipment performance issues identified through the Retro-Commissioning Program prior to involvement in the program. Generally, some of the issues identified via the Retro-Commissioning program were known prior to commencing the program, but these issues tended to be intuitive, such as simply turning off lights or equipment when not in use. One service provider suggested that the study helped staff identify habitual behaviors that resulted in unneeded use such as leaving lights turned on during periods when the building was unoccupied. It was also noted that facilities do not always have the staff to identify ways in which equipment is not functioning at maximum efficiency. Facility staff generally focuses on preventative maintenance and keeping equipment operating. The more complicated and less apparent issues, which often involved controls, were not typically identified prior to the retro-commissioning process.

Service providers also noted that the level of awareness varied dependent on the person's position in the organization. Non-technical staff and those making decisions were generally not aware of specific problems, though they may have a general concern that utility bills are higher than they had been in the past.

Respondents noted the importance of listening to building managers and operating personnel and taking into account their observations and recommendations. Building personnel were often more focused on ensuring that everything was running rather than ensuring that everything was running efficiently.

There's operators who are really very much involved in the day to day affairs of the systems. And the ones who are in charge. The people who are responsible for everything, they are not aware of what's going on. People who are really involved day-to-day affairs, they may know a little bit about it, and some of them may even know what is possible, making the system or bypassing the system, not making it run the way it is designed to run. A lot of times I've seen when people try to solve the problem but they are not capable of knowing what to do so they most of the time do the wrong things. And that really affects the system and proper operation and it becomes inefficient operation.

Service providers were also asked about participants' awareness of the measures and/or upgrades needed for energy efficiency. Prior awareness of the measures required to improve building efficiency decreased inversely with the sophistication of the measure. Participants were aware of obvious recommendations, such as raising AC or turning off lights. However, in cases where these measures were already identified, the program helped increase awareness of their importance. One service provider noted that building operators may allow inefficient operational conditions to persist out of habit or because they are not aware of how much energy is being consumed unnecessarily. Moreover, most service providers noted that participants were generally not aware of most of the measures identified in the retro-commissioning study.

Overall not very aware, outside of turning things off at night and adjusting some temperature set points, some of the basic type things a homeowner would know. More complex measures that have to deal with the sequence and how the equipment operates, they were not very aware of those.

I would say it really depends on the measure. If it's a repair where they know something is broken and not working properly, we put it in the report, it's more than likely they knew there was a problem and just didn't get around to fixing it or didn't have the money to fix it. The other half the time when we recommend say a controls programming change, most of the time the building manager have not really heard of those types of recommendations. We're talking about like a automatic air discharge reset or an automatic static pressure reset. A lot of time they are unaware of those type of control strategies. As sophistication increases, the likelihood of them knowing decreases.

Service providers also stated that participants would not likely have had the same retro-commissioning services provided if the Retro-Commissioning Program had not been available. Tight budgets and a lack of knowledge about the benefits and payback of improved energy efficiency would have been significant barriers before the Retro-Commissioning Program, and continue as barriers presently.

In think that especially on the public side, I think it's unlikely [that they would have retro-commissioning performed without the program.]

I think that in my opinion, not many people would be going for retro-commissioning if they have to stay on budget, so I would say it would be hard for people to hire for retro-commissioning without the incentive. I would say that in public sector, they won't do anything.

They probably wouldn't [have had the retro-commissioning services if not for DCEO's Retro-Commissioning Program].

One of the issues that I'm trying to dispel with the clients that I get in this public sector is the notion that they're only on the hook for \$10,000. The program says that they have to spend \$10,000 if they want to take advantage of the services that the engineers provide. But we come back with projects in excess of \$10,000. If there's a focus on only spending \$10,000, they're probably not going to get the full benefit. I realize that budgets are tight, I understand that. But it seems like different entities are able to find whatever money they need to. I think the bigger issue is that the client is not expecting to spend more than \$10,000.

The main barriers to retro-commissioning as a service and to program participation were:

- Money/budgets/funds availability. Even though the study itself is paid for, the commitment to spend at least \$10,000 in implementation of the findings can be a barrier. Service providers noted that the \$10,000 can be particularly problematic because they do not know what energy savings they will get for this amount prior to committing to the program.
- Getting in contact with staff members who can be influential on deciding to do the project.
- Building and facilities staff may have no time available to participate in the study itself, or to implement and monitor the changes recommended by the study.
- Management often exhibits inertia and resistance to the idea of an outsider coming in to tell them how to run their facilities' plant better and possibly making them look bad.
- Limited knowledge of the actual existence of the Retro-Commissioning Program and the benefits that can be achieved.

If we are trying to approach a client and we are meeting first with the building engineer, there is almost always some resistance to having someone come in and recommend changing operations. I think it's just a natural reaction. A lot of these guys have been operating the same buildings for 15-20 years. To have someone come in and tell them they should be doing it or it would be beneficial to do it this way versus the way they've been doing it, there is some resistance there. There's a pushback.

I think it's money and time and commitment. In addition to the money they have to spend, it's taking their engineers a little bit away from their job that they currently have to do by spending time with us.

The people just are not aware of the benefit of investing money into retro-commissioning.

The money, the \$10,000 commitment. Even though it's a low number, they just don't like the idea of committing to spending that money without seeing results.

Two service providers noted that the \$10,000 funding requirement may act as a barrier to energy savings because participants treat it as the maximum investment rather than as the minimum investment required.

One of the issues that I'm trying to dispel with the clients that I get in this public sector is the notion that they're only on the hook for \$10,000. The program says that they have to spend \$10,000 if they want to take advantage of the services that the engineers provide. But we come back with projects in excess of \$10,000. If there's a focus on only spending \$10,000, they're probably not going to get the full benefit. I realize that budgets are tight, I understand that. But it seems like different entities are able to find whatever money they need to. I think the bigger issue is that the client is not expecting to spend more than \$10,000.

I will say the one good thing about that is they are also required to implement a certain minimum number of items to get a savings goal. With the DCEO program, they are required to spend \$10,000 and it has to be something that was identified but if one measure costs \$10,000 then they could stop.

4.8.7 Program Promotion

In terms of marketing the Retro-Commissioning Program, the level of promotional activity differed among service providers. About half of the interviewed service providers had done very little marketing of the program, while the other half had promoted it more heavily. This difference in marketing activity may have accounted for the disparity in number of public retro-commissioning projects that each service provider had completed and in the percentage of total work accounted for by public retro-commissioning projects.

While some service providers used the program as way to initiate contact with potential customers, others did not appear to use it as a tool for business development. The service providers did note that DCEO and SEDAC/360 Energy Group should do more to identify prospects and help service providers market the service, especially in making potential participants aware that the Retro-Commissioning Program exists.

Major suggestions for promoting the Retro-Commissioning Program included:

- Preparation of a list of public sector buildings that would qualify for the Retro-Commissioning Program, with energy use and contact names
- Joint calls on prospects with 360 Energy/SEDAC/DCEO staff – apparently joint calls are available from the utility companies for private sector prospects – it is expected that this would generally add credibility to the Retro-Commissioning Program, as long as Program Staff were viewed by prospects as sufficiently experienced and knowledgeable
- Increased mailing, both email and snail mail, to increase awareness of the Retro-Commissioning Program
- Preparation of case studies that present situations, solutions, and savings, and which would add credibility to the Retro-Commissioning Program
- Host seminars or meetings where potential participants and service providers can network

Examples of the types of comments related to these suggestions include the following:

If they have an actual list of buildings that could apply to the program, that would help tremendously. If we had a short list where we could approach prospective clients knowing

that they might not meet physically the requirements of the program, but are at least worth consideration.

Joint calls? Sure. I think it might help convince some hesitant clients. I think in today's world facility operators, managers, the financial people are bombarded with options. And sometimes getting over that barrier, if this isn't just another somebody trying to take advantage of them, instead it's helping convince them it's a great service.

Maybe more mailings. I know SEDAC sends flyers and everything, but it doesn't catch the attention of people. There should be maybe more seminars and more oriented toward the potential client, along with the potential provider of services together.

4.8.8 Program Satisfaction and Areas of Improvement

Service providers were satisfied with the Retro-Commissioning Program, both in terms of how the Retro-Commissioning Program functioned and the staff they have dealt with, but also in terms of what the Retro-Commissioning Program was able to accomplish.

Overall it's been good. It's been hard work sometimes but the people I've been working with, it's been nice. Good experience.

Very satisfied. I just think at this point a lot of the kinks are worked out. Each year they strive to improve the program. We work to improve our calculations and the product we provide. I think it's a mutually growing process. Each side is trying to improve what we can provide to the client.

I was very satisfied, no question. The Retro-Commissioning Program is very good. Most of the things really except for in the beginning, starting up, other than that, the initial hitches, everything was pretty smooth.

Feedback from participants has been uniformly positive. Participants recognized the opportunity that the Retro-Commissioning Program provided to improve the energy operating efficiency of their building and to offset the monetary burden by helping with implementation costs.

Our clients have been pretty satisfied with the program. It's all been good. I think from the client's standpoint, they're extremely happy getting it without paying a dime and getting a full report on their facilities.

There were a number of areas that service providers believed should be modified or changed to further improve the program:

- Report and phase deadlines should be more flexible rather than concrete in order to fit particular situations better.
- Assistance should be provided to the client in implementing the measures that are identified during the Retro-Commissioning Program. Ideally this would be provided by the service providers.
- Project reviews should focus less on the format of the report and more on the content – less on what the report looks like and more on the energy savings that have been identified.

However, it should be noted that this comment may have been triggered by efforts to streamline and improve the consistency of the reporting, which is a worthwhile objective.

- Compensation should be provided to the service provider earlier in the process. A large amount of preparatory work and commitment of time takes place before the service provider can submit the first invoice. Recently a change went into effect that allows service providers to bill monthly. This change applies to EPY6/GPY3.
- The spreadsheet format for presenting energy savings calculations has created more work for service providers and does not seem to always present information accurately.
- Report content requirements appear to change frequently. Service providers would like DCEO or 360 Energy to decide what should be in the report and not change it unless absolutely necessary.
- Consider adapting the Retro-Commissioning Program to smaller buildings.

Some examples of the types of comments reflecting these recommendations are:

One of the bigger challenges is after we deliver the planning report to the client, they are kind of left alone to implement all the measures that are recommended or all the measures they select. We have found in almost all of our projects, that when left alone the client does not implement the measures properly or they delay as long as possible. We personally feel there should be a little more involvement from the service provider and maybe even 360 during the implementation phase so that things get implemented correctly and more important they get implemented in a timely manner.

Another issue that we tend to have is the review process, although it's quick, it doesn't focus on what we feel is the more important part of the measure which is the actual energy saving, the scope of work and the description of the measure itself. It focuses more on kind of like the structure of the report and basically the deliverable has to fit into a template.

The SEDAC program does ask us to do a fair amount of work up front with no reimbursement. So basically we're out on a limb doing all the front-end work to qualify a potential project, and perhaps all at our cost if it doesn't support under the program.

The other main issue, and it hasn't been that big an issue, is about a year ago they switched to where they wanted to see all the energy analysis done under kind of a spreadsheet format. We had been doing the analysis using energy modeling software, which we find to be more effective and more accurate. The spreadsheet format that they ask for is a little unusual, uncomfortable and cumbersome for us, and I know others have the same concern.

4.9 Program Operations Perspective

This section summarizes the core findings of interviews that were conducted with the Retro-Commissioning Program implementation staff.

In order to gather information regarding the operational efficiency and program delivery process, in-depth interviews were conducted with key program implementation staff from 360 Energy Group.

The 360 Energy Group, in coordination with DCEO and the Smart Energy Design Assistance Center (SEDAC), implements the Retro-Commissioning Program. In 2007, 360 Energy Group was established to support DCEO's SEDAC Design Assistance program and in 2009, it expanded its offering to include the support of the Retro-Commissioning Program. Services provided by 360 Energy Group include implementation, oversight, outreach, education, and training.

Respondents discussed their perspective on program structure, operations, and marketing. The key findings from these discussions are summarized below.

- **Sufficient Activity during EPY5/GPY2:** Program staff characterized the activity during the program year as strong. They noted that a larger number of projects with verified savings were completed than in the prior year and that the first gas savings were realized. Staff reported that demand for the program typically exceeds the number of projects that can be funded with the current budget. Moreover, staff has requested additional funds from DCEO to fund additional projects.

Staff reported that the types of organizations with verified savings during EPY5/GPY2 were similar to the types of organizations that have participated in the past. Participating facility types consisted of schools, municipal buildings, local government facilities, and airports.

- **Improvements Made to the Program for EPY5/GPY2:** Program staff made a few changes to the participation process and the administration of the program. Regarding participation process changes, program participants now submit a notice of interest at the beginning of the participation process. Prior to this change, program staff collected similar information through a telephone call. Another change made to the participation process is that service providers complete an initial scoping of the proposed site for a study to determine if there are sufficient saving opportunities.

Program staff has also developed new materials for service providers. These materials include a service provider manual to outline guidelines and expectations, checklists to help ensure that all saving opportunities are identified at a site, and templates to standardize how recommended energy saving improvements are reported to facilitate the administration of the program. In addition to these changes, the program has developed tighter project management procedures to ensure that projects continue to move forward and to monitor the share of project budgets utilized. Program staff noted that monitoring the program budget is important because a few projects were completed under budget. Projects that are completed under budget are problematic because those funds are locked up and cannot be allocated to other projects to generate additional savings. Closer monitoring of project budget utilization allows staff to redirect unspent funds to other projects prior to final project completion.

- **Focus on Project Quality:** The Retro-Commissioning Program has a number of processes in place to aid the identification of saving opportunities and the accurate estimation of savings. In addition to the checklist and reporting templates previously discussed, an engineer is assigned to the team overseeing each project to ensure that energy saving calculations and estimations are reasonable. Additionally, program staff closely monitors the workload assigned to each service provider. In general, service providers are limited to four projects at a time although this limitation may be relaxed if the provider is easily meeting project milestones.
- **Service Providers Encouraged to Identify Capital Improvement Projects:** The primary focus of the Retro-Commissioning Program is to identify low- and no-cost improvements to building operations. However, service providers are encouraged to identify capital improvement projects that may lead to additional savings. Although expenditures on these projects do not count towards the participants' requirement to spend \$10,000 on energy efficiency improvements, they are listed in an appendix of the retro-commissioning report. Furthermore, service providers are encouraged to refer their clients to the DCEO incentive programs to implement these improvements.
- **Program Engages in a Variety of Marketing Efforts:** In addition to the service providers' efforts to promote the program, program implementation staff also engages in a variety of marketing tactics. These include promotion of the program in newsletters, presentations at workshops and events, working with clients who had received energy assessments through the assessment program provided by Smart Energy Design Assistance Center Program, and some press coverage of successful projects. The program has also completed a case study as promotional material. Overall, the program staff assessment is that the program marketing is adequate because they have not had any difficulty meeting their program activity targets.
- **Project Delays Most Likely to Occur during the Implementation Stage:** Program staff reported that delays in the progression of a project are most likely to occur during the implementation stage. These delays can occur for various reasons such as requirements by participant organizations to put the work out for bid and difficulty in allocating funds for measure implementation. In order to ensure that projects continue to move forward, program staff and service providers regularly follow up with participants. Program staff also offers to answer questions and provide assistance to service providers if needed.

5. Conclusions and Recommendations

Since its initial launch, the Retro-Commissioning Program has continued to develop and to improve the efficiency of public sector buildings in Illinois. Program participants and service providers are generally satisfied with the program and staff has implemented methods that are designed to improve program operation and delivery.

5.1 Key Conclusions

The following presents a selection of key findings from the most recent program year and full program cycle:

- **High Level of Program Activity:** Program staff reported that the program year was successful. The number of completed projects more than doubled from the prior year, and expected electric savings were nearly twice the expected savings from the prior year. Additionally, EPY5/GPY2 marks the first year that the program realized natural gas savings from studies initiated during natural gas program year one.
- **Continued Demand for the Retro-Commissioning Program:** Program staff indicated that there was significant demand for the program and noted that there are more public entities interested in completing retro-commissioning project than can be funded with the current program budget. Furthermore, service providers indicated that demand for retro-commissioning was either remaining steady or growing as awareness of the potential energy savings increases.
- **Barriers to Program Participation:** Despite the demand for the program, service providers noted some barriers to participation. Service providers indicated that the \$10,000 commitment can prevent some organizations from participating in the program. This spending requirement may be particularly problematic for decision makers who have little knowledge of the potential energy benefits from retro-commissioning. Another barrier noted by service providers is that the facility staff members who are aware of energy inefficiencies at their facilities are often not the same individuals with the authority to commit the organization to participating in the program.

Participant survey responses indicated that public sector facilities typically have one or two individuals that make decisions about energy efficiency improvements. A key factor for the successful promotion of the program by service providers is that their facility contacts are the individuals with the authority to commit the facility. Service providers noted that not having the correct contact can be a barrier to program participation.

Other barriers to program participation noted by service providers include a lack of facility staff resources to dedicate to the project, and resistance to allowing outsiders into the facility to complete the study.

- **Spending Commitment may Effectively Limit Investments in Efficiency for Some Participants:** One of the strengths of the program for gaining participation is that

participants receive the retro-commissioning services in exchange for a relatively modest commitment to spend \$10,000 on energy efficiency improvements identified through the study. This incentive design likely appeals to public sector entities that often cite limited energy efficiency improvement budgets as a barrier to implementation. However, some service providers noted that for some participants, the \$10,000 spending requirement effectively acts as a cap on the facility's expenditures. That is, although considerably more than \$10,000 worth of efficiency improvements may be identified in a study, some participants are only interested in spending as much as is required by the program. Participation data supports this observation as a number of projects saw a relatively small share of the recommended savings implemented. Studies of larger scope for which only a small share of the recommended improvements are implemented create inefficiencies for the program. In these cases, the scope of the retro-commissioning study, and consequently its cost, may be disproportionate to the amount participants' are intending to spend on the improvements.

- **Program Marketing is Adequate Given Current Program Budget:** The program has seen sufficient activity to commit all of the program's budget, and funds from supplementary requests, to retro-commissioning projects. The ability to fully utilize its budget suggests that the program marketing is sufficient given its current level of funding.

However, additional attention to program marketing will likely be needed should the program expand. In particular, the level of promotion by service providers may not be sufficient to drive additional program activity. Approximately half of the interviewed service providers indicated that they did not expend much effort in promoting the program. Additionally, most surveyed participants heard of the program from a source other than the service providers. Although the program is promoted by program staff, service providers are critical to the promotion of the program and some may not be fully engaged in this effort.

- **Service Providers Noted Few Program Administration Problems:** Service providers were generally satisfied with the retro-commissioning program and noted few problems with how the program is administered. Service providers noted that the approval process was quick in comparison to other retro-commissioning programs they had worked with and that the reporting requirements are similar to other programs, although they are more structured. Service providers also stated that program staff is knowledgeable and responsive to inquiries. Service providers who were new to the program stated that the training provided on program structure and operation was useful.

However, service providers did provide some suggestions for improving the administration of the program. Some of these suggestions included focusing on reporting content rather than format and keeping reporting requirements consistent over time. However, the suggestions regarding changes to the reporting content likely reflect program staff's attempts to streamline and improve the program. Additionally, some service providers indicated a preference to receive compensation earlier in the process because of the large amount of preparatory work that occurs before the first invoice can be submitted. Program staff recently

instituted a change that allows service providers to submit monthly invoices for projects. This change went into effect during EPY6/GPY3.

- **Participants Satisfied with the Program and the Participation Process:** From the participant perspective, the program appears to be operating well. All of the participant survey respondents indicated that they were very satisfied with the program overall. Additionally, all of the respondents were very satisfied with the professionalism of the service providers. Few participants noted problems with the participation process. However, a few issues were noted regarding contractors' implementation of the recommended measures. These included contractors' reluctance to implement one of the recommended measures and contractors failing to install some of the equipment detailed in the selected recommendations. Overall, these comments were the exception rather than the rule and do not suggest systematic problems with the program.

5.2 Recommendations

Overall the Retro-Commissioning Program is operating effectively and delivering energy savings for the DCEO. However, the following recommendations may serve to further improve the program processes and capacity to deliver cost-effective savings.

- **Consider Balancing Spending Requirement with Savings Potential and Study Scope:** The relatively low participant spending requirement likely facilitates participation in the program. However, in some instances, large savings identified in the studies may be unrealized because participants are only required to spend \$10,000. In order to generate additional value from the studies, program staff should consider varying the spending commitment by a factor such as the facility size or its energy use intensity. Alternatively, program staff may consider offering prospective participants varying levels of financial commitments which would be tied to the scope of the retro-commissioning study. For example, the total allowed cost of the retro-commissioning will be set at one level for participants who commit to spending \$10,000, while the retro-commissioning study budget will be higher for participants who commit to spending \$50,000.
- **Consider offering Retro-Commissioning Training to Service Providers:** Some service providers noted interest in additional training on completing retro-commissioning studies. Given the depth of SEDAC's expertise, program staff may consider offering training on special topics related to identifying energy savings in retro-commissioning studies, or hosting events where service providers can meet and discuss best practices. Prior to offering any training, it is recommended that the program staff perform a thorough analysis of service providers' specific training needs. This will assist in developing a tailored training that will be useful to service providers.
- **Provide Additional Information on Savings Potential:** Some service providers noted that the \$10,000 spending commitment may prevent some of their prospective customers from participating because they have to commit to the spending requirement before knowing what their energy savings will be. Although the program has a brochure that identifies the typical savings for a retro-commissioning project, program staff may consider providing information

about the savings that are typically realized for a \$10,000 investment. Additionally, as more facilities complete retro-commissioning studies, it may be possible for the program to develop more tailored materials that provide estimated savings by facility type, size, energy use intensity, or other factors. This additional information may help reduce potential participants' uncertainty about agreeing to the \$10,000 commitment.

- **Potential for Expanded Scope of Program:** Given program staff and service provider observations about the level of demand for this program, there is potential for generating additional savings through the Retro-Commissioning Program. However, such a change in program scope would have to be considered in the context of several factors including the need for greater promotional efforts from service providers, the potential for greater efficiencies in the achievement of savings as previously discussed, and the ability of the retro-commissioning program to deliver energy savings that are at least as cost effective as what could be achieved through other programs in DCEO's portfolio.

Appendix A: Questionnaire for Decision Maker Survey

1. Name of Public Entity
2. Your name (please correct if necessary)
3. What was your role in the decision to retro-commission the facility?
 - ☐ Main decision maker
 - ☐ Assisted with the decision
 - ☐ Was not part of the decision process (If Checked, go to 3A)
- 3A. Who was the main decision maker?
- 3B. What is this person's telephone number?
- 3C. What is this person's email address?
4. What are the main sources your organization relies on for information about energy efficient equipment, materials, practices and design features? (Do not read list. Check all that apply)
 - ☐ A DCEO Representative
 - ☐ The DCEO Website
 - ☐ A utility representative
 - ☐ Brochures or advertisements
 - ☐ Trade associations or business groups you belong to
 - ☐ Trade journals or magazines
 - ☐ Friends and colleagues
 - ☐ The Smart Energy Design Assistance Center (SEDAC) and SEDAC RCx Service Providers
 - ☐ The Energy Resource Center (ERC)
 - ☐ Architects, engineers or energy consultants
 - ☐ Equipment vendors or building contractors
 - ☐ Other (please describe)
 - ☐ Don't know / Refused
5. Which of the following policies or resources does your organization have in place regarding energy efficiency improvements at this facility? (*Check all that apply*)
 - ☐ An energy management plan (If checked, go to 5A)
 - ☐ A staff member responsible for energy and energy efficiency
 - ☐ Policies that incorporate energy efficiency in operations and procurement
 - ☐ Active training of staff
 - ☐ Do not have policies or procedures for energy efficiency improvements
 - ☐ Other (please specify)
 - ☐ Don't know

- 5A. Does your energy management plan include goals for energy savings?
- ☐ Yes (If checked, go to 5B)
 - ☐ No
 - ☐ Don't know
- 5B. Could you briefly describe the goals specified in your energy management plan?
6. How many facility operations staff members are employed at this facility?
7. Are the facility operators also tasked with general facility maintenance such as painting and cleaning?
- ☐ Yes
 - ☐ No
 - ☐ Don't know
8. How would you describe the approach to HVAC maintenance at this facility? Would you say that it is...(Read List)
- ☐ Reactive, we run equipment to failure and then repair or replace it
 - ☐ Preventative, we perform maintenance at scheduled periods to maintain equipment
 - ☐ Predictive, we monitor equipment and use the information to determine when maintenance is needed
 - ☐ Other (please describe)
 - ☐ Don't know
9. How does your organization decide to make energy efficiency improvements for this facility? Is the decision: (Read list)
- ☐ Made by one or two key people
 - ☐ Based on staff recommendations to a decision maker
 - ☐ Made by a group or committee
 - ☐ Made in some other way
 - ☐ Don't know
10. What barriers does your organization face in making energy efficiency improvements? (Do not read list. Use as possible prompts. Select all that apply)
- ☐ Insufficient funding for improvements
 - ☐ Lack of information on energy efficient equipment and practices
 - ☐ Approval processes that are slow or make purchasing difficult
 - ☐ Schedules that dictate when equipment is to be replaced or maintained regardless of efficiency levels
 - ☐ Incentive program time requirements
 - ☐ Current equipment that is too new to be replaced with more efficient equipment
 - ☐ Other (please specify)
 - ☐ Don't know

11. How important is past experience with energy efficient equipment or practices for your decision making regarding energy efficiency improvements? Would you say... (Read list)
- ☐ Very important
 - ☐ Somewhat important
 - ☐ Only slightly important
 - ☐ Not important at all
 - ☐ Don't know
12. How important is advice and/or recommendations received from DCEO or its partners (SEDAC or SEDAC Service Providers) for your decision making regarding energy efficiency improvements? Would you say... (Read list)
- ☐ Very important
 - ☐ Somewhat important
 - ☐ Only slightly important
 - ☐ Not important at all
 - ☐ Don't know
13. Which financial methods does your organization typically use to evaluate energy efficiency improvements for this facility? (Read list. Select all that apply)
- ☐ Initial Cost
 - ☐ Simple payback (If checked, go to 13A)
 - ☐ Internal rate of return (If checked, go to 13B)
 - ☐ Life cycle cost (If checked, go to 13C)
 - ☐ None of these
- 13A. What payback length of time do you normally require in order to proceed with an energy efficiency project? Please provide either a specific value or an estimated range.
- 13B. What rate of return do you normally require in order to proceed with an energy efficiency project? Please provide either a specific value or an estimated range.
- 13C. What discount rate do you normally apply when determining life cycle costs? Please provide either a specific value or an estimated range.
14. Has your organization paid for any energy efficiency improvements in the last three years for which you did not apply for a service or financial incentive through an energy efficiency program?
- ☐ Yes, paid for energy efficiency improvements but did not apply for incentive. (If checked, go to 14A)
 - ☐ No efficiency improvements were paid for by the organization.
 - ☐ No, an incentive was applied for. (If checked, go to 14B)
 - ☐ Don't know

- 14A. Why didn't you apply for an incentive for that project? (Do not read list)
- ☐ Didn't know whether improvements qualified for incentives
 - ☐ Didn't know about incentives until after efficiency improvements were completed
 - ☐ Didn't have time to complete paperwork for the incentive application
 - ☐ Too much paperwork for the incentive application
 - ☐ The incentive was insufficient
 - ☐ Other (please specify)
 - ☐ Don't know
- 14B. Did you receive all of your incentives for these past energy efficiency projects?
- ☐ Yes
 - ☐ No
 - ☐ Don't know
15. When did you learn of the Retro-Commissioning Program?
- ☐ Before planning to retro-commission the facility
 - ☐ During your planning to retro-commission the facility
 - ☐ Once a retro-commissioning plan was established but before it was implemented
 - ☐ After the retro-commissioning was complete
 - ☐ Some other time (please explain)
 - ☐ Don't know
16. How did you learn of the Public Sector Retro-Commissioning Program? (Do not read list. Select all that apply)
- ☐ Approached directly by a representative of the Public Sector Retro-Commissioning Program
 - ☐ A DCEO representative mentioned it
 - ☐ The DCEO Website
 - ☐ From a utility representative
 - ☐ Received an informational brochure on the Public Sector Retro-commissioning Program
 - ☐ Trade association or business group you belong to
 - ☐ Trade journal or magazine
 - ☐ Friends or colleagues
 - ☐ From a representative of Smart Energy Design Assistance Center (SEDAC) or a SEDAC Service Provider
 - ☐ From an Energy Resource Center (ERC) representative
 - ☐ An architect, engineer or energy consultant
 - ☐ Equipment vendor or building contractor
 - ☐ Attended a conference, workshop or seminar
 - ☐ Past experience with the program
 - ☐ An energy service company
 - ☐ Other (please describe)
 - ☐ Don't know

17. Before participating in the Retro-Commissioning Program, had you completed similar retro-commissioning projects?
- ☐ Yes
 - ☐ No
 - ☐ Don't know
18. Did you have plans to have this facility retro-commissioned before hearing about the Retro-Commissioning Program?
- ☐ Yes (If checked, go to 18A)
 - ☐ No
 - ☐ Don't know
- 18A. How long before finding out about the Public Sector Retro-commissioning Program did you have plans to retro-commission the [FACILITY]? Did you have plans for: (Read list)
- ☐ Less than 6 months before
 - ☐ 6 months to less than 1 year
 - ☐ 1 year to less than 2 years
 - ☐ 2 years to less than 5 years
 - ☐ 5 or more years
 - ☐ Don't know
- 18B. Would you have gone ahead with this retro-commissioning even if you had not participated in the program?
- ☐ Yes
 - ☐ No
 - ☐ Don't know
19. Did you have experience with DCEO energy efficiency programs prior to participating in the Retro-Commissioning Program?
- ☐ Yes(If checked, go to 19A)
 - ☐ No
 - ☐ Don't know
- 19A. How important was previous experience with the DCEO programs in making your decision to have this facility retro-commissioned? Would you say... (Read list)
- ☐ Very important
 - ☐ Somewhat important
 - ☐ Only slightly important
 - ☐ Not at all important
 - ☐ Don't know
20. Did a Retro-Commissioning Program or other DCEO representative recommend that you retro-commission the facility?
- ☐ Yes (If checked, go to 20A)
 - ☐ No
 - ☐ Don't know

- 20A. If the Retro-Commissioning Program or other DCEO representative had not recommended that you retro-commission the facility, how likely is it that you would have done it anyway? Would you say... (Read list)
- ☐ Definitely would have
 - ☐ Probably would have
 - ☐ Probably would not have
 - ☐ Definitely would not have
 - ☐ Don't know
21. Did a representative of the Smart Energy Design Assistance Center (SEDAC) or a SEDAC Service Provider recommend that you perform the retro-commissioning?
- ☐ Yes (If checked, go to 21A)
 - ☐ No
 - ☐ Don't know
- 21A. If the SEDAC or SEDAC Service Provider representative had not recommended that you retro-commission the facility, how likely is it that you would have done it anyway? Would you say... (Read list)
- ☐ Definitely would have installed
 - ☐ Probably would have installed
 - ☐ Probably would not have installed
 - ☐ Definitely would not have installed
 - ☐ Don't know
22. Would your organization have been financially able to retro-commission the facility without the assistance from the Retro-Commissioning Program?
- ☐ Yes
 - ☐ No
 - ☐ Don't know
23. If the retro-commissioning service had not been provided at no cost through the program, how likely is it that you would have had the facility retro-commissioned anyway? Would you say... (Read list)
- ☐ Definitely would have
 - ☐ Probably would have
 - ☐ Probably would not have
 - ☐ Definitely would not have
 - ☐ Don't know

24. How did the availability of information and the service incentive provided through the Retro-Commissioning Program affect the quantity of energy efficiency improvements you implemented? Did you implement more energy efficiency improvements than you otherwise would have without the program?

- ☐ Yes (If checked, go to 24A)
- ☐ No
- ☐ Don't know

24A. What additional improvements did you implement?

25. How did the availability of information and the service incentive provided through the Retro-Commissioning Program affect the timing of the retro-commissioning project? Did you retro-commission the facility earlier than you otherwise would have without the program?

- ☐ Yes (If checked, go to 25A)
- ☐ No
- ☐ Don't know

25A. When would you otherwise have retro-commissioned the [FACILITY]? Would you have done it in... (Read if needed)

- ☐ Less than 6 months before
- ☐ 6 months to less than 1 year
- ☐ 1 year to less than 2 years
- ☐ 2 years to less than 5 years
- ☐ 5 or more years
- ☐ Don't know

26. Did you have any problems with the application process?

- ☐ Yes
- ☐ No
- ☐ Don't know

26A. What problems did you have?

27. Did the retro-commissioning project go smoothly?

- ☐ Yes
- ☐ For the most part (If checked, go to 27A)
- ☐ No (If checked, go to 27A)
- ☐ Don't know

27A. Please explain in what ways the retro-commissioning did not go smoothly.

28. Did you have any problems adhering to the agreement to install \$10,000 worth of measures?

- ☐ Yes
- ☐ No
- ☐ Don't know

28A. What problems did you have?

29. Did the energy efficiency improvements from the retro-commissioning meet your expectations? (Read list)

- ☐ My expectations were exceeded
- ☐ My expectations were met
- ☐ My expectations were mostly met (If checked, go to 28A)
- ☐ My expectations were not met (If checked, go to 28A)
- ☐ Don't know

29A. Please explain in what ways the energy efficiency improvements did not meet your expectations.

30. Do you feel that the retro-commissioning service provider did a good job of identifying energy efficiency improvements?

- ☐ Yes
- ☐ For the most part (If checked, go to 29A)
- ☐ No (If checked, go to 29A)
- ☐ Don't know

30A. Please explain in what ways you do not feel the service provider did a good job.

31. Did you have any of the retro-commissioning measures implemented by a contractor?

- ☐ Yes (If checked, go to 30A)
- ☐ No
- ☐ Don't know

31A. For those measures implemented by a contractor, do you feel you got a quality implementation of the identified improvements?

- ☐ Yes
- ☐ For the most part (If checked, go to 30B)
- ☐ No (If checked, go to 30B)
- ☐ Don't know

31B. Please explain in what ways you did not receive a quality implementation.

32. Have the measures you implemented through the retro-commissioning program been verified by a representative of SEDAC or a SEDAC Service Provider?

- ☐ Yes (If checked, go to 31A, then 31B)
- ☐ No
- ☐ Don't know

32A. Were any changes made as a result of this verification?

- ☐ Yes (If checked, go to 31B)
- ☐ No
- ☐ Don't know

32B. Please explain what changes were made.

33. Since participating in the Retro-Commissioning Program, have you made any additional energy efficiency improvements similar to those implemented through the program that you did not apply or receive an incentive for?

- ☐ Yes (If checked, go to 32A-32G)
- ☐ No
- ☐ Don't know

33A. Did the additional energy efficiency improvements result in the same or higher level of efficiency as the improvements implemented through the program?

- ☐ Yes
- ☐ No
- ☐ Don't know

33B. Were these additional improvements implemented at the same facility (or facilities) as the retro-commissioning project that you received an incentive for?

- ☐ Yes
- ☐ No; Where were the improvements made? (please specify)
- ☐ Don't know

33C. Did a recommendation from a program staff member or contractor influence your decision to implement the additional measures?

- ☐ Yes (If checked, go to 32D.1)
- ☐ No
- ☐ Don't know

33D. How important was this recommendation to your decision to implement the additional energy efficiency improvements? Would you say... (Read list)

- ☐ Very important
- ☐ Somewhat important
- ☐ Neither important or unimportant
- ☐ Somewhat unimportant
- ☐ Unimportant
- ☐ Don't know

33E. How important was your experience with the Public Sector Retro-commissioning Program to your decision to implement the additional energy efficiency project? Would you say... (Read list)

- ☐ Very important
- ☐ Somewhat important
- ☐ Neither important or unimportant
- ☐ Somewhat unimportant
- ☐ Unimportant
- ☐ Don't know

- 33F. How important was any past experience with energy efficiency programs to your decision to implement the additional efficiency improvements? Would you say... (Read list)
- ☐ Did not participate in any other programs in the past
 - ☐ Very important
 - ☐ Somewhat important
 - ☐ Neither important or unimportant
 - ☐ Somewhat unimportant
 - ☐ Unimportant
 - ☐ Don't know
- 33G. Why didn't you apply for or receive financial assistance or incentives for the improvements? (Do not read list. Use as possible prompts. Check all that apply)
- ☐ Didn't know whether the improvements qualified for financial incentives
 - ☐ Financial incentive was insufficient
 - ☐ No financial incentive was offered
 - ☐ Too much paperwork for the financial incentive application
 - ☐ For some other reason (please specify)
34. Since participating in the program, have you implemented any other energy efficiency improvements that were not similar to what you implemented through the program and that you did not apply or receive an incentive for?
- ☐ Yes (If checked, go to 33A-33G)
 - ☐ No
 - ☐ Don't know
- 34A. What energy efficiency improvements did you implement?
- 34B. Were these improvements made at the same facility (or facilities) as the retro-commissioning project that you received an incentive for?
- ☐ Yes
 - ☐ No; Where was the equipment installed? (please specify)
 - ☐ Don't know
- 34C. Did a recommendation from a program staff member or contractor influence your decision to implement the additional measures?
- ☐ Yes (If checked, go to 33D.)
 - ☐ No
 - ☐ Don't know
- 34D. How important was this recommendation to your decision to implement the additional energy efficiency improvements? Would you say... (Read list)
- ☐ Very important
 - ☐ Somewhat important
 - ☐ Neither important or unimportant
 - ☐ Somewhat unimportant
 - ☐ Unimportant

- 34E. How important was your experience with the Public Sector Retro-commissioning Program to your decision to implement the additional energy efficiency project? Would you say... (Read list)
- ☐ Very important
 - ☐ Somewhat important
 - ☐ Neither important or unimportant
 - ☐ Somewhat unimportant
 - ☐ Unimportant
 - ☐ Don't know
- 34F. How important was any past experience with energy efficiency programs to your decision to implement the additional efficiency improvements? Would you say... (Read list)
- ☐ Did not participate in any other programs in the past
 - ☐ Very important
 - ☐ Somewhat important
 - ☐ Neither important or unimportant
 - ☐ Somewhat unimportant
 - ☐ Unimportant
 - ☐ Don't know
- 34G. Why didn't you apply for or receive financial assistance or incentives for the improvements? (Do not read list. Use as possible prompts. Check all that apply)
- ☐ Didn't know about financial incentives
 - ☐ Didn't know whether the measures qualified for financial incentives
 - ☐ Financial incentive was insufficient
 - ☐ No financial incentive was offered
 - ☐ Too much paperwork for the financial incentive application
 - ☐ For some other reason (please specify)
35. How would you rate your satisfaction with the following - *Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied, or Very Dissatisfied?* (If dissatisfied, go to 35A)
- The energy efficiency of the facility since the retro-commissioning
 - Savings on your monthly bill
 - Incentive amount
 - The effort required for the application process
 - Information provided by the retro-commissioning service provider
 - Quality of the retro-commissioning service provider's work
 - The retro-commissioning service provider's level of professionalism
 - Quality of the work conducted the contractor implementing the measures
 - Information provided by DCEO
 - Information provided by Smart Energy Design Assistance Center (SEDAC)
 - The elapsed time until you received the incentive
 - Overall program experience

35A. Please describe in what ways you were not satisfied with the program.

36. Do you have any other comments that you would like to relay to DCEO about energy efficiency in public entities or about their programs?

Appendix B: Decision Maker Survey Responses

As part of the evaluation work effort, a survey was made of a sample of decision makers for facilities that received under the Retro-Commissioning Program. This survey provided the information used in Chapter 3 to estimate free ridership for projects in the Retro-Commissioning Program. The survey also provided information used to perform the program process evaluation.

Each participant was surveyed using the survey instrument provided in Appendix A. The surveys were conducted by internet. During the survey, a participant was asked questions about (1) his or her general decision making regarding purchasing and installing energy efficient equipment, (2) his or her knowledge of and satisfaction with the Retro-Commissioning Program, and (3) the influence that the Retro-Commissioning Program had on his or her decision to implement the retro-commissioning project.

The following tabulations summarize DCEO participant survey responses. Two columns of data are presented. The first column presents the number of survey respondents (*n*). The second column presents the percentage of survey respondents.

	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
3. What was your role in the decision to retro-commission the facility?	Main decision maker	8	67%
	Assisted with the decision	4	33%
	Was not part of the decision making process	0	0%

	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents*</i>
4. What are the main sources your organization relies on for information about energy efficient equipment, materials, practices, and design features?	A DCEO representative	1	8%
	The DCEO website	2	17%
	The Smart Energy Design Assistance Center (SEDAC) and SEDAC RCx Service Providers	1	8%
	The Energy Resource Center (ERC)	0	0%
	A utility representative	1	8%
	Brochures or advertisements	1	8%
	Trade associations or business groups you belong to	2	17%
	Trade journals or magazines	3	25%
	Friends and colleagues	2	17%
	Architects, engineers, or energy consultants	3	25%
	Equipment vendors or building contractors	5	42%
	Other (please describe)	7	58%
	Don't know / Refused	1	8%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents*</i>
5. Which of the following policies or resources does your organization have in place regarding energy efficiency improvements at this facility?	An energy management plan	5	42%
	A staff member responsible for energy and energy efficiency	8	67%
	Policies that incorporate energy efficiency in operations and procurement	8	67%
	Active training of staff	6	50%
	Do not have policies or procedures for energy efficiency improvements	1	8%
	Other (please specify)	1	8%
	Don't know	0	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

5a. Does your energy management plan include goals for energy savings?	<i>Response</i>	<i>(n=5)</i>	<i>Percent of Respondents</i>
	Yes	5	100%
	No	0	0%
	Don't know	0	0%

6. How many facility operations staff members are employed at this facility?	<i>Average Number of Staff Members, (n=12)</i>		
	Average		167.8

7. Are the facility operators responsible for general facility maintenance such as painting and cleaning?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	10	83%
	No	2	17%
	Don't know	0	0%

8. How would you describe the approach to HVAC maintenance at this facility? Would you say...	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Reactive, we run equipment to failure and then repair or replace it	1	8%
	Preventative, we perform maintenance at scheduled periods to maintain equipment	6	50%
	Predictive, we monitor equipment and use the information to determine maintenance needed	0	0%
	Other (please describe)	5	42%
	Don't know	0	0%

9. How does your organization decide to make energy efficiency improvements for this facility? Is the decision:	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Made by one or two key people	6	50%
	Made by a group or committee	4	33%
	Based on staff recommendations to a decision maker	2	17%
	Made in some other way	0	0%
	Don't know	0	0%

10. What barriers does your organization face in making energy efficiency improvements?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents*</i>
	Insufficient funding for improvements	10	83%
	Lack of information on energy efficient equipment and practices	1	8%
	Approval processes that are slow or make purchasing difficult	3	25%
	Schedules that dictate when equipment is to be maintained regardless of efficiency levels	1	8%
	Incentive program time requirements	3	25%
	Current equipment is too new to be replaced with more efficient equipment	7	58%
	Other (please specify)	1	8%
	Don't know	0	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

11. How important is past experience with energy efficient equipment or practices for your decision making regarding energy efficiency improvements? Would you say...	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Very important	7	58%
	Somewhat important	3	25%
	Only slightly important	2	17%
	Not important at all	0	0%
	Don't know	0	0%

12. How important is advice and/or recommendations received from DCEO or its partners (SEDAC or SEDAC Service Providers) for your decision making regarding energy efficiency improvements? Would you say...	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Very important	7	58%
	Somewhat important	4	33%
	Only slightly important	1	8%
	Not important at all	0	0%
	Don't know	0	0%

13. Which financial methods does your organization typically use to evaluate energy efficiency improvements for this facility?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents*</i>
	Initial Cost	6	50%
	Simple payback	6	50%
	Internal rate of return	3	25%
	Life cycle cost	7	58%
	None of these	0	0%
	Don't know	0	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

13a. What payback length of time do you normally require in order to proceed with an energy efficiency project?	<i>Average Years, (n=5)</i>	
	Average	5.6

	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
14. Has your organization paid for any energy efficiency improvements in the last three years for which you did not apply for a service or financial incentive through an energy efficiency program?	Yes, paid for energy efficiency projects but did not apply for incentive.	9	75%
	No efficiency improvements were paid for by the organization.	0	0%
	No, an incentive was applied for.	2	17%
	Don't know	1	8%

	<i>Response</i>	<i>(n=9)</i>	<i>Percent of Respondents</i>
14a. Why didn't you apply for an incentive for that project?	Didn't know whether improvements qualified for incentives	1	11%
	Didn't know about incentives until after efficiency improvements were completed	1	11%
	Didn't have time to complete paperwork for the incentive application	3	33%
	Too much paperwork for the incentive application	0	0%
	The incentive was insufficient	1	11%
	Other (please specify)	3	33%
	Don't know	0	0%

	<i>Response</i>	<i>(n=2)</i>	<i>Percent of Respondents</i>
14b. Did you receive all of your incentives for these past energy efficiency projects?	Yes	2	100%
	No	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
15. When did you learn of the Retro-Commissioning Program? Was it...	Before planning to retro-commission the facility	12	100%
	While planning to retro-commission the facility	0	0%
	Once a retro-commissioning plan was established but before it was implemented	0	0%
	After the retro-commissioning was completed	0	0%
	Some other time (please explain)	0	0%
	Don't know	0	0%

16. How did you learn of the Public Sector Retro-Commissioning Program?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents*</i>
	Approached directly by a representative of the Public Sector Retro-commissioning Program	0	0%
	A DCEO representative mentioned it	2	17%
	The DCEO website	3	25%
	From a utility representative	2	17%
	Received an information brochure on the Public Sector Retro-commissioning Program	0	0%
	Trade journal or magazine	0	0%
	Trade association or business group you belong to	0	0%
	Friends or colleagues	3	25%
	From a representative of Smart Energy Design Assistance Center (SEDAC) or a SEDAC Service Provider	2	17%
	From an Energy Resource Center (ERC) representative	0	0%
	An architect, engineer, or energy consultant	1	8%
	Attended a conference, workshop or seminar	1	8%
	An energy service company	0	0%
	Past experience with the program	1	8%
	Equipment vendors or building contractors	0	0%
	Other (please describe)	1	8%
	Don't know	1	8%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

17. Before participating in the Retro-Commissioning Program, had you completed similar retro-commissioning projects?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	5	42%
	No	7	58%
	Don't know	0	0%

18. Did you have plans to have the facility retro-commissioned before hearing about the Retro-Commissioning Program?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	4	33%
	No	8	67%
	Don't know	0	0%

	<i>Response</i>	<i>(n=4)</i>	<i>Percent of Respondents</i>
18a. How long before finding out about the Public Sector Retro-Commissioning Program did you have plans to retro-commission the facility?	Less than 6 months before	0	0%
	6 months to less than one year before	2	50%
	1 year to less than 2 years before	0	0%
	2 years to less than 5 years before	2	50%
	More than 5 years before	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=4)</i>	<i>Percent of Respondents</i>
18b. Would you have gone ahead with the retro-commissioning even if you had not participated in the program?	Yes	4	100%
	No	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
19. Did you have experience with DCEO energy efficiency programs prior to participating in the Retro-Commissioning Program?	Yes	5	42%
	No	7	58%
	Don't know	0	0%

	<i>Response</i>	<i>(n=5)</i>	<i>Percent of Respondents</i>
19a. How important was previous experience with the DCEO programs in making your decision to have the facility retro-commissioned? Would you say...	Very important	2	40%
	Somewhat important	2	40%
	Only slightly important	1	20%
	Not important at all	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
20. Did a Public Sector Retro-commissioning Program or other DCEO representative recommend that you retro-commission the facility?	Yes	2	17%
	No	9	75%
	Don't know	1	8%

	<i>Response</i>	<i>(n=2)</i>	<i>Percent of Respondents</i>
20a. If the Public Sector Retro-commissioning Program or other DCEO representative had not recommended that you retro-commission the facility, how likely is it that you would have done it anyway? Would you say...	Definitely would have	0	0%
	Probably would have	0	0%
	Probably would not have	2	100%
	Definitely would not have	0	0%
	Don't know	0	0%

21. Did a representative of the Smart Energy Design Assistance Center (SEDAC) or a SEDAC Service Provider recommend that you retro-commission the facility?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	4	33%
	No	7	58%
	Don't know	1	8%

21a. If the SEDAC or SEDAC Service Provider representative had not recommended that you retro-commission the facility, how likely is it that you would have done it anyway? Would you say...	<i>Response</i>	<i>(n=4)</i>	<i>Percent of Respondents</i>
	Definitely would have	0	0%
	Probably would have	1	25%
	Probably would not have	3	75%
	Definitely would not have	0	0%
	Don't know	0	0%

22. Would your organization have been financially able to retro-commission the facility without the assistance from the Retro-Commissioning Program?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	4	33%
	No	7	58%
	Don't know	1	8%

23. If the retro-commissioning service had not been provided at no cost through the program, how likely is it that you would have had the facility retro-commissioned anyway? Would you say...	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Definitely would have	0	0%
	Probably would have	3	25%
	Probably would not have	6	50%
	Definitely would not have	2	17%
	Don't know	1	8%

24. How did the availability of information and the service incentive provided through the Retro-Commissioning Program affect the quantity of energy efficiency improvements you implemented? Did you implement more energy efficiency improvements than you otherwise would have without the program?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	11	92%
	No	1	8%
	Don't know	0	0%

25. How did the availability of information and the service incentive provided through the Retro-Commissioning Program affect the timing of the retro-commissioning project? Did you retro-commission the facility earlier than you otherwise would have without the program?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	10	83%
	No	2	17%
	Don't know	0	0%

25a. When would you otherwise have retro-commissioned the facility?	<i>Response</i>	<i>(n=10)</i>	<i>Percent of Respondents</i>
	Less than 6 months later	0	0%
	6 months to less than 1 year later	0	0%
	1 year to less than 2 years later	0	0%
	3 years to less than 5 years later	7	70%
	More than 5 years later	2	20%
	Don't know	1	10%

26. Did you have any problems with the application process?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	1	8%
	No	11	92%
	Don't know	0	0%

26a. Did you have any problems adhering to the agreement to install \$10,000 worth of measures?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	0	0%
	No	12	100%
	Don't know	0	0%

27. Did the retro-commissioning project go smoothly?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	9	75%
	For the most part	3	25%
	No	0	0%
	Don't know	0	0%

28. Did you have any problems adhering to the agreement to install \$10,000 worth of measures?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	0	0%
	No	12	100%
	Don't know	0	0%

29. Did the energy efficiency improvements implemented through your participation in the retro-commissioning meet your expectations? Would you say...	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	My expectations were exceeded	2	17%
	My expectations were met	7	58%
	My expectations were mostly met	3	25%
	My expectations were not met	0	0%
	Don't know	0	0%

30. Do you feel that the retro-commissioning service provider did a good job of identifying energy efficiency improvements?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	11	92%
	For the most part	0	0%
	No	1	8%
	Don't know	0	0%

31. Did you have any of the retro-commissioning measures implemented by a contractor?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	9	75%
	No	3	25%
	Don't know	0	0%

31a. For those measures implemented by a contractor, do you feel you got a quality implementation of the identified improvements?	<i>Response</i>	<i>(n=9)</i>	<i>Percent of Respondents</i>
	Yes	5	56%
	For the most part	4	44%
	No	0	0%
	Don't know	0	0%

32. Have the measures you implemented through the retro-commissioning program been verified by a representative of SEDAC or a SEDAC Service Provider?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	7	58%
	No	2	17%
	Don't know	3	25%

32a. Were any changes made to the measures as a result of this verification?	<i>Response</i>	<i>(n=7)</i>	<i>Percent of Respondents</i>
	Yes	2	29%
	No	5	71%
	Don't know	0	0%

33. Since participating in the Retro-Commissioning Program, have you made any additional energy efficiency improvements similar to those implemented through the program that you did not apply or receive an incentive for?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	4	33%
	No	8	67%
	Don't know	0	0%

33a. Did the additional energy efficiency improvements result in the same or higher level of efficiency as the improvements implemented through the program?	<i>Response</i>	<i>(n=4)</i>	<i>Percent of Respondents</i>
	Yes	3	75%
	No	0	0%
	Don't know	1	25%

33b. Were these additional improvements implemented at the same facility (or facilities) as the retro-commissioning project that you received an incentive for?	<i>Response</i>	<i>(n=4)</i>	<i>Percent of Respondents</i>
	Yes	3	75%
	No	1	25%
	Don't know	0	0%

33c. Did a recommendation from a program staff member or contractor influence your decision to implement the additional measures?	<i>Response</i>	<i>(n=4)</i>	<i>Percent of Respondents</i>
	Yes	1	25%
	No	3	75%
	Don't know	0	0%

33d. How important was your experience with the Public Sector Retro-commissioning Program to your decision to implement the additional energy efficiency project? Would you say...	<i>Response</i>	<i>(n=1)</i>	<i>Percent of Respondents</i>
	Very important	0	0%
	Somewhat important	1	100%
	Neither important or unimportant	0	0%
	Somewhat unimportant	0	0%
	Unimportant	0	0%
	Don't know	0	0%

33e. How important was your experience with the Public Sector Retro-commissioning Program to your decision to implement the additional energy efficiency project? Would you say...	<i>Response</i>	<i>(n=4)</i>	<i>Percent of Respondents</i>
	Very important	2	50%
	Somewhat important	2	50%
	Neither important or unimportant	0	0%
	Somewhat unimportant	0	0%
	Unimportant	0	0%
	Don't know	0	0%

33f. How important was any past experience with energy efficiency programs to your decision to implement the additional energy efficiency improvements? Would you say...	<i>Response</i>	<i>(n=4)</i>	<i>Percent of Respondents</i>
	Very important	2	50%
	Somewhat important	1	25%
	Neither important or unimportant	1	25%
	Somewhat unimportant	0	0%
	Unimportant	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=4)</i>	<i>Percent of Respondents*</i>
33g. Why didn't you apply for or receive financial assistance or incentives for the improvements?	Didn't know about financial incentives	0	0%
	Didn't know whether the project qualified for financial incentives	0	0%
	Financial incentive was insufficient	0	0%
	No financial incentive was offered	2	50%
	Too much paperwork for the financial incentive application	0	0%
	Other reason (please describe)	2	50%
	Don't know	0	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
34. Since participating in the program, have you implemented any other energy efficiency improvements that were not similar to what you implemented through the program and that you did not apply or receive an incentive for?	Yes	1	8%
	No	10	83%
	Don't know	1	8%

	<i>Response</i>	<i>(n=1)</i>	<i>Percent of Respondents</i>
34a. Were these improvements made at the same facility (or facilities) as the retro-commissioning project that you received an incentive for?	Yes	1	100%
	No	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=1)</i>	<i>Percent of Respondents</i>
34b. Did a recommendation from a program staff member or contractor influence your decision to implement the additional measures?	Yes	0	0%
	No	1	100%
	Don't know	0	0%

	<i>Response</i>	<i>(n=0)</i>	<i>Percent of Respondents</i>
34c. How important was this recommendation to your decision to implement the additional energy efficiency improvements? Would you say...	Very important	0	0%
	Somewhat important	0	0%
	Neither important or unimportant	0	0%
	Somewhat unimportant	0	0%
	Unimportant	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=1)</i>	<i>Percent of Respondents</i>
34d. How important was your experience with the Public Sector Retro-commissioning Program to your decision to implement the additional energy efficiency project? Would you say...	Very important	0	0%
	Somewhat important	1	100%
	Neither important or unimportant	0	0%
	Somewhat unimportant	0	0%
	Unimportant	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=1)</i>	<i>Percent of Respondents</i>
34e. How important was any past experience with energy efficiency programs to your decision to implement the additional energy efficiency improvements? Would you say...	Very important	0	0%
	Somewhat important	1	100%
	Neither important or unimportant	0	0%
	Somewhat unimportant	0	0%
	Unimportant	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=1)</i>	<i>Percent of Respondents*</i>
34f. Why didn't you apply for or receive financial assistance or incentives for the improvements?	Financial incentive was insufficient	0	0%
	No financial incentive was offered	0	0%
	Too much paperwork for the financial incentive application	0	0%
	Other reason (please describe)	1	100%
	Don't know	0	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

	<i>Response*</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
35a. On a scale of very satisfied to very dissatisfied, how satisfied were you with the energy efficiency of the facility since the retro-commissioning?	5	5	42%
	4	6	50%
	3	0	0%
	2	0	0%
	1	0	0%
	Don't know / Not applicable	1	8%
	Average		4.5

*Each response was assigned a numerical value from one to five (5=Very Satisfied, 4=Satisfied, 3=Neither Satisfied nor Dissatisfied, 2=Dissatisfied, 1=Very Dissatisfied)

	<i>Response*</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
35b. On a scale of very satisfied to very dissatisfied, how satisfied were you with the savings on your monthly bill?	5	5	42%
	4	6	50%
	3	0	0%
	2	0	0%
	1	0	0%
	Don't know / Not applicable	1	8%
	Average		4.5

*Each response was assigned a numerical value from one to five (5=Very Satisfied, 4=Satisfied, 3=Neither Satisfied nor Dissatisfied, 2=Dissatisfied, 1=Very Dissatisfied)

	<i>Response*</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
35c. On a scale of very satisfied to very dissatisfied, how satisfied were you with the effort required for the application process?	5	6	50%
	4	3	25%
	3	2	17%
	2	0	0%
	1	0	0%
	Don't know / Not applicable	1	8%
	Average		4.4

*Each response was assigned a numerical value from one to five (5=Very Satisfied, 4=Satisfied, 3=Neither Satisfied nor Dissatisfied, 2=Dissatisfied, 1=Very Dissatisfied)

	<i>Response*</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
35d. On a scale of very satisfied to very dissatisfied, how satisfied were you with the information provided by the retro-commissioning service provider?	5	9	75%
	4	2	17%
	3	0	0%
	2	1	8%
	1	0	0%
	Don't know / Not applicable	0	0%
	Average		4.6

*Each response was assigned a numerical value from one to five (5=Very Satisfied, 4=Satisfied, 3=Neither Satisfied nor Dissatisfied, 2=Dissatisfied, 1=Very Dissatisfied)

	<i>Response*</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
35e. On a scale of very satisfied to very dissatisfied, how satisfied were you with the retro-commissioning service provider's level of professionalism?	5	12	100%
	4	0	0%
	3	0	0%
	2	0	0%
	1	0	0%
	Don't know / Not applicable	0	0%
	Average		5.0

*Each response was assigned a numerical value from one to five (5=Very Satisfied, 4=Satisfied, 3=Neither Satisfied nor Dissatisfied, 2=Dissatisfied, 1=Very Dissatisfied)

	<i>Response*</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
35f. On a scale of very satisfied to very dissatisfied, how satisfied were you with the quality of the work conducted by the contractor implementing the measures?	5	3	25%
	4	6	50%
	3	1	8%
	2	0	0%
	1	0	0%
	Don't know / Not applicable	2	17%
	Average		4.2

*Each response was assigned a numerical value from one to five (5=Very Satisfied, 4=Satisfied, 3=Neither Satisfied nor Dissatisfied, 2=Dissatisfied, 1=Very Dissatisfied)

	<i>Response*</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
35g. On a scale of very satisfied to very dissatisfied, how satisfied were you with the information provided by DCEO?	5	8	67%
	4	3	25%
	3	0	0%
	2	0	0%
	1	0	0%
	Don't know / Not applicable	1	8%
	Average		4.7

*Each response was assigned a numerical value from one to five (5=Very Satisfied, 4=Satisfied, 3=Neither Satisfied nor Dissatisfied, 2=Dissatisfied, 1=Very Dissatisfied)

	<i>Response*</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
35h. On a scale of very satisfied to very dissatisfied, how satisfied were you with the information provided by Smart Energy Design Assistance Center (SEDAC)?	5	9	75%
	4	2	17%
	3	0	0%
	2	1	8%
	1	0	0%
	Don't know / Not applicable	0	0%
	Average		4.6

*Each response was assigned a numerical value from one to five (5=Very Satisfied, 4=Satisfied, 3=Neither Satisfied nor Dissatisfied, 2=Dissatisfied, 1=Very Dissatisfied)

	<i>Response*</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
35i. On a scale of very satisfied to very dissatisfied, how satisfied were you with the overall program experience?	5	12	100%
	4	0	0%
	3	0	0%
	2	0	0%
	1	0	0%
	Don't know / Not applicable	0	0%
	Average		5.0

*Each response was assigned a numerical value from one to five (5=Very Satisfied, 4=Satisfied, 3=Neither Satisfied nor Dissatisfied, 2=Dissatisfied, 1=Very Dissatisfied)

Appendix C: Questionnaire for Service Provider Survey

Responses from service providers for the following questions are discussed in detail in Section 4.6.

1. How did you learn about the DCEO Retro-Commissioning Program?
2. How much interaction do you have with program staff?
 - 2a. Who do you interact with? [DCEO staff, SEDAC staff?]
 - 2b. What are the main purposes of these interactions? [Data transfer, program issues, updates, etc.]
 - 2c. If you have a question about the program, where do you go to find the information?
 - 2d. Is the program staff responsive and helpful?
3. Are there any aspects of the participation process that you would recommend be modified? [If needed: the main phases of the participation process are the application phase, planning phase, implementation phase, verification phase]
 - 3a. What works well?
 - 3b. What are the challenges with the process?
 - 3c. Do you discuss issues with the program with DCEO or SEDAC staff, or to recommend program changes?
4. Have you received any feedback from participants about the program? If so, what? [Possible types of feedback: regarding program experiences, satisfaction, desires for program changes]
5. Do you provide retro-commissioning services through any of the other non-DCEO retro-commissioning programs such as those offered by other utilities? [Ameren Illinois and ComEd retro-commissioning programs]
 - 5a. If so, how does the DCEO program compare to the utility programs? [Possible points of comparison: the incentive level and structure, the participation process, the requirements for becoming a service provider, the project documentation that service providers provide]
6. Why did you become a service provider with the DCEO Retro-Commissioning program?
 - 6a. What are the benefits of participating to your firm?

7. Did you have a prior working relationship with any of the customers for whom you have performed retro-commissioning services in the previous year of the program?
 - 7a. Please explain.
8. Before participating in the program, did you have experience performing RCx services in public sector buildings?
 - 8a. What percent of your business involved performing RCx services in public sector buildings? [If unable to provide a specific percentage, request a qualitative description]
 - 8b. What percent of your business involves performing RCx services in private sector buildings? [If unable to provide a specific percentage, request a qualitative description]
9. How much do you promote the program to your public sector customers?
10. Is there anything the program could do to help you be more effective in promoting the program?
11. On average, how likely is it that participants would have had the same retro-commissioning services performed if the program had not been available?
 - 11a. Would customers complete retro-commissioning projects smaller in scope than they would without the program or would they not do it at all? Why?
12. In general, how aware were participants of the equipment performance issues identified through the retro-commissioning study PRIOR to conducting the study?
 - 12a. Are there any issues that customers are typically more/less aware of?
13. In general, how aware were participants of the measures and/or upgrades recommended to them prior to the retro-commissioning study?
 - 13a. In your opinion, why were the measures not previously implemented?
14. Have you participated in any training provided by the program?
 - 14a. If so, was this training about how the program works or about technical aspects of completing retro-commissioning projects?
 - 14b. Was the training helpful? If so, why was it helpful? If not, what could be done to improve it?
15. What do you view as the main barriers to retro-commissioning as a service for public sector clients?

- 15a. Are the barriers different for different kinds of organizations? [probe for knowledge of benefits of retro-commissioning, staff resources, budget restrictions, building characteristics such as age]
- 15b. What could be done to overcome these barriers?
- 16. What do you view as the main barriers to public sectors clients' participation in the Retro-Commissioning Program?
 - 16a. What could be done to overcome these barriers?
 - 16b. Are there different barriers for public sector organization than for private sector organizations? [Probe for awareness, budget restrictions, timelines]
- 17. What do you perceive to be the demand for the services provided by the program?
 - 17a. Do you believe that this level of demand has changed, or is likely to change over time?
- 18. Overall, how satisfied are you with your experiences working with DCEO Retro-Commissioning program? Please explain.
- 19. Do you have any recommendations on how to improve the program or the role that service providers play in the program?