2004-2005 Los Angeles County-Internal Services Department/Southern California Edison/Southern California Gas Company Energy Efficiency Partnership Process Evaluation Study

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SCE-SoCalGas-LAC-ISD Partnership
Process Evaluation

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1. Executive Summary

By direction and approval by the California Public Utilities Commission (CPUC), Southern California Edison (SCE), Southern California Gas Company (SoCalGas), and the County of Los Angeles (LAC) agreed upon a two-year program partnership in 2004 to address retrofit, retrocommissioning (RCx)[1], and multifamily building services. A technology transfer element was also included in the partnership plan. The program, called Los Angeles County-Internal Services Department/Southern California Edison/ Southern California Gas Company Energy Efficiency Partnership specified electricity and natural gas savings, and electricity demand reduction goals.

The Partnership proved to be a successful endeavor. The structures put in place helped the program achieve its ex ante gross energy goals. The partnership also conducted a "technology transfer": workshop to spread awareness of energy efficiency technologies among local government entities. These efforts were looked upon as a foundation for increasing energy efficiency among the County's existing building stock.

The retrocommissioning element in particular proved to be a fruitful approach to achieving energy savings. No systematic retrocommissioning of the County's buildings had been performed prior to the establishment of the Partnership and critical input from SCE staff in particular assisted this element's success. Furthermore, lessons learned from this initial round of retrocommissioning projects should help streamline later projects and achieve savings more cost effectively.

Elements that led to the success of this project include the following:

A. The leadership commitment to success from both the utilities and county partners. This was demonstrated through goals expressed in the ISD strategic plan, a personal commitment expressed by senior management during the interviews, and evidence of team commitment towards gaining and applying "real time" learning lessons.
B. Strong management processes during the partnership. This was demonstrated by the establishment of clear paths of communication and clear identification of responsibilities, reinforced and maintained through frequent and consistently scheduled meetings.
C. Sound procedures in the RCx projects to ensure maintenance staff "buy-in", and the use of an internal champion.
D. The application of technical innovation within the RCx projects, as evidenced by the use of benchmarking, a robust RCx procedure, and the creative adaptation of RCx to older pneumatic controls.

[1] For ease of reading and reference, "retrocommissioning" is spelled out when referenced by itself; when used as an adjective, the term is shortened to "RCx", as in "RCx provider", "RCx process", etc.

The program was operated in several components, with the main focus on retrofit and retrocommissioning projects. The retrofit work was an extension of lighting upgrade projects that the county had been pursuing in the past. Candidate buildings for retrocommissioning were identified through the use of ISD's energy management systems.

As part of the retrofit work, buildings were eligible for lighting upgrades, building wide lighting controls, chiller retrofits, and boiler retrofits. The technology transfer portion of the partnership worked to create awareness among public agency staff of some of the best energy management practices. The last aspect of the partnership was a multi-family metering element. This element has been placed on hold due to several issues discussed later in this report.

The partnership was a success on many levels. Ultimately the program activity achieved "ex ante" savings of than 146% of the kWh goals and 99% of the therm goals. In addition to the successful energy savings, the working group of the partnership was a success story as well. The teamwork experienced by all of the participants has helped form a cohesive group that can draw on a wide amount of resources both now and in the future. This allows the partnership to move projects along quickly and smoothly while obtaining the most savings possible.

These are some of the "lessons learned" and recommendations for future programs:

- Fine tune the building screening and contracting
- Stagger the RCx projects instead of doing them all at once
- Make allowances for the RCx provider to serve in a consultative position (that is, provide professional input about the direction and nature of the RCx work during the project)
- Establish benchmarks and baselines for non-energy benefits
- Build in "quick decision" response processes

2. Key Findings and Recommendations

2.1.1 Key Findings

The partnership between the utilities and the county proved to be a success, with all parties indicating interest in continuing the partnership. The working group of the partnership experienced teamwork that helped them form a cohesive group and allows them to draw on a wide variety of resources now and in the future.

The program efficiency measures exceeded their gross electric energy savings goals and met their natural gas savings goals. The Program only achieved 22% of their peak coincident goals as the majority of Program electrical energy savings were realized during off-peak hours.

The retrocommissioning element realized most of the Partnership's energy savings. This was the first time that the county has employed a third party contractor for systematic retrocommissioning services of their buildings and the establishment of the partnership assisted this element's success. The partnership enabled SCE's retrocommissioning experts to be included throughout RFP the project, which ensured the programs success.

The April 20, 2005 workshop for Public Agency Energy Efficiency Technology Transfer element was another successful program activity. In a follow-up survey, 70% of responding attendees agreed that information provided at the workshop addressed the unique issues and challenges facing their organization. Considering the wide audience of Public Agency employees, providing pertinent information for two-thirds of the audience should be considered a reasonable successful.

2.1.2 Recommendations for Program Changes

The success of this program was contingent upon the partnership group and indicative of the trust that was formed. Regardless, these are a few recommendations, generally minor in nature, that RLW would make to further build upon the success of the initial partnership agreement and to incorporate into future partnership arrangements. Each will be expanded upon later in the report.

A. Fine tune the building screening and contracting

Many aspects of the initial project process were intentionally left open-ended; however, contractors indicated that they would have preferred greater specificity in terms of cost and scope.

B. Stagger the RCx projects instead of doing them simultaneously.

Managing ten complex RCx projects at once became difficult and forced the team to learn lessons in real-time. Staggering projects would allow better management of the projects and prevent "bottlenecking."

C. Make allowances for the RCx provider to serve in a consultative position

Interviews with firms indicated that they would prefer consultative positions that would allow more involvement in planning and discussion. Also recommended is the introduction of an experienced maintenance staff person to serve as a liaison between the contractor, partnership team, and maintenance staff.

D. Establish benchmarks and baselines for non-energy benefits

Initial discussions indicated that county staff members were concerned about preserving the comfort levels of their building tenants. It would be useful, if possible, to track and record, during the baseline and benchmarking phase, quantitative non-energy metrics relating to occupant comfort and productivity.

E. Build in "quick decision" response processes

Since contractor work was generally performed at night, any questions directed to the utility could not be answered until the next day. If similar partnerships like this are formed in the future, it is recommended that the team members should construct a "quick decision" communications process where immediate "on-site" questions can be readily transmitted and responded.

3. Evaluation Objectives and Methodology

Southern California Edison tasked RLW with producing a process evaluation of the partnership protocols and outcomes as part of the larger evaluation performed for the Partnership. It is the goal of this report to highlight both successes and lessons learned that came from the program. This evaluation serves to answer these two essential questions:

- How well did the program work?
- How could the program work better?

3.1 Primary Process Evaluation Objectives

The goal of any process evaluation is to examine the way in which a program was executed and determine its success. A good process evaluation assesses how closely the program execution followed the program plan. Additionally, it scrutinizes the program, trying to answer the question; how could the program be improved? The primary evaluation objectives of this study are to,

1. Assess the level of initial success,
2. Identify ways to increase the efficiency and value of the program to the stakeholders,
3. Identify directions to streamline the program,
4. Identify ways to increase levels of energy and demand savings achieved,
5. Identify ways to increase all participant satisfaction.

3.2 Detailed Process Evaluation Objectives

Per the approved work plan, the list of researchable questions was developed into interview guides for each of the following partnership actors and participants. These questions were developed and discussed in basic form during the kickoff meeting, and then subsequently refined and submitted to the evaluation team. They were then reviewed and approved by all parties to be eventually converted into interview guides. Column entries that show no check simply represent areas where all parties recognize that these interviewees would either not know the answers to the question, or the question itself would not be relevant to that interviewee.

Table 1: Researchable Questions

Question Topics	Sources of Information		
	Utility and County Staff	Contractors	Facility Mgt (ISD)
Program design - background and development	✓		
Desired and perceived program outcomes	✓		✓
Program goals clearly understood		✓	✓
Program delivery effectiveness	✓	✓	✓
Proper and effective communications between all parties	✓	✓	✓
Clear and effective program management structure	✓	✓	✓
Quality and effectiveness of contractors	✓		✓
Timeliness of program delivery	✓	✓	✓
Levels of satisfaction for all parties in the process	✓	✓	✓
Types and levels of motivation for participating	✓	✓	✓
Why the multifamily part of the project was dropped	✓		
Perceptions and motivations for non-energy benefits	✓	✓	✓
Deferred opportunities	✓	✓	✓

3.3 Methodology

Scope of Work

The evaluation scope of work entailed four tasks:

Task 1: Review Program Background and Documentation
- Program Plan Review
- Program Development and Communications Review
- Tracking System Review

Task 2: Project Manager and Staff Interviews
- Develop Interview Instruments
- Conduct Interviews

Task 3: Map Processes

Task 4: Prepare Process Report

The evaluation project initiation meeting was conducted on July 22nd, 2004. The meeting reviewed the projects and timelines to date, the objectives for the process and impact evaluations, and initial strategies for the evaluation tasks. Minutes of the meeting were kept by RLW and forwarded to the evaluation team. The proposal and updated decisions or information brought up at the project initiation meeting were used to develop a final work plan. After the project initiation meeting, the RLW team requested and reviewed all data relating to the program participants to comprehensively understand the project and to prepare for the final work plan.

A total of 12 interviews were planned and completed as shown below:

Table 2: Interview Counts

Partnership Participant Type	Planned	Completed
Utility Staff and Administrators	5	5
LA County Staff and Administrators	4	4
Contractors	3	3
TOTAL	**12**	**12**

In-depth interviews were performed in-person for one Program contractor, all SCE utility project administrators, and much of the county personnel. Phone interviews were conducted with one staff member each of SoCalGas and SCE, and three of the Program contractors.

Interview guides were developed and submitted to SCE's evaluation project manager ahead of time, and comments were incorporated into the guides before final versions were completed for use. Each type of program participant was interviewed using guides that were tailored to

gather information that was specific to his/her role in the program. Interview questions were composed to follow these researchable questions shown at the top of this section. In order to ensure we had comprehensive interview answers, we also conducted several brief follow up calls and e-mails with interviewees to get final details or to clarify project issues.

Secondary and Follow Up Research

In support of the project, RLW took several steps above the scope of work to gather further research. One step was to attend two different on-line seminars on efficiency programs (called a "brown bag session") hosted by the Association of Energy Service Professionals. The first one on March 1, 2006, had three presentations given by NYSERDA, Nexant (for Xcel Energy's Colorado programs), and PECI (on the San Diego Gas and Electric program). The presenters described the results to date for their individual RCx programs. This provides a solid foundation to do a comparison with the results of this partnership, and further strengthen the validity of our recommendations for this pilot by taking advantage of the lessons learned from these other programs. RLW attended this particular session independent of this study scope of work and budget.

The second, on May 23, 2006, was three presentations on innovative DSM programs, of which two were by Howard Choy of Los Angeles County, and Mark Martinez of Southern California Edison. In particular, Mr. Choy spoke of the retrocommissioning results of the SCE-SoCalGas-LAC-ISD partnership projects, while Mr. Martinez presented the concepts and outcomes to date for the different partnerships SCE has begun, including this one being evaluated. Attendance at this session was deemed important by RLW and the evaluation program manager to gain additional insight and information on the partnership mission and outcomes to date. In turn, this session allowed us to further understand and illustrate the program communication and management paths, as shown later in this report.

In addition, other industry reports and conference presentations were reviewed by us to further strengthen the analysis about the program design and recommendations. In particular, these sources were used to assess related outcomes from this partnership, as well as provide citations that reflect or support recommendations made in this report.

Program Flow and Logic Model

The assumed program theory is that the Partnership allows SCE to leverage the County's existing energy management infrastructure and more effectively identify, treat, and maintain energy efficient operations within County buildings. This theory logic assumes that the absence of such a Partnership would allow energy efficiency barriers to remain in the forms of facility management inertia, lack of knowledge, higher utility outreach and administrative costs toward identifying opportunities within County facilities, and lower rates of adoption of energy efficient systems and behavior by County facilities staff.

Because County staff and management may be relatively new to the utility program evaluation process, an illustrative map of the program delivery process is shown in this report ("Figure 3: LAC-ISD-SCE-SoCalGas Management Chart (as planned)", page 27, and "Figure 4: LAC-ISD-SCE-

SoCalGas Management Chart (as finally evolved)" page 29, and allows RLW and SCE to translate the process evaluation research into a readily understandable presentation when reporting program delivery functions and timelines, and to show how they serve the program theory. Per the interviews conducted by RLW, county staff and management contributed to the final construction of these illustrations. By the use of this illustrative step, the conditions or situations that RLW has identified as either contributive to program delivery success or to be improved will be better demonstrated to the partnership and CPUC.

Based on the interviews, the additional industry sessions we attended, and our subsequent analysis, we believe that the program plan and outcome – although performed absent a specific program logic model – had indeed reduced or eliminated historical energy efficiency barriers along these lines:

1. Facility management inertia – Facility staff stated that they would not have progressed as far, or as extensively in the upgrade work, if the Partnership did not exist;
2. Lack of knowledge – The use of utility staff in a facilitative and consultative role helped bridge the knowledge barriers among county staff. As described later on in this report, it would be beneficial if the third party ESCOs (energy service companies) could be entrusted in a consultative role as well;
3. Higher utility outreach and administrative costs toward identifying opportunities within County facilities – Once teaming was established, it became systematic for the utility to identify and support efficiency measures within County buildings that otherwise may have been bypassed in a more passive customer-utility relationship; and
4. Lower rates of adoption of energy efficient systems and behavior by County facilities staff – Per the outcomes described above, higher levels of adoption appear to be shown than would have been pursued absent the Partnership.

In this report, RLW has produced a map of program processes and activities. The maps detail the structure of the program delivery, and the accompanying narrative will describe the map flow.

4. Partnership Development, Design, and Implementation

This section provides the following narratives:

a. Program concept and rationale
b. Partnership objectives and plan
c. Outcomes

4.1 Program Concept and Rationale

The development and launch of the LAC-ISD-SCE-SoCalGas partnership is rooted in the CPUC encouragement and support for California utilities to search and develop partnerships, which SCE has acted to fulfill. SCE developed this particular partnership with Los Angeles County, who likewise made a commitment towards the project concepts as had been established in the ISD's strategic plan.

This partnership was a two-year plan that incorporated retrofits, Retrocommissioning ("RCx"), a public housing/multi-family metering project, and a technology transfer workshop. The filed program approved by the CPUC included electricity and natural gas usage savings goals and demand savings goals.

Of the number of goals within this partnership program, one unique aspect was a primary goal of the partners towards achieving HVAC system optimization of the selected buildings through retrocommissioning, with the belief that this optimization will lead to energy savings. This is a reflection of the larger partnership program philosophy of the "leap of faith" in putting primary focus on building HVAC system optimization - with a belief that significant energy savings will appear – was justified by the ultimate outcome of those projects.[2]

CPUC Role

The California Public Utilities Commission ("CPUC") issued its decision regarding future energy efficiency policies, Decision 05-01-055, on January 27, 2005. The decision returned the utilities to a lead role in energy efficiency program choice and portfolio management. It required the utilities to identify a minimum of 20% of funding for the entire portfolio that will be put out to competitive bid to third parties. The decision also required the utilities to form advisory groups that provide input to the program design and selection process for the 2006 – 2008 program cycle.

Before this formal decision was issued, CPUC had been conducting a series of energy efficiency workshops to advance the goals of the "Energy Action Plan" for the state. The results of the workshops and the public comments gathered from all stakeholders - utilities, program providers, consumers, manufacturers, consultants, government agencies and community

[2] This characterization of "leap of faith" was coined by one interviewee, and also used in a recent presentation by two team members about the partnership's retrocommissioning process at the 2006 National Conference on Building Commissioning.

organizations – has helped the Commission build energy efficiency into the state's long-term energy policy, and help ensure that energy efficiency is integrated into the utilities' long-term resource plans. In particular, the CPUC conducted a workshop focused on identifying successful energy efficiency program partnerships and the ways an energy efficiency program administrator could foster such partnerships in the future. In total, programs classified as partnerships accounted for 8% of the energy efficiency programs funded with public goods charge monies in 2004-05.

SCE Role

SCE currently operates several collaborative programs designed to enhance the energy efficiency program offerings through a partnership between SCE and local governments and other entities. By using SCE's existing energy efficiency program experience and the local governments' communication and delivery channels, the two entities help residents, businesses, cities, and schools to save money on energy bills through various energy efficiency services. These services may include direct installation of energy-efficient equipment, energy audits, seminars, and more.

Los Angeles County – Internal Services Department Role

The Internal Services Department ("ISD") serves within the Los Angeles County government administration to provide in-house, contracted, and advisory services in the areas of purchasing, contracting, facilities, information technology and other essential support and administrative services.

ISD's goal is to improve the quality of life in Los Angeles County by providing responsive, efficient, and high quality public services that promote the self-sufficiency, well-being and prosperity of individuals, families, businesses and communities.

ISD itself is composed of four main functional areas (table, below):

- Administration and Finance Service
- Information and Technology Service
- Facilities Operations Service
- Purchasing and Contract Service

The partnership worked within the Facilities Operations Service ("FOS"), which in turn is composed of the following divisions:

- Planning and Administration
- Maintenance and Operations Division
- Alterations and Improvements Division
- Energy Management Division
- Custodial Services

Specifically, the partnership activities were coordinated and run with the Energy Management Division, although eventually other divisions, particularly the Maintenance and Operations Division, were included in project development and post-project persistence.

Description of Energy Management Division ("EMD")

The County maintains an "in-house" energy management division within the Internal Services Department that includes administrators, project managers, energy analysts, technical support, and facility databases. Specifically, the EMD administers the County's Utilities Budget, acquires utility services and commodities (electricity, gas, water, etc), develops and implements projects to decrease energy utilization, and obtain more benefit from the Utilities Budget expenditures; operates four conventional power and three cogeneration plants that provide heating and air conditioning and some electricity to various County complexes.

Through services by the FOS, the County maintains an Enterprise Energy Management Information System ("EEMIS") – a "real-time," internet-based energy management program that archives and displays detailed facility consumption and operations information. EMD maintains relationships with all 38 County departments, other County affiliated agencies (including the Office of Education, Public Housing, Metropolitan Transit Authority, Office of Small Business), and other local governments. The 2004 strategic plan specifies how the courts make up the largest amount of these customers at about 42% of the operating revenues for building and grounds maintenance. The plan also mentions that deferred maintenance projects had substantially decreased, and that energy management continues to face increasing requirements due to shortages and price increases for electric and gas.

ISD Strategic Plan - FOS Objectives Relating to Energy Leadership

The initial foundation for the ISD's energy leadership is rooted within ISD's strategic plan. The ISD originally published its plan in 2000; this plan is reviewed and updated annually. The 2004 update specifically addressed goals for the ISD and the county, which in turn became elements of the Partnership plan.

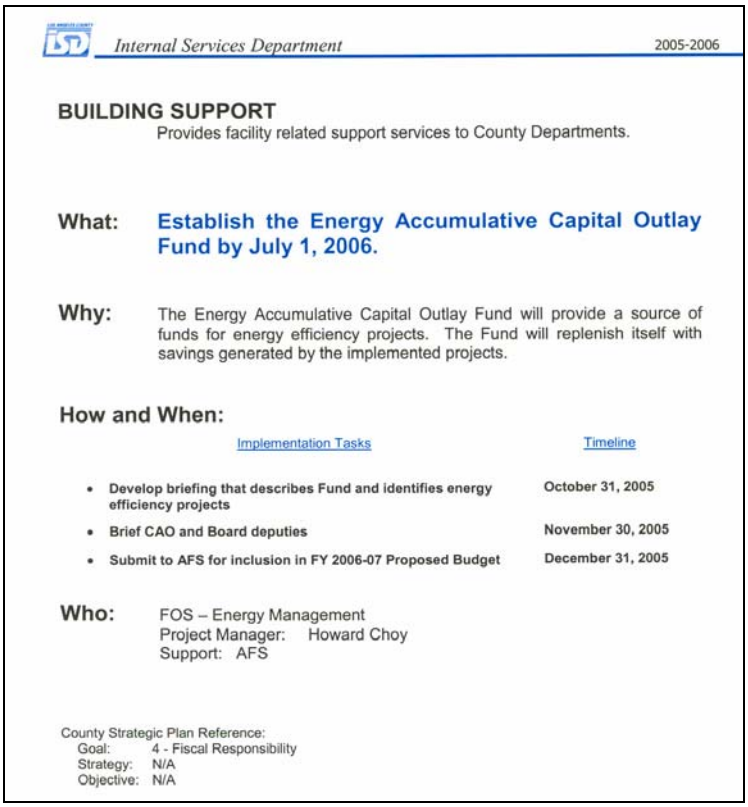
In the strategic plan, the ISD has six major goals (Customer Service and Focus, Workforce Excellence, County Leadership, Infrastructure and Logistics, Fiscal Responsibility, and Services to Children). Each of these major goals is addressed through specific strategies. Next, each functional service within the ISD developed specific tactical objectives which serve these strategies, which in turn serve these larger ISD goals. In particular, the Partnership plan was built on FOS objectives to serve the goals of "County Leadership" and "Infrastructure and Logistics". The table below shows the structure of the Strategic Plan and the relevant FOS objectives:

Table 3: Elements of ISD 2004 Strategic Plan Relating to Partnership

ISD Strategic Plan – Main Goal	Goal Definition	Support Strategy (served through one or more functional areas)	FOS Objective # and Description
Goal B : County Leadership	ISD will provide leadership in long-range strategic initiatives; emphasize the need for ISD to assess areas where its leadership is essential, develop the necessary expertise, and provide leadership to the County's policy-makers and County departments.	"Utilize the expertise ISD has as a service provider to influence and add value to the county's decision making process and policies."	**FOS Objective B2**: By April 30, 2004, prepare a report that outlines the implementation status of the ISD "healthy building" strategy.
			FOS Objective B3: Develop a Retrocommissioning (building tune-up) Plan by January 31, 2004
Goal C: Infrastructure and Logistics		"Use technology and automation to improve the effectiveness and efficiency of operations."	**FOS Objective C3**: By December 15, 2003, improve the user friendliness of the process for analyzing energy-related data for buildings based on the Enterprise Energy Management Information System (EEMIS). Information will focus on identifying savings from building modifications, repair, maintenance, and operational changes.

The figure below shows the level of planning that ISD puts into their goals each year. They clearly explain what the goal is and why it should be accomplished. The plan details the tasks to be completed and assigns a date, and assigns primary and support staff to be responsible for the completion of the goal.

Figure 1: ISD Strategic Plan- Excerpt



Internal Services Department 2005-2006

BUILDING SUPPORT
Provides facility related support services to County Departments.

What: **Establish the Energy Accumulative Capital Outlay Fund by July 1, 2006.**

Why: The Energy Accumulative Capital Outlay Fund will provide a source of funds for energy efficiency projects. The Fund will replenish itself with savings generated by the implemented projects.

How and When:

Implementation Tasks	Timeline
• Develop briefing that describes Fund and identifies energy efficiency projects	October 31, 2005
• Brief CAO and Board deputies	November 30, 2005
• Submit to AFS for inclusion in FY 2006-07 Proposed Budget	December 31, 2005

Who: FOS – Energy Management
Project Manager: Howard Choy
Support: AFS

County Strategic Plan Reference:
Goal: 4 - Fiscal Responsibility
Strategy: N/A
Objective: N/A

The Los Angeles County Internal Services Division has a long history of developing and implementing energy efficiency projects, both with local utilities and independently. This partnership agreement was a renewal of a previous initiative in the county's 2002 and 2003 energy efficiency portfolios as independent projects.

The ISD has been performing energy efficiency projects and retrofits through ESCO contracts in past years. The partnership leveraged this practice by allowing SCE to hire the contractors through the competitive bid process and manage them in-house. ISD then provided all of the project management the contractors needed. This approach allowed for the work to be done much more directly with SCE having a strong voice in what energy efficiency measures were implemented and ISD streamlining the contractors' access to buildings. For this partnership some of the contractors had been previous sub-contractors on the ESCO contracts. This provided some degree of familiarity between the Partnership and the contractors as to how the work should be performed.

4.2 Partnership Objectives

The LAC/ISD-SCE–SoCalGas Energy Efficiency Partnership program was developed by the partners with the following objectives:

1. Cost-Effective Energy Savings

This Partnership program targeted annual energy and demand savings (see table below).

Energy Savings Plan

The tables below are the energy savings program goals that were submitted to the CPUC.

Table 4: Partnership - Energy Savings and Peak Demand Reduction Goals

Peak Demand Reduction (Net kW)	Annualized Energy Savings (Net kWh)	Annualized Energy Savings (Net therms)
1,902	4,723,641	402,428

Table 5: Partnership - Summary of Savings Goals by Program Element

Program Element	Peak Demand Reduction (Net kW)	Annualized Energy Savings (Net kWh)	Annualized Energy Savings (Net Therms)
Audits/Retrofits	501	2,010,322	N/A*
Retro/Continuous-Commissioning	1,401	2,713,319	402,428
Public Agency Energy Efficiency Technology Transfer	N/A	N/A	N/A
TOTAL	1,902	4,723,641	402,428

* Gas retrofit measures were added subsequent to the original plan.

The realization of these savings goals are assessed in detail in the impact evaluation report developed separately by RLW.

2. More Efficient Energy Operations, Maintenance, and Better Identification of Future Retrofit Opportunities

A major goal of the program was to institute an aggressive, long-term retrocommissioning ("RCx") program that will maximize the County's ability to operate facilities' HVAC systems efficiently. This program was to systematically diagnose and resolve root cause problems wit HVAC systems, and provide on-the-job training to County facility operating staff on how to

operate buildings to use energy more efficiently. As Partnership contractors implement retrocommissioning activities, they will train building facility managers on how to use their equipment most efficiently. Accurate RCx documents and reports would be provided to the County to allow Operations and Maintenance (O&M) personnel to operate, monitor and maintain the County buildings' HVAC systems efficiently, without compromising the thermal comfort, ventilation, and indoor air quality delivered by the systems. Building managers will become proficient in identification and correction of system operating, control, and maintenance problems. The results will include a healthy, comfortable, and productive working environment for occupants, more efficient operation of energy-using equipment; energy cost savings that pay back investment; reduce maintenance costs and comfort calls (i.e. internal requests by occupants to modify temperature or humidity); and complete and accurate building documentation. As projects are performed, those buildings will be connected to the county's web based energy management system, and building managers will be trained on how to access and use data. LAC/ISD staff will work with customers on an ongoing basis to make sure they are accessing building data and using it to streamline energy operations.

Retrofits

The retrofit portion of the program focused on the following measures:

Lighting Retrofits. The plan for this component was replacement of inefficient lighting fixtures in 62 facilities, primarily branch libraries, throughout the county. A comprehensive audit of each facility prior to retrofit work was included in the scope of work. Most of the retrofits were planned as a straight one-for-one replacement of T12 with T8 linear fluorescent fixtures.

Lighting Controls. The plan was for building wide lighting controls installed at one county facility and occupancy sensors installed in two other facilities.

Chiller Retrofits. Two facilities were planned to have old chillers replaced with more efficient chillers.

Boiler Retrofits. The boiler retrofits were the final addition to the retrofit program. Thirty-two facilities had old boilers replaced with more efficient units.

The strategy for the retrofit program was for LAC/ISD to continue to provide energy management and program management services to its customers to complete energy retrofit projects. LAC/ISD did not receive funding for the administrative and technical resources and services it provided. This "in-kind" contribution represented the County's share towards the funding the CPUC provided to this program.

The table below describes the major activities LAC/ISD, SCE, and SoCalGas had submitted in their plans to conduct and oversee to implement the retrofit program.

Table 6: Partnership – Retrofit Plan

Key Activity	Description
1. Conduct project startup activities	The *Program Implementation Plan* and the *Monitoring and Verification Plan* will serve as ongoing guides throughout the project.
2. Begin ongoing marketing and outreach activities	LAC/ISD, SCE, and SoCalGas will begin a multifaceted approach to communicate the goals and benefits of the program to our customers, including personal contact, articles in the County digest and the County's energy web site, countywide e-mail communications, and training sessions on the County's Enterprise Energy Management Information System ("EEMIS").
3. Perform audits	LAC/ISD will provide assessment (audits) of potential energy conservation measures for each site through coordination with customers.
4. Identify priorities	LAC/ISD will analyze the data collected during the audits and identify the specific facilities in which to implement energy efficiency measures under this program.
5. Gain customer agreement	LAC/ISD will work with the customers to identify the measures that meet the cost-effectiveness criteria and provide project incentives based upon chosen measures.
6. Select providers	SCE and SoCalGas will oversee the selection of retrofit contractors that will be responsible for installing the energy efficiency measures.
7. Implement measures and conduct measurement and verification activities	The retrofit contractors will be responsible for the design, equipment purchase, and installation of the systems. SCE and SoCalGas will contract with a service provider to perform the necessary measurements to establish baseline (pre-implementation) performance and verify the savings resulting from the measures, in accordance with CPUC requirements.
8. Provide ongoing guidance and support	LAC/ISD and SCE will provide administrative and project management services throughout the process, relieving department personnel of the monitoring, coordination, and supervisory burdens typically associated with implementation of the targeted energy efficiency measures. During the equipment installation process, these services include the day-to-day monitoring of the progress of the work to assure that the installation is on schedule and within the approved project budget and approved design.

Retrocommissioning

The plan included retrocommissioniing ("RCx") of 10 county facilities. When budgeting appeared favorable, an 11th building was added. The RCx portion included a systematic and comprehensive evaluation of building HVAC, and subsequent measures to optimize occupant comfort and building energy performance. The persistence portion of the element was planned to consist of strategies to maintain optimal building performance after the retrocommissioning portion has been completed.

In particular, the County looked to meet these objectives through the RCx projects:

- Benchmark the HVAC systems' optimized performance;
- Use EEMIS to manage sustainable and optimized HVAC performance;

- Train building maintenance staff on the RCx process and the new HVAC system operating parameters; and
- Meet or surpass the energy and demand savings goals filed with the CPUC.

The table below describes the planned approach to implement the retrocommissioning ("RCx") program, enroll participants, conduct outreach activities, and purchase and install the equipment specified for the program component measures.

Table 7: Partnership – Retrocommissioning Plan

Key Activity	Description
1. Develop Draft RCx Scope of Work	SCE, SoCalGas, and LAC/ISD will determine scope of work, roles and responsibilities, schedule, budget, and project organization.
2. Develop site specific assessment tools and checklists	LAC/ISD will investigate facilities; determine equipment and systems, develop facility prioritization procedures. LAC/ISD's EEMIS will be heavily utilized in this phase.
3. Market program, enroll customers	LAC/ISD will meet with and educate County facility managers and administrators about program scope, goals, their participation and follow-up.
4. Hire contractors, determine roles	SCE will solicit bids and select RCx technical resource, implementer, and EM&V contractor.
5. Hold building scoping meetings, site investigations, staff interviews	LAC/ISD and technical resources/contractor will analyze the data collected during the investigations and identify the specific facilities in which to implement energy efficiency measures under this program.
6. Install monitoring systems for initial diagnostic monitoring.	LAC/ISD and contractors will work with the customers to record initial operating data. Much of this step will utilize EEMIS where it is already installed to provide historical operating data.
7. Analyze data and develop recommendations	LAC/ISD and contractors will review data, determine recommended improvements, and determine feasibility. Improvements will include no-cost measures as well as potential retrofit measures.
8. Implement improvements	RCx contractor and LAC/ISD will implement improvements.
9. Second round of diagnostic monitoring	LAC/ISD and contractors will work with the customers to record further operating data. Much of this step will utilize EEMIS where it is already installed to provide historical operating data.
10. Make final improvements	RCx contractor will implement final improvements as needed. RCx contractor will also identify opportunities to retrofit EE gas and electric measures to improve building operation.
11. Train building staff	RCx contractor develops training manuals, and provides training to LAC/ISD facility operations staff on implemented measures and recommended follow-up activities.
12. Project close out, submit final report	RCx contractor will record improvements, recommendations and project annual and long term savings. Follow-up activities and recommendations will incorporate LAC/ISD's long-term ability to monitor performance via EEMIS.

3. A Process and Forum for Energy Efficiency Information Exchange Among Public Agency Energy Managers and Hard to Reach Markets

This program element was to provide information on energy management best practices to other public agency staff through the Public Agency Energy Efficiency Technology Transfer component. The goal was to educate local government energy managers participating in this program to develop and implement energy efficiency projects, optimize operations of their energy consuming facilities and equipment; assess and quantify energy savings opportunities; identify best energy management practices and resources; identify advantageous coalitions and/or partnerships, share experiences, successes, challenges, understand industry issues, and minimize their energy-related costs. The Partnership conducted the workshop on April 20, 2005. This program element will also fund a study to determine how these goals can be accomplished and implemented on a more permanent, long-term basis.

RLW conducted a survey of workshop attendees in late 2005, which was developed into a report and submitted earlier to the CPUC. Key observations made from that report were:

- **Attendees said the workshop effectively covered most of the topics outlined in the brochure.** A majority said the workshop covered all of the topics; however, about a quarter of the respondents did not feel that the workshop fully explained "funding opportunities" to their satisfaction.

- **About 70% of attendees surveyed felt that the workshop addressed the unique issues and challenges facing their organization.** However, 30% responded that the workshop was not geared toward their specific needs.

- **The workshop resulted in technology transfer for 57% of the respondents.** Respondents said that technology transfer is occurring because the workshop provided information, aided support and collaboration, and provided new ideas and inspiration to the attendees. On the other hand, 43% claim that the workshop did not result in technology transfer for them because; no new information was disseminated at the workshop. Many viewed the workshop as a good *introduction* to energy efficiency, however.

- **Over one-third of the attendees said they would encourage others to attend a similar workshop in the future.** Only 5% say they would not tell others that it would be worthwhile to attend. Overall, attendees were satisfied with the workshop; the average satisfaction rating was an 8 on a 1-10 scale.

- **Attendees overwhelmingly support workshop-style deliveries.** The respondents said that they preferred face-to-face interaction, networking opportunities, and the chance to ask questions. The topics that they would like to discuss include: (1) energy efficient measures, (2) policy, (3) funding, (4) conservation, (5) outreach, and (6) alternative energy. The least favored deliveries include web-seminars, websites, and information packets.

4. Public Housing / Multi Family Metering Element

This portion of the plan called for the installation of 350 meters with real time displays of energy usage in public housing in order to encourage conservation. Scope of work for this element included acceptance testing, meter purchasing and installation, and tenant training. Although there are no claimed savings for this element, the possibility exists for savings that could be realized. Because of technical issues, this portion of the plan was deferred for future consideration.

This aspect of the program has been placed on hold. There have been several extenuating circumstances that motivated the partnership to re-evaluate the multi-family element. First, it became very difficult for SCE to obtain revenue grade meters. It took nearly a year to receive just two meters to evaluate. SCE spent some time evaluating the use of the meters for this program, and when they were done with their evaluation the vendor was not able to deliver the product.

Secondly, the single point of contact the partnership was using is no longer in place. This requires each site to be contacted individually. The amount of effort required to gain participation this way can easily overcome a project budget and timeline.

It was explained from the interviews that if this element in the partnership is dropped in the future, the money allocated for it will likely be moved to the RCx portion of the program given its great success. At the time of this report, most of that money has in fact been reallocated.

A general recommendation that could be derived from this dropped program element, for the first barrier, would be to first verify if revenue grade meters are going to be readily available in the marketplace; or, the utility could first research the validity and use of non-revenue grade meters for the specific use of such non-revenue grade equipment for this kind of application.

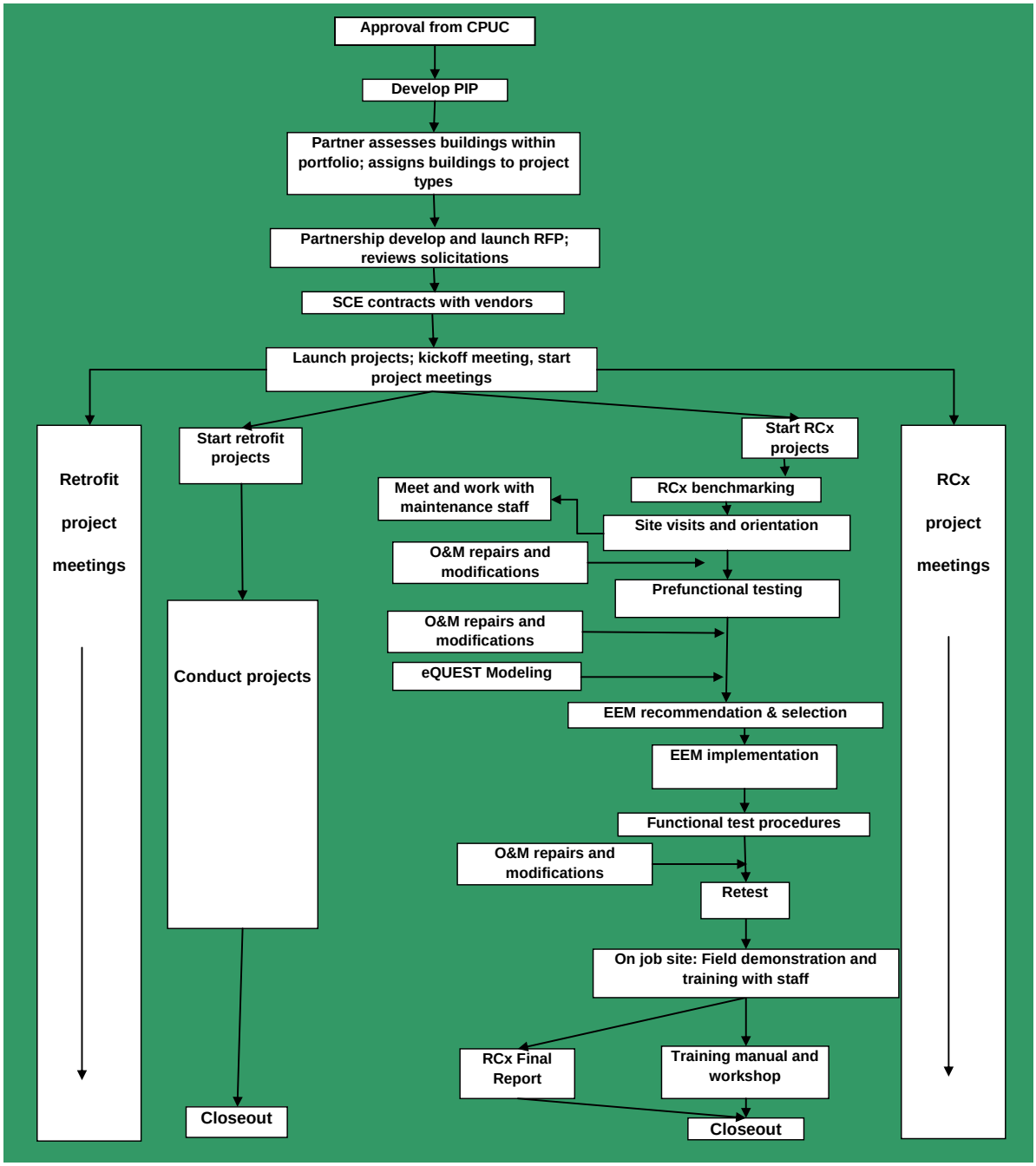
The second barrier was simply an unfortunate coincidence of timing on the loss of a single point of contact.

4.3 Partnership Process

The partners in this collaboration followed the plans for the retrofit and retrocommissioning projects, but new elements and improvements were added to the management and implementation of these projects as they unfolded. These modifications proved to be success factors in the final delivery and completion of the projects, and were expressed by all participants as elements they would like to continue to use for further partnership work. These success factors are described later on in the report, and we can recommend that such structural arrangements could be well replicated to other sectors, such as schools, state institutions and departments, and other county and city jurisdictions.

The figure below diagrams the program flow by the end of 2004-2005 Program activities:

Figure 2: Program Process – part 1



As shown, the launch and implementation of the retrofit projects were simple and similar to past efficiency projects the County has performed before. The Retrocommissioning projects entailed a significant number of intermediate steps, which both partners recognized and responded upon as new challenges in managing these projects became apparent.

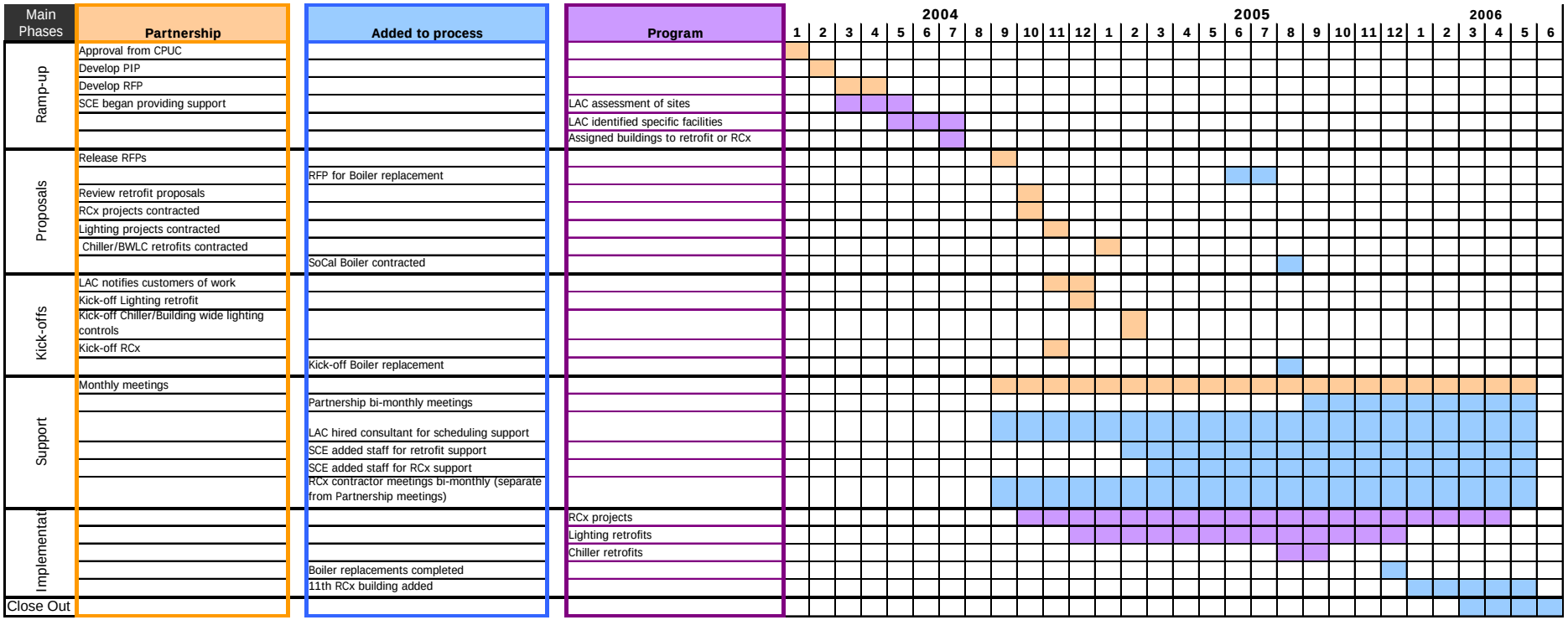
4.4 Timelines

The figure below shows the milestone timelines for the partnership and individual projects.

This Gantt chart shows many of the milestones for the program. The dates were taken from a collection of meeting minutes, monthly reports, and interview responses. The color-coding scheme for the chart is intended to show three different portions of the program:

- The tan color shows the partnership milestones. These activities were primarily administrative.
- The blue color shows activities that were added to the program mid-stream.
- The purple color show the physical activities performed in the program. These include activities related to measure implementation. The rows are grouped into similar activity types.

Figure 3: Partnership Project Timeline



4.4.1 Program Design and Development Process Steps - Descriptions

This section describes how the partnership process unfolded.

Approval from CPUC; Development of PIP

As discussed above, approval for the partnership was given by the CPUC in January 2004. A Program Implementation Plan ("PIP") was completed and implemented in February 2004.

Building Assessment

The county conducted an initial screening and assessment of which buildings to target. The final list that was constructed to go into the retrofit contractor Request for Proposals ("RFP") was lighting retrofits for 62 buildings and two chiller replacements; the RCx RFP was eight building groups with a total of 24 buildings selected by the County as likely RCx candidates. The buildings selected were those that had historically demonstrated a high energy utilization index ("EUI"), EUI is building energy usage divided by conditioned floor space, usually expressed as kWh/sf and/or therms/sf. Other factors considered were the integration of the County's energy management system, and whether lighting and HVAC retrofits had been completed in those buildings.

RFP Development, Solicitation, and Responses

Under the Partnership agreement, SCE was the contracting entity with each of the vendors chosen to provide these program services to the ISD. Two separate RFPs were developed and launched – one for retrofit projects, and the other for RCx. For the RCx projects, the partnership team originally looked to place the burden of defining RCx process tasks and energy savings calculation upon each bidder. After further deliberation, it was decided to include a technical scope of work ("protocols") towards the RCx process. The provider would also be required to estimate the energy savings from the implemented optimization measures, but would not be accountable for achieving the project savings goals. Economies of scale were requested of contractors, although they were allowed to bid on any number of buildings. No specific certification was required of the contractors.

A pre-bid meeting was held, and 14 of 19 different contractors that were invited came to the meeting. For final responses, 9 of the 14 firms actually submitted a bid. Awards were given to one contractor each for Retrocommissioning in October 2004, lighting retrofits in November 2004, and building-wide lighting controls and chillers in January 2004.

Implementation

Upon notification of contractor awards, project initiation meetings were held with each contractor. The ISD also notified their building customers of the pending project work would be occurring.

Building Retrofits

As described in the interviews, these projects were reiterations of similar lighting, controls, and chiller retrofit projects the County has pursued in the past. The only difference, as recounted by both the contractor and County staff, was on the contracting entity (SCE), whom they had to report and send communications. Each contractor was already familiar with the ISD staff. The contractors recounted that their firms had performed the same kind of work in the past for the county, either directly or as a subcontractor to a larger energy services company (ESCO).

Walkthroughs were arranged with the contractors, and a scope of work was submitted and approved for each building. Work was performed in the evenings after the building was closed and the occupants had left. Contractors were given specific directives to communicate directly to SCE staff, and to defer communicating to the building staff about project issues. This was requested by the County to ensure communications and decisions were managed through a single source. The other reason is that since the County treats the building occupants as their "customers" in a real sense, they wanted to ensure that these "customers" aren't caught up or disturbed in any way by the work taking place, and the ISD staff wanted to ensure their relationships with these building customers were not disrupted by the contractors.

An additional component of the program was the boiler replacements. The partnership reviewed the building reports and found several opportunities for gas efficiency in replacing old boilers with higher efficiency units. Originally only one boiler was called out for replacement; however after a more complete review others were identified. The new boilers were installed through an incentive channel instead of a direct install method.

4.4.2 Retrocommissioning

RCx was an entirely new process for the County, and entailed a number of incremental steps leading up to the actual project. A significant amount of management, planning, and real-time learning and modification took place during the roughly one and half years the RCx projects were launched and ultimately completed. The process and teaming procedure that was finally put into place proved to be a very good model that we can recommend other jurisdictions (state, county, or city) can emulate in a similar partnering arrangement with the utility.

In the RFP, each bidder was requested to deliver RCx services according to the following service categories:

- HVAC system performance benchmarking
- RCx project planning
- Prefunctional testing
- Prefunctional energy efficiency measure implementation
- Functional performance testing
- Implementation
- Training
- Final reporting

The RFP also indicated that another vendor may be chosen by the partnership to install the final measures selected for implementation. After the program implementation got underway, the County decided to keep the installation task within the contracts of the existing vendors. No specific reason was offered by the County project managers but simply that it made economic sense to them to stay with the firms that provided the scoping studies rather than go through another round of solicitations to secure a separate implementation firm.

All ten buildings were launched at approximately the same time. An eleventh building was added when it became apparent that enough program funding was available. As the projects unfolded, these steps became expanded, refined, and then at the final project a number of steps were collapsed into shorter and smaller time-effective steps for the final project.

Benchmarking

The RCx contractor was given facility documentation and 3-year billing histories. The contractor had the responsibility to look through the building list to determine opportunities. Benchmarking tools were next used to assess the Energy Use Index (EUI) of each building, and then the final building list of ten selected sites was developed. Although the main goal of the benchmarking was to define the energy use baseline of the buildings, the baseline was intended to be used - along with the EM&V effort - to track energy savings due to the RCx program.

RCx Planning

This step consisted of an initial site visit arranged by the county to have the contractor conduct a preliminary walkthrough and interviews with the building maintenance staff for each site. In the walkthroughs, the building staff was asked about their knowledge of the building systems, histories of modifications, and desired solutions from the project. The RCx provider audited each building to review and assess the HVAC system, including deficiencies that needed to be corrected first before RCx measures could even be assessed and recommended. In latter walkthroughs, it was found to be beneficial to have the maintenance technician directly behind the RCx engineer to fix the deficiency on the spot as soon as it was discovered.

After the audit, the RCx provider submitted a planning report that contained comprehensive building information and deficiencies noted. The County then relayed the deficiency logs in these reports to the appropriate building staff to address and rectify.

Prefunctional Testing

During this stage the RCx provider along with the subcontractor teams, performed a comprehensive examination of the building controls, control sequences, HVAC systems, and trending logs from the energy management system. Similar to the retrofit projects, this work was conducted during unoccupied hours to avoid any intrusion or disruption to the building occupants. Any additional deficiencies were further relayed to maintenance staff for follow up.

In the case of where any significant capital improvement equipment was identified for replacement, the County looked to install that replacement through other funding sources before this step was completed.

Baseline energy modeling of the existing facility was done using an established simulation tool called “eQuest” (Quick Energy Simulation Tool). An initial set of measures were modeled to generate projected energy and demand savings. The estimates from the prospective set of measures were then used to assess and determine a finalized set of measures based on cost-effectiveness.

A final scope of work and cost proposals were then developed and delivered for energy efficiency measures (EEMs). During this phase, the RCx provider began setting up and receiving data streams from EEMIS. This effort also included significant work in porting the data streams over from the older building energy management system as well. This eventually led to the final project monitoring after all measures were completed.

Implementation

The scope of work was reviewed by the partnership team for fit, as well as a determination of expected benefits against the projected costs. EEMs were then divided into work that could be performed in-house versus those that would be contracted out. Although the RFP originally kept a clause for implementation work to be performed by another vendor, the partnership team felt it would be timely and of equal cost to have the RCx provider perform that portion of the work. A change order was created to the RCx contract to allow funding for this work, as well as commissioning and a demonstration exercise for the county staff.

Functional Performance Testing

During the initial implementation, a set of procedures for functional performance testing was composed and approved. Once the initial set of measures was implemented, the testing was conducted during unoccupied hours. Similar to the prefunctional testing stage, any further RCx measures or deficiencies for internal follow up were identified; internal staff was dispatched or further change orders were provided for these additional tasks.

After completion of this testing and follow up, the RCx provider continued remote monitoring of the buildings through the County's energy management and information system.

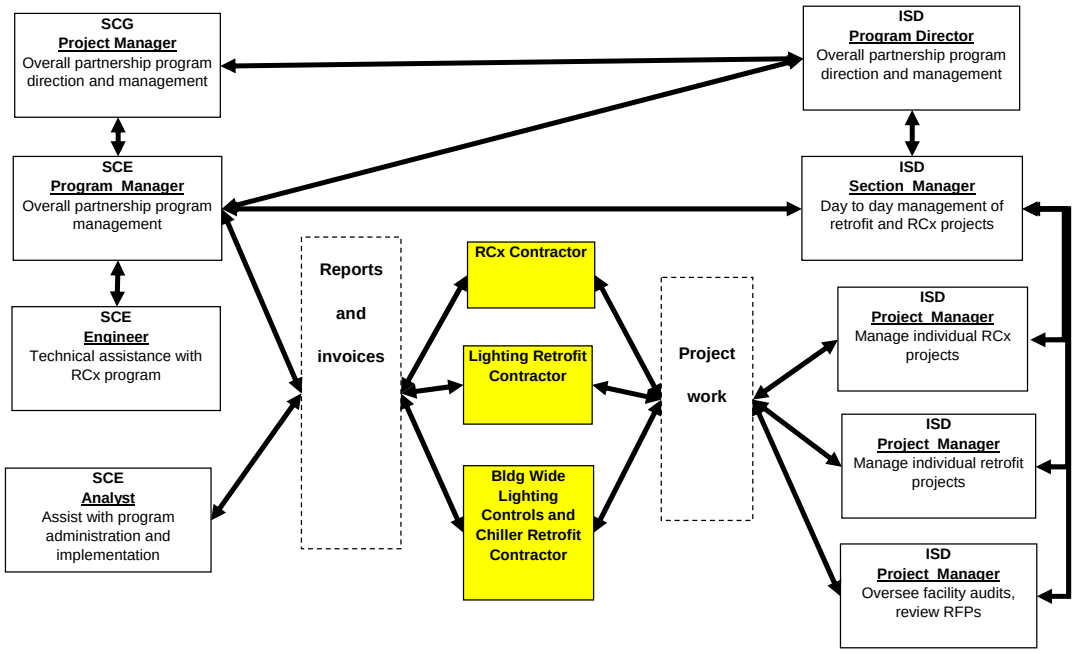
Final Report and Persistence Training

The project documentation, reporting, and trending information was compiled into individual site reports and submitted to the partnership for review and approval. A comprehensive building operation training manual was delivered to the County staff, followed by a training workshop and on-site training sessions to familiarize the building mechanical staff on the measures and the persistence steps detailed in the manual.

4.4.3 Project Management

The management and administrative function of the partnership was a key success element in the partnership arrangement. As originally envisioned in the partnership plan, a key senior person from each partner was identified as the main source of communications and decision-making, with project support staff clearly identified with specific responsibilities. The figure below shows the overall reporting and communications paths as derived from the project plan and interviews:

Figure 3: LAC-ISD-SCE-SoCalGas Management Chart (as planned)



As the projects came on line, however, both the utility and the county staff became increasingly weighed down with project management administrative tasks and day-to-day issues. Both parties recognized the necessity to bring additional staff resources in to manage these items in order to move the projects along in a timely fashion.

In February 2005, SCE hired and placed first a new analyst to serve as the central point of day to day contact, as well as manage the flow of administrative issues, coordinate communications (including meetings), process invoices, and track the projects. As the RCx projects ramped up, it became apparent that a second analyst was needed, who was brought on board in March 2005. This person replicated the same tasks as the first, but strictly for the RCx projects only.

All parties within the partnership point to the critical and valuable contribution that these hires had made to keep the partnership projects moving forward in a timely and professional manner. One contractor in particular expressed that this new hire for project coordination and liaison "knocked six to seven weeks off the project timeline".

Along the same lines, the coordination and liaison for the building maintenance staff became a rising and important function for the RCx projects. As explained by the county staff, an experienced Building Crafts Superintendent familiar with the county buildings, the energy management system, and the HVAC systems for these buildings was promoted up to the Energy Management Division just as the RFPs for the RCx projects were being developed. Along the same line of growing need for support SCE had perceived, the ISD staff recognized the value of this person in providing timely and crucial support in coordinating the RCx project rollouts, leveraging

the networking and familiarity he had already with the various building maintenance staff, and having a deep level of knowledge about HVAC systems and the energy management system. Similar to SCE's timely resource increase, all parties (including the RCx provider) expressed the valuable role that this person served in moving the RCx projects along.

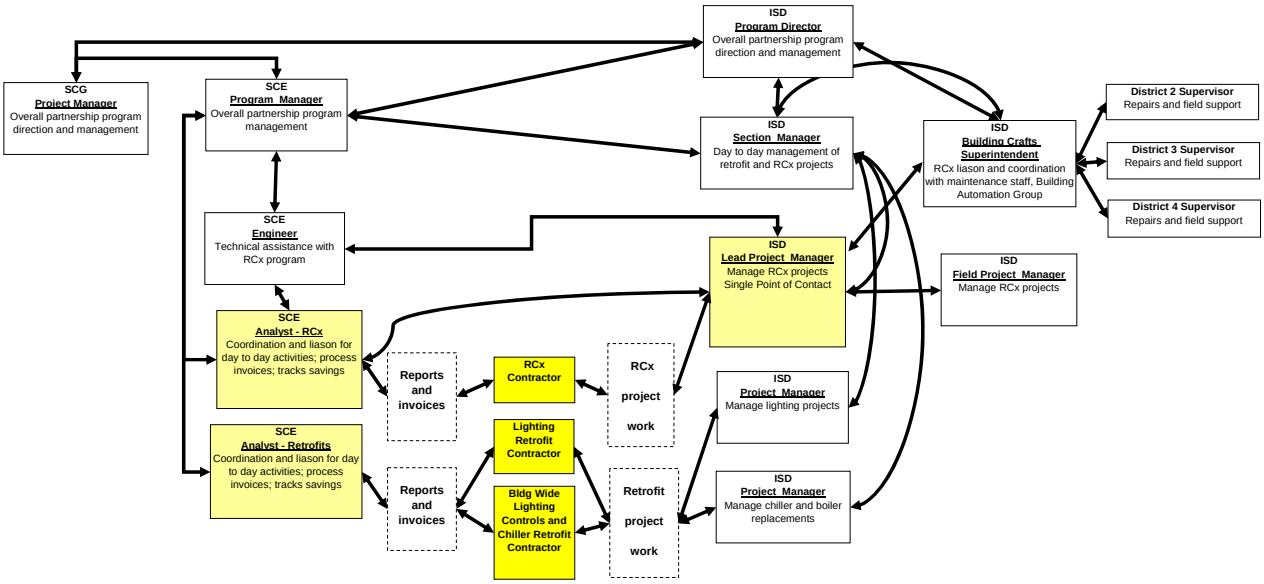
Other external and in-house resources were leveraged by the project team as well. For example, the SCE engineer supporting the RCx project was familiar and knowledgeable about retrocommissioning, and was credited by others as providing a high degree of technical knowledge in developing the RFP and designing the RCx protocols in collaboration with the LAC/ISD engineer. He was also credited for identifying and applying a professional meeting agenda tracking system that the partners used to great effectiveness. This background knowledge appears to have helped move the projects along expediently once they got underway.

In another case, the ISD section manager also leveraged her background in construction management to pragmatically identify, manage, and resolve project issues that inevitably came up during the implementation stages for both the retrofit and RCx projects. Finally, as RCx project details became complex to track and monitor, the ISD brought in a third party software specialist in project management (whom the County had under contract for other support elsewhere) to design and maintain a comprehensive project management tool. This tool allowed the partnership team to visually track the progress of every RCx protocol step for each of the ten originally planned (and then eventually eleven completed) RCx building projects.

Future programs can benefit from the use of internal resources. Program management techniques are important in any large, complex projects like RCx, and it would be wise for future project designs to include a provision for such expertise as provided by the partners, or, hired from the outside.

The next figure below shows the final management and communication paths that had evolved by the end of the initial 2004/2005 partnership program:

Figure 4: LAC-ISD-SCE-SoCalGas Management Chart (as finally evolved)



4.4.4 Project Meetings

A key element in the success of the partnership was the provision and enforcement of the project meetings. Although the PIP did not specify any performance or frequency of meetings, the partnership team began monthly meetings shortly after the launch of the initiative.

By mid-2005 (about halfway into the projects) two changes were made. First, the partnership team decided to increase the meetings to twice each month. This allowed resolution of issues and decision-making to move in a more timely and effective manner. It also compelled all parties to remain focused on resolving project issues right away instead of becoming sidelined or overlooked as newer issues surfaced.

Secondly, a systematic tracking method was incorporated into the meeting agenda and minutes that emulated best practice in construction management. This is a method where these set of simple but robust of rules were applied for recording, updating, and eventually closing out every item raised and discussed in the meetings:

1. Each set of meeting minutes are titled by consecutive numbers, ex. Meeting Minutes #1, Meeting Minutes #2, and so on.

2. The minutes were separated in sections covering major partnership elements - A. Retrocommissioning; B. Retrofit: Lighting; C. Retrofit: Building Wide Lighting Controls; D. Retrofit: Chillers; E. Gas Measures; F. Public Housing; and G. Feasibility Study

3. Each major section was separated as "Old Business" and "New Business":

"New Business" items were assigned a tracking number that identifies the meeting it was first raised and discussed, followed by an identifying number in the order it was brought up under that major section. For example (below), the minutes for Meeting #17, under section "A. Retrocommissioning", show item "17-1, Energy savings tracking" as the first "New Business" item brought up under that section. Other "New Business" items brought up under Retrocommissioning show them labeled as "17.2", "17.3", and so on. Each new item is then earmarked as who is responsible for it until final resolution – "SCE", "SCE/SoCalGas", "ISD", or "All"; any informational items that do not call for further action were simply labeled "Info".

Figure 5: Sample entry – Meeting Minutes #17

RCx NEW BUSINESS:

ALL 17.1 Energy savings tracking.
The Partnership shall request that EMC create a table of cumulative savings for RCx.

SCE/SCG 17.2 CPUC time extension on the RCx program.
The Partnership discussed the issue of a time extension to complete the RCx program. SCE and SC Gas to discuss filing requirements with respective staffs.

ALL 17.3 Library HQ air balance work to commence on Wed., July 27.
Partnership to review air balance work scope and provide comments by Tuesday, July 26.

a. New items were then subsequently moved up into "Old Business" for the next meeting. Thus, the meeting minutes automatically became the starting agenda for the next upcoming meeting. Each "Old Business" item was then reviewed or discussed; the discussion was then recorded with a prefix in parentheses that identifies the meeting number for that discussion. For example (below), the minutes for Meeting #22 now shows item 17.1 and the subsequent updates from Meeting #18 through Meeting #22.

Figure 6: Sample entry – Meeting #22

OLD BUSINESS:

ISD 17.1 Energy savings tracking.
The Partnership shall request that EMC create a table of cumulative savings for RCx.
(18) SCE to make request of EMC at the RCx project meeting on Thursday, 11th of August.
(19) The Partnership decided to track cumulative savings internally. ISD shall maintain a cumulative measure savings document to be included in our biweekly meeting discussion.
(20) ISD provided a table of energy savings and costs. This table indicates that the program energy savings goals should be exceeded and that there is a small, remaining balance of approximately $57,000.00. This table will be reviewed at the biweekly meetings.
(21) Updated savings table was distributed by ISD. SCE will review the workbook values to reflect those in the updated table. The remaining balance for the RCx project is now $22,265.00.
(22) Updated savings table was distributed by ISD. The mixing box repairs at Compton CH are not moving forward in order to save approximately $27,000 as a contingency fund until the El Monte CH measures are authorized.

b. Each of these agenda items would continue as "Old Business" until it was completed or resolved; once finished, the item would changed from its original responsibility earmark (i.e. "SCE", "ISD", or "All") to "Closed", and then subsequently dropped from future meeting minutes.

A separate meeting schedule (every two weeks) was also begun with the RCx provider in January 2005, and ran concurrent to the partnership meetings. These meetings were staggered as a teleconference followed by an in-person meeting from the first December meeting up to June 2005, and then were more frequently held as teleconferences. These meeting minutes also used the same agenda method as the partnership meetings early on in the process. Ad hoc phone meetings were also held as needed when particular items arose that needed prompt attention.

Since retrofits were much more of an established process, there were less scheduled meetings. Retrofit contractor meetings were regulated to problem situations. It was expressed by utility staff that, as long as everything was okay for the retrofit projects, the team felt no need to meet with the retrofit contractors.

All parties felt the meeting process and the frequency of the meetings were productive, necessary, and vital towards moving the projects along to completion. In the interviews, it was expressed by both utility and ISD staff that the initial face-to-face meetings were especially critical to settle a number of important issues during the initial planning and ramp up to the actual projects.

4.4.5 Savings Outcome

The electrical and natural gas energy and coincident peak demand savings are documented in RLW's impact evaluation of Program. Interviewees expressed that the electrical demand savings was not quite met, but overall felt a high level of satisfaction over the total savings.

4.4.6 Non-Energy Benefits

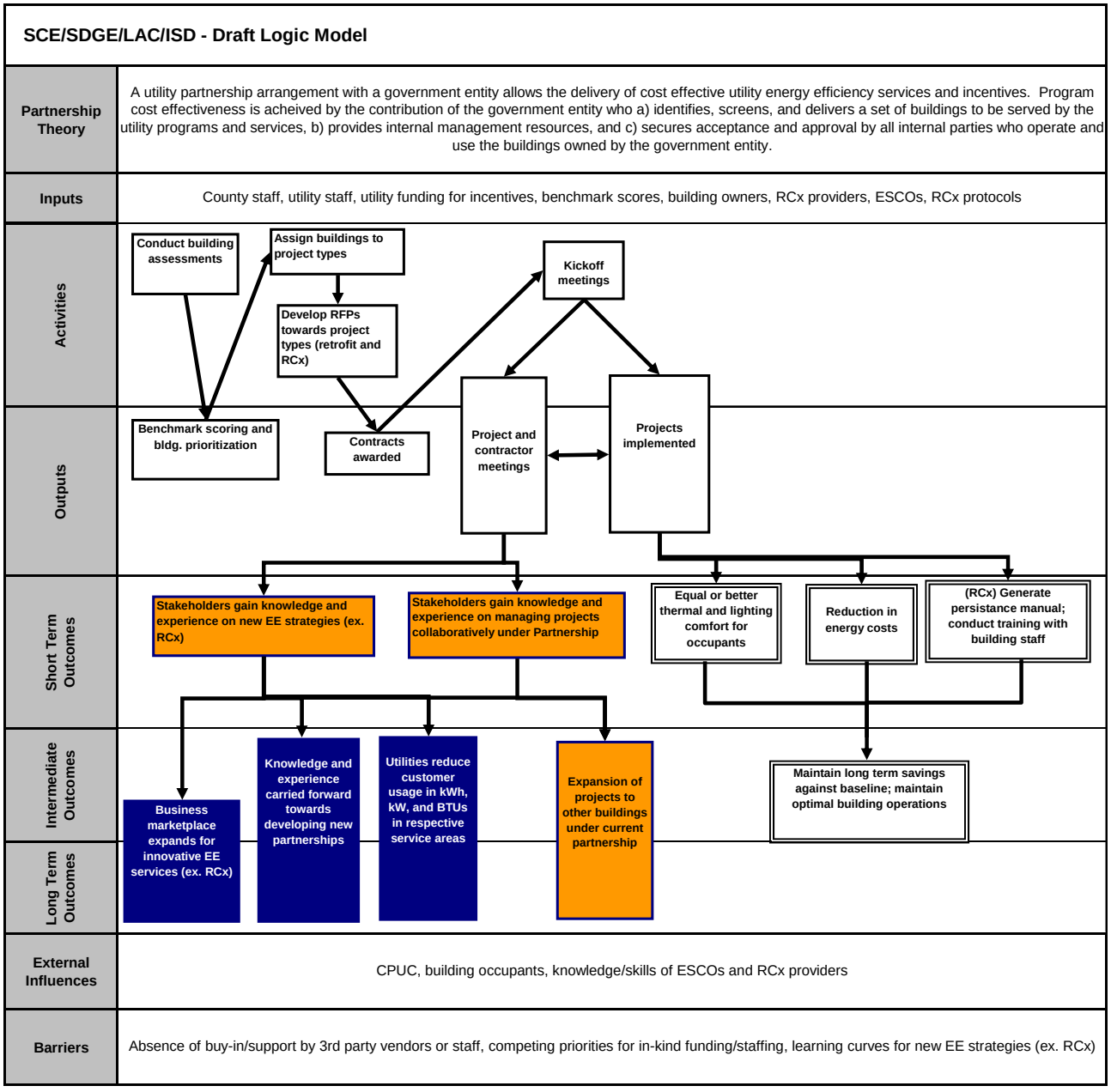
Because of the care and sensitivity ISD has towards its building customers, the staff expressed during the interviews that they wanted to be careful that none of the projects would be perceived as affecting thermal comfort or lighting quality in any way. In particular, the court building operational conditions are ultimately controlled by the presiding judge for the court, who has final say on every aspect of the thermal and lighting conditions inside the courthouse.

It was expressed by county staff that they were pleased with the results in terms of no negative responses from any of the building customers during the RCx process. Although there were no specific "wow" stories, county staff reported that they have gotten favorable responses from some building occupants who say "the air feels better".

4.5 Logic Model

As described above, the partnership design was conceived and launched based on a plan developed collaboratively between the utilities and the County. The figure below shows a partnership logic model that incorporates all the elements discovered by RLW through the process interviews and the partnership agreement.

Figure 8: Partnership Logic Model



In this model, the activities and outputs are steps that integrate activities and resources from all the partners and contractors. For the outcomes, there are three types of colored boxes that represent the short, intermediate, and long term outcomes anticipated various parties:

- The blue or dark boxes represent outcomes anticipated or desirable to the utility sponsors;
- The orange or light colored boxes represent outcomes anticipated by both partners as well as related stakeholders (such as the CPUC); and
- The clear, double-lined boxes represent outcomes desired by the building owner partner.

As shown, the major elements are:

1. **Partnership theory**. This summarizes the intent of the partnership as expressed by a number of stakeholders and participants during the interviews and materials review.
2. **Inputs**. These are the direct inputs used in the partnership implementation.
3. **Activities**. These are the direct activities stemming from the partnership inputs. The outputs come directly from the activities, which in turn generate further activities.
4. **Outputs**. These reflect the direct, tangible outputs from the activities performed. For the partnership, the project output of the project and contractor meetings is as a critical element as the project implementation step itself. The learning and understanding of how to collaboratively work in the partnership come primarily out of this critical project element.
5. **Short, intermediate, and long term outcomes**. These are the expected and desired outcomes from the previous steps. As explained above, there are three general types of outcomes that pertain to each or both parties (below).

Short Term Outcomes

For all stakeholders:

A. While well-established energy efficiency practices such as lighting retrofits are simply conducted as before but with different funding arrangements, the stakeholders also gain knowledge and experience on new energy efficiency practices introduced through the partnership, such as retrocommissioning and technology transfer workshops.

B. Stakeholders gain immediate knowledge and experience on managing projects collaboratively under the partnership

For building owner partner:

A. Treated buildings provide equal or better thermal and lighting comfort for occupants.

B. The partner enjoys a reduction in energy costs

C. For retrocommissioning projects, the partner receives a training manual and follow-up training for the building staff. This is an important element, because savings derived from

Retrocommissioning (as compared to the established usage baseline) will diminish and possibly even disappear if proper persistence steps are not followed.

Intermediate and Long Term Outcomes

For utility sponsors:

A. The knowledge and experiences gained from successfully launching and running this partnership can be carried forward towards developing new partnerships.

B. The partnership collaboration continues to treat other buildings within the owner's portfolio, and both utility partners may claim reductions in customer usage of kWh, kW, and therms.

C. Although not an expressed desire by interviewees, it would appear that innovative energy services introduced through the partnerships would create demand large and consistent enough to eventually draw in established companies or support entrepreneurs who want to provide those services as a third party vendor.

For all stakeholders:

A. The initial success of the partnership leads to further identification and implementation of energy efficiency projects within the owner's portfolio.

For building owner partner:

A. Long term savings are maintained against the optimized baseline, and optimal building operations are sustained for both the savings and occupant comfort.

5. Analysis

This section describes the analysis of results found from the process interviews and documentation review. References are also made to any outcomes or issues similar to other RCx programs.

The partnership strengths are first described, followed by learning lessons for future program recommendations. These strengths stand out as recommendations to incorporate into future partnership designs.

5.1 Partnership Strengths

From the interviews and the document review, these items stood out as the overall strengths of the partnership.

A. **There was a leadership commitment to success from both the utility and county partners.** This was demonstrated through goals expressed in the ISD strategic plan, a personal commitment expressed by senior management during the interviews, and evidence of team commitment towards gaining and applying "real time" learning lessons.

B. **Strong management processes were developed during the partnership**. This was demonstrated by the establishment of clear paths of communication and clear identification

of responsibilities, reinforced and maintained through frequent and consistently scheduled meetings.

C. **Procedures in the RCx projects were created to ensure maintenance staff "buy-in", and the use of an internal champion.** The partners and the RCx contractor took steps to visit with maintenance staff during their walkthroughs, and solicited the staff input on building issues and challenges. This demonstrated to the staff that their building knowledge and insight was important to the success of the coming project, and ensured their cooperation during the project as well as strengthened the likelihood that they would embrace and perform all of the new post-project O&M (operations and maintenance) practices.

D. **Program innovation within the RCx projects arose to ensure good program planning and long term success.** The application of technical innovation by the program was evidenced by the use of benchmarking, a robust RCx procedure, and the creative adaptation of RCx to older pneumatic controls.

In detail, these strengths were:

A. Leadership commitment towards success. This was demonstrated through:

- *ISD strategic plan*. This set the foundation for the long term success of the partnership. As discussed above, the plan specified goals that the retrocommissioning projects, in particular, were developed to reach. In addition, the strategic plan has been in place in 2000 and regularly upgraded. The ISD's previous EM&V report from 2002-2003 showed that the projects in that program fully met its goal.[3] Both of these documents provide demonstration that the management of ISD has a vested interest in these goals and have been able to reach them in the past.

  The net outcome is that ISD management would be focused towards achieving successful outcomes for the projects and will truly champion them, as well as provide additional resources when needed. This indeed was demonstrated through the contribution of in-kind resources in additional management staffing, availability of maintenance staff to perform O&M follow up work during the RCx process, and the use of an ISD third party vendor to create and maintain a master project schedule.

- *Expressed personal commitment by senior management.* Management on both sides of the partnership expressed their personal interest in ensuring the partnership worked well. Parties on both sides expressed that the collaboration was a true partnership and a true teaming effort. This personal commitment was also evidenced in the contribution of additional resources in staffing and vendor support from both partners to ensure the projects would be completed successfully.

[3] Aloha Systems. "Evaluation, Measurement, and Verification (EM&V) Report". Analysis prepared for Eli W. Kollman, Energy Division, California Public Utilities Commission. May 20, 2004.

- *A team commitment towards utilizing "real time" learning.* This was evident in the number of adaptations of the process steps and project protocols while the partnership projects unfolded. This can be seen, for example, in the inclusion of additional resources (as noted above), as well as modifications in the communications and decision-making steps. Another notable adaptation was the inclusion of an eleventh RCx project after the first ten reached completion. In this final project, the original benchmarking, planning, and prefunctional phases were combined into one investigative phase; the benchmarking tasks themselves were streamlined; the planning phase tasks were reduced to the creation and use of forms to complete and follow; and testing was streamlined. The learning lessons of the previous projects were thus immediately put to use in the final, eleventh project even before the partnership funding ended.[4]

B. Strong management processes developed during the partnership. This is evident in the following three areas:

- *Clear paths of communications.* The plan started with the identification of a senior manager on both sides of the partnership responsible for the partnership projects. When project details became complex to manage, SCE brought in a new person to serve as the central person for all project communications and day-to-day management for retrofit projects, and the same for the retrocommissioning projects. Each of these staff members were identified as SCE's single point of communications for the contractors and ISD. Likewise, ISD had singular sources of contact as well.

- *Clear identification of responsibilities, reinforced and maintained through frequent and consistently scheduled meetings*. As identified in the analysis, the meetings structure and management became critical tools towards the project progress. The agenda and minutes structure ensured that responsibility for individual action items was clearly identified up front, and no item could slip by through oversight or lack of attention. The frequency of the meetings helped ensure issues were readily addressed and resolved without too much time passing by.

  This need for constant and continuous RCx project management was echoed in an AESP brown bag presentation about the Xcel Energy RCx program in Colorado. In this program, the administrators had also found that when customers were left to their own devices, projects became significantly delayed; according to the presenter, "we realized that it was [of] key [importance] *to be in constant touch* with the customers and providers to make sure things moved along" [5] (italics added here for emphasis).

C. "Buy in" steps and establishment of an internal champion. As mentioned in the project implementation description for retrocommissioning, an initial site visit arranged by the county had the contractor conduct a preliminary walkthrough and interviews with the building maintenance

[4] Information detailed here comes in part from Poeling, Tom. "Tuning Up the Retrocommissioning Process", Proceedings of the National Conference on Building Commissioning, April 19-21, 2006, pp. 12-13.
[5] Webster, Lia, PE, Nexant Inc. "Xcel Energy's Colorado Recommissioning Program" (web- and phone-cast presentation). AESP Brown Bag Seminar, March 1, 2006.

staff for each site. In the walkthroughs, the building staff was asked about their knowledge of the building systems, histories of modifications, and desired solutions from the project. This step not only gave the RCx provider the "insider knowledge" that would have not readily been discerned through building data or drawings, but also contributed towards the larger project success by the very demonstration to the maintenance staff that their insights were important; by virtue of that demonstration, the partner team increased the likelihood that the maintenance staff would "buy into" the projects. This human element of RCx project ramp up is as important as any technical step, because successful retrocommissioning relies on staff following through on any O&M deficiencies identified in the walkthrough, as well as dedication of time and effort towards maintaining the RCx measures after the project is completed (i.e. faithfully following all of the tasks detailed in the building's RCx persistence manual).

This "people" element to start the RCx process cannot be underestimated. Commissioning specialists in this project and other RCx programs that RLW have examined have pointed out the need to carefully build a trusting relationship with the building owner and maintenance staff:

> "The key to sustaining an optimum mechanical system is involving the facility maintenance staff into the RCx process as soon as possible. It can be a challenge for an outside consultant or contractor to gain the trust of maintenance personnel. As the outsider, the RCx provider is often 'guilty until proven innocent.'"[6]

Other recent RCx program presentations provided by NYSERDA and PECI raised the same issue as a lesson learned for their respective programs.[7] Both presenters said they had realized their programs had taken much more time than expected because of the need for both the building owners and providers to get acclimated and comfortable with each other as they developed their business relationship.

Establishing an internal champion is also an important success factor for RCx projects. The "champion" is the singular source of contact, knowledge, and motivation within the building ownership's internal structure that can cut through the number of small issues and problems that inevitably crop up in an RCx project. This person is as vital to the project's success as any other element in the project. For example, any RCx project managed by Marriott International - a recent proponent of ongoing commissioning and RCx - a person is actually identified and designated as the "energy champion" for specific monitoring, reporting, and supervising functions during the project, while ultimately reporting to a building's Director of Engineering.[8]

D. Programmatic innovation. As discussed earlier, the Retrocommissioning element of this partnership utilized new, innovative approaches that took time and effort to set up and run. Some of the highlights of those approaches were.

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[6] Poeling, Tom. "Tuning Up the Retrocommissioning Process", p. 11.

[7] Khan, Alica. "San Diego Retrocommissioning Program" (web- and phonecast presentation); and Lanihan, Kim. "The NYSERDA Retrocommissioning Initiative (web- and phonecast presentation). AESP Brown Bag seminar, March 1, 2006.

[8] Haasl, Tudi, Robert Bahl, E.J. Hilts. "The Marriot Retrocommissioning Program." Proceedings from the National Conference on Building Commissioning, May 4-6, 2005.

- *Comparative Building Benchmarking.* This was a useful step that was built into the initial planning and proved itself as a contributive factor towards ensuring savings opportunities could be captured. As discussed earlier, the partnership team worked with the RCx provider towards setting up spreadsheets and an energy benchmarking software program to determine energy density metrics in electricity and gas usage. The benchmarking used billing data and building specifications to obtain a therm per square foot per year and kWh per square foot per year figure by facility.

  This internal benchmarking was useful in this partnership because it was applied to similar building types, which allowed for a reasonable comparison. Comparisons can also be made on larger national scales as well, such as the US EPA's Building Portfolio Manager, which has been used in another recent RCx pilot.

- *Robust RCx procedure*. The structure of the RCx protocols follows fairly close to other RCx programs implemented in other areas of the country. The RCx protocol flow of benchmarking, investigation, implementation, verification, and persistence training are replicated in similar steps by those RCx programs or pilots for Xcel Energy, San Diego Gas and Electric, NYSERDA, and Northeast Utilities. However, the pre-functional and functional testing stages were, in fact, much more comprehensive than what has been ever used elsewhere.

- *Creative adaptation of RCx to older pneumatic controls*. One interesting discovery that came out of the interviews was the story of the county and the RCx provider determining that the county buildings would be better served in restoring and maintaining the original pneumatic controls instead of replacing them with direct digital controls ("DDC"). As related by the county staff, a number of controls are of an older technology that used pneumatic controls and actuators to physically move working components of the HVAC system, such as dampers, vents, etc. The modern strategy in upgrading these systems is to replace these controls – either in entirety or in part for key components – with DDCs, which are generally accepted in the industry to be a more easily maintained and controllable technology. However, the county and RCx provider staff recognized that replacing pneumatic controls can be capital intensive; and as important, the county has older staff that has extensive familiarity these types of controls. It was related in the interviews that these older staff members actually needed to explain some of the nuances of pneumatic controls to some of the more junior staff serving the RCx provider, who had limited experience with them.

  It was decided by the team and the RCx provider to repair or replace the pneumatic controls, and build in a maintenance strategy in the training manual to keep them functioning accurately. The county staff said that this move also helped to create further buy-in with some of the older staff that is knowledgeable and comfortable with this technology. In contrast, a switchover to DDCs may have alienated some of the older staff and negatively affected the long term savings.

5.2 Further Lessons Learned for Recommendations

A hallmark of this particular partnership is the demonstration of real-time learning and incremental improvements that both parties pursued when faced with challenges during the partnership events. Rather than maintain a static process per the original partnership plans, all parties appeared to readily recognize and respond to unfolding conditions with variations or modifications to what the original plans called for. This level of creativity and trust helped make the partnership successful.

In this light, there are a number of learning lessons that, in a static relationship, would then become recommendations for further implementation. However, the partners had already incorporated those changes by the time the 2004/2005 funding had ended, and these in fact became some of the strengths identified in the earlier section. We have also identified some further issues that elicited comments for improvements or were readily determined from the evaluation tasks performed (i.e. from the interviews, documentation review, and secondary research) as items for changes in a subsequent offering. RLW would characterize these as incremental learning lessons, generally minor in nature, to further build upon the success of the initial partnership agreement, as well as to incorporate into future partnership arrangements.

Our recommendations are:

A. Fine tune the building screening and contracting;

B. Stagger the RCx projects instead of doing them all at once;

C. Make allowances for the RCx provider to serve in a consultative position;

D. Establish benchmarks and baselines for non-energy benefits; and

E. Build in "quick decision" response processes.

Each are explained in detail below.

A. Fine tune the building screening and contracting. Contractors from both sides of the RFPs expressed some dissatisfaction with the RFP construction and offered suggestions on improvements. RLW assessed their comments, and determined that the RFPs can be improved along the following steps:

- The retrofit RFP should make it clear if the contractor's initial audit costs should or should not be included with their bid price, and if the contractor would be compensated for those costs. The contractors had not expected to spend as much time as actually was required in the initial step, and there was no specific provision in the RFP for compensation for that time.

Our recommendation is to specify that an initial scoping study be conducted by the RCx contractor, and initial findings developed and presented by the contractor to the partnership

team. The partners should specify that this scoping study provides an initial assessment of the RCx work identified, an estimated range of cost, and an estimated range of time to complete the work. The RCx contractor should also identify and present all possible impact points – good or bad – that will affect the price and time.

- The scope of work needs to be specific, and a list of targeted buildings needs to be included. In general, the contractors for both the retrofit and RCx projects would have preferred getting a definite set of buildings to treat rather than a group to search through, which likewise appears logical to us. In particular, the lighting contractor went out to identify retrofit opportunities among all the buildings identified in the RFP list, and then had to look for other buildings later on when funding remained available for further projects.

  The contractors also would have liked to have more detailed scopes of work available in the RFP's. In the interviews, it was shared by the partnership team that the scope of work was left somewhat open to accommodate different contractors, with the intent of issuing change orders as the needs arise during the projects. Since this kind of work had not been performed before with County buildings, it may have been inevitable that the RFP language was fairly open-ended. New RFPs should now incorporate a scope-of-work language that details each of the RCx protocols this partnership had fully developed. Both the partner team and the RCx contractor recognized that the original Retrocommissioning RFP had some open ended elements that eventually became worked out during the project process, and the latest RFP has incorporated those learning lessons.

- The contracts with the engineering firms should be set as "time and materials" instead of a blanket purchase order. A blanket purchase order was written to accommodate for these change orders mentioned above, which the utility staff said became a documentation problem itself. The utility staff acknowledged after the fact that a time and materials contract would work better.

B. Stagger the RCx projects instead of doing all of them at once. The team and the RCx provider both said they recognized during the heart of the project implementation that managing ten RCx projects became complex, and in addition precluded the opportunity to build in real time learning lessons if the projects were started separately. Running all of the projects concurrently also made them susceptible to "bottle-necking".

As recounted earlier, a number of learning lessons about managing the RCx phases were used in a final eleventh project that was added on the end. The county staff expressed during the interviews that they would be predisposed to stagger the launch of any future multiple RCx projects during the next program funding cycle.

C. Make allowances for RCx provider to act in a consultative position. From the interviews of this pilot, as well as narratives given by some RCx providers in another RCx pilot RLW is currently evaluating, the firms that specialize in retrocommissioning prefer a more consultative approach

when working with customers and (in the case of utility programs) their program sponsors rather than serving – and being perceived as - strictly hired contractors.

Specifically, the items that were borne out from the interviews for changes we recommend would be the following:

- Plan opportunities for the RCx provider to be involved in initial planning and discussions on approaches. Allow the contractor to provide some initial expertise and insight during the planning stages, such as over the course of the walkthrough and during the benchmarking phase.

- Allow for the contractor to participate, to the time and trust levels allowed, to hold informal discussions with the maintenance staff. In this same consultative role, the RCx providers would prefer an opportunity to interact a little more with the maintenance staff during the deficiency correction and implementation phases to gain further "buy-in" and trust towards the process and the final measures. Gaining this level of acceptance and trust is critical if the persistence steps for maintaining the RCx measures are going to be religiously followed and documented, and particularly true for older mechanical controls such as pneumatics. A few incremental and informal meetings along the way with the maintenance staff before the training manual is delivered will be ultimately helpful in securing the buy-in and acceptance at the end.

We would stress, however, that the introduction of an experienced maintenance staff person to serve as the "internal champion" and key liaison between the partnership team, the contractor, and the building maintenance staff in this past offering was, as detailed earlier, a significant contribution in the success of these RCx projects; this recommendation above would look to further build upon that successful element.

D. Establish benchmarks and baselines to test for non-energy benefits. Per the initial discussion during the evaluation project initiation meeting and subsequently in the interviews, the county staff expressed an interest in the idea of measuring and assessing non-energy metrics directly relating to their staff operating costs and productivity. As described earlier, the initial anecdotal information about tenant comfort was positive. It would be useful to determine if there could be an opportunity during the baseline and benchmarking phase to track and record quantitative non-energy metrics relating to occupant comfort and productivity. These could be such things as direct metrics, such as pre- and post-count (by sheer number or of frequency) of tenant complaints, or, of agreed-upon and reasonable proxy indicators, such as any productivity measures currently collected and measured by the county.

E. Build in "quick decision" response processes. The contractors brought up that they were satisfied with the communication procedures with the SCE project team, but noted that it took time to get the answers to questions that would pop up during project work. Since the established project procedure was to refer all questions with the utility instead of the county staff, some issues had taken longer to address because the contractor had to go back to the utility to get an answer

on the question. Since projects were being performed at night, there were few opportunities to get a question answered on the same day.

The recommendation would be that, if the same contractual and communications arrangement is set up again in this or similar partnerships, the team members should construct a "quick decision" communications process where immediate "on-site" questions can be readily transmitted and responded. This would mean one of the following procedures needs to be established:

a) A utility representative with the power to make the call on new decisions is always scheduled to be on-site during the project work;

b) a quick link communications protocol is set up (i.e. using real time technology, whether it is cellular phone communications, wireless e-mail, etc.) to give the RCx provider reasonable real time access to the proper utility decision maker; or

c) the partners – in collaboration and agreement with the contractors - have to construct a set of guidelines that stipulate when county staff can be empowered to make on-site decisions, and what kind of decisions they can be; if the utility reserves the right to key decision factors, they must incorporate a) or b) above in their planning.

6. Conclusions

The partnership proved to be a successful relationship between the utilities and the county. KWh and therm savings were achieved beyond the partnership goals, with all parties expressing interest in maintaining the partnership into another round of program funding.

The retrofit projects proved to be a successful continuation of similar past work that the county has performed, and thus had a more established routine and predictable outcome. A major part of the program was to institute an aggressive, long-term retrocommissioning program that will maximize the County's ability to optimize facility HVAC operations. From an assessment on the process side, the partnership was able to meet their planned goals:

- On-the-job training to County facility engineers, technicians, and mechanics managers on how to operate and maintain buildings to use energy more efficiently;
- train building facility managers on how to use new equipment most efficiently;
- a healthy, comfortable, and productive working environment for occupants;
- more efficient operation of energy-using equipment;
- energy cost savings that pay back investment;
- complete and accurate building documentation.

An additional goal of reducing maintenance costs is also targeted, which can be a follow up item for the county to track once an entire year passes with the completed projects.