

*A Proposal to*  
**THE CALIFORNIA PUBLIC UTILITIES COMMISSION**

**PACIFIC GAS AND ELECTRIC  
BUILDING TUNE-UP PROGRAM**

***CONFIRMATION/PROPOSAL NUMBER:***

***IMPLEMENTER: QUANTUM CONSULTING, INC.  
2030 Addison Street  
Berkeley, CA 94704***

***ADDITIONAL PROPOSALS BEING SUBMITTED***

***PRIMARY***

- ***PG&E California Wastewater Process Optimization Program***
- ***SDG&E California Wastewater Process Optimization Program***
- ***SCE California Wastewater Process Optimization Program***
- ***SCE Building Tune-Up Program***

***SUBCONTRACTOR***

- ***PG&E's Local Government Partnership Program: EBEP***
- ***SDREO's San Diego Building Tune-Up Program***



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## ***I. PROGRAM OVERVIEW***

Quantum Consulting (hereafter “QC” or “Quantum”) is pleased to submit this proposal for the Building Tune-Up Program for retro-commissioning (r-Cx) services and Energy Management Plans (EMPs) for medium and large commercial and industrial buildings in PG&E Service Territory. The program will deliver significant, cost-effective savings through a proven program implementation process. In this section we present our program concept, rationale, and objectives.

### ***I.A PROGRAM CONCEPT***

The primary goal of the Building Tune-Up Program is to provide cost-effective, long lasting energy and demand savings through commissioning of existing nonresidential buildings in PG&E service territory.<sup>1</sup> This program fills a much-needed market niche because there is currently no other energy efficiency program focused solely on capturing the significant energy and peak demand savings associated with the commissioning of existing buildings (referred to as retro-commissioning or “r-Cx”). As described in this proposal, our approach to cost-effectively capturing these savings is proven and unique. Our program integrates a logical, high close-rate marketing and recruitment process, with industry-leading r-Cx engineering, optimized customer information and incentives, and turn-key customer assistance to ensure the highest level of cost-effective savings possible. Our r-Cx services will consist of identifying and implementing changes in building operations and related hardware to reduce energy use while maintaining comfort and health objectives. Our program achieves long-term persistence of savings by emphasizing “hard” measures (e.g., via hardware that must be installed with tools, repositioning control points, and software changes that require specialized skills that cannot be easily reversed) and by providing monitoring tools, operator training, and building system manuals. Furthermore, our program provides a value-added Energy Management Plan (EMP), which outlines additional cost-effective retrofit opportunities beyond the low- and no-cost options associated with the core r-Cx element. Finally, our r-Cx program maximizes the installation of all appropriate cost-effective measures by providing an independent, in-depth assessment of opportunities coupled with consistent customer support throughout the entire project development and installation process.

### ***I.B PROGRAM RATIONALE***

The Building Tune-Up program will provide an extremely important and valuable component of the portfolio of energy efficiency programs needed to deliver cost-effective energy and peak demand savings for ratepayers and resource planning in the State of California.

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<sup>1</sup> If the East Bay Energy Partnership is funded, we will exclude Alameda and Contra Costa Counties from the eligible customer base, as they will be served through the EBEP Tune-Up Program.

### ***I.B.1 Why Select Quantum for this Program***

The distinguishing features of Quantum's Building Tune-Up Program are summarized below. The proposed program:

- ***Utilizes a Proven, Turnkey Approach.*** This program builds off our Building Tune-Up program that is currently having great success as part of the 2002/2003 Oakland Energy Partnership. Our approach to ***capturing persistent, cost-effective r-Cx savings*** includes the following elements:
  - **An integrated and sustained program participation process** that shepherds customers through the entire project development and implementation cycle, from r-Cx potential screening through measure installation and validation;
  - **An efficient and effective marketing and outreach process**, which is currently producing an exceedingly high close rate (approximately 80% of qualifying customer agree to participate);
  - **A credible and thorough building screening process** that independently and tangibly demonstrates the value to customers of continuing to the implementation phase (see Appendix A which is included in the hard copy of the proposal for sample report);<sup>2</sup>
  - **The use of expert building systems engineers** to create the detailed feasibility plans necessary to ensure effective contractor and customer implementation of the r-Cx measures (see Section VII for staff qualifications); and
  - **A thorough measure inspection and validation process** that includes provision of the information and training needed by building operators to maintain measure effectiveness on an on-going basis.
- ***Cost-Effectively Captures a Significant Share of an Otherwise Untapped Efficiency Resource, Including Vitaly Needed Gas Savings.*** The program will achieve 18.4 GWh, 5.0 MW, and 664,000 therms of savings at with a TRC ratio of 2.5. These savings are roughly 7.4% and 9.1% of whole-building electricity and natural gas consumption, respectively, for participating customers. By their very nature, these tune-up savings will remain lost opportunities without the focused and concerted program effort we have proposed. Roughly 20% of program benefits are associated with natural gas savings, which are of critical import given the increased dependence on and volatility of this fuel.
- ***Emphasizes “Hard” r-Cx Measures.*** There are a wide variety of measures that are discovered in any retro-commissioning process. These measures span a spectrum from more behaviorally oriented to purely hardware based. Our building assessments make a concerted effort to find and emphasize measures that have permanent, lasting savings.

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<sup>2</sup> Jump, David and Adan Rosillo, 2003. *Commissioning Existing Buildings: A Program Perspective*, International Conference on Enhanced Building Operations, Berkeley, CA, October.

Our program weighted measure life of 8 years is supported by our database of actual measures developed on the current Building Tune-Up program being conducted in the Oakland Energy Partnership program. Many other r-Cx programs will typically focus on soft measures with 1-3 year paybacks

- ***Minimizes Lost Opportunities Via Use of r-Cx Specialists.*** Our approach matches specialized r-Cx service providers to jobs to ensure all savings opportunities are identified across a range of building systems. Unlike some r-Cx programs, we do not have vendors bring us clients and guarantee they get to do the job because, at the current nascent stage of r-Cx market maturity, traditional vendors such as HVAC contractors will typically only be able and motivated to identify measures that fit in with their current business specialties.
- ***Efficiently Deploys Public Goods Funds through a High Percentage of Direct Customer Incentives, Low Overhead, and Appropriate EM&V.*** Direct customer incentives and building services account for 76% of our budget, while non-marketing administration accounts for only 7%, and EM&V 5%.
- ***Focuses on High Potential and Equitable Target Markets.*** The program will target offices, colleges, hotels, refrigerated warehouses, and hospitals that are over 100,000 square feet. We are not tied to only doing work for city, county or college-owned buildings. We have strong relationships with many multi-property owners that have already agreed to participate; which will result in significant participation among renter-occupied office buildings.
- ***Builds California-based r-Cx Capabilities and Provides Economic Development.*** All team firms are California-based businesses. It is expected that most of the project installation work will flow toward California-based businesses as well. As a result, our program provides economic development benefits to the State. Moreover, the program will help to build a long-term market for r-Cx services in California. Our in-State focus will allow us to maintain close contact with participants, prospect opportunities on-site cost-effectively, and ensure quality installations through timely, local follow-up.
- ***Provides Coordination and Synergies.*** Our Building Tune-Up participants receive an Energy Management Plan in addition to their r-Cx Plan. The Energy Management Plan provides recommendations that customers are encouraged to implement through the IOUs statewide programs. This will result in additional savings beyond those estimated.
- ***Leverages Quantum's Experience and Expertise in Program Delivery, Program Management, and Evaluation.*** Quantum has a proven track record providing project management, program delivery, and evaluation services to the IOUs and CPUC for the current 2002/2003 programs. Quantum will leverage its full-service energy efficiency capabilities to provide a high level of quality in all phases of the program implementation and evaluation process.

- ***Will Be Launched Quickly and Seamlessly.*** The proposed program builds off of our existing Building Tune-Up program. As such, we have the program materials and procedures developed, service providers in place, and potential participants identified. Competing r-Cx approaches that require development of new program concepts and must seek out and qualify service providers as an initial program implementation step will take much longer to develop a qualified pool of customer participants and resulting installations. By contrast, our program is road-tested and positioned to begin customer recruitment immediately at the outset of 2004, or sooner depending on the timing of CPUC approval.

### ***1.B.2 Basis and Need for Program***

Retro-commissioning services consist of identifying and implementing changes in building operations, such as control strategies and schedules, to reduce energy use while maintaining comfort and health objectives. More technically, retro-commissioning tune-ups involve the use of specific test procedures designed to identify design, installation, and operational faults and optimize energy performance. A combination of utility bill information, building documentation, equipment specifications, and measurements of critical system parameters (e.g. supply air temperature, chilled water temperature and ambient wet and dry bulb temperatures for HVAC systems) made over a period of a few weeks are used to identify faults. Depending on the configuration of HVAC, lighting and control systems, a spectrum of faults to be corrected in a building include control system set points and schedules, leaking valves, malfunctioning economizers, and ineffective reset schedules for supply air and chilled water temperatures.

Building commissioning services began to be a recognized resource for improving building performance during the early 1990s. Many demand-side management program evaluations showed that many building energy conservation measures did not provide as much energy savings as anticipated during design.<sup>3</sup> That is, most building systems are installed without proper commissioning. New construction commissioning is a set of procedures to bring systems from design to full operation while ensuring that they operate in accordance with design intent. Early commissioning studies found that dynamic systems, especially building controls, failed to be implemented and fully tested before operations began. As techniques to commission buildings were developed, similar sets of techniques were developed to commission, or tune-up existing buildings.

The term “retro” in retro-commissioning refers to the “retrofit-like” intervention during ongoing operations. Since most buildings were never properly commissioned when they were new, or have since altered their space use and requirements, many opportunities exist to improve existing building performance by careful examination of dynamic systems, such as controls, set points, schedules, etc. By targeting the operation of existing systems and equipment, r-Cx addresses the lost opportunity savings available in most existing buildings.

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<sup>3</sup> PG&E, 2000. *California Commissioning Market Characterization Study.*

It is believed that the percentage of existing buildings commissioned in the US is far less than 1 percent; however, some portion of the market will have a low savings potential because the buildings are very well maintained and operated regardless of a formal r-Cx process. In either case, there is clearly an unmet need for this service as documented by the r-Cx literature review associated with the PG&E Commissioning Study. In addition, this site-level potential has been verified by our own program experience in Oakland: of the 31 buildings we have screened in Oakland, only 3 have been rejected due to low savings potential.

To demonstrate the need for and potential of r-Cx, we have present a simplified and conservative set of estimates in Exhibit I-1. Note that the savings percentage used is based on our analysis of savings found in our current program in Oakland (see Section IV for details). This estimate is purposefully conservative and about half of what was estimated in the PG&E Commissioning Study. Our conservative estimate of total r-Cx electricity potential across the three IOU service territories is 621 GWh per year. We propose to capture roughly 5 percent of that potential per year across all of the Quantum Building Tune-Up programs submitted to the CPUC for the 2004/2005 program cycle.

***Exhibit I-1***  
***Estimated Maximum Achievable Electric Savings Potential for r-CX Across CA IOUs for Targeted Building Types***

<b>Building Type</b>	<b>Millions of Square Feet (a)</b>	<b>kWh/ft2 (b)</b>	<b>Applicability Factor ( c )</b>	<b>Not Complete Factor (d)</b>	<b>Feasibility Factor (e)</b>	<b>Savings Factor (f)</b>	<b>Potential GWh Savings (g)</b>
Large Office	799	17.4	48%	90%	90%	7%	400
Refrig. Warehouse	40	22.4	91%	90%	90%	7%	49
College	201	10.9	49%	50%	75%	7%	30
Hospital	249	30.5	60%	50%	50%	7%	84
Hotel/Motel	233	12.4	61%	90%	50%	7%	58
<b>Total</b>							<b>621</b>

(a) CEC forecast data spreadsheet, 2000.

(b) Combination of CEC forecast data and PG&E CEUS, 1999.

( c ) Estimated fraction of floorspace of buildings >100,000 ft2, QC estimate from PG&E CEUS, 1999.

(d) & (e) QC estimates (Office estimates based on current Building Tune-Up program).

(f) Estimated savings from participants in current Building Tune-Up program.

(g)  $a \times b \times c \times d \times e \times f$

As we discussed in our market barriers section, currently there is little demand for r-Cx services. As a result there are a limited number of qualified service providers to perform these services. Our current program has demonstrated through our recruitment and implementation process that our approach is capable of creating demand for these needed services, which will not only capture critically needed savings, but also lead to a more viable and effective r-Cx industry. To our knowledge, our current r-Cx program in Oakland is the only comprehensive retro-commissioning program in the IOU service territories. None of the existing statewide or other programs are capturing these vital and substantial savings opportunities.



### ***I.B.3 Current Program Effectiveness***

The Building Tune-Up Program is currently being implemented in Oakland as part of the Oakland Energy Partnership, a 2002 Local Program funded by CPUC. The program infrastructure has demonstrated its effectiveness in raising customer awareness, recruiting buildings, and achieving cost-effective, long-lasting savings. Through our focused marketing efforts, we have arranged meetings and made presentations to owners of 31 facilities, representing over 10.8M square feet of privately held and government offices, hotels and conventions centers, and community colleges. Currently, we have signed up 17 sites, representing 5.5M square feet of floor space, only three buildings, representing 0.7M square feet, have been rejected, and the remaining 11 sites, representing 3.2M square feet are considering participation. Clearly, the participation rate is high and we remain on track to meet our 10.5M square foot goal.

One reason for the success in marketing to and signing up customers is the screening process employed at the outset of the recruitment process. The Tune-Up Program's screening process is designed to evaluate data collected from different sources: utility bills, a preliminary walk-through assessment, interviews with building operators, and interviews with property managers or owners. Through this process, the Tune-Up Program assures that participating buildings have significant savings potential, but also the building operator provides that crucial support, and the building manager or owner demonstrates a commitment to installing the identified measures. We have executed this process in 22 facilities, and once the data is available, have refined the process to take only a few days to complete. This will be a key element for the Building Tune-Up Program.

We have also been very successful in identifying high levels of energy savings that provide long-term savings, with an average measure life of 8 years. This is in part due to the process by which we conduct the investigation and implementation phases of our program. Instead of running the program similar to a bidding or SPC program, where a vendor brings a customer to the program, we directly recruit and perform the screening analysis on the customer ourselves and match the needs of the building with the skill sets of one or more service providers. This provides more quality control and ensures that opportunities are not missed. Many service providers are narrowly skilled in one area (if not none at all) of retro-commissioning, and if not properly teamed with complimentary skill sets, a service provider may miss many viable opportunities. Because we manage each project closely and have a presence in the building, we can be sure that opportunities are not missed, particularly with "hard" measures. We also generally have one team do the investigation phase, and another team do the actual measure implementation. Often times buildings have relationships with vendors, or have their own in house staff, that can perform the implementation. Unfortunately, these are generally not individuals skilled in retro-commissioning, capable of identifying viable measures.

Through the Oakland program, we have developed strong relationships with property management firms, and other organizations that have buildings in PG&E's service territory. Through their awareness, and successful experiences with the Oakland Tune-Up Program, we expect to start fast and generate participants very quickly. EBBOMA has been very helpful in promoting the Oakland Tune-Up Program.

Our program has a track record for achieving long-term persistence of savings by placing an emphasis on identifying “hard” measures (either hardware that must be installed with tools, such as new sensors or actuators, or repositioning existing control points, or software changes in control systems that require specialized skills that operators do not possess) and by providing monitoring tools, operator training and building system manuals. Furthermore, our program provides an EMP, which outlines additional cost-effective retrofit opportunities beyond the low- and no-cost options within retro-commissioning. PG&E has indicated it will support the program’s effort to aid the participant in implementing identified retrofit opportunities and take advantage of incentives offered by PG&E’s SPC and Express Efficiency Program.

Most importantly, the current program in Oakland is now hitting full stride. After conclusion of contract signing and program implementation plans in late summer 2002, we developed all of the program procedures and materials quickly during the fall. As a result, we began customer recruitment near the end of the year, which was less than optimal due to the holidays and the fact that normal building operator decision-making cycles are at their low during these months. Recruitment picked up significantly in the first and subsequent quarters of 2003 and has gone extremely well ever since. We are now successfully moving projects from the preliminary analysis and sign up stages to the detailed investigation and implementation phases.

#### ***I.B.4 CPUC Evaluation Criteria – Hardware/Incentive or Information***

We respectfully request that Building Tune-Up program be evaluated by the CPUC as a Hardware/Incentive program.

### ***I.C PROGRAM OBJECTIVES***

#### ***Meeting the CPUC’s Policy Objectives***

##### **Cost Effectiveness**

This program is extremely cost effective to society and participants with Total Resource Cost and Participant Test benefit-cost ratios of 2.5 and 7.4, respectively. TRC net benefits are \$5.8 million. As described in Section IV, the cost-effectiveness calculations were based on results from customer buildings that are participating in the Oakland tune-up program. We are finding roughly the same level of energy savings on a per square foot basis that we originally projected. Furthermore, we have been able to achieve long- term energy savings, with a measure life equal to our projection, because our existing program has placed an emphasis on identifying “hard” measures.

##### **Long-Term Annual Energy Savings**

Over the life of the measures, the program will deliver 147 million kWh in net electric energy savings and 5.3 million Therms in net gas savings, and \$20 million in customer bill savings, for a program cost of roughly \$3.4 million. The program will identify and install a mix of long-life, or “hard” measures, and measures that may have a shorter life, for an equivalent measure life of over 8 years. These estimates are based on actual measures identified in ten Oakland buildings,

which span 50 measures, delivered as part of our existing program (see Section IV, for more details).

## **Electric Peak Demand Savings**

The program will deliver 5.0 MW in net electric peak demand savings. See Section IV, for more details.

## **Equity Considerations**

This program addresses the medium to large commercial sectors, including leased buildings. The substantial majority of the buildings targeted are office buildings due to the relatively large inventory of buildings in that sector relative to the others that are in our preferred scope (see Section III for a detailed description of the target markets). The program will focus attention on tenant-occupied office buildings to address under-served, tenant-occupied buildings. Since the tenants pay the energy bills, building owners typically have little incentive to implement energy savings measures. In our existing program, we have educated owners on the many potential benefits they will acquire through r-Cx, which include lower maintenance costs, fewer discomfort complaints and improved tenant retention. Properly educating owners on these benefits has resulted in successful recruitment of a number of leased space buildings into our existing program.

## **Ability to Overcome Market Barriers**

A long-term goal of the program is to demonstrate convincingly that there exist ample opportunities to achieve efficiency gains in the operation of existing buildings. This program will help building owners to achieve those gains through the further creation of an infrastructure that supports the development of an r-Cx market capable of providing cost-effective r-Cx services on a self-reinforcing basis. This will be achieved by:

- Demonstrating the potential benefits of r-Cx in California's medium and large commercial buildings to a greater segment of the California market by providing case studies that quantify the success and value of r-Cx to medium and large commercial customers.
- Stimulating the further development of the commissioning provider industry in California by developing a "sub-industry" that other CA customers can refer to for help in reviewing the success of r-Cx and acquiring building commissioning services, thereby helping to enhance the energy efficiency skills of the important large commercial customer market segment in the State.
- Supporting the California Commissioning Collaborative efforts to develop and support a viable building commissioning industry in the State.
- Obtaining a clear picture of the logical next steps to further develop a market for r-Cx in California.

These activities will mitigate a number of market barriers over time as discussed below.

**Higher start-up expense for high-efficiency measures relative to standard-efficiency measures.** This barrier is addressed in the program through the provision of incentives to specify and carry out the r-Cx measures. Incentive amounts will be based on the specific need of each building, according to its size, HVAC system, savings potential, identified measures, and other factors. Incentives will cover 100% of the investigation phase of the retro-commissioning process in all cases, and average up to 75% of the implemented measure cost. Over time these incentives can be reduced as the financial returns and other benefits of r-Cx are demonstrated to customers and an appropriately sized infrastructure of r-Cx service providers is established to meet this demand.

**Lack of consumer information about energy efficiency benefits.** Virtually by definition, customers do not perceive that they have r-Cx related problems. Whereas it is relatively easy for facilities staff at larger commercial establishments to be aware of and understand the benefits of a high-efficiency versus standard efficiency piece of equipment, such as a chiller, awareness of r-Cx measures and actions to correct them is typically more limited. This is in part because r-Cx measures in a typical building are often numerous and highly varied across building systems. The value of the Tune-Up program is that our scoping and detailed site investigations identify and explain the r-Cx opportunities in clear, concrete terms that include specification of site-specific costs and savings. As customers participate in the program, other customers will become more aware of the extent of r-Cx opportunities in their own buildings through normal diffusion of information channels. Our program will accelerate this diffusion of information through the development of program marketing materials and case studies.<sup>4</sup>

**Lack of financing for energy-efficiency improvements.** We do not believe that this is a significant barrier for customers other than institutional. Most private sector firms can get access to capital, albeit for a price. More importantly, many private sector firms have accounting rules prohibiting third-party, off-balance sheet financing. Nonetheless, this barrier is mitigated like the higher first cost barrier through the use of incentives to increase r-Cx measure installation rates.

**Split incentives (between owners/landlords and tenants).** This barrier will be addressed by educating both owners and tenants on the benefits of retro-commissioning. The benefits to the owner include reduced maintenance costs, fewer discomfort complaints and improved tenant retention. Owners will be encouraged to use their program participation to demonstrate they are taking an active role in managing operating costs, which are normally passed on to tenants.

**Lack of a viable and competitive set of providers of energy efficiency services in the market and Barriers to the entry of new energy efficiency service providers.** These barriers are often secondary barriers that are driven by lack of customer demand for the energy-efficiency product or service in question. In most cases, if significant customer demand exists, the supply-side of the market will adjust to offer the product or service. However, there is an inherent “chicken and egg” dimension to these barriers. For example, customer demand is more likely to increase if there is a cadre of r-Cx service providers in the market who are marketing to and educating

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<sup>4</sup> See, for example, Jump, et al., 2003. *Retro-Commissioning Buildings with Public Goods Funds – Learning Lessons in Oakland*, 11<sup>th</sup> National Conference on Building Commission, May 20-22, Palm Springs.

customers on the benefits of identifying and correcting r-Cx measures. However, no such cadre is likely to exist without some initial customer demand. The Tune-Up program helps to address this barrier by providing a jump start to the industry by stimulating customer implementation of projects and creating the case studies and successful project results necessary to motivate additional customers to invest in r-Cx services. As the program matures, service providers will have a foundation and body of successful projects upon which to conduct their own marketing and education of customers, thus providing the initial basis for a self-reinforcing industry.

**Lack of availability of high-efficiency products.** This barrier is not significant for r-Cx measures as most of the measures involve correcting design, installation, and operational flaws of existing systems.

**Performance uncertainty** will be addressed through the program's screening process, detailed investigation phase, measure validation, case studies, and M&V. These processes document participants' r-Cx opportunities, their expected and actual savings potential and costs, and disseminate this information to new prospective participants.

Our existing program has been extremely successful in overcoming these barriers, as is evident by the fact that only 2 of the 31 buildings recruited for the program have dropped out on their own accord.

## **Innovation**

The key innovative features of this program are:

- A comprehensive, turnkey approach, which maximizes savings per participant and mitigates the market barriers discussed above.
- The program places particular emphasis on “hard” r-Cx measures, which results in a weighted effective useful life of 8 years (see Section IV for discussion).
- The program also differentiates itself from other r-Cx programs by establishing a pool of pre-qualified, independent r-Cx service providers that are able to identify savings opportunities that cut across building systems.
- The program also contains a significant customer education effort on the benefits of r-Cx.
- The program purposefully maintains flexibility in applying site-specific incentives to maximize per participant savings.
- The program also delivers an Energy Management Plan (EMP) to the customer to guide them in continuing to adopt energy efficiency measures, and to build upon their successful r-Cx experience.

## **Coordination with Programs Run By Other Entities**

The Tune-Up Program has strong synergies with three PG&E-sponsored programs and one CEC initiative. These programs are the Standard Performance Contract Program (SPC), the Express Efficiency Program (EE), the Building Operator Certification Program (BOCT), and the CEC's Enhanced Building Automation Program (EBA). As part of the services to its participants, the

Tune-Up Program will provide Energy Management Plans (EMPs). The EMPs will describe energy efficiency projects in which building owners may invest in capital projects to reduce energy consumption in their facilities. The energy efficiency projects recommended by the EMPs may qualify for incentives under either the SPC Program, or the EE Program. To leverage benefits from each of these programs, we plan to inform each customer directly in the EMP. We will be able to work directly with the participant to aid them in implementing identified retrofit opportunities and take advantage of incentives offered by PG&E's SPC and EE Programs. Even though we believe it is likely that the EMP will result in significant savings both within and outside these other programs, no savings are claimed by our program for this objective.

The BOCT program is very complimentary to the Tune-Up Program in many ways. It provides certification training to the same building staff that the Tune-Up Program targets. Their training curriculum provides training in r-Cx of building equipment and controls, which are key elements of the Tune-Up Program. Participants in BOCT will be better able to understand and implement Tune-Up Program recommendations and maintain them, which serves to increase persistence of the measures. We will coordinate with the BOCT program manager and BOCT program implementer in the following ways:

- To determine course schedules and availability,
- To include BOCT Program informational materials with Tune-Up Program information materials to encourage prospective customers to enroll in training, and
- To coordinate and provide a suitable training facility, should BOCT decide to offer training in PG&E service territory.

We will contact the BOCT Program Manager within a month of contract start to coordinate Tune-Up Program activities with BOCT Program activities.

The Tune-Up program provides valuable opportunities for motivated participants to identify loads and control strategies that can participate in demand response programs such as the Enhanced Building Automation Program being coordinated by the CEC. Eventually participating customers will be prepared for demand response programs being prepared by IOU's. These programs will result in additional bill savings for sophisticated customers.

## ***II. PROGRAM PROCESS***

### ***II.A PROGRAM IMPLEMENTATION***

#### ***Overview of Program Areas***

The Building Tune-Up Program is structured into the following five distinct tasks of program activity:

- Task 1 - Management
- Task 2 - Marketing
- Task 3 - Customer Recruitment
- Task 4 - Project Implementation
- Task 5 - Evaluation, Measurement, and Verification
- Task 6 – Coordination with Other Programs

#### ***Task 1 – Management***

Quantum will provide all contact and program management services including program activity tracking, required CPUC reporting, subcontractor management, and draft and final program reports. Program management includes contract and program management, memorandum of understanding (MOU) development, solicitation and establishment of additional r-Cx service providers (if necessary), and monthly, quarterly, and final reporting. Contract and program management includes management of subcontractors, maintenance of a program tracking system, and generally insuring that the program proceeds as planned.

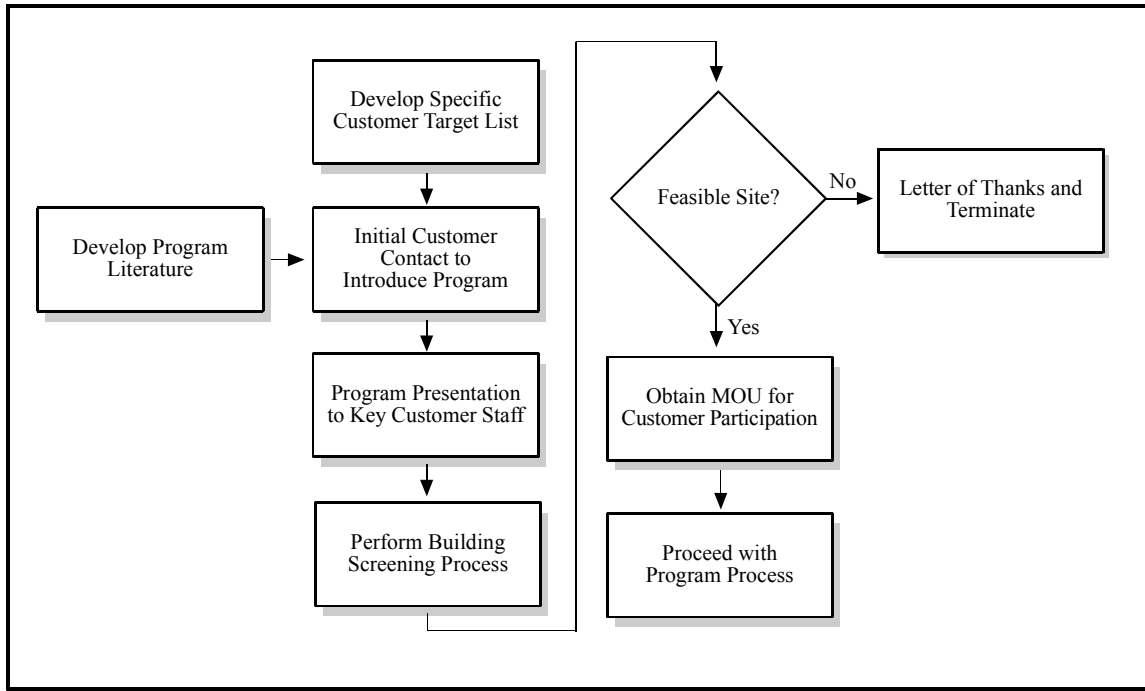
#### **Deliverable: Monthly and Quarterly Progress Reports, Draft and Final Reports**

#### ***Task 2 – Marketing***

In Exhibit II-1, we provide an overview of the flow of marketing and recruitment activities.

QC will begin by developing all marketing materials, articles, and case studies to be used for program promotion. QC will work with industry groups to coordinate and present the program to customers. Development of all program marketing materials will be a primary activity in the Marketing task. Program descriptions and information will be written for various media: program brochures, presentations to groups and to customers, and articles and advertisements for industry trade journals and newsletters. Indirect marketing activities will be undertaken to raise customer awareness of the availability and benefits of the program. These include presentations at trade group meetings and shows, and meetings facilitated through local Chambers of Commerce.

**Exhibit II-1**  
**Customer/Building Recruitment Process**



The Tune-Up Program is aggressive in its direct marketing efforts, as it is important to make contact and sign up customers as early as possible because it does take time to proceed all the way through the project installation process. Direct marketing efforts include establishing a list of potential customers, contacting customers directly through email, letters and personal telephone calls, and making presentations in person at the customer’s site. The assistance of our local government partners will also be critically important. The local government partners will leverage their relationships with building owners and operators to generate participation prospects as well.

Additional information is provided under Section II.B.

**Deliverables: Program Marketing Materials and Customer Presentations**

**Develop List of Potential Sites**

QC shall use a number of sources to complete a target customer list. The list will include at least 90 customer sites representing over 22 million square feet of conditioned space. Sources include Dun and Bradstreet data, Black’s Guide to Commercial Real Estate, City Officials’ (including the mayor) recommendations and contacts, BOMA recommendations and contacts, initial customer references, recommendations and current contacts of the Team (including some specific contacts available from QC and its service providers), members of the commercial real estate business and



City Chambers of Commerce. We will continually add prospective customer's contact information to the list until we have recruited enough customers with estimated saving that meet the program's goals.

### **Select Potential Customers / Sites and Perform Recruiting Activities**

QC shall contact the potential customers by telephone and letter, informing them of the expected benefits of participation in the Program and seeking an early appointment to visit the site. The QC Team shall make presentations on the Program, its purpose and its benefits to the customer at all potential sites that respond positively to the initial contact.

**Deliverable: Updated Customer Presentation List (provided in Monthly reports).**

### ***Task 3 - Customer Recruitment and Assessment***

The most important phase of the enrollment process is the Customer Recruitment phase. After the program has been introduced directly to the customer, we request to proceed with the preliminary screening process. Taking this next step is very easy, as there are no risks or costs to the customer. We review utility information, perform a preliminary walk-through inspection, interview building managers and operators, and analyze the data. If there is a good fit for the program, the preliminary report is very useful to convince the customer to move forward in the program. The screening process helps in several other key areas: 1) it allows us to match appropriate r-Cx providers to the building, 2) it helps determine budgets for the r-Cx services and rebates, 3) it generates data that can be compared across all the buildings in the program. Customer recruitment sub-tasks are described below, additional information is provided under Section II.B.

This phase begins the process of assessing and specifying opportunities for the buildings recruited. An overview of the r-Cx building process, which includes this phase and the Task 4 – Implementation activities, is shown in Exhibit II-2.

### **Perform Customer/Building Screening Process**

QC shall request and collect customer utility bill information, and 15-minute electric interval data, if available. QC will perform a walk-through inspection of the site. QC shall conduct facility staff interviews, both to help identify energy savings and demand reduction opportunities, and to assess the ability of the staff and service contractors to implement operational changes that will reduce energy use and peak demand.

### **Assess Customer Sites**

QC shall assess the site for potential cost-effective energy savings and demand reduction through implementation of r-Cx. If the customer's site is found to be a good fit for the program, the customer will be asked to sign a memorandum of understanding (MOU) in order to participate.

## **Develop Project Scope and Budget**

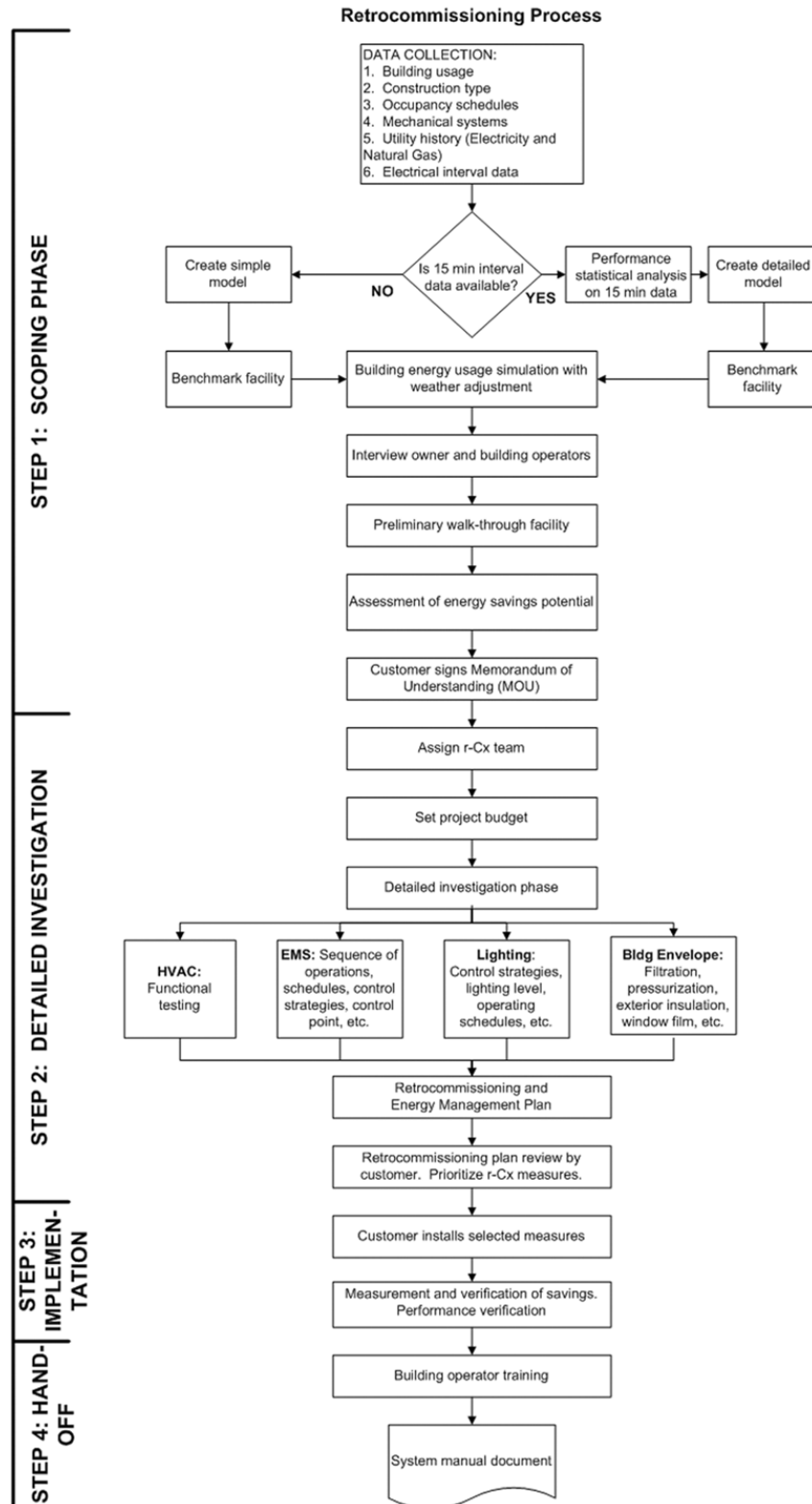
QC shall review r-Cx service provider qualifications, and select the best service provider for the customer. QC will negotiate a scope of work with the r-Cx service provider that describes the specific systems and level of detail of the work. QC will assign a budget to the project, and come to agreement with the r-Cx service provider before issuing a work authorization.

**Deliverable: Completed Preliminary Reports and Signed MOUs.**

### ***Task 4 – r-Cx Project Implementation***

During the Project Implementation phase, r-Cx service providers begin work in the building. There are three phases of work: Detailed Investigation, Measure Implementation, and Hand-off. The first, and most time-consuming phase, is the detailed investigation of the building's systems. R-Cx service providers must develop a list of r-Cx measures, complete with measure costs, and energy and cost savings estimates. Providers must also provide Energy Management Plans (EMPs), which include lists of more capital-intensive energy efficiency measures, self-generation opportunities, or other energy management actions the customer may consider. Rebates are offered only for the r-Cx measures. This list is provided to the customer, and agreement is reached on what the customer will implement. At the end of the Implementation phase, r-Cx service providers inspect that the measures have been installed, take additional measurements if necessary, and verify that the measures have been installed properly. Rebates are paid after measure installation. In the Hand-off phase, the systems manual is delivered, and training is provided to the building operator on its use. Systems manuals document the current facility requirements, optimum operation of the system, and preferred setting of controls.

**Exhibit II-2**  
**Detailed Retro-Commissioning Steps and Activities**



## **Task 4A - Detailed Investigation**

### **Collect and Review Building Documentation and Assess Building Operations, Prepare R-Cx Plan**

R-Cx service providers shall collect and review building drawings, equipment schedules, O&M Manuals, control systems drawings, previous reports and studies, and so on. R-Cx providers shall also define the building's current facility requirements, and conduct an operation and maintenance site assessment to identify key issues regarding the current system. An r-Cx plan shall be developed according to specified formats, and shall document initial findings and provide a plan of r-Cx activities throughout the remainder of the project.

**Deliverable: R-Cx plan for each building.**

### **Analyze Building Control System Data, Develop and Perform Functional Tests, Document Master List of Deficiencies**

The r-Cx agents shall specify and initiate short-term 'trend logs' and data logging in selected buildings and investigate operational irregularities identified from the analysis of the interval meter data or from the walk-through inspection. The r-Cx agents identify equipment faults, control problems and other opportunities to reduce energy use and peak demand. The collected building, equipment, and systems documentation, as well as the trend or logged data, shall be used to define the building's baseline for M&V purposes. R-Cx agents shall specify functional testing, and carry out those tests. A master list of deficiencies shall be developed and maintained throughout the detailed investigation process. The r-Cx agents shall also identify EMP measures, as described previously. All information, data collected, assumptions, analysis methodologies, shall be maintained in a project binder.

**Deliverable: Master List of Deficiencies**

### **Develop r-Cx Measures List and Energy Management Plan**

The r-Cx agents shall estimate energy savings for those measures included on the master list of deficiencies. Costs for implementing those measures shall be estimated through contractor quotes, or other reliable means. The r-Cx agents shall calculate the simple payback of each r-Cx measure. The r-Cx agents shall also estimate the savings and costs for the recommended EMP measures, using the best available site data available. QC shall review the r-Cx measure list and EMP and determine the r-Cx measures for which rebates are offered. QC and the r-Cx agents shall present the r-Cx measures list, and EMP in person to the building staff, and determine which r-Cx measures shall be installed.

**Deliverable: R-Cx Measure List and Energy Management Plan**

## **Task 4B - Measure Installation**

### **Installation Validation**

The r-Cx agents shall provide technical advice as the owner installs the r-Cx measures. After installation, the r-Cx agents shall inspect and validate the installed measures, and take spot measurements or collect trend log data, if necessary.

**Deliverable: Short installation validation report**

### **Rebate Payment**

Upon receipt of the installation validation report, and copies of the customer's invoices, QC shall pay the agreed-upon rebates to the customer.

**Deliverable: Copies of rebate checks issued to customer.**

## **Task 4C - Deliver Systems Manual and Training**

R-Cx agents shall revise savings estimates based on installed measure characteristics, if necessary. R-Cx agents shall develop a systems manual according to a prescribed format, and deliver it to the facilities operator, with copies to QC. R-Cx agents shall provide training on the use and information provided in the systems manual. R-Cx agents shall provide all data, documentation, assumptions, analysis and collected materials to QC.

**Deliverable: Systems Manual and Completed Project Work Binder**

### ***Task - 5 Evaluation, Measurement and Verification***

The evaluation, measurement, and verification (EM&V) for this program will be discussed in more detail in Section VI. QC shall collect all r-Cx project documentation, and baseline information, and deliver it to the EM&V contractor, in order that the EM&V contractor may perform its duties under the contract. QC shall facilitate site visits by the EM&V contractor, and be available for conference calls and interviews. QC shall review interim EM&V reports and provide comments. Finally QC shall provide CPUC with all EM&V reports.

**Deliverable: Interim and Final EM&V reports.**

### ***Task 6 - Coordination with Other Energy Efficiency Programs***

QC will facilitate coordination between the Building Tune-Up Program and PG&E's existing statewide and local programs. It is essential to coordinate program activities in order to minimize duplicative administrative costs, enhance consistency in rebates and take advantage of co-marketing opportunities. The Tune-Up Program will provide direct recommendations for energy savings measures eligible for PG&E programs. It is important to hand off these measures as seamlessly as possible so that the relationship can be maintained while fresh in the mind of the participant. Quantum Consulting and each of the program sub-contractors intend to maximize

this opportunity, which will result in energy and budget benefits for each participating organization. PG&E has indicated it will coordinate this hand-off from the Tune-Up Program to its SPC and EE programs.

In the first monthly report QC will present proposed coordination activities and list programs that are affected. Program descriptions will be shared with program managers in each of the programs affected and procedures for handling these opportunities will be developed. These coordination activities will be documented in the future monthly reports.

We will work with PG&E to coordinate between the Tune-Up Program and services offered under PG&E's Local Government Initiatives program. Both parties are expected to benefit under this arrangement.

QC will coordinate the Tune-Up Program with all approved local programs. It is crucial that program managers in overlapping geographical areas are aware of all the programs for which their customers are eligible. This reduces confusion on behalf of the customer and increases participation rates with minimal incremental costs.

In addition to coordinating programs, QC will take advantage of the synergies available with PG&E's award winning training facilities at the Pacific Energy Center in San Francisco and the San Ramon Training Center. We will discuss with PG&E the following possibilities:

- The PEC serving as a tool lending resource for the Tune-Up Program.
- The PEC providing training for Tune-Up Program.
- Program breakfast meetings, trainings and seminars conveniently located at PG&E's San Ramon Training Center. Training facilities offer classrooms and presentation materials conducive to productive meetings.

Coordination with existing non PGC programs: There are several programs that currently exist in counties in PG&E's service territory: examples include the Northern California Green Business Program and San Jose City, San Mateo and Marin County Green Building Programs. Based on its experience in Oakland, where several customers inquired about green building certifications, the Tune-Up program managers will integrate information or program offerings from both of these programs into their design to minimize overlap and increase cross sponsorship.

### **Deliverable: Coordination Plan.**

## ***II.B MARKETING PLAN***

This section provides additional details on our marketing plan.

### ***Develop Program Literature/Collateral***

Program literature will be developed that describes what r-Cx is and its benefits, the r-Cx process, the program enrollment process, reference to past project successes in the industry, and case studies from the Oakland Program. It will also describe the program, the Team, the support of the CPUC, the process of assessing the building for eligibility, the MOU and its purpose,

anticipated energy efficiency measures to be implemented, and a description of an EMP and its benefits to the customer.

Case studies will be developed from buildings completed in the program. It is anticipated that results from the Oakland Tune-Up Program will be developed first, and the remaining 3 case studies developed from the Building Tune-Up Program. The case studies will include information on building type, size, and the systems investigated. The recommended measures, savings and rebates will be described, along with any experiences with the program the customer provides. All case studies will have the same ‘look and feel’ so that they are clearly identified with the program. QC will develop case studies from representative buildings – 2 for office buildings, and two from other sectors.

(Associated Workbook-Related Activities: **Design and Print Program Marketing Brochures** [300 brochures, cost: \$13,436] and **Design Case Studies** [3 case studies, cost: \$31,350]. Costs are based on labor and material expenses for similar marketing materials developed for the Oakland Tune-Up Program.)

### ***Develop Specific Customer Target List***

QC will use a number of sources to develop the target customer list. Sources include Dun and Bradstreet data, Black’s Guide Real Estate Directory, City Officials’ recommendations and contacts, BOMA recommendations and contacts, initial customer references, recommendations and current contacts of the Team (including some specific contacts available from QC), members of the commercial real estate business, and Chamber of Commerce sources. QC will also seek the cooperation of PG&E account managers to assist with identifying likely r-Cx candidates.

After development of the contact list, we will reach out by phone and letter to customers until the customer enrollments reflect the potential for reaching program energy and peak demand savings goals. Marketing and outreach for this type of program is very straightforward since the required number of customers is relatively small.

At this time we have identified a preliminary list of customers that may be approached for this project. That list will be finalized once the Program has been funded.

(Associated Workbook-Related Activity: **Develop List of Potential Customers / Sites** [List of 90 customer contacts, cost: \$15,012]. Costs are based on labor and materials, e.g. postage, for similar task in the Oakland Tune-Up Program.)

### ***Conduct Initial Customer Contact to Schedule Presentation***

Next, initial customer contacts will commence by telephone and letter to introduce the project. QC will perform customer recruiting throughout the territory. Recruiting involves the completion of a list of targeted northern California customers and associations that will be approached for recruitment into the program. The recruitment process will involve making calls, sending letters and making presentations to targeted customers and customer segments. During

this task, QC expects to generate a very high level of interest in the program. The QC Team views the introductory presentation as the key method to recruit customers for the program.

(Associated Workbook-Related Activity: **Direct Marketing to Customers** [90 customers, cost: \$70,464]. Costs are based on labor and materials, e.g. postage, for similar task in the Oakland Tune-Up Program.)

### ***Make Recruitment Presentation***

A key component of QC's marketing tools for this program are customer and group presentations. The template presentation will be developed and ready for use within six weeks of a signed contract. Although this presentation will be tailored to the specific customer audience, all presentations will have the same basic structure and messages. The presentation will also remain a dynamic document as innovations are added over time.

QC expects to make recruitment presentations to customers through the 4<sup>th</sup> quarter of 2005 so that all commitments are secured by the end of 2005 and completed by the end of the 1<sup>st</sup> quarter, 2006. Senior members of the QC Team will make the presentation.

(Associated Workbook-Related Activities: **Customer Presentations** [90, cost: \$68,810] and **Develop/Conduct Customer Presentations to Groups** [6, cost: \$37,193]. Costs are based on labor, materials, and meeting room rental, for similar tasks in the Oakland Tune-Up Program.)

### ***Perform Building Screening and Assess Potential***

A simple written or verbal expression of interest by the customer will initiate presentations by members of the recruitment team. QC staff will schedule and make a presentation on the Program's purpose and its benefits to the customer. Most customers are willing to take the next step, which is initiation of the screening process. This process includes utility bill analyses, preliminary walk-through inspections, and interviews with owners or managers, and operators. While the screening process, once the utility data is collected, takes only a few days from walk-through inspection to preliminary assessment report, it allows us a chance to discuss with the building staff more extensively about the r-Cx process and its benefits. We find this extra customer contact during the screening process to be the primary reason for the success rate of our Oakland Program's enrollment.

QC will analyze 12 to 24 months of interval meter data, if available. A walk-through inspection of the site, including facility interviews, will be made to assess the likelihood that there are enough potentially cost-effective HVAC, lighting, and control energy savings measures, or other substantial opportunities at the facility to justify continuing. Building operators will be interviewed to determine the level of resources they can apply to a potential project, their level of understanding of the r-Cx process, and their willingness to participate. Building owners or managers will be interviewed to determine their understanding of program benefits, their business needs, and their willingness to implement recommended measures.



If the preliminary assessment does not indicate that substantial cost-effective energy savings and peak demand reductions are likely then QC will discuss the results of the assessment with the customer and explain to them why they cannot participate in the program.

(Associated Workbook-Related Activities: **Customer Recruitment** [18Mft<sup>2</sup>, or equivalent savings goal potential, cost: \$177,525] Costs are based on labor, materials, and meeting room rental, for similar tasks in the Oakland Tune-Up Program.)

### ***Obtain Signed MOU***

For those customers, the vast majority to date, that pass the screening and potential assessment, we will then pursue the signing of our memorandum of understanding. As discussed in the next section, the MOU outlines the commitments and responsibilities of both parties associated with participation of the program.

## ***II.C CUSTOMER ENROLLMENT***

If the building is a good candidate, the customer will be asked to sign an MOU to secure their participation in the Program. The MOU will be a binding agreement requiring the following from the customer (partial list of items):

- To cooperate with the Project Team,
- To provide building access and to disclose all building operation information and data needed by the Team,
- To provide interval meter data and billing records, or a release for the Team to obtain it from PG&E
- To allow the Team to install metering and monitoring equipment and access to such equipment,
- Indemnify the CPUC, PG&E, and the QC Team from liability, and
- To provide testimonials and references for other customers.

Upon receipt of the signed MOU, the customer is enrolled in the program. The QC Team will compare the building's mechanical and electrical system characteristics and control system type and architecture with the qualifications of its r-Cx service providers. The best match will be preferred. A work authorization with the standardized scope of services will be issued. In cases where the building size or savings potential is not large, or the r-Cx project should be limited to a subset of the building's equipment, the full scope of standardized services needs to be scaled down. The QC Team will assign a budget for the building and issue the work authorization to the most qualified service provider. Through negotiations, an agreement is reached on the scope of the provider's services. Customers may review the scope of services and modify portions if they choose.

## ***II.D MATERIALS***

Customers are responsible for procuring and installing the r-Cx measures. Usually, these measures may be installed by their in-house staff, or by their mechanical, electrical, or controls service contractors. The customer will purchase all materials (equipment). The equipment is unique to each project based on the r-Cx service provider's recommendations. Due to the nature of these projects, most equipment is unique to each customer's HVAC, lighting, and control systems.

For example many projects involve installing new control system sensors, replacing valves, adjusting or repairing dampers and actuator arms, or control system software changes that require reprogramming sequences of operation, installation of setpoint reset strategies, addition of sensors and control points, and adjustment of setpoints and schedules. The r-Cx measures are custom designed for each building (see Exhibit IV-1 in Section IV for list of sample measures).

## ***II.E PAYMENT OF INCENTIVES***

Participating customers will receive a detailed operations assessment of their facilities. The Tune-Up Program provides these services at no cost to the customers. Customers who have installed the recommended measures for which rebates are provided, and who's measures have been verified by the r-Cx service provider, will receive the agreed-upon rebate in cash after copies of invoices are provided.

Incentives for participating customers are determined by the estimated savings potential in their buildings. This is determined during the screening process. The buildings energy use intensity (EUI) benchmark in kBtu/ft<sup>2</sup>-yr is compared with benchmarks in other same-type buildings in the same climate zone. There are numerous databases available for these benchmarks. If the customer's building is at or above the average EUI of its peer buildings, it is a good candidate for the program. QC estimates how much savings is expected from the customer's building, usually 6 to 12 percent of its annual energy consumption, and assigns a proportionate amount of the program's incentive budget to the project. The incentives pay for 100% of the investigation, EMP and documentation phases of the r-Cx services and up to 75% of the measure implementation cost.

Based on our experience with the Oakland Energy Partnership program, we are projecting that the total incentive paid will average 14.9 cents per square foot of commissioned floor space.

## ***II.F STAFF AND SUBCONTRACTOR RESPONSIBILITIES***

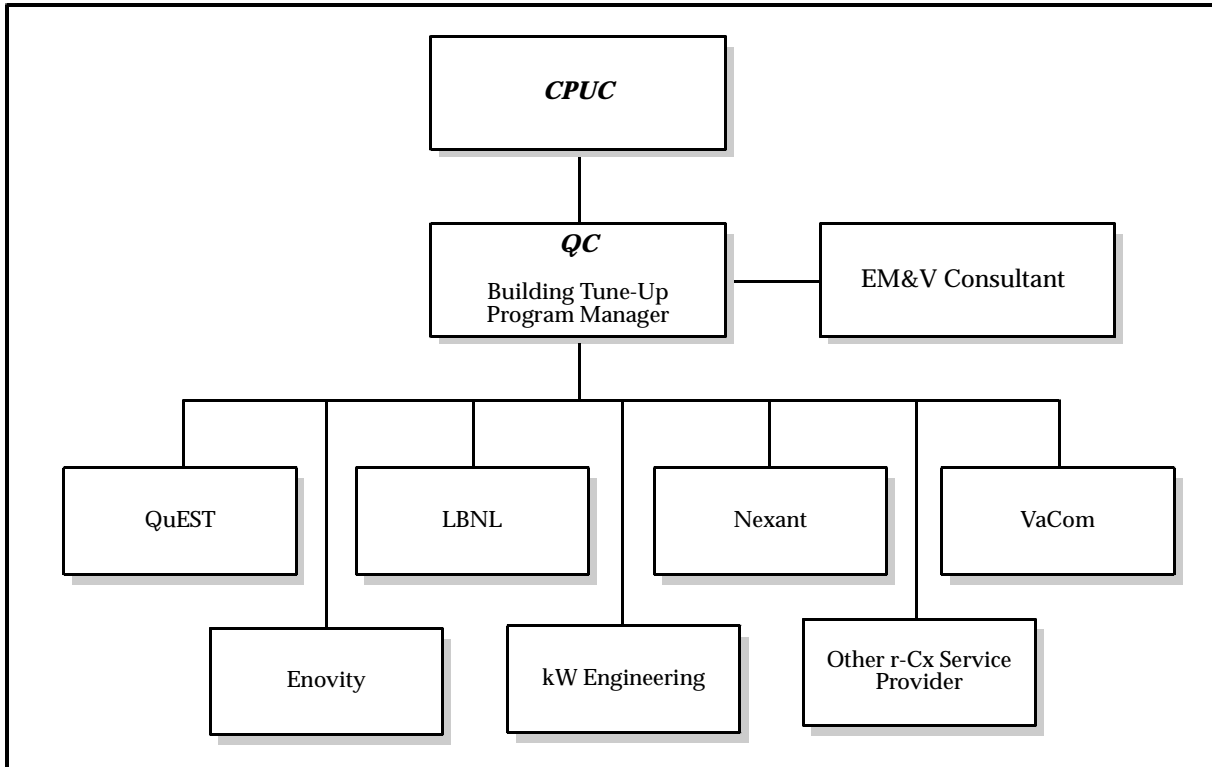
Clear delineation of roles and responsibilities among the project team, and definitive understanding of available resources and schedule characterize the management structure of the Building Tune-Up Program. The tasks of contract, program, and staff management are made much easier by three factors:

- 1) Almost two years experience in managing the same program in Oakland,
- 2) Familiarity with team members roles and responsibilities in the program, and

3) Local presence of each team member.

Exhibit II-3 summarizes the overall project management structure for the Building Tune-Up Program. This program has four distinct components: administration; marketing and customer recruitment; project implementation; and evaluation, measurement and verification (EM&V). The following describes the roles of each team member.

**Exhibit II-3**  
**Overview of Implementation Team Structure**



**Management.** The primary objective of program administration is to ensure that the Tune-Up Program meets its objectives and performance goals, while maintaining a high level of client and customer (i.e., energy user) satisfaction. This is achieved through a well-devised overall program design that clearly defines the target market, the marketing and outreach plans, the customer eligibility requirements, the measures covered, and performance goals. It is therefore the role of the project manager to ensure that the program follows these plans, and is successful in meeting its performance goals.

**Marketing/Customer Recruitment.** The purpose of the marketing and customer recruitment phases of the program are to raise customer awareness about the program benefits, and to enroll qualified buildings. QC will be responsible for developing all marketing materials need for indirect and direct marketing activities. These include program brochures, presentations, press releases, trade journal articles, and so on.

QC will be responsible for executing the screening process in each candidate building. It is important that one entity develops and maintains contact in order to avoid customer confusion. It also facilitates tracking of each customer as they are contacted, recruited, screened, and served by the program. QC will develop all r-Cx service provider work authorizations, assign all project budgets, and manage all service provider work in each customer's building. QC will maintain a tracking system that tracks recommended r-Cx measures, EMPs, and customer installation progress. Program status will be reported monthly and quarterly.

***Project Implementation.*** Project implementation is the execution of the r-Cx process in each customer's facilities. This is the responsibility of the assigned r-Cx service provider under the strategic direction of QC. Pre-qualified service providers include those who submitted qualifications and provided services in the Oakland Tune-Up Program. These firms include: the Lawrence Berkeley National Laboratory (LBNL), Quantum Energy Services and Technologies, Inc. (QuEST), Enovity, Inc., Nexant, Inc., VaCom Technologies, Inc., and kW Engineering, Inc. Collectively, these firms' qualifications include experience with virtually all HVAC, lighting and control systems anticipated in the targeted market sectors. Other firms will be pre-qualified as the program progresses, and need arises. QC will oversee and perform review and quality control on all r-Cx implementation activities.

***Evaluation, Measurement and Verification.*** A third-party firm will provide Evaluation, Measurement and Verification (EM&V) services according to guidelines specified in Section VI, and the Energy Efficiency Policy Manual. QC will seek qualified firms to provide this service, and evaluate their qualifications, proposed approach, and availability to provide the services. QC will provide access to its customer database, and r-Cx provider reports so that the EM&V firm can carry out its duties in a timely and effective manner.

## ***II.G WORK PLAN AND TIMELINE FOR PROGRAM IMPLEMENTATION***

In this subsection we provide a table summary of our workplan, key milestones, and associated target dates. **The task descriptions are provided in Section II.A**, additional details on marketing, materials, incentives, and team structure and responsibilities are provided in Sections II.B-F.

The key to rolling out this program successfully will be our ability to begin marketing and customer recruitment immediately, as we indicate in Exhibit II-3. We will be able to begin this process immediately because virtually all of the program materials and processes are already in place. We will be able to rely on an existing program infrastructure, build upon existing relationships with building owners and utilize an existing pool of qualified service providers, that will quickly bring a proven program to market. Our experience with running the Oakland Tune-Up Program shows that the detailed investigation phase lasts from 1 to 4 months, depending on size and complexity, with customers taking several months more to install the recommended measures. Because of the lead time inherent in the process, our marketing efforts will be directed to sign up multiple sites, so that multiple r-Cx projects are running simultaneously. The Building Tune-Up Program's first and foremost focus is on achieving the energy savings and cost-effectiveness goals required by CPUC. Because of our experience with the Oakland Energy Partnership program, we will be able to quickly begin seeing energy savings accomplishments.

The Program Process described below includes a detailed list of tasks to be provided under this program as well as deliverables.

The work plan for this program is characterized by the six program phases described previously: administration, marketing, customer recruitment, project implementation, EM&V, and coordination. Milestones and completion dates are described for each activity in Exhibit II-4.

**Exhibit II-4**  
**Program Milestone Date (assuming start 1/1/04)**

<b>ID</b>	<b>Task Name</b>	<b>Quantity</b>	<b>Milestone Dates</b>
<b>1</b>	<b>Management</b>		
1.1	Contract and program management		ongoing through contract duration
1.2	Finalize MOU	1	2/12/04
1.3	Establish list of service providers		ongoing through contract duration, initial list complete
1.4	Monthly reports	24	14th of each month
1.5	Quarterly reports	8	17th of each 3rd month
1.6	Program draft report	1	3/1/06
1.7	Program final report	1	5/1/06
1.8	EM&V report to CPUC	1	7/1/06
<b>2</b>	<b>Marketing</b>		
2.1	Begin development of marketing collateral		1/1/04
2.2	Develop brochures	300	2/12/04
2.3	Develop customer group presentation materials	6	2/12/04
2.4	Develop customer presentation materials	90	2/12/04
2.5	Develop customer list		2/12/04
2.6	Develop Case Studies	4	3/19/04, 8/19/04, 1/19/05, 6/19/05
2.7	Presentations to customer groups	6	3/26/04, 5/26/04, 7/26/04, 9/26/04, 1/26/05, 6/26/05
2.8	Contact customers directly	3-6 per month	30th each month for first 18 months, beginning 2/29/04
2.9	Make customer presentations	3-6 per month, 90 total*	30th each month for first 18 months, beginning 2/29/04
<b>3</b>	<b>Customer Recruitment</b>		
3.1	Complete screening process	2-5 per month	30th each month for first 18 months, beginning 3/14/04
3.2	Customer enrollment	2-5 per month, 75 Total*	30th each month for first 18 months, beginning 3/14/04
<b>4</b>	<b>Project Implementation</b>		
4.1	Deliver r-Cx measures and EMP reports	2-4 per month, 75 Total*	14th every other month for 20 months, beginning 5/14/04
4.2	Inspect measure installations	2-4 per month, 75 Total*	16th every other month for 20 months, beginning 7/16/04
4.3	Deliver Systems Manuals	2-4 per month, 75 Total*	18th every other month for 20 months, beginning 7/18/04
<b>5</b>	<b>EM&amp;V</b>		
5.1	Provide EM&V firm with data		14th of every 3rd month, beginning 1/14/05
5.2	EM&V activities		ongoing beginning 1/14/05 through 3/17/06
5.3	EM&V final report to QC	1	3/17/06
<b>6</b>	<b>Coordination with Other Programs</b>		
6.1	Proposed Coordination Activities		1 <sup>st</sup> Monthly Report
6.2	PEC/San Ramon Class		See item 2.7

\*Or equivalent to reach overall goal of 18 million participating square feet

### **III. CUSTOMER DESCRIPTION**

#### **III.A CUSTOMER DESCRIPTION**

Exhibit III-1 below shows the medium and large commercial building market segments targeted for this program. The program will also be open to the office building portion of industrial facilities. This program will target commercial and industrial buildings with roughly 100,000 square feet or larger in conditioned space. More specifically, the program will focus on medium to large office buildings, hotels, refrigerated warehouses, colleges and universities, and hospital customers. Targeting 100,000-plus square foot buildings is more cost-effective than smaller buildings since there are significant fixed costs for r-Cx services regardless of building size to understand the building's energy equipment infrastructure, energy use patterns, building control systems, and building operator behavior in operating energy systems. Also, buildings greater than 100,000 square feet are likely to have an energy management and control system, a key target criterion for r-Cx services.

For the PG&E service territory, QC estimates that 18 million ft<sup>2</sup> in approximately ninety 100,000 ft<sup>2</sup> or larger buildings are required to meet our energy savings goals. The data in Exhibit III-1 were taken from PG&E's 1999 Customer End-Use Survey Report (CEUS), and show the total number of premises and square footage for buildings over 100,000 ft<sup>2</sup> in the entire PG&E service territory. Using these data, we estimate that our program will capture 6.3% of the applicable square footage over the two-year program period.

**Exhibit III-1  
Initial PG& Population and Program Population Estimates**

<b>Targeted Business Types</b>	<b>Thousands of Square Feet</b>	<b>Number of Premises</b>	<b>&gt; 100k sqft (% of floorspace)</b>	<b>&gt; 100k sqft (# of premises)</b>	<b>&gt; 100k sqft Available (1)</b>
Office	631,620	90,900	1%	909	227,250
Refrigerated Warehouse	27,600	1,000	10%	100	10,000
Colleges	60,710	600	20%	120	12,000
Hospitals	58,670	1,400	10%	140	14,000
Lodging	86,350	3,500	6%	210	21,000
<b>PG&amp;E TOTAL</b>	<b>864,950</b>	<b>97,400</b>		<b>1,479</b>	<b>284,250</b>
<b>PG&amp;E TARGET</b>	<b>18,000</b>	<b>75</b>		<b>75</b>	<b>18,000</b>
<b>% TARGETED</b>	<b>2.1%</b>	<b>0.1%</b>		<b>5.1%</b>	<b>6.3%</b>

Source: PG&E territory based on 1999 PG&E CEUS

(1) Assumes average building above 100,000 square feet is 240,000 square feet

As shown in Exhibit III-2, the participant office buildings, hotels, colleges, hospitals, and refrigerated warehouses over 100,000 square feet in PG&E territory are projected to result in energy savings of 18.4 GWh's and 664 thousand therms in annual energy savings and 5.0 MW's in peak demand reduction, assuming the savings obtained from retro-commissioning are 7.4% for

electricity and 9.1% for gas usage, which is a conservative estimate based on results to date in the Oakland Tune-Up program. The program will deliver services to 12 million square feet to reach the savings goal. We estimate that 75 buildings, averaging 250,000 ft<sup>2</sup> are required to meet this goal. A complete discussion of the basis for these savings estimates is provided in Section IV.

***Exhibit III-2  
Projected Energy Savings for Tune-Up Program***

Targeted Business Types	Projected kWh Savings (000's)	Projected Therm Savings (000's)	Projected kW Savings (000's)
Office	10,497	241	2.9
Refrigerated Warehouse	2,011	19	0.6
Colleges	1,127	87	0.3
Hospitals	2,669	213	0.7
Lodging	2,053	105	0.6
<b>TOTAL</b>	<b>18,357</b>	<b>664</b>	<b>5.0</b>

### ***Characteristics of Target Market***

Commercial buildings include leased office space, owner-occupied buildings, government office buildings, hospitals, hotels, refrigerated warehouses, and institutional facilities such as university or community college campuses. In most cities, a large sub-sector is leased commercial office space. **Market actors** include owners and property management firms who are concerned primarily with maintaining or improving the building's asset value, helping achieve return on investment, and maintaining tenant comfort and satisfaction. Cash flows and net operating income are important business drivers to these actors. Another critical market actor is the building operator. These actors are important to the project's success because the program relies on their availability and intimate knowledge of the building. Building staff in the commercial sector hire service contractors to maintain and repair HVAC, lighting, and control systems. Service contractors are the main source of costs of the recommended r-Cx and EMP measures. Service contractors can also act as good trade allies in promoting the program. Owner and manager associations, such as the Building Owners and Managers Association (BOMA), International Association of Refrigerated Warehouses (IARW), and the like, also are important agents to help promote the program.

Customers occupying commercial leased office space meet the CPUC Policy Manual's definition of hard-to-reach because the owner's investments in the building benefit the customer only during the lease period, while the owner benefits longer. Data on the fraction of the target (i.e. > 100k sqft) market that is leased in northern California are not readily available. Based on data for related markets, the fraction of leased space will likely be between 20 and 40%.

### ***III.B CUSTOMER ELIGIBILITY***

Customer eligibility requirements are:

- Nonresidential buildings or facilities that are characterized as Large Nonresidential (over 500kW), or Medium Nonresidential (between 100 and 500 kW),
- The building must be located in PG&E's service territory. If the East Bay Energy Partnership is funded, the Building Tune-Up Program will not be available in Alameda or Contra Costa Counties.
- The customer must pay the public goods charges,
- The customer must sign a memorandum of understanding,
- The customer's facility must have a preliminary analysis completed within the program that identifies a material level of expected energy savings from r-Cx services.

QC will target office buildings, refrigerated warehouses, colleges and universities, hotels and convention centers, hospitals and other medical facilities, and other building types that meet the above criteria.

### ***III.C CUSTOMER COMPLAINT RESOLUTION***

QC takes great pride in its attention to customer service and satisfaction. QC maintains a call center serviced by qualified staff well versed in energy efficiency. Call center staff training will be conducted to educate staff on all relevant aspects of the Building Tune-Up program. The call center is capable of handling up to 24 inbound calls at any given time. The call center is generally staffed during regular business hours and is equipped with voicemail capability during off hours.

In the event of a customer complaint or dispute, a QC representative will contact the customer within one business day of notification of the pending dispute. The QC representative will then speak to the appropriate r-Cx service provider, if necessary, to allow them to properly remedy the dispute. The r-Cx service provider shall reasonably attempt to cure the dispute within 5 business days of notice. If the r-Cx service provider has not reasonably resolved the dispute within the cure period, QC will work with both the customer and the r-Cx service provider to arrive at a mutually beneficial solution within 30 business days of the original dispute date.

In addition, QC will inform customers of the Commission's informal and formal complaint processes, which are available through the Consumer Services Division, as another channel through which customers may file a complaint.

### ***III.D GEOGRAPHIC AREA***

The program is open to customers in PG&E service territory. If the East Bay Energy Partnership is funded, the Building Tune-Up Program will not be available in Alameda or Contra Costa Counties. We will place more emphasis on California System Operator identified Constrained Areas in the program's service territory.



#### ***IV. MEASURE AND ACTIVITY DESCRIPTION***

In this section, we describe our measure and cost-effectiveness estimates. We begin by discussing the types of measures associated with r-Cx and identified in our current Oakland Tune-Up program. We then describe how we used data from the actual buildings in the Oakland program to develop savings, costs, and EUL estimates for the proposed Tune-Up effort.

R-Cx looks at non-capital, operations and maintenance opportunities for energy savings and comfort in customer facilities. R-Cx is a powerful non-capital tool to create substantial energy savings. Reviews of the Texas LoanSTAR program revealed that the savings from r-Cx are a substantial portion of the energy savings of retrofits and in some buildings, exceeded retrofit savings<sup>5-6-7</sup>. The LoanSTAR program funded retrofits as well as r-Cx for commercial buildings within Texas.

The Tune-Up Program provides r-Cx services to investigate all of the customer's mechanical, electrical and control systems. This approach is comprehensive by nature, seeking to capture all possible savings at the customer's premises. The type and nature of r-Cx measures recommended for a building depend highly on the configuration of the building's HVAC, Lighting, Refrigeration, and control systems. These systems provide a convenient way to categorize r-Cx measures. Some examples of measures found in office buildings are shown in Exhibit IV-1. These examples are based on actual measures identified in our building assessments of 10 buildings in the current Oakland Tune-Up program.

Because a building's size, equipment configuration, schedule, operational characteristics, skills of operations staff, and other factors are all unique, no two sets of building-specific r-Cx measure recommendations or EMPs are alike. This is borne out by our experience with the Oakland Tune-Up Program, and several hundred case studies in the literature<sup>8</sup>.

The energy efficiency measures identified in this program are determined through comprehensive investigations of each building by qualified r-Cx agents. In the Oakland Tune-Up Program, working with building staff to access equipment, understand operational history and facility requirements, and collect data, the r-Cx agents recommended a number of cost-effective r-Cx

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<sup>5</sup> W. Dan Turner, David E. Claridge, Dennis L. O'Neal, Jeff Haberl, Warren M. Heffington, Dub Taylor, Theresa Sifuentes, "Program Overview: The Texas LoanSTAR Program: 1989-October 1999, a 10-Year Experience," The Twelfth Symposium on Improving Building Systems in Hot and Humid Climates Proceedings, May 2000.

<sup>6</sup> M. Liu, J. Houcek, A. Athar, T.A. Reddy, D.E. Claridge, J.S. Haberl, "Identifying and Implementing Improved Operation and Maintenance Measures in Texas LoanSTAR Buildings," ACEEE 1994 Summer Study.

<sup>7</sup> D.E. Claridge, J.S. Haberl, M. Liu, J. Houcek, A. Athar, "Can You Achieve 150% of Predicted Retrofit Savings? Is It Time for Recommissioning?," ACEEE Summer Study, August 1994, Vol. 5.

<sup>8</sup> See case study papers presented at the International Conference on Enhanced Building Operations, [www-esl.tamu.edu/icebo/index.html](http://www-esl.tamu.edu/icebo/index.html), or the National Conference on Building Commissioning, [www.peci.org/nbc/index.html](http://www.peci.org/nbc/index.html), or the ACEEE Summer Study in Asilomar, CA, [www.aceee.org/pubsmeetings/curmtgindex.htm](http://www.aceee.org/pubsmeetings/curmtgindex.htm).

**Exhibit IV-1**  
**R-Cx Measure Examples from 10 Oakland Offices**

<b>System</b>	<b>Measure</b>
<b>1. HVAC</b>	
Chilled Water Plant	<ul style="list-style-type: none"> <li>• Optimize CW/CHW setpoints</li> <li>• Improve chiller staging</li> <li>• Trim pump impellers</li> <li>• Reset chilled water supply temperature</li> <li>• Stage cooling tower fan operation</li> </ul>
Hot Water Plant	<ul style="list-style-type: none"> <li>• Tune-Up boilers</li> <li>• Decrease deadband on HW supply temperature</li> <li>• Eliminate fighting heating/cooling</li> <li>• Install/optimize boiler lockout</li> </ul>
Air Handling Units	<ul style="list-style-type: none"> <li>• Economizer optimization</li> <li>• Repair broken dampers</li> <li>• Reduce static air pressure setpoint</li> <li>• Move static pressure sensors from fan discharge</li> <li>• Install supply air temperature (SAT) reset schedule</li> <li>• Reduce SAT deadband</li> <li>• Remove variable inlet vanes</li> <li>• Lower SAT to modulate fan VFD</li> </ul>
Packaged DX units	<ul style="list-style-type: none"> <li>• Clean evaporator coils</li> <li>• Recharge refrigerant</li> <li>• Improve air and water-side economizer and compressors staging</li> </ul>
<b>2. Lighting</b>	<ul style="list-style-type: none"> <li>• Relocate/tune occupancy sensors</li> <li>• Relocate photocells</li> <li>• Optimize sweep timers</li> <li>• Repair exterior lighting timers</li> <li>• Adjust lighting schedules</li> </ul>
<b>3. Control</b>	<ul style="list-style-type: none"> <li>• Building start-up schedule adjustments</li> <li>• Soft start</li> <li>• Tune control loops - eliminate “hunting”</li> <li>• Improve integrated sequence of operations</li> <li>• Calibrate sensors</li> <li>• Install or relocate OA sensor</li> </ul>

measures that both improve building performance and save energy. In Exhibit IV-2 we present a summary of the savings and costs estimates associated with measures identified for ten buildings in our current Oakland Tune-Up program.

(Associated Workbook-Related Activities: **Non-Residential Comprehensive Measures**)

***Exhibit IV-2***  
***Example r-Cx Measure Savings and Costs for 10 Buildings***

<b>System Category</b>	<b>Measures</b>	<b>kWh Savings</b>	<b>Therm Savings</b>	<b>Measure Cost</b>
Chilled Water Plant	9	273,518	3,348	\$20,013
Hot Water Plant	9	6,122	61,238	\$15,808
Air Handling Units	14	1,124,489	9,657	\$130,673
Lighting Systems	1	239,200	-	\$38,813
Energy Management System	15	634,410	52,715	\$49,598
<b>Total</b>	<b>48</b>	<b>2,277,739</b>	<b>126,959</b>	<b>\$254,903</b>
Total SQFT Retro-Commissioned (10 Buildings)				2,696,451

There are a wide variety of measures that are discovered in any r-Cx process. These measures span a spectrum from more behaviorally oriented to purely hardware based. R-Cx measures recommended in the Tune-Up Program are both “hard,” long-life measures, and “soft,” potentially shorter life measures. Examples of hard measures include measures that must be installed with tools, such as new sensors, adjustments of damper linkages and actuators, or specialized software programming changes that the operators do not have the skills to undo. Examples of soft measures include building operation and major equipment schedules, setpoints of supply air temperature, chilled water temperature, or lockout settings. The measures that generated the savings shown in Exhibit IV-2 are a mixture of both types. As discussed in detail below, we estimated the estimated useful life (EUL) of each measure, and determined the weighted average using each measure’s savings. The EUL for the measures recommended in the ten Oakland buildings is 8 years.

Due to the comprehensive nature of r-Cx, the combined impact of r-Cx services is measured in terms of percentage of bill savings. Publications in conference proceedings and professional journals cite typical savings in the range of 5 to 15% of annual energy usage.<sup>1,2,3</sup> R-Cx measures recommended in the Oakland Tune-Up Program confirm these estimates, with 7.4% electric and 9.1% gas savings. These percentages were used to generate the savings estimates provided below. Details of the savings calculations can be provided upon request.

#### ***IV.A ENERGY SAVINGS ASSUMPTIONS***

Because of the site- and systems-specific nature of the Tune-Up Program, it is not possible or advisable to drive savings estimates based on a pre-set list of discrete measures. In addition, a majority of the measures that are identified in the program are not included in the DEER database

and Energy Efficiency Policy Manual tables. We therefore estimate percent energy savings as a function of whole building electric and gas EUIs (kWh/square foot), EULs, and costs based on our experience with a representative group of 10 office buildings in the current Oakland program.

The savings estimates for these ten buildings were developed on a case-by-case basis by our qualified r-Cx service providers and reviewed by QC. Measure savings were estimated using standard techniques within the industry, and are dependent upon the type of equipment or system involved. Standard techniques used to estimate these savings include:

- ASHRAE Primary and Secondary HVAC Systems and Equipment Toolkit.
- DOE-2 based whole building energy simulation software. (e.g. eQUEST, VisualDOE)
- ASHRAE Bin and Modified Bin Methods.
- Other public-domain building, system, or equipment modeling software. (e.g. EZ Sim, Transys)
- Manufacturer design simulation software. (e.g. Trane Trace, Carrier HAP, etc.)
- Engineering calculations.
- Statistical analysis.

Energy savings estimates are based on the results of 48 measures from 10 participating buildings in the Oakland Energy Partnership’s Tune-Up program. The 48 measures will provide a total estimated savings of 2,278 MWh, 126,959 Therms, and 625 kW. The average EUIs (energy usage intensities) for these buildings, based on actual billing data, is approximately 11.43 kWh and 0.52 Therms per square foot. Based on these values, our savings estimates will reduce usage by 7.4% of the electric usage and 9.1% of the gas usage.

The Building Tune-Up program will cover buildings that are exposed to more extreme weather than those participating in Oakland. For the building types targeted by the Building Tune-Up Program, we estimate that the average building EUIs are 13.8 kWh and 0.40 Therms per square foot, using PG&E’s 1999 Commercial Building Survey Report. This is consistent with the expectation that the PG&E service territory in general would have a slightly higher electric usage, due to more extreme summer weather, but lower gas usage, due to more year around heating needs in Oakland.

Based on these EUIs and on our 7.4% and 9.1% estimates of kWh and Therms savings, we estimate that we will save 1.02 kWh and 0.037 Therms per square foot of retro-commissioned floor space. Furthermore, we assume a coincident demand reduction of 0.00028 kW a square foot, based on the same ratio of kW to kWh as found in our 10 buildings.

Energy savings projected for the Building Tune-Up Program, based on 18 million square feet of retro-commissioned floor space, are:

Coincident Peak Demand Reduction	Electric Energy Savings	Gas Energy Savings
5.0 MW	18.357 GWh	664,359 Therms

#### **IV.B DEVIATIONS IN STANDARD COST-EFFECTIVENESS VALUES**

Cost-effectiveness values estimated for the Building Tune-Up Program are:

Net to Gross Ratio	Estimated Useful Life	Incremental Measure Cost
1.0	8	\$0.17

**Net to Gross Ratio.** The net-to-gross ratio used in the cost-effectiveness is 1.0. There was no guidance in the Policy Manual for commissioning services. As of 1998 the percentage of existing buildings commissioned in the US was less than 0.03 percent as stated on page one of the California Commissioning Market Characterization Study, A Report Prepared for Pacific Gas and Electric, November 2000. Furthermore, any potential ‘free ridership’ that might occur will be largely offset by the spillover effects of the case studies in stimulating retro-commissioning activity outside this program, and any savings generated as a result of our EMPs. In fact, there is an argument that the Net-to-Gross ratio could be greater than one, because we are not taking credit for potential savings generated by the EMPs. For example, in the Oakland Energy Partnership program, we are already finding that some of our participants are planning to implement some of our recommendations provided in the EMP, which are generally more capital intensive measures not covered under the Tune-Up program. Whether any spillover effects could be attributed to our program would depend on the extent to which installation of measures in the EMPs are attributed to subsequent participation in other programs such as SPC and Express.

**Estimated Useful Life.** The CPUC Energy Efficiency Policy Manual does not provide guidance on the persistence of r-Cx services. To estimate the measure life, we again utilized the findings from our Oakland Energy Partnership program. For each of the 48 measures in the 10 buildings that were used above to develop the per unit savings estimates, we estimated a measure life. Wherever possible, we used measure lives provided in the Energy Efficiency Policy Manual. For measures considered “soft” we generally applied a 3 year measure life consistent with an audit program. We feel this is conservative as we are also providing systems documentation manuals and operator training. For some soft measures, we took an even more conservative approach and assigned 1 year. For many “hard” measures, like adding controls or VFDs, we were able to use the energy policy manual. There were also a subset of measures that could be classified as controls measures, with a 15 year life, but we took a more conservative approach and assumed 8 years ( average of a 1 year and a 15 year life). These measures generally included equipment not listed in the policy manual or specialized software programming changes that the operators do not have the skills to undo. Of the 48 measures used to develop our measure life, only 7% of the energy savings was associated with those measures assumed to have 8 year lives. The “soft” 1-3 year measures comprised 40% of the kWh savings, with the 15 year plus “hard” measures comprising 53% of the measures. To get a sense for the costs involved with these three categories of measure lives, the 1-3 year measures had an estimated cost of 6 cents per kWh to implement, compared with a cost of 22 cents and 14 cents for the 8 year and 15 plus year measures. As expected, longer measure lives are more expensive to implement, as they require more specialized skills and hardware.

For each of the 48 measures, we used the measure specific savings and measure life estimates to estimate the TRC avoided cost for each measure, using the LU – Avd. Costs TRC tab in the CPUC workbook. Across all 48 measures, we estimated the lifetime TRC avoided costs to be \$1,068,820 for electric savings, and \$288,824 for gas savings. By dividing these values by the first year annual kWh and Therms savings, respectively, we estimate that average lifetime avoided TRC per kWh and Therms savings is 47 cents per kWh saved and \$2.27 per Therms saved. Again, using the LU – Avd. Costs TRC tab in the CPUC workbook, we did a look-up to determine what the measure life is that would be associated with a measure that provides 47 cents per kWh and \$2.27 per Therms saved. Based on this look up we determined that our 48 measures were providing an average measure life of 9.17 years for electric savings and 5.77 years for gas measures (the workbook only provides integers, so we interpolated to obtain our results). Weighting these values by the respective lifetime TRC avoided costs for electric and gas savings, we estimated a measure life for the portfolio of 48 measures to be 8.45 years. For the purposes of this proposal, which needs an integer, we rounded down to an 8 year measure life. Interestingly, this is equivalent to what was originally proposed for the Oakland Energy Partnership. However, we feel that this 8 year measure life is conservative, because of the significant amount of measures that are associated with 1 to 3 year measures lives. We believe that our approach to providing training and documentation will yield a longer measure life (up to the 8 years based on the documented sources in the Oakland Energy Partnership proposal). Even with this conservative assumption, we are still able to achieve the previously proposed 8 year measure life due to our emphasis on identifying “hard” measures.

**Incremental Measure Cost.** To develop the incremental measure costs, we used the same methodology as described for the energy savings and measure life, which is to base our values on actual expenditures and expected costs from 10 buildings and 48 measures identified in the Oakland Energy Partnership program. The *actual* costs for the investigation phase associated with the 2.7 million square feet of retro-commissioned space in these 10 buildings is \$211,864, or 7.86 cents per square foot. The expected costs for implementing the 48 measures is \$254,903, or 9.45 cents per square foot. Therefore, the total cost of the retro-commissioning service is estimated to be 17.3 cents per square foot of retro-commissioned space.

#### ***IV.C REBATE AMOUNTS***

The program has a very strong linkage between r-Cx services costs and measure costs. The program’s incentives are structured so that the r-Cx service is provided at no cost to the customer. This is because the two principal barriers to r-Cx investigations are that: 1) by definition, customers do not perceive that they have r-Cx related problems and are therefore reluctant to pay for detailed investigation, and 2) service providers have little to no incentive to work at risk (e.g., with payment contingent on the customer installing) without assurances that measures identified will be implemented. In the Oakland project, when staff marketed the tune-up program, they spent significant time convincing the owners of the program’s benefits, which were subsequently born out in the scoping and detailed investigation phases. R-Cx service providers, according to the PG&E Market Characterization Study, report that there is very little demand for r-Cx services by owners due to lack of knowledge of the extent of cost-effective r-Cx savings available in their buildings.

Because the fixed costs per building of recruiting participants and conducting the detailed investigation are significant, it is important to use incentives effectively to maximize the fraction of measures identified that are installed. Otherwise the savings remain lost opportunities while the investigations are sunk costs. Total resource cost net benefits will be maximized by capturing as much of the cost-effective potential identified at each site as possible.

Incentive amounts will be based on the specific need of each building, according to its size, HVAC system, savings potential, identified measures, and other factors. Incentives will cover 100% of the investigation phase of the retro-commissioning process in all cases, and average up to 75% of the implemented measure cost.

#### ***IV.D ACTIVITIES DESCRIPTIONS***

There are no direct implementation activities not expected to produce energy savings.

## ***V. GOALS***

### ***V.A ENERGY AND DEMAND SAVINGS GOALS***

The goals for the Building Tune-Up Program are summarized in the Exhibit V-1 below.

***Exhibit V-1  
Building Tune-Up Program Goals***

Net Resource Benefit	\$9,709,629
Net Lifecycle kWh	146,854,973
Net Lifecycle Therms	5,314,870
Net Coincident Peak Demand	5,034
Net Annual kWh	18,356,872
Net Annual Therms	664,359
Total Square Footage	18,000,000
Number of Buildings	75
TRC Ratio	2.54

### ***V.B OTHER GOALS***

Other interim milestones and goals than can be used to assess program progress are:

- Developing 300 brochures.
- Developing and holding 6 presentations to industry groups and meetings.
- Developing 4 case studies.
- Presenting the program to 90 customers, or equivalent to reach 18 million square feet target.
- Perform screening process and assessing 90 customer's buildings for energy savings potential, or equivalent to reach 18 million square feet target.
- Delivering 75 energy management plans, or equivalent to reach 18 million square feet target.



## ***VI. PROGRAM EVALUATION, MEASUREMENT AND VERIFICATION***

The basic approach to the EM&V of savings resulting from the r-Cx program will be to do appropriate levels of verification on a facility-by-facility basis, and then sum the savings for each facility to arrive at the total program demand and energy savings. This bottom-up approach will be designed and implemented to accurately assess savings, while keeping costs under control to maximize the program cost effectiveness.

### ***VI. A IMPACT EVALUATION***

#### ***Impact M&V Methodologies***

M&V for the tune-up program will be based on, and in compliance with the *International Performance Measurement and Verification Protocol*<sup>9</sup>. M&V for the r-Cx program will consist of two primary components, 1) partially measured retrofit isolation, and 2) calibrated simulation. These two methods correspond to M&V Options A and D respectively, as described in the IPMVP.

#### ***M&V Implementation***

To frame the M&V activities in the context of the proposed program, the following discussion describes how M&V activities will be included in each phase. The M&V process has many steps: 1) define base year equipment and systems; 2) define variables that influence equipment or building energy use in the base year; 3) establish a model or set of equations that predict base year energy usage, and estimate savings; 4) install the energy efficiency measures; 5) collect data that influence energy use in the post installation year; and 6) use model or equations to determine base year energy consumption under post-installation year conditions; and 7) compare actual savings with predicted savings. There are two r-Cx service provider activities during the Project Implementation phase of the program that provide opportunities to initiate M&V steps 1, 2, and 3. These are: *detailed investigation*, and *handoff*. Each of these three activities is briefly described below with M&V elements shown in *italic* for emphasis.

#### **Detailed Investigation Phase**

- Preliminary r-Cx plan – The preliminary plan will provide groundwork for efficiency development and implementation, including M&V in the following stages. It defines the equipment and systems of interest.
- Collect and define utility bill information, and other data that characterizes the base year. Create a model, using accepted techniques, of the energy consumption of the system or equipment of interest for the base year. Estimate savings for recommended r-Cx

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<sup>9</sup> The IPMVP is available at [www.ipmvp.org](http://www.ipmvp.org).

measures. For recommended measures, an M&V procedure is defined. The procedure identifies if implementation verification requires a visual check, spot measurements, or short term monitoring.

### **Hand-off**

- R-Cx service providers prepare documentation on the systems and equipment examined during the program. At this point in the process, all data and materials on the installed measures may be passed to the EM&V firm.

### ***VI.B PROCESS EVALUATION***

The evaluation will include a process evaluation element. The process evaluation will address the following issues:

- Analysis of program tracking data, program milestones, participant characteristics.
- Participant feedback on the program requirements and participation process.
- Participant satisfaction with the program experience.
- Participant feedback on program attribution.
- Participant feedback on program effects on efficiency-related business practices.
- Non-participants and customer drop out (if any) reasons for not participating.
- Program manager feedback on process-related issues.
- r-Cx and service provider and contractor feedback on process-related issues.

Interviews will be conducted with program participants, non-participants, and the program manager and r-Cx service providers.

### ***VI.C POTENTIAL EM&V SERVICE PROVIDERS***

Itron, Inc. – located at San Diego, 11236 El Camino Real, San Diego, California 92130-2650 has extensive experience in evaluating energy efficiency programs for utilities and government energy agencies. These evaluations have spanned the full range of programs, from residential energy efficient lighting to industrial load curtailment programs. They have also encompassed both detailed process evaluations and powerful statistical impact and market effects assessments. RER/Itron has done it all and can satisfy all of your evaluation needs. Itron currently provides EM&V services for the Oakland Energy Partnership Program.

SBW Consulting, Inc., located at 2820 Northup Way, Suite 230, Bellevue, WA 98004 was established in 1990, and provides a wide range of energy efficiency services to both utilities and end users. Among many engineering services, SBW also provides measurement and verification, and program evaluation services for utility clients and third party entities running energy efficiency proposals. SBW, under subcontract to Itron, is currently providing EM&V service to the Oakland Tune-Up Program.

## ***VII. QUALIFICATIONS***

### ***VII.A PRIMARY IMPLEMENTER***

Quantum Consulting has been providing program design, implementation, and evaluation services across the nation and abroad for 17 years. QC is uniquely qualified to manage the Building Tune-Up Program, as QC brings to this project not only the perspective of program implementation, but also years of experience in design and evaluation. Combined, QC is currently implementing over \$8 million of PGC-funded energy efficiency programs in California. QC is managing the largest PGC funded multi-program local government partnership program, the \$6 million Oakland Energy Partnership Program. Goals for this program are to generate over \$14 million in net lifecycle benefits as measured by the Total Resource Cost test. This translates to yearly energy savings of 28.6 GWh, 10.3 MW and 161,000 therms and, at current rates, over \$4 million per year of bill savings for participants. QC is acting as the prime contractor for the program, which is being delivered with CPUC funding and contract management by PG&E. The program is currently on budget and on track for meeting its savings goal at the end of the contract term. The Program will be running until March 31, 2004 (or June 30, 2004 if our extension filing is accepted). Offerings include a total of six sub-programs being managed by QC, spanning the single family, multi family, small commercial, large commercial, industrial and new construction segments as listed below:

- Large Commercial Building Tune-Up Program – Retro-commissioning services for large nonresidential customers.
- Energy Efficiency Design Assistance Program - New construction design assistance for multifamily, commercial and industrial customers.
- CheckMe AC Tune Up Program - AC tune-up for small commercial and residential customers.
- High Tech Duct Repair Program - Duct sealing for small commercial and residential customers.
- Building Energy Services Team Program- Direct install for hard-to-reach commercial customers.
- Street and Area Lighting Demonstration Program – Improving the efficiency of street and area lighting.

As part of the Oakland Energy Partnership, QC is also directly implementing the largest program element, the Building Tune-Up Program, which is one of the largest Retro-commissioning programs in the nation. QC is also managing two other PGC-funded programs, the SCE and PG&E Municipal Wastewater Retro-commissioning programs. These programs were extensions of our successful PG&E Cross-cutting Demand Wastewater Retro-commissioning and CEC Municipal Wastewater Retro-Commissioning Programs.

QC has also played a key role historically in assisting PG&E with designing their energy efficiency programs. Between 1999 and 2001 QC also assisted SCG with managing their portfolio of Residential Single-Family, Multi-family and Third Party Programs. This assistance included interacting regularly with the nine contractors who participated in the multifamily element as well as the company performing site inspections and verifications. In addition, QC assisted SCG in managing other external organizations involved in their single family program (e.g., Edison, RER, League of California Homeowners, Mowris & Associates, and Energy Analysis Technologies). QC continues to provide SCG with technical review and support on an as-needed basis.

To summarize, QC's relevant qualifications for managing, designing and implementing energy efficiency programs include:

- Oakland Energy Partnership, CPUC Third Party Local Program
- Oakland Energy Partners Large Commercial Building Tune-Up Program
- Wastewater Retro-commissioning, CPUC Third Party Local Program
- PG&E Cross-cutting Demand Wastewater Retro-commissioning Project
- CEC Municipal Wastewater Retro-Commissioning Program
- Management Assistance for SCG's Residential Third Party Initiatives Programs
- Management Assistance for SCG's Residential Contractor Program
- Management Assistance for SCG's Residential Rebates Programs
- Design and Implementation of Commonwealth Edison's Online Home Energy Audit
- Implementation Assistance for Reddy Kilowatt's Online Home Energy Audit
- Design of American Electric Power Service Corporation and Columbus Southern Power's Residential Load Control Program
- Design of FPL's Nonresidential New Construction Program
- Design of FPL's BuildSmart™ Residential New Construction Program
- Design Assistance for FPL's Residential Load Control Project

Quantum Consulting also has assigned to this project, key senior staff that have years of experience in program design and implementation. QC's proposed staff members have held the following positions or performed the following activities:

- Program Manager for PG&E's Standard Performance Contract Program
- Program Manager for PG&E's Power Saving Partners (PSP) Program
- Implementation Assistance for SCE's Standard Performance Contract Program
- Implementation Assistance for Sacramento Municipal Utility District (SMUD) Recommissioning Program

- Implementation Assistance for Sacramento Municipal Utility District (SMUD) Demand Responsive Load Management Project
- Design and Rollout of NYSERDA's Standard Performance Contract Program
- Design of Reliant's Residential Energy Star Program
- Design of Reliant's Commercial Performance Contracting Program
- Design of Reliant's Retail Air Conditioner Distribution Program

Quantum Consulting is also one of the leading market assessment and evaluation firms in the nation, as well as within California. For example, Quantum Consulting is currently managing or directly involved with the evaluation of seven Statewide Programs, including the:

- Statewide SPC Program Evaluation
- Statewide Express Efficiency Program Evaluation
- Statewide Nonresidential Audit Program Evaluation
- Statewide Nonresidential New Construction Program Evaluation
- Statewide Residential Single-Family Rebate Program Evaluation
- Statewide Residential Lighting Program Evaluation
- Statewide Residential Audit Program Evaluation

Within the past two years, QC has provided California's energy efficiency community with invaluable research resulting from its market assessment studies, including the:

- Statewide Nonresidential Customer Hard-to-Reach Study
- Statewide Cost-to-Serve Small Nonresidential Customers Study
- Statewide Renter-Building Owner Scoping Study and Market Characterization.
- Statewide Small Nonresidential Customer Needs and Wants Study
- Statewide Small Industrial Customer Needs and Wants Study
- Statewide Large Nonresidential Customer Needs and Wants Study
- Statewide Best Practices Study (in progress)

In addition to QC's work in California, QC has extensive experience performing market assessment and evaluation studies across the nation. Below is a representative sample of just a few of the projects QC has been involved with over the past couple of years:

- Conectiv's Residential Load Control Program Evaluation
- Connecticut's Energy Efficiency Potential Study
- Delta-Montrose Electric Association's Residential Load Analysis
- Florida Power and Light's Residential and Commercial DSM Program Evaluations,

- General Public Utilities’ Residential Load Control Program Evaluation
- Idaho Power Corp’s DSM Peak Load Reduction Study (in progress)
- Northwest Energy Efficiency Alliance’s Evaluation of the Commissioning in Public Buildings Project
- PacifiCorp and Converge’s Residential Load Control Program Evaluation
- Southwestern Public Service Company’s EnergyStar Home Baseline Project
- Wisconsin Focus on Energy’s Commercial and Industrial Supply Side Market Assessment

## ***VII.B SUBCONTRACTORS***

### ***VII.B.1 Quantum Energy Services and Technologies, Inc.***

Quantum Energy Services and Technologies, Inc. (QuEST) provides energy efficiency engineering services to commercial, educational, and municipal facilities. Our mission is to provide high quality audits and feasibility studies, design, specification, and construction management of site-specific energy efficient systems that deliver energy and demand savings in a cost-effective and timely manner. Our key practice areas include facility commissioning, energy efficiency project development, measurement and verification, energy research, and due diligence services. (More information on QuEST can be found at [www.quest-world.com](http://www.quest-world.com).)

**Oakland Energy Partnership’s Large Commercial Building Tune-Up Program**, Quantum Energy Services and Technologies, Inc (QuEST) staff developed and implemented a screening process that assesses a facility’s energy savings potential. Using the monthly electric and natural gas utility bills, and 15-minute electric demand data when available, QuEST established each energy use benchmarks and compared them to peer buildings. Using the load profiles, we identified typical problems in electric use. We performed a short assessment of each facility to identify the HVAC, lighting, and control systems, and interviewed facility staff. We identified energy savings measures that could be implemented in the existing equipment and systems, and major system retrofits and replacements.

QuEST has performed the preliminary assessment on the following facilities: Oakland-Piedmont Municipal Court, Alameda County Courthouse and Administration, Marriott Hotel / Oakland Convention Center, Marriott Hotel / Oakland Convention Center, Marriott Courtyard Hotel, Kaiser Permanente, Laney College, Merritt College, and Rotunda.

### ***VII.B.2 Lawrence Berkeley National Lab***

The Commercial Buildings Systems Group focuses on the development of advanced computer-based building design tools that assist the architect or engineer in decision making from early, schematic design through building construction, commissioning and operation. In the spirit of the Healthy or Green Building, the Group also seeks ways to integrate a variety of isolated building technologies into complete systems that allow for compounded energy efficiency and an

increased building life-cycle. LBNL will provide r-Cx services and technical assistance to the Building Tune-Up Program. (More information on LBNL can be found at [www.lbl.gov](http://www.lbl.gov).)

### ***VII.B.3 VaCom Technologies***

VaCom Technologies is a design-build engineering firm specializing in efficient cooling, heating and refrigeration for the commercial /industrial market sectors. VaCom provides technical services, develops energy efficiency projects and produces custom products utilizing vapor compression technology and computerized controls. It is a licensed contractor in California and other Western states.

VaCom has specialized technical skills based on its research of vapor compression systems over many years, resulting in an ability to optimize the energy performance of existing HVAC/Refrigeration systems as well as successfully develop new products and large scale energy efficiency projects using fundamental engineering methods. In addition to extensive supermarket and industrial refrigeration plant simulation capability, engineering and economic models have been created for specialized applications including food processing plants, ice arenas and wineries. (More information on VaCom can be found at [www.vacomtech.com](http://www.vacomtech.com).)

### ***VII.B.4 Nexant, Inc.***

Nexant, Inc. is an energy industry-leading consulting firm, providing owner's representation, project management, program design and implementation, and engineering services for energy projects. Since our inception in 1986, at the time known as Schiller Associates, we have been providing management and engineering services to government agencies, utilities, as well as commercial, institutional and industrial facility owners to help them manage energy consumption and reduce costs in their facilities. (More information on Nexant can be found at [www.nexant.com](http://www.nexant.com).)

### ***VII.B.5 Enovity***

Enovity, Inc. is a full-service energy engineering, sustainable design and facility management firm based in San Francisco. The firm employs eighteen qualified energy and facility management specialists. Enovity, Inc. principals have been active in commissioning and r-Cx for the past 6 years. They have directed and completed projects encompassing a wide variety of the building systems, including chilled water systems (chillers, pumps, VFDs, and system performance); heating systems (boilers, pumps, VFDs, and system performance); air handlers (fans, coils, dampers, individual and group performance); lighting controls; building automation systems (front end computers, field control modules, programming, and point verification); and electrical monitoring systems. (More information on Enovity can be found at [www.enovity.com](http://www.enovity.com).)

### ***VII.B.6 kW Engineering***

kW Engineering is an independent provider of energy engineering services specializing in assessments of commercial, institutional, and industrial facilities. Their staff have expertise with all major energy-using systems, know proven methods for reducing utility costs, and have developed accurate techniques for estimating energy and cost savings. kW Engineering can use

these skills to help customers identify and implement well-engineered projects that save energy and improve profitability. KW has five licensed mechanical engineers and four Mechanical Engineering Master's degrees. (More information on kW can be found at [www.kw-energy.com](http://www.kw-energy.com).)

### ***VII.C DESCRIPTION OF EXPERIENCE FOR KEY QC STAFF***

***MR. JOHN CAVALLI, PRESIDENT***, will be QC's Managing Partner. Mr. Cavalli has over 15 years of experience in all aspects of energy efficiency consulting and implementation. He has been responsible for numerous large, multi-year engagements across a wide variety of projects and clients, including the Oakland Energy Partnership.

***DR. DAVID JUMP, Director of Engineering***, will be the overall Project Manager for the Tune-Up program. He will be responsible for all aspects of program management, performance, and quality control. Dr. Jump currently leads a team of five engineers in providing commissioning, energy project development, and applied research. Dr. Jump has developed and managed a \$1.8 M building retro commissioning program in the City of Oakland. He has expertise in commercial building HVAC, central plant technologies, and building energy management systems. He has developed and executed monitoring and evaluation plans for performance contracts, utility program evaluations, and as an owner's representative. His experience with data acquisition and analysis techniques and tools has enabled him to author chapters in M&V guidelines, and develop tools for assessing measurement protocol cost effectiveness. Dr. Jump is an experienced project manager who has overseen many large projects and programs, including research programs. He received a Ph.D. in Mechanical Engineering from the University of California, Santa Barbara and has over ten years experience in the energy-engineering field.

***ADAN ROSILLO, P.E., C.E.M. Senior Associate***, will be the Lead Engineer. He will assist Dr. Jump with the building-specific quality control functions. Mr. Rosillo is a professional engineer with extensive experience in facilities engineering, design and construction of energy conservation projects, project management, and performance contracting. He has considerable experience in HVAC systems design operation and analysis, computer simulation, utility rate analysis, project cost estimating, and energy savings analysis. At QuEST, Mr. Rosillo performs detailed engineering audits in commercial buildings to develop retro-commission projects under a local energy program sponsored by the California Public Utilities Commission.

Mr. Rosillo is a member of the American Society of Heating, Refrigeration, and Air Conditioning (ASHRAE). He holds a Bachelors degree in Chemical Engineering and a Masters degree in Physics from the Technology Institute of the Advanced Studies of Monterrey, Mexico. He is a Professional Mechanical Engineer registered in California and a Professional Chemical Engineer registered in Mexico. He is also a registered Physics Instructor by the Board of Governors of the California Community Colleges.

***KRISTOPHER L. KINNEY, Associate***, will be one of QC's Field Engineering staff. Mr. Kinney specializes in integrating energy efficiency concepts, design, IT, web interfaces and operations with clients. At QC, Mr. Kinney has provided r-Cx services for the Oakland Convention Center, Rotunda, and Courtyard Marriott projects. In prior employment, he has worked in collaboration with the Lawrence Berkeley National Laboratory for the design and installation of real-time web



accessible building monitoring systems. Equally at home in the field, Mr. Kinney has recently completed extensive energy audits and conceptual design studies for two Hyatt Hotels in San Francisco, and The Grand Hyatt, Singapore. Mr. Kinney was a technical session speaker on new developments in Data Visualization Methods for HVAC Applications under the Existing Building Commissioning II: Diagnostic Methods seminar at the 1999 Annual ASHRAE meeting, USA. He has also presented at the American Council for an Energy Efficient Economy (ACEEE). Mr. Kinney holds a degree in Architectural Engineering from the University of North Carolina.

#### ***VII.D LIST OF KEY STAFF FROM ADDITIONAL R-CX SERVICE PROVIDERS***

- kW Engineering: Eben Twombly, P.E., Kevin Warren, P.E.
  
- QuEST: Fred Smothers, Asim Tahir
  
- LBNL: Mary Ann Piette, Ph.D., Phil Haves, Ph.D.
  
- Nexant: Ed Jerome, C.E.M., Arik Cohen
  
- VaCom: Doug Scott, David Goldberg
  
- Enovity: Greg Cunningham, AIA, Jonathan Soper, P.E.

**VIII. BUDGET**

**Exhibit VIII-I  
Budget**

<b>Budget Items</b>	<b>Sub-Total</b>	<b>Budget Total</b>
<b>Administrative Costs</b>	<b>386,766</b>	
<b>Marketing/Advertising/Outreach</b>	<b>188,279</b>	
<b>Direct Implementation</b>	<b>2,690,479</b>	
<b>Evaluation, Measurement &amp; Verification</b>	<b>137,772</b>	
<b>Total Program Budget</b>		<b>3,403,296</b>

If multiple Building Tune-Up Programs are funded, we have already identified areas where we can reduce costs due to economics of scale. Depending on the number of Building Tune-Up Programs funded, we believe we can reduce our Administrative, Marketing, and EM&V costs by as much as 15%.