A Proposal to

THE CALIFORNIA PUBLIC UTILITIES COMMISSION

SOUTHERN CALIFORNIA EDISON
CALIFORNIA WASTEWATER PROCESS OPTIMIZATION PROGRAM

CONFIRMATION/PROPOSAL NUMBER:

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PRIMARY

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

SUBCONTRACTOR

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

QUANTUM CONSULTING

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I. PROGRAM OVERVIEW

Quantum Consulting (Quantum) is pleased to submit this proposal for the Southern California Edison portion of the California Wastewater Process Optimization Program (Cal-POP). 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 California Wastewater Process Optimization Program (Cal-POP) continues our current 2002/2003 program and focuses on continuing to bring significant energy efficiency savings to wastewater treatment plants. Generally speaking, wastewater treatment facilities (WWTFs) are typically designed for a 20-year life-cycle, under "worst case" conditions. These same facilities are designed without significant process control technologies and therefore run closer to their future needs rather than today's - paying tomorrow's O&M costs today.[1] The Cal-POP will install "hard" monitoring, control, and equipment measures in addition to training staff in facility optimization. While training can achieve some level of savings, the more permanent nature of hard measures will increase savings persistence. The focus for the program will move beyond the current 1 to 5 MGD range to include facilities that are less than 15 MGD – larger facilities, greater than 15 MGD, have sufficient resources such that they do not need assistance from this program. Our $1.2M energy efficiency upgrade for the City of Santa Barbara (9 MGD) demonstrates our program's ability to achieve energy efficiency implementation in larger facilities, while our ongoing installations in smaller facilities has shown our efficacy in completing projects in smaller communities as well. In addition to expanding the size of facility that the program will serve, we will provide process optimization to institutional and agricultural WWTFs, such as prisons and canneries located in non-urban areas. The program will continue to bring wastewater energy efficiency services, including process optimization consulting and equipment, directly non-urban facilities.

I.B PROGRAM RATIONALE

As an industry, water and wastewater account for nearly seven percent of the state's total energy consumption[2]. Clearly any efforts to reduce energy consumption in the state should continue to focus, at least in part, on water and wastewater energy efficiency.

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[1] The City of Calistoga is currently completing a $4M upgrade. During a recent visit to the facility it was revealed that the VFDs, part of the original upgrade design, have been eliminated do to budget constraints. Clearly any savings would have covered the VFD costs within a few years.

[2] Conversation with Shahid Chaudry Director of wastewater efforts for the California Energy Commission.

I.B.1 Why Select Program

For more than three years, the Cal-POP has filled a void by providing energy efficiency to non-urban wastewater treatment facilities. Quantum's wastewater programs have distinguished themselves by **moving audits to cost-effective installations.** Our approach to the wastewater industry is different from other wastewater program offerings in its focus on hard savings, its turnkey approach, and its delivery of significant energy savings. The proposed program:

- ***Is an Integrated Part of a Consistent Statewide Program for Wastewater Facilities that Avoids Unnecessary Balkanization.*** Wastewater facilities should be addressed through a single program that reaches the entire market, including smaller facilities, through a consistent, integrated approach. Our program will achieve this through a proven, turnkey approach that is currently being successfully implemented in the SCE and PG&E territories. We propose to provide the program to all three IOU service territories on a consistent basis for 2004/2005.
  - For many program areas, the benefit of working through municipalities is clear. However, in specialized and technical areas such as wastewater, the benefits of leveraging experiences learned in other facilities is invaluable.
  - Providing public goods funds to municipalities and others to achieve savings on a local, one-off basis would not be an efficient use of ratepayer funds and would unnecessarily balkanize the market.
  - Funding other stand-alone wastewater training and information programs is unlikely to produce the level of demonstrable savings produced through our programmatic approach and may unnecessarily confuse market participants with multiple wasterwater-related public goods programs.
  - As demonstrated throughout this proposal, continuation and expansion of Quantum's California Wastewater Process Optimization Program will maximize economies of scale and net TRC benefits while minimizing customer confusion for this important market segment.

- ***Employs an Aggressive, Persistent Marketing Strategy that Produces High Project Screening and Installation Close Rates.*** Having been in more than 200 facilities, our experience shows that rarely will direct mail, initial phone calls, or emails result in an invitation to a facility. Only through consistent, compelling, and repeated contacts that include face-to-face recruiting meetings will the target facilities for this type of program be convinced to participate. This approach has resulted in high rates of customer agreement to proceed with the analysis and implementation phases of the program. Under our current program the ratio of signed commitments and installations is nearly 50 percent[3].

[3] Currently Quantum has completed installations or received signed commitments for 19 facilities. Preliminary audits were conducted in 40 facilities, implying a close rate of 47.5 percent.

- ***Achieves a High Participation Rate in Moving Audits to Installations.*** To date Quantum wastewater programs have completed 21 installations with a combined annual savings of 16,091 MWh. These installations include five facilities under the current 2002-2003 CPUC program. In addition to these five facilities, 16 other facilities are either scheduled for installation in Q4 2003, or have signed commitment letters and will be installed during Q1 2004.

- ***Cost-Effectively Captures a Significant Share of an Otherwise Untapped Efficiency Resource***. The program will achieve 2,041 MWh in net first-year savings, and 208 kW savings with a TRC ratio of 2.9. Net life-cycle savings for the project will be 40,124.5 MWh, yielding $1,680,086 in financial benefits. Case studies demonstrating the program's effectiveness are presented in Appendix B.

- ***Achieves Significant per Participant Savings that are Transparent and Easily Observed via Load Data.*** Savings are typically around 15 percent of a participating facility's usage. The savings are usually so significant that they can be easily observed from simple comparisons of pre- and post-billing and interval load data. These dramatic reductions are prominently featured in the case studies developed and used for the program.

- ***Focuses on Implementation Rather than Only Training.*** More permanent savings are likely to result from installation of "hard" measures rather than training. At best, training-only solutions can expect a few years of savings, if they can even achieve that. Our experience shows that brief changes in external factors (e.g., higher oxygen demand) are enough to undo the best training program. Staff turnover, which is significant, also reduces the persistence of training only savings impacts.

- ***Works effectively in smaller and medium-sized facilities.*** Our track record of completing installations in smaller facilities is un-matched. The experience gained in closing projects with smaller facilities has transferred well to larger facilities such as Santa Barbara where the city has signed commitments for a $1.2M energy efficient project saving more than 200 MWh annually.

I.B.2 Basis and Need for Program

Although important savings have been acquired through our program to date, significant opportunities for wastewater efficiency improvements remain. As shown in Sections III and IV of this proposal, untapped savings remain in many facilities through the territory. The basis and need for continuing our program is as follows:

- **Significant remaining potential.** We estimate that annual wastewater energy consumption is 8,876 GWh based upon 3.5 percent of total energy consumption. Current Quantum/BacGen projects have achieved more than 15 percent energy reduction. Assuming a very conservative 2.5 percent reduction yields a technical potential of 221.9 GWh in savings, without considering growth in energy usage due to population increases or tighter regulatory restrictions.

- **Statewide incentive programs like SPC and Express do not fully mitigate market barriers such as transactions costs, asymmetric information, etc. for wastewater facilities.** Because of the significant barriers to efficiency optimization at these facilities, a turnkey approach is needed in which the preliminary and final audits are included in the program package. It is critical that the program then continue to work with the participants though both information and strategic use of financial incentives to shepard the measures identified through to installation and verification. Letters voicing support for the program are included in Appendix A, which is included in the bound volume.

- **Wastewater treatment is still focused on permit compliance to the disadvantage of energy efficiency.** Energy efficiency continues to not be a focus. Our experience shows that city management pays limited attention to their wastewater treatment facility unless there are compliance issues.

- **Facilities are typically designed for a 20 year-life, under "worst case/extreme event" conditions without risk of failure.** These same facilities, particularly small to medium, are designed without significant process control technologies and therefore are required to pay tomorrow's O&M costs today.

- **Lack of resources from other state agencies has left a void for wastewater focused energy efficiency.** In previous years, water and wastewater, given their relatively large share of energy consumption, have been a focus for energy efficiency, particularly the California Energy Commission (CEC). Given current state budget constraints, the CEC does not have sufficient resources to offer a program targeted at wastewater facilities.

- **Benefits to energy efficiency have impacts beyond the facility.** Unlike other energy efficiency initiatives, energy reduction in WWTFs has a broader impact on the community at large. Any benefits that accrue to the facility will be distributed to residential, commercial, and industrial customers alike by keeping sewer rates down.

- **Non-Municipal WWTFs have a similar need for energy efficiency assistance.** Institutional wastewater treatment, including prisons, and agricultural facilities such as canneries and dairies, have many of the same energy efficiency issues as municipal WWTFs.

I.B.3 Current Program Effectiveness

The California Process Optimization program was funded by the CPUC during 2002-2003 program period. This program is a continuation of efforts undertaken since 1999. The current success of the program can attributed to our program process (See Section II) which has been refined over the last five years. Exhibit I-1 presents the current status for our program components in the SCE and PG&E territories.

Exhibit I-1
2002-2003 CPUC Program Status

	Goal	Status
Site Installations - SCE	13	1 installation completed 7 signed commitment letters 5 verbal commitments
Site Installations - PG&E	7	3 installations completed 8 signed commitment letters 4 verbal commitments
Savings - SCE	6,500,000	103,000 kWh installed 2,963,224 kWh commited (signed) 820,000 kWh commited (verbal)
Savings - PG&E	3,500,000	296,852 kWh installed 2,034,819 kWh commited (signed) 1,400,000 kWh commited (verbal)

As shown above, the project has exceeded some goals and is on track to meet the remaining goals. **For the PG&E territory, Quantum will complete installations in at least 11 facilities, exceeding the program goal by 43 percent. Additionally, Quantum will likely exceed its savings goal in the PG&E area, without a budget increase.** To date we have one installation and seven signed commitments, with a goal of 13 installations in the Edison territory. Five facilities have provided verbal commitments to the program in the Edison territory. The savings for the Edison territory is currently short of the goal, so we have started preliminary audits in a series of secondary facilities – these are facilities that did not make the initial screen, but still represent good savings candidates.

The program successes described above are in contrast to the EEGOV wastewater focused-initiative operated in the Edison and PG&E territories which has yet to complete an installation or even attain a single program commitment[4].

The hallmark of our previous wastewater projects is our ability to move audits through to installations, even when significant facility contribution is required. As described in Section II, Quantum staff take very seriously the task of "closing deals" with cities. We spend significant effort making energy efficiency a compelling proposition – due to this, facility contributions have ranged from $15,000 to more than $1,000,000. For all of these projects continuous follow up has been required to move facilities from general interest through installation. While other programs have relied upon international engineering firms to push their implementation projects, we have proven that our continuous persistence and follow up can deliver installations.

As shown in Section III, the need for the Cal-POP program continues to exist (see Section III for our candidate facilities). Given the focus of other CPUC wastewater efforts on purely training

[4] Energy Efficiency Local Government Program CPUC # 144AB-02 Quarterly Report for: Second Quarter (Q2) 2003 Submitted by: KEMA-Xenergy Inc, August 1, 2003.

related activities, the Cal-POP program remains the only initiative concentrated on maximizing installations of hardware and systems.

I.C PROGRAM OBJECTIVES

As stated above, the industry has been focused, since its inception, on meeting permit requirements – at the expense of all other resources including energy. While the industry is coming around to the need for energy savings through process optimization, this is a conservative industry that is slow to change. The objectives of this program are twofold:

- **to overcome market barriers limiting the acceptance and spread of our process control practices and supporting technology, and;**

- **to create a viable and sustainable market for wastewater facility process optimization.**

Underlying these objectives is a desire to build on the successes of our 2002-2003 CPUC, PG&E Peak Reduction and the CEC Demand Reduction programs. Through these programs we have been able to compile the most comprehensive database of facilities in the state – an invaluable resource. We continue to initiate interest in process optimization as evidenced by our ability through 20 installations/optimizations completed already and the 20 or more that will be completed as part of the 2002-2003 CPUC program. These case studies serve as the strongest proof of concept in this largely conservative and skeptical industry.

The Quantum Team proposes the following steps to meet our objectives.

- **Continue to implement cost-effective energy efficiency process optimization installations.** To date our process optimization installations are saving more than 16,091 MWh annually. Under this solicitation our program will deliver 2,041 MWh in net annual savings.

- **Continue to develop case studies proving the efficacy of our process and technology.** The wastewater industry has limited interest in lab research or engineering estimates. They want to see real proof, from real facilities, where they can talk to real operators. Anything less will ensure slow progress towards wide adoption. By January 2004, the Quantum Team will have more than ten installations on-line from our 2002-2003 program.

- **Continue to use wastewater site visits as a means to develop interest in energy efficiency.** Much of our current success can be attributed to a dedication to visiting facilities, rather than relying on direct mail, e-mail, and phone calls. Our previous program experience has shown these methods to be ineffective.

- **Continue to conduct in-depth audits that will lead to process optimization installations.** Building on our existing brief phone audits, the Quantum Team will conduct in-depth audits and recommendations. These audits as well as the case studies

will form the basis for moving facilities and communities from awareness and knowledge to action and adoption.

- **Continue to move facilities from audits and recommendations to installations.** The case studies described above form a foundation for moving newer facilities to installations. Our continued persistence and follow up with city decision makers will ensure that facilities continue to move from audits to implementation.

- **Build on current successes to promote wastewater energy efficiency in agricultural and institutional settings.** Inefficiencies in wastewater are not limited to municipal facilities. Many agricultural processors such as canneries, dairies, and wineries have inefficient wastewater operations. Institutions such as prisons also have their own wastewater treatment facilities that are in need of energy efficiency retrofits. The program will assist these facilities when they are located outside of urban areas.

I.C.1 Meeting Policy Objectives

Section I of the CPUC's Energy Efficiency Policy Manual (Manual) describes the Commission's goals and objectives for energy efficiency programs. Using these guidelines we have addressed explicitly how the Cal-POP meets each objective.

I.C.1.1 Cost Effectiveness

The Cal POP program will achieve a TRC value of 2.9 and PPT value of 10.2. Net program benefits are $1,090,974.

I.C.1.2 Long Term Annual Energy Savings

Unlike other wastewater focused initiatives, the Cal-POP program is focused on installation of hard measures that achieve hard savings. While we claim training related savings, our experience shows that these savings can be short lived and unlikely to persist beyond three years. Under this project, net life-cycle savings for the project will be 40,124.5 MWh, yielding $1,680,086 in financial benefits. See Section IV for more details.

I.C.1.3 Electric Peak Demand Savings

Based upon our demand reduction focused projects for PG&E and California Energy Commission, and our current energy-reduction CPUC programs we expect to reduce peak demand by 50 kW per facility, or 250 kW total (208 kW net). Demand reduction for audits is assumed to be 2 kW. These estimates are based upon data on aeration kW from our facilities database and application of our tiered cycling protocols. See Section IV for more details.

I.C.1.4 Equity

As stated above, large urban wastewater facilities generally do not face the same resource constraints as their non-urban counterparts. **The Manual defines nonresidential customers outside of the San Francisco Bay Area, San Diego, area, Los Angeles Basin, and**

Sacramento as being geographically Hard-to-Reach. The Cal-POP project will deliver process optimization technologies to non-urban communities.

I.C.1.5 Addressing Market Failures

Currently the market for process control/optimization is insignificant for small to medium-sized facilities. Fear of violating one's discharge permit leads directly to a conservative and skeptical industry – an industry that is focused on the status quo. The Cal-POP builds upon initial installations and education that were funded through PG&E and the California Energy Commission. Through case studies, CPUC program authorization, and word-of-mouth the Cal-POP will effectively reduce **lack of consumer information/asymmetric information** barriers. In the wastewater industry, operators talk, and results speak volumes. Through reduction of information barriers, **lack of availability** can be addressed. Process optimization/control technologies are available, but only for large urban facilities. Our research report for the Northwest Energy Efficiency Alliance, Report #01-079 Pacific Northwest Water and Wastewater Market Assessment http://www.nwalliance.org/resources/reports/79.pdf, shows that engineering firms are not interested in process optimization for small and medium sized facilities, only large well-funded urban facilities. In constructing our California wastewater treatment facility database we interviewed more than 400 facility operators, each one corroborating our research in the Pacific Northwest.

I.C.1.6 Innovation

Cal-POP uses state-of-the-art sensors and controls to reduce energy consumption (and demand) in municipal wastewater facilities. However, the most innovative aspect of the Cal-POP may be our focus on system biology. Where most others have focused solely on mechanized solutions (e.g. fine-bubble aeration), we have chosen to develop a deep understanding of each system's biology. Through improved collection of biological data and sophisticated modeling software, the Quantum/BacGen Team has been able to re-define the treatment process parameters, which when combined with control systems lead to better management and ultimately significant energy savings.

The program is also innovative for two other reasons. First, the program delivers systems that are within reach of facilities over 15 MGD. While the systems that we install are available, it is usually only larger facilities, 15 MGD and higher, that can afford these systems and operate them effectively. Cal-POP delivers simpler versions of these systems and provides the training to use them. Another innovation is our approach to the market. Through our experience we have developed a deep understanding of what works and what doesn't when delivering energy efficiency to wastewater facilities. The best example of our experience is presented in the Contingency Table (Exhibit II-2). In this table, common industry bottlenecks to energy efficiency installations are identified and overcome. **This understanding is a key driver to our success in turning audits into installations**.

I.C.1.7 Synergies

Where possible, the Quantum/BacGen team staff will use our access to facilities to promote other energy savings programs such as motor retrofits.

The remainder of this proposal follows the outline dictated by the CPUC. Section II covers the overall program process. Section III describes the target customer. Section IV presents a discussion of energy efficiency measures and activities. Sections V and VI contain the program goals and EM&V plan, respectively. Qualifications of program staff are presented in Section VII. A summary of the program budget is provided in Section VIII.

II. PROGRAM PROCESS

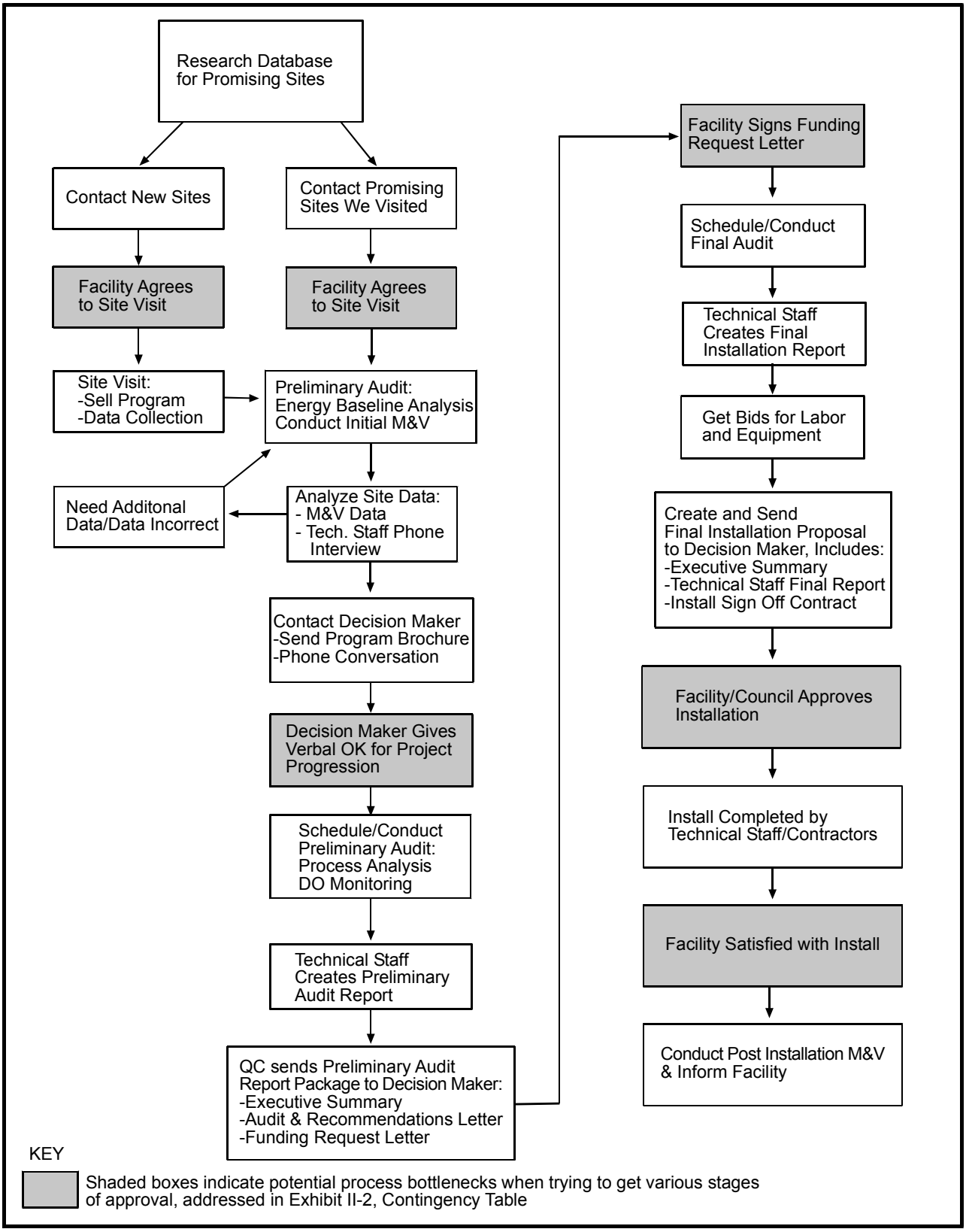
II.A PROGRAM IMPLEMENTATION

The program implementation process for this program is based on the success achieved and lessons learned from PG&E's Cross-cutting Demand Reduction Program, the California Energy Commission's Innovative Peak Load Reduction Program and the California Public Utilities Commission's Municipal Wastewater Retro-commissioning and Process Optimization Program (implemented in both PG&E and SCE service territories).

The sections below describe the process in more detail, step by step. Exhibit II-1, the Program Implementation Flow Chart, also shows the process graphically and highlights potential bottleneck areas in the process where approval is needed to progress. The program begins with Initial Program Site Selection and Recruiting, where screening is done for new implementation candidates as well as previously visited sites that are a fit for the program. When candidate sites are selected, a Preliminary Audit is performed, consisting of an Energy Baseline Analysis as well as a Process Analysis for the facility. From this information, the best candidates are chosen for implementation. These sites receive a Final Audit, creating a detailed project plan for implementation. When the facility signs off on the plan, the actual Installation of recommended measures will occur.

As a result of past project work, the program process has been refined and improved numerous times. Given past experience and our current progress in site selection, the project team is ready to hit the ground running.

Exhibit II-1
Program Implementation Flow Chart



II.A.1 Task 1 - Initial Program Site Selection and Recruiting

Preliminary screening to identify suitable WWTFs has already begun. Exhibit III-1 presents the best candidates for implementation in the utility service territory. The project team has already queried its comprehensive database of California municipal WWTFs and used our site identification algorithm to identify the facilities in Exhibit III-1. The database was founded on facility data as reported to the State and various Regional Water Quality Control Boards, and was refined through hundreds of phone interviews, preliminary audits, site visits and web research. The project team compiled this comprehensive database as part of the wastewater project work completed for PG&E, the California Energy Commission, and the California Public Utilities Commission mentioned above. It is unquestioningly the most accurate and robust database of California municipal WWTFs available.

Promising sites are determined through database queries based on facility parameters:

- Treatment type.
- Treatment capacity vs. existing flow.
- Installed vs. applied aeration horsepower.
- Seasonal variation in flow and biochemical oxygen demand.
- Extent of industrial vs. municipal loading.
- Population of municipality.

The top candidate facilities are then divided into two categories:

- **New Sites –** these are facilities where we have not completed initial site visits in previous programs and have limited data.
- **Previously Visited Sites -** Facilities with completed initial site visits from previous programs with detailed facility data.

II.A.1.1 Implementation Candidates - New Sites

New facilities fall into two general categories, 1) facilities that were contacted over the phone and did not express any interest in the program, 2) facilities that were not contacted due to the sheer number of sites in the state. Currently our database contains basic records on all 736 municipal plants in the state with more detailed site information on 464 facilities.

These new facilities will be contacted, the program is briefly explained and a short screening interview will be conducted to obtain basic facility information. If the screening shows good opportunities for savings and the facility looks like a favorable candidate for the program, an initial site visit will be scheduled.

Exhibit II-2
Contingency Table, Issues 1-5

Issues	Solution	Example
1. Facility operator will not agree to site visit:	• **Move up chain of command to get necessary authorization**. Speak with the facility superintendent, the city engineer, or the public works director to get clearance. In smaller communities gaining site access is often through a consulting engineering firm who manages facility operations. • **Offer to stop by the facility while visiting nearby facilities.** Facilities are much more comfortable accepting an audit if they understand that you are already within close proximity and auditing other facilities in their area. Any sense of a quid pro quo is lessened with this approach. • **If facility is not confident that auditor has the technical expertise to deal with process modification in a wastewater plant.** Put facility in contact with project staff wastewater engineer to verify our background and address concerns. • **Facility hesitates to allow unfamiliar personnel in plant.** Use city service provider contacts and facility personnel from previous projects to provide credibility to project to permit an audit.	At Sanger WWTF previous attempts to work with the facility had been rebuffed. Our frequent contact with service providers generally revealed that a service provider, Telstar, could assist in pitching our program to facility management. This relationship resulted in complete facility support for site visit.
2. Decision maker will not give verbal ok for project progression:	• **Decision maker does not feel comfortable in any program that may cost him money or change the way his facility is operated.** Deliver on site presentation to address concerns about the program. Help decision maker understand his obligations for participation in the program and potential benefits to the facility. Financial models can also be useful in gaining support. • **Decision maker requests justification for project (city engineer or outside firm).** Summarize and present M&V and/or DO data collected at facility to show potential for energy savings. Providing access to technical staff can be helpful.	At Lancaster WWTF, after several attempts to gain project support, staff presented program and project details to county supervising engineer on site. Addressed all program funding concerns and project possibilities. Achieved strong support for project to move forward.
3. Facility will not sign funding request letter:	• **Facility employees very hesitant to sign any document.** Deliver on site presentation on the program and specific project for facility or prepare and send presentation to facility. Explain funding request letter in detail, addressing all facility concerns and reasons for delay. • **Involve someone concerned with financial implications of project.** Present long-term financial benefits of project for facility and consequences of not participating.	At Santa Barbara WWTF, when facility supervisor was uninterested in pursuing project, presentation was made to city finance personnel. Financial benefits were outlined and resulted in strong project support from city and signed funding request letter.
4. Facility/Council hesitant to approve installation:	• **Deliver presentation to facility/council outlining project.** Give all facility and council members an opportunity to voice concerns, address all concerns with examples of previous installations and present project testimonials from other city and facility staff. Facility/council is more comfortable giving approval to someone with a successful history in their area. • **Impose hard deadlines with financial penalties to city for project approval.** Present financial consequences to city for failure to act within a reasonable time frame. • **Prepare collateral for facility to present at council meeting outlining funding sources, project costs and benefits and financial consequences for lack of participation.** City resources can be limited, providing assistance can increase likelihood of moving forward. • **Work through city chain of command to inform additional decision makers and gain project support.** Often city will only approve projects based on recommendations through certain channels (public works director, city manager or city funded consulting engineering firm) • **Present multiple contractors bids for project to demonstrate accuracy of project cost.** Facilities are generally more comfortable with projects that do not have the appearance of being sole sourced.	At Gustine WWTF, main decision maker (city manager) was on extended leave and could not approve project and deliver to city council. Made contact with city consulting engineer and public works director and imposed deadline for approval with financial consequences. Consulting engineer provided support to the project, allowing PWD to present it to council in time to meet deadline, bypassing city manager.
5. Facility not fully satisfied with installation:	• **Project staff wastewater engineers will contact facility on a regular basis to offer technical support until facility is satisfied with installation.** Technical staff continues to follow up for six months after installation. • **Withhold funding from project until installation is completed properly.** Projects that are not completed on time can be handed to other contractors for completion.	At Buena Vista WWTF a new downsized blower was installed but not satisfying the aeration requirement due to severe leaks in the air delivery piping. Follow up phone calls were made to facility operator and new piping was installed to allow the new blower to function properly.

Our experience shows that during this initial interview it is very common for the phone screener to encounter resistance from the facility to commit to an initial site visit. Our track record in gaining access to and enrolling municipal WWTFs is a line of consistent successes, and we see no reason why a similar approach will not continue to succeed. We have encountered roadblocks in the past to scheduling site visits and have solutions to these issues are outlined in Exhibit II-2 - Contingency Table, issue 1.

During the initial site visit for new facilities the project is explained in detail to each facility manager and chief operator. A program brochure, including case studies, is presented to the facility personnel and contact information is requested for the "decision maker" at the facility or the city. It is critical to have this information so future project proposals will not get stalled moving though the chain of command.

Our knowledge of the wastewater treatment industry delegates a high priority to gaining the trust of wastewater staff. This trust is gained through straightforward discussion of our services and outstanding history at other facilities. Gaining the trust of the WWTF's chief operator, and involving operators in every step of this process, is especially important. We have often referred hesitant city officials to operators and public works directors with whom we have worked in the past – our reputation is flawless.

In addition, the initial site visit is used to collect detailed information regarding facility loading characteristics, equipment size (kW), seasonal flow differences, permit problems, etc. Energy consumption estimates are generated from this refined data and candidate facilities are ranked accordingly. If the facility still looks like a favorable candidate a preliminary site audit will be conducted to gather more in-depth measurements.

II.A.1.2 Implementation Candidates - Previously Visited Sites

For facilities where we have completed initial site audits in previous programs we have a good understanding of potential for energy savings at the facility. However, there are a number of reasons why the site may have not been a good fit for a previous program. Typical reasons for lack of participation are:

- Facility was in the middle of completing an upgrade/expansion project.
- Facility management simply thought program benefits were not worth the cost/trouble to implement.
- Previous facility budget had no funds available for a co-pay project.

These facilities need to receive follow up to determine if these issues can now be resolved or no longer exist, for example:

- Upgrade is complete and certain energy efficiency measures were eliminated due to budget constraints.

- Facility management has changed or has new direction/priorities involving energy conservation or cost reduction.

- Early contact is made in time to include project in upcoming facility budget.

The previously visited sites will be contacted to see if these issues can be overcome as shown or through other avenues. If sufficient data is available on the facility, the initial site visit is bypassed and a preliminary site audit will be conducted to gather more in-depth measurements – this may be the case for facilities that have completed an upgrade. Here some resistance may be encountered from facility personnel to commit to an audit. Again, using the same techniques to deal with these roadblocks as shown in Exhibit II-2 - Contingency Table, issue 1, we can successfully schedule an audit.

II.A.2 Task 2 - Preliminary Audit

As a result of the extensive preliminary screening, site visit and phone conversations with facility staff, a strong indication will be established that the facility is a good fit for the program. At this point in the project it is critical to have facility support for the program, in both gathering information and moving the project forward politically. This minimizes the chance of a facility dropping out of the program.

Prior to going on site for the preliminary audit, technical staff will conduct a phone interview with facility personnel. Staff will confirm critical facility information and determine exactly what measurements need to be taken. The preliminary audit consists of two separate parts, the energy consumption analysis and the process analysis. The two parts are described below.

II.A.2.1 Task 2.1 - Energy Baseline Analysis

The Energy Baseline site visit focuses on establishing baseline energy consumption and verifying the initial site visit data that we collected previously. If the initial site visit was bypassed because site data was already on file from a previous project, a program brochure would be presented at this time and the contact information for the decision maker at the facility would be requested.

To create an accurate savings estimate for any energy conservation measure at a facility, the energy consumption baseline must be determined. The baseline is measured on the specific pieces of equipment (typically aeration and/or pumping motors) that will receive controls for the reduction of run-time or be replaced with a more efficient model. The measurement is done by taking instantaneous or "spot" kW readings, in addition to installing logging devices that collect kW data over time. This energy consumption data is collected on short intervals (usually every 15 minutes) for a period of two weeks to one month to get a good understanding of the equipment operation schedules and diurnal flows, and their effect on aeration and pumping requirements. Making these measurements early in the program process is critical to avoid inflated savings estimates. The operation schedules for aeration and pumping equipment in wastewater treatment plants can often be quite complex, changing dramatically on a daily or seasonal basis, or based on who happens to be working at the plant on a particular day.

Conversations with facility staff about operation schedules are also very important, but our experience shows that they must be verified with real measurements.

Once the energy use data has been collected it can be analyzed to establish an accurate baseline for the facility. The data may show inconsistencies or unreasonable values due to faulty logging equipment or tampering with the logger while it was on site. It may also be shown that additional equipment exists that has not been accounted for in the logging thus far. For any of these situations it will be determined if the baseline can be calculated with the current data or if an additional trip to the site for logging and verification is necessary. The energy consumption baseline is the foundation of an accurate savings estimate and thus a successful project. These values must be measured as accurately as possible early in the project.

After an accurate energy baseline has been determined, the decision maker at the facility is sent a program brochure and contacted. He/she will be briefed on the program and the benefits available to the facility based on the energy baseline information collected up to this point. This conversation should lead to some form of verbal support for the project to continue forward. We have encountered resistance to participate at this point in the past, usually because the decision maker is hesitant to agree to anything without more information and time to consider the idea. These issues are addressed with solutions in Exhibit II-2 - Contingency Table, issue 2. Typically an on site presentation on the program will satisfy their concerns and create additional support for the project.

II.A.2.2 Task 2.2 - Process Analysis

With support from the facility decision maker, a process analysis audit is scheduled for the Quantum/BacGen Team. This visit focuses on profiling the facility for precise benchmarking and on-going dynamic optimization modeling through the installation of Quantum/BacGen Team's Respirometry or DOSS (Dissolved Oxygen and Suspended Solids) sensing and data collection units. These units will be positioned within the primary aeration basin/lagoon/aerobic digester where the system's loading and biochemical oxygen demand (BOD) are at their highest. The sensing units (monitoring equipment) are designed to be extremely low maintenance, being both self-cleaning and self-calibrating in-situ. The units are fully programmable and have built-in data logging and fault diagnostics capabilities.

The sensors measure and analyze a broad range of critical system parameters including Oxygen Uptake Rates (OUR), Dissolved Oxygen (DO), Temperature, pH, and Oxygen Reduction Potential. In addition, the units will monitor endogenous respiration rates, respiration rates for each aeration and decay cycle, the dynamic concentration of oxidizable substances and the required system treatment time utilizing biological and hydraulic loading data and dynamic respiration rates. The collected information may then be modeled, calibrated and tuned for optimal system performance and energy utilization recommendations to facility staff.

In addition, technical staff will be gathering information to analyze airflow delivery rates, schedules and efficiencies in activated sludge facilities. This involves procuring blower curves, wiring diagrams, facility layout drawings and dimensions, and any available SCADA

programming logic for aeration. In addition, any existing problems at the facility are discussed and demonstrated.

When all of the necessary data has been collected, technical staff will analyze this information in combination with the energy baseline analysis. From here the overall preliminary audit report can be developed with energy conservation recommendations along with an accurate savings estimate. This audit report also contains estimated project costs and an estimate of funding incentives available for the project based on potential energy savings.

This report is used to generate an audit and recommendations letter, a document designed to convey all of the information from the audit report in more readable format geared toward facility management and decision makers. This letter is part of the preliminary audit report package sent to the facility and the decision maker, containing the following:

- Audit and recommendations letter.
- Executive summary.
- Funding request letter.

The executive summary is a one-page document outlining the project highlights, costs, benefits, and next steps for the decision maker. Experience has shown decision makers avoid reading through lengthy reports to become familiar with a project. They prefer condensed, high level information. The executive summary addresses this issue, allowing the project to be conveyed quickly and easily to non-technical personnel.

The funding request letter is a document the decision maker signs to show a formal interest in the program. It states that the facility would like to proceed further with the project and would like Quantum to set aside program funding for potential project implementation at their facility. The executive summary explains this letter must be signed to move forward with the project, but does not obligate the facility in any way. While there is no explicit obligation, these letters have focused the requisite attention of decision makers and opened a dialogue for moving the project forward. Obtaining a signed funding request letter has been an obstacle in the past, however different methods have been adopted to overcome this. These issues and their solutions are outlined in Exhibit II-2 - Contingency Table, issue 3. This will often require a visit and presentation on the program to the decision maker and other more senior facility/city personnel. Once a presentation and meeting has been completed, we have never had additional resistance in getting a funding request letter signed.

II.A.3 Task 3 - Final Audit

Once the signed funding request letter has been received, the final installation audit will be scheduled with the facility. This audit focuses on the details of actually doing the installation and obtaining cost quotations for labor and equipment.

The final audit is performed by the Quantum/BacGen Team site installation personnel. This audit can be time consuming due to the level of detail required. The final audit can be broken down into two separate areas:

- Electrical system evaluation.
- Communications requirements.

II.A.3.1 Electrical System Evaluation

All facility electronics systems must be inspected and evaluated for the installation of additional equipment. This typically involves individually testing each electrical "bucket" or potential junction where control equipment and wiring will be added. Voltage and amperage values are measured and all wiring systems are evaluated for robustness. The motor control center (MCC) is also evaluated along with any blower wiring and inlet vane adjustment for installation of automated control equipment. A preliminary wiring scheme is created and an electrician is brought on site for an evaluation and price quotation.

II.A.3.2 Communications Requirements

Installations that involve system control and monitoring upgrades for energy efficiency will require communications between the control/monitoring equipment and the facility operator. Communication can be made by hard wire or radio signal. Facility layout (line of sight, distance to control room, topography, etc.) needs to be evaluated to determine which solution is the best fit. In addition, specifications such as system PLC (programmable logic controller) requirements, communication control box location/mounting/wiring, and phone line switching capabilities (for remote monitoring) need to be determined.

After the site data is collected, the Quantum/BacGen Team can create their installation design and specifications. With this completed, pricing information will be assembled from equipment suppliers and service providers, and the final installation audit report can be drafted. The final report contains a detailed written description of the design and installation plan for the facility. It also has all updated cost and savings estimates for the project based on the final design. This report is used by Quantum engineers to generate any additional equipment specifications, installation drawings, price quotes and labor costs from contractors required for installation.

Once this information is assembled, the report is sent as part of the final installation proposal to the decision maker and facility management containing the following:

- Quantum/BacGen Team final installation audit report.
- Executive summary.
- Installation sign-off contract.

The executive summary, again, is a one-page document outlining the project installation costs, benefits, and next steps for the decision maker to progress forward. This document is geared

toward a non-technical audience and can be used by officials at city council meetings to present the project for approval.

The installation sign-off contract is a brief legal document stating that the Quantum/BacGen Team will perform the installation of the described energy conservation measures (in the final installation audit report) for the price indicated minus project incentives. The incentives for each project are based on energy savings and may be large enough to fund the entire cost of the project. This document requires a signature before any installation activities can begin and may be modified to incorporate city or facility legal concerns.

Getting approval for a project installation and a signature on this contract can take time and persistence, even when there is no cost to the city. There are several potential issues surrounding approval that we have encountered in the past, and they are outlined with solutions in Exhibit II-2 - Contingency Table, issue 4. Again, final approval will often require a visit and presentation to city council members and senior facility personnel.

II.A.4 Task 4 - Installation

After approval for installation has been received and the contract has been signed, site installation can be scheduled. The energy conservation measures are installed according to the final installation audit report, all work completed primarily by the Quantum/BacGen Team or contractors supervised by the Quantum/BacGen Team.

When all new equipment installation and process changes have been completed for the installation, the Quantum/BacGen Team will follow up with the facility on a regular basis until the treatment process has stabilized and the facility is satisfied with the installation. There are often small changes and adjustments to be made at the facility to allow treatment to run smoothly and obtain the highest efficiency possible from the installed measures. In other cases, unforeseen issues arise as "side effects" of an installation that may cause problems at the plant. We have dealt with several such issues and these situations are outlined with solutions in Exhibit II-2 - Contingency Table, issue 5. These issues must be resolved to get the facility to sign off on a successful installation and receive incentive funding.

II.A.4.1 Task 4.1 – Conduct Post Installation M&V

After the facility has signed off on the installation, post installation energy consumption must be determined to calculate the final savings achieved for the project. This is completed in the same manner as the baseline energy consumption measurement, with kW readings taken over an extended time period on equipment effected by the project. When the overall savings have been determined, the facility is informed and the project is complete.

The resulting installations provide significant energy and demand savings, a more informed group of operators, and better system management capabilities, all in one comprehensive program.

II.A.5 Task 5 – Hire EM&V Contractor

Independent of the individual project schedule described above, the Quantum/BacGen Team will develop a RFP, solicit three bids from EM&V contractors and choose most qualified and cost effective provider of EM&V services.

II.A.6 Task 6 – Reporting

Based on the schedule shown in Exhibit II-5, the Quantum/BacGen Team will complete the following reporting requirements to the CPUC:

- Monthly Reports (Recurring)
- EM&V Plan
- Final Report to CPUC
- EM&V Report to CPUC
- Final Invoice

II.B MARKETING PLAN

The marketing plan will be similar to the approach used during the last four years of the program. During the implementation of our first program, we tried marketing through direct mail and email – this did not work. Given the skeptical nature of the industry, direct marketing is ineffective, only actual site visits have produced results.

Our extensive market research suggests that the best way to affect energy use practices in the wastewater treatment industry is through recommendations to facility operators. Due to strict permit requirements, wastewater treatment is a conservative trade and operators have strong incentives to maintain the status quo. WWTF operators are not readily influenced by engineering studies or laboratory test results; most are unwilling to be 'guinea pigs' for process modifications untested in the field. In general, process modifications are shunned unless they can be proven at nearby facilities employing similar treatment practices. Facility operators in a given area know each other and talk to one another. They generally value the advice of their colleagues very highly, much more so than that of others outside the trade. To the extent possible, the team will enlist facility operators to talk with local WWTF operators about the project – some have already given an open invitation to talk with others about the program.

To be clear, the project team believes the best way to disseminate project results is to achieve consistent success. This belief is founded upon years of industry research and lessons learned in the team's wastewater-specific work for PG&E, the CEC and the CPUC. However, other means will also be employed.

- Follow up calls will be made to a selection of facilities/cities to answer additional questions and encourage adoption as outlined in the Program Implementation section.

Through compilation of the California Wastewater Database, Quantum/BacGen Team staff has made initial contact with facility operators and will leverage this introduction to promote the new program.

- The project team has used presentations to local government conferences and trade shows to successfully gain interest in adopting energy conservation measures. Project staff will speak or set up booths at such events in California, with a specific focus on rural communities and local governments.

- The project team will use marketing materials based on extensive experience with facility audits and subsequent project work. These materials will usually be hand delivered and explained to facility personnel during site visits. They will also be made available online and sent out only to specific officials in candidate facilities. A program brochure will be created containing the following:
  - A brief overview of the program concentrating on the incentives available and the potential process improvements and cost savings to the facility. Quantum's past experience in wastewater and energy efficiency will also be highlighted. We have learned from past experience that the first questions asked by facility personnel about the program are about the amount and source of the funding available.
  - A letter from the CPUC project manager briefly outlining the scope of the program, attesting to its legitimacy. Past experience has shown most facility personnel are extremely wary of salesmen promising "free money" and cost savings. The need to overcome this perception quickly (before your brochure is thrown away) is critical. A signed letter on utility letterhead with a contact phone number is a very powerful tool.
  - Case studies from past projects. Quantum has developed five case studies based upon earlier implementation projects. Under the current project we will develop additional case studies focused on our successes in different types of treatment facilities. Quantum would like to present case studies to facilities that are relevant to them in some way, either plant design, size, or location. Facility staff can always relate better to a project that was completed successfully in a plant that is very similar or close to their own.

Project costs for marketing related activities are presented below in Exhibit II-3. Projected costs include all general and administrative costs.

Exhibit II-3
Projected Marketing Costs

Program Activity	***Program Objective***	***Projected Costs***
Develop Database	Augment existing database	$6,214
Screen Database	Using Quantum algorithm, develop list of 20 facilities for site visits (See Exhibit III-1 for preliminary list).	$13,759
Develop Program Materials	Develop one program brochure and two case studies	$16,745
Visit Facilities	Visit 20 facilities	$42,075

II.C CUSTOMER ENROLLMENT

The enrollment for the program has evolved based upon lessons learned. Previous incarnations of the program have tried to work solely through operators believing that without complete buy in from operations staff the project will stall. While buy in from operations is still critical, it is also essential to gather support from decision makers early in the project. The process for enrollment is explained in detail in the Program Implementation Section II.A and shown in the flow chart Exhibit II-1. In summary it includes:

- Research eligible facilities for optimum candidates.
- Make initial phone contact with candidate facility staff.
- Recruit facility for a site energy audit.
- Complete site visit and determine facility energy baseline.
- Contact facility decision maker and obtain verbal project OK.
- Perform process audit and send report to facility and decision maker.
- Obtain signature of facility decision maker for funding request and program enrollment..

For wastewater energy conservation projects, enrollment is one of the most difficult aspects of the program. Our experience with facility personnel has led to improvements in the enrollment process. The two most important lessons learned from previous projects for a more successful enrollment process are shown below:

- **Secure some level of commitment earlier in the process.** A number of facilities continued to voice their support and interest in the projects we were developing for them. At the time of final sign-on several operators had not cleared the project with their superiors (Public Work Directors, City Manager). It was only after having invested significant project resources in developing the projects that we were informed we could not proceed. Currently we gather an initial interest and reservation signature from an authority with the city. We also follow up much earlier in the project with a final sign off letter. This final document must be signed by someone with authority to bind the city to a contract.

- **Longer and more frequent biological data gathering.** Previous collection of initial biological data was from facilities, using their own systems. Generally these systems do not have the ability to gather time series data over short intervals (e.g. 15 minutes.) The advantage of gathering time series data earlier in the analysis phase is that it provides a more compelling case to facilities – greater proof that the savings can be achieved in their facility. Currently, once initial interest has been established, full monitoring of the facility is conducted to serve as a better proof of concept.

II.D MATERIALS

The Quantum/BacGen Team will purchase all materials (equipment). Equipment is unique to each project based on plant design. Due to the nature of these projects, most equipment is custom designed to the engineering specifications of each application. For example many projects involve installing automated control on existing aeration systems based on dissolved oxygen readings. These control systems are custom designed for each plant using equipment supplied by the Quantum/BacGen Team. Other projects involve the installation of electric blowers, pumps, or variable frequency drives. In this case an engineering specification for premium efficiency equipment is called for. These materials are procured through and installed by sub-contractors local to the plant. Installation may also be done by qualified plant personnel (when possible) to reduce costs.

II.E PAYMENT OF INCENTIVES

The program does not offer prescriptive rebates but customizes each incentive to the project at hand. Roughly, incentives are a function of the savings achieved in each facility – higher savings, higher incentives. On average, incentive payments are approximately .08¢ per kWh saved annually for equipment and labor for a process optimization installation. This value is based upon average savings values of previous projects as shown in Section IV.A. We do reserve some flexibility, however, to increase, or decrease, incentives based upon each project. For example, a project for a small community may be offered a slightly higher incentive if eliminating any co-pay increases the likelihood of installation.

Depending on the project, incentives have either been paid to the municipality, a sub-contractor working for the municipality, or have been deducted from the installation costs when Quantum has implemented the project.

II.F STAFF AND SUBCONTRACTOR RESPONSIBILITIES

Staff and subcontractor responsibilities are broken down in Exhibit II-4 based on activity. The primary responsible party ("Who") is listed first in collaborative efforts. The activities listed are based on the program implementation process described in more detail in section II.A.

Exhibit II-4
Staff and Subcontractor Responsibilities

Activity	Who
Program Administration and Reporting	QC
Develop Marketing Materials	QC
Initial Program Site Selection and Recruiting	QC
Research Database for Promising Sites	QC
Contact Sites We Have Visited/Schedule Visit	QC
Contact New Sites/Schedule Visits	QC
Initial Site Visit	QC
Preliminary Audit	QC/BG
Energy Baseline Analysis	QC/BG
Install M&V Equipment	QC
Collect M&V Data	QC
Analyze M&V Data - Determine Baseline	QC/BG
Phone Interview by Technical Staff	BG
Contact Decision Maker, Get Verbal OK	QC
Process Analysis	BG/QC
Install DO Monitoring Equipment	BG/QC
Collect DO Data	BG/QC
Analyze DO/Biological/Process Data	BG
Write Preliminary Audit Report	BG
Create Preliminary Audit Report Package	QC/BG
Funding Request Letter Signed	QC
EM&V Contractor Pre-Install Site Visit	EC
Final Audit	BG/QC
Conduct Final Audit	BG
Create Final Installation Report	BG
Get Bids for Equipment and Labor	BG/QC
Create Final Installation Proposal	QC/BG
Facility Approves Installation	QC
Installation	BG/QC/SP
Installation Performed by Staff/Service Provider	BG/SP
Facility Sign Off on Installation	QC
Conduct Post Install M&V	QC
Install M&V Equipment	QC
Collect M&V Data	QC
Analyze Data and Inform Facility	QC
EM&V Contractor Post Install Site Visit	EC
EM&V Contractor Post Analysis	EC

QC - Quantum Consulting
BG - BacGen Technologies
SP - Service Provider (unique to project)
EC - EM&V Contractor

II.G WORK PLAN AND TIMELINE FOR PROGRAM IMPLEMENTATION

The work plan for program implementation is explained in detail in Section II.A along with a Program Implementation Flow Chart shown in Exhibit II-1. A timeline for this plan is outlined in Exhibit II-5 below with task numbers referencing back to descriptions in Section II.A.

Exhibit II-5
Timeline for Program Implementation

Activity	Duration	Start	Finish
Task 1 - Initial Program Site Selection and Recruiting	250 days	1/5/04	12/17/04
Research Database for Promising Sites	60 days	1/5/04	3/26/04
Contact Sites We Have Visited/Schedule Visit	230 days	1/12/04	11/26/04
Contact New Sites/Schedule Visits	230 days	1/26/04	12/10/04
Initial Site Visit	230 days	2/2/04	12/17/04
Task 2 - Preliminary Audit	280 days	2/16/04	3/11/05
Task 2.1 - Energy Baseline Analysis	250 days	2/16/04	1/28/05
Install M&V Equipment	230 days	2/16/04	12/31/04
Collect M&V Data	230 days	3/8/04	1/21/05
Analyze M&V Data - Determine Baseline	230 days	3/8/04	1/21/05
Phone Interview by Technical Staff	230 days	3/15/04	1/28/05
Contact Decision Maker, Get Verbal OK	230 days	3/15/04	1/28/05
Task 2.2 - Process Analysis	255 days	3/22/04	3/11/05
Install DO Monitoring Equipment	230 days	3/22/04	2/4/05
Collect DO Data	230 days	3/29/04	2/11/05
Analyze DO/Biological/Process Data	230 days	3/29/04	2/11/05
Write Preliminary Audit Report	230 days	4/12/04	2/25/05
Create Preliminary Audit Report Package	230 days	4/26/04	3/11/05
Funding Request Letter Signed	230 days	5/3/04	3/18/05
Task 3 - Final Audit	275 days	5/10/04	5/27/05
Conduct Final Audit	260 days	5/10/04	5/6/05
Create Final Installation Report	260 days	5/17/04	5/13/05
Get Bids for Equipment and Labor	260 days	5/24/04	5/20/05
Create Final Installation Proposal	260 days	5/31/04	5/27/05
Facility Approves Installation	260 days	6/14/04	6/10/05
Task 4 - Installation	340 days	6/28/04	10/14/05
Installation Performed by Staff/Service Provider	290 days	6/28/04	8/5/05
Facility Sign Off on Installation	290 days	7/5/04	8/12/05
Task 4.1 - Conduct Post Install M&V	335 days	7/5/04	10/14/05
Install M&V Equipment	290 days	7/5/04	8/12/05
Collect M&V Data	290 days	8/30/04	10/7/05
Analyze Data and Inform Facility	290 days	9/6/04	10/14/05
Task 5 - Hire EM&V Contractor	45 days	1/5/04	3/5/04
Task 6 - Reporting	685 days	1/5/04	3/5/04
Submit EM&V Plan	62 days	1/5/04	3/30/04
Monthly Reports (by 21st of each month)	Recurring	1/5/04	12/30/04
Final Report to CPUC	85 days	1/2/06	5/1/06
EM&V Report to CPUC	130 days	1/2/06	7/1/06
Final Invoice	165 days	1/2/06	8/21/06

III. CUSTOMER DESCRIPTION

III.A CUSTOMER DESCRIPTION

The Cal-POP targets municipal, institutional and agricultural wastewater treatment facilities. As stated below in Section III.D, the program will focus on wastewater facilities within the SCE service territory, but outside of the Los Angeles Basin.

III.B CUSTOMER ELIGIBILITY

Any municipal, institutional and agricultural wastewater treatment facility under 15 MGD is eligible for the program. The program will make exceptions for facilities that are out of compliance with State water quality control regulations.

Quantum has pre-screened our database and identified 20 facilities as initial candidates shown in Exhibit III-1. Depending on the facility's interest and other factors, facilities on this list may not make it to the screening phase.

Exhibit III-1
Candidate Facilities

Facility name:	Location of plant (city):	County:	Managing entity:	Summer flow (MGD):	Treatment type:
LANCASTER WWTF	LANCASTER	LOS ANGELES	Los Angeles County Sanitary District	13	Aerated Lagoon
LINDSAY WWTF	LINDSAY	TULARE	City of Lindsay	1.1	Activated Sludge
LYTLE CREEK WWTF	LYTLE CREEK	BERNARDINO	Crestline Sanitary District	0.1	Activated Sludge
PALM DESERT (PLANT #10) WRP	PALM DESERT	RIVERSIDE	Coachella Valley Water District	12	Activated Sludge
PALMDALE WWTF	PALMDALE	LOS ANGELES	Los Angeles County Sanitary District	9	Aerated Lagoon
PORTERVILLE WWTF	PORTERVILLE	TULARE	City of Porterville	4.6	Activated Sludge
RIPLEY WWTF	RIPLEY	RIVERSIDE	Riverside County Sanitation Authority	0.05	Aerated Lagoon
TAPIA WWTF	CALABASAS	LOS ANGELES	Las Virgenes Municipal Water District	9.5	Activated Sludge
WILLOW CREEK WWTF	ARROWHEAD	BERNARDINO	Lake Arrowhead CSD	0.5	Activated Sludge
AVALON WWTF	AVALON	LOS ANGELES	City of Avalon	0.85	Activated Sludge
BRIDGEPORT WWTF	BRIDGEPORT	MONO	Bridgeport PUD	0.03	Aerated Lagoon
CAMARILLO ST HOSP WWTF	CAMARILLO	VENTURA	na	1.4	Activated Sludge
CARPINTERIA WWTF	CARPINTERIA	BARBARA	Carpinteria Sanitation District	1.65	Activated Sludge
GLEN HELEN WWTF	SAN BERNARDINO	BERNARDINO	San Bernardino County	na	na
MAMMOTH COMMUNITY WWTF	MAMMOTH LAKES	MONO	Mammoth Community Water District	1.6	Activated Sludge
MARICOPA WWTF	MARICOPA	KERN	City of Maricopa	0.03	na
POMONA WRP	POMONA	LOS ANGELES	Los Angeles County Sanitary District	12	Activated Sludge
VALENCIA WWRP	VALENCIA	LOS ANGELES	Los Angeles County Sanitary District	14	Activated Sludge
YUCAIPA VALLEY WATER DISTRICT WWTP	YUCAIPA	BERNARDINO	Yucaipa Valley Water District	3.5	Activated Sludge
CAMARILLO WWTF	CAMARILLO	VENTURA	Camarillo Sanitary District	3.7	na

In addition to these municipal facilities, Quantum received more than 10 audits from the California Department of Corrections. The audits have been analyzed by Quantum staff and show significant cost-effective savings opportunities.

III.C CUSTOMER COMPLAINT RESOLUTION

After working with nearly 20 municipalities over the last two years, the project team has yet to experience a complaint. Should complaints or questions arise, they should be forwarded to the project manager, Derrick Rebello, at 510-540-7200.

The project team will work with equipment manufacturers to replace any faulty equipment. Complaints related to treatment quality will be handled as follows:

1. Facility will be instructed to immediately revert to pre-installation protocols.
2. Program staff will work with facility and review data to identify any problems.
3. As needed project staff will visit facility to further investigate problems.
4. Once problems are identified, project staff will develop new set of protocols.
5. If facility still has problems or complaints, equipment will be removed from the facility at no charge.

III.D GEOGRAPHIC AREA

The Cal-POP program will be targeted at areas outside of the Los Angeles Basin.

IV. MEASURE AND ACTIVITY DESCRIPTION

IV.A ENERGY SAVINGS ASSUMPTIONS

Energy savings assumptions are based upon our previous program including the 2002-2003 CPUC program, and previous Quantum wastewater programs. Measures for this program are process optimization installations and process audits. Based upon the previous 21 installations, and shown in Exhibit IV-1, the average savings for a less than 15 MGD facility is 766,243 kWh. If installed and committed facilities are analyzed, as shown in Exhibit IV-2, average savings per installation is 617,094 kWh. A specific example is provided in the case study for the City of Riverbank, Exhibit IV-3 (additional case studies are provided in Appendix B.) The project will assume, conservatively, that the gross average facility savings is 500,000 kWh.

Exhibit IV-1
Annual Savings for Previous Process Optimization Installations

Facility Name	Utility	Annual Savings (kWh)
Buena Vista	PG&E	163,374
Ceres	PG&E	1,051,200
Coalinga	PG&E	243,638
Escalon Dom	MID	525,600
Escalon Ind	MID	246,375
Fallbrook	SDG&E	394,200
Gustine	PG&E	326,617
Hill Canyon	SCE	102,492
Hollister	PG&E	2,518,500
King City	PG&E	1,971,000
Lake Camanche	PG&E	48,478
Lake County	PG&E	328,500
Lemoore	PG&E	1,559,280
Lincoln	PG&E	389,820
McFarland	PG&E	657,000
Moorpark	SCE	657,000
Nipomo	PG&E	326,967
Red Bluff	PG&E	492,750
Riverbank	MID	3,613,500
San Simeon	PG&E	85,000
Willows	PG&E	389,820
AVERAGE		766,243

Exhibit IV-2
Annual Savings for Previous Process Optimization Installations
Including Commitments

Facility Name	Utility	Annual Savings (kWh)
Atascadero	PG&E	555,471
Avenal	PGE	657,000
Bass Lake	PG&E	80,000
Blythe	SCE	294,270
Buena Vista	PG&E	163,374
Ceres	PG&E	1,051,200
Coalinga	PG&E	243,638
Corona	SCE	130,000
Deer Creek	PG&E	432,000
Del Rey	PG&E	230,456
Escalon Dom	MID	525,600
Escalon Ind	MID	246,375
Fallbrook	SDG&E	394,200
Goleta	SCE	19,597
Gustine	PG&E	326,617
Hill Canyon	SCE	102,492
Hollister	PG&E	2,518,500
Ironhouse	PG&E	800,000
King City	PG&E	1,971,000
Lake Camanche	PG&E	48,478
Lake County	PG&E	328,500
Lancaster	SCE	230,000
Lemoore	PG&E	1,559,280
Lincoln	PG&E	389,820
McFarland	PG&E	657,000
Montecito	SCE	78,840
Moorpark	SCE	657,000
Nipomo	PG&E	326,967
Red Bluff - Digestor	PG&E	492,750
Red Bluff - Aeratino Basin	PG&E	163,308
Rialto	SCE	460,000
Riverbank	MID	3,613,500
San Simeon	PG&E	85,000
Santa Barbara	SCE	2,100,000
Summerland	SCE	65,323
UC Davis	PG&E	657,000
Western Riverside	SCE	405,194
Willows	PG&E	389,820
AVERAGE		617,094

Exhibit IV-3
Riverbank Case Study

California Process Optimization Program
Case Study No.1

City of Riverbank Wastewater Facility:

Lower Operating Costs, Stable Treatment Process with Energy-Efficiency Improvements

Aeration pond at the City of Riverbank wastewater facility. The Central Valley city, population 16,000, will save a projected $20,000 annually in energy costs through process improvements fully funded by the California Process Optimization Program.

At Riverbank's wastewater treatment facility, recent monitoring showed that selected aerators could be switched off part-time with no change in treatment quality. This strategy will reduce energy use by an average of 18 percent and save $20,000 annually while giving operators real-time data to help fine-tune treatment.

The Facility: 3 to 4 mgd of Municipal and Cannery Wastewater

In early 2002, the Riverbank facility underwent a free process audit funded by state agencies and utilities as part of the California Process Optimization Program (CalPOP) for wastewater facilities.

The facility handles 1.5 million gallons per day (mgd) of municipal wastewater year round and as much as 2.5 mgd of tomato cannery wastewater from July to October. In summer, three aeration ponds treat the combined influent. Pond 1, with three 75-horsepower (hp) aerators, and Pond 2, with fourteen 75-hp aerators, discharge into Pond 3, which has three 50-hp and two 75-hp aerators. Pond 3 feeds into a series of polishing and percolating ponds. In winter, the facility treats only municipal wastewater, and Pond 2 becomes inactive.

Process Audit Identifies Energy Savings

CalPOP's authorized team from Quantum Consulting/BacGen Techologies audited the facility. They found:

- In Ponds 2 and 3 during summer, because of algae growth during daylight hours and resulting diurnal variations in dissolved oxygen (DO) levels, some aerators could be switched off part of the time.
- In Pond 2 during summer, additional aerators likely could be switched off during the beginning and end of the cannery season.
- In Ponds 1 and 3 during winter, because of diurnal DO variations, some aerators could be switched off part of the time.

The Quantum/BacGen team recommended that it install a DO monitoring system, then, working with facility operators, use the data to optimize aeration schedules.

(Continued on other side)

Monitoring and New Computer Give Real-Time Data

With 100 percent funding through CalPOP, the team installed two self-cleaning, floating DO probes.* The first probe was located in Pond 3. The second probe will alternate between Pond 1 in winter and Pond 2 in summer. The probes are mounted on an aluminum float anchored by stainless steel cable to shore-mounted posts. Aerator timers were already in place.

The probes transmit data on changing DO levels via a wireless radio modem/antenna to a newly installed system control and data acquisition (SCADA) PC system in the facility's office/lab building. The system includes a screen displaying real-time DO levels and an alarm screen in case the probes malfunction.

Results: Optimized Aeration Schedule, Significant Cost Savings

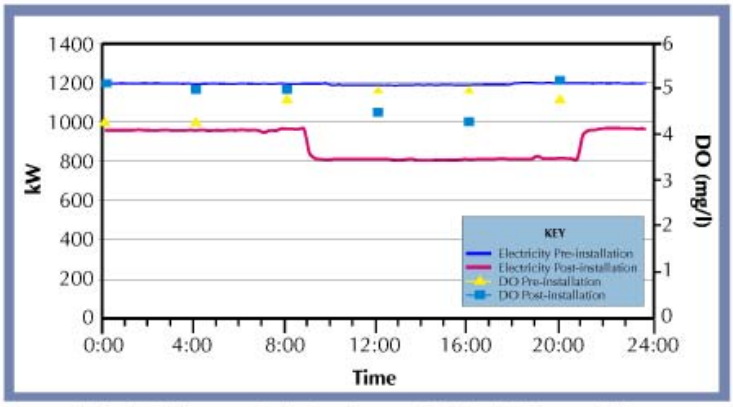
The Quantum/BacGen team remotely monitored the SCADA system. Then, with the summer cannery season already underway, the team helped implement a new aerator operation schedule based on the DO trends.

Two of the fourteen aerators in Pond 2 were switched off continuously and two additional aerators were switched off for twelve daylight hours. In Pond 3, three aerators were turned off during the twelve daylight hours. As the cannery season tapered off, more aerators in Pond 2 were switched off. For both ponds, the probes showed that DO levels were similar to historical levels.

The team expects that during winter, all three aerators in Pond 1 will be switched off for three hours/day and two aerators in Pond 3 will be switched off for eight hours/day.

The team trained facility operators on how to use the monitoring system and adjust timer settings. Now, operators access both real-time and historical data on DO and other trends. The city will save an estimated $20,000 annually because of the optimized schedule.

*Project funding through SB-5X and administered by California Energy Commission.



Average daily electricity use and dissolved oxygen (DO) levels before and after optimization of aerator schedules. With a minor decrease during aerator switch-off, DO remains well above the level required for adequate treatment.

California Municipal Wastewater Treatment Facility Process Optimization Program (CalPOP)

- Fully funded by state agencies and utilities
- More than $2.5 million still available
- Pays for energy-saving process improvements at any municipal forced-aeration wastewater treatment facility
- Training and equipment included
- No financial obligation to facility

Since 2001, CalPOP has helped public wastewater treatment facilities cut energy costs by optimizing processes. Twelve California treatment facilities have already benefited. In less than six months, plant operators gained more information, more stable processes, and lower costs. CalPOP's authorized representative Quantum Consulting/BacGen Technologies worked hand in hand with plant operators to perform free process audits, install new monitoring equipment, and provide training.

For more information or to sign up, contact:

Derrick Rebello, CalPOP Representative
Quantum Consulting
(510) 540-7200
drebello@qcworld.com

QUANTUM CONSULTING BACGEN TECHNOLOGIES

Savings for the process optimization installations can include the following: mechanical timers, dissolved oxygen probes, total suspend solids probes, SCADA programming and optimization, control systems with dissolved oxygen set-points, motor change out, aeration blower VFDs, etc.

The process audit energy savings is based upon a similar approach used during our CEC program. We are taking a conservative approach that assumes on average a facility can throttle back blower inlet vanes, or reduce timer schedules such that less than three horsepower reduction is achieved. A three horsepower reduction translates to 19,905 in annual energy savings. For process audits we will conservatively assume annual process audit and training (non-installation) impacts of 15,000 kWh annually.

IV.B DEVIATIONS IN STANDARD COST-EFFECTIVENESS VALUES

Net to gross ratio and estimated useful life were attained from the Policy Manual and do not deviate. Cal-POP is a process optimization/overhaul program implying an estimated useful life of 20 years. The Policy manual states that "all other nonresidential programs is 0.80". For the process audit component of the program the manual states that the estimated useful life is three years. The process audit will use the net to gross ratio for "Industrial Information and Services," 0.73.

Incremental costs for the process optimization installations is assumed to be $91,000, the cost of a process optimization installation, plus the average facility contribution for the last 21 installations, $2,300. Total incremental cost for process optimization installations is $93,300. Incremental measure cost for the process audit is assumed to be the cost of the audit, $8,700.

IV.C REBATE AMOUNTS

Incentives for the program are closely tied to the barriers present when providing energy efficiency to wastewater facilities. As stated in Section I, programs such as SPC do not serve the wastewater industry for two primary reasons, 1) the program does not compensate directly for audits, and 2) incentives are not high enough to move a conservative and status quo focused industry. Given the focus on system biology, wastewater audits are significantly more expensive than pure mechanical audits. Furthermore, the risk of a facility not implementing energy efficiency measures is sufficiently high that few would be willing undertake this task at their own expense. Rebates for process optimization installations are $91,000, which includes process audits, systems specifications, training, and all equipment and installations. The rebate for process audits is only $8,700.

IV.D ACTIVITIES DESCRIPTIONS

All implementation activities produce energy savings. Marketing activities are presented in Section II.

V. GOALS

V.A ENERGY SAVING TARGETS

The total gross program savings goal is 2,500,000 kWh for five facilities, with average savings of 500,000 kWh per facility. The savings targets are based upon previous installations where the average annual per facility energy reduction is 766,243 kWh, and are therefore conservative estimates. Current 2002-2003 CPUC projects will average 617,094 kWh savings. A list of the 21 previous installations is presented in Exhibit IV-1.

V.B DEMAND SAVINGS TARGETS

Based upon implementation in five facilities, the Program expects to reduce demand by at least 50kW per facility. Total program demand reduction will be 250kW.

V.C NON-ENERGY / DEMAND PROGRAM GOALS

Ideally the Cal-POP program will have lasting effects and help reduce barriers to energy efficiency adoption with the wastewater industry. In reality, the barriers for this industry are significant and require intervention from regulatory agencies such as the California Water Resources Board, or California Regional Water Quality Control Boards. Cal-POP will continue to show that energy efficiency and permit compliance can go hand in hand.

VI. PROGRAM EVALUATION, MEASUREMENT AND VERIFICATION

VI.A EVALUATION, MEASUREMENT AND VERIFICATION PLAN

The measurement and verification plan will follow those used in previous work. Program staff will install 15-minute interval recorders in each implementation site prior to installation of control and monitoring equipment. Data will be collected for at least two weeks prior to installation. Post-installation data will be collected for one month after full implementation of protocols. Note that experience shows that it may take as long as two months to collect sufficient DO and MLSS data before protocols can be refined. Once protocols have been implemented, one month of data will be collected. Load recorders will be kept in each facility, so additional data may be available. Average load shapes for pre-installation and post-installations periods will be generated, with the difference serving as the average daily impact. The average daily impact will be annualized to generate annual savings estimates. The measure life for this program based upon CPUC documents is 20 years. Our field experience shows that free-ridership is zero for the target of this program, small and medium sized facilities.

The role of the M&V contractor will be two fold. First, the M&V contractor will verify that the equipment is installed and functioning in facility. This task will be accomplished by doing a pre and post inspection of the facility. Second, the M&V contractor will analyze savings calculations produced by Quantum staff. Note Quantum staff will install recorders and collect all program data. The M&V contractor will have access to all datasets included both "raw" and "cleaned" data. Quantum staff will provide documentation on the data cleaning process.

VI.B EM&V PROVIDERS

Quantum has selected two potential EM&V contractors to evaluate the program.

Itron

Itron has experience conducting EM&V of Distributed Generation (DG) installed at wastewater facilities under the CA Self Generation Incentives Program. Under this program, wastewater treatment facility operations management team installs DG equipment to generate additional electricity from digester gas captured during the processing of wastewater. Itron's role under this Program is to conduct site specific EM&V on the energy produced and the efficiency at which the DG plant operates, while ensuring that the sensitive nature of the process operations are not disrupted. Additionally, Itron has evaluated the technical, economic and the market potential for enhancement of biogas production and utilization at both wastewater treatment and centralized dairy waste facilities within a local region in Southern California that are partially funded under the CEC's PIER RD&D Program. EM&V plans are currently under development for these biogas projects.

SBW Consulting

SBW Consulting, Inc, established in 1990, provides audit, end use metering, diagnostic testing, and savings verification services to electric, water and gas utilities, government agencies and corporate end users. These services help their clients identify, implement and evaluate cost-effective energy, water, and other resource efficiency projects in commercial and industrial facilities. Their engineering staff has extensive experience with efficiency improvements for a wide variety of industrial processes, including wastewater. SBW has a broad range of experience in the wastewater treatment industry including operation of municipal wastewater treatment plants; pilot testing wastewater treatment processes; working with a regulatory agency to establish effluent permit requirements; and designing wastewater treatment facilities. Staff have conducted feasibility studies on use of bio-solids in land application and evaluated pilot testing of a sludge drying process.

VI.C EM&V BUDGET

Per industry standards, five percent of the program budget will be dedicated to EM&V. The total EM&V budget for the program is $35,420.

VII. QUALIFICATIONS

Quantum Consulting and BacGen Technologies have successfully delivered energy efficiency installations to numerous California wastewater facilities since 1999. The close collaboration of the two firms is certainly a source for our success, in delivering cost-effective process optimization installations. Prime and subcontractor do not give justice to the working relationship of the firms.

These projects have been funded by PG&E, the California Energy Commission, and most recently through California Public Utility Commission. Under our 2002-2003 California we have already completed installations in five facilities, with more than nine months remaining to complete the remaining 15 installations.

VII.A PRIMARY IMPLEMENTER

Quantum has transferred its deep understanding of the energy efficiency market for wastewater treatment facilities into successful installations. Our understanding of market barriers for the industry and municipal government has been used to our advantage to move audits to implementations. Under three previous programs, described below, Quantum and BacGen have saved more than 16,901 MWh annually through 21 California wastewater facility process optimization installations. Our previous installation programs are described in detail below.

VII.A.1 Quantum Consulting Projects

Wastewater Retro-commissioning, CPUC Third Party Local Program 2002-2003. Quantum Consulting and its technology partner, BacGen Technologies, have been providing two optimization or 'retro-commissioning' programs for wastewater treatment facilities (WWTFs) in California. The goal of these programs is to achieve significant energy savings and demand reduction at these facilities. The program is currently involved with over 100 sites across the State and expects to implement process optimization implementations in more than 20 facilities, thereby exceeding our program goal.

- **Installations to date – 5**
- **Installed savings to date – 967,928 kWh**
- **Installed and Committed savings to date – 5,841,029 kWh**

PG&E Cross-cutting Demand Wastewater Retro-commissioning Project, Phase I. The WRP Team implemented the Wastewater Retro-commissioning Project (WRP) in PG&E service territory. This project identified eight municipal wastewater treatment facilities of which four were selected for full implementation, including the installation of a wastewater monitoring and process control system. Facilities were selected following a rigorous screening process involving hundreds of preliminary phone audits and dozens of subsequent on-site audits. Monitoring and process control systems installed at selected facilities have resulted in 40 to 75 percent energy

reduction, depending on the facility. WRP was installed to help PG&E meet its summer demand reduction goals.

PG&E Cross-cutting Demand Wastewater Retro-commissioning Project, Phase II. This project is a continuation of the Cross-cutting Demand Wastewater Retro-commissioning Project Phase I. Ten additional municipal wastewater treatment facilities were selected for Phase II. These facilities were selected based on audit data collected during Phase I. Retro-commissioning installations at these eight facilities provided approximately 1262 kW reduction between Noon and 8:00 P.M. and achieved 5,922,308 annual kWh savings.

- **Installations to date – 8**
- **Installed annual savings– 5,922,308 kWh**
- **Installed and Committed annual savings– NA (project complete)**

CEC Municipal Wastewater Retro-Commissioning Program. Quantum Consulting completed the Municipal Wastewater Retro-Commissioning Program for the California Energy Commission. Aaggressive implementation of retro-commissioning was implemented in eight facilities. Following walk-through audits, comprehensive monitoring and process control systems were installed at these facilities, with expected peak demand reduction of 25 to 75 percent per facility. At an additional 100 facilities, energy conservation measures were recommended to facility staff along with the technical assistance and training to implement these recommendations. Project staff actively sought out funding for implementations.

- **Installations to date – 8**
- **Installed annual savings– 8,721,675 kWh**
- **Installed and Committed annual savings– NA (project complete)**

VII.A.2 Quantum Consulting Staff

Derrick Rebello, Ph.D., Principal. Dr. Rebello has over ten years of experience in energy efficiency evaluation and implementation. Dr. Rebello has managed more than $7M in wastewater implementation, achieving significant energy and demand savings. In addition to wastewater implementation projects, Dr. Rebello has conducted the most in-depth market assessment of wastewater facilities and their views on energy efficiency. This has given Dr. Rebello a clear understanding of the energy efficiency market barriers in the wastewater industry, and how best to deliver energy efficiency products and services to the industry.

Eric Eberhardt, Senior Consultant. Mr. Eberhardt has a broad engineering background in thermal/mechanical design in addition to programming and consulting experience. He has also spent time in a technical sales and marketing role working with potential customers to establish business relationships. As a Senior Consultant at Quantum Consulting he has filled a project engineering and management role in the California Wastewater Optimization Project. Mr. Eberhardt has worked to research qualified candidates and conduct facility site audits for energy efficiency. He has completed detailed energy savings analysis, created detailed site recommendation reports and managed implementations of recommended energy efficiency

measures in wastewater treatment facilities. Mr. Eberhardt has also coordinated measurement and verification (M&V) efforts to establish energy baseline consumption for various processes in treatment plants. In addition, Mr. Eberhardt has created a comprehensive database cataloging every wastewater treatment facility in the state of California along with the corresponding technical audit data. Mr. Eberhardt has a B.S. degree in Mechanical Engineering from the University of Wisconsin, Madison.

William Mastrude, Field Technician. Mr. Mastrude, as a metering systems and equipment technician, is responsible for field operations, implementing on-site auditing and whole premise / end-use metering projects for residential, commercial, municipal and industrial utility customers. At Quantum, Mr. Mastrude has performed metering site inspections and installed monitoring equipment for residential, commercial, and industrial sites as part of comprehensive DSM program evaluations for many utilities including Florida Power & Light. Major end uses evaluated in the commercial DSM programs include chillers, DX HVAC systems, and lighting systems. Mr. Mastrude has conducted on-site inspections and installed data loggers and metering systems for impact assessments of utility retrofit programs and commercial and residential load control programs. His duties include coordinating the work of outside contractors, performing site surveys, designing metering installation plans, specifying and purchasing metering equipment, installing metering hardware, and repairing and calibrating equipment. Mr. Mastrude has also installed power monitoring equipment and Respirometry or DOSS (Dissolved Oxygen and Suspended Solids) sensing and data collection units in municipal wastewater treatment facilities. Wastewater facility metering and data collection was completed as part of the California Public Utilities Commission Municipal Wastewater Retro-Commissioning and Process Optimization Program.

Adan Rosillo, P.E., C.E.M. Senior Associate. 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 wastewater and HVAC systems design operation and analysis, computer simulation, utility rate analysis, project cost estimating, and energy savings analysis. At Quantum Consulting, Mr. Rosillo performs detailed engineering analysis and manages major retro-commissioning construction projects in wastewater treatment facilities under the Municipal Wastewater Retro-Commissioning and Process Optimization Program sponsored by the California Public Utilities Commission.

Mr. Rosillo's previous experience includes working for a wastewater treatment facility and two energy service companies. As senior project engineer he has conducted on-site audits, taken spot measurements, performed functional test on mechanical equipment, and installed data loggers in support of impact assessments of energy retrofit programs. He has also done an extensive amount of mechanical equipment and systems design and selection for institutional and commercial facilities.

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.

VII.B SUBCONTRACTORS - BACGEN TECHNOLOGIES

BacGen Technologies, Inc., was founded in 1997 and has endeavored to develop water treatment practices and process protocols that allow for the highest quality treatment at the lowest possible operating cost. Over the last five years they have surveyed hundreds of municipal water facilities with this highly specific objective, establishing an unmatched expertise in energy efficient treatment process and technology.

The resulting **BacGen solutions** have now been deployed in freshwater and wastewater facilities throughout the Northwestern United States and California - creating a higher quality level of treatment while delivering significant energy savings. In addition, they have developed funding strategies that help municipalities take advantage of these technologies and services immediately - instead investing significant levels of time and effort to find funding alternatives of their own.

VII.B.1 BacGen Technologies Projects

Northwest Energy Efficiency Alliance BioWise Project: In this unique project, the Alliance is funding the development and demonstration of a process optimization technology that will greatly enhance a wastewater treatment facility's ability to process effluent. The project targets municipal, industrial, and agricultural wastewater facilities. As part of the project, a business plan was be developed and implemented along with dissemination of demonstration site results. BacGen expects to enlist 20 facilities for full implementation by 2005, and will develop a long-term sustainable business model focused on shared savings/service agreements.

Bonneville Power Administration Energy Conservation Program. BacGen will implement Re-commissioning at up to 20 municipal water and wastewater facilities through 2002. The initial five implementations will be fully funded by BPA in order to establish "localized" project credibility. At the remaining 15 sites, BPA will pay $.18 per kWh saved (based upon a pre-upgrade annual projection) or 80% of upgrade cost, whichever is less. The remaining cost payment shall be negotiated solely between BacGen and participating municipalities. Energy savings will be measured based on historical vs. current electricity usage as noted on power billing statements. Assuming continued positive performance, BacGen expects project continuation into 2003.

VII.B.2 BacGen Technologies Staff

Maud de Bel, Ph.D, PE. Dr. de Bel is a process engineer with expertise in process optimization. She is an internationally renowned expert in respirometry. She will be responsible for facility profiling, benchmark calibration, and monitoring, in addition to process performance tasks and identification of potential energy conservation measures opportunities.

Martin J. Shain, President, has been successful in bringing BacGen Technology to the market in the Pacific Northwest. Under Mr. Shain's direction eight facilities are either using the

technology, or have agreed to use the technology. Mr. Shain has deep experience and success in identifying market opportunities and developing strategic, executable methods to capitalize on such conditions. He has over 20 years of direct experience in creating product and service businesses addressing varied industries from environmental technologies and consumer packaged goods to Internet distributed software applications.

Rodger Phillips, CFO has been directly involved in all aspects of implementing BacGen in the Pacific Northwest. Mr. Phillips has a strong background in both chemistry and biochemistry within wastewater treatment plants with a focus on microbiological testing via DNA testing Denaturing Gradient Gel Electrophoresis – Phospholipid Fatty Acid (DGGE-PLFA).

Richard Ely, Ph.D. Dr. Ely is a Professor and Department Chair of Biochemistry at Yale University. Dr. Ely is one of the foremost experts in wastewater treatment and wastewater system biology specifically. Previously, Dr. Ely was wastewater toxicology and field specialist for more than 20 years at Brown and Caldwell's. Dr. Ely is well published and lectures extensively on the areas of toxicology, respirometry, and the DNA profiling of wastewater biology.

Greg Rupert, Ph.D, Dr. Rupert is Professor of Environmental Sciences at Georgia Tech where he focuses on water treatment and distribution, and wastewater collection system efficiency. Dr. Rupert has worked with numerous water and wastewater facilities in the Southeast on implementing efficiency strategies for water and wastewater.

Thomas Reid Mr. Reid has more than 30 years experience as a Supervisory Control and Data Acquisition System (SCADA) systems and telemetry architect, and specialist. Mr. Reid has been a graded wastewater facility operator. Mr. Reid heads all aspects of BacGen's SCADA systems, PLC, and telemetry design, development and installation.

VII.C RESUMES

VII.C.1 Resumes – Quantum Consulting

DERRICK M. REBELLO, Ph.D.

Dr. Rebello has over ten years of experience in energy efficiency evaluation and implementation. Dr. Rebello has managed more than $7M in wastewater implementation, achieving significant energy and demand savings. In addition to wastewater implementation projects, Dr. Rebello has conducted the most in-depth market assessment of wastewater facilities and their views on energy efficiency. This has given Dr. Rebello a clear understanding of the energy efficiency market barriers in the wastewater industry, and how best to deliver energy efficiency products and services to the industry.

Dr. Rebello has also recently completed conducting a process evaluation and market assessment of the Third Party Initiatives Program for the California Board for Energy Efficiency. This evaluation analyzed 13 different markets, ranging from residential new construction, to training of rural building inspectors. Dr. Rebello is currently managing two process evaluations and market assessments for the Northwest Energy Efficiency Alliance. Other recent process evaluations have shown diversity ranging from an evaluation of PG&E's data collection systems, procedures and processes to an evaluation of the processes and procedures within Southern Company's Direct Load Control and Customer Controlled Load Management Programs.

EXPERIENCE

Principal ***Quantum Consulting Inc.***
(1993 to present)

PG&E Cross-cutting Demand Wastewater Retro-commissioning Project, Phase I. The WRP Team implemented the Wastewater Retro-commissioning Project (WRP) in PG&E service territory. This project identified eight municipal wastewater treatment facilities of which four were selected for full implementation, including the installation of a wastewater monitoring and process control system. Facilities were selected following a rigorous screening process involving hundreds of preliminary phone audits and dozens of subsequent on-site audits. Monitoring and process control systems installed at selected facilities have resulted in 40 to 75 percent energy reduction, depending on the facility. WRP was installed to help PG&E meet its summer demand reduction goals.

PG&E Cross-Cutting Demand Wastewater Retro-commissioning Project, Phase II. This project is a continuation of the Cross-Cutting Demand Wastewater Retro-commissioning Project Phase I. Ten additional municipal wastewater treatment facilities were selected for Phase II. These facilities were selected based on audit data collected during Phase I. Retro-commissioning efforts at these ten facilities will provide approximately 1262 kW reduction between Noon and 8:00 P.M. and should achieve 2,704,650 annual kWh savings. Site access and installation agreements are completed at three of the ten Phase II facilities and installation in those facilities

will be completed by the end of 2001 with the remainder of the ten to be completed by March 2002.

California Energy Commission Municipal Wastewater Retro-Commissioning Program. Quantum Consulting currently operates the Municipal Wastewater Retro-Commissioning Program for the California Energy Commission. Twenty facilities will be selected for aggressive implementation of retro-commissioning. Following walk-through audits, comprehensive monitoring and process control systems will be installed at these facilities, with expected peak demand reduction of 25 to 75 percent per facility. At an additional 100 facilities, energy conservation measures will be recommended to facility staff along with the technical assistance and training to implement these recommendations. Project staff will actively seek funding for implementations. This program will deliver an expected 6 MW of peak demand reduction.

Consulting and Management Assistance for SoCalGas' Residential Programs. Under this contract QC assists the SoCalGas in day to day management of some residential programs including the single family and multi-family RCP, Statewide Appliance and Lighting, and Third Party Initiative program.

Evaluation of the 1998 California Third Party Initiative Program for Southern California Edison. QC, as the primary contractor in association with Megdal & Associates and Shel Feldman Management Consulting, performed a process evaluation of the Third Party Initiative program. As part of this evaluation, the QC team conducted a series of focus groups, in-person interviews and phone interviews. In addition, the QC team conducted individual market assessments for 13 diverse markets.

Evaluation of the Fan Speed Market Transformation Program for NEEA. QC is responsible for characterizing the market for pneumatic conveyance systems used in the wood products industry. The characterization will include identify all barriers and possible interventions for each actor. QC is also responsible for reviewing all interview guides for their effectiveness, accuracy and lack of bias.

Evaluation of the BacGen BioWise Market Transformation Program for NEEA. QC is the primary contractor for this market transformation assessment of a new wastewater treatment additive. During the initial phase of the evaluation QC will be establish a baseline for the aerated lagoon market. Interviews with all market actors, from plant operators and engineers to regulators and community groups, will provide the foundation for the market baseline.

Process Evaluation for PG&E's Electric Load Data Services Department. Dr. Rebello was the project manager for the process evaluation of PG&E's Load Data Services Department. As part of this project, QC conducted a thorough evaluation of the procedures and processes used to collect load data. This analysis was supported by a thorough review of current procedures, observation of daily activities, and interviews with analysts, trainers, and managers.

Residential End-Use Data Development Project for Houston Lighting & Power and EPRI. Dr. Rebello was the senior analyst for this research project. Quantum Consulting assisted HL&P in the design, collection and analysis of baseline residential end-use load shapes and supporting customer information. The REUDDP is producing robust, segment-level, whole-premise, and

end-use data that HL&P can use for market analyses, competitive assessments and demand-side planning and evaluation.

QC prepared a detailed Data Development Plan for collection of baseline residential end-use load shapes and supporting customer and end-use information. The integrated REUDDP Plan included an internally consistent analysis plan, data development plan, and sample design. This Plan was founded on detailed interviews of HL&P employees in several departments conducted by the QC project staff. The Plan employed state-of-the-art data leveraging techniques to make full use of a relatively small sample of end-use metered sites, nested within a larger sample of audited sites with whole-premise metered load data.

Evaluation of Union Electric's "No Sweat" Direct Load Control Program. Dr. Rebello was the senior analyst for this research project. Quantum Consulting evaluated the "No Sweat" Direct Load Control Program for Union Electric. The evaluation was supported by air conditioner load data from approximately 240 participants. Metered air conditioner load data were available for 40 of these customers; for the remaining 200 customers, air conditioner load profiles were derived by disaggregating their premise level load profiles using the Heuristic End-Use Load Profiler (HELP™). These air conditioner data were used for three primary tasks. First, the duty cycle approach was used to derive impacts by day type for four cycling strategies. Second, feeder level impacts were subsequently estimated. Third, these impact estimates were used in conjunction with weather data to estimate an impact prediction model.

Evaluation Plan to Measure T&D Impacts of Targeted DSM Program for Seattle City Light. Dr. Rebello was the senior analyst for this research project. Quantum Consulting developed an integrated Evaluation Plan to assess the transmission and distribution (T&D) impacts of SCL's Peak Energy Program. The Program is a geographically targeted load control program designed to reduce load on two distribution feeders in the Highline/Duwamish area of SCL's service territory. The Plan describes the customer metering and survey activities that SCL can undertake to meet the objectives of the Program. QC made recommendations in the Plan for the Program, based on the measurement goals and Program budget.

Design and Analysis for Residential Appliance End-Use Metering Study (RAEUS) Project for Southern California Edison. Quantum Consulting staff developed and implemented a sample design for a large-scale, multi-year residential end-use load research program for SCE. The sample is designed to place approximately three hundred load monitors throughout the utility's service territory. The RAEUS program monitors up to three appliances per household, as well as total household load. Sixteen different residential appliances are monitored. The comprehensive sampling methodology developed by QC, called QUOST, accounts for differences in design and operating characteristics of each of the 16 appliance categories. A stratified random sample was drawn that will allow accurate measurement of load profiles for each of the appliance types being studied. QC also provided close project management support to the client throughout the project. Quantum Consulting's sample implementation software (SMART™) was adapted to meet the client's needs. Survey information has been analyzed to decrease the costs of soliciting participation in the project.

EDUCATION

Ph.D., Economics, University of Washington, Seattle, WA.

ERIC EBERHARDT

Mr. Eberhardt has a broad engineering background in thermal/mechanical design in addition to programming and consulting experience. He has also spent time in a technical sales and marketing role working with potential customers to establish relationships. At Quantum Consulting as a Senior Consultant he has filled a project management role in the California Wastewater Optimization Project, working to find qualified candidates and implement recommended energy efficiency measures.

EXPERIENCE

Senior Consultant ***Quantum Consulting Inc.***
(2002 to Present)

At QC, Mr. Eberhardt is part of the energy services implementation team. Specifically, he has worked in a project management role for the California Wastewater Optimization Project. He has worked to find and interview qualified candidates for the program and coordinate site audits with these facilities. He has also completed detailed energy savings analysis on potential candidates, then coordinated equipment installation into facilities meeting the necessary cost to energy savings requirement. He has also created a comprehensive database cataloging every wastewater treatment facility in the state of California along with the corresponding technical audit data.

PREVIOUS EXPERIENCE

Sales Engineer – Network Management Hardware/Software ***SysMaster Corporation***
At SysMaster, Mr. Eberhardt developed working relationships with Value Added Resellers effectively establishing new sales channels and presented complex networking concepts to clients, demonstrating a total data center management solution. He also created a product marketing strategy for resellers and end clients differentiating from competing products and produced supporting documentation for the sales team, presenting product capabilities and specifications.

Consultant – Site Development and System Integration ***Fort Point Partners***
Mr. Eberhardt conducted client interviews and made enhancement recommendations through presentations to senior staff and completed requirements analysis and presented results to senior technical architects team, determining key features needed for first release of configuration management automation project (Jumpstart). He also configured app server and version control software creating an effective project development environment and built Developers Network and Jumpstart project pages improving project efficiency.

Product Design Engineer – SunFire Midrange Server Group ***Sun Microsystems***
At Sun, Mr. Eberhardt designed, built and tested prototype qualifying the addition of a new compact server to an existing product family late in the design cycle, then oversaw assembly and test of product in a manufacturing environment, verifying robust server design. He was also awarded U.S. patent (#5949646) for a compact computer redundant air moving system, legally securing innovative intellectual property. Mr. Eberhardt implemented a PC data acquisition

system for thermal testing improving data visualization and archiving and supervised layout and setup of thermal design lab upgrading prototyping and testing environment. In addition he also partnered with vendors and universities to develop new technologies creating competitive future products.

EDUCATION
BS, Mechanical Engineering, University of Wisconsin - Madison, 1997

VII.C.2 Resumes – BacGen Technologies

MAUD DE BEL PH.D.

EMPLOYMENT HISTORY

2001 - *BacGen Technologies, Seattle, WA, USA*
Lead Process Engineering & Facility Optimisation Partner

Responsible for all facility audits, including profiling, benchmark calibration and modelling yielding summary recommendations for facility optimisation and subsequent implementation. Real-time online analysis and modelling of facility operating parameters and control systems, parameter trending and alert response, facility operations training, consultation and advisory services focused upon optimal treatment performance with lowest possible operating and capital expenditures.

1999-to 2001 *United Utilities Ltd, Warrington, UK*
Technical Investment Planner

Appraisal of requirements for optimisation, refurbishment and the addition of new treatment units in capital projects for upgrading of wastewater treatment facilities to comply with stricter effluent consent standards as a result of regulatory drivers. Current portfolio includes 10 projects representing a value of £40 million. Responsibilities include co-ordination between network of participants (Field Operations, Engineering Consultant, Environment Agency), project budget and milestone control, design and engineering tasks, business case preparation for the United Utilities Board approval process.

1996-1999 *North West Water Ltd, Ellesmere Port, UK*
Research Scientist

Management of research projects, pilot plant studies, optimisation, consent compliance, development of measurement methodologies, tracer studies, respirometric studies and phosphorus removal at numerous wastewater treatment facilities. Activities included staff management, business case and report writing, modelling, design calculations, hands-on field studies, co-ordination between various parts of the business and technical advice as part of an international Operations and Maintenance bid in Canada.

MARTIN J. SHAIN

1996-2000 BacGen Technologies – Co-Founder, business focused upon the dynamic modeling and optimization of microbiology and process controls in wastewater treatment facilities, serving small to medium sized municipal markets. First company in market to bring PLFA-DGGE DNA profiling to wastewater microbiology, allowing accurate species identification and activity data. Built strategic alliances with investor owned and public utilities, energy efficiency utility alliances, academia (Yale and Clemson Universities), Federal and State government. Firm has been highly successful in implementing its technologies within the northwestern U.S., currently considering expansion into other regions under joint operating agreements and extended contract agreements with utilities.

1994-1996 Youth in business curriculum development volunteer. Speaking engagements, youth entrepreneuring and career guidance, skills judge and mentor. Delta Epsilon Chi and DECA.

1985-1994 WinterBrook Beverage Group - Co-Founder, President, premium beverage and bottled water company. Brands LaCroix, WinterBrook, Cascadia. First non-Coke or Pepsi soft drink to penetrate the warehouse club channel (Costco, Price, Sam's). Largest domestically owned bottled water producer, (Perrier Group and Bottled Waters of France (Evian) largest), twice voted by Inc. Magazine to the Inc. 500, two time finalist Ernst & Young Entrepreneur of the Year, speaker at entrepreneurial conferences, MIT Enterprise Forum, DECA Youth Leadership and Business. Sold interests.

1985-2000 WinterBrook Investment Partners- Founder and Co-Manager, private investment partnership focused upon funding and/or managing seed stage companies, LBO's and real estate development.

1979-1986 Espresso West, Inc. – Founder and President - Built Seattle's first dedicated espresso bars catering to captive audience mass transit riders. Sold in 1986.

1977-1979 The Broadway, Inc., G. Raden & Sons - Wine Programs Director- Direct Imports and Distribution

1975 - National Science Foundation Scholarship-Genetic Sciences

VIII. BUDGET

Budget components and total are presented below in Exhibit VIII-1. All detail and references for budget line items are presented in the project workbook.

Exhibit VIII-1
Project Budget

Budget Items	Sub-Total	Budget Total
Administrative Costs	**114,087**	
Marketing/Advertising/Outreach	**30,300**	
Direct Implementation	**498,500**	
Evaluation, Measurement & Verification	**35,420**	
Total Program Budget		**678,307**