PROPOSAL FOR WASTEWATER TREATMENT PLANT IMPROVEMENT PROGRAM IN THE SCE SERVICE AREA

Prepared for

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Prepared by

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KEMA-XENERGY PROPOSALS SUBMITTED

Program Name	Utility Area(s)
Comprehensive Compressed Air Program	PG&E, SCE, SDG&E
EEGOV B.E.S.T. Program	PG&E, SCE
Enhanced Automation Initiative	PG&E, SCE
Green Building Education and Technical Assistance Program	PG&E
Positive Energy Loan Program	PG&E
Wastewater Treatment Improvement Program	PG&E, SCE

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1 PROGRAM OVERVIEW

1.1 PROGRAM CONCEPT

KEMA-XENERGY is pleased to offer the Wastewater Treatment Plant Improvement Program (hereafter, also referred to as the WTPIP or Program), for consideration as part of the 2004-2005 CPUC Energy Efficiency Programs. The Program targets the nonresidential process overhaul market segment. It is a comprehensive approach to reducing energy use in wastewater treatment plants (WWTPs), in which energy education, site-specific energy analysis, financial incentives, process optimization, process design, equipment procurement, and installation are provided. The proposed program will promote energy efficiency in WWTPs run by local government agencies such as cities, counties, and water and sanitation districts. The primary focus of this program will be to optimize the use of electrical and natural gas energy through a combination of operator training, process control optimization, and high-efficiency process upgrade measures. Reducing peak demand will also be addressed.

Where possible, the WTPIP will capitalize on the lessons learned in the 2002-2003 version of the program. One of the important lessons is the long sales cycle for WWTPs. We have improved our marketing strategy dramatically in the past year. Our first step will be to follow up with plants we contacted in the previous program year that were interested but were not able to participate in the window provided. We believe this valuable service has only begun to tap into the potential available.

1.2 PROGRAM RATIONALE

WWTPs operated by local government agencies throughout the IOU service territories represent a sizable and very significant opportunity for energy conservation. These plants operate around the clock, year round. An average-size plant consumes between 6,000,000 kWh and 10,000,000 kWh annually. They are complex, highly developed networks of process vessels, pumps, piping, equipment, and controls. Historically, WWTP operation has focused on meeting stringent discharge requirements with very few energy-efficiency guidelines and little operational focus on energy-use optimization.

A similar CPUC program has been underway in the service territories of Pacific Gas and Electric (PG&E) and Southern California Edison (SCE) administered by KEMA-XENERGY. In the first year of this program, 16,658,000 kWh per year of annual energy savings have been identified in the first 10 participating plants. Plant operators and management have been highly enthusiastic about the program. There are more than 100 other plants in California that have not been so analyzed. Essentially, we propose to continue to offer an improved version of the 2002–2003 Program in 2004–2005 as well.

KEMA-XENERGY is particularly well qualified to conduct a successful project and meet the program's objectives. Few, if any, firms are as experienced as KEMA-XENERGY in designing and conducting energy audits and monitoring and evaluating programs. Our strengths include:

- Extensive experience in energy-efficiency auditing and monitoring and evaluation of industrial, commercial, and agricultural facilities and technologies
- An analytic approach based on over 25 years of energy auditing, monitoring, and evaluation experience in a broad spectrum of commercial, industrial, and agricultural facilities
- The perspective of experienced plant engineers who know what kind of information is needed to provide a timely, cost-effective evaluation
- The proven ability to write clear, informative reports and complete work on time under tight schedules.

Projects retrofitting existing water and WWTPs require a unique blend of expertise in energy conservation, process operations, and control/system design. For the WTPIP program, KEMA-XENERGY has teamed with Brown and Caldwell, a premier provider of engineering and consulting services to the wastewater treatment industry. The team of KEMA-XENERGY and Brown and Caldwell provides the know how and proven experience to run a practical, cost-effective program customized to the particular needs of the wastewater treatment industry. This team is currently providing all of the services in the 2002-2003 version of the WTPIP in the service territories of PG&E and SCE.

1.3 PROGRAM OBJECTIVES

The projected accomplishments of the program for the 2-year period are shown in Table 1-1.

Table 1-1
Projected WTPIP Accomplishments in 2004-2005

	Annual kWh Savings	Summer Peak MW Savings	Annual Therm Savings
SCE	2,180,000	259	20,000

These impacts will result in significant cost savings for customers due to lower energy use and reduced peak demand.

1.4 MARKET SEGMENTS

The WTPIP targets the nonresidential process overhaul market segment.

The target market will be comprised entirely of WWTPs operated by local government agencies. Plants processing more than 4 million gallons per day of sewage use significant amounts of energy and generally employ process technologies that can be optimized to minimize energy use.

Plants smaller than this probably do not have a significant enough load for a program such as this to remain cost-effective and hence will not be actively recruited.

Approximately 60 WWTPs in the SCE service territory will be targeted for recruitment. Participation will be on a first-come, first-served basis. All of these plants are owned and operated by local government agencies.

2 PROGRAM PROCESS

2.1 PROGRAM IMPLEMENTATION

The Wastewater Treatment Plant Improvement Program (WWTPIP) will provide energy-use benchmarking analysis of plant processes and equipment, train operators in a continuous improvement process focused on improving plant energy efficiency, identify cost-effective process control improvements and equipment upgrades, offer incentives for preliminary measure design development, and offer incentives for installation of energy-efficient equipment upgrades in wastewater treatment plants (WWTPs) operated by local government agencies. Program services will be provided by KEMA-XENERGY, a leader in the energy efficiency and evaluation industry, and Brown and Caldwell, a premier service provider to the WWTP industry.

The likelihood of project implementation is enhanced by offering incentive payments for implementation of cost-effective energy-efficiency measures. Once a plant has agreed to proceed with final design and installation, a competitive bidding process will be used to select the lowest cost service or equipment provider from a network of proven sources used by Brown and Caldwell for the construction of its many wastewater treatment projects. Incentives will be paid in the form of a check to the plant upon satisfactory completion of the work.

There are three major types of activities in the WWTPIP:

- Benchmarking surveys
- Process optimization
- Equipment measure incentives.

The measures that will be implemented under each of the major activities are distinct and each will be tracked separately on a site-specific basis. The savings that will be claimed for each site will be tied to specific measures that have been recommended and implemented. KEMA-XENERGY will develop site surveys and measure-specific savings estimates using a combination of monitoring data and engineering analysis. The evaluation, measurement and verification activities will be used to verify the claimed savings for a sample of the sites where one or more measures were implemented.

The savings for the above measures are based on what is expected for an average-sized plant for specific measures that have been identified in similar plants. However, the actual savings that will be claimed by this program will be based on site-specific engineering calculations (utilizing measured site data) or direct measurements for the specific measures that are implemented. Although all the plants that are expected to be studied will be processing wastewater, it must be recognized that the treatment requirements for each plant are unique. Consequently each plant is designed around technologies designed to meet its individual requirements. Recognizing this,

this program is designed to evaluate each plant and select custom measures that will apply to each plant.

Key features of the Program are highlighted below.

- ***Comprehensive Approach.*** This program offers a process by which energy-efficiency education, site-specific energy analysis, financial incentives, process optimization, process design, equipment procurement, and installation are all provided. This process provides customers with free analysis and training and identifies practical energy-saving measures. Incentives are then offered to customers to help pay for the costs of recommended equipment upgrades. In some cases, incentives will be offered in two phases. The first incentive will be offered to help with process design development, and the second will cover final mechanical design, procurement and installation. Offering incentives for design assistance at the beginning of the process reduces the risk to the local government that funds will be spent studying project concepts that may prove to be unattractive.
- ***Energy Benchmarking.*** Benchmarking of plant energy use will be performed to identify areas of opportunity for energy conservation measures. Selected equipment and processes will be metered to establish energy-use profiles for the plant, plant processes, and specific pieces of equipment. These profiles will be used to develop energy-use benchmarks at each plant for energy use per million gallons of flow processed and per pound of biochemical oxygen demand (BOD) removed. These benchmarks and the measured demand profiles help to identify inefficiencies that lead to recommendations for cost-effective process improvements.

  During the benchmarking process, KEMA-XENERGY team engineers will work in collaboration with plant staff to discuss the unit processes of the plant and any ideas for energy savings proposed by either plant staff or the KEMA-XENERGY team engineers. This ensures that the plant staff already deems any measures that go on to feasibility calculations are practical and workable.

  The measures that will be installed as part of both the benchmarking and process optimization activities will involve operational changes. During the benchmarking surveys, some operational measures may be identified that can be implemented with no additional analysis and at little or no cost. The typical types of measures expected from the benchmarking surveys include the following:

  1. Turn off unnecessary equipment such as pumps or fans
  2. Re-establish automatic control for equipment being run manually
  3. Recalibrate meters that are malfunctioning.
- ***Operator Training for Energy Efficiency.*** Recognized industry experts will provide training to plant operators on specific energy conservation techniques for WWTPs. The training will focus on those areas where savings are most likely to be found and will emphasize practical day-to-day methods that can be easily implemented and tracked by the plant operators. A continuous process improvement technique will be taught and

implemented to capture operational energy savings on an ongoing basis and to form the basis for capturing future savings as plant operations change.

- ***Process Control Optimization.*** WWTPs use a variety of methods and devices to control the treatment process. Many cash-strapped plants have not modernized or integrated their process control systems. Older systems may have stand-alone manual or semi-manual controls that lead to poor energy management. This program will review existing control schemes, operating methods, and plant procedures and recommend improvements designed to optimize the use of the equipment and minimize the use of electrical energy.

  A series of services will be provided as part of the Process Optimization Activities to identify these measures and assist with their implementation. These activities will start with a formal operator training program but will largely consist of ongoing support activities that will reinforce the training and result in the specific optimization measures being implemented. Examples of measures that are expected to be implemented as part of the process optimization activities include:

  1. Fine tuning existing controls to modulate equipment operation
  2. Using an existing monitoring point as a process control variable to reduce energy usage
  3. From monitoring of process variables and laboratory data, fine tuning manual control of equipment operation to reduce energy usage without reducing treatment effectiveness
  4. Programming time-of-day controls in existing process control system for identified equipment to reduce runtime or shift runtime to off-peak periods
  5. Performing process simulation studies to quantify energy-savings measures and determine impacts on treatment process effectiveness.

- ***Multi-Stage Incentives Designed to Increase Measure Adoption.*** Local government agencies generally have limited budgets for capital improvements and must get approval for expenditures from a governing board or council. This process has been historically slow and difficult for WWTP operators because projects for improvement in these plants can include lengthy, high-cost process studies without the guarantee that the study will result in an attractive project. Offering incentives for design assistance at the beginning of the process reduces the risk to the local government that funds will be spent studying project concepts that may prove to be unattractive. Once the design has progressed to the schematic stage, incentives will be offered for final design, procurement, and installation to encourage implementation. This two-stage incentive approach will help overcome the often-encountered barrier that plant managers do not have an available budget for efficiency improvements.

  In addition to the process optimization control measures, KEMA-XENERGY will also identify potential equipment that can be installed to further reduce energy usage through process optimization.

  1. Controllers for modulating equipment output

2. Meters for monitoring process variables to provide data for manual control or to provide feedback to automatic controls
3. Equipment control devices such as a variable-speed controller or inlet guide vanes for air blowers.

- ***Effective, Specialized Wastewater Efficiency Services.*** KEMA-XENERGY and Brown and Caldwell combined for this program to form a team with unparalleled reputations in the energy analysis, measurement and verification, and wastewater treatment industries. The services of these premier providers at bargain prices, with the opportunity for substantial energy cost reduction, will be very attractive to most treatment plants. Because of existing barriers to implementation, many of these customers have never participated in statewide incentivized Process Optimization programs.

Several of the key attributes of the WWTPIP are discussed below to highlight some of the program design issues that we have addressed:

- ***Energy-Use Benchmarking Analysis.*** Energy-use profiles will be established by KEMA-XENERGY for plant processes and equipment through direct measurement and trending of energy consumption. These measurements will be obtained from the plant process control system where available or through the use of portable monitoring devices. Plant operating data and laboratory results will be used to establish benchmarks of energy consumption as a function of plant flow rate and the biochemical oxygen demand (BOD). These benchmarks and the results of the monitoring on specific items of equipment will be used to identify energy savings opportunities, and benchmarking establishes a plant specific baseline for determining all post-intervention savings. The benchmarking study provides information to the customer. The customer will perform the implementation.

  The full cost of the energy-use benchmarking analysis will be included in the program. Detailed information on the actual customer-specific measure opportunities will be developed, by definition during program implementation. Determination of savings is part of the measurement and verification process.

- ***Operator Training.*** Brown and Caldwell will teach a continuous improvement program for energy conservation to the plant operators, and specific areas and processes of each plant will be targeted for improvement. Operators will be taught which operating parameters to monitor and control to optimize the energy use of the plant. The full cost of the training program will be included in the program. Final training curriculum will be developed for each plant tailored to the unique requirements of each plant.

  The training budget includes time for Brown and Caldwell to coach plant operators and management on implementing process optimization processes and procedures learned in the training and developing standard operating procedures for the plant. Thus, the training results in process optimization savings as measures are implemented. Due to the custom nature of this program, detailed information on the actual customer-specific measure opportunities will be developed, by definition, during program implementation. The initial benchmarking study is expected to establish baseline energy use, and the

measurement and evaluation activities will be used to evaluate a sample of site-specific measures to determine whether site-specific savings claims are reasonable.

The budget for process optimization activities is $25,000 per plant. The budget will be spent on three major items as shown in Table 2-1.

Table 2-1
Process Optimization Budget

Item	Plant Budget	No. of Plants	Total
Curriculum Development	2,500	4	10,000
Training Sessions	6,000	4	24,000
Follow up Support	16,500	4	66,000
Total	25,000		100,000

The follow-up support will consist of on-site support where KEMA-XENERGY or Brown and Caldwell staff will work directly with operators to set up and analyze trend data, identify measures, and conduct tests and process analyses to determine optimal settings.

2.2 MARKETING PLAN

We have refined our marketing and outreach approach significantly as a result of our recent experience. Brown and Caldwell will utilize customer contact lists developed during the previous program's marketing campaign and leverage established business relationships with WWTPs. The most effective marketing technique in the previous program was a telemarketing campaign. Lessons learned from that telemarketing effort will guide Brown and Caldwell in making contacts with the persons most interested and most empowered to participate in a grant program such as this one. Presentations to local chapter meetings of the California Water Environment Association will also be made in an effort to advertise the program to WWTP operators and engineers.

Brown and Caldwell is an established California consulting engineering firm with a long history of involvement of commitment and service to the wastewater industry. They have been a part of this specific and highly specialized industry since their founding. We believe that the barriers to the initial contact will be low due to the reputation of Brown and Caldwell in the industry and the general interest in energy cost reduction following recent increases in the cost of electricity. It has been our experience that there is a great desire on the part of WWTP operators to curtail energy costs, but little knowledge of how to accomplish it.

As stated previously, we will also follow up with plants contacted during PY2002-2003 that were not able to participate in the program time window.

The plant will be provided with information on the program and rough estimates of likely costs and benefits. If the plant expresses interest, a proposal will be presented committing the plant to the energy benchmarking process. Following the results of the benchmarking study, the plant

will be apprised of the recommendations for operator training, process improvements and control optimization and presented with another agreement to proceed with implementation of the recommendations. The plant commits to being a program participant once the proposal agreement is signed.

2.3 CUSTOMER ENROLLMENT

Customers will be asked to fill out an application that provides necessary information to determine eligibility. Based on the information obtained during the contact interview and the information provided in the enrollment application, a face-to-face meeting will be set up to present the details of the program and to get more information about the facility. This meeting will include a review of any recently completed energy assessment reports and a walkthrough tour of the plant to get a quick feel for potential energy savings opportunities.

Customers that meet program eligibility requirements, have sufficient energy improvement opportunities, and who, in the judgment of the program administrator, demonstrate a credible desire to follow through with recommended improvements will be given the opportunity to complete an audit access agreement. This agreement will grant permission to the program to audit the plant (if an energy assessment report has not been prepared previously) to benchmark its energy consumption and identify opportunities for energy and demand reduction measures.

Similarly, following the audit, a training access agreement will be offered to the plant to enroll the customer in this phase of the program and allow access for training of plant staff. A customer will apply for incentive funds for those projects that in the judgment of the program administrator meet the cost-effectiveness criteria of the program and that can be installed within the program time frame.

2.4 MATERIALS

Equipment Procurement and Installation. A competitive bidding strategy will be used to achieve the lowest possible measure costs while maintaining high quality. Qualified contractors from a network of service and equipment providers utilized by Brown and Caldwell for WWTP construction projects will be asked to provide costs for any or all program measures. Contractors can put in bids for equipment only, installation only, or both.

Competitive bidding for equipment purchase and installation is a standard business practice for Brown and Caldwell on its many construction projects in WWTPs. They have many sources of suitable, reliable, high-quality equipment used in wastewater plants around the world. Brown and Caldwell has also established ongoing relationships with a network of qualified installation contractors experienced in construction projects in wastewater plants.

Once a plant has signed an implementation agreement, the plant can choose to employ Brown and Caldwell for the work or can contract with another entity of their choice. For those that select Brown and Caldwell to complete the work, Brown and Caldwell will proceed with design and procurement activities. Brown and Caldwell will direct successful bidders throughout the

construction process. Brown and Caldwell will inspect all projects and thoroughly track accomplishments.

Coordination and inspection of work in progress at those sites that select someone other than Brown and Caldwell will be provided by KEMA-XENERGY. Following notification of completion of the work KEMA-XENERGY will make a post-retrofit inspection to verify proper installation of the equipment in accordance with the measures identified in the benchmarking study. Incentives will be paid for the work accomplished. All projects will be inspected before payment is made.

Equipment Warranties. Program policies and procedures will require contractors to provide normal equipment warranties. The program will provide no warranties.

2.5 PAYMENT OF INCENTIVES

The intent of providing our own incentives is to avoid double-counting any savings claimed by other programs such as the IOU-sponsored SPC program or any non-utility-sponsored incentive programs and to capture turnkey synergy with the niche technical services we are offering.

All WWTPs operated by local government agencies in the service territory of SCE that meet the eligibility requirements of the program and who agree to participate in Phases I and II of the program would also be eligible for incentives for capital improvement projects. However, in agreeing to accept the incentive for preliminary design services, the plant also agrees that it will accept no incentives from state or utility programs for the completion of that work except those offered by the WWTPIP. This is necessary to prevent double counting of claimed savings by other programs such as the IOU-sponsored SPC program or any non-utility-sponsored incentive programs.

Customers will be paid an incentive to cover up to 50 percent of the design, equipment, and installation costs of these measures at the rate of $0.125/kWh of predicted first-year savings. In some cases, this incentive will be split into two phases. The first incentive, covering up to 40 percent of design costs, will be provided to encourage the plant to go forward with the preliminary design stage of the project development. By developing the design to the P&ID stage, plant staff can be confident that the proposed measure has been sufficiently thought through and that the proposed changes will not degrade the treatment process or the reliability of the plant. This will allow the plant to more confidently approach its governing board or council for the funds necessary for installation. A second incentive will be offered for payment following the installation of the measure. Since the incentives will be paid directly to the plant, the plant will be at risk for the incentives if the installation is not completed on time.

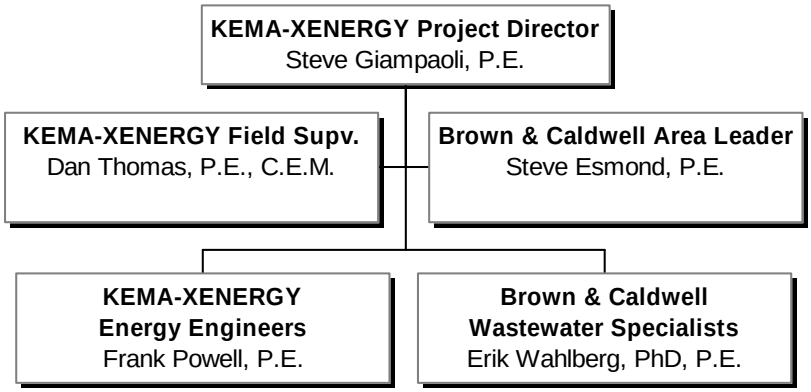
The customer will be offered the option of using Brown and Caldwell for design and implementation. Regardless of whom the customer chooses to perform the design work, the customer receives an incentive of up to 40 percent of the cost of the services rendered. All customers who install measures will be provided with project coordination support regardless of

which contractor is used. KEMA-XENERGY anticipates that plants will face barriers associated with obtaining funding for the remainder of the design costs. However, we believe that the opportunity for the 40 percent co-payment and the various support services provided by KEMA-XENERGY will be sufficient in several cases to overcome this barrier. We also believe it is critical to begin the project activities as quickly as possible to provide sufficient time for the plants to obtain the necessary funding.

2.6 STAFF AND SUBCONTRACTOR RESPONSIBILITIES

The project staffing structure for the WWTPIP is shown in Figure 2-1. Brief biographies of key management personnel are included in Section 7.

Figure 2-1
WWTPIP Program Staffing Plan



The KEMA-XENERGY Project Director Steve Giampaoli will have overall responsibility for managing for the entire contract to ensure technical excellence and overall client satisfaction. He will be responsible for taking the big picture view of all tasks, providing high-level technical support, and ensuring client satisfaction. In his current position as Director of Western Region Engineering Services, he administers the 2002-2003 WTPIP program, develops and implements energy auditing and program impact evaluation for demand-side management activities, directs energy auditing teams for commercial, industrial, utility, institutional, and government clients; evaluates and designs energy-efficiency measures for industrial and commercial sites; performs independent third-party review of utility industrial and commercial energy efficiency rebate programs; and consults with industrial and commercial clients on energy-efficiency and energy cost-reduction measures

The project director will be assisted in the project management activities by the Brown and Caldwell area leaders/field supervisors and the KEMA-XENERGY field supervisor. The field supervisors will also have a key role in coordinating with the various contractors. Energy engineers and wastewater specialists will conduct on-site surveys, inspections and other technical activities.

2.7 WORK PLAN AND TIMELINE FOR PROGRAM IMPLEMENTATION

The performance targets and milestones are presented in Table 2-2. As displayed, we anticipate launching the program soon after signing a contract in January. While there are many program activity tasks, we have only assigned milestones to the tasks that have distinct end products or quantifiable targets. Progress on program milestones will be reported in the monthly, quarterly, and final reports.

Table 2-2
Project Timeline

Activity	Start Date	Completion Date
Program kick-off	January 1, 2004	
Implementation Plan	January 1, 2004	January 31, 2004
Program Set-up	January 1, 2004	January 31, 2004
Policies and Procedures Manual	January 1, 2004	February 28, 2004
Marketing and Outreach	January 31, 2004	July 31, 2004
Energy Benchmarking Analysis	March 1, 2004	March 1, 2005
Select EM&V Contractor	April 1, 2004	June 30, 2004
Final EM&V Plan	June 30, 2004	August 31, 2004
Proposal Development	June 1, 2004	May 1, 2005
Installations	Sept 1, 2004	Oct 31, 2005
Inspections Visits	Jan 1, 2005	Oct 31, 2005
Evaluation Visits	Nov 1, 2005	Dec 1, 2005
Develop Final Report	Dec 1, 2005	Dec 31, 2005

The next section provides descriptions of the various program activities. A section containing our proposed program milestones follows.

2.7.1 Proposed Milestones

Program Planning

The first milestones are to develop an implementation plan and a Policies and Procedures Manual for the WWTPIP. Depending upon the timing of the contract signing, these tasks could be started and completed in the month of January. However, delays in approval of the program or protracted contract negotiations could cause these steps to be delayed. These are extremely important steps in implementing a successful program. The implementation plan lays out the

program elements and establishes timelines and responsibilities. The Policy and Procedures Manual facilitates consistency in customer service, efficiency of program delivery, and a clear understanding of goals and objectives of the program. To demonstrate completion of this task, the Policies and Procedures Manual will be provided in hard copy and electronically with the quarterly report.

Additional program planning activities that will take place in the first quarter of 2004 include the development of customer contract forms and a tracking database. These items will also be submitted with the quarterly report.

2.7.2 Marketing

Marketing milestones include the development and approval of a program flyer for the WWTPIP. This flyer will provide a brief summary of the program benefits, rules, customer eligibility requirements and contact information.

Presentation materials will also be developed in the first quarter of 2004. These materials will be used in face-to-face meetings with customers to present the benefits and requirements of the program. We will capitalize on lessons learned to develop updated marketing materials to more effectively address customer needs.

KEMA-XENERGY and Brown and Caldwell will also update and expand on the 2002-2003 Program prospect list for marketing the program to treatment plants in the SCE service territory. This list will target plant engineers and operating superintendents in eligible plants. A list of contacts made at each location will be provided in the quarterly report. A response hotline will be established prior to March 1, 2004 at Brown and Caldwell to respond to inquiries from interested plants.

2.7.3 Implementation

The monthly and quarterly reports will summarize the following to support progress on the established milestones:

- Number of plants contacted
- Number of plants not interested
- Number of audits conducted
- Number of proposals generated
- Number of proposal agreements signed
- Potential kWh savings as identified in the proposals
- Number of installations completed
- Number of post installation site inspections
- Number of incentives paid

- Total kWh of installed measures.

Program savings from process improvement/process optimization will begin flowing in the third quarter of 2004 after the first energy-efficiency benchmarking audits are completed and commitments for implementation from the plants are obtained. Additional savings will accrue as each operator training session is competed at each site. We expect to have achieved all of the program savings for these measures by the end of the second quarter of 2005.

Proposals will be presented beginning in the third quarter of 2004. These will be important milestones because the decision making process for these plants and equipment procurement cycles can be lengthy. Consequently, we are not expecting installations to be completed until the third or fourth quarter of 2005.

2.7.4 Evaluation, Measurement, and Verification (EM&V)

There are three milestones associated with the EM&V task. The first milestone is to select an EM&V contractor by the end of the second quarter of 2004. Additionally, we will approve the EM&V plan and get final approval the Commission on this plan by the end of the third quarter 2004. Submittal of the final EM&V report is due by March 31, 2006, representing a milestone in the first quarter of 2006.

2.7.5 Monthly, Quarterly, and Final Reports

The monthly, quarterly, and final reports are not listed as specific milestones. However, these reports will serve to document progress on the milestones discussed above and displayed in Table 2.

3 CUSTOMER DESCRIPTION

3.1 CUSTOMER DESCRIPTION

Based on our experience in the 2002-2003 Wastewater Treatment Plan Improvement Program (WWTPIP), target customers for the 2004-2005 WWTPIP program will be plants employing treatment technologies such as oxidation ditch or activated sludge with flows greater than 4 million gallons per day (MGD). These plants use significant amounts of energy and because of their size and complexity have been found to generally have significant opportunities for process optimization and equipment efficiency upgrades.

The 2002-2003 WWTPIP program for plants in the SCE service territory targeted facilities treating from 7 to 20 MGD of sewage. At the time the program was designed, it was expected that plants processing more than 20 MGD generally would have sufficient funding to already include a staff of plant engineers to oversee operations and be responsible for optimizing the process on a daily basis, including a regular analysis of energy efficiency. However, actual experience has shown that while plants ranging from 20 to over 100 MGD do have staff engineers, these engineers are typically focused on process reliability and meeting effluent permit requirements. They generally do not have the training or the time to analyze energy opportunities, but interest in energy cost savings is quite high. Additionally, most plant engineers are not familiar with electric and gas rate structures, peak demand, and opportunities for its control.

Similarly, a lower limit for the target plants in the 2002-2003 program was set at 7 MGD, expecting that plants smaller than this would not have a significant enough load for a program such as this to remain cost effective. However, it was found that the potential for energy savings opportunities in WWTPs was not as much limited by the size of the plant but more by the type of treatment process employed. For example, smaller plants with aerated activated sludge or oxidation ditches have much more opportunity than most larger plants with trickling filters or lagoons. The former are much more energy intensive and utilize much more processing equipment than the latter. Moreover, opportunities for self-generation in the latter are limited and unit costs tend to be higher.

3.2 CUSTOMER ELIGIBILITY

Customers operating publicly owned WWTPs processing more than 4 MGD will be eligible to participate in the program. Actual program enrollment will be based on the opportunity for cost-effective savings determined during the initial review and walkthrough. Because the intent of the program is to provide cost-effective annual savings through the implementation of process optimization and capital improvement measures, some customers may not be accepted for enrollment that are just interested in a free energy audit but have little potential energy savings opportunities.

3.3 CUSTOMER COMPLAINT RESOLUTION

KEMA-XENERGY's approach to dispute resolution and consumer protection is outlined in this section. There are several methods through which disputes between program staff and end-user customers will be resolved. First, when problems arise, it is the job of the KEMA-XENERGY program manager to use all means at his disposal to resolve the issues at hand. If these are not successful, the issue is brought to the attention of the principal in charge for his input and problem resolution skills. If we still have not been successful, if necessary and as a last resort, KEMA-XENERGY contracts specialists will be enlisted depending on the nature of the problem.

It should be pointed out that never in KEMA-XENERGY's long history of delivering programs and implementing consulting engagements has there been a customer complaint that was not successfully resolved. In fact, KEMA-XENERGY has rarely had to go beyond the program manager and principal in charge to resolve conflicts. KEMA-XENERGY values our long-standing working relationship with various players in the industry and looks forward to continued mutual success on future projects. Integrity remains one of the cornerstones of the work done, and it is a key value that is brought to any situation in which problems arise.

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

3.4 GEOGRAPHIC AREA

This program will be available to publicly owned treatment plants in the service territory of Southern California Edison.

4 MEASURE AND ACTIVITY DESCRIPTIONS

This section provides information on our energy savings assumptions and provides descriptions of or planned program activities.

4.1 ENERGY SAVINGS ASSUMPTIONS

The target market for this program is municipal wastewater treatment plants with activated sludge or oxidation ditch processes. As such, each plant is unique and no two are the same. Many processes run continuously, but the loading on equipment continuously changes.

Most of the measures are not standardized in the DEER database for the way the equipment is used in wastewater plants. In order to make sure that energy savings estimates are reasonable, the calculations will be done using baselines of actual energy use. Where available, actual submetered data will be obtained from plant process control computers (SCADA or DCS.). Where plant submetered data is not available from the SCADA or DCS, demand (kW) will be determined using actual electric measurements taken where accessible. Where not accessible, estimates will be made by an engineer experienced in such measurements.

Discussions with plant staffs will reveal appropriate measures. Calculations of energy use after implementation of these measures will be calibrated using the actual electric measurements obtained at the plants. Electric energy savings (kWh) will be calculated using actual run time information obtained from plant SCADA or DCS, where available. Where not available, calculations will use the schedules of the equipment as programmed into the SCADA/DCS or reported by plant staff.

Similarly, gas energy (therms) baseline will be obtained from installed customer submeters as reported by the SCADA/DCS. Gas energy use after energy-saving measures will also be calibrated to the existing actual use.

4.2 DEVIATIONS IN STANDARD COST-EFFECTIVENESS VALUES

For consistency, KEMA-XENERGY will exclusively use the cost-effectiveness variables from the Energy Efficiency Policy Manual and the CEC's DEER database for:

- Net-to-gross ratio
- Estimated useful life
- Incremental measure cost.

4.3 REBATE AMOUNTS

Incentives up to half the cost of the project are to be paid to the plant based on expected first-year kWh savings at the rate of $0.125/kWh. For example, a measure with expected first-year savings of 105,000 kWh costing $40,000 to implement, will be rebated at the rate of

$0.125/kWh. This would result in an incentive of $13,125, which is less than half of the cost of the project. The net cost to the customer for this project would then be $26,875. If the plant's average cost for electricity is $0.16/kWh, the annual payback for this measure becomes:

$$\begin{aligned}\text{Annual Payback} &= \text{Net Cost/Annual Savings} \\ &= \$26{,}875/(105{,}000\ \text{kWh/yr} \times \$0.16\ \text{kWh}) \\ &= 1.6\ \text{years}\end{aligned}$$

It is expected that for this industry, projects with paybacks as high as 5 years will be attractive enough to be implemented in most plants.

4.4 ACTIVITIES DESCRIPTIONS

Specific program activities comprising implementation; marketing; and evaluation, measurement, and verification (EM&V) are discussed in this section. Implementation activities are described as either being unit-based or task-based. Unit-based implementation activities are presented as those with and without measurable energy savings. Both classes of activities are described next.

4.4.1 Unit-Based Implementation Activities with Measurable Energy Savings

Measurable savings implementation activities are categorized into five measures. Associated with each measure category are estimates of demand reduction, hours of usage, and annual savings per unit. Additionally, net-to-gross inputs and net-to-gross ratios are provided, as well as total program goals per measure category. KEMA-XENERGY will recommend all measures that pass the TRC test to the program participants. The numbers and the measures that are provided in the plan are for planning purposes only. Actual measures installed may involve more measures at fewer plants or fewer measures at more plants. There is also no per-customer cap on measures.

Process Improvement and Optimization. These two services are offered free by the program to customers. Use of these services by the customer improves the operation of its plant without the need for changes in design or the addition or replacement of equipment. By operating the plant in an optimized fashion, energy use is reduced without degrading the effectiveness of the plant treatment process. The benchmarking and training activities generate all recommendations for process improvement and optimization energy savings activities and measures. Actual measures recommended and adopted will be specifically identified, verified, and measured.

Plant operators will be trained to implement a continuous process improvement program directed at maintaining optimal process variables. This process focuses the efforts of the operators on important process variables that when properly configured, calibrated, and managed result in improved plant energy performance without reducing the effectiveness of the treatment process. Savings are tracked automatically via the plant control system or manually through the use of logs and charts maintained by the plant operators on each shift. Savings thus obtained are sustained and even increased over time through a continuous process of close attention and incremental improvements over time. The benefits of this type of operating philosophy have

been achieved in other continuous process industries such as oil refineries, chemical plants, and semiconductor fabrication plants.

For some process optimization measures, a process analysis or simulation may be necessary before the plant will be willing to proceed with implementation. Brown and Caldwell is uniquely suited to perform these analyses, present the results to the plant, and assist with implementation. Should studies like this become necessary, they will be funded from the program process optimization budget.

Referring to the effective useful lives of energy-efficiency measures from the CPUC Energy Efficiency Policy Manual, the measures that result from the process optimization activities are expected to be control system improvements not unlike those that are implemented in the Standard Performance Contract (SPC) Program, which is essentially a custom measure program, for System Controls, or Energy Management System categories. All of these measures show 15-year measure lives in the table and, of the measures available in the EUL table, are closest to the measures anticipated to be implemented as a result of process optimization activities. Therefore, it is expected that the process optimization measures will have similar measure lives (15 years).

Energy-Efficiency Conservation Measures. Energy conservation measures implemented as a result of the energy-efficiency benchmarking study for each customer will be rebated at the rate of $0.125/kWh of predicted first-year savings up to 50 percent of total design and installation costs. Total program savings were projected based on an average participant plant size of 10 MGD and what we feel is the mix of measures most likely to be identified and implemented. However, since no two wastewater plants are identical and since each plant's throughput volume is different, the costs incurred, rebates paid, and savings achieved for each measure cannot be known at this time. It is also possible that other measures that meet or exceed program TRC requirements may be identified by the energy-efficiency benchmarking survey and could be implemented as part of the WWTPIP.

Incentives can be offered in two phases. The first incentive will be provided to encourage the customer to go forward with the preliminary design stage of the project development. By developing the design to the P&ID stage, plant staff can be confident that the proposed measure has been sufficiently thought through and that the proposed changes will not negatively affect the treatment process or the reliability of the plant. This will allow the plant to more confidently approach its governing board or council for the funds necessary for installation. A second incentive will be offered for payment following the installation of the measure.

4.4.2 Unit-Based Implementation Activities without Measurable Energy Savings

There are five implementation activities without measurable energy savings, which are discussed below.

Feasibility Benchmarking Audits and Follow-up. Feasibility benchmarking and follow-up studies are done at each plant to determine where and how much energy is being consumed and to identify opportunities for energy-efficiency improvements. The findings of these studies will

be summarized in a report for the customer that includes preliminary savings and cost estimates for each measure. The results of these studies will form the basis for all other services offered.

Project Proposal Development. From the results of the energy benchmarking study, a proposal for further services may be developed. These services may include operator training, process optimization, and design and installation services.

Project Coordination. Should a customer decide to proceed with implementation of a measure with Brown and Caldwell, a project coordination service will be offered to expedite installation to meet the program installation deadline. However, if the customer elects to use a contractor other than Brown and Caldwell for design and installation, it will be up to the customer to manage its contractors and suppliers to ensure timely completion of the facilities.

Post-Inspection Visit. Following completion of an installation, inspection for compliance with the proposal will be conducted by the program. These inspections will ensure that program funds are spent on only those facilities that are necessary for the achievement of the energy conservation measures.

Incentive Application Processing and Tracking. Incentive application processing and progress tracking activities will be necessary for all implementation projects. These activities will be necessary to ensure compliance with program eligibility rules, and to keep the program apprized on progress toward completion. This will provide information required for reporting of quarterly progress to the Commission.

4.4.3 Task-Based Implementation Activities

Two implementation activities are classified as task-based and are detailed below.

Develop Policies and Procedures. The policies and procedures will define the eligibility requirements for customers and measures, the rebate levels and customer reporting requirements. In addition, the policy manual will make it clear to the customers that receiving incentives from more than one program for a single measure (double dipping) will not be allowed.

Develop Tracking Database. The use of project tracking systems is a fundamental element of KEMA-XENERGY's programmatic philosophy. The tracking system to be used will allow program staff to efficiently track projects through the system, as well as to track other customer-related activities, such as phone calls to the hotline. As with the policies and procedures, the tracking system can evolve as necessary.

4.4.4 Unit-Based Marketing Activities

This subsection provides a description to the four identified marketing activities.

Telemarket to Prospects. Following the mailing of the program flyer, Brown and Caldwell will conduct a telemarketing campaign with respondents to the mailer and to contacts known to

Brown and Caldwell at selected facilities. The goal of this campaign will be to establish appointments for face-to-face program presentation meetings with appropriate decision makers and staff at interested facilities.

Face-to-Face Program Presentations. For those customers that show an interest in the program, follow-up phone calls will be made leading to a face-to-face meeting to formally present the program with the goal of commencing an energy benchmarking feasibility study. These presentations will be directed at the plant engineering and plant operating staffs, and targeted at key decision makers in the plant management. The goal of these meetings will be to reach an agreement to commence energy benchmarking feasibility studies in each plant.

Project Proposal Presentations and Follow-ups. Following the completion of the presentation of the benchmarking feasibility study, a proposal will be prepared and presented to the customer for implementation of the study recommendations. Follow-up activities including phone calls, letters, and meetings will be conducted as necessary to gain approval of the project.

Direct Mailing of Program Flyer. The program will mail a flyer that describes the program and its benefits to all of the eligible facilities identified in the SCE service territory.

4.4.5 Task-Based Marketing Activities

There are three task-based marketing activities that will be conducted as a part of the WWTPIP, as discussed below.

Establish a Prospect List. Brown and Caldwell will create a prospect list from its marketing database of wastewater plants in California and the telemarketing list developed in the previous WWTPIP. Only those facilities in the SCE service territory will be included on the list. Site contacts will include plant engineers and operations managers.

Develop Presentation Materials. Presentation materials will include handouts for use in the face-to-face presentation meetings. They will include information on eligibility rules, program deadlines, and other program requirements. These materials will emphasize the benefits of the program and the capabilities of KEMA-XENERGY and Brown and Caldwell to provide the customer a high-quality service.

Develop a Program Flyer. A flyer will be developed that briefly describes the attributes and benefits of the program suitable for mailing and faxing to prospects in the SCE service territory. This mailer will be the precursor to the telemarketing campaign.

4.4.6 Evaluation, Measurement and Verification Activities

This subsection describes the seven activities comprising the evaluation and measurement and verification efforts associated with the Program.

Selection of Measurement and Verification Contractor. The program administrator will select an EM&V contractor from the list of approved evaluators provided by the commission. This evaluator will be selected early in the project so that he can track progress and be aware of what is accomplished.

Sample Selection. Once all of the sites have been recruited and preliminary savings have been determined, a sample population can be selected that will be representative of the entire population. This sample will form the basis of the measurement and verification plan, the data collection plan and the data analysis.

Develop Site Evaluation Plans. A site evaluation plan will be written for each sample site that establishes data collection needs and methodologies and examines the ex ante savings claim. The plan will indicate the particular equipment items to be monitored and the methodology for calculating the baseline and post-case energy-use profiles.

Conduct Post-Retrofit Monitoring. Following completion of the installation of the energy conservation measures, post-retrofit monitoring will be performed at the selected sample sites. The customer's meters and process control system will be used to trend data where possible. Where customer meters are not available, portable metering equipment will be installed.

Site Verification Visits. The evaluation contractor will make a post-retrofit site verification visit to verify the installation of the measures and review the data collection activities. During this visit, he will observe the operation of the equipment, examine customer operating and accounting data, and will interview facility staff to determine the mode of operation and control of the equipment and to establish any seasonality of energy use.

Data Analysis. Data obtained from the post-retrofit monitoring and the site visit will be analyzed to determine the baseline and the post case energy usage and demand profiles. These profiles will then be used to determine ex post savings.

Develop EM&V Report. The EM&V contractor will prepare the EM&V report from the data collected and analyzed. This report will describe the operation of the equipment at the sites, the methodology used to determine the base case and post-case energy usage and demand profiles and the annual energy-use savings.

5 GOALS

5.1 ENERGY AND PEAK DEMAND SAVINGS TARGETS

Our gross energy savings goals are 2.180 million kWh and 20,000 therms. Our detailed energy, kW, and therm targets are shown in the following table:

Energy, kW, and Therm Savings Goals in the SCE Service Territory

Measure Description	No. of Units	Annual kWh Savings per Unit	Total Annual gross kWh Savings	Total Annual gross kW Savings	Annual Therm Savings per Unit	Total Annual gross Therm Savings
Benchmarking audit	4	80,000	320,000	96	0	0
Operator Training for Process Optimization	3	320,000	960,000	72	0	0
Aeration Control Optimization	1	540,000	540,000	38	0	0
Primary Clarifyer Optimizaiton	1	180,000	180,000	38	0	0
Influent/Effluent Pump Motor VSD	1	180,000	180,000	14	0	0
Solids Dewatering VSD	0	144,000	0	0	0	0
Engine Fuel Balancing	1	0	0	0	20,000	20,000
Total			2,180,000	259	20,000	20,000

The basis for these savings claims were arrived at from on our experience with the 2002-2003 Wastewater Treatment Plant Improvement Program (WWTPIP) and similar measures from other programs. Previous energy optimization projects achieved significant savings from a variety of measures in four general areas of a wastewater treatment plant (WWTP). These measures and the average savings and costs per measure are shown below for a typical plant. It is expected that similar measures will be developed for the plants recruited for the WWTPIP. Savings are based on the assumption that the typical participating plant in the program will be sized to treat between 7 and 20 million gallons per day. Plants in this size range have been found to consume an average of approximately 8 million kWh per year, with a coincident peak kW demand of 1,200 kW.[1] Documentation for our cost-effectiveness assumptions is provided below:

[1] *Wastewater Treatment Plant Energy Benchmarking Study Draft Report*, prepared by KEMA-XENERGY Inc. for Pacific Gas and Electric Company, December, 2001.

Optimized process	Typical Savings Level Achieved in Practice	Cost to Implement 10 MGD plant	kWh savings, approx. percent	Savings, 10 MGD plant kWh	No. of Part. Plants	Total Annual kWh Savings	%Peak kW Savings	Peak kW Savings per 10 MGD Plant	Total Peak kW Savings
Identification of Energy Savings Opportunities	1% to 5% reduction, total plant	$15,000	1%	80,000	5	400,000	1%	12	60
Energy Efficieny Training for Operators	3% to 10% reduction, total plant	$25,000	5%	400,000	5	2,000,000	2%	24	120
Aeration diffuser optimizaation	5% to 10% aeration system reduction	$200,000	5%	180,000	0	0	6%	29	0
Aeration blower replacement	3% to 8% aeration system reduction	$250,000	5%	180,000	0	0	6%	29	0
Aeration system control optimization	10% to 30% aeration system demand reduction	$150,000	15%	540,000	1	540,000	8%	38	38
Premium efficiency motor upgrade	4% motor demand reduction	$50,000	4%	144,000	0	0	4%	19	0
Primary clarifier optimization	5% to 30% aeration system demand reduction	$100,000	5%	180,000	0	0	8%	38	0
Variable speed drives	15% reduction of motor demand	$50,000	15%	180,000	1	180,000	8%	14	14
Right-size pump	5% to 30% motor demand reduction	$150,000	5%	60,000	0	0	0%	0	0
Premium efficiency motor upgrade	4% motor demand reduction	$50,000	4%	48,000	0	0	0%	0	0
Right-size pump or compressor	5% to 30% motor demand reduction	$100,000	5%	40,000	1	40,000	8%	10	10
Variable speed drives	15% motor dedmand reduction	$40,000	15%	120,000	0	0	8%	10	0
Premium efficiency motor upgrade	4% motor demand reduction	$50,000	4%	32,000	0	0	4%	5	0
Right-size equipment	5% to 30% motor demand reduction	$100,000	5%	48,000	0	0	8%	10	0
Process modification	5% to 30% motor demand reduction	$100,000	5%	48,000	0	0	50%	60	0
Variable speed drives	15% motor demand reduction	$50,000	15%	144,000	1	144,000	8%	10	10

Based on the outcome of the energy benchmarking analyses, it is anticipated that measures from one or more groups will be found to be appropriate for each plant but that not all plants will participate in the implementation phase. During the 2-year project period, we expect to be able to complete benchmarking in four plants that are customers of SCE. We believe that most of those plants will agree to participate further with the operator training program as shown above. Additionally, we expect that up to four in the SCE plants will be implemented. For the purpose of the program benefits calculation, it was assumed that that the most likely opportunities are those indicated in the above tables, but any measures in the tables may be implemented, and other measures may be identified that will yield attractive savings opportunities.

Measure cost figures and average expected measure savings are averages based on previous projects of a similar nature installed by Brown and Caldwell in similar plants.

5.2 OTHER PROPOSED BENCHMARKS FOR EARNING PERFORMANCE PAYMENTS

None proposed.

5.3 COST-EFFECTIVENESS CALCULATIONS

The cost-effectiveness calculations are based on results from the spreadsheet provided by the California Public Utilities Commission for use in proposing non-utility programs for 2004 and 2005. The Total Resource Cost (TRC) and Participant Test ratios for the WWTPIP, assuming that the programs includes customers of both SCE and PG&E are 2.53 (TRC) and 10.97 (Participant Test). The gross annual energy, demand, and therm savings attributed to this program are 2.180 million kWh, 259 kW and 20,000 therms, respectively.

6 PROGRAM EVALUATION, MEASUREMENT AND VERIFICATION (EM&V)

This section outlines our program evaluation approach for evaluating program success and measuring and verifying energy and peak demand savings. The detailed EM&V plan will provide additional details on these program evaluation and verification strategies.

6.1.1 Study Description and Objectives

The Wastewater Treatment Plant Improvement Program (WWTPIP) evaluation consists of a verification of energy savings and assessment of customer satisfaction. Data will be collected for a random sample of two customers from the program participants. The evaluation will include an analysis of monitoring data and engineering estimates, on-site verification, and telephone surveys with the customers.

6.1.2 CPUC Objectives

The Table 6-1 explicitly outlines the objectives of the evaluation as outlined in the CPUC Policy Manual and provides the WWTPIP evaluation approach.

6.1.3 Impact Evaluation

This section provides additional information on the plan for verifying savings attributed to the program. Details regarding the process evaluation will be provided in the EM&V plan.

Data Collection

We will conduct an assessment of two of the WWTPIP participants. The sites will be chosen at random from the participant list.

Collect Monitoring Data and Site-Specific Reports. Energy audit reports and the pre- and post-installation monitoring data from the sample sites will be collected. Data on plant throughput, which affects energy use, will be provided for the periods of kW monitoring and for the year. The pre-monitoring data will be considered baseline data upon which to base energy savings measurement.

Table 6-1
CPUC Objectives and the WWTPIP Evaluation

Objectives	WWTPIP Evaluation Approach	Evaluation Component
Measuring level of energy and peak demand savings achieved (except information-only)	We will use the IPMVP Option B to measure the energy and peak demand savings achieved for a specified sample of sites.	Impact
Measuring cost-effectiveness (except information-only)	We will re-calculate the Program cost effectiveness using actual program expenditures and the ex-post energy savings verified through the evaluation.	Impact, Process
Providing up-front market assessments and baseline analysis, especially for new programs	A comprehensive baseline market assessment is beyond the scope of this evaluation. The baseline energy usage assessment for this EM&V plan will be determined by the collected monitoring data.	Impact
Providing ongoing feedback, and corrective and constructive guidance regarding the implementation of programs	The evaluation team will be in close contact with KEMA-XENERGY and will provide ongoing feedback and recommendations as necessary through the evaluation.	Process
Measuring indicators of the effectiveness of specific programs, including testing of the assumptions that underlie the program theory and approach	The process evaluation explicitly develops effectiveness indicators as the primary way to assess program efficiency.	Process
Assessing the overall levels of performance and success of programs	Utilizing the impact and process evaluations together, we will assess and comment on the overall level of performance and success of the program.	Impact, Process
Informing decisions regarding compensation and final payments (except information-only)	The effectiveness indicators developed will allow the CPUC to assess the achievement of the program and therefore make an informed decision regarding compensation and final payments.	Impact, Process
Helping to assess whether there is a continuing need for the program.	The impact and process evaluations will assess program performance and the continuing need for the program.	Impact, Process

Conduct On-Site Visits. On-site visits with WWTPIP participants will focus on the following issues:

1. **Assess accuracy of monitoring data**. Assess the accuracy of monitoring data and ascertain how the monitoring data were collected with respect to the wastewater treatment process.
2. **Verify major capital improvements**. Review the reported capital improvements and verify that these have actually occurred.
3. **Verify other actions taken due process optimization consultation and education**. Because participants may take other actions due to consultation and education, relevant changes to the treatment process must be verified.
4. **Develop an understanding of the treatment process in order to properly annualize the monitoring results**. Assess accuracy of annualization of energy savings. For example, if the monitoring was conducted in the summer, review operation logs to assess how seasonal changes will affect energy consumption and therefore program impacts.

6.1.4 Analysis

Analysis of energy savings for all of the sample sites will be conducted in accordance with IPMVP Option B, "Retrofit Isolation." According to the IPMVP manual, when using Option B, "savings are determined by field measurement of the energy use of the systems to which the ECM was applied, separate from the energy use of the rest of the facility. Short-term or continuous measurements are taken throughout the post-retrofit period." Direct short-term system-level measurements of kW are the basis of our savings analysis. This method will be used to assess all relevant energy efficiency measures, including process optimization changes and capital improvements.

Review Engineering Models. Two types of models for each facility, the ex ante model based on site audits and the ex post model based on monitoring data, will be reviewed. Both models will be developed for some sites. Other sites will receive only audit models. In the audits that are prepared for each participant, savings are estimated for each energy conservation measure (ECM) based on engineering models that include such variables as pump lift and motor efficiencies. The analysis of monitored data used to estimate savings will include data on plant throughput and engineering assumption of how to annualize the short-term monitoring results. The review of the monitoring models is discussed below.

Review Monitored Data. The raw monitored data and the steps used to reduce the data into annual savings estimates will be reviewed. Checks will be made to confirm that the monitoring models are reasonable and that the monitoring data has been properly applied. Models will be revised where necessary.

Conduct Baseline Analysis. Baselines will be created for all sample sites, using the pre-implementation operating conditions, demand, and energy usage for each.

Estimate Site-Specific Energy Savings. For each sample site, the monitored data will be analyzed to estimate the annual gas, electricity energy, and demand savings of the effected systems. If more than one ECM affects a system (such as premium-efficiency motors and improved control of effluent pumps), it will not be possible to directly measure the savings on an ECM-specific level, so the total savings for the system will be determined.

Estimate Site-Specific Demand Savings. Demand impacts will be evaluated for the specific site based on the energy savings in the peak period divided by the hours in the peak period. As is described above, energy savings will be determined from the monitored data.

Determine Realization Rates. For each site, separate realization rates will be determined for demand (kW) and energy (kWh and therms). Specifically, we will determine the ratio of the demand and energy savings presented in the audit to the ex-post savings estimates.

Estimate Program Energy and Demand Savings. The savings predicted in the audits will be adjusted based on the ECMs that are actually performed as indicated in the tracking database.

The average realization rate for the sample sites will be used as the realization rate for the WWTPIP program. The realization rate will be applied to the ex ante savings estimates in the tracking database for all sites to determine the ex post program impact.

6.1.5 Cost Effectiveness

Using the actual program expenditures and evaluation assessment of ex-post energy savings, the Total Resource Cost (TRC) test will be recalculated. We will compare the actual to expected cost effectiveness as an indicator of program efficiency and success.

6.1.6 Reporting and Outcomes

The process and impact evaluations will take place near the end of the program. After these tasks have been completed, a final report will be developed that will describe the EM&V methodology and findings. The report will present impact and process evaluation results. In addition, the combination of impact and process evaluation will:

- Provide an assessment of the overall levels of performance and success of the WWTPIP program
- Help inform CPUC decisions regarding compensation and final payments
- Help to assess whether there is a continuing need for the program
- Provide relevant recommendations for improving program implementation and a summary of lessons learned from the process evaluation.

6.2 SUGGESTED EM&V CONTRACTORS

KEMA-XENERGY recommend two potential EM&V contractors for consideration to provide evaluation services for the WWTPIP: Quantec, LLC and kW Engineering. Both firms were on the list of approved EM&V contractors for the 2002-2003 CPUC Programs. They were also both approved as contractors eligible to bid on the 2002-2003 version of this program in the PG&E and SCE service territories.

1. Quantec, LLC

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7 QUALIFICATIONS

7.1 PRIMARY IMPLEMENTER

Since 1975, XENERGY, now KEMA-XENERGY, has been a recognized leader in providing industrial, commercial, and institutional facilities with a complete and integrated set of energy services designed to improve energy efficiency and reduce energy costs. KEMA-XENERGY's staff is highly experienced at implementing public benefit energy and water conservation programs. KEMA-XENERGY has conducted numerous energy studies of industrial facilities including dozens of wastewater treatment plants.

The California Public Utilities Commission awarded a contract to KEMA-XENERGY to conduct the Wastewater Treatment Plant Improvement Program in the service territories of Pacific Gas and Electric Company and Southern California Edison. The program is a comprehensive approach to reducing energy use in wastewater treatment plants. The program provides energy-use benchmarking analysis of plant processes and equipment, trains operators in a continuous improvement process focused on improving plant energy efficiency, identifies cost-effective process control improvements and equipment upgrades, offers incentives for preliminary measure design development, and offers incentives for installation of energy-efficient equipment upgrades in wastewater treatment plants operated by local government agencies. The overall goal of the program is to generate savings of 4.7 GWh per year and demand reductions of 610 kW at a total cost of $0.965 million.

KEMA-XENERGY was previously selected to study energy use in wastewater treatment plant aeration processes in the Pacific Gas and Electric service territory. In all, nine processes were benchmarked for energy use against daily average throughput and pounds of BOD destroyed. In addition, an oxygen utilization factor was calculated for each process. The benchmarks for these processes were then compared. The processes studied included surface aeration, coarse bubble diffusion, fine bubble diffusion, rotating biological contactors, and pure oxygen technologies.

KEMA-XENERGY can provide a benchmarking audit report for the Oakland treatment plant operated by the East Bay Municipal Utilities District upon request. The results are for one of the 10 plant studies performed by KEMA-XENERGY for the 2003-2003 WWTPIP program and demonstrates KEMA-XENERGY's ability to design and conduct energy audits in wastewater treatment plants, and to analyze and present meaningful results.

Below, we have included project descriptions of a sample of the most relevant work that demonstrates KEMA-XENERGY's experience and capabilities administering turnkey programs and performing technical service and auditing. More qualifications on these and other experience areas, such as planning, market research and program evaluation are available upon request.

7.1.1 EEGOV-Wastewater Treatment Plant Program, California Public Utilities Commission

As mentioned above, the California Public Utilities Commission awarded a contract to KEMA-XENERGY to conduct the Wastewater Treatment Plant Improvement Program in the service territories of Pacific Gas and Electric Company and Southern California Edison. The program is a comprehensive approach to reducing energy use in wastewater treatment plants. The program provides energy-use benchmarking analysis of plant processes and equipment, trains operators in a continuous improvement process focused on improving plant energy efficiency, identifies cost-effective process control improvements and equipment upgrades, offers incentives for preliminary measure design development, and offers incentives for installation of energy-efficient equipment upgrades in wastewater treatment plants operated by local government agencies. The overall goal of the program is to generate savings of 4.7 GWh per year and demand reductions of 610 kW at a total cost of $0.965 million.

7.1.2 Wastewater Plant Benchmarking Study, Pacific Gas and Electric

KEMA-XENERGY was selected to study energy use in wastewater treatment plant aeration processes in the Pacific Gas and Electric service territory. In all, nine processes were benchmarked for energy use against daily average throughput and pounds of BOD destroyed. In addition, an oxygen utilization factor was calculated for each process. The benchmarks for these processes were then compared. The processes studied included surface aeration, coarse bubble diffusion, fine bubble diffusion, rotating biological contactors, and pure oxygen technologies. The results of the study will be presented to a roundtable of industry experts in November.

7.1.3 EEGOV-B.E.S.T. Program, California Public Utilities Commission

The California Public Utilities Commission awarded KEMA-XENERGY a contract to manage a direct installation program for the hard-to-reach, small commercial market in economically depressed areas. Targeted measures include indoor and outdoor lighting and HVAC. The program is a turkey approach, offering marketing, energy education, site-specific energy analysis, financial incentives, equipment procurement, and installation, an approach tailored to this market segment. Door-to-door marketing is key to the program's success because these customers generally do not respond to mail or telephone solicitations. The program leverages local government participants and community-based organizations for outreach activities. Relatively high cash incentives deliver high participation levels and low per-unit marketing costs. The program's gross annual energy, demand, and therm savings goals are 5.4 million kWh, 1,117 kW, and 20,800 therms, respectively. The B.E.S.T. Program along with the WWTP program described above were components of a suite of programs that KEMA-XENERGY submitted to the CPUC under the acronym EEGOV.

7.1.4 Innovative Peak Load Reduction Small Grants Program, California Energy Commission

KEMA-XENERGY is currently the program administrator for small grants under the California Energy Commission's Innovative Peak Load Reduction Program. With a $14 million budget, this statewide program offers small grants for projects that reduce peak electric demand. The program was launched on a fast track in response to the California energy crisis. Within a 1-month period, KEMA-XENERGY was able to launch a mass marketing outreach campaign to solicit applications, create, and staff a call center for application support via web and telephone hotline, develop a tracking database to share with the CEC, and create a policies and procedures manual to guide program implementation. Lighting retrofits, HVAC and process improvements, peak load shifting, distributed generation utilizing waste-heat recovery and many other measures are eligible to receive grant funding. The project scope includes marketing, application processing, technical analysis, program tracking, site verifications, and grant payment processing.

7.1.5 Nevada Sure Bet Program, Nevada Power and Sierra Pacific

KEMA-XENERGY developed the Nevada Sure Bet incentive program to help customers facilitate the implementation of cost-effective energy-efficiency improvements. The Nevada Power and Sierra Pacific Power companies are offering this program to their small- and medium-sized commercial customers; KEMA-XENERGY acts as the program administrator. The Sure Bet program offers prescriptive incentives on a per-unit basis for common high-efficiency lighting, cooling, and motor technologies, while a custom incentive option allows for flexibility in choosing energy-saving measures. KEMA-XENERGY trained contractors in Nevada on the program policies and procedures and continues to work closely with them to market energy savings opportunities. In addition to cash incentives, KEMA-XENERGY performs energy audits and project proposal reviews for commercial electricity customers in Nevada.

7.1.6 Compressed Air and Pump System Efficiency Program, New York State Energy Research and Development Authority

Under contract to NYSERDA, KEMA-XENERGY is currently operating a program to help compressed air equipment distributors develop and market services to increase the energy efficiency of compressed air systems in their customers' plants. The objectives of the program are: to persuade compressed air equipment distributors that the promotion of energy efficiency in the systems they sell and service is a good business strategy; and, to provide participating distributors with the tools they need to pursue such a strategy effectively and profitably. The KEMA-XENERGY team has developed new and effective methods for assessing compressed air system opportunities, plant inspection protocols and report templates to assist vendors in developing efficiency projects, and hands-on project development guidance to participating vendors. The program has recruited 11 distributors and resulted in 11 completed pilot projects to date.

7.1.7 Nonresidential Audits, Pacific Gas and Electric Company

Under a technical services contract with Pacific Gas and Electric Company, KEMA-XENERGY is providing commercial and industrial audits, feasibility studies, monitoring and evaluation, and technical support for specific industry studies. To date, audited sites have included wineries, refrigerated storage, food processing, and equipment manufacturing facilities. KEMA-XENERGY also provides follow-up contact with each customer to encourage implementation, identify barriers, and suggest ways to overcome the barriers.

7.1.8 Roseville Electric Company, Roseville, California

KEMA-XENERGY is providing technical assistance for industrial and commercial customers of Roseville Electric Company, a California municipal utility. These audits include an evaluation of all electrical systems, including lighting, HVAC, motors, and process end uses. To date, KEMA-XENERGY has performed audits of 30 sites, including city buildings, the municipal wastewater treatment plant, a semi-conductor fabrication facility, a hospital, office buildings, a solid waste treatment facility, a college campus, and a telephone company. In addition, KEMA-XENERGY was selected to help implement the Summer Peak Load Reduction Program for the city. KEMA-XENERGY helped to recruit customers to participate in the voluntary load shedding program, identified and quantified curtailable loads, advised the customers and Roseville Electric on technologies necessary to automate the curtailment, and verified the installation and effectiveness of the measures. KEMA-XENERGY also assisted in developing baseline load profiles for each of 29 participating customers to be used in determining payments by the state program to Roseville Electric and its customers.

7.1.9 Enhanced Automation Campaign, California Energy Commission

The California Energy Commission (CEC) has contracted with KEMA-XENERGY to develop case studies of successful enhanced automation installations and perform various other marketing, technical assistance and research activities. The purpose of this contract is to increase customer awareness, installation, and use of enhanced automation in targeted market segments by learning from the lessons of the first round of AB970 demand-responsive (DR) activities sponsored by the CEC. Enhanced automation refers to strategies to increase the capability of existing energy or building management systems to control current and plan for future building energy costs while maintaining the comfort and productivity of all building occupants. The primary products for this project are a collection of marketing materials, including a brochure, several four-page, glossy, case study write-ups and two guidebooks that assist customers with the enhanced automation decision-making process.

Specifically, KEMA-XENERGY (1) developed case studies of successful enhanced automation installations; (2) conducted market research including focus groups and telephone interviews with DR pilot program participants and nonparticipants to assess interest, barriers, and opportunities for increased penetration of enhanced automation; (3) developed marketing materials such as brochures and guidebooks; and (4) are distributing marketing materials through various channels. Under this contract, KEMA-XENERGY also provides technical assistance to

customers requesting additional help in implementing enhanced automation and assist in the implementation of building automation systems that demonstrate the full range of benefits that can be achieved through enhanced automation.

7.1.10 Strategic Electric Plan, City of Santa Ana, Santa Ana, California

KEMA-XENERGY was hired by the City of Santa Ana to develop a Strategic Electric Plan for energy cost control in the City. As part of this contract, KEMA-XENERGY studied all 795 city electric accounts, conducted a right/best analysis for each account, and did energy audits of city libraries, police and fire stations, city parks, outdoor stadiums, parking structures, senior centers, and the City Hall. KEMA-XENERGY also conducted an in-depth analysis of energy uses for city street lighting, traffic control, and the city's municipal water department. Taken together, KEMA-XENERGY's recommendations for energy conservation measures; improvements to the way in which city accounts were structured, billed, and paid; and procurement strategies are expected to save the city over $1 million annually.

7.2 SUBCONTRACTORS

Brown and Caldwell has become a leader in energy systems studies and design by anticipating the needs of its clients and developing timely, cost-effective solutions. Brown and Caldwell designed its first cogeneration system in the early 1950s, long before "cogeneration" was invented. The firm's power generation experience includes fuels such as biogas, wood waste, agricultural waste, and other alternative fuels. More than 60 power generation projects, ranging in size from 20 kW to 55 MW, have been completed to-date. Brown and Caldwell designed the nation's first large thermal energy storage system in the 1960s and has since completed over 40 other projects. In addition the firm has designed more than 200 central heating and cooling plants.

Today, projects retrofitting existing water and wastewater treatment plants require a unique blend of expertise in energy conservation, process operations, and control/system design. For over a decade, thanks to its expanded capabilities in plant operations and energy conservation, Brown and Caldwell has met the challenge of achieving cost-effective water delivery and pollution control.

Brown and Caldwell's highly skilled professionals are adept at analyzing energy consumption and developing conservation programs while optimizing process effectiveness. The following descriptions of selected energy studies produced by Brown and Caldwell illustrate the firm's innovative approach to energy and energy conservation.

7.2.1 Santa Cruz Wastewater Treatment Plant, Santa Cruz, California

Brown and Caldwell performed pre-design studies, design, construction engineering, start-up, and air permitting services for the 650-kW digester gas cogeneration system in Santa Cruz, California. The firm conducted a plant-wide energy audit, including an evaluation of the existing rich-bum cogeneration system and recommended a new digester gas management system and a

new lean-bum, low-emission, digester gas fueled cogeneration system. The study identified nine energy-saving recommendations that would significantly reduce the high energy costs incurred by this 12-mgd treatment plant. These recommendations included installation of higher efficiency motors, energy-efficient lighting, and automatic control of the digester sludge heating. All recommendations have attractive life-cycle payback periods based on U.S. Environmental Protection Agency guidelines. The cogeneration system design was completed as part of the plant's expansion and improvement project in 1989. The revised digester gas management system included gas conditioning and natural gas blending equipment. The cogeneration engine incorporated a low-emissions pre-combustion chamber design to meet Monterey County Air Quality Management District emissions requirements.

7.2.2 Sacramento Regional Wastewater Treatment Plant, Sacramento, CA

Brown and Caldwell performed a comprehensive, two-phase energy conservation study for this large, 125-mgd wastewater treatment plant. The firm's investigation included a detailed audit of both normal and emergency electric power consumption for this large facility. Pretreatment, primary treatment, secondary treatment, solids handling, and plant auxiliary system were examined. Energy conservation opportunities (ECO) were developed, with nine ECOs having less than a 6-year simple payback. A detailed plant motor list was prepared along with a lighting study for all nine major plant buildings. ECOs were developed for plant processes, HVAC, odor control, lighting, and plant operations and maintenance. Plant electrical services and power purchase arrangements were reviewed and optimization recommendations were made.

7.2.3 Dublin San Ramon Services District WWTP, Dublin, CA

Brown and Caldwell implemented an aeration blower retrofit to reduce electrical energy consumption at the wastewater treatment plant in the Dublin San Ramon Services District. Multi-stage aeration air blowers were replaced with high speed, high-efficiency, single-stage blowers. Projected savings 1.25 GWh per year.

7.2.4 Diablo Delta WWTP, Antioch, CA

At the Diablo Delta wastewater treatment plant, Brown and Caldwell investigated process performance optimization and plant energy conservation services. Their recommendations included three energy conservation improvements with projected electrical savings of over 930 MWh per year.

7.3 RESUMES OR DESCRIPTION OF EXPERIENCE – KEY STAFF

The WTPIP program offers a seasoned team of energy engineers and wastewater treatment process engineers. Together, this proven team of experts comprises all of the skills necessary to provide practical, cost-effective evaluation, training, analysis and recommendations for improvement.

7.3.1 KEMA-XENERGY

Steven Giampaoli, P.E. Mr. Giampaoli will have overall responsibility for the entire contract to ensure technical excellence and overall client satisfaction. He will be responsible for taking the big picture view of all tasks, providing high-level technical support, and ensuring client satisfaction. In his current position as Director of Western Region Engineering Services, he administers the 2002-2003 WTPIP program, develops and implements energy auditing and program impact evaluation for demand side management activities, directs energy auditing teams for commercial, industrial, utility, institutional, and government clients; evaluates and designs energy efficiency measures for industrial and commercial sites; performs independent third-party review of utility industrial and commercial energy efficiency rebate programs; and consults with industrial and commercial clients on energy efficiency and energy cost reduction measures.

Dan Thomas, P.E., C.E.M. Mr. Thomas will be conducting the benchmarking studies. He has a degree in wastewater treatment and has been doing energy engineering for over 20 years. He has conducted energy audits and analyses, and energy engineering training in a dozen states and five foreign countries. Two of his wastewater energy management projects won energy awards from national engineering societies. He has extensive experience in not only wastewater treatment, but all other types of commercial and industrial customers. Dan is part of the project team for the California Public Utilities Commission's 2002-2003 WWTPIP program.

Frank Powell, P.E. Frank Powell is a senior engineer who provides technical analysis of complex energy technologies in commercial and industrial applications, detailed energy conservation, efficiency, and peak load reduction audits, and prepares customized rebate projects for review by utilities and customers. Formerly, Mr. Powell was the Director of Engineering and Regional Director for the National Energy Management Institute. Mr. Powell graduated from Cornell University with a BS in Engineering and a Master's in Engineering. Frank is part of the project team for the California Public Utilities Commission's 2002-2003 WWTPIP program.

7.3.2 Brown and Caldwell

Steven Esmond, P.E. Steven Esmond has more than 30 years of experience in the planning, design, construction, and operation of wastewater treatment plants. Over his career, he has served as the engineer-of-record for more than $500 million worth of constructed and operating wastewater treatment plants. As a registered treatment plant operator in two states, Mr. Esmond brings together the often disparate design and operation philosophies, and is able to deliver technically sound design specifications that are operator friendly and result in the lowest possible life-cycle costs. Mr. Esmond is part of the project team for the on-going joint effort with KEMA-XENERGY on the California Public Utilities Commission's 2002-2003 WWTPIP program. He has worked on several projects for Orange County Sanitation District, California; the City of Houston, Texas; The City of Fort Worth, Texas; and the City of Phoenix, Arizona.

Eric Wahlberg, Ph. D., P.E. After earning a bachelor's degree in Public Health from the University of Massachusetts, Mr. Wahlberg worked for 7 years as a WWTP operator in Colorado and Wyoming. He left operations to get first a masters degree and then a doctorate in

environmental engineering. Currently, he is vice president of process optimization for Brown and Caldwell. Confirming his professional goal of putting theory and research into the hands of operators, he was the 1995 recipient of WEF's Eddy Medal, given for outstanding research and the 1997 recipient of WEF's Gascoigne Medal, given for making a significant contribution to operations. He has written extensively on primary and secondary clarifiers and activated sludge process control.

8

BUDGET

The summary of the budget for the Wastewater Treatment Plant Improvement Program for SCE customers is shown in Table 8-1. KEMA has also proposed a similar program in the Pacific Gas and Electric service area and is on a separate proposal in the San Diego Gas and Electric service area in partnership with the San Diego Regional Energy Office. Should one or both of these other programs be selected along with this program in the SCE service territory, a discount for administrative and EM&V costs of approximately 5 percent for the combined programs is possible due to economies of scale and synergies between the programs. With lower costs, overall cost effectiveness is enhanced.

Table 8-1
SCE WWTPIP Program Budget Summary

Expense Category	Amount	% of Total
Total Administrative	**$259,395**	**52.53%**
Managerial & Clerical	$26,823	5.43%
HR Support & Development	$46,853	9.49%
Travel & Conference Fees	$9,600	1.94%
Overhead	$176,119	35.66%
Total EM&V Costs	**$32,375**	**6.56%**
EM&V Activity	$27,500	0.99%
EM&V Overhead	$4,875	5.57%
Total Direct Implementation	**$191,059**	**38.69%**
Financial Incentives	$124,500	25.21%
Activity	$53,143	10.76%
Installation	$0	0.00%
Hardware & Materials	$0	0.00%
Rebate Processing & Inspection	$13,416	2.72%
Total Marketing	**$11,000**	**2.23%**
Financing Costs	**$0**	**0.00%**
Potential Performance Award	**$34,568**	**7.00%**
Total Program Budget	**$493,829**	

Table 8-2 shows our incentive projections by measure.

Table 8-2
Total Incentives by Measure

MEASURE / ACTIVITY NAME	UNIT GOALS	UNIT DEFINITION	FINANCIAL INCENTIVE PER UNIT	FINANCIAL INCENTIVE PER MEASURE
Operation Improvements	4	Per Plant		$0
Process Optimization	4	Per Plant		$0
Aeration System Control	1	Per Unit	$67,500.00	$67,500
Primary Clarifyer Optimization	1	Per Unit	$22,500.00	$22,500
Infl/Effl Pump VSD Motor Control	1	Per Unit	$22,500.00	$22,500
Dewatering Pump VSD Motor Control	0	Per Unit	$18,000.00	$0
Optimize Engine Fuel Use	1	Per Unit	$12,000.00	$12,000
Total				$124,500

Additionally, this program is expected to provide the benefits shown in Table 8-3.

Table 8-3
SCE WWTPIP Program
Projected Benefits/Costs

TRC Net Benefits	$784,893
TRC Ratio	**2.1147**
PT Net Benefits	$3,288,665
PT Ratio	**8.4742**
TRC Levelized Cost Electric	0.0369
TRC Levelized Cost Gas	4.7975

Additionally, the energy effects shown in Table 8-4 will be realized.

Table 8-4
SCE WWTPIP Program
Projected Net Energy Effects

Net Coincident Peak kW	188
Net Annual kWh	2,256,000
Net Lifecycle kWh	30,768,000
Net Annual Therms	16,000
Net Lifecycle Therms	240,000