Water/Wastewater Guide 1:

Reduce Energy Use in Water and Wastewater Facilities Through Conservation and Efficiency Measures

Highlighted Water and Wastewater Agencies

- Central Contra Costa Sanitary District (CCCSD)
- Inland Empire Utilities Agency (IEUA)
- North Tahoe Public Utility District (PUD)
- Orange County Water District (OCWD)
- Paradise Irrigation District
- Patterson Irrigation District (PID)
- Santa Clara Valley Water District (SCVWD)
- South Tahoe Public Utility District (PUD)
- Vallejo Sanitation and Flood Control District

Flex Your Power worked with hundreds of water and wastewater agencies to conserve 15 percent within their own facilities in 2001.

Summary

Water and wastewater agencies rely on electricity to pump, treat and distribute water and are California's most significant users of energy. Pumping alone accounts for 5 percent of the State's peak load and 7 percent of California's total electricity usage.[1] A water distribution or wastewater treatment facility can spend more than $500 million annually on energy, representing 50 to 75 percent of an agency's total costs.[2]

To avoid rate hikes (sometimes as high as 50 percent) and rolling blackouts, which can have a severe environmental and health impact on the surrounding community, many water and wastewater districts enacted conservation and efficiency measures in 2001. The State's energy conservation and efficiency campaign in 2001 and 2002, Flex Your Power, worked with hundreds of water and wastewater agencies to conserve 15 percent within their own facilities in 2001[3]. Aided by federal, state and utility agency incentives, many water distri-

1. Association of California Water Agencies (ACWA), "California's Energy Crisis: What it Means for Water Agencies," accessed online at www.acwanet.com/products/acwausa/energycrisis/whatitmeans.asp on December 20, 2002.
2. California Energy Commission (CEC), "The Water-Energy Connection," Accessed online at www.energy.ca.gov/process/water/water_index.html on December 20, 2002.
3. The Flex Your Power campaign, coordinated by the California State and Consumer Services Agency (SCSA) in 2001 and 2002, was the most aggressive, comprehensive and integrated energy conservation and efficiency effort in the history of the United States, "Flex Your Power Final Report," December 2002.

Some of the projects required a large investment in time, personnel and money, but the energy savings realized by the water and wastewater districts more than paid for the improvements.

bution and wastewater treatment agencies improved the efficiency of their facilities and water systems. Projects included adjusting operation schedules, increasing water storage, utilizing generators, optimizing cogeneration and installing efficient water system equipment, variable frequency drives (VFDs) and advanced equipment controls. While treatment and pumping consumes the most energy, some agencies greatly benefited by auditing and upgrading building shells, heating, ventilating, air-conditioning (HVAC) systems and lighting. Some of these projects required a large investment in time, personnel and money, but the energy savings realized by the districts more than paid for the improvements and are expected to continue for years to come.

Water distribution and wastewater treatment agencies that are interested in reducing energy use in their facilities should consider the strategies described in this Best Practice Guide, as well as the specific actions taken by Central Contra Costa Sanitary District (CCCSD), Inland Empire Utilities Agency (IEUA), North Tahoe Public Utility District (PUD), Orange County Water District (OCWD), Paradise Irrigation District, Patterson Irrigation District (PID), Santa Clara Valley Water District (SCVWD), South Tahoe Public Utility District (PUD) and Vallejo Sanitation and Flood Control District. This Best Practice Guide aims to provide water and wastewater agencies with information on planning, implementing and financing various energy efficiency and conservation plans, descriptions of existing programs in California, contact information for project leads and useful energy resources.

For information on successful public outreach programs implemented by a variety of water and wastewater districts in California, see Water/Wastewater Guide #2, "Promote Energy Conservation and Efficiency through Public Outreach, Services, Incentives and Assistance."

Step-by-Step Procedures

Step 1: Gather Data

✓ **Conduct a water system audit**, energy audit and/or technical engineering analysis of facilities to determine the areas of greatest need or to identify the most cost effective energy saving opportunities.

Central Contra Costa Sanitary District (CCCSD) has always been very aware of its energy use. The senior engineer constantly monitors energy use, and CCCSD consistently looks for ways to improve energy efficiency. During the past 20 years, CCCSD has performed two comprehensive energy audits – one by CCCSD staff, the other by Pacific Gas and Electric (PG&E). Prior to the start of CCCSD's lighting retrofit project, a PG&E subcontractor performed energy audits.

Inland Empire Utilities Agency (IEUA) hired two consultants to help staff operators and engineers review IEUA's energy centers. The review consisted of power readings and investigating conservation and self-generation options that could be implemented by July 2001. Each plant and process (primary, secondary and tertiary) was evaluated on a case-by-case basis so that the consultants, operators and engineers could determine how much energy each plant and process consumed and which could be run at off-peak hours. Operators examined how to better operate plants; the engineering department helped operators determine where data could be collected and helped design new projects.

North Tahoe Public Utility Department (PUD) researched cost-effective, energy-efficient treatments that could be implemented at its plant and found that UV was the least costly technology, in terms of capital and annual operations and maintenance (O&M) (ozone treatment was the second most cost alternative; energy and operations were more expensive). With the help of an outside consultant, North Tahoe PUD investigated the feasibility of the UV system at the plant, analyzing Lake Tahoe's water quality among other issues. The UV system also had to be approved by the Department of Health Services because it would be the first UV system to treat potable water.

Orange County Water District (OCWD) hired outside contractors to help conduct an on-site, pre-project inspection of its facilities. The contractors and OCWD gathered power readings from power monitors and monthly kilowatt (kW) and amp readings from the administration buildings' chillers. OCWD hired a consultant to perform an audit on the HVAC systems, including analyses of the HVAC water systems and water pumps.

Prior to beginning an energy conservation project, Paradise Irrigation internally analyzed its past energy use and costs.

Patterson Irrigation District's (PID) general manager conducted a water system audit in coordination with the Irrigation Training and Research Center (ITRC) at Cal Poly State University in San Luis Obispo. PID also hired an electrical engineering firm to conduct an audit on its electrical delivery systems. The electrical audit documented reliability, safety and remaining life and usefulness of PID's electrical hardware, including motor control centers, transformers and power factor correction capacitors.

Santa Clara Valley Water District (SCVWD) staff identified existing energy conservation practices and critical systems and components receiving electrical power; determined duration of required operations time during loss of PG&E power; and contacted industry peers, power specialists, suppliers, engineers and regulators to find out what others were doing. SCVWD collected the data through audits, surveys and face-to-face discussions. SCVWD also hired an advertising firm to coordinate focus group research to test public outreach messages to encourage water and energy savings.

South Tahoe Public Utility District (PUD), with the help of outside consultants, performed an on-site inspection, discussed operations with plant personnel and determined energy consumption patterns and history of the plant facilities. The inspection included an examination and analysis of the dissolved oxygen (DO) control system, the filter influent pump, plant effluent pumps and the feasibility of installing VFDs on pumps.

Vallejo Sanitation and Flood Control District hired an outside consultant to perform an energy assessment. The consultant documented operational procedures (what and how equipment was operated; chemical, electrical and gas usages) through employee interviews and a review of operational data. The data was used to determine cost effectiveness of various projects either as standalone or in conjunction with energy rebates.

For a "How to" guide on hiring an energy consultant/auditor, energy services company or a construction manager, refer to the California Energy Commission's (CEC) handbooks:[4]

- How to Hire an Energy Auditor to Identify Energy Efficiency Projects

Through audits and interviews with plant personnel, water and wastewater agencies were able to determine energy consumption patterns of equipment and systems and identify cost-effective and feasible projects.

Some water districts appointed a coordinator to lead a team in designing, communicating and implementing projects.

- How to Hire a Construction Manager for Your Energy Efficiency Projects
- How to Hire an Energy Services Company

Step 2: Devise a Plan

✓ **Build an energy management team**. Appoint a coordinator to lead the team in designing, communicating and implementing projects.

CCCSD organized an eight-member "Energy Team" comprised of department managers and engineers to guide and promote energy efficiency and conservation within and outside the agency.

OCWD built an energy management team, headed by the associate general manager, the I&E supervisor and the water production superintendent.

Paradise Irrigation's treatment plant superintendent worked with the District's treasurer and the heads of each department to design and implement pump and motor efficiency programs.

PID is a small district, without a multi-level staff hierarchy. Office staff included and was limited to a General Manager, Treasurer/Secretary and as of December 2001, a Water Conservation Technician. All planning and program ideas originated with the General Manager, who then presented the efficiency projects to the Board of Directors for approval.

✓ **Define the targets, objectives and quantifiable goals** based on a careful review and analysis of the research gathered by the team. Discuss the assumed need, the most cost-effective practices, the staffing requirements and the community response.

The CCCSD Energy Team proposed to the Board of Directors a plan to reduce energy consumption, specifically on-peak energy use. The plan was adopted on April19, 2000. The plan identified the following areas for energy projects: cogeneration enhancements; optimization of operations to minimize on-peak power demand; maximization of use of landfill gas as an alternative energy source; and installation of new lighting.

IEUA management developed a Seven Point Emergency Energy Action Plan, identifying the following efficiency and conservation targets:

- Maximize efficiency of existing office and plant operations;
- Minimize external energy, natural gas and other fuel cost;
- Maximize operational flexibility of plants to "roll off" electric grid and natural gas sources, particularly during peak usage periods;
- Maximize "self-sufficient" operations;
- Generate new local sources of energy for plant operations, support of related facilities and ultimately sale into the grid
- Promote regional energy and water conservation programs; and
- Promote development of local water supply options.

4. For more information visit www.energy.ca.gov/reports/efficiency_handbooks/index.html. You can also order these documents from the Commission's Nonresidential Buildings Office by calling (916) 654-4008.

OCWD's energy management team identified three short-term goals for energy efficiency: reduce energy load, save money and preserve/extend the life of the equipment. The team planned to target OCWD buildings' electrical and lighting systems and the chemical and energy management of the plant treatment process and HVAC systems. OCWD also identified a long-term efficiency project: conversion of Water Factory 21 into the Ground Water Replenishment System, an MF (microfiltration)/RO (reverse osmosis) facility to be designed with the latest energy-efficient equipment and processes. The project is set to begin mid-2003 and is projected to save 140 kWh/year.

Paradise Irrigation's energy conservation goals were to optimize the treatment plant's filtration filter/clarifier runs (filters are backwashed to remove accumulated suspended matter).

To respond to Gov. Gray Davis' call for energy conservation, PID reiterated its commitment to reduce energy consumption within irrigation district facilities by at least 8 percent, and 20 percent during Stage 2 electrical emergencies.[5] PID's commitment to reduce energy began in 1997 and 1998. With the help of ITRC and the U.S. Bureau of Reclamation (USBR), PID designed a modernization program that would increase water use and electrical efficiencies. Projects included automation of two pumping plants utilizing VFDs and pump staging in order of efficiencies. In 2001, PID planned to expand the upgrades to all five of its pumping plants, including installing motor controls with soft starters, advanced monitoring and diagnostic capabilities, a Programmable Logic Controller (PLC), radio communications and power/diagnostic monitoring software and replacing mounted transformers with modern solid-state and enclosed pad mounted transformers.

After a review of its facilities, SCVWD planned to: perform white-paper assessments of operational needs; increase backup battery capacity for small critical systems and equipment; add backup generator capacity for large critical systems and equipment; and lower HVAC and lighting usage. SCVWD's energy conservation and efficiency program was designed to help prevent rolling blackouts and to ensure water supply in spite of external power interruptions. SCVWD's utility engineering, operations, maintenance, HVAC and public information staff took part in designing and implementing the internal programs.

South Tahoe PUD's goals were to reduce electrical energy consumed at the plant and to reduce energy costs. Due to the high amount of energy required to operate the effluent pump, South Tahoe PUD had twice the energy costs of most wastewater facilities. Seven energy conservation measures were identified for the existing facilities, six of which were considered feasible for implementation: install automated dissolved oxygen control system; limit peak discharge flows through flow equalization; install a VFD on one effluent pump; improve efficiency of all plant effluent pumps; install VFDs on and replace on filter influent pump; avoid running three pumps at one of its stations; and install VFDs at the sewage station.

SCVWD's energy conservation and efficiency program was designed to help prevent rolling blackouts and to ensure water supply in spite of external power interruptions.

5. The California Independent System Operator (ISO) issues a Stage 1 emergency declaration when operating reserves dip below 7 percent. Consumers are asked to lessen the strain on the State's power grid by conserving electricity, especially during afternoon hours. The California ISO can access emergency resources to help maintain operating reserves. A Stage 2 is declared when reserves drop below 5 percent. At this level, large commercial that have signed up to voluntarily curtail power during high demand days will be asked to do so, enabling the California ISO to access emergency resources to help maintain operating reserves. A Stage 3 is declared if an operating reserve shortfall of less than 1.5 percent is unavoidable. Involuntary curtailments of service to customers, including "rotating blackouts," are possible.

To help defray program expenses, many agencies tapped into rebate and incentive programs offered by local utilities and state agencies.

Vallejo Sanitation's goals were to find the most cost-effective treatment of wastewater and to apply for financial rebates/grants when possible.

✓ **Utilize online resources** for help in planning and designing energy efficiency upgrade projects such as the Association of California Water Agencies (ACWA) website and/or the California Energy Commission (CEC)'s Energy Partnership Program.[6]

The CEC's Energy Division helped South Tahoe PUD hire a consultant to assess the specific areas with the most potential for energy savings. The consultants evaluated, analyzed and prepared an Energy Assessment Report for the CEC.

✓ **Research funding options and set a budget**. Local utilities and state agencies offer a wide range of incentives to underwrite energy-conserving behavior and investments.

Due to high energy costs in general, CCCSD had a critical need to minimize power usage to remain within its established operating budget. CCCSD received a rebate of $60,000 from CEC for cogeneration air in-take replacement. The rebate was made possible through funding opportunities in Senate Bill (SB) 5X/Assembly Bill (AB) 29X in 2001. The district also received a rebate of $3,600 for motion sensors from the California Public Utilities Commission (CPUC). At a cost of approximately $6,000 per year, CCCSD expected a two-year payback on the investment.

IEUA staff negotiated with various natural gas providers, including British Petroleum Gas (BP), for the best price possible for long-term natural gas contracts. IEUA wanted to run generators more often to reduce on-peak demand at its water recycling plants. IEUA was looking for cheaper and cleaner air technologies; diesel generation operations have long-term air quality issues and are only allowed to operate 200 hours/year by the Southern California Air Quality Management District (SCAQMD). IEUA's contract with BP saved the agency more than a dollar/therm: Average power costs during first quarter 2001/02 were 16.25¢ per kilowatt-hour (kWh) and 7¢ per kWh during the second quarter 2001/02. In addition, IEUA estimated the cost to design, construct and install the new generation equipment to be $1 million per megawatt (MW) of electricity generated, with a return on investment of five to seven years.

- IEUA also received incentives from BP and Southern California Edison (SCE) for micro turbine installation upgrade projects.

North Tahoe PUD estimated the total construction cost of the UV disinfection plant at $3.1 million and $6,700/year for power.

OCWD set a project budget for short-term efficiency projects at $17,000. Funding came from the general fund. The district expected a payback of less than two months.

PID applied for USBR grants through the Mid-Pacific Region Field Services Program for its modernization and automating projects.

South Tahoe PUD estimated $211,000 for the total capital costs with a payback period of 1.1 years for the seven energy conservation management improvements. Using Sierra Pacific Power Company's (SPPC) rate schedule, an outside contractor computed the cost savings associated with each improvement by comparing demand and

6. The CEC's Partnership program helps cities and counties to reduce energy use in their office buildings, police and fire stations and other buildings. An initial, free feasibility study identifies possible energy efficiency projects. For more information visit www.energy.ca.gov/efficiency/partnership or call (916) 654-3838 or (916)-654-5070. To contact ACWA visit www.acwa-net.com.

usage reductions to the existing operating conditions. All improvements were funded from the capital improvement budget.

Most of the funds for Vallejo Sanitation's projects came from operating funds, usually out of the electrical budgets, as many of the projects had a return on investment of less than one year. The district also tapped into several incentive and rebate programs:

- The Energy Power Research Institute (EPRI) funded Vallejo Sanitation's energy assessment under EPRI's Municipal Water and Wastewater Program.[7]
- Efficiency improvements were partially funded by the CEC's Distributed Generation Retrofit Program for Water/Wastewater Facilities, PG&E's Energy Efficient Lighting and Electronic Ballast Replacement Program and PG&E's Variable Frequency Drive (VFD) program. The VFD program provided funds for VFD installation on fixed speed motors as well as replacement of older inefficient VFDs.

To learn more about utility services and rebate and incentive programs, check with your local municipal utility, or contact:

- Pacific Gas & Electric (PG&E)
- San Diego Gas & Electric (SDG&E)
- Southern California Edison (SCE)
- CEC's Rebate and Demand Reduction Program Database[8]
- For a comprehensive list of all incentive programs targeted at water and wastewater agencies, go to the ACWA website[9]

South Tahoe PUD prioritized projects based on payback time and ease of implement-action. Others had to take into account utility and government funding rules and deadlines.

✓ **Set a timeline**. Plan programs so that they will coincide with peak energy use seasons. Timelines should take into account the local government's budget cycle and utility and government funding rules and deadlines.

SCVWD began planning projects in January 2001 with the goal of implementing the programs by the summer of 2001. SCVWD also wanted to make temporary installations permanent by the end of 2001.

South Tahoe PUD's manager of wastewater operations prioritized the projects based on payback time and ease of implementation.

In order to qualify for a generator replacement grant, Vallejo Sanitation needed to design and complete the project by a certain date. The district structured the project's implementation around the grant deadline. In addition, Vallejo Sanitation chose to focus first on the projects that had the quickest paybacks, generally of five years or less.

✓ **Consider strategies that can make the projects more effective or cost-efficient**. These include requesting technical assistance from or initiating a partnership with other entities (such as businesses, utility companies, neighboring cities and schools); providing incentives; or prohibiting an action.

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7. EPRI provided a one-time grant to fund an energy assessment at two water agencies, one large and one small from southern and northern California. EPRI approached Vallejo and asked if the district was interested in participating in the program.
8. The database links to a wide range of rebates offered by utilities and state agencies to encourage energy users (residential, business and government) cut electricity use. For more information visit www.consumerenergycenter.org/rebate/index.php.
9. For more information visit www.acwanet.com.

CCCSD removed from service as many unit processes and equipment as possible to minimize power consumption while still maintaining prudent performance of the treatment plant.

PID received technical support and expertise on canal pumping, plant modeling and downstream control algorithms from the ITRC and USBR.

See Water/Wastewater Guide #2, "Promote Energy Conservation and Efficiency through Public Outreach, Services, Incentives and Assistance."

See Local Government Guide #4, "Promote Energy Conservation and Efficiency Through Public Services, Incentives and Technical Assistance."

Step 3a: Implement Programs/Operations – Conservation

The following section describes the areas in which water and wastewater agencies have successfully conserved energy in their facilities. The specific actions varied according to the agency's goals, size and resources, such as budget and staff.

Water/Wastewater System Equipment

✓ **Alter schedules** of high-energy-using equipment and processes to reduce usage during peak demand times and/or shift load to off-peak hours. Establish an Electrical Load Management System, utilizing time-of-use (TOU) and differing rate schedules. Use programmable control systems and an energy management system (EMS) to regulate schedules.

CCCSD shifted as much of the power demand of pumping equipment as possible to off-peak periods.

IEUA shut down non-essential pumps in various wastewater treatment plants and decreased aeration during peak energy use.

South Tahoe PUD altered its pumping schedule and operations to allow the older higher head pumps to come on-line only to pump to the emergency storage reservoir or to facilitate a backwash. To determine the optimum pump combinations for the pump control strategy, South Tahoe PUD ran various pump combinations with the corresponding flowrates. The district also switched pumping schedules to avoid running three pumps at the 7,000-foot high Luther Pass. Final pumps now only run at full speed and are started and stopped manually by the operators. When necessary, a second final pump was allowed to start during the off-peak hours.

✓ **Turn off and/or bypass less efficient system equipment**.

CCCSD removed from service as many unit processes and equipment as possible to minimize power consumption while still maintaining prudent performance of the treatment plant.

IEUA bypassed and completely shut down one of its four sewage treatment plants from June 4 to October 7 in favor of a more energy-efficient plant. The bypassed plant consumed significant amounts of energy for its UV disinfection process. The by-pass required significant changes in staff work schedules and locations.

OCWD turned off high-energy-demand water treatment pumps when possible and used the pumps that were more efficient.

✓ **Install computerized management systems and devices** that will automatically regulate or enable users to completely control the use of energy in treatment and pumping equipment.

PID undertook several large system control projects in 2001.

- Beginning in 1999, PID installed a plant control and Supervisory Control and Data Acquisition (SCADA) system on one of its main pumping plants on the San Joaquin River. The changes reduced energy consumption by 23 percent. In 2000 and 2001, PID upgraded two additional pumping plants following the early model. The plant control and SCADA system allowed PID to utilize its various water sources more efficiently and automate and remotely monitor and control its pumping stations. The SCADA system also enabled PID to pinpoint and fix potential problems before they became catastrophic.
- In 2001, PID installed five solar-powered Remote Terminal Units (RTU) on its Main Canal and one on its gravity flow Delta-Mendota Canal turnout. The RTUs gather and send data, such as volume, flow rate and alarms, to a central monitoring unit in the main building, thus allowing PID to gather real-time data for more precise and frequent analysis for water and energy management.[10]
- PID also replaced the motor controls of two of its major pumps.

South Tahoe PUD installed a new programmable logic controller (PLC) system to control the blowers and new analyzers on the main aeration basin. Operators can now provide pre-programmable blower sequencing and/or throttling valve position control schedule, or allow the PLC system to automatically control the blowers and valves based on real-time DO residuals.

Vallejo Sanitation continued to install power meters (watt transducers) on electric motors tied to the distributed control system. The meters allowed staff to set wet levels and control sequences throughout a 60 million gallons per day (MGD) treatment facility. The controls were installed as part of treatment facilities improvements done over several years and with three different construction projects. Currently, Vallejo Sanitation has 30 meters in place.

Some agencies altered the settings of their HVAC system. According to ENERGY STAR®, 1 to 2 percent of summer cooling costs can be saved for every degree F the thermostat is raised.

Heating, Ventilating and Air Conditioning (HVAC)

✓ **Alter settings of HVAC system seasonally**. According to ENERGY STAR®, 1 to 2 percent of summer cooling costs can be saved for every degree F the thermostat is raised. Use installed programmable control systems and an EMS to regulate settings.

IEUA raised temperatures to 78 degrees during the summer in headquarters and operations buildings where staff was located.

OCWD changed the temperatures on the HVAC seasonally, moving the thermostat to 76 degrees during the summer months, and implemented an aggressive nighttime lighting program.

SCVWD raised thermostat settings two degrees higher during working hours in the summer and turned off the HVAC at night.

✓ **Prevent solar entry or air-conditioning loss**.

Many agencies closed shades and blinds in office spaces during the day and kept doors and windows closed while the HVAC system was running.

10. Stuart Styles, Charles Burt, Mike Lemhkulh and John Sweigard, "Case Study: Modernization of the Patterson Irrigation District," Irrigation Training and Research Center Paper 99-006, Accessed online at http://www.itrc.org/papers/uscid/Pid.pdf on July 24, 2002.

Vallejo Sanitation installed 100 motion sensors throughout the district, including remote pump stations.

✓ **Install devices, software or management systems** that will regulate and/or track the use of energy by HVAC systems and equipment.

✓ **Alter schedules of HVAC systems** to reduce on-peak energy use and/or shift load to off-peak hours. Use programmable control systems and an EMS to regulate schedules.

✓ **Adjust workplace schedules** to reduce on-peak HVAC usage.

Lighting

✓ **Turn off lights** in areas/rooms that are not bring used or spaces with sufficient natural lighting. Use programmable control systems and an EMS to regulate schedules.

Many water and wastewater agencies requesting staff to turn off lights when they went home for the day.

✓ **Disconnect or remove part of lamps** in multiple lamp type fixtures to reduce lighting.

IEUA turned off 50 percent of the lighting in its headquarters, administration and plant operations buildings, leaving lights on only in areas critical for operation and maintenance.

OCWD reduced lighting in 3 to 5 percent of its buildings.

SCVWD reduced and phased off parking-lot lighting each evening and on weekends; reduced office lighting; and reduced 90 percent of outside lighting in evenings.

✓ **Install devices, software or management systems** that will regulate the use of energy in light fixtures and systems. Occupancy sensors, for example, can save up to 20 percent of a building's lighting energy usage.

CCCSD used the FastTrack Lighting Program and installed 75 motion-sensing devices in all offices, break rooms, restrooms, copy rooms and conference rooms in the headquarter office buildings. These areas were selected because of their high potential for energy savings. Spaces not included were workshops and open office spaces containing several cubicles. CCCSD expected a two-year payback on the investment and estimated net energy reduction at 55,000 kWh, a cost of approximately $6,000 per year.

OCWD installed automatic light sensors in numerous offices and restrooms.

Vallejo Sanitation installed 100 motion sensors throughout the district, including remote pump stations, as part of PG&E's Energy Efficient Lighting and Electronic Ballast Replacement program.

✓ **Adjust workplace schedules** to reduce on-peak lighting usage.

Office and Building Equipment and Nonessential Features

✓ **Enable power save mode** on printers, monitors and copiers.

✓ **Turn off unnecessary equipment** during peak demand times and/or shift load to off-peak hours.

Many water and wastewater agencies requested that employees turn off all office equipment, i.e., computers and printers, when not in use and at the end of the day.

OCWD management conducted random walk-throughs to monitor employee compliance with a memo from the general manager to turn off equipment when not in use. Walk-throughs were followed up with verbal advice or e-mails to the areas that did not comply with the memo.

✓ **Unplug or disconnect nonessential features**.

OCWD shut down its decorative fountain, which used 40,000 gallons of water a year and had a night-light.

✓ **Adjust workplace schedules** to reduce on-peak use of office equipment.

Alternative and/or Renewable Energy Sources

✓ **Consider dropping off the electrical grid** for a certain amount of time.

IEUA purchased and installed three natural gas/ methane fueled internal combustion engines, which enabled the agency to reduce grid load by 100 percent during peak periods.

Paradise Irrigation agreed to cut full power usage at the treatment plant during peak times in an agreement with Ancillary Services Coalition. The district used a generator to run the treatment plant. The generator also served to prepare Paradise Irrigation for rolling blackouts.

✓ **Install and maximize use of alternative energy sources** such as landfill, methane gas, generators and solar power.

To meet its goal of being self-sufficient in 2001, IEUA installed generation equipment at all of its wastewater treatment facilities. The generators produced electricity at costs that were economically preferable to those available from SCE.

- IEUA purchased and installed: 20 microturbines that provide 4,200 MWh annually; three natural gas/ methane fueled internal combustion engines that provide 2,260 MWh of generation for IEUA's plants; two natural gas/methane consuming internal combustion engines, with a capacity of generating 1.915 MW; and 11 diesel generators to back up wells, with combined capability of generating 1.4 MW. IEUA estimated the cost to design, construct and install the new generation equipment to be $1 million/MW of electricity generated, with an ROI of five to seven years.
- IEUA also increased its methane gas production to reduce natural gas demand, including the development of a pilot 1-MW renewable energy project using dairy manure.

Vallejo Sanitation participated in the CEC's Distributed Generation Retrofit Program for Water/Wastewater Facilities. The district used the funding to replace 2.6 MW of existing diesel generators with 2.4 MW of Level 1 BACT rated natural gas fired engine generators. Vallejo Sanitation intends to operate the generators to reduce on-peak demand – running the generators at least six hours a day to drop the demand charges and avoid peak power costs of $.17 /kWh. Partial peak load only costs $.11 / kWh.

- The estimated cost for operation of the generators was $.07 / kWh or $2,411,00.
- Estimated savings was $168,000.
- Estimated payback was six years with $120,000 in funding, 10 years without.

IEUA purchased and installed natural gas/ methane-fueled internal combustion engines, which enabled the agency to reduce grid load by 100 percent during peak periods.

CCCSD installed a modified air inlet on its cogeneration gas combustion turbines to produce 200 kW of additional power.

SCVWD leased and installed 1,500 kW diesel generators at three key facilities to ensure energy availability. One of the generators was installed permanently. SCVWD returned the other two generators, but left in place the connection network for use with other leased units as necessary. SCVWD also installed 20-kW permanent generators at critical water turnouts where remote valves and pumps might be required to operate in an emergency to provide water to retail water companies serving businesses and homes throughout Santa Clara County.

- As part of SCVWD's long-term projects, the district planned to install 1,000-kW natural gas generators at the Penitencia Water Treatment Plant by 2005 and at the campus at its Almaden Headquarters by 2003. The Almaden Headquarters generator installation will have the added feature of a heat recovery system for use with HVAC.
- As part its alternate energy studies, SCVWD evaluated known alternate energy forms of distributed generation. SCVWD chose to install two solar systems at the Almaden Headquarters: a 136-kW system on top of the district's administrative building and a 98-kW carport solar system visible from the highly traveled Almaden Expressway to serve as a centerpiece of SCVWD's commitment to the environment.

✓ **Maximize use of alternative means** of pumping water that require less energy.

PID pumps water from the San Joaquin River uphill into its Main Canal through a series of pump stations and pools. PID upgraded its Delta Mendota Canal turnout with automated controls to allow for more precise control of these supplies. The new system allowed PID to utilize its Delta Mendota Canal gravity supplies during the months of July and August to reduce pumping by an average of 30 cfs (cubic feet per second) per day, a reduced daily pumping load of approximately 250 kW.

Specifically for Wastewater Facilities

✓ **Maximize use of cogeneration**. Depending on anaerobic digester gas (ADG) production, wastewater facilities can optimize cogeneration engines to increase energy production, provide energy during on-peak or power crunch periods or sell energy to other areas.

CCCSD installed a modified air inlet on its cogeneration gas combustion turbines to produce 200 kW of additional power.

Alternative Water Sources

✓ **Increase storage or reservoir use**. Pumping water from distant sources costs significantly more than from local sources and conjunctive-use programs provide a greater and more reliable water supply.

IEUA, in coordination with Chino Basin Watermaster, Santa Ana Watershed Project Authority (SAWPA) (and its other member agencies) and Metropolitan Water District (MWD), promoted the development of local water supply options by encouraging everyone to capture storm water where available.

Due to the rising population of Orange County and increased water and energy shortages, OCWD, in conjunction with Orange County Sanitation District (OCSD), planned to convert one of its facilities by mid-2003 into the Ground Water Replenishment System (GWR). The GWR, designed with the latest energy-efficient equipment and processes, will purify for reuse secondary-treated wastewater from OCSD and

store it in Orange County's groundwater basin. OCWD predicts that the GWR will save 140 kWh each year.

Vallejo Sanitation initiated an incentive program that provided 10 percent of the first year's energy cost savings to the employee who suggested the applicable project.

Public and Employee Outreach

✓ **Disseminate information and tips** to employees through such media as e-mail, newsletters, memos and company websites.

Supervisors at North Tahoe PUD communicated conservation tips, such as turning off computers and lights, to employees.

SCVWD encouraged employees to limit use of office equipment through e-mail announcements and small group meetings with supervisors/managers.

✓ **Provide incentives**, such as contests, discounts, coupons and public recognition.

Supervisors at North Tahoe PUD began a "Putting Ideas Down" program that provided cash rewards to employees who recommended cost-saving measures.

Vallejo Sanitation initiated a company incentive program that provided 10 percent of the first year's savings to the employee who suggested the cost-saving project. The largest award in 2001 was $5,200.

For details on a slew of other employee outreach and incentive programs, see Business Guide #3, "Target Business Employees for Energy Conservation in the Workplace."

For details on public outreach and incentive programs, see Water/Wastewater Guide #2, "Implement a Public Outreach Campaign Through Water and Wastewater Agencies."

Step 3b: Implement Programs/Operations – Efficiency

The following section lists several areas in which water and wastewater agencies have retrofitted their facilities with high-performance, energy-efficient equipment. The specific actions varied according to the agency's goals, size and resources, such as budget and staff.

Water/Wastewater System Equipment

✓ **Test, clean and upgrade pumps and pipes**.

Paradise Irrigation tested the efficiency of its water pumping equipment. The staff evaluated the volume of water being pumped and the amount of energy used to do the pumping. Paradise also hired two consultants to detect leaks using a "leak correlator," a computer-based device that analyzed signals from both ends of a pipe. In 1993, the district experienced 660 water main leaks resulting in a 32 percent water loss. After implementing a water-main replacement program in 1993 and a leak detection program in 2000, water loss fell to 16 percent and the number of leaks fell to 140 in 2001.

✓ **Test, maintain and replace disinfection equipment**.

CCCSD increased maintenance activities to reduce power consumption. CCCSD uses UV light for disinfection. In 2001, CCCSD increased maintenance and cleaned and replaced UV bulbs, which enabled a reduction in the number of UV banks from nine to six. Each bank of lamps used 35 kW, so the total power reduction was 105 kW.

PID installed VFDs to eliminate over-pumping on its Main Canal pumping system and soft-starters and capacitors to all motors at all pumping stations to help reduce startup load and energy imbalance.

IEUA performed maintenance on the UV lamps at one of its four plants and reduced power consumption by 80,285 kWh compared with the previous year.

✓ **Test, maintain and replace control system equipment**.

SCVWD replaced and installed additional new batteries throughout the district at SCADA communications locations, UPS's (Uninterruptible AC electric Power System, which converts battery power to AC power without interruption when utility power is lost) and other critical sites that use low voltage power sources.

✓ **Upgrade motors to energy-efficient models**. Although sometimes higher in cost, energy-efficient motors are 2 to 8 percent more efficient than standard motors and have longer insulation and bearing lives, lower heat output, less vibration and lower failure rates.[11]

IEUA retrofitted pump drives, replacing 14 eddy current clutches with high efficiency direct drive motors. IEUA achieved a 10 percent reduction in energy demand, saving 475,000 kWh annually.

South Tahoe PUD installed a more efficient pump with a VFD to act as the lead secondary pump.

Vallejo Sanitation replaced a throttling value operation and two 150 horsepower motors with two high-energy, efficient, 50 horsepower motors and VFDs.

✓ **Install variable frequency drives (VFD)**. Unlike single speed drives, VFDs have a soft start and allow for precise control of motors and process, thereby extending the life and enhancing the efficiency of motors, and significantly reducing energy demand.[12]

PID installed five VFDs to eliminate over-pumping on its Main Canal pumping system and soft-starters and capacitors to all motors at all five pumping stations to help reduce startup load and energy imbalance. The VFDs installed varied in cost by size and difficulty to integrate into the existing electrical system and resulted in significant energy savings by almost eliminating recirculation and the load reduction characteristics of VFDs on motors.

Vallejo Sanitation participated in PG&E's VFD program and installed four VFDs.

✓ **Utilize emerging technologies** to make processes more efficient.

Paradise Irrigation used a new polymer to extend the time between backwash runs on filters. The new polymer increased the time between clarifier runs by a factor of two or greater during the summer of 2001; the clarifiers were flushed every eight to 10 hours instead of the normal four to five hours. As a result, power use for the clarifier flush was cut in half.

Heating, Ventilating and Air Conditioning (HVAC)

✓ **Replace inefficient HVAC equipment** with energy-efficient models.

For more information about HVAC systems, refer to:

11.CEC, "Energy-water connection," Accessed online at: www.energy.ca.gov/process/water/water-supply.html on July 24, 2002.

12.Ibid.

- ENERGY STAR® Building Manual[13]
- For ENERGY STAR®-labeled products and services, refer to its Service and Product Provider Directory[14]
- The U.S. Department of Energy's Energy Efficiency and Renewable Energy Network (EREN)[15]

✓ **Maintain HVAC systems** to increase energy efficiency.

OCWD performed chemical treatment analyses on water system boilers and chillers and periodically cleaned the coils. These measures not only extended equipment life, but also optimized heat transfer of equipment and saved energy.

OCWD maintained its water system boilers and chillers, which helped to increase the energy efficiency of the system.

Lighting

✓ **Retrofit T12 lamps** (1-1/2 inch diameter) and magnetic ballasts with T8 lamps (1 inch diameter) and electronic ballasts, which provide nearly as much light and use approximately 40 percent less energy.

CCCSD replaced more than 5,000 fluorescent lighting fixtures with high-efficiency lamps and ballasts at the treatment plant and headquarters building, saving more than 800,000 kWh/year.

OCWD replaced lights with T8 lights where feasible.

Vallejo Sanitation replaced approximately 600 fluorescent T12 lamps with T8 lighting -and electronic ballasts as part of PG&E's Energy Efficient Lighting and Electronic Ballast Replacement Program.

For more information about energy-efficient lighting, refer to:

- ENERGY STAR® Building Manual[16]
- For ENERGY STAR®-labeled products and services, refer to its Service and Product Provider Directory[17]
- The U.S. Department of Energy's Energy Efficiency and Renewable Energy Network (EREN)[18]

✓ **Upgrade exit signs** with light-emitting diode (LED) lamps.

Alternative and/or Renewable Energy Sources

✓ **Maintain generator systems** to increase energy efficiency. Replace old circuitry and batteries.

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13. For the Building Manual visit http://yosemite.epa.gov/estar/business.nsf/content/business_resources_upgradebuilding.htm.
14. For the Service and Product Provider Directory visit http://yosemite1.epa.gov/estar/business.nsf/content/espdirectoryhome.htm.
15. For more information visit www.eren.doe.gov or call (916) 341-4376. For information specifically on building topics visit www.eren.doe.gov/EE/buildings.html.
16. For the Building Manual visit http://yosemite.epa.gov/estar/business.nsf/content/business_resources_upgradebuilding.htm.
17. For the Service and Product Provider Directory visit http://yosemite1.epa.gov/estar/business.nsf/content/espdirectoryhome.htm.
18. For more information visit www.eren.doe.gov or call (916) 341-4376. For information specifically on building topics visit www.eren.doe.gov/EE/buildings.html.

In 2001, CCCSD agreed to use ENERGY STAR® tools to track, measure and benchmark energy performance.

SCVWD upgraded circuitry on an emergency generator at Santa Teresa Water Treatment Plant. The district also replaced an old, faulty 500-kW diesel generator and associated circuitry to ensure operation of SCVWD e-mail and critical phone systems.

New Construction Projects

✓ **Make energy efficiency a top priority** when designing and constructing new projects.

In designing and building its National Avenue UV water treatment plant, North Tahoe PUD tried to maximize cost-efficiency and energy efficiency. The UV disinfection process utilizes significantly less energy than standard systems and is easier to maintain and use in the long run. North Tahoe PUD fit the plant with VFDs and highly efficient UV lamps that run at variable power and supply only the required amount of energy to disinfect the water.

Step 4: Monitor and Measure Results

✓ **Gather information on an ongoing basis** to monitor the progress of programs and to make adjustments to maximize results and adapt to changing circumstances. Create a tracking system or use monitoring tools provided by local utilities. Some incentive and rebate programs, such as 20/20, require applicants to provide detailed tracking and analysis of their energy use. Results should be measured against the original budget and goals of the program.

CCCSD monitored energy use and constantly looked for new ways to reduce energy consumption. In 2001, CCCSD agreed to use ENERGY STAR® tools to track, measure and benchmark energy performance.

At OCWD, in-house and outside consultants gathered and evaluated power readings of various areas each month, as well as the chemical analysis of HVAC water systems.

PID tracked electrical energy usage and total load in conjunction with volume pumped from the San Joaquin River on a monthly and annual basis to calculate the financial and energy savings of the efficiency improvements.

As a participant in the PG&E and CEC incentive and rebate programs Vallejo Sanitation received regular energy use and savings audits from PG&E and the CEC.

For a "How to" guide to recording, analyzing and reporting energy consumption and cost, refer to the CEC handbook, "Energy Accounting: A Key Tool in Managing Energy Costs."[19]

To track energy performance and to benchmark buildings, see the ENERGY STAR® Portfolio Manager. To ensure an accurate benchmark score, buildings must meet certain eligibility criteria.[20]

19. For more information visit www.energy.ca.gov/reports/efficiency_handbooks/index.html. You can also order these documents from the Commission's Nonresidential Buildings Office by calling (916) 654-4008.

20. For more information visit "ENERGY STAR®'s Benchmarking/ Portfolio Manager" online at http://yosemite1.epa.gov/estar/business.nsf/content/multiarea_portfolio_manager.htm?opendocument&pca=Business#benchmarking.

✓ **Evaluate the success of programs** by looking at resources saved, money saved, money spent, the impact on the local economy, city personnel response and the public benefit created. The following results are estimated savings for 2001 unless otherwise noted.

IEUA reduced demand on the energy grid by up to 90 percent during peak hours and saved 2,991,980 kWh in the summer of 2001.

Central Contra Costa Sanitation District (CCCSD) saved approximately $1 million dollars and received $63,600 in rebates for its energy projects.

TABLE W1-1. Central Contra Costa Sanitation District Results

Program	Impementation Costs	Annual Energy/ Water Savings	Rebates and Grants	Annual Financial Savings
Modified air intake of cogeneration	$80,000	325,000 kWh	$60,000 from CEC	$36,000
Motion sensors	$11,500 (after rebate)	55,000 kWh	$3,600	$6,000/year
Optimizing operation to minimize on-peak power demand	$50,000	2.6M kW	None	$289,000
Maximizing use of landfill gas	None	Not available (N/A)	None	$700,000
Total	**$141,000**	**Approx. 3 million kWh**	**$63,000**	**Approx. $1 million**

Inland Empire Utilities Agency (IEUA) reduced demand on the energy grid by up to 90 percent during peak hours and saved 2,991,980 kWh in the summer of 2001.

- During the summer months, energy use at the administrative building was reduced by 14 percent.
- During the first quarter of the 2001/02 fiscal year, power costs were up by 8 cents per kW. IEUA reduced the effect of the price increase by: increasing power production at two recycling plants to an all time high of 6,435.5 MWh, maximizing digester gas usage at these two plants to fuel the generators and by-passing flows at the least energy-efficient plant during peak periods. This resulted in a reduction of operational costs by $379,209 during the first quarter of fiscal year 2001/02.

TABLE W1-2. Inland Empire Utilities Agency Results

Program	Impementation Costs	Annual Energy/ Water Savings	Rebates and Grants	Annual Financial Savings
Conservation measures	Not available (N/A)	12% reduction or 6,200MWh for year	N/A	$3,990 for 2nd Q of '01/'02
By-passed sewage treatment plant	N/A	28% reduction or 537,000kWh for year, 393,571 kWh for 1st Q	N/A	$60,062 for 1st Q of '01/'02

OCWD reduced its total load by 3 percent and saved $35,000 annually as a result of its HVAC and lighting projects in 2001.

TABLE W1-2. Inland Empire Utilities Agency Results

Program	Impementation Costs	Annual Energy/ Water Savings	Rebates and Grants	Annual Financial Savings
UV maintenance on plant	N/A	80,285 kWh from previous year	N/A	$5,620 for the 2nd Q of 01/02
Retrofitted pump drives, 14 units replaced	$188,000	10% reduction or 475,000 kWh annually	N/A	$71,000
Installed generation equipment: Total co-generation at 2 plants	1MW of energy cost $1M to construct, design and instal. $157,689 worth of natural gas and $82,305 in O&M costs for 1st & 2nd Q of 2001/02	N/A	N/A	$254,391 for the 1st & 2nd Q of 01/02
Increased methane gas production	N/A	Expected production: 259kWh	N/A	$150,000
Total	**N/A**	**Reduced grid energy demands by up to 90% on-peak and saved 2,991,980 kWh during 120 days in summer 2001**	**N/A**	**N/A**

North Tahoe Public Utility District (PUD) has realized more than $430 million in energy cost savings as a result of its energy efficient projects since 1995. The UV plant implemented in 2001 was expected to save North Tahoe PUD an estimated $6,700/year in energy costs.

TABLE W1-3. North Tahoe Public Utilities District

Program	Impementation Costs	Annual Energy/ Water Savings	Rebates and Grants	Annual Financial Savings
Leak Detection Project (since 1995)	$1,780 /year or $12,460 since '95	819.6 GPM	None	$430,781,760
UV plant	Over $3.1 million	Not available (N/A)	None	$6,700/year in power cost
Total	**Over $3.1 million**	**Over 819.6 GPM**	**None**	**Over $430 million since 1995**

Each project that Orange County Water District (OCWD) undertook in 2001 resulted in some energy and cost savings. Overall, OCWD reduced total load by 3 percent and saved $35,000 annually.

TABLE W1-4. Orange County Water District Results

Program	Impementation Costs	Annual Energy/ Water Savings	Rebates and Grants	Annual Financial Savings
HVAC	$10,000	Not available (N/A)	N/A	$3,000
Lighting retrofits	$4,000	N/A	N/A	$700
Automatic light sensors	$3,000	N/A	N/A	$200
Total (including other projects)	**$17,000**	**250,000 kW per year – reduced load by 3%; Saved 40,000 gallons of water with fountain**	**N/A**	**$35,000 annually**

Patterson Irrigation District's (PID) 2001 energy conservation and efficiency programs were a success.

- The SCADA system was estimated to reduce energy demand by 1,444 kW, annual energy consumption by 650,000 kWh and save the District approximately $23,000 annually based on 1998 – 2000 pumping and electrical data.
- The VFDs installed varied in cost by size and difficulty to integrate into the existing electrical system and resulted in significant energy savings by almost eliminating recirculation and the load reduction characteristics of VFDs on motors. Based on projected results from the first few months of 2002, installation of the VFDs will decrease energy usage by approximately 45,000 kWh per month and electrical demand will be reduced 12.5 kW per day.
- PID received a $4,000 grant for dropping off the grid and cut its power usage in half with the new polymer for clarifying runs.

South Tahoe Public Utility District (PUD) saved 2,710,700 kWh and $184,475 in energy costs in 2001. In recognition of the district's extraordinary efforts, the CEC, in partnership with industry professional associations and electrical utilities, chose

The CEC chose South Tahoe PUD's treatment plant to serve as a demonstration site from which other plant managers could learn about successful energy efficiency measures.

Due to smart planning and new technologies, SCVWD did not lose a minute of critical operations time during or after the 2001 energy crisis.

South Tahoe PUD's treatment plant to serve as a demonstration site from which other plant managers could learn about successful energy efficiency measures.

TABLE W1-5. South Tahoe Public Utilities District Results

Program	Impementation Costs	Annual Energy/ Water Savings	Rebates and Grants	Annual Financial Savings
Install automated DO Control System	$16,000	109,200 kW	PUC; CEC	$9,275
Limit peak discharge through flow equalization	Not yet completed	2,024,100 kW	PUC; CEC	$69,100
Improve efficiency of plant effluent pumps	Not yet completed	Not yet completed	Not available (N/A)	Not yet completed
Install VFDs on filter influent pump, replace 1 pump,	$136,900	498,600 kW	PUC; CEC	$33,100
Avoid running 3 pumps at Luther Pass	$10,000	N/A	PUC; CEC	$68,300
Install VFD at A1 Tahoe Sewage lift system	$37,500	78,800 kW	PUC; CEC	$4,700
Total (only includes implemented projects)	**$200,400**	**2,710,700 kW**	**PUC; CEC**	**$184,475**

Due to smart planning and new technologies, Santa Clara Valley Water District (SCVWD) did not lose a minute of critical operations time during or after the 2001 energy crisis.

For its conservation and efficiency efforts in 2001, Vallejo received over $737,000 in rebates and $189,000 in energy cost savings.

TABLE W1-6. Santa Clara Valley Water District Results

Program	Impementation Costs	Annual Energy/ Water Savings	Rebates and Grants	Annual Financial Savings
Long term (natural gas generators)	$2 million	Minimal	Not available (N/A)	Expected payback time: Natural gas generators approx 7 yr.
Short-term immediate reliability (leased generators)	$2 million	Lowered usage rates of HVAC and lighting. Reduced pumping and high power use operation during peak power periods and stage alerts	None	N/A
Lighting, HVAC, and other enhancements	Staff time	Minimal	N/A	N/A
Alternative energy (solar and generators)	$10 million	N/A	N/A	Expected payback time: Solar projects approx 10 years; Savings were one-third to half the cost of PG&E power.

For its conservation and efficiency efforts in 2001, Vallejo Sanitation and Flood Control District received over $737,000 in rebates and $189,000 in energy cost savings. Vallejo attributed its success in part to the support and encouragement of management and the local government.

TABLE W1-7. Vallejo Sanitation and Flood Control District Results

Program	Impementation Costs	Annual Energy/ Water Savings	Rebates and Grants	Annual Financial Savings
Installed power meters	$15,000	Unknown	Not available (N/A)	Unknown
Retrofitted lights	$3,000	166,000kWh	$3,000	$20,000
Motion sensors	$1,500	125,000 kWh	$2,500	$15,000

To prevent or fix costly mistakes, PID found it helpful to consult qualified experts and communicate with other districts and agencies that had completed similar projects.

TABLE W1-7. Vallejo Sanitation and Flood Control District Results

Program	Impementation Costs	Annual Energy/ Water Savings	Rebates and Grants	Annual Financial Savings
Motor replacement	$21,000	450,000 kWh	$12,000	$54,000
VFD replacement program	$106,000	625,000 kWh	$26,000	$75,000
Generator replacement	$2,411,000	988,235 kWh	$720,000	$168,000
Total	**$2,557,500**	**2,354,000 kWh**	**$737,000**	**$332,000**

Lessons Learned

- CCCSD tried to implement the use of landfill gas in the cogeneration turbine at a 50/50 natural gas to landfill gas blend, but operational instability, high carbon monoxide levels and restrictions by air-permit requirements caused CCCSD to scrap the project.
- IEUA found that projects sometimes took longer than expected, but agency engineers, operators and maintenance worked as a team to see projects through.
- To prevent or fix costly mistakes, PID found it helpful to consult qualified experts and communicate with other districts and agencies that had completed similar projects.
- Paradise Irrigation had a difficult time getting energy-use information to be exchanged between Ancillary Service Coalition and PG&E. Paradise Irrigation also found that its staff was more reliable in detecting leaks via listening devices than external consultants with high-tech and costly computer-based technology.
- The plant manager at Vallejo found that the best way to implement conservation and efficiency projects was to have a high-ranking person(s) in the organization willing to continually investigate ways to conserve energy and look for programs that provide funds to defray the costs of the projects.

Contacts

Contact information for the water and wastewater agencies discussed in this Best Practice Guide are listed below. See the case study on the water/wastewater agency for additional program information and summaries.

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- **Inland Empire Utilities Agency**
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- **North Tahoe Public Utility District**
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- **Orange County Water District**
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- **Santa Clara Valley Water District**
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- **South Tahoe Public Utility District**
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- **Vallejo Sanitation and Flood Control District**
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