

Process Evaluation of the PG&E, SCE SDG&E and SCG Water Pilot Programs

Study ID: SCE0294.01

Final Report

ECONorthwest

ECONOMICS • FINANCE • PLANNING

222 SW Columbia Street
Suite 1600
Portland, Oregon 97201
503-222-6060

December 6, 2010

Acknowledgements

This report was prepared by ECONorthwest's Portland office for Southern California Edison under the supervision of Carol Yin. Dr. Stephen Grover was the ECONorthwest project director for this evaluation and John Boroski was the project manager. Questions regarding the report should be directed to John Boroski at boroski@portland.econw.com or by phoning the Portland office at (503) 222-6060. Dr. Grover and John Boroski were assisted in this project by Anne Fifield, Alex Reed, Emma Stocker, Chad Fulton and Logan Van Ert.

Additional firms and individuals involved with this evaluation include Quantum Market Research and John Stevenson (University of Wisconsin Survey Center).

TABLE OF CONTENTS

Executive Summary	i
1. Introduction.....	1
1.1 Evaluation Overview.....	1
2. PG&E Large Commercial Customers Program Results	5
2.1 PG&E Large Commercial Customers Program Background.....	5
2.2 PG&E Large Commercial Customers Program Logic Model and Program Theory.....	7
2.3 PG&E Large Commercial Customers Program Evaluation Overview	12
2.4 PG&E Large Commercial Customers Program Evaluation Results	13
2.5 PG&E Large Commercial Customers Program Issues and Observations.....	20
3. PG&E (Single Family) Low Income High Efficiency Toilets Program Results.....	24
3.1 PG&E Low Income High Efficiency Toilets Program Background	24
3.2 PG&E Low Income High Efficiency Toilets Program Logic Model and Program Theory	24
3.3 PG&E Low Income High Efficiency Toilets Program Evaluation Overview.....	28
3.4 PG&E Low Income High Efficiency Toilets Program Evaluation Results.....	28
3.5 PG&E Low Income High Efficiency Toilets Program Issues and Observations	34
4. PG&E Emerging Technologies Program Results	36
4.1 PG&E Emerging Technologies Program Background.....	36
4.2 PG&E Emerging Technologies Program Logic Model and Program Theory.....	37
4.3 PG&E Emerging Technologies Program Evaluation Overview	40
4.4 PG&E Emerging Technologies Program Evaluation Results	40
4.5 PG&E Emerging Technologies Program Issues and Observations.....	46
5. SCE (Multifamily) Low Income High Efficiency Toilet Program Results	49
5.1 SCE Low Income High Efficiency Toilet Program Background	49
5.2 SCE Low Income High Efficiency Toilet Program Logic Model and Program Theory.....	50
5.3 SCE Low Income High Efficiency Toilet Program Evaluation Overview	53

5.4	SCE Low Income High Efficiency Toilet Program Evaluation Results	53
5.5	SCE Low Income High Efficiency Toilet Program Issues and Observations	60
6.	SCE Express Water Efficiency Program Results	61
6.1	SCE Express Water Efficiency Program Background	61
6.2	SCE Express Water Efficiency Program Logic Model and Program Theory	62
6.3	SCE Express Water Efficiency Program Evaluation Overview	66
6.4	SCE Express Water Efficiency Program Evaluation Results	66
6.5	SCE Express Water Efficiency Program Issues and Observations	69
7.	SCE Leak Detection Program Results	71
7.1	SCE Leak Detection Program Background	71
7.2	SCE Leak Detection Program Logic Model and Program Theory	72
7.3	SCE Leak Detection Program Evaluation Overview	76
7.4	SCE Leak Detection Program Evaluation Results	76
7.5	SCE Leak Detection Program Issues and Observations	80
8.	SCE/SCG Lake Arrowhead Program Results	82
8.1	SCE/SCG Lake Arrowhead Program Background and Cancellation	82
9.	SDG&E Managed Landscapes Program Results	83
9.1	SDG&E Managed Landscapes Program Background	83
9.2	SDG&E Managed Landscapes Program Logic Model and Program Theory	84
9.3	SDG&E Managed Landscapes Program Evaluation Overview	88
9.4	SDG&E Managed Landscapes Program Evaluation Results	88
9.5	SDG&E Managed Landscapes Program Issues and Observations	94
10.	SDG&E Recycled Water Retrofits Program Results	96
10.1	SDG&E Recycled Water Retrofits Program Background	96
10.2	SDG&E Recycled Water Retrofits Program Logic Model and Program Theory	96
10.3	SDG&E Recycled Water Retrofits Program Evaluation Overview	100

10.4	SDG&E Recycled Water Retrofits Program Evaluation Results	100
10.5	SDG&E Recycled Water Retrofits Program Issues and Observations.....	103
11.	SDG&E Large Customer Audits Program Results	105
11.1	SDG&E Large Customer Audits Program Background.....	105
11.2	SDG&E Large Customer Audits Program Logic Model and Program Theory	106
11.3	SDG&E Large Customer Audits Program Evaluation Overview	110
11.4	SDG&E Large Customer Audits Program Evaluation Results	110
11.5	SDG&E Large Customer Audits Program Issues and Observations.....	117
12.	SCG Gas Pump Testing Program Results	120
12.1	SCG Gas Pump Testing Program Background	120
12.2	SCG Gas Pump Testing Program Logic Model and Program Theory	121
12.3	SCG Gas Pump Testing Program Evaluation Overview	124
12.4	SCG Gas Pump Testing Program Evaluation Results	124
12.5	SCG Gas Pump Testing Program Issues and Observations	127
13.	Overall Program Observations.....	129
14.	Appendix: Survey Instruments and In-Depth Interview Guides	132
14.1	PG&E Low Income High Efficiency Toilets Phone Survey	132
14.2	SCE Low Income High Efficiency Toilets Mail Survey	139
14.3	In-Depth Interview Guides.....	143
14.4	Supplemental Questions for Partner Water Agencies	153

EXECUTIVE SUMMARY

Introduction

Past research has shown that considerable energy is required to obtain, treat and distribute water supplies to end-use customers. In October 2006, the Assigned Commissioner to the energy efficiency proceeding issued a ruling soliciting Investor-Owned Utility (IOU) applications for an approximately \$10 million one-year pilot program “to explore the potential for future programs to capture water-related embedded energy savings.”¹ More specifically, the ruling directed the four largest IOUs to partner with one large water provider to implement a jointly funded program designed to maximize embedded energy savings per dollar of program cost.² This pilot would focus on efforts that would:

- 1) Conserve water;
- 2) Use less energy-intensive water (gravity-fed or recycled versus groundwater, aqueducts or desalination); and
- 3) Make delivery and treatment systems more efficient

The IOUs initially filed their proposed program designs in January 2007, and the proposed programs were further refined through a series of workshops and supplemental filings. In December 2007, the California Public Utilities Commission (CPUC) approved the Pilot programs (in D. 07-12-050), through which the four largest IOUs would develop partnerships with water agencies, undertake specific water conservation and efficiency programs, and measure the results.³

This report presents the process evaluation results for the Pilots that were implemented by Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), San Diego Gas and Electric Company (SDG&E) and Southern California Gas Company (SCG). The Pilots were initiated in July 2008 and were initially scheduled to end June 30, 2009. The program end date was later extended to December 31, 2009 as several programs and projects experienced implementation delays. Tasks completed for this process evaluation included: logic model and program theory development, in-depth interviews with a wide range of program participants, customer phone and mail surveys, and reviews of program-specific materials. Following are key findings for each of the Pilots.

PG&E Large Commercial Customers Program

PG&E partnered with East Bay Municipal Utility District (EBMUD) and water retailers of Sonoma County Water Agency (SCWA) and the Santa Clara Valley Water District (SCVWD) to offer audits to large commercial, industrial and institutional customers to recommend water efficiency improvements. The program also offered financial incentives to help offset the cost of improvements.

¹ October 16, 2006, ACR, R.06-04-010, page 3.

² Embedded energy is defined as “the amount of energy needed to acquire, pump, treat, distribute, and operate water treatment and delivery systems for a given amount of water.” It excludes the savings directly associated with end-use application.

³ Decision (D.) 07-12-50, “*Order Approving Pilot Water Conservation Programs Within the Energy Utilities’ Energy Efficiency Programs*” in Application 07-01-024.

Types of eligible improvements included: water recirculation systems, new ozone laundry systems, winery and food processing changes, commercial kitchen retrofits, toilet and shower upgrades, and recycled water retrofit projects. For ozone retrofits in laundry facilities, program-approved ozone installers performed the audits. For other water efficiency improvements, audits were conducted by water agency (or city) staff or consultants retained by PG&E.

The program initially planned to serve about 50 customers in a variety of sectors and ended up installing water conservation measures at 11 customers (primarily ozone laundry systems); other customers received program audits but did not proceed to install measures. The main challenges for this program were a poor economy that limited capital investments, difficulties engaging busy water agencies staff to track potential projects, and insufficient time. When the program was initially approved, PG&E and its partners only had one year to recruit customers, conduct their audits, obtain project approvals and complete the project installations. Several ozone laundry projects were completed because one program vendor aggressively marketed the program rebates. Despite these challenges, most of the program customers had a positive participation experience, as did the water agencies, some of which developed entirely new water conservation programs to serve their customers going forward. Recommendations for improving this type of program include: a longer period to accommodate large capital projects, careful selection of partner water agencies with adequate staff resources, increased program budget to allow additional comprehensive water audits, and continued focus on recruiting food processing companies (which have high water usage) and high-level management of hotel chains, who can decide to install ozone laundry systems at multiple sites.

PG&E (Single Family) Low Income High Efficiency Toilets Program

PG&E partnered with the Santa Clara Valley Water District (SCVWD) to install high efficiency toilets (HETs) for low-income customers living in single-family residences. Only toilets that flush at 3.5 gallons per flush or greater were eligible for replacement. PG&E utilized its existing Low Income Energy Efficiency (LIEE) program contractors to identify the target customers and eligible toilet replacements and hired a direct install contractor to complete the HET installations.

PG&E planned to install between 850 and 900 HETs in SCVWD territory. When the program ended, 478 HETs had been installed in 206 households. The main challenge for this program was participant recruitment. The program was designed so that energy audit staff would identify eligible households through the audit process. However, the auditors were not focused on water-using equipment and did not generate enough participants (and also identified ineligible toilets). Towards the end of the program, PG&E was able to increase participation by involving the installation contractor, with expert knowledge of water measures, in the recruitment. In addition, the program specifically focused on single-family residences, however, many low-income households live in more affordable housing types, such as mobile homes and apartments. The narrow focus also made it difficult to meet participation goals. While the program did not meet its participation goals, the installation contractor and participant households were satisfied with their program experience. Recommendations for improving this type of program include: ensuring that program contractors are sufficiently trained to identify program-qualifying equipment, expanding the program to include mobile homes, and working with community organizations that serve low-income populations.

PG&E Emerging Technologies Program

PG&E partnered with two water agencies to integrate real-time electricity consumption data from water pumping into existing SCADA⁴ systems. One water agency planned to utilize the energy data in a new water-pumping algorithm that would automatically control a subset of system pumps. The other water agency planned to have system operators manually change the pump operations in response to displayed energy consumption. PG&E hired two consultants to assist the agencies with project implementation and data analysis. This program was not designed to conserve water, and instead focused on reducing energy consumption under different flow and pressure conditions.

Both projects successfully connected a subset of PG&E energy meters to their SCADA systems, which was a key achievement since it was not known how this would occur at the program start. At one water agency, a new pumping algorithm was developed to reduce energy use at four pumping stations, however the algorithm was not programmed into the SCADA by the agency during the program period due to schedule delays and the need for further consideration by management. At the other agency, the SCADA screen display was updated to show real-time energy efficiency data at three pumping stations, giving operators the opportunity to change the pumping operations in response to changing water demand and energy use. However, the operators did not utilize the new information to adjust the pumping operations during the program period.

The main challenge for this program was allocating sufficient water agency staff time to the projects. While the consultants could give hardware installation assistance and conduct the data analysis, agency staff were still needed to develop pumping test data, do the SCADA programming and coordinate between departments (e.g., management, engineering, operations, design). One agency had so much difficulty obtaining staff time it nearly dropped out of the Pilot Program. The Pilots schedule extension was critical for both projects, enabling one to actually implement new SCADA screen metrics and the other one to collect sufficient data to develop a pumping algorithm for future implementation. In addition, operational policies and time constraints at one agency prevented the operators from manually responding to the new energy consumption data that were available to them. On a positive note, more water agency staff developed an awareness of operational energy consumption, and there is still an interest in learning how to more effectively utilize the new data. Recommendations for improving this type of program include: a longer implementation period, requiring water agencies to contribute to new equipment and study costs, contracts enabling IOUs to terminate projects with non-cooperating water agencies, and requiring water agencies to select high-level project managers with broad oversight responsibilities.

SCE (Multifamily) Low Income High Efficiency Toilet Program

SCE partnered with the Metropolitan Water District of Southern California (MWD) and its member water agencies to install high efficiency toilets (HETs) for low-income customers living in multifamily residences. Only toilets that flush at 3.5 gallons per flush or greater were eligible for replacement. To target multifamily properties, SCE utilized its existing LIEE contractors as well as existing local government partnerships. SCE also coordinated with MWD and its member water agencies with larger low income and multifamily customer bases to identify and reach target customers.

⁴ SCADA are Supervisory Control and Data Acquisition systems, which typically monitor and store data on water flows, pressure, and storage levels.

The program targeted the installation of approximately 550 HETs. At one project in Irvine, 276 HETs were installed in 176 apartment units reserved for low-income households. Subsequently, the program also installed 170 HETs at another apartment building in Long Beach (this evaluation only focused on the Irvine project due to budgetary constraints). A primary challenge for this Pilot was MWD's funding issues at the start of the program. In the years between the Pilot proposal and the program implementation, MWD's financial situation changed significantly and the agency had to reduce its planned financial contributions. During this period, it was not clear if or how the Pilot could proceed. Once MWD's funding was restored, however, the program moved forward relatively smoothly. Another challenge was identifying low-income apartment tenants. The Pilot was ultimately able to identify eligible participants because the City of Irvine has very few property owners of multi-family properties and the water agency has very detailed customer data. Lastly, although the apartment tenants' satisfaction with the HETs was fairly high overall, a high number were flushing their toilets multiple times and/or not always using the two-button models correctly. To improve this type of program in the future apartment tenants and property managers should periodically be given instructions about proper HET usage, and additional testing and volume calibrations should be performed during the installation process.

SCE Express Water Efficiency Program

SCE partnered with MWD to deliver pH controllers for cooling towers and Weather Based Irrigation Controllers (WBICs) to commercial customers with chilled water HVAC and/or large landscape irrigation systems. A pH controller is a programmable device that monitors and adjusts the chemistry of the system to reduce water that must be bled from cooling towers. WBICs achieve water savings by switching from manual irrigation to weather based controllers. MWD provided rebates for the two program measures and SCE served as the "marketing arm" of the Pilot, incorporating these measures into its existing Express Efficiency nonresidential retrofit rebate program. SCE planned to market the program directly to customers through its customer account executives, providing access to customers previously unavailable to MWD.

SCE's program was budgeted to serve up to 100 pH controllers and 20 WBICs participants, however the program did not have any formal participation goals. When the program ended, no customers had installed WBICs or pH controllers as a direct result of SCE's marketing efforts. While some SCE account executives did promote the measures, most did not because they were not made aware of the program or were busy promoting many other SCE programs, and water savings obtained through the Pilot would not contribute to representatives' formal energy saving goals. After MWD started to have funding problems, the SCE program manager and account executives stopped marketing the Pilot.

Going forward, it is unlikely that SCE's program, as designed, would have a significant impact on attracting participation or changing the market for this equipment, and thus a wholly different program delivery approach is needed. If the Pilot's core design is retained, then SCE should: ensure that account executives have an incentive to promote program measures, provide account executives with training on relevant water and equipment issues (e.g., service territories and other rebates, equipment performance, expected paybacks) and consider other water saving measures with broader applicability.

SCE Leak Detection Program

For this program, detailed, top down water audits that comply with International Water Association and American Water Works Association protocols were completed for three water agencies. These audits identify and validate different types of water volumes (e.g., authorized consumption, “apparent losses” due to metering errors, leakage) that collectively add up to each agency’s total water supply for the audit period. The program contractor hired by SCE also conducted proactive leak detection for each agency, and the agencies repaired the found leaks. The Pilot did not have formal goals for the number of audits to be completed or water savings to obtain through leak detection and repairs. When the program ended, actual water savings from leak repairs totaled to approximately 83 million gallons (255 acre feet) per year, and the audits also identified opportunities to significantly reduce leakage in the future.

The participant water agencies had high satisfaction with the program because they received comprehensive, detailed and credible information about their water systems, and pragmatic guidance on how to improve their system operations. All of the agencies noted that their system understanding is now strong enough that they can continue to conduct audit activities more regularly on their own. The agencies were also pleased that system leaks had been detected and repaired in the short-term. It was possible to achieve these results in part because SCE’s program manager was highly involved, increasing the program’s credibility and agency staff interest. Similarly, the experienced contractor was able to clearly present and justify the project goals and tasks, which enhanced the perceived value of audits and reduced staff reluctance to assist with leak detection and data collection tasks. If SCE continues this type of program in the future it should: pre-screen prospective participants for high expected leakage (to maximize water/energy savings), obtain basic information about agencies’ data and billing systems during program recruitment (to identify potential audit problems), engage high-level water agency staff as project managers, and proactively discuss and diffuse agency cultural issues that may reduce staff cooperation.

SDG&E Managed Landscapes Program

This Pilot was conducted in the San Diego region and targeted multifamily apartment complexes, condominiums, office parks, commercial properties, homeowner associations, and estate properties with at least four irrigated acres. SDG&E hired a contractor to recruit participant properties and install proprietary equipment and software that converts conventional irrigation controllers into controllers that utilize daily evapotranspiration (ET_o) and weather information to automatically and dynamically control the amount of water used for irrigation. SDG&E paid for the first year equipment and installation costs at each site, after which participants could sign an agreement with the contractor for continued services. Water savings incentives were also available from MWD. San Diego County Water Authority (SDCWA) contributed \$25,000 to the program, helped to select the irrigation contractor, and provided technical assistance to SDG&E staff.

The program goal was to serve about 20 sites with 3 to 5 controllers each, for a total of 60 to 100 installed controllers. When the program ended, 71 controllers had been installed at 13 sites, which satisfied the terms of SDG&E’s contract with the installation contractor. From a delivery standpoint, the main program challenges were obtaining water consumption data from city water agencies (so the contractor could track water savings) and obtaining variances to city watering restrictions imposed during the program period. Due to the persistence of the contractor and SDCWA staff, all the

required data and variances were obtained and no sites were forced to drop out of the program. On the administrative side, the contract language regarding the installer’s incentive payment was unclear and could be improved. In particular, terms pertaining to the contractor’s savings goals and claimable water savings (e.g., from leak repairs) were not completely clear. Despite these issues, the program partners and implementation contractor were generally satisfied with the overall program delivery and outcomes. Recommendations for improving this type of program include: proactively defining procedures for obtaining city water billing data and variances; more precise contract language defining contractor goals, claimable savings, and normalization methods; staggered contractor incentive payments and periodic reporting on customer landscape conditions and satisfaction.

SDG&E Recycled Water Retrofits Program

This program increased the use of recycled water by assisting retrofit projects that switched from a potable water source to a recycled water source. To implement the program, SDCWA and its member agencies identified sites with completed retrofit plans that would allow the customer to switch from potable water usage to recycled water usage during the program period. After the final program participants were selected by SDCWA, SDG&E provided matching capital funding to projects that completed installation and started operations during the program period.

The program goal was to assist “about 6” retrofit projects. Six projects were selected and all six were installed and operational before the program ended. This program highlighted the fact that schedule flexibility (i.e., a sufficiently long program period) is particularly important for recycled water projects, as each retrofit faces unique construction and permitting issues related to location, terrain, and facility uses. In addition, many public agencies have slow moving administrative processes and the program sponsors have no control over the project installation staff and third party contractors. For this Pilot, the program extension of 6 months was critical in allowing two of the six projects to complete construction and commence recycled water deliveries. Importantly, all three agencies that completed retrofit projects were satisfied with the Pilot, and appreciated SDG&E’s schedule flexibility and efforts to extend the program period so they could resolve unforeseen issues. The SDG&E funding also elevated the priority of these projects within the agencies, enabling the projects to be completed sooner. While SDG&E staff were initially unfamiliar with the unique nature of recycled water retrofit projects, they have more knowledge now that the projects are completed.

SDG&E Large Customer Audits Program

For this Pilot, SDG&E provided capital funding to install water conservation measures at sites that had received prior water audits through SDCWA, upon which the customers had not acted. The second part of the program strategy was to develop and implement an integrated water/energy audit for large customers, where water and energy savings can be significant. Working with an auditing contractor retained through an RFP process, SDG&E and SDCWA coordinated in the development of an integrated water/energy audit template that could be used to conduct water/energy audits of commercial, industrial and institutional high water users in San Diego County. Incentives were also (temporarily) available through MWD’s regular conservation programs for some measures, although these incentives were not part of the core program design and could not be affected by SDG&E or SDCWA. Participant recruitment was conducted by SDCWA, the audits contractor and SDG&E account executives.

The program goal was to complete 7 to 10 new, combined water and energy audits (hopefully leading to measures installations). When the program ended, combined audits had been completed for 9 customer sites, and 4 customers had installed a range of measures including a boiler water reuse system, autoclaves equipment and process changes, reverse osmosis process changes, water saving toilets and urinals, and toilet flush timers (to prevent misuse and flooding at an institutional facility).

Participant recruiting was a key challenge for this program. In particular, many large water users had already received SDG&E energy audits in the past, and customer budgetary constraints in a poor economy reduced the number of companies that could feasibly consider expensive water process changes. One key finding from the recruitment is that the combined water/energy audits should probably be separated. Some customers need water audits, others need energy audits, but few need or want both. MWD's loss of incentive funding also exacerbated the recruitment challenges, although this was beyond SDGE's control. On the implementation side, SDG&E staff turnover and the CPUC's delayed program extension contributed to coordination problems temporarily. Regular participant tracking by the program auditor stopped for a period, and when it resumed it was initially unclear how to coordinate with the impacts evaluator, and who should give implementation guidance to the customers. These issues were resolved relatively quickly, however. Importantly, program satisfaction among the customers interviewed for this evaluation was very high, due to the high quality of audits, observed water savings after the installations, and positive interactions with SDG&E and contractor staff. Recommendations for improving the program include: removing the energy portion of the audit, contacting potential participants earlier in the program so they can reserve funding, defining process and communication protocols among program implementers and evaluators early in the program, and involving wastewater agencies in the program.

SCG Gas Pump Testing Program

Many water agencies measure the efficiency of their natural gas pumps using assumptions based on standard product load curves, and not actual performance. This Pilot was designed to conduct gas pump field-testing at Eastern Municipal Water District (EMWD) and Crestline-Lake Arrowhead Water Agency (CLAWA) to measure actual pump performance and identify equipment maintenance and upgrades that would improve overall pumping efficiency at the water agencies. The program was also to integrate the results of the field-testing into a new gas pump testing protocol that would allow other water agencies to conduct similar testing and improve energy efficiency also. The program did not have a specific short-term energy savings goal.

While CLAWA dropped out of the program at the very start, SCG's engineering contractor successfully completed gas pumps testing at EMWD and developed new testing protocols within the program period. The contractor was also able to utilize innovative testing techniques and equipment at EMWD, which was a secondary goal of the program. The primary implementation challenge was that pump testing scheduling was more complicated than planned. The contractor needed to work with multiple individuals, all of whom had full schedules. In addition, the engineering firm had not fully understood how the pumps needed to be scheduled. The pumps are essential to delivering water, and coordinating when individual pumps could be taken out of service was more complicated than expected. Despite these scheduling challenges, all parties perceived that the program implementation went relatively smoothly, resulting in high satisfaction levels. In particular, EMWD learned how to accurately measure the horsepower of gas pump engines, and planned to purchase new testing equipment so they could continue testing other pumps and identify energy saving opportunities. Key

factors to the program's success were EMWD's high level of enthusiasm and engagement, and significant involvement by an SCG account executive with a strong knowledge of water agency operations. Future IOU gas pump testing programs should: involve dedicated IOU staff that understand water production issues, obtain pumping schedules and operating requirements early in the project or as part of scoping process, and implement gas testing activities during off-peak seasons for the water agencies.

Overall Observations

The CPUC's final decision approving the Pilots was made in December 2007, and the implementation start date was moved to July 1, 2008. The delayed approval, in conjunction with the economic downturn and drought conditions, negatively impacted almost all of the Pilots, as the compressed schedule gave little leeway for IOU staff turnover, recruitment challenges, competing water agency priorities, projects planning and installations, and M&V activities. In addition, the late approval of the Pilots schedule extension by the CPUC was problematic, as the IOUs could not tell their water agency partners or customers if they should move forward on projects or not with certainty, and some momentum was lost.

MWD's funding problems caused recruitment problems for some of the southern California programs, and this needs to be addressed in the future if possible. Ideally, MWD's funding cycle would be synchronized with those of future electric IOU water programs, and MWD's program funding would be increased (or a higher percentage would be reserved to specifically supplement IOU incentives). If this is not possible, then future partnership programs must clearly and consistently communicate to prospective participants that MWD and/or other water agencies funding may only be available for a limited period. This is the most likely scenario, since it is highly unlikely that the electric IOUs would be able to synchronize their funding cycles with the hundreds of water agencies that exist in the state.

Collecting water and energy data from the water agencies to estimate embedded energy savings was very challenging. Water agencies that were involved in conceptualizing the programs from an early stage expected that production and energy data would eventually be required in some form. Other water retailers, however, were not aware that they would need to provide data, even if their water wholesaler was a Pilot program partner. Similarly, wastewater and recycled water agencies that operate independently of water wholesalers and retailers did not know of the need for embedded energy data until contacted by the evaluators. While most of the agencies did eventually provide data, they were surprised at the detailed level of data that was initially requested, and the amount of staff time required to collect and review the data. Future studies of embedded energy need to systematically inform *all of the agencies* from which data will be requested about the pending need, and also the staff that will be affected (i.e., not just the conservation managers).

Despite the challenges that many of the programs experienced, there was generally high satisfaction among the participating water agencies, contractors and customers. Water agency customers highly valued the energy savings incentives, capital projects funding and other services (e.g., comprehensive water audits) provided by the IOUs, and the water agencies were pleased to serve their customers better and forge stronger relationships with IOU staff. Program contractors were able to learn more about available water conservation incentives, increase their revenues, and strengthen ties with existing and new clients, and IOU program managers.

1. INTRODUCTION

1.1 EVALUATION OVERVIEW

This report presents the process evaluation results for the Water Pilots Programs (Pilots) that were implemented by Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), San Diego Gas and Electric Company (SDG&E) and Southern California Gas Company (SCG). The Pilots were initiated in July 2008 and were initially scheduled to end June 30, 2009. The program end date was later extended to December 31, 2009 as several programs and projects experienced implementation delays for reasons explained in this report.

Past research has shown that there is considerable energy that is required to obtain, treat and distribute water supplies to end-use customers.⁵ In October 2006, the Assigned Commissioner to the energy efficiency proceeding issued a ruling soliciting Investor-Owned Utility (IOU) applications for an approximately \$10 million one-year pilot program “to explore the potential for future programs to capture water-related embedded energy savings.”⁶ More specifically, the ruling directed the four largest IOUs to partner with one large water provider to implement a jointly funded program designed to maximize embedded energy savings per dollar of program cost.⁷ This pilot would focus on efforts that would:

- 1) Conserve water;
- 2) Use less energy-intensive water (gravity-fed or recycled versus groundwater, aqueducts or desalination); and
- 3) Make delivery and treatment systems more efficient

Funding for these programs was to be separate from the 2006-2008 energy efficiency program cycle and the utilities could not get credit for these savings towards their 2006-2008 savings goals, since the primary purpose of measuring such savings is to develop a general understanding of program benefits, rather than affecting rewards or penalties.

The IOUs initially filed their proposed program designs in January 2007, and the proposed programs were further refined through a series of workshops and supplemental filings. In December 2007, the California Public Utilities Commission (CPUC) approved the Pilot programs (in D. 07-12-050), through which the four largest IOUs would develop partnerships with water agencies, undertake specific water conservation and efficiency programs, and measure the results.⁸

⁵ *California's Water – Energy Relationship*. California Energy Commission. November 2005.

⁶ October 16, 2006, ACR, R.06-04-010, page 3.

⁷ Embedded energy is defined as the amount of energy needed to acquire, pump, treat, distribute, and operate water treatment and delivery systems for a given amount of water. It excludes the savings directly associated with end-use application.

⁸ Decision (D.) 07-12-50, “*Order Approving Pilot Water Conservation Programs Within the Energy Utilities' Energy Efficiency Programs*” in Application 07-01-024.

A separate impact evaluation will help inform the Commission in determining whether water conservation programs and/or measures should be added to the utilities' energy efficiency portfolios.⁹ Impact evaluations serve many purposes including supporting cost-effectiveness analyses, providing data for future programs, and strategic planning in California. As some programs may be problematic from a cost effectiveness perspective, that evaluation will develop data to help quantify the benefits and problems with these programs and measures, and find out whether deploying them in the future on a larger scale would be beneficial from an energy efficiency perspective. This process evaluation is to provide additional information that can be used to improve the delivery of Pilot programs that are recommended to continue in the future.

Following are the programs that were evaluated in this report:

1. PG&E Large Commercial Customers
2. PG&E Low Income High Efficiency Toilets (Single-family)
3. PG&E Emerging Technologies
4. SCE Low Income High Efficiency Toilets (Multi-family)
5. SCE Express Water Efficiency
6. SCE Leak Detection
7. SCE/SCG Lake Arrowhead Water Conservation
8. SDG&E Managed Landscape
9. SDG&E Recycled Water Retrofits
10. SDG&E Large Customer Audits
11. SCG Gas Pump Testing

Some of the key issues assessed in this evaluation include:

- Program delivery successes and challenges (e.g., recruitment, data collection, measures installations)
- Program staffing and coordination issues
- Program funding issues
- Satisfaction among IOU staff, water agency staff, program vendors and customer participants
- Barriers to customer participation
- Programs goal attainment

The evaluation tasks were generally the same for each program and are discussed in each of the individual program chapters. Major evaluation tasks included:

- *Logic model and program theory.* A logic model and program theory for each program established a starting point for all evaluation activities. The structure of the logic model that links program activities and expected outcomes is a useful instrument for identifying

⁹ ECONorthwest and a team of subcontractors conducted the impact evaluation.

specific program assumptions that can be tested using a survey or other primary data collection activities. Importantly, the logic models describe the programs as they were originally designed; significant changes from the planned delivery approach (and the resulting impacts) are discussed in more detail in each program chapter.

- *In-depth interviews.* Seventy-five in-depth interviews were conducted with Pilots program managers and other IOU staff, water agency program managers, program contractors (e.g., auditors, installers), and program participants. Program staff members helped to gauge program achievements, provided valuable insight into program delivery, and proposed research topics to be addressed by the evaluation. For most programs, ECONorthwest conducted phone interviews with the person at the customer sites most knowledgeable about the project. Table 1 summarizes the interviews that were conducted by program (program managers are denoted as “PMs”).

Table 1: In-Depth Interviews Conducted

Program	IOU PMs and Staff	Water Agency PMs	Contractors	Participants
PG&E Large Commercial Customers	3	5	2	8
PG&E Low Income High Efficiency Toilets	2	1	1	phone survey
PG&E Emerging Technologies	2	NA*	2	1
SCE Low Income High Efficiency Toilets	1	3	1	1 manager (and mail survey)
SCE Express Water Efficiency	4	2	1	1
SCE Leak Detection	1	NA*	1	3
SDG&E Managed Landscapes	2	1	1	4
SDG&E Recycled Water Retrofits	2	1	NA**	3
SDG&E Large Customer Audits	3	1	3	4
SCG Gas Pump Testing	2	NA*	1	1
Total	22	14	13	26

* For these programs, water agencies were the program participants.

** Program participants used their own installation contractors.

- *Participant phone and mail surveys.* For the two programs that installed high efficiency toilets, participant surveys were conducted to assess the recruitment and installation processes, and participants’ experience with measure usage and satisfaction. Similar questions were used for both surveys so that comparisons could be made on key

elements. However, each survey also included questions to address differences in the participant recruitment and specific measures.

- *Program-specific materials reviews.* ECONorthwest also reviewed program documents and marketing materials provided by the IOUs, including marketing brochures, vendor contracts, audit reports and contractor project tracking tools.
- *Water agencies email survey.* A short questionnaire was sent to water and wastewater agencies that were expected to provide production and energy usage data to the Pilots impact evaluation team, to support the embedded energy calculations. Agencies that provided data directly to the Embedded Energy in Water (EEW) Study 2 team were not contacted, as they were recruited differently.¹⁰

The remainder of this report is organized as follows. Separate chapters present detailed evaluation results for each of the Pilot programs covered in this evaluation. Each chapter includes sections describing: the program goals and achievements, a logic model and program theory, an assessment of the partnership delivery strategy, the experience of program vendors and participants, and recommendations for changes if the programs are continued. The Lake Arrowhead Water Conservation Program was officially cancelled by the CPUC (at the request of SCE and SCG) soon after it started, however, and as a result this chapter is limited to presenting the planned program elements and reasons for the cancellation. The report concludes with a summary of issues that affected all or many of the Pilot programs; this includes findings from the water agencies survey and experience gleaned from the impact evaluation. Lastly, the appendices contain the data collection instruments used for the evaluation.

¹⁰ Study 2 was charged with developing a database of water agencies data and energy intensity calculations (kWh/million gallons), and there was significant coordination between the Pilots evaluators and Study 2 team regarding data collection instruments and processing methods. While the Pilots evaluators utilized data collected by Study 2 for some water agencies, they were originally recruited by Study 2 to populate the statewide database, which could be used for multiple evaluation purposes.

2. PG&E LARGE COMMERCIAL CUSTOMERS PROGRAM RESULTS

2.1 PG&E LARGE COMMERCIAL CUSTOMERS PROGRAM BACKGROUND

PG&E partnered with East Bay Municipal Utility District (EBMUD) and water retailers of Sonoma County Water Agency (SCWA) and the Santa Clara Valley Water District (SCVWD) to implement the Large Commercial Customer Program. Large commercial and industrial businesses that are joint customers of PG&E and EBMUD, SCWA or its water supply retailers, or SCVWD retailers were eligible to participate in the program. SCWA retailers that participated in the Pilot include the cities of Santa Rosa and Petaluma, the Town of Windsor, the Sonoma Valley County Sanitation District, and the Marin Municipal Water District.

The program offered audits to large commercial and industrial customers to recommend water efficiency improvements at selected facilities. The program also offered financial incentives to help offset the cost of improvements implemented by the customer within the program period. Types of eligible improvements included: ozone laundry systems, winery and food processing changes, hospitality sector bath and shower upgrades, and large customer landscape projects. For ozone retrofits in laundry facilities, a program-approved ozone installer performed the audits. For other water efficiency improvements, audits were conducted by a combination of water agency (or city) staff and consultants retained by PG&E. Each audit included:

- A review of existing water bills and facility information
- A physical inspection of the customer's facility to observe existing equipment and its operation
- Preparation of an inventory of water-using equipment, processes and operating times
- Identification of options to reduce water use

In the ozone laundry element of the program, PG&E contractors installed machinery that adds ozone to water used to do laundry in commercial buildings such as hotels. The ozone increases the cleaning power of the water, allowing a smaller quantity of cooler water to do the work of a large quantity of hot water.

PG&E and its partners also advocated for the inclusion of recycled water projects, which utilize treated wastewater that has been diverted for reuse rather than returned to a receiving water body. PG&E and the water agencies gave financial incentives to participants that decided to install a recycled water system, and the customers used independent contractors to do the work.

In the water audit element of the program, a water agency or contractor audited large customer facilities and gave recommendations for water savings. Water audit participants were given financial incentives if they hired independent contractors to install recommended equipment. Some customers also came to PG&E with water savings ideas already identified.

Program Goals and Achievements

Table 2 shows the expected and actual participation for the program, and shows that the majority of program participants were hospitality sector customers (e.g., hotels) that installed new ozone laundry systems. Collectively, these new ozone systems were estimated to save approximately 5,828,000 gallons of water per year according to calculations performed by the project applicants

and water agencies. Other projects installed through the program include plumbing and toilet upgrades at a county prison, university cafeteria improvements, and recycled water equipment at a manufacturer and a school district, resulting in total (estimated) annual water savings of 27.4 million gallons for the program.

PG&E and water agencies staff also worked with several other customers in various sectors (e.g., wineries, a boys school), and some of these customers also received audits and/or considered implementing water conservation projects. However, these customers did not proceed to actually install measures or implement process changes during the program period ending December 31, 2009, and thus they are not tabulated as participants.

Table 2: Planned and Actual Program Participation

Business type	Possible water efficiency improvements	Expected participation	Actual participation	Estimated water savings (gallons per year)*
Hospitality	Ozone treatment	15-20	7	5,828,000
Wineries	Hot water closed loop systems, barrel washer efficiency and tank washing cascaded rinsing	2-3		
Food processors	Cleaning and sanitation measures, cooling tower improvements, water recycling and re-use	15-20		
Health care facilities	Kitchen operations and ozone treatment	2-5		
Medical facilities	Dialysis and toxicology services	1-2		
Health clubs	Bathroom/showers and landscaping	2		
Prison	Food service and laundry, toilet upgrades	1	1	2,428,000
Residential boy's school	Kitchen operations, ozone treatment, bathroom water use and landscaping	1		
University	Cafeteria operations	0	1	535,000
Manufacturer of personal care products	Cooling water holding tank, recycled water	1	1	5,947,000
Manufacturer of laminate trusses	Retrofit of steam kiln and boiler	1		
Carwashes	Recirculation systems	2-5		
Wine storage	Retrofit chilling system	1		
Municipal facilities	Recycled water, plumbing retrofits	0	1	12,704,000
Total		44-62	11	27,442,000

*Estimated by the project applicants and water agencies.

2.2 PG&E LARGE COMMERCIAL CUSTOMERS PROGRAM LOGIC MODEL AND PROGRAM THEORY

The following program theory for PG&E's Large Commercial Customer program builds on the program logic model and provides additional detail on program activities, outputs, and outcomes. (The logic model diagram follows the discussion of program theory.)

ACTIVITIES

Partnership formed with water agencies

PG&E partners with East Bay Municipal Water District (EBMUD), Sonoma County Water Agency (SCWA) and its associated water retailers, and retailers in the Santa Clara Valley Water District (SCVWD) territory to develop a program that provides water audits to large commercial and industrial businesses. The goal of the program is to achieve water efficiency improvements through installations of equipment and process changes.

Targeted customer recruitment

PG&E and the partner water agencies identify large industrial and commercial businesses that are joint customers of both PG&E and the partner water agency. Once a qualifying customer is identified, they are recruited to join the program, primarily by PG&E account executives. Potential candidates include: hospitality sector businesses, wineries, food processing companies, prisons, municipal facilities, health clubs and large customer landscapes.

Water audits

PG&E partners with the water agencies to conduct the water audits. Some of the water agencies use their own staff members to conduct audits, and PG&E also hires a consultant for those agencies that need them. Audits consist of: a review of water bills and facility information, an on-site inspection of the facility and inventory of water-using equipment, a review of water process and operating schedules, and identification of various options to curtail water use. For ozone retrofits in laundry facilities, audits are performed by installation contractors approved by the program.

Water conservation measure incentives

Performance-based cash incentives are provided by both PG&E and the water agencies to customers who implement water saving process or equipment changes as recommended in their audit. PG&E provides an incentive of \$.08 per estimated kWh saved by the measure, EBMUD pays an incentive based on its rebate calculator, and each SCWA or SCVWD water retailer has differing cash incentive structures. Together, these contributions may cover a significant portion of the project cost.

Verification and QA

The water agency partners establish verification and QA processes.

SHORT TERM OUTCOMES

PG&E customers informed of audit/install opportunity

Program outreach efforts successfully reach the target customer groups, who understand the program opportunity and its potential benefits to them.

Large commercial customers get water savings audit at no cost, potential water savings identified

Decision makers at the large customer companies desire to learn more about potential water saving opportunities, elect to participate in the program, and submit an application to their PG&E account representative. The audits are conducted and recommendations to reduce water use are given to the commercial customers.

Water savings equipment installed, processes changed.

The customers receive their audit results and understand the water savings opportunities and recommended measures and/or process changes. Some companies choose to adopt the audit recommendations and proceed to install water saving measures and/or change their production processes as their circumstances allow (e.g., available company budget, logistics constraints, etc.)

Installations verified by water agencies, incentives paid to participants

A water agency representative verifies installation of all eligible equipment and process changes initiated by participants after the audit and verifies the resulting water savings. Each partner water agency or retailer estimates the rebate associated with the water savings and provides this information to PG&E. PG&E estimates the incentive it will pay based on the water savings reported by the partner water agencies. The customer provides project invoices, and incentives are then awarded to participants.

MID TERM OUTCOMES

Water savings achieved, reduced water bills for participants

After the installations, water usage is reduced for the business, which leads to a reduction in water bills.

kW, kWh savings for water suppliers and wastewater treatment, reduced operating costs

When large commercial customers reduce their water consumption, upstream water suppliers and downstream wastewater providers realize indirect/embedded energy savings, by reducing surface conveyance, groundwater pumping, treatment, distribution, as well as wastewater pumping and treatment.

Improved understanding of embedded energy in water services

Analyses conducted by M&V contractors quantify the embedded energy savings that water suppliers and wastewater providers are expected to realize. The findings are published so that the CPUC, PG&E, and water agencies have an improved understanding of the embedded energy in water supply and treatment systems. Data from the evaluation are used to update the embedded energy calculator, which allows for simpler estimation of embedded energy savings for future programs.

LONG TERM OUTCOMES

Additional measures (previously considered not cost effective) are now considered cost effective

Measures that were once considered not cost effective based on water savings alone may now pass the cost effectiveness test when embedded energy savings are also considered. This may allow PG&E to justify including water measures in other efficiency programs.

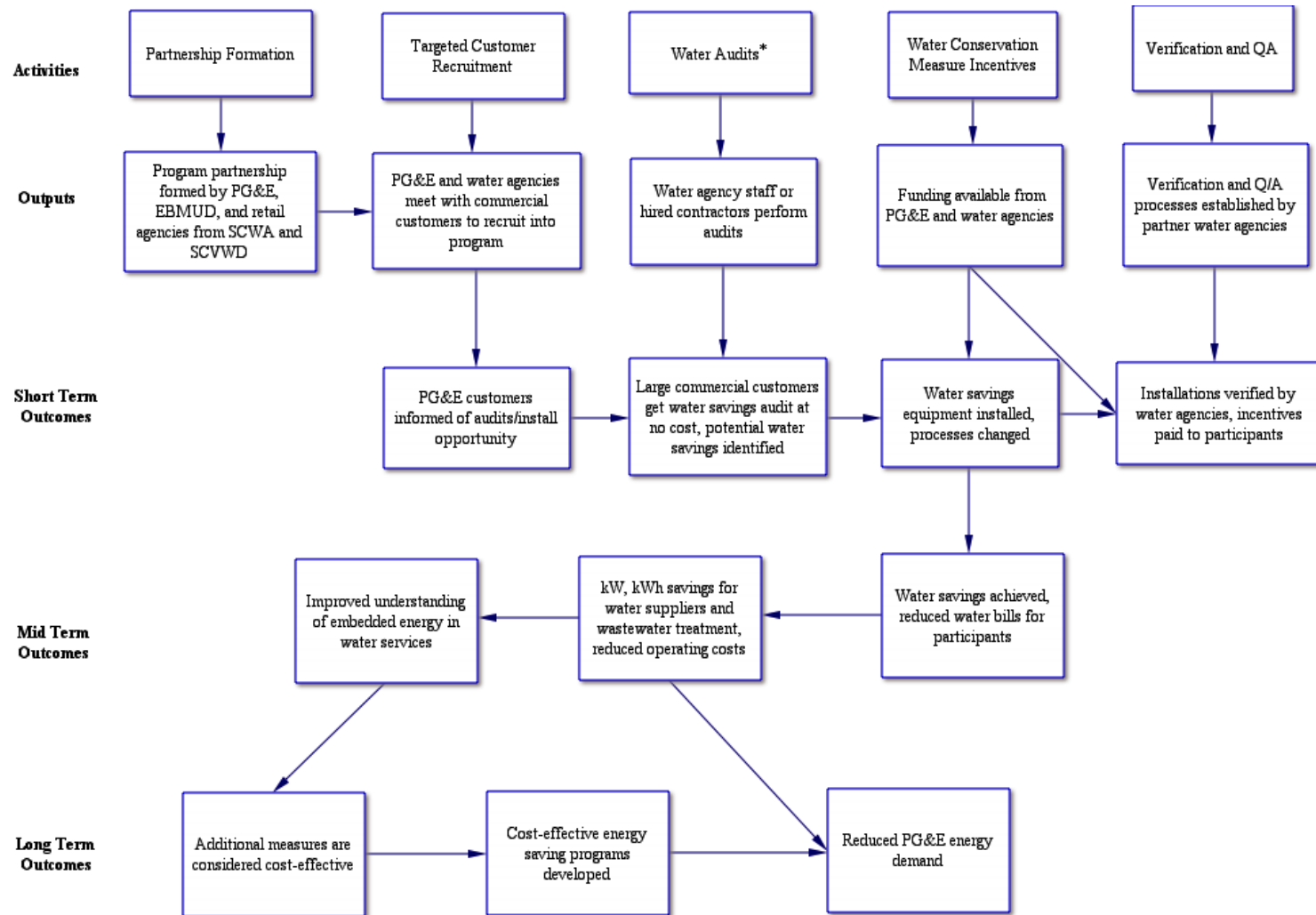
Cost-effective energy saving programs developed

The Large Commercial Customers program has successfully targeted and served large commercial customers and has achieved both water and embedded energy savings. If the water conservation measures are found to be cost-effective, then they may be included in energy utility energy efficiency portfolios.

Reduced PG&E energy demand

Large customers utilize PG&E's new program, creating additional embedded energy savings to upstream/downstream water suppliers and wastewater providers. As a result, PG&E achieves long-term energy savings and California's electric grid is positively impacted.

Figure 1: PG&E Large Commercial Customers Program Logic Model



*Ozone laundry audits are performed by the program's ozone laundry installation contractors.

2.3 PG&E LARGE COMMERCIAL CUSTOMERS PROGRAM EVALUATION OVERVIEW

The evaluation activities completed for this program included:

1. Three in-depth interviews with PG&E program managers and account executives
2. Five in-depth interviews with partner water agencies staff
3. Two in-depth interviews with program contractors that installed ozone laundry systems and conducted comprehensive water use audits
4. In-depth interviews with six customers that installed water conservation measures through the program (ozone laundry systems, recycled water retrofits, commercial dishwasher) and two customers that initiated participation but did not complete the program¹¹

Interviews with program staff were conducted in the fall of 2009, while the other interviews were conducted in January through March of 2010. Following are some of the topics that were discussed during the interviews:

- Ease of partnership formation
- Success of customer recruitment
- Ease of customer participation
- Usefulness of the comprehensive water use audits
- Customer satisfaction with installed measures and participation experience
- Barriers to customer participation and installations
- Success of program coordination and tracking activities
- Overall satisfaction among IOU staff, water agency staff, program vendors and customer participants

Detailed results of the data collection and analysis are discussed below.

¹¹ Other customers were contacted but did not respond to requests for interviews.

2.4 PG&E LARGE COMMERCIAL CUSTOMERS PROGRAM EVALUATION RESULTS

Partnership Formation and Program Delivery

The partner water agencies stated that the program formation generally went smoothly, and only required them to agree to partner with PG&E; there were no complicated contracts to sign. Afterwards, some of the water agencies had to develop new incentives programs and more coordination with PG&E was required, so that the account executives, program vendors and customers would receive consistent information. The main barrier to launching the program was the CPUC's delayed approval, which caused some of the early program planning to lose momentum.

Participant recruitment was done mostly through PG&E's account executives, who proactively contacted their own regular customers and also eligible companies identified by the water agencies. Two PG&E account executives with extensive customer and water agency contacts in the region were particularly involved in the program recruitment. Sometimes prospective participants were discussed in face-to-face meetings, while some water agencies submitted screened customer lists to PG&E. In general, it was not hard to identify program-eligible customers. From there, agency representatives wanting a high level of involvement met with selected customers personally (often with PG&E staff), while others relied on PG&E staff to approach customers. Some potential participants were identified by PG&E and the water agencies *before* the program was officially approved, however most of these customers ended up not participating.

PG&E developed a fact sheet to promote the program, which was sent to targeted customers, account executives and the water agencies. Because the program had restricted eligibility, however, no program information was put on the PG&E website, and program marketing was minimized so as not to turn away many ineligible applicants. Some water agencies developed their own marketing flyers to send to customers, while others simply distributed PG&E's materials and followed up by phone or email.

The recruitment of ozone laundry participants went particularly well, and strategically started with a well-known hotel that was expected to realize large water savings to show to other prospects. Many of the ozone laundry participants were identified and successfully recruited into the program by a single ozone installer (more information about their role and experience is discussed subsequently).¹² Some companies could not participate, however, due to budget constraints in the poor economy or because they could not complete an installation by the program end date. Moreover, hospitals cannot use ozone due to sanitation (i.e., blood) issues, and industrial cleaners with large tumble washers require significant hot water because of grease used in the operations.

¹² One water agency representative said that having the ozone installer also doing recruitment added complexity and confusion, and required that they try to decipher long, detailed and sometimes incomplete email correspondence between PG&E and the installer.

Regarding the program implementation, the water agencies offered different levels of fixed and custom incentives, which added complexity for the ozone installer who wanted to estimate rebate amounts for their customers. To serve one prospective ozone customer, one agency developed a new custom incentive program from scratch (which then had to be revised), leading to project approval and implementation delays. Another agency had to develop a new 2-tiered incentive structure, because they provide wastewater services to some areas but not others.

On the technical side, the impact evaluation required that the ozone installer use specialized meters, which required frequent coordination with the evaluators and sometimes repeat site visits by the installer (based in Texas) to switch meters. In addition, most of the hotels were not able to record the number of washed loads or pounds correctly, and occupancy data then had to be used to estimate water savings.

For one wine industry customer, multiple water sources became an issue. This customer obtains water from both a program water agency and its own well, and does its own wastewater treatment. When the customer asked for a comprehensive water audit, to estimate water savings from recycling barrel washing water and other changes, the water agency representative determined on their own that most the water savings would come from the customers own well water, for which they should not receive city incentives. PG&E ultimately paid for the customer audit, and the customer elected to defer installation of the recycled water system until 2010.

To track program progress (e.g., participation, estimated water savings, rebates paid), PG&E continuously collected data from the water agencies, program vendors and account executives. These data were also shared with the impact evaluation team on a weekly basis. PG&E staff also attended one or two internal team meetings each week (in addition to calls with the impacts evaluators) to discuss projects issues and next steps, so that information could be returned to the water agencies and ozone installer. One water agency with more program participants also noted that it took a lot of time to estimate water savings and give PG&E updates.

As the program progressed, PG&E staff found that the PG&E incentives were too small to justify the calculation process and required staff time. Most of the participants were not PG&E's largest customers, and the time spent working on the projects far exceeded the paid incentives. Staff felt that PG&E should only offer deemed incentives in the future, unless much larger water saving projects were expected. Some water agencies staff also expressed frustration at amount of time needed for tracking water savings and calculating incentives, and would favor a deemed incentives approach also.

One PG&E manager said it was initially hard to know which water agencies served participating customers. In addition, it was often difficult to get timely responses from busy water agency staff, especially at smaller water agencies where staff perform many roles. In some cases, this delayed the development and marketing of new water savings incentives, and also the tracking of interested customers. When they were available, the water agencies staff were happy to give assistance.

To improve program understanding and coordination at start of the program, PG&E conducted monthly conference calls with the partner agencies. The agencies reported that these calls were done very professionally, and that it was good to hear about issues that other agencies were experiencing. Two agencies said that they were able to proactively improve their metering requirements after hearing about metering issues at other sites. As the program progressed, the

calls shifted from discussing general program topics to specific site issues (with smaller attendance).

Although the water agencies were generally satisfied with communications from PG&E, two agencies had specific complaints. One agency representative had heard rumors that PG&E had moved ozone laundry projects into a regular two-year deemed savings program, and was only able to confirm this by contacting PG&E directly. Another agency representative with only one program project was initially unsure who the project “PM” was – the customer, PG&E, or the water agency. After PG&E took charge of coordinating the impact evaluation metering, the representative had more confidence that the project would be completed.

Despite the program’s challenges, PG&E staff claimed that working with the water agencies had been a positive experience overall. Existing relationships had been solidified and new ones developed, and staff gained insights into how the water agencies operate. The program has brought increased attention to water use at PG&E, and many staff were pleased to learn that embedded energy in water systems was receiving careful study. Staff were also pleased that the water agencies were continuing to refer opportunities for direct energy saving projects to PG&E.

The water agency representatives were also generally pleased with the Large Commercial Customer program. They stated that PG&E staff were easy to work with, and they highly valued their strengthened relationships with PG&E’s account executives and their new vendor contacts. The water agencies now know much more about PG&E’s program offerings (e.g., for hot water projects) and can serve their own customers better. One representative was also pleased to learn how his customers finance their improvements and calculate return on investment.

Most of the water agencies stated that the partnership caused their customers to learn about the important connection between water and energy usage, which was one of their goals. Offering both water and energy saving incentives through the program was particularly attractive to customers with available capital funding, and customers were continuing to look for water saving opportunities after the Pilot Program ended. The water agencies that created new rebate programs specifically for the Pilot Program were continuing to promote them, and most agencies had projects lined up for 2010 installations.

The main source of water agency dissatisfaction pertained to the program impact evaluation. A few agency representatives stated that some of the projects metering was taking a surprisingly long time to start and complete, which prolonged their required involvement and tracking. Moreover, some agencies were anxious to see the actual metering results, so they could confirm their water savings estimates, and were frustrated that the impact evaluation was not able to disclose interim findings.

Vendor Experience, Satisfaction and Challenges

ECONorthwest interviewed two vendors regarding their experience with the program. One was an ozone laundry installer (not under contract to PG&E); the other, an engineering consulting firm that conducted water audits for the program.

Ozone Laundry Vendor

The ozone laundry vendor was involved in every step of the projects they worked on. The first step was recruitment. Recognizing that program incentives could be used to leverage their own sales revenues, the vendor aggressively recruited businesses in the healthcare and hospitality industries, informing them of the benefits of ozone laundry equipment and the incentives available. As a result, the vendor recruited the vast majority of all the PG&E ozone laundry participants.

Factors that helped the vendor recruit customers were the size of the incentives, which could collectively cover up to 90 percent of the project costs, and the vendor's extensive contacts in the hotel industry.¹³ Recruitment barriers were: unfamiliarity with the ozone technology, disbelief at the incentive amounts (i.e., the program is not credible), and requirements for corporate office approval. Many hotels said they could not spend any money at all on upgrades due to the poor economy.

After a business became interested in the program, the vendor would give them a preliminary estimate of water savings. Then the vendor pre-metered their water consumption for 30 days to establish a baseline measurement. This metering step could be challenging, as the vendor needed data to be read from the meter every week but customer staff did not do this reliably. After installing the new equipment, metering continued for 30 more days.

The vendor's metering activities were complicated by the impact evaluation. For one customer, the post installation data were collected with a different type of specialized meter that could be read remotely, and the water agency had concerns that the post installation data was not consistent with the pre installation data. In the end, all of the collected site data were valid and usable, although the water agency had not expected the metering changes. At other sites, the need to use specialized meters delayed some projects by 4 to 5 months, as the impact evaluators used their own subcontractors to change the meters.

The vendor also helped the customers to complete their rebate applications, and then tracked the applications through PG&E's payments process. The vendor knows that most hotel staff are too busy to complete and keep track of program paperwork, and they provided this service to enhance customer satisfaction. According to the vendor, it was taking both PG&E and the water agencies 3 to 4 months to pay the customer incentives after the installations.

The vendor communicated frequently with PG&E staff concerning the projects. Staff at PG&E would confirm that customers were approved for installation, validate meter readings, and help make sure that incentives were paid quickly. The vendor was quite satisfied with communications with PG&E staff, saying they were very accessible and involved.

The ozone laundry installer was very satisfied with the program overall. The vendor's sole recommendation for improvement was that higher incentives would help increase program participation.

¹³ Three incentives were available, from PG&E's Pilot and Nonresidential Retrofits programs, and the local water agency.

Water Audit Vendor

PG&E asked this vendor to perform comprehensive water audits for two wine industry customers that PG&E staff had convinced to participate. In addition, the auditor also estimated water savings from a specific proposed process change for a dairy products manufacturer. PG&E and County funding only allowed for the two thorough audits and the limited analysis task.

The contracting process with PG&E took awhile to complete, but was typical of the auditor's prior experience with PG&E. On the other hand, the scope of work was very clear once the negotiations were complete; this helped to make sure everyone's needs were met.

For the two wine industry customers - one a bottling plant, the other a winemaker and bottler - the auditor performed a site walkthrough and interviewed company staff. One of the customers was surprised at how much time the vendor required with company staff to discuss operations, and would have preferred that more of the information be gathered by sub metering. After collecting as much information as possible, the auditor developed draft reports with recommendations for process changes and equipment upgrades that would save water. The vendor tried to make the list of feasible changes as comprehensive as possible.

After the wineries reviewed their draft reports, the auditor helped draft an action plan for each. The auditor found the wineries generally easy to work with, although the wineries took a long time to review their draft reports and schedule meetings to review the action plans.

The auditor was generally satisfied with communications with PG&E staff and the handoff to the impacts evaluators, who asked questions about the audit reports. The auditor noted that when performing the water audits they were unclear about what types of incentives were available. For example, both wineries used ground and city water supplies. The vendor did not know if PG&E would offer incentives for both water sources, and if one source was prioritized over another. In addition, the vendor recommended many process changes, but speculated that these were harder for PG&E to incentivize because no equipment is needed. Having more information on the eligible incentives in advance would have helped the vendor to focus on areas with the highest return on customer investment.

The vendor recommended a few changes to the program:

- Target wineries with grape-crushing operations; these customers consume large amounts of water and can have complex wastewater issues to address on-site.
- Provide details about the incentive structure earlier in the process.
- Provide incentives for process changes as well as equipment upgrades.
- Clarify whether groundwater usage will be considered in water savings.

Participating Customer Experience, Satisfaction and Challenges

Customers' participation generally occurred in three stages. First, the customer would hear about the program and would contact PG&E staff or a contractor, who would guide them through the program. Second, the customer and their contact(s) would determine which measures or processes would (cost-effectively) conserve water and then proceed to plan and implement the projects. Lastly, the customer would work to receive financial incentives from PG&E.

Customers learned of the program from the following sources:

- PG&E staff - Four customers learned of the program through PG&E staff—in three cases through their account representative.
- Program contractors - Two customers were contacted directly by an ozone laundry installer contracted by the program.
- Local water providers - A municipal water utility and a recycled water provider told two of the interviewed customers about PG&E’s program.

In the second stage, customers identified equipment and process changes that could contribute to their water saving goals, and available PG&E incentives. The amount of effort that the customers had to give in this stage varied widely.

Most of the ozone laundry customers found participating to be relatively straightforward, as a single contractor took responsibility for physically inspecting their facilities, calculating expected rebates, and installing new ozone laundry equipment. These customers’ responsibilities were limited to interacting with the contractor and determining if the benefits of the project outweighed the cost.

One ozone laundry customer, however, ran into problems and was ultimately unable to participate due to their designated PG&E account type. This customer provides housing for the elderly in a continuing care community, and their PG&E account is designated as residential, rather than commercial. According to the customer, PG&E took a long time determining their eligibility, which became “a burden” to the customer. In the end the customer was ruled ineligible for rebates, and without these the customer could not justify installing the equipment.

The other four interviewed customers needed to expend more effort to participate in the program, although they also implemented larger scale projects. The customer with the smallest project was a University cafeteria, which installed a more efficient dishwasher and a system that reuses dishwasher water to pre-rinse dishes. This customer found communication and coordination with program staff to be problematic and frustrating. Specifically, they had many points of contact among PG&E staff and installation subcontractors, with no one person clearly in charge.

Two customers completed recycled water retrofit projects. These projects are typically larger in scale and scope because new pipes or canals must be installed to bring the recycled water to the project sites. The fourth customer created a system to reuse their own process water. This customer had an employee planning and managing their water reuse project full-time for nearly a year. The major tasks for this employee were getting approvals from regulatory agencies (e.g., the city health department), developing accurate calculations of the expected costs and savings attributable to the project, and arranging for construction of the facility.

These three customers all had single primary PG&E contacts - either Pilot Program staff or the customer’s account manager. For all three customers, having a primary contact was helpful, because that person was tracking all aspects of their projects. In one case, the primary point of contact changed midway through the program. This caused significant disruption while the new person became familiar with the project.

Lastly, customers filled out forms to receive their rebates. The customers generally found the forms easy to fill out. Customers whose PG&E contacts helped them fill out the forms, in some cases by highlighting the appropriate portions, were especially pleased.

Most of the interviewed customers were satisfied with the program, but all had at least some complaints. On a scale of one to ten, with ten denoting “extremely satisfied”, six of the eight customers rated their experience with the program an eight or higher. The other two customers were quite unhappy with PG&E because they had invested significant time pursuing their projects with little to show for it. They rated their experiences a three or four. The primary determinant of customers’ satisfaction was whether or not they received the benefits they expected from the program. This depended both on what benefits they received and on how clear communications were during their participation.

The benefits that customers desired and expected varied greatly, but generally included financial incentives, water savings, and/or new equipment. The two interviewed customers who were dissatisfied with the program had received no incentives. One of these was pursuing a new ozone laundry system, while the other had received a water audit and had their high priority water reuse project deemed ineligible (other projects could have potentially received rebates).

For those who received incentives, the sizes varied greatly. One customer received a rebate for less than one percent of the total cost of the installation, while others had essentially all of their costs covered. One customer found that the ozone laundry contractor had made a calculation error, and the rebate they received was less than they had expected. The contractor covered half of the difference, but the remaining shortfall was poorly received by the customer’s management.

Most interviewed customers did not have information on how much water the new equipment was saving them, but two did. One was extremely satisfied with the quantity of savings, but the other customer had not experienced as much water savings as anticipated.

Two of the ozone laundry customers had experienced problems with their equipment. One had trouble with a strong odor in the laundry room, and was concerned that the odor might indicate a health risk. As of the time of the interview, this problem had not been rectified.¹⁴ The other had found it difficult to figure out the proper mix of chemicals to use with the new equipment. By the time of the interview, the second customer had figured out the correct chemicals mix, but it had taken a while.

The nature and effectiveness of communications that customers experienced also varied considerably. The two customers who ended up not receiving rebates both would have appreciated clearer communication from program staff. One decided not to apply for rebates because previous communications with program staff had been poor, and they thought it would not be worth their time. The other was not eligible for rebates, but had invested significant effort into the program before discovering this. Before their ineligibility was confirmed, this customer had gathered baseline water and energy consumption data and supervised contractors measuring their washers’ and dryers’ water and energy use. This customer would have preferred to find out that they were ineligible sooner.

Two customers felt that they had no primary contact responsible for their participation in the program. They thought that a primary contact would have made their participation easier. Four

¹⁴ Subsequently, the customer switched back to their old system, and the installer absorbed the cost to do this.

customers would have liked greater clarity about the benefits of participation (both one-time rebates and ongoing water savings) before installing the equipment.

The technical evaluation of water savings had not had an impact on most of the respondents as of the time of the interview. However, one respondent had been negatively impacted by the evaluation. This respondent had not known that they were “signing up” for the evaluation, and they first heard of the technical evaluation when an evaluation contractor called. This respondent was nervous about the evaluation procedure, which involved putting water meters on interior pipes. The evaluator initially wanted to cut pipes in order to insert in-flow meters, but the respondent refused this approach, fearing that the cutting and/or patching would be done badly and that they would incur the cost of subsequent repairs.

Customers had many ideas for program improvement:

- Have one person at PG&E coordinate a customer’s entire experience. This person should guide the customer through the program from start to finish and inform the customer about contractors and evaluators before the contractors and evaluators contact the customer.
- Inform customers early on about potential impact evaluation activities, and how these could impact them and their facilities.
- Assess program eligibility very early in the participation process. It is a burden on customers to prepare for a program and then be told they are not eligible.
- Provide customers with research findings about worker health and recommended chemical use in ozone laundry facilities.
- Make sure that rebates are accurately calculated and confirmed before equipment installation. After customers detail the equipment they expect to install, PG&E should confirm the amount of the rebates they will receive. When the customer subsequently sends in receipts to confirm that they actually installed the expected equipment, PG&E would send them the exact amount from the first step.
- Provide detailed pre-installation water usage measurements for customers that are especially interested. This could require metering specific parts of a customer’s facility.
- Improve follow-up with ozone laundry customers to make sure their equipment is working well.

2.5 PG&E LARGE COMMERCIAL CUSTOMERS PROGRAM ISSUES AND OBSERVATIONS

The main challenges for this program were insufficient time and a poor economy that limited capital investments. When the program was initially approved, PG&E and its partners only had one year to recruit customers, conduct their audits, obtain project approvals and complete the project installations. In addition, projects undergoing an impact evaluation required additional time for pre and post-project metering. Because PG&E and water agency staff were not sure how many projects could actually be completed in the program period, program marketing was relatively limited.

In addition, the compressed timeframe exacerbated coordination difficulties with smaller water agencies that needed to design new water incentives programs, or whose staff were hard to engage due to busy schedules. Water agencies with existing programs had an easier time working with PG&E, since their processes, materials, and applications were already developed.

Ozone laundry projects became the primary program driver, although interviewees noted that food processing companies remain an untapped market, and that water reclamation projects have large potential due to rapidly improving technologies. Several ozone laundry projects were completed because one program vendor aggressively marketed the program rebates and brought projects to PG&E. To grow this market, more key decision makers in the hospitality sector need to be educated and convinced of the benefits and safety of ozone laundry systems.

Importantly, most of the program customers had a positive participation experience. Ozone laundry customers were reportedly achieving their savings targets and had their new systems mostly paid for. The installer also gave hotels staff training on how to tune up the new machines so they could do this on their own. After the initial period of breaking-in and minor adjustments, customers had few problems with the new equipment. Some customers, however, felt that they were “hassled” to provide occupancy and laundry loads information to the program, which was a function of the impact evaluation and not the core program design.

Although program participation lagged expectations, particularly at the start, it did not “die on the vine”, and many interviewees attributed this to the persistence of PG&E’s program manager to recruit and track potential participants. The rate of program participation increased as the program continued past the original expiration date.

Lastly, the partner water agencies were generally pleased with the program. They perceived that the water incentives offered through the program were truly valuable to their customers, enabling the agencies to achieve much high water saving than they would through customary toilet and showerhead replacement programs. For some agencies, the Pilot Program accelerated the development of entirely new water conservation programs.

Program Recommendations

Based on the evaluation results, the following are recommendations for the Large Commercial Customer program if it continues in the future:

- **Ensure that the program period is long enough to accommodate large capital project audits and installations.** For some projects, it can take a long time to arrange, conduct and debrief audits, and then complete the installations. This is particularly true when companies must secure funding that they have not budgeted for, secure multiple permits, and/or when additional metering is needed to measure water savings.
- **Inform water agency partners of staff time and information needs during partnership formation.** In particular, staff at smaller agencies need to be able to give customer recruitment updates in a timely manner, and also implement their own program changes expeditiously. If agencies cannot commit to doing this, they should not be included as program partners.

- **Inform water agency partners about embedded energy data that will be required of them during partnership formation.** Some of the partner water agencies did not provide any water or energy data required to calculate embedded energy savings for their customer projects. In addition, agencies that did provide data were surprised at the level of detail of the data requested and the amount of staff time needed to collect the data. The water agencies need to understand up front what types of data will be required from them, so that appropriate agency staff can plan accordingly.
- **Have one PG&E point of contact for customers.** This happened for most of the program projects, resulting in higher customer satisfaction. Customer project managers became frustrated when new staff had to get up to speed on projects and momentum was lost, and sometimes this added to confusion in dealing with the impact evaluation contractors. Importantly, the primary contact should clarify the roles of program contractors and evaluators early on, so customers know what activities to expect (e.g., pre and post metering), how long they could take, and how they need to assist.
- **Utilize a deemed incentives approach for less complex measures.** PG&E switched to this approach for ozone laundry systems as the Pilot Program was expiring, to reduce its tracking and computations workload. (Ozone laundry customers no longer have to do pre-installation metering or submit an initial application for approval). This program design is also easier for customers to understand and reduces their anxiety about reimbursement levels.
- **Contact high-level management at hotels about ozone laundry projects.** Local hotel managers often refer program information to these key decision makers, and this could hasten the approval process. In addition, key managers often need to be convinced of the benefits of ozone laundry systems, and if they can be “converted” they can change company policies and bring other company hotels into the program.
- **Continue to try to recruit food processors.** These companies are large process water users and each has unique operations and savings opportunities.
- **Increase the program budget if more comprehensive water audits are needed.** The Pilot Program was only able to fund two comprehensive (non-ozone) water audits. If the program expects to serve more large process water users in the future, it will require more funding to do so.
- **Give program auditors clear direction on which water sources, equipment and processes to focus on.** This will enable the auditors to focus their attention on projects that will garner the highest incentives for customers, and to provide more detailed project implementation plans.
- **Look for ways to conduct regional (or statewide) marketing and implementation.** It is not cost effective for small water agencies to do extensive program marketing, and agency staff are typically too busy working on program development and implementation. Broad based marketing by agencies such as the Urban Water Conservation Council or California Energy Commission could help to bring more partner

water agencies into IOU programs, get them more engaged, and leverage additional marketing from the local agencies. Similarly, a regional lead water agency could develop a joint powers agreement to help smaller water agencies implement their programs.

3. PG&E (SINGLE FAMILY) LOW INCOME HIGH EFFICIENCY TOILETS PROGRAM RESULTS

3.1 PG&E LOW INCOME HIGH EFFICIENCY TOILETS PROGRAM BACKGROUND

For the Low Income High Efficiency Toilets Program, PG&E partnered with the Santa Clara Valley Water District (SCVWD) to offer direct install, high efficiency toilets (HETs) to low-income customers living in single-family residences (up to a four-plex). PG&E utilized its existing Low Income Energy Efficiency (LIEE) program contractors to identify the target customers and hired a direct install contractor to complete the HET installations. Toilet replacements were available to customers that meet the LIEE criteria for low income, are served by both PG&E and a partner water agency, and have toilet models that flush at 3.5 gallons per flush (gpf) or greater. Ultra Low Flush Toilets were not eligible for replacement. The cost for each HET was estimated to be \$280 per toilet. The participating water agencies paid \$150 per toilet, and PG&E covered the remaining cost. PG&E paid the contractor for their work directly and invoiced SCVWD for \$150 per toilet.

Program Goals and Achievements

PG&E initially planned to install up to 1,000 HETs in SCVWD territory. PG&E developed this estimate based on the number of low-income customers the LIEE program planned to contact in one year, and assumed that 30 percent of these homes would already have low-flow toilets and not be eligible for the rebate.

Subsequently the installation goal was reduced to between 850 and 900 HETs based on the approved contractor's cost proposal. When the program ended, 478 HETs had been installed in 206 households.¹⁵

3.2 PG&E LOW INCOME HIGH EFFICIENCY TOILETS PROGRAM LOGIC MODEL AND PROGRAM THEORY

The following program theory for PG&E's Low Income High Efficiency Toilet program builds on the program logic model and provides additional detail on program activities, outputs, and outcomes. (The logic model diagram follows the discussion of program theory.)

ACTIVITIES

Partnership formed with water agency

PG&E partners with the Santa Clara Valley Water District (SCVWD) to develop a program to directly install High Efficiency Toilets (HETs) in low-income single-family homes. The goal of the program is achieve both water and energy savings as a result of the installations.

Targeted customer recruitment

¹⁵ The program installed Vortens Loretto Round Front 1.28 gpf HETs, and each was estimated to save 23.75 gallons per day.

PG&E leverages existing Low Income Energy Efficiency (LIEE) contractors to identify low-income single-family customers during standard home energy assessments. PG&E and SCVWD also identify single-family homeowners in low-income mutual SCVWD and PG&E service territories for the direct installation of HETs.

HET installations

A plumbing contractor is hired to perform direct installations of the HETs.

HET funding

SCVWD pays \$150 per HET, while PG&E covers the rest of the cost (total HET cost is estimated at \$280). Together, these contributions cover the full cost of the equipment and installations.

Verification and QA

SCVWD has established procedures to conduct follow-up installation verifications at program participant homes.

SHORT TERM OUTCOMES

Low-income single-family homeowners are aware of the program opportunity

Program outreach efforts successfully reach the target customer group, who understand the program opportunity and its potential benefits to them.

HET measures installed at no cost to homeowners

Low-income homeowners with existing high-volume toilets are motivated to install HETs by expected water savings/financial benefits, environmental concerns or other factors and elect to participate in the program. PG&E's installation contractor installs the HETs at no cost to the property owner.

SCVWD verifications

SCVWD may do follow-up verifications on a sample of homes where HETs are installed.

MID TERM OUTCOMES

Water savings achieved, reduced water bills for homeowners

After the HET installations, residents use the single-flush model toilets properly. Water usage is reduced for the home, resulting in lower water bills.

kW, kWh savings for water suppliers and wastewater treatment, reduced operating costs

When low-income properties reduce their water consumption, upstream water suppliers and downstream wastewater providers realize indirect/embedded energy savings, by reducing surface conveyance, groundwater pumping, treatment, distribution, as well as wastewater pumping and treatment.

Improved understanding of embedded energy in water services

Analyses conducted by M&V contractors quantify the embedded energy savings that water suppliers and wastewater providers are expected to realize. The findings are published so that the CPUC, PG&E, and water agencies have an improved understanding of the embedded energy in water supply and treatment systems. Data from the evaluation are used to update the embedded energy calculator, which allows for simpler estimation of embedded energy savings for future programs.

LONG TERM OUTCOMES

Additional measures (previously considered not cost effective) are now considered cost effective

Measures that were once considered not cost effective based on water savings alone may now pass the cost effectiveness test when embedded energy savings are also considered. This may allow PG&E to justify including water measures in other efficiency programs.

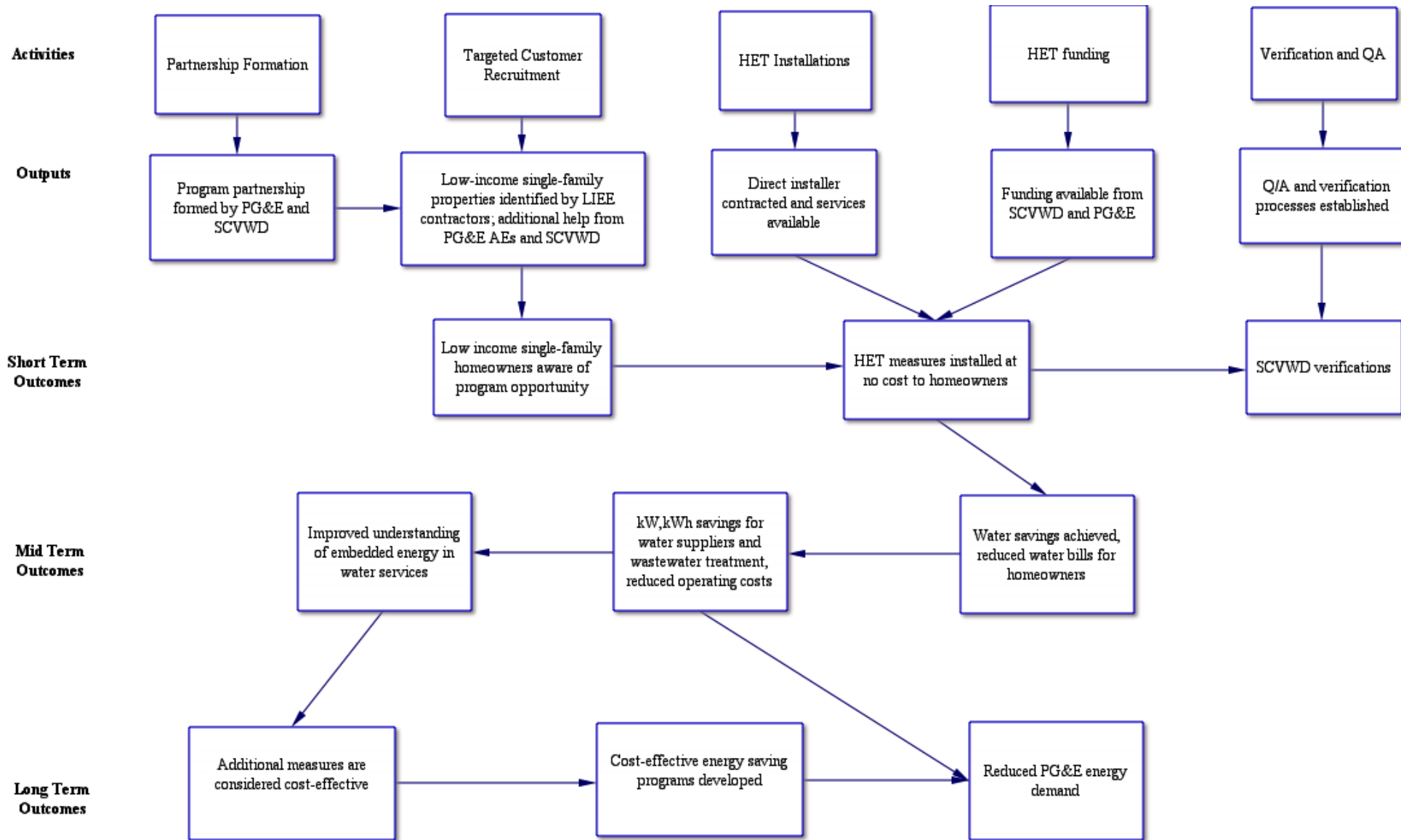
Cost-effective energy saving programs developed

The HET program has successfully targeted and served low-income homeowners and has achieved both water and embedded energy savings. If the HET measure is found to be cost-effective based on the embedded energy savings, then it may be included in energy utility energy efficiency portfolios.

Reduced PG&E energy demand

Low-income customers utilize PG&E's new program, creating additional embedded energy savings to upstream/downstream water suppliers and wastewater providers. As a result, PG&E achieves long-term energy savings and California's electric grid is positively impacted.

Figure 2: PG&E Low Income High Efficiency Toilets Program Logic Model



3.3 PG&E LOW INCOME HIGH EFFICIENCY TOILETS PROGRAM EVALUATION OVERVIEW

The evaluation activities completed for this program included:

1. Interviews with the Pilots and Low Income program managers at PG&E
2. An interview with the program manager at SCVWD¹⁶
3. An interview with the toilet installation contractor
4. A telephone survey of 76 customers that received HETs through the program

ECONorthwest conducted the interviews from November 2009 through January 2010 and implemented the telephone survey in April 2010. Following are some of the topics that were assessed in the interviews and survey:

- Ease of partnership formation
- Success of customer recruitment
- Ease of customer participation
- Actual HET usage patterns
- Customer satisfaction with the HETs and participation experience
- Success of program coordination and tracking activities
- Overall satisfaction among IOU staff, water agency staff, program vendors and customer participants

Detailed results of the data collection and analysis are discussed below.

3.4 PG&E LOW INCOME HIGH EFFICIENCY TOILETS PROGRAM EVALUATION RESULTS

Partnership Formation and Program Delivery

Although there were no hurdles to forming the partnership in concept, PG&E staff noted that it took over a year to actually approve the new water agency rebate form and amount. Program implementation was also delayed because PG&E's original installation contractor (the only bidder to the RFP) was convicted of fraud in another jurisdiction and a new solicitation was required. In hindsight, PG&E's program managers would have liked to receive multiple bids to the first RFP, although the initial contractor's bid was acceptable.

¹⁶ Due to staff turnover, this was the third person to manage the program for SCVWD. PG&E staff perceived that the level of engagement and responsiveness had varied noticeably among the three managers.

PG&E and its contractors were responsible for customer recruitment for the program. SCVWD posted information about the program on its website and helped to develop an informational flyer, but it did not participate in the recruitment effort.

Initially, the program identified eligible households through contractors working for PG&E's low-income energy audit program. As energy auditors conducted assessments of energy consumption, they were supposed to determine if households had inefficient toilets that would be eligible for the program. Staff at PG&E and the toilet installation contractor reported that this system was ineffective because the energy audit staff are trained on household energy equipment and not water equipment. As a result, the energy auditors often reported households to the program that had existing low-flow toilets, and the toilet contractor could not serve these customers when they subsequently came out to their homes.¹⁷ In addition, some auditors targeted multi-family housing that was ineligible for the program. These issues combined to give the program a slow start.

To improve the low participation rate, PG&E changed the recruitment method by having the installation contractor recruit households. To do this, the contractor called low-income households in the SCVWD service area that are served by PG&E.¹⁸ During the calls, the installer asked if the household was interested in the program, and then determined if it met the program's income requirements. This contrasted with the initial recruitment method, which determined eligibility first, and interest second.

As noted earlier, the program did not achieve its toilet installation goal. Participation increased after changing the recruitment method, however, and if the program had implemented the second method for the duration of the project it would have met its participation goals, according to the program manager and the contractor.

The program's narrow definition of eligibility also contributed to the program's lower than planned participation. Staff at SCVWD reported that there is not a large number of low-income households residing in single-family homes in the area. For other water programs for low-income households, SCVWD has focused on households in mobile homes, but the CPUC determined that mobile homes are not single-family homes, even if they are sub-metered. This decision limited the number of eligible households in the SCVWD service area. SCVWD also recommended that PG&E use community organizations that work with low-income populations to conduct program outreach in the future.

PG&E staff reported that the billing process between PG&E and SCVWD was complicated. SCVWD paid for half the cost of installing each toilet, up to \$150. PG&E staff had to review the installer's invoices to identify the original installation costs and explicitly exclude charges for service callbacks (e.g., to repair leaks) before invoicing SCVWD. PG&E staff believed that a simpler method—perhaps multiplying a specific dollar amount times the number of toilets installed—would be easier to implement and sufficiently accurate.

Regarding program tracking and data sharing, SCVWD tries to keep track of its water conservation program participants but was unable to obtain a database of program participants

¹⁷ It is also possible that the energy auditors missed opportunities to install new efficient toilets.

¹⁸ Calls were made in both English and Spanish.

from PG&E, due to confidentiality reasons. Using the original customer applications given to PG&E SCVWD has been able to build a database, but would like to compare that data to the PG&E data. SCVWD would have also preferred more frequent updates on installation numbers. They did not receive data about installations until they received billings from PG&E.

Staff at PG&E reported that the toilet program was inherently different than its programs that focus only on energy. There were lots of small details that were different, for example, the contracting language (although this process went well overall). PG&E staff are relatively unfamiliar with water conservation issues and equipment and it took time to learn about them.

Staff at SCVWD reported that the program was easy to deliver. They were verifying 10 percent of the installations and the verification process had gone well. Compared to other programs they have delivered in the past there had been few customer complaints.

Staff at PG&E, SCVWD, and the installation contractor perceived that customers are satisfied with the toilets, in part because the contractor selected a high quality toilet model. SCVWD and PG&E have received no complaints regarding toilet performance, and the few callbacks that have been received from customers were for small problems that were easily corrected, such as a rocking toilet. Staff at PG&E were satisfied with the performance of the toilet contractor, describing the firm as efficient and flexible.

Based on the interviews, it is not clear if a rebate or a direct installation program is the most effective delivery mechanism. One staff person believed that a rebate program would be simpler to implement, but another perceived that direct installations are more effective for the low-income population.

Vendor Experience, Satisfaction and Challenges

The program contractor was initially hired to install the toilets, but their role was subsequently expanded to include recruitment. Working with a list of households that had participated in weatherization programs with PG&E in the past, the contractor called the households about the HET program. If the contractor could not reach a household on the phone, the firm visited individual houses when they were in the neighborhood.

The installation contractor reported that the contracting with PG&E was simple and straightforward. The firm had positive interactions with their primary contact at PG&E, and every email and phone call was answered in a timely manner. The contractor enjoyed working with PG&E and would like to continue working with them. The firm believes the HET program is a good one and it would have met its participation goal if the firm had been responsible for recruitment earlier in the program.

Participant Phone Survey Results

In March and April 2010 a telephone survey was conducted among 76 PG&E households that received HETs through the program. Sixty percent of the surveys were conducted in English and 40 percent were conducted in Spanish. Demographic information was requested from all survey respondents, including the respondent's ethnicity and age, as well as the age ranges of all household inhabitants.

Of special interest were households with children under five years of age, representing 33 percent of respondents, and those with senior citizens, representing 42 percent of respondents. All of the results presented below were examined for differences between the entire group and these two specific groups. No significant differences were found.

Program Awareness

Survey respondents were asked to identify the source(s) from which they learned about the opportunity to receive HETs. Table 3, below, shows that most of the respondents learned of the program from Energy Partners staff (29 percent) or the toilet installation contractor (29 percent). As shown in the table, many respondents identified PG&E as the organization they interacted with, when in fact it most likely was PG&E’s installation contractor, since PG&E did not do any recruiting itself.

Table 3: Sources of Program Awareness

Source	Percentage of Respondents ¹⁹ (N = 76)
Energy Partners staff who visited my home	29%
Word of mouth/friend/relative	25%
PG&E called me	16%
PG&E visited	7%
I called PG&E	7%
Mailed materials	7%
Other	4%
Don’t know	8%

Reasons for Participation

Respondents were asked to rate the importance of several potential reasons for receiving new HETs, and the results are shown in Table 4. From the responses, all of the reasons were approximately equal in importance; over 80 percent of respondents rated each reason as very or extremely important except for needing to replace old or broken equipment, which only 70 percent of respondents rated as very or extremely important.

¹⁹ Since respondents were allowed to identify more than one source, percentages do not necessarily sum to one hundred.

Table 4: Reasons for Getting HETs and Importance

Reason	Not at All Important (1)	A Little Important (2)	Somewhat Important (3)	Very Important (4)	Extremely Important (5)	Don't know	Mean (N=76)
The toilet was free	0%	1%	5%	51%	41%	1%	4.3
Wanted the latest technology	3%	0%	13%	53%	32%	0%	4.1
Wanted to save money on water bills	1%	1%	4%	49%	45%	0%	4.3
Wanted to save water	1%	0%	1%	49%	49%	0%	4.4
Wanted to help protect the environment	1%	0%	5%	54%	38%	1%	4.3
Needed to replace old or broken equipment	11%	5%	13%	41%	29%	0%	3.7
Program outreach staff said it was a good idea	1%	1%	8%	58%	28%	3%	4.1
PG&E created the program	1%	0%	4%	65%	29%	1%	4.2
Energy Partners was involved with the program	3%	0%	7%	62%	26%	3%	4.1

Satisfaction with Install Process

Respondents who were present during the installation of the HET(s) were asked several questions to determine their satisfaction with the install process, including setting up the appointment, the cleanliness, timeliness, and politeness of the installation contractor, as well as their overall satisfaction. For each of these, over 90 percent of respondents indicated that no problems occurred or that they were very or extremely satisfied.

Twenty-one percent of the respondents, however, indicated that there was a problem with how the toilet worked right after its installation. Of those, 56 percent reported problems related to water continuing to run after the toilet was flushed, and 18 percent reported problems related to leaking. All other reported problems (e.g., the handle got stuck) were only identified by single respondents.

Satisfaction with HET Performance

Since the installed HETs were low-flow toilets, one question specifically asked how often the respondents have to flush their toilet more than once after using them; the results are shown in Table 5, below. Sixty-five percent of the respondents said they “rarely” or “never” need to flush their HET(s) more than once, while 11 percent said they do this “often” or “always”.

Table 5: Frequency of More Than One Flush

Frequency	Percentage of Respondents (N = 76)
Always	3%
Often	8%
Sometimes	22%
Rarely	12%
Never	55%
Total	100%

When asked about other problems with the HETs, 70 percent of respondents indicated that they had none. Table 6, below, lists the problems that were encountered by 30 percent of the respondents (some respondents had multiple problems). The most frequently mentioned problems were the handle not working correctly and the toilet continuing to run/refill.

Table 6: Problems with HETs

Problem	Percentage of Respondents (N = 76)
Handle not working correctly	16%
Toilet does not stop running/refilling	12%
Trouble with the toilet clogging, more than a regular toilet	9%
Problems with the toilet leaking	4%

In describing problems encountered with their HETs, some respondents indicated that the installation contractor had returned to fix the problem, and among the 23 respondents that encountered problems, only one replaced their HETs.

Overall, respondents reported a very high level of satisfaction with the newly installed HETs, shown below in Table 7; 93 percent were very or extremely satisfied.

Table 7: Overall Satisfaction with HETs

Satisfaction	Percentage of Respondents (N = 76)
Extremely satisfied	28%
Very Satisfied	65%
Somewhat satisfied	5%
A little satisfied	1%
Not at all satisfied	1%
Total	100%

3.5 PG&E LOW INCOME HIGH EFFICIENCY TOILETS PROGRAM ISSUES AND OBSERVATIONS

PG&E staff expressed concern that they themselves do not understand water issues as well as energy issues, and felt it was difficult to synchronize this program with others at PG&E because it focused on water. At the time of the interviews, staff had not seen any data on actual energy saved through the program, and the relevance of the program was not obvious to staff. All of the interviewees expressed support for the program concept, although PG&E’s future support was contingent on a more complete understanding of actual water and energy savings.

The program specifically focused on low-income households in single-family residences, however the majority of low-income households live in more affordable housing types, such as mobile homes and apartments. The narrow focus made it difficult to meet participation goals.

In addition, the program’s initial recruitment method turned out to be ineffective. The program had been designed so that energy audit staff would identify eligible households through the audit process. However, the energy auditors were not focused on water-using equipment and were not generating enough participants. This problem resulted from the broader issue that staff in the energy field are not fully aware of water issues, and it is challenging to coordinate water and energy conservation efforts. PG&E staff developed a different and effective recruitment method with the installation contractor during the course of the pilot program, greatly increasing participation rates.

Overall, staff at SCVWD and PG&E and the installation contractor found the HET program to be effective. The program delivered about 500 HETs in the service area and the individual households appear to be satisfied with their new toilets.

Program Recommendations

Based on the evaluation results, the following are recommendations for the HET program if it continues in the future:

- **Inform wastewater agencies about embedded energy data needs.** While water and energy data were obtained from the water agency that serves the majority of HET

customers, no data were provided by the agency that provides wastewater treatment. As HETs reduce potable water demand and wastewater treatment requirements, these data were also needed for the embedded energy calculations. As for potable water suppliers, wastewater agencies also need to understand up front what types of data will be required from them, so that appropriate agency staff can plan accordingly.

- **Consider using a single rebate application for PG&E and water agency customers.** The application could cover a range of energy and water saving measures and potentially reduce program start-up time if new water agency applications do not have to be developed regularly. This could also reduce paperwork for program participants and recruiters. PG&E currently uses joint energy/water rebate applications for its clothes washer program.
- **Ensure that program recruitment contractors are sufficiently trained to identify program-qualifying equipment.** This may require additional or recurring training of hired contractors or more focused screening during the contractor selection process.
- **Expand the single family program to include mobile homes.** Low-income households are likely to live in this type of housing, and the program will attract more participants if lower-cost housing types are eligible.
- **Work with community organizations that serve low-income populations.** These groups can be effective in identifying eligible households, and have helped PG&E to promote other programs (e.g., Local Government Partnerships). Per the recommendation above, organization staff may require training to identify program-eligible toilets if they are to do direct recruiting.
- **Simplify the billing process.** The process used during the pilot program was labor-intensive for PG&E staff and slow to reach SCVWD. A simple yet accurate system would benefit PG&E and its partner water agency.
- **Conduct additional post-installation HET testing.** The most common installation problem that was reported was prolonged water running after toilet flushes. Future installations should test for this problem (particularly if the same toilet model is used) more closely.

4. PG&E EMERGING TECHNOLOGIES PROGRAM RESULTS

4.1 PG&E EMERGING TECHNOLOGIES PROGRAM BACKGROUND

For the Emerging Technologies Program, PG&E partnered with two water agencies to investigate emerging monitoring and telecommunications technologies to determine whether these technologies can help water agencies distribute water more energy efficiently. Before selecting the two water agencies, a preliminary scoping study was conducted to inventory SCADA related technologies and innovations that hold significant potential for energy savings.²⁰ Some of the technologies that were investigated included: integration of water flow and energy monitoring to detect water losses, integration of customer metering and SCADA to improve water distribution and energy efficiency, and/or pairing SCADA with programmable logic controllers to optimize pumping efficiency. (The scoping study was not a focus of this process evaluation.)

From the scoping study, PG&E concluded that one of the best opportunities for energy savings is the integration of real-time pump electricity consumption data into existing SCADA systems. This facilitates real-time analysis of pumping system efficiency, which in turn helps system operators optimize energy use. After selecting two water agencies to test the recommended technology, PG&E hired two consultants to assist the agencies with project implementation and data analysis. One water agency planned to utilize real-time energy data in a new water pumping algorithm that would automatically control a subset of system pumps. The other water agency only planned to integrate energy data in their SCADA system, and then rely on system operators to manually change the pump operations in response to displayed energy consumption.

This program was not designed to conserve water, and instead focused on reducing energy consumption under different flow and pressure scenarios.

Program Goals and Achievements

After the scoping study was completed, the overall goal of the program was to learn if integrating real-time energy usage data into the SCADA systems of two water agencies would impact pumping operations and reduce energy consumption. The program did not have a specific energy savings goal.

Both Pilot projects successfully connected a subset of PG&E energy meters to their SCADA systems, which was a key achievement since it was not known how this would occur at the program start. At one water agency, the SCADA screen display was updated in July 2009 to show real-time energy efficiency data at three pumping stations, giving operators the opportunity to change the pumping operations in response to changing water demand and energy use. In December 2009 and January 2010 the SCADA display was further enhanced to include energy *intensity* data (kWh/million gallons pumped). In the end, however, the operators did not utilize the new information to adjust the pumping operations, for a range of reasons (discussed more subsequently).

²⁰ SCADA are Supervisory Control and Data Acquisition systems, which typically monitor and store data on water flows, pressure, and storage levels.

At the other water agency, a new automatic pumping algorithm was developed to reduce energy use at four pumping stations, however the algorithm was not programmed into the SCADA by the agency during the program period due to schedule delays and the need for further consideration by management.

4.2 PG&E EMERGING TECHNOLOGIES PROGRAM LOGIC MODEL AND PROGRAM THEORY

The following program theory for PG&E's Emerging Technologies program builds on the program logic model and provides additional detail on program activities, outputs, and outcomes. (The logic model diagram follows the discussion of program theory.)

ACTIVITIES

PG&E feasibility and scoping study

PG&E hires a consultant to conduct a scoping study to research new technologies and energy savings opportunities in water and waste water systems. Water utilities are solicited for input on what technologies would be good candidates for the program. The scoping study also provides guidance for the subsequent implementation and evaluation of the Pilot.

Partnership formed with water agencies

The scoping study helps PG&E identify possible program participants. After recruiting several agencies, PG&E partners with the East Bay Municipal Water District (EBMUD) and the San Jose Water Company (SJWC). The goal of the program is to incorporate energy use data into pumping operations decisions, via the water agencies' SCADA systems and/or other tools (e.g., reference tables).

Equipment installs and data analysis

PG&E hires consultants to conduct the operational efficiency evaluations recommended in the scoping study. The consultants will implement required equipment upgrades at the water agencies and analyze the data collected to identify new pump combination operating efficiencies.

Program funding

PG&E provides funding for the program, which includes equipment upgrades and the consultants' analyses.

Verification and QA

PG&E and the consultants have the expertise to validate the water agency data and equipment performance.

SHORT TERM OUTCOMES

Pumping and electrical systems at water agency sites updated

The contractors and water agencies staff connect PG&E's electric meters to the SCADA systems, and some controls (i.e. programmable logic controllers) are upgraded.

Water flow and energy data collected

The consultants collect historic and current water flows, energy use, pump operations and water pressure data from the water agency SCADA systems.

PG&E, consultants verify equipment performance and data validity

PG&E staff and the consultants review the data obtained from the water agencies and perform consistency and reasonability checks to ensure that the data are usable. As part of this process, they also confirm that any required electrical system upgrades are functioning correctly.

MID TERM OUTCOMES

Data analyzed, pumping operational efficiencies identified

Consultants analyze data from SCADA metering and determine which pump combinations are the most efficient (i.e., reduce kWh per million gallons pumped) under different operating conditions.

Agencies adopt procedures, algorithms to operationalize found efficiencies: realize kW, kWh savings and reduced operating costs

The water agencies decide to implement operational changes to capture energy savings opportunities revealed by the consultants' studies. When the water agencies utilize their pumping systems more efficiently, they save energy and reduce their operating costs.

LONG TERM OUTCOMES

Operational efficiency improvements are now considered cost effective

Comparing the realized and expected energy savings with the study/system upgrade costs shows that operational improvement projects such as this can be cost effective. This may allow PG&E to justify including similar pumping efficiency studies in other programs.

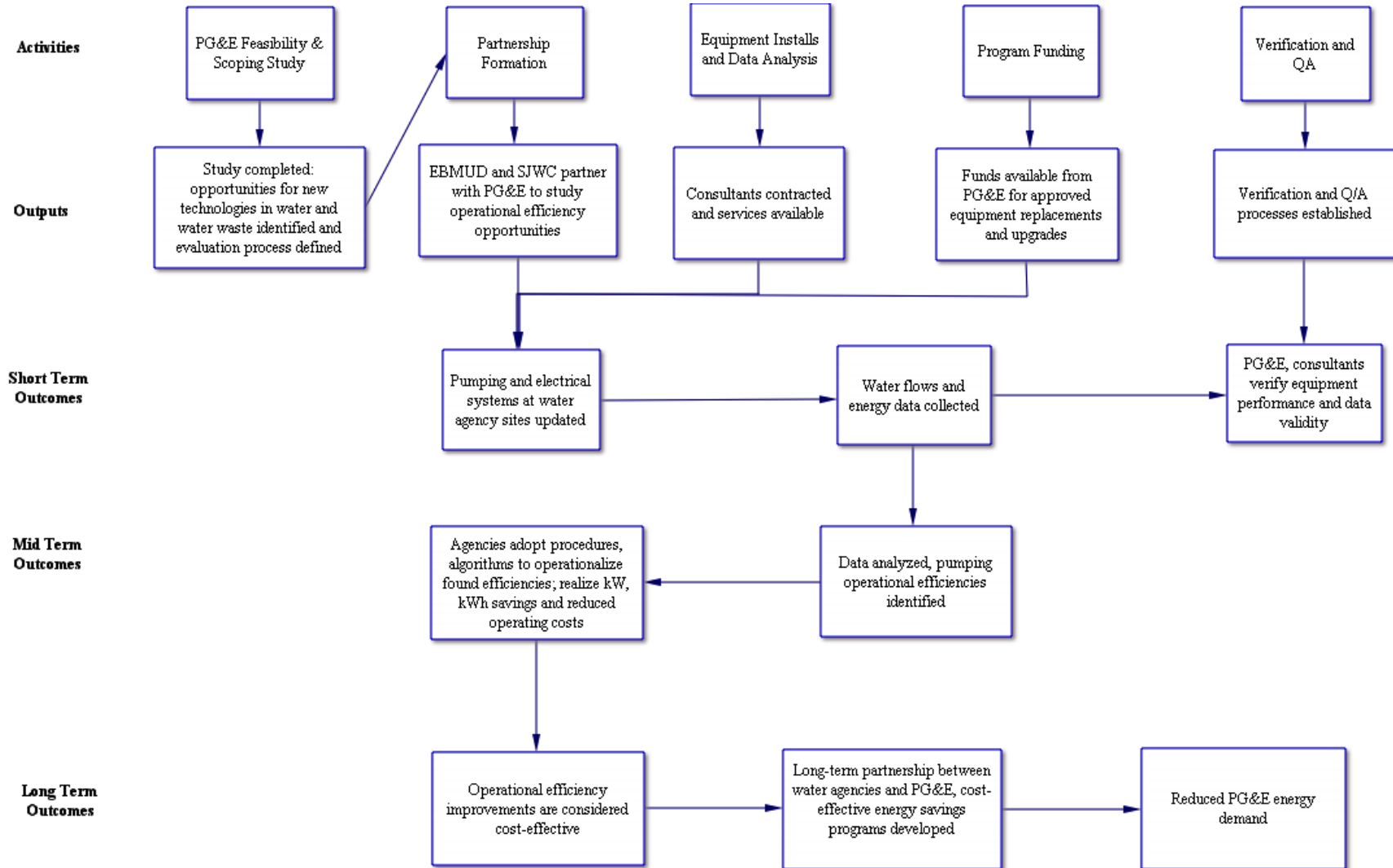
Long-term partnership between water agencies and PG&E, cost-effective energy savings programs developed

The partnership program has successfully targeted and served PG&E customer water agencies and has achieved energy savings. If pumping operations studies are found to be cost-effective, then they may be included as part of a longer-term PG&E program.

Reduced PG&E energy demand

Other water agencies utilize PG&E's new program, creating additional energy savings. As a result, PG&E achieves long-term energy savings and California's electric grid is positively impacted.

Figure 3: PG&E Emerging Technologies Program Logic Model



4.3 PG&E EMERGING TECHNOLOGIES PROGRAM EVALUATION OVERVIEW

The evaluation activities completed for this program included:

- 1) In-depth interviews with PG&E's Pilots programs manager and Emerging Technologies program manager
- 2) In-depth interviews with the two implementation contractors that worked with PG&E and the participating water agencies
- 3) An in-depth interview with the project manager at one of the water agencies²¹

All of the interviews were conducted in January and February of 2010. Following are some of the topics that were discussed during the interviews:

- Ease of water agency participation
- Program implementation successes and challenges
- Water agency utilization of installed measures
- Water agency satisfaction with installed measures and participation experience
- Success of program coordination and tracking activities
- Overall satisfaction among IOU staff, water agency staff, and program vendors

Detailed results of the data collection and analysis are discussed below.

4.4 PG&E EMERGING TECHNOLOGIES PROGRAM EVALUATION RESULTS

Partnership Formation and Program Delivery

When the program was conceived, PG&E expected that advanced SCADA controls could be used to attain energy savings at water agencies, but did not know which technologies were commonly used, newly emerging, or actually effective in the real world. To answer these questions, PG&E hired a water services contractor to conduct a scoping study to inventory advanced controls practices in the international industry (particularly in places with frequent water shortages), their effectiveness, and potential interest in testing technologies among San Francisco area water agencies and product vendors.

At the conclusion of the scoping study, an opportunities matrix was developed listing feasible emerging technologies and interested water agencies. From this matrix, PG&E decided to focus

²¹ The project manager at the other water agency did not respond to requests for an interview.

on electric meter data acquisition at two water agencies based on their stated level of interest, implementation feasibility within one year, and energy savings potential.²²

According to the scoping contractor, who was selected later to implement one of the projects, PG&E was wise to conduct the scoping and participant recruitment separate from the Pilots implementation. Having the program implementers start with recruitment would have added significant risk, and can take a long time for demonstration or Pilot programs. Another advantage of this process was that both participating water agencies had a good understanding of the program scope and intent, allowing them to focus more on refining the implementation details. Overall, the contractor believed that PG&E did a good job of selecting both the emerging technologies to implement and the water agencies to work with.²³

After the water agencies were recruited, PG&E hired two water services contractors to implement the projects. According to the scoping contractor, this process went well also.²⁴ No formal RFP was issued, and instead PG&E's program manager solicited bids from its matrix of approved contractors asking them how they would implement the detailed work scopes already developed by PG&E. Because staff in PG&E's Purchasing department has worked extensively with the Emerging Technologies program and had reviewed previous bids from the contractor, the whole contracting process went quickly and smoothly.

Going forward, the contractors worked directly with the two water agencies to collect data, upgrade hardware and implement the projects, while PG&E's manager was available to resolve conflicts, help make key decisions, and manage the overall schedules and reporting. For one of the projects, PG&E's manager also helped to develop a questionnaire for the pumping station operators, to learn more about how the new SCADA screen metrics were actually being used.

Throughout the program, the PG&E Emerging Technologies and overall Pilots managers communicated by phone and email as needed to review the projects' status, emerging issues, and project risks and opportunities (e.g., analysis of additional post implementation data). This informal process was reported to be effective, and no formal or regular status reporting was recommended because these types of projects have only a few key milestones separated by lots of data collection and long periods of data analysis.

PG&E's Emerging Technologies manager was somewhat satisfied with the program's achievements, noting that relatively simple but novel approaches to integrating energy and water data had been successfully employed, and that a lot of data and water agency staff had been utilized effectively. That said, they were reserving final judgment until actual energy savings had been assessed for one water agency (with the new SCADA screen metrics) and the other water agency decided whether or not to actually implement the new pumping algorithm. With these

²² Both agencies were already monitoring water flows and pressures in their SCADA systems.

²³ At the time of the interview, the contractor was unaware that the pumping operators at their water agency client were not utilizing the new SCADA screen metrics, or that the new SCADA algorithm planned for the other water agency was not implemented.

²⁴ The other consultant project manager was not directly involved in the contracting, and could not comment on this.

outstanding issues, the program manager was unsure if PG&E should continue the program, noting that specialized water pumping consultants could provide similar services. While PG&E now has a good understanding of how to integrate its energy data into water agency SCADA systems, water agencies still employ a wide range of operating and energy management strategies that make it difficult to predict if or how new energy consumption data would be utilized.

Vendor Experience, Satisfaction and Challenges

Both of the implementation contractors performed similar high-level tasks for the program. These tasks included:

- 1) Daily project management – Both contractors worked directly with the water agency project managers and their staff to clarify detailed work tasks and responsibilities, establish schedules, and track potential project barriers (e.g., required access authorizations, interdepartmental coordination).
- 2) Evaluation of energy data acquisition options – This was a key task of both projects, which critically depended on integrating real-time energy consumption data into the SCADA systems, to inform new energy intensity screen display metrics or automatic pumping algorithms. In the end, both projects were generally able to utilize the existing PG&E energy meters with minor modifications and wiring, which reduced the project hardware costs payable by the contractors.²⁵
- 3) Quality control – The contractors worked with the agencies to ensure that the energy data were being accurately captured and interpreted by the SCADA systems.
- 4) Data collection and analysis – One project required agency staff to implement different pumping scenarios so the resulting energy efficiencies could be measured via the SCADA system for subsequent analysis. Similarly, the other project had the pumping operators generate initial efficiency metrics for each pump combination (stored in tabular format), to provide a high level understanding of which pumps to start with in different scenarios. Both projects also collected and analyzed historic pumping data (billed energy, flows, pressure) to further understand the operations of each pumping station.
- 5) Development of real-time energy intensity information and management tools – One project initially developed a new SCADA screen display of real-time pumping energy efficiency, which was subsequently supplemented with a display of real-time energy intensity (i.e., kWh/million gallons pumped). These metrics would allow the operators to manually adjust pump combinations in real-time to reduce energy consumption. The other project developed an algorithm to automatically adjust pumping combinations to reduce energy consumption.

²⁵ At EBMUD, some meters were replaced to accept pulse signals, and two pumping plants utilized wireless communications instead of new underground wiring.

- 6) Reporting – Both contractors developed project implementation plans after the kick-off meetings, detailing how the technology assessments and data collection would occur. One project has developed reports describing *actual* changes in pumping energy intensity after new SCADA screen metrics were implemented, while the other project has described the *potential* energy saving benefits from an automatic pumping algorithm (had it been used to control historic operations).

The key challenge for both projects was allocating sufficient water agency staff time to complete tasks on schedule. Both contractors noted that when water agency staff were available to work on the projects (e.g., take measurements, test equipment, provide data), they were highly interested, willing to help, and performed high quality work. However, agency bureaucracy, a very busy peak summer season and overall staff shortages all contributed to limit staff availability. Anticipating this situation, one contractor purposely scheduled more face-to-face meetings than they would for their private industrial clients, to keep staff personally engaged. In the end, these constraints delayed the implementation of the new SCADA screen displays at one agency, and prevented the algorithm from being implemented within the program period at the other agency. In particular, one contractor was disappointed that they could not complete a survey of operations staff (due to scheduling and coverage issues) to learn how they were actually reacting to the new SCADA screen metrics, and also how other operational factors matter (e.g., input suction pressure). (Note: The survey was completed and returned to the contractor after this interview; key results are discussed later in this chapter.)

One contractor perceived that water agency staff were initially skeptical about finding potential energy savings, and may not have been truly invested in the project early on. Staff clearly became more engaged after seeing preliminary energy savings findings, but then time constraints became even more problematic, further slowing the project down.

Water agency bureaucracy and liability concerns affected the projects in several ways. Both agency project managers had to coordinate activities with staff from the engineering, operations, information technology, architectural design and electrical departments, and it was not always clear which department needed to act first. One project took three months to finalize an access agreement so the contractor could perform certain work on site.²⁶ Another agreement was also needed to request that PG&E complete the meter upgrades to accept pulse signals; this took a long time to finalize also.

On the technical side of things, the contractor charged with developing the pumping algorithm noted that just analyzing the baseline data to understand general pumping operations was a daunting task, requiring extensive analysis and significant time. In addition, actually integrating the new pumping algorithm into the SCADA (not completed) would require additional analysis and planning, as the SCADA already includes a different algorithm focused on costs reduction, including capital costs for pumps replacement.

The other contractor charged with developing the new SCADA display metrics described how the project team was somewhat surprised to learn that *pumping* efficiency does not correlate

²⁶ The agreement had to be signed by three legal departments and the water agency Board of Directors.

perfectly with *energy* efficiency, due to overlapping efficiency curves and other factors.²⁷ In actuality, there are complex relationships between water flows, pressure and pumping that are difficult to model and even more difficult to communicate to non-technical staff. One challenge of this project was to keep the team focused on reducing energy intensity (kWh/million gallons pumped) as opposed to other interesting performance metrics.

Both contractors were highly satisfied with their interactions with the PG&E program manager, who was very available, responsive and willing to motivate the water agencies as needed. In addition, they believed that the “rolling” bi-weekly project journal entries they submitted were an excellent communication and project documentation tool, which effectively captured the tone of the project, the continuous coordination, and the most important challenges.

Both contractors were also very satisfied with the project outcomes. One contractor was particularly pleased that their water agency was willing to extend the project to test the effectiveness of the new energy intensity metric that was added to the SCADA screen late in the program period, to complement the previously implemented pumping efficiency metric. The other contractor was also highly satisfied because they had met their project goals, which were to deliver a pumping optimization algorithm by the end of 2009, and to simulate how energy would have been saved in 2008 based on actual water demand.²⁸ (They were also pleased that the simulation showed that high energy savings were achievable.) Furthermore, they were very complimentary of water agency staff, noting that they were given complete and accurate data to analyze, and tasks were completed correctly the first time (e.g., connecting the PG&E meters to the SCADA, conducting well level testing).

Participating Customer Experience, Satisfaction and Challenges

ECONorthwest conducted an in-depth interview with the project manager at one of the participating water agencies, to learn about their participation experience and overall satisfaction with the program.

Participation Process

The water agency initially became involved with the program when it was contacted during the initial scoping study, to solicit suggestions for working with PG&E to implement emerging technologies to improve agency operations. In the agency’s response, the project manager noted that the agency had long been interested in capturing real-time energy data from PG&E’s electric meters, to integrate with other data (e.g., pumps on/off, tank levels) already in the agency’s SCADA systems, but did not know if this was possible. Subsequently, PG&E’s Emerging Technologies program manager contacted the water agency project manager to ask if the agency would participate in the second phase of the program, to actually implement new technology.

²⁷ For instance, it is often possible to increase pumping efficiency by pumping higher volumes, which in turn increases friction and increases required energy.

²⁸ It was the water agency’s responsibility to actually program the new algorithm into the SCADA system, which they did not do during the program period.

During the project scoping, the project managers agreed that a key goal would be to connect PG&E's energy meters to the SCADA system, although the exact process would be determined during the course of the study. The project scoping also confirmed the water agency's responsibilities during the project, which was primarily to provide project management support, electrical wiring services, and make prescribed operational changes at the behest of the implementation contractor to measure pumping efficiencies. The agency did not have to pay for any project capital costs.

According to the water agency project manager, it was easy to amend and finalize the scope of work (via email), which was developed primarily by PG&E. Subsequently the agency also signed a non-disclosure agreement with the implementation contractor without any difficulties.

Key project tasks included:

- Hardware upgrades—agency staff had to run new wires from the SCADA system to new contacts installed at the PG&E meters, to enable pulse readings. The meters themselves did not have to be changed.
- Efficiency testing—agency operators changed the pumps on/off at the direction of the implementation contractor so different scenarios could be modeled and captured in the SCADA. The results (energy, flows, pressure) were then sent to the consultants for analysis. The testing was completed in 3 to 4 days over 3 months.
- Results review—the project manager and agency staff attended a meeting with the consultant to review the analysis findings, to learn how a new SCADA pumping algorithm could save pumping energy and costs (e.g., multiple stations feeding one pressure zone can save energy by initially running one pump at each station before adding more).

Satisfaction and Suggestions

The primary challenge for the water agency was making staff available to complete initial project tasks, so the contractor could proceed to analyze the pumping data. To address this issue (and keep the agency from dropping out of the program), PG&E's project manager intervened to ensure that agency time requirements would be minimized, and the contractor would do as much of the work as possible.

In the end, the agency project manager was very satisfied with the clarity and thoroughness of the energy savings analysis completed by the contractor, and the efforts they took to reduce agency workload. The contractor was easy to work with, technically competent and appropriately persistent, and the water agency would welcome opportunities to work together again.

In particular, the agency was pleased that the contractor determined how to get data from the PG&E energy meters into the SCADA system; this was a key project milestone. Going forward, the agency plans to conduct instantaneous pump testing at some of the project pump stations, and also to install additional meter connections at other pump stations, working with PG&E and/or a contractor.

In the future, the water agency project manager suggested that participating water agencies be compensated for labor contributed, since staff has significant time constraints (particularly when they are monitoring operations in response to drought conditions). Alternatively, if water agencies cannot be compensated for their time commitment, the CPUC could classify this type of project as a “capital investment”, upon which investor owned water utilities may earn a 10 percent return.

System Operators Survey

At the other participating water agency, four operators are responsible for operating the three pumping plants included in the Pilots project. For the impact evaluation of this program, ECONorthwest in coordination with PG&E and its implementation contractor developed and submitted a survey in February 2010 to collect qualitative information about how the operators actually considered and responded to the new energy metrics on the SCADA screen. The survey was submitted to the agency’s project manager, who then surveyed each of the four operators. The operators work in a different agency department, and do not report directly to the (engineering) project manager. A written summary of the operators’ responses was ultimately provided to the implementation contractor in June 2010, after the interviews for this evaluation were completed. Following are some key findings from the survey:²⁹

- 1) The operators had difficulty adjusting to the concept of selecting the most efficient pump (or combination of pumps) versus maintaining even run-time hours, as they have historically done. Overall, they did not use the real-time SCADA feedback much to make instantaneous decisions.
- 2) Because the operators were not forced to participate in the project, and operator performance goals were not linked to positive project results, the operators’ level of personal investment varied.
- 3) Conserving energy is a goal, however other factors must be considered first. Required flows are particularly important; if required flows can be met by a more efficient combination then the operator may change the pumps selection. The operators must also consider reservoir levels, water volume changes needed to prevent stagnation, and maintaining zone pressures.
- 4) The operators cannot commit much time on a daily basis to optimizing energy efficiency, as each day typically includes a range of “emergencies” and unique operating scenarios. Dealing with the unexpected is regular part of an operator’s day.

4.5 PG&E EMERGING TECHNOLOGIES PROGRAM ISSUES AND OBSERVATIONS

Getting the water agencies to commit staff time to the projects was a key challenge, particularly during drought conditions when operational priorities changed. While the consultants could give hardware installation assistance and conduct the data analysis, agency staff were still needed to develop pumping test data, do any required SCADA programming and coordinate between

²⁹ These findings were compiled from the draft project report developed by the project consultant for PG&E.

departments (e.g., management, engineering, operations, design). One agency had so much difficulty obtaining staff time it nearly dropped out of the Pilot Program. This agency was also participating in the Operational Energy Efficiency Program (OEEP), and PG&E's Pilots manager perceived that staff were overburdened and probably confused.³⁰ At the other water agency, the program manager had to use creative means to accelerate task completion. The Pilots schedule extension was critical for both projects, enabling one to actually implement new SCADA screen metrics and the other one to collect sufficient data to develop a pumping algorithm for future implementation. That said, neither water agency actually utilized the new energy management tools developed through the program.

Several things went well for the program. The initial projects scoping by PG&E's program manager was very thorough and well thought out, enabling the contractors to sign on and start implementation work relatively quickly. According to the project managers at PG&E and one water agency, two very good consultants were selected.³¹

In addition, it was surprisingly easy and inexpensive to upgrade the PG&E electric meters and integrate the energy data into the two SCADA systems. This reduced the capital costs the contractors were responsible for, allowing them to dedicate time and budget to other tasks.

The agencies obtained highly valued energy metering hardware at no cost and new data in their SCADA systems. Although the projects did not deliver energy savings during the program period, more agency staff developed an awareness of operational energy consumption, and there is still an interest learning how to more effectively utilize the new data.

Lastly, at the water agency that progressed fastest, the project manager had direct control of staff responsible for the SCADA interface programming. As a result, this task took only an afternoon to complete, and could have taken 1 or 2 months if long advance notice and significant coordination were required. This project manager also monitors monthly energy use personally, had access to historical SCADA data, and performed the queries for project, making it proceed more quickly.

Program Recommendations

Based on the evaluation results, the following are recommendations for the Emerging Technologies program if it continues in the future:

- **Confirm that new energy management tools can and will be used during water agency selection.** While agency management claimed to be interested in understanding and monitoring energy usage during the program recruitment, operations staff at one agency actually had limited opportunities to change operations (to reduce energy use) due to logistical constraints, actual water demands and policy guidelines. It is not known if the other water agency has or will implement the pumping optimization algorithm that

³⁰ The OEEP was expected to recruit from nonparticipating Pilot Program agencies.

³¹ One water agency manager declined to be interviewed.

was developed. If the water agencies do not actually use the energy management tools provided through the program, there is no value in offering the program.

- **Inform water agency partners of staff time and information needs during partnership formation.** Before detailed scopes of work are developed, water agency management must fully understand that staff time could be needed to provide water operations data, take measurements, install and test equipment, receive training and review study results. If agencies cannot firmly commit to providing adequate staff time in a timely manner, they should not be included as program partners and/or should have their participation terminated at the discretion of the IOU program manager per a participation Memorandum of Understanding.
- **Have the water agencies contribute towards the equipment installation and study costs.** This would increase their investment in the program, and the likelihood that they will dedicate appropriate staff time and utilize new energy management tools.
- **Have participating water agencies select motivated, high-level project managers with broad oversight responsibilities.** This could streamline agency decision-making and potentially reduce departmental scheduling conflicts that result in project delays. If the project manager must always delegate task management to separate departments, overall coordination becomes more difficult. More importantly, the project must have ongoing, solid support from the high-level manager, as operations staff may not take ownership of the project or be able to affect key implementation decisions.
- **Address skepticism among agency staff early in the project.** While it is sometimes difficult to get full support when no energy savings have been demonstrated, it is important to try to do so, so project tasks receive high priority from the very outset. Case studies of previous successful projects could help to generate support among future program participants.
- **Draft required project implementation agreements early in the project.** Agreements addressing contractor site access, metering upgrades and other liability or procurement issues should be drafted soon after the project initiation, anticipating that it could take several months to finalize these. The third-party contractors could also provide a template for the access agreement as part of their bid submittal.
- **Make the program period long enough to accommodate water agency time constraints.** Water agency staff will always be busy and have multiple demands on their time, which cannot be avoided (and project consultants will also require sufficient time to conduct data analysis).

5. SCE (MULTIFAMILY) LOW INCOME HIGH EFFICIENCY TOILET PROGRAM RESULTS

5.1 SCE LOW INCOME HIGH EFFICIENCY TOILET PROGRAM BACKGROUND

For the Low Income High Efficiency Toilets Program, SCE partnered with the Metropolitan Water District of Southern California (MWD) and its member water agencies to deliver the direct installation of high efficiency toilets (HETs) for multifamily households in low-income areas within mutual SCE and MWD service territories. Under the program, only toilets flushing at 3.5 gallons per flush (gpf) or higher could be replaced with new HETs that have flush rates no greater than 1.28 gpf.³² This program was intended to augment and complement PG&E's similar program, which targeted single-family residences exclusively.

To offset the costs of the direct installations, MWD provided funding of \$165 per HET while participating member agencies contributed \$50 per HET. SCE funded the remaining installation costs, estimated at \$70-115 per HET, and other costs to assess multifamily units for HET eligibility and suitability. SCE utilized plumbing contractors engaged in MWD's program to install the HETs.

To target multifamily properties, SCE utilized its existing LIEE contractors as well as existing local government partnerships (e.g., the South Bay and Ventura partnerships). SCE also coordinated with MWD and its member water agencies with larger low income and multifamily customer bases to identify and reach target customers.

Program Goals and Achievements

After reducing the program funding proposed in the original budget, the CPUC acknowledged that the program would likely be able to fund the installation of approximately 550 HETs. In August 2009, two adjoining apartment buildings in Irvine, California had 276 HETs installed in 176 units reserved for low-income households. These units were retrofit with "dual-flush" toilets using two different flush volumes - 1.6 gpf intended for solid waste and 0.8 gpf for liquid waste.³³ Subsequently, the program also installed 170 HETs at another apartment building in Long Beach, California. This project utilized a different dual-flush HET model at 1.6/1.1 gpf. This evaluation only focused on the Irvine project, however, as the CPUC directed the impact evaluation to only assess the Irvine project due to budget limitations. Additionally, the Long Beach project was confirmed after the work scope for the impact evaluation was finalized.³⁴

³² In the case of dual-flush toilets, such as those installed in Irvine for this program, the average flush volume must equal 1.28 gpf or less.

³³ Due to space constraints found during the initial site inspections, 1.6/0.8 gpf Caroma Sydney Low Profile 305 Round Front Plus toilets were installed at this project. Originally a 1.28/0.8 gpf model was planned for this project.

³⁴ This project installed Vortens Vienna White Round Front HET combo toilets. After completing the Irvine Ranch project, CPUC determined that the Pilot Program had devoted enough resources to study HETs, and that SCE need not pursue more projects for impact evaluation purposes. SCE continued to pursue and complete the Long Beach project with CPUC approval for program-related learning purposes.

5.2 SCE LOW INCOME HIGH EFFICIENCY TOILET PROGRAM LOGIC MODEL AND PROGRAM THEORY

The following program theory for SCE's Low Income High Efficiency Toilets program builds on the program logic model and provides additional detail on program activities, outputs, and outcomes. (The logic model diagram follows the discussion of program theory.)

ACTIVITIES

Partnership formed with water agency

SCE partners with Metropolitan Water District of Southern California (MWD) and selected member agencies to develop a program to directly install High Efficiency Toilets (HETs) in low-income multi-family apartment buildings. The goal of the program is achieve both water and embedded energy savings as a result of the installations.

Targeted customer recruitment

SCE and the partner water agencies identify multifamily apartment owners in low-income mutual MWD and SCE service territories for the direct installation of HETs. SCE also leverages existing Low Income Energy Efficiency (LIEE) contractors and local government partnership programs to identify potential low-income customers and other multi-family opportunities.

HET installations

Plumbing contractors are hired to perform direct installations of the HETs. The contractors also help to identify low-income apartment owners.

HET funding

MWD provides an incentive of \$165 per HET and participating member agencies provide \$50 per HET. SCE is authorized to provide up to \$130 per HET. Together, these contributions cover the full cost of the HETs and installations.

Verification and QA

MWD and SCE establish procedures to verify the installation of random samples of HETs.

SHORT TERM OUTCOMES

Low-income multi-family property owners are aware of program opportunity

Program outreach efforts successfully reach the target customer group, who understand the program opportunity and its potential benefits to them.

HET measures installed at no cost to property owner or low-income tenants

Low-income apartment owners are convinced of the equipment performance and the water savings and financial benefits to them, and elect to participate in the program. SCE's installation contractors install the HETs at no cost to the property owner. Tenants that receive new HETs are given instructions on how to use their new toilets.

Installations verified by MWD and SCE

MWD and SCE staff conducts on-site visits and reviews purchase orders to verify the installation of the HETs.

MID TERM OUTCOMES

Water savings achieved, reduced water bills for property owners and/or low-income tenants

After the installations, tenants understand how to use the dual-flush model toilets and use them properly. Water usage is reduced for the property, and the property owner and/or tenants reduce their water bills. Even if the full benefits of the dual-flush toilets are not realized, (e.g., tenants only flush with the higher volume selection), water savings are still achieved (i.e., 1.6 gpf instead of 3.5 gpf).

kW, kWh savings for water suppliers and wastewater treatment, reduced operating costs

When low-income properties reduce their water consumption, upstream water suppliers and downstream wastewater providers realize indirect/embedded energy savings, by reducing surface conveyance, groundwater pumping, treatment, distribution, as well as wastewater pumping and treatment.

Improved understanding of embedded energy in water services

Analyses conducted by M&V contractors quantify the embedded energy savings that water suppliers and wastewater providers are expected to realize. The findings are published so that the CPUC, SCE, and water agencies have an improved understanding of the embedded energy in water supply and treatment systems. Data from the evaluation are used to update the embedded energy calculator, which allows for simpler estimation of embedded energy savings for future programs.

LONG TERM OUTCOMES

Additional measures (previously considered not cost effective) are now considered cost effective

Measures that were once considered not cost effective based on water savings alone may now pass the cost effectiveness test when embedded energy savings are also considered. This may allow SCE to justify including water measures in other efficiency programs.

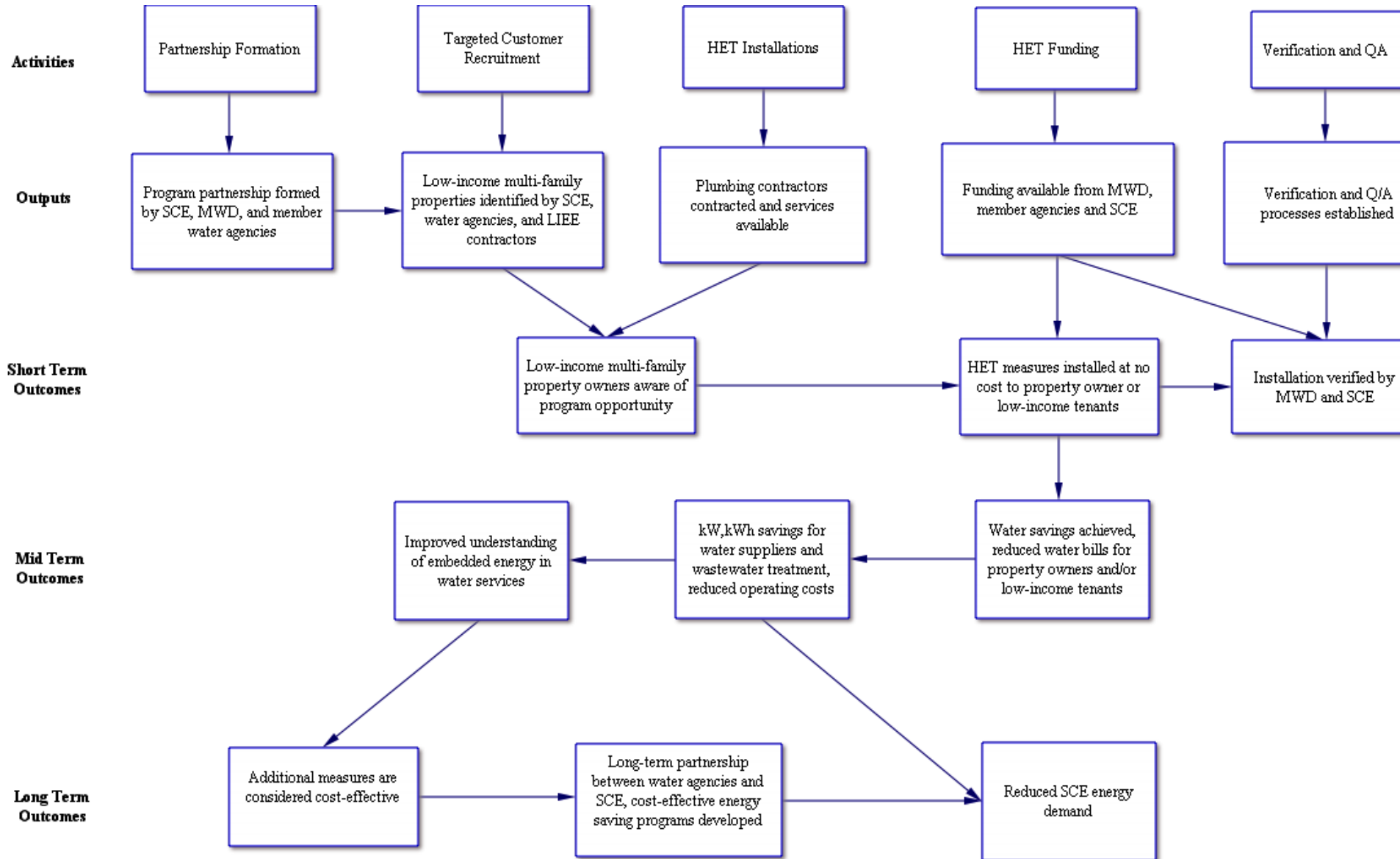
Long-term partnership between water agencies and SCE, cost-effective energy saving programs developed

The partnership program has successfully targeted and served low-income multi-family properties and has achieved both water and embedded energy savings. If the HET measure is found to be cost-effective to SCE based on the embedded energy savings, then it may be included as part of a longer-term partnership program between SCE and the water agencies.

Reduced SCE energy demand

Apartment building owners with low-income residents utilize SCE's new program, creating additional embedded energy savings to upstream/downstream water suppliers and wastewater providers. As a result, SCE achieves long-term energy savings and California's electric grid is positively impacted.

Figure 4: SCE Low Income High Efficiency Toilet Program Logic Model



5.3 SCE LOW INCOME HIGH EFFICIENCY TOILET PROGRAM EVALUATION OVERVIEW

The evaluation activities completed for this program included in-depth interviews with:

- The program manager at SCE
- The program manager at Metropolitan Water District (MWD)
- Two staff members at Irvine Ranch Water District (IRWD)
- The toilet installation contractor
- A manager of a participating apartment complex

ECONorthwest also conducted a mail-in survey of households that received HETs through the program. There were 85 completed responses to the survey. ECONorthwest conducted the interviews from November 2009 through March 2010 and implemented the mail survey in April 2010.

Following are some of the topics that were assessed in the interviews and survey:

- Ease of partnership formation
- Success of customer recruitment
- Actual HET usage patterns
- Customer satisfaction with the HETs and participation experience
- Success of program coordination and tracking activities
- Overall satisfaction among IOU staff, water agency staff, program vendors and customer participants

Detailed results of the data collection and analysis are discussed below.

5.4 SCE LOW INCOME HIGH EFFICIENCY TOILET PROGRAM EVALUATION RESULTS

Partnership Formation and Program Delivery

This evaluation focused on the partnership between SCE, MWD and IRWD (other water retailers could participate too). MWD is a large, regional water wholesaler and IRWD is the water district serving the Irvine area. According to MWD staff, in the years between the initial pilot program proposal and its approval by the CPUC, MWD's financial situation changed significantly. At the time the CPUC approved the pilot program, MWD was experiencing budget problems. MWD had initially committed to a \$165 rebate per toilet, but when the program was finally approved, MWD had reduced its rebates generally and the rebate for low-flow toilets had dropped to \$50 per toilet. Eventually MWD was able to fund its portion of the program and was able to

grandfather in the higher rebate rate. However, the MWD funding issue slowed the program down in its early stages until the partners' financial contributions could be confirmed.

SCE did not have formal contracts with MWD or IRWD, and only contracted with the toilet installation contractor.³⁵ The contractor was already an approved plumber for the property owner and had completed numerous installations previously, which helped to alleviate any potential concerns about the contractor's qualifications and quality of work. The contractor was directly reimbursed by SCE (which pays approved purchase orders), and also by MWD's rebates processing contractor, which packaged payments from IRWD and MWD. None of the parties mentioned any problems related to this two-payment system for a Pilot program.

Staff at all three agencies reported that there was a very good working relationship between them, which contributed to their high satisfaction levels. MWD noted that it already had a good working relationship with IRWD, and that this collaborative relationship benefited this project. Staff at both water agencies also commended the SCE program manager's enthusiasm and efforts to better understand water usage issues and agency operations.

Communication during the course of the program went very smoothly. The different agencies used email and telephone calls as needed to keep everyone informed and the program on track. IRWD facilitated communication between the apartments property owner and SCE. As the property owner is a major customer, the water district had regular communication channels already in place.

Initially this pilot program had specific criteria for project eligibility (to facilitate an impacts analysis): low-income households in multifamily units *that allow for per-unit water use measurement*. Most apartment complexes have a master water meter, and it is not common for units to be individually metered. Identifying eligible low-income households was challenging in itself, and the added evaluation criteria of multiple meters exacerbated the recruitment challenges.

Although Irvine has a relatively high-income population, the program was able to identify eligible participants because of the IRWD's existing customer database and its working relationship with the property owner. The IRWD had data on when each water account was established, allowing them to narrow the search to complexes built before 1992 and thus more likely to have older, higher-volume toilets. The IRWD database also had information on which apartment units had already used a rebate and which complexes had individual metering. To identify low-income households, IRWD worked with a large property owner in the community. The City of Irvine requires that a portion of new development be low-income, but the City lacks entirely low-income apartment complexes. IRWD coordinated with the property owner to document that individual units qualified as low-income.

³⁵ SCE originally attempted to establish a co-funding agreement with MWD and IRWD without success; both SCE and MWD experienced significant delays during this process. If future programs intend to issue a single check to the installation contractor, additional time and effort will be needed to complete a partnering contract between SCE and MWD.

The participating agencies noted that it was difficult to identify qualifying households, and one reason IRWD was selected as a program partner was its good billing data. The pilot program was fortunate to work with IRWD because the water district serves apartments that have both individual meters and low-income households. Going forward, IRWD staff suggested that it might be helpful to work directly with an agency that exclusively serves low-income households, to help find eligible sites. However SCE staff would prefer to remove the low-income requirements but still focus on multifamily apartments. In particular, the program would have been more cost-effective for the installation contractor if they could have avoided the low-income criteria. The low-income criteria added a layer of administrative complexity and it would be simpler and more cost-effective to replace all the toilets in a single apartment complex, and perhaps only fund the portion of units that qualify as low-income.

Staff at all three partner agencies reported high satisfaction with the pilot program. All interviewees reported that it was an effective program that replaced older, inefficient toilets with high quality, efficient toilets, yielding water savings. SCE staff reported that the pilot program was coming in well under its budgeted cost, and slightly below its targeted installation goals. SCE believed it could have met the installation goals if it had more time.

The owner of the apartment complexes was able to select the toilet model and IRWD staff believed that this helped to ensure customer satisfaction. They perceived that the upper management of the apartment complexes is completely satisfied with the program, because they now have new and high quality toilets, which should reduce long-term operating costs for the property owner.

Vendor Experience, Satisfaction and Challenges

The installation contractor worked directly with the building managers to identify units that could potentially receive new toilets. The management provided access to the individual units and the contractor installed the new toilets immediately after confirming the eligibility of the existing toilet(s). The contractor also tracked which units received new toilets, a relatively simple task because the program only involved two properties. All of the installations were completed in two weeks.

The installation contractor stated that he helped to connect the property owner with the Pilot Program. The contractor is familiar with rebates for water-efficiency programs, and he saw this program as an opportunity for the property owner to make a worthwhile investment. He also stated that he helped tie together the rebates from the IRWD, MWD, and SCE.

The contractor reported that initially there was some confusion about which party SCE should communicate with, the contractor or the property owner. They were able to agree that SCE would communicate directly with the contractor, and there were no further communication issues.

The vendor also reported that his contract with SCE was clear and that he would gladly work with SCE again. His only recommendation for the program was to make the combined rebate larger, so it covers the full installation cost for customers.³⁶

Participating Customer Experience, Satisfaction and Challenges

IRWD's primary contact at the property owner, who identified low-income households, did not respond to requests for an interview. Instead, we interviewed the on-site manager of one of the apartment complexes. The manager of the second apartment complex during the installation was no longer employed by the property owner.

The apartment manager stated that he had no responsibility for participating in the Pilot Program, but in this apartment complex there is a subset of apartments that are explicitly income restricted. Management at the corporate level identified those units for the program.

The apartment manager coordinated the installation process. He worked with the vendor to determine the number of toilets that could be installed in a single day, and together they worked out the likely schedule. The manager then sent the tenants a notice, to let them know someone would be in the apartment to install a new toilet, within a specified two-day window. He also provided the tenants with information about what to expect from the installation process, such as the length of the installation process and the expected mess.

The manager said he was satisfied with the new toilets, because no tenants had complained. He experienced no problems participating in the program, and the whole process went smoothly. He had no interaction with SCE and all his interactions with the installation contractor were satisfactory. He was aware of the water meters that were installed for the impact evaluation, and this activity had not caused him any problems.

The manager's lone recommendation to improve the program was to provide the apartment complex management instructions for using the toilets. While the individual tenants may have received their own instructions, management never received any. The toilets have two buttons, and it is not difficult to determine which is the appropriate button to use, but instructions would have eliminated the need for him to actually test the toilet to identify the appropriate use for the buttons.

Participant Mail Survey Results

ECONorthwest conducted a mail survey of the 176 households that received new HETs at the two apartment buildings in Irvine. The survey was sent to the households via U.S. mail in March and April 2010.

A number of steps were taken to maximize the number and reliability of responses. First, the initial mailing was made as attractive and compelling as possible, incorporating hand-written addresses, interesting commemorative stamps, a straightforward questionnaire and two-dollar cash rewards for completing the survey. Survey recipients were then sent a postcard reminder a

³⁶ In fact, the program did this.

few days after the initial mailing. Lastly, recipients who had not responded within two weeks were sent a second copy of the survey.

ECONorthwest received complete surveys from 85 households within four weeks of the initial mailing, achieving a 48 percent response rate. The vast majority of the surveys received were complete.

Demographic information was requested from all survey respondents, including the respondent’s gender, ethnicity, and age, as well as the age ranges of all household inhabitants.

Households with children under five years of age represented 12 percent of respondents, and those with senior citizens represented 21 percent of respondents. All results presented below were examined for differences between the entire group and these two specific groups.

Results

Eighty-four percent of the respondents stated that they were the apartment tenant when the HET was installed, while seven percent said that a previous tenant had been living in the unit during the installation. Nine percent did not provide their tenant status.

Fifty-seven percent of the respondents had one HET installed, 38 percent received two new toilets, and 4 percent had three HETs installed. Thirty-four percent of the respondents said they were given information on how to use the toilet, 56 percent were not, and ten percent did not recall. Of those who were given information, 96 percent said the information was helpful.

Relatively few respondents said there had been problems with the initial installation. Eleven percent of the respondents said that the installer had left debris in their apartments, and the same percentage said that there had been initial problems with the toilets, such as not flushing well. Only three percent of the respondents said that the installation took too long to complete.

Respondents’ satisfaction with the installation process is shown in Table 8. Out of 68 respondents, 19 percent were less than “very satisfied” with the overall process.

Table 8: Satisfaction with Installation Process

Satisfaction Level	Installer Timeliness (N =68)	Installer Politeness (N =68)	Overall Satisfaction (N =68)
Extremely Satisfied	28%	30%	40%
Very Satisfied	52%	41%	40%
Somewhat Satisfied	13%	16%	10%
A Little Satisfied	3%	4%	3%
Not At All Satisfied	0%	2%	6%
Does Not Recall	4%	7%	1%
Total	100%	100%	100%

Regarding the performance of the HETs, the most common problem that respondents had was having to flush multiple times. Table 9 shows how often respondents had to flush multiple times.

Out of the 85 respondents, 30 percent said they had to flush their HETs multiple times “often” or “always”.

Table 9: Frequency of More Than One Flush

Frequency	Percentage (N=85)
Always	15%
Often	15%
Sometimes	28%
Rarely	26%
Never	13%
Don't Know / No Response	3%
Total	100%

Twenty-nine respondents reported having other problems, which are listed in Table 10 (some respondents had multiple problems). The second most common problem, reported by 21 percent of respondents, was difficulty remembering which button to push.

Table 10: Problems Other Than Multiple Flushes

Problem	Percentage (N=85)
Difficulty remembering which button to push	21%
Trouble with toilet clogging, more than a regular toilet	9%
Buttons not working properly	5%
Does not stop refilling	3%
Water level too low	4%
Other	4%

Overall, thirty-seven respondents said they need to flush their HETs multiple times “often” or “always”, or reported other problems. Twenty-two of these respondents had not received instructions on how to use their HETs. This suggests a relationship between having received instructions and not experiencing problems, but the relationship is not statistically significant.

Table 11 shows respondents' satisfaction with their toilet's performance. Households that had at least one problem with their toilet(s) were significantly more inclined to give low satisfaction ratings, while significantly fewer households with elderly tenants reported being "not at all satisfied".

Table 11: Satisfaction with Toilet Performance

Satisfaction Level	Had at Least One Problem (N=37)	Respondents with Young Children (N=10)	Respondents with Elderly Persons (N=18)	All Respondents (N=85)
Extremely Satisfied	8%*	0%*	28%	19%
Very Satisfied	33%	50%	50%	42%
Somewhat Satisfied	16%	30%	17%	15%
A Little Satisfied	16%*	20%	5%	8%
Not At All Satisfied	24%*	0%	0%*	11%
Does Not Recall / No Response	3%	0%	0%	5%
Total	100%	100%	100%	100%

*Difference from other households statistically significant at the 90% level

All but two of the 48 respondents who reported no problems still had the two-button toilets installed, while six of the 37 tenants who had reported at least one problem had replaced the toilets.³⁷ Table 12 shows which type of toilet the respondents said they would prefer. Eighty-four percent of those who reported no problems preferred to have the new two-button toilet, compared to only forty-nine percent of those reporting at least one problem.

Table 12: Type of Toilet Respondent Would Prefer

Type of Toilet	Had no Problems (N=48)	Had at Least One Problem (N=37)	All Respondents (N=85)
New two-button	84%*	49%*	67%
One-button	6%*	19%*	12%
Lever	2%*	13%*	7%
Don't know / No Response	8%	19%	14%
Total	100%	100%	100%

*Difference from other households statistically significant at the 90% level

³⁷ The survey did not inquire if the replacement toilet was also a two-button model or another model.

5.5 SCE LOW INCOME HIGH EFFICIENCY TOILET PROGRAM ISSUES AND OBSERVATIONS

A primary challenge for this Pilot was MWD’s funding issues at the start of the program.³⁸ In the years between the proposal for the Pilot and its implementation, MWD’s financial situation changed significantly. Once the issue was resolved the program moved forward smoothly. Based on the experience with this Pilot, staff at MWD believed that the agency should not guarantee specific rebate levels in the future. MWD’s annual budget cycle does not match SCE’s three-year budgets, and rebate levels can and do shift depending on circumstances each year. In the future, MWD may use partnering language that allows more funding flexibility.

The program partners also highlighted the difficulty of identifying low-income households. The Pilot Program was ultimately able to identify eligible units because the City of Irvine has very few property owners of multi-family residences and the retail water agency has very detailed data.

According to the partner agencies, the program was implemented successfully. One important key to its success was the individual staff members at all three agencies. They all reported high satisfaction with each other; everyone was an effective part of the team. Furthermore, they all perceived that the program was a worthy endeavor, and that there are large opportunities for energy and water providers to work together to achieve common conservation goals.

Although we could not interview the apartment buildings owner directly, partner agency staff speculated that the owner would have a high satisfaction level also, as the property owner was able to select the HET model. The owner was also familiar with the installation contractor, and regularly relied on the contractor’s services. The apartment owner had confidence in the contractor’s service quality.

While the apartment tenants’ satisfaction with the HETs was fairly high overall, there appear to be some usage issues that warrant further exploration. In particular, 30 percent of survey respondents said they are flushing their toilets multiple times “often” or “always”, and 21 percent did not always remember which button to push. Because the property owner would not provide tenants’ phone numbers to the evaluation team, the information that could be collected from tenants about these and other issues was limited.

Program Recommendations

Based on the evaluation results, the following are recommendations for the SCE Low Income High Efficiency Toilets program if it continues in the future:

³⁸ MWD had a first-come, first-served rebates reservation system. According to the processing contractor, while the installation/rebate processing period typically takes 6 to 8 weeks from start to finish, the Irvine project took much longer due to concerns over MWD’s funding ability. The Irvine rebates application was received in June 2009 and the final rebates check was issued 4 months later. The other HET installation project in Long Beach was also delayed due to concerns about MWD’s ability to pay rebates.

- **Encourage IOU staff to learn about water conservation issues.** The SCE program manager made a strong effort to understand the partner water agency's operations and ability to assist the program, which had a positive effect on program outcomes. Staff at the two water agencies appreciated the program manager's effort and knowledge about water issues.
- **Allow the property owners to select the toilet model.** The property owner was able to select the toilet model, which improved their comfort level and helped to ensure customer satisfaction. Program partners perceived that the upper management of the apartment complexes is completely satisfied with the program, because they now have new and high quality toilets.
- **Provide apartment tenants and management with (extra) instructions about proper HET usage and simple adjustments.** Although the two-button toilets are not difficult to use, it is apparent from this evaluation that a fair number of tenants are not using them as intended. The program should consistently provide instructions to management and the tenants to reduce confusion and usage problems. Management could also include copies of the instructions in new tenant materials they regularly distribute.
- **Perform additional post-installation HET testing and calibration.** A high number of tenants reported flushing their HETs multiple times, and it is possible that some HETs are not refilling completely. The flush volumes should be confirmed before the installer completes work at each unit. If instead multiple flushing is primarily due to repeatedly depressing the wrong button, it may be necessary to install a different model with more prominently labeled flushing options or augment the education process.
- **Inform water agency partners about embedded energy data that will be required of them during partnership formation.** While IRWD was able to provide useful water, wastewater and energy data for the embedded energy calculations, management and operations staff were not initially aware of the data needs when contacted by the evaluation team. In addition, staff were surprised at the level of detail of the data requested and the amount of staff time needed to collect the data. The water agencies need to understand up front what types of data will be required from them, so that appropriate agency staff can plan accordingly.

6. SCE EXPRESS WATER EFFICIENCY PROGRAM RESULTS

6.1 SCE EXPRESS WATER EFFICIENCY PROGRAM BACKGROUND

For this program, SCE partnered with the Metropolitan Water District of Southern California (MWD) to deliver pH controllers for cooling towers and Weather Based Irrigation Controllers (WBICs) to commercial customers with chilled water HVAC and/or large landscape irrigation systems in mutual SCE/MWD service territories. A pH controller is a programmable device that monitors the pH of the water circulating in the cooling tower and adds a mixture of dilute acids and other treatment chemicals in order to maintain a pH in the circulating water below 8.3. This prevents the formation of calcium carbonate scale in the system. By adjusting the chemistry of the system to greatly reduce the risk of scale formation it is possible to operate the tower at much higher levels of concentration, which reduces the amount of water that is necessary to bleed from

the tower.³⁹ WBICs achieve water savings by switching from manual irrigation controllers to weather based controllers. Since many irrigation controllers are known to over-irrigate landscaped areas due to how they are programmed, switching to a controller that automatically adjusts the application based on actual weather conditions should save water.

To offset the cost of the pH controllers and the WBICs, MWD provided rebates of \$1,900 per cooling tower controller and \$630 per irrigated acre controlled by a WBIC. While MWD is able to give rebates for specific water conservation measures, it is not able to provide technical assistance or design recommendations to customers. Thus, SCE served as the “marketing arm” of the program and offered these measures to customers as if they were part of the existing Express Efficiency nonresidential retrofit rebate program, which is a prescriptive component of the Business Incentives and Services package of energy efficiency programs. Through its customer account executives and other Express Efficiency program delivery channels, SCE marketed the program directly to its customers, providing access to customers previously unavailable to MWD.

Program Goals and Achievements

SCE’s program was budgeted to serve up to 100 pH controllers and 20 WBICs participants, however, the program did not have any formal participation goals. When the program ended, no customers had installed WBICs or pH controllers as direct result of SCE’s marketing efforts.

SCE was able to help facilitate the installation of three pH controllers at one customer site, although the customer was recruited to the program by West Basin Municipal Water District.

6.2 SCE EXPRESS WATER EFFICIENCY PROGRAM LOGIC MODEL AND PROGRAM THEORY

The following program theory for SCE’s Express Water Efficiency program builds on the program logic model and provides additional detail on program activities, outputs, and outcomes. (The logic model diagram follows the discussion of program theory.)

ACTIVITIES

Partnership formed with water agency

SCE and the Metropolitan Water District of Southern California (MWD) develop a program to motivate the installation of water conservation measures for commercial customers in shared territories. Specifically, the goal of the program is to persuade eligible customers to install pH controllers and WBICs, which will result in both water and energy savings.

³⁹ Operating the cooling tower with less scale also improves its thermal performance, which reduces the energy consumption of the entire mechanical system to which the tower is attached.

Targeted customer recruitment and program marketing

SCE utilizes its customer account representatives and other Express Efficiency program delivery channels to market the pH controllers and WBICs to commercial customers that are located in mutual SCE/MWD service territories. Primary marketing efforts include educating and persuading customers to install the program's cost-effective water conservation measures.

Project Funding

MWD provides a rebate incentive of \$630 per irrigated acre controlled by the WBIC and \$1,900 per cooling tower controller. Some areas also have water retailers offering incentives to customers as well. Together, these contributions cover a significant portion of the installation cost.

Verification and QA

MWD has established procedures to verify measures installations.

SHORT TERM OUTCOMES

Commercial customers aware of program opportunity

Program outreach efforts successfully reach the target customer groups, who understand the program opportunity and its potential benefits to them.

pH controllers and WBICs installed, incentives paid out

Commercial customers are convinced of the water savings and financial benefits to them and elect to participate in the program. Customers use their own staff or installation contractors to install the water conservation measures. Incentives are paid out to customers by MWD.

Installation verified by MWD

MWD conducts random post-installation verifications at customer sites.

MID TERM OUTCOMES

Water savings achieved, reduced customer water bills

After the installations, customers realize water savings and save money on their water bills.

kW, kWh savings for water suppliers and wastewater treatment, reduced operating costs

When customers reduce their water consumption, upstream water suppliers and downstream wastewater providers realize indirect/embedded energy savings, by reducing surface conveyance, groundwater pumping, treatment, distribution, as well as wastewater pumping and treatment.

Improved understanding of embedded energy in water services

Analyses conducted by M&V contractors quantify the embedded energy savings that water suppliers and wastewater providers are expected to realize. The findings are published so that the CPUC, SCE, and water agencies have an improved understanding of the embedded energy in

water supply and treatment systems. Data from the evaluation are used to update the embedded energy calculator, which allows for simpler estimation of embedded energy savings for future programs.

LONG TERM OUTCOMES

Additional measures (previously considered not cost effective) are now considered cost effective

Measures that were once considered not cost effective based on water savings alone may now pass the cost effectiveness test when embedded energy savings are also considered. This may allow SCE to justify including water measures in other efficiency programs.

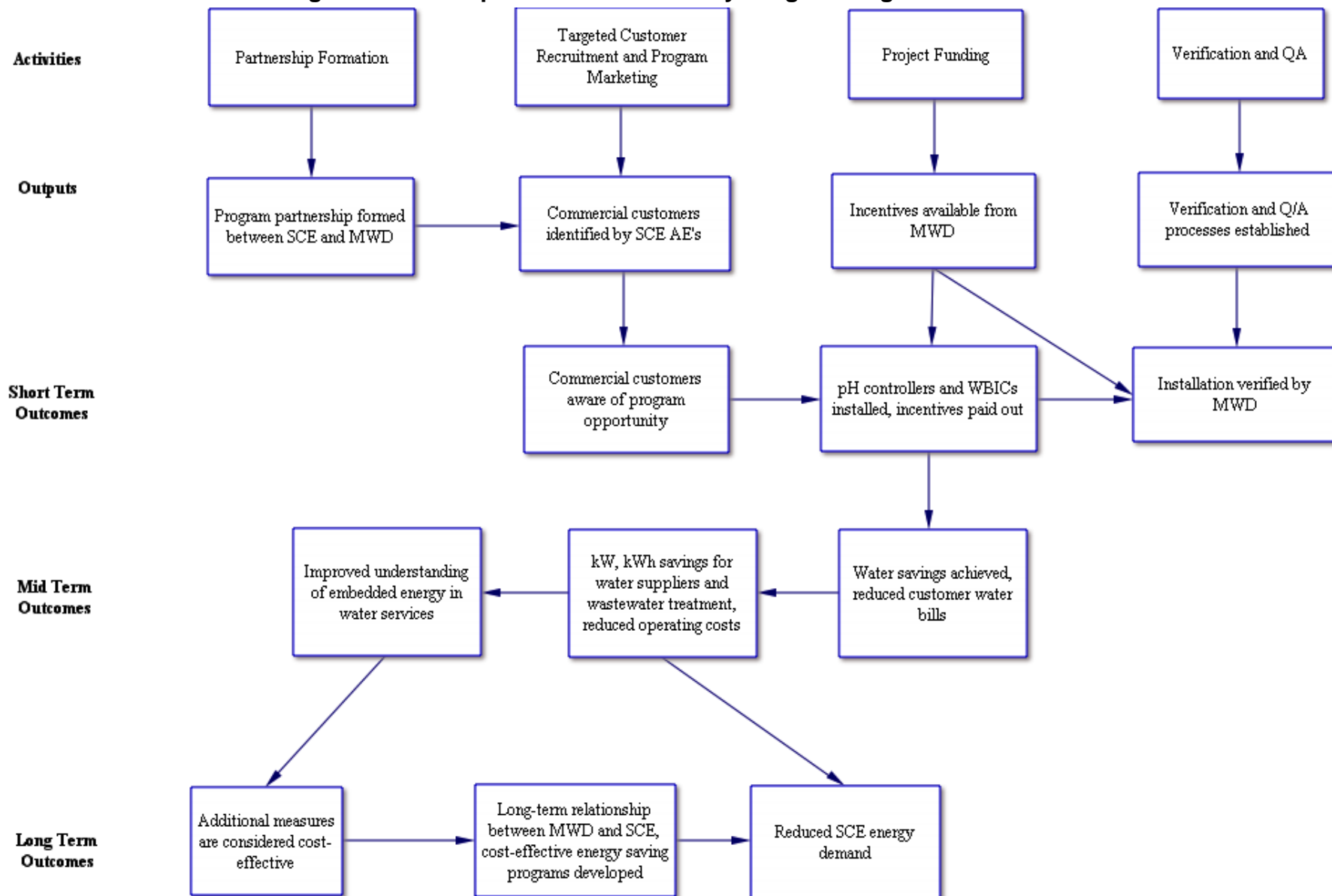
Long-term partnership between MWD and SCE, cost-effective energy saving programs developed

The partnership program has successfully targeted and served commercial customers and has achieved both water and embedded energy savings. If the prescriptive water conservation measures are found to be cost-effective to SCE based on the embedded energy savings, then they may be included as part of a longer-term partnership program between SCE and MWD.

Reduced SCE energy demand

Commercial customers utilize SCE's new program, creating additional embedded energy savings to upstream/downstream water suppliers and wastewater providers. As a result, SCE achieves long-term energy savings and California's electric grid is positively impacted.

Figure 5: SCE Express Water Efficiency Program Logic Model



6.3 SCE EXPRESS WATER EFFICIENCY PROGRAM EVALUATION OVERVIEW

For this program evaluation interviews were conducted with:

- 1) The program managers at SCE and MWD
- 2) Three customer account executives at SCE
- 3) MWD's rebates processing contractor
- 4) The water conservation program manager at West Basin Municipal Water District (West Basin)
- 5) The SCE customer that installed three pH controllers

All of the interviews were conducted between November 2009 and April 2010. Following are some of the topics that were discussed during the interviews:

- Ease of partnership formation
- Success of customer recruitment and effectiveness of program design
- Ease of customer participation
- Customer satisfaction with installed measures and participation experience
- Barriers to customer participation and installations
- Success of program coordination and tracking activities
- Overall satisfaction among IOU staff, water agency staff, and customer participants

Detailed results of the data collection and analysis are discussed below.

6.4 SCE EXPRESS WATER EFFICIENCY PROGRAM EVALUATION RESULTS

Partnership Formation and Program Delivery

The CPUC initially considered offering the program through selected water retailers, however, MWD was subsequently confirmed as the official program partner, since it serves many local water retailers (and because it would be difficult to select some and not other retailers). When the program design was finalized, SCE had only an informal agreement to partner with MWD, although the lack of a formal contract did not significantly impact the program positively or negatively.⁴⁰

⁴⁰ Both SCE and MWD can require a significant amount of time to develop formal contracts.

One of the first program tasks was to develop program applications and tracking procedures. SCE initially planned to do its own participation tracking, but because only two measures were offered through the program, the partners decided to simplify the process and utilize MWD's existing "backbone system", which records applications for all its rebated measures. SCE worked with MWD's rebates processing contractor to develop a one-page co-branded application for each measure that would run through MWD's system and also be "tagged" as originating from SCE.

After the applications were developed, the focus shifted to customer recruitment. SCE's program manager originally hoped to develop robust training for the account executives, but was dissuaded by senior staff, who countered that the executives would have little time to dedicate to a Pilot program that offered no claimable energy savings. Subsequently, more simplified training (e.g., a PowerPoint presentation) was considered, but this was abandoned when MWD began to have funding problems, and SCE became concerned about potentially over-promoting the program. In the end, a generic email "blast" was developed by SCE and MWD, and select account executives serving different customer segments and geographic areas distributed the email along with a program application to their customers.⁴¹ The account executives were also asked to follow up any potential leads with phone calls and/or personal visits, as they typically do for their energy program prospects.

In the end, few customers responded to the emails with inquiries, and no applications were received by MWD as a result of the email blast or personal distribution by the account executives. The account executives interviewed for this evaluation described several challenges as they promoted the program measures. First, they did not all know the boundaries of MWD's service territory or the territory of local water retailers, which might also be offering (supplemental) incentives for the same measures. In addition, they did not know the typical payback period for the measures, which is a key consideration in customer decision-making. In SCE's coastal territory, packaged HVAC units are often preferred to cooling towers and chillers, and there is also some skepticism about the performance of pH controllers. For WBICs, many customers with large landscaped areas already had them or were not in the MWD service area. Other customers had budget constraints, and some were confused by the many rebates being offered by different parties.

After MWD's program funding closed down, the SCE program manager and account executives stopped marketing the program. Subsequently, SCE's program manager learned that West Basin Municipal Water District had identified an SCE customer that wanted to install three pH controllers, and began coordinating with them to complete the project. West Basin had been running its own pH controllers program (also based on MWD incentives), and found the customer through their own consultant contractor.

For the project, SCE paid the costs for three new water meters required for the impacts analysis, and West Basin covered the remaining project costs through a combination of MWD rebates and grant money from California Department of Water Resources (DWR). While the project was free to the industrial customer (except for required staff time), the customer did have initial questions

⁴¹ The AE's served office, industrial, commercial, country club, and hospitality customers.

about the safety and operations of pH controller equipment, and was not initially fully committed to installing controllers. Grant money secured from DWR was used to reimburse a project consultant to educate the customer about the safety and operations of pH controllers, and guide them through the installation.

West Basin’s consultant noted that other customers (e.g., a medical facility, an office building, a supermarket) were also interested in pH controllers but that they were dissuaded for various reasons, such as concerns about transporting acid on building roofs. When recruiting customers in the future, the consultant believed that a corporate “culture of sustainability” and project champion are prerequisites (and were qualities of the participant). Timing is also important, as industrial process changes require large cash outlays that may not be feasible in the middle of budget years.

Although the program did not directly recruit any SCE customers, both SCE and MWD were satisfied with the partnership foundation and plan to continue working together. The co-branded application development went particularly well and was completed in only three weeks, a relatively quick time for SCE. The two program managers worked well together generally, each commending the other’s diligence and creative thinking. Since implementing the partnership, SCE has included MWD information in its traveling education vehicle. In addition, MWD has convinced some water retailers to contribute to SCE residential audits; retailers that pay \$10 per home can have the homes receive detailed water and electricity consumption data directly from SCE. Both partners noted, however, that in order to partner directly on future water conservation programs, MWD’s budget periods and amounts should be brought more in line with SCE’s so funding does not expire prematurely.

Vendor Experience, Satisfaction and Challenges

As SCE was having difficulties recruiting customers through its customer account executives, MWD’s rebates processing vendor was enlisted to help with the marketing effort. To do this, the vendor utilized their database of customers that had received rebates for pH controllers in the past, and called them to see if they were interested in installing controllers through the Pilot Program. In the end, the vendor was able to discuss the program with about 20 customers or their water maintenance contractors, and three customers were referred to the impact evaluation contractor for additional discussions and eligibility screening. Two of these customers were served by SCE and eligible for the program, and one customer in Manhattan Beach was initially interested in the program before ceasing communications with the impacts evaluator.

The rebates processing vendor experienced several challenges in conducting their recruitment. Most critically, they had little information about the program and its potential benefits for customers when they started contacting customers. To address this, the contractor emailed their understanding of the customer data requirements to SCE, MWD and the impacts evaluator, and the impacts evaluator clarified and confirmed the data requirements. In retrospect, the vendor believed they might have been more effective had they been given more program information up front (e.g., detailed data requirements, answers to expected questions, a flyer to email before/after making calls). While the vendor did develop a standard email to send to customers, they believed more detailed and “catchy” information was needed. They also did not have enough information to have in-depth conversations about expected benefits to the customer.

On the logistics side, the vendor did not know if database customers were served by SCE or other electric providers, and could not target the recruitment. In addition, most customers do not have readily available data on their water and pH use and rely on their water contractors for this information. Overall, it was difficult to get pH customers' time to discuss the program and convince them of the benefits of participation. Despite aggressive callback efforts, many customers failed to reply at all.

The vendor noted that while some customers were initially interested in the program, it was difficult to get their water maintenance contractors interested, and customers rely heavily on these contractors for technical guidance.⁴² The vendor speculated that the water contractors may be reluctant to add to their maintenance responsibilities, particularly if they believe the customers will not pay them more.

Participating Customer Experience, Satisfaction and Challenges

The SCE customer that received new pH controllers was not willing to conduct a telephone interview (due to their time constraints) and instead provided answers to the interview questions via email.

The customer learned of the program from staff at the West Basin Municipal Water District, and had not considered installing new pH controllers prior to these communications. The customer's initial questions pertained to out-of-pocket expenses and project timing and duration. When West Basin staff explained that the customer would incur no financial costs and that the project installation and assessment could be scheduled around the customer's schedule, the customer had no remaining concerns and agreed to participate in the program. To do so, they signed an agreement with West Basin to arrange for cost reimbursement, and then had their own water treatment contractor install water flow meters and then the new pH controllers.

The customer interacted on a few occasions with SCE staff, but most of their communications were with their own water contractor and the impact evaluation consultants to understand how the installations would occur and when. The customer said that communications and coordination for the project went very well overall, noting that the impact evaluation staff were very accommodating and informative.

The customer was quite satisfied with the project overall, although it took longer than initially promised to get the equipment installed and operational. However, their primary objective was to save money on their water bill, and this was achieved. The customer estimated that they would save \$7,000 to \$8,000 per year on water. The customer did not have any suggestions for improvements to the program.

6.5 SCE EXPRESS WATER EFFICIENCY PROGRAM ISSUES AND OBSERVATIONS

In the case of pH controllers and WBICs, it is unlikely that SCE's program, as designed, would have a significant impact on attracting participation or changing the market for this equipment. The original program plan was to have SCE account executives aggressively promoting the

⁴² Only two were willing to discuss the program.

measures to their customers, who would then install controllers or WBICs to save water and obtain rebates from MWD. While some SCE representatives did promote the measures, most did not because they were not made aware of the program or were busy promoting many other SCE programs, and water savings obtained through the program would not contribute to representatives' formal energy saving goals. As a result, no program participants were recruited through SCE's formal marketing channels, although SCE did contribute financially to the pH controller project that was installed.

Program Recommendations

The Pilot Program design resulted in no customer participation, and thus a wholly different program delivery approach is needed. If the current program delivery system is retained, then we make the following recommendations:

- **Ensure that SCE account executives have an incentive to promote program measures.** Personal, face-to-face interactions are often the best way to recruit commercial and industrial customers, whereas mass market advertising can work well for residential customers. Unless SCE account executives are able to have their sales achievements applied towards their performance goals, they should not be expected to support the program (which should then be discontinued). The account executives must be able to claim embedded energy savings for their efforts, or SCE should develop other measurable metrics upon which to assess performance and compensation.
- **Include other water saving measures.** According to the program managers, MWD has never received many rebate applications for pH controllers and WBICs, although they can provide high water savings. In particular, pH controllers are expensive and use acid, which is a safety concern for some customers. Conversely, the market for WBICs in MWD territory may be reaching saturation. Including a broader range of measures would give account executives more opportunities to serve their customers.
- **Provide SCE account executives with training on relevant water issues.** Before marketing to their customers, account representatives should have a good understanding of water district boundaries (i.e., where incentives can be paid), how the conservation measures save water, likely payback periods, and direct and/or indirect energy savings that may result.
- **Ensure that MWD or SCE are able to provide incentives through the program cycle.** As the program was designed, incentives from MWD were a critical component of this program, and the program should not be offered unless stable funding is assured.
- **Inform water agencies about embedded energy data that will be required of them.** The retail water agency that serves the one customer participant did not provide any water or energy data for the embedded energy calculations, and was not aware of the need to do so when contacted by the impact evaluators. (Wastewater production and energy data were obtained by EEW Study 2.) The water agencies need to understand up front what types of data will be required from them, so that appropriate agency staff can plan accordingly.

7. SCE LEAK DETECTION PROGRAM RESULTS

7.1 SCE LEAK DETECTION PROGRAM BACKGROUND

This program analyzed water agency leakage and loss control strategies through primary and secondary research, to learn more about the significance of water losses due to both distribution system and end-user water leaks, and the potential for cost-effective interventions to reduce water losses. For the primary research, detailed top down water audits that comply with International Water Association (IWA) and American Water Works Association (AWWA) protocols were completed for the Las Virgenes Municipal Water District, Apple Valley Ranchos Water Company and Lake Arrowhead Community Services District by Water Systems Optimization Inc. (WSO), under contract to SCE. The top down water audit is a process of identification and validation of the different types of water volumes that collectively add up to each agency's total water supply for the audit period. In a top down audit, all water volume components are evaluated starting with each agency's total system input and working down (through a process of subtraction) to validate water consumption and then identify real water losses. Water system components that were analyzed include:

1. Total System Input – this is the total water produced during the audit period, accounting for water from all sources (e.g., wells, lakes, imported water).
2. Authorized Consumption– this is the volume of billed and unbilled water used by authorized customers, for residential, commercial, industrial and institutional purposes. It also includes water exported to other jurisdictions, water used for fire fighting, water granted to special accounts, flushing of mains and sewers, etc.
3. Apparent Losses – these are due to inaccurate meter readings, data transcription errors, and unauthorized consumption. Reducing apparent losses will not reduce physical water losses, but will help to recover lost revenue.
4. Real Losses – these are due to physical leaks, and consist of reported breaks, background leakage, and hidden leaks, which can be located through active leak detection, and thus is recoverable leakage.

The final reports included economic cost/benefit assessments to identify appropriate types and levels of intervention (e.g., leak detection/repair work, water pressure management) to reduce water losses in the future.

The contractor also demonstrated a variety of techniques to estimate hidden leakage in specific areas.⁴³ Lastly, for each agency a field leak detection and repair campaign was conducted to show agency staff how leak detection is performed. The contractor performed the leak detection

⁴³ A District Metered Area (DMA) is a hydraulically discrete part of the distribution network that can be isolated from the rest of the system, and is typically supplied through a single metered line so that total inflow to the area can be measured.

and the agencies repaired the found leaks. (The impact evaluation of this program includes additional details about all of the aforementioned program activities.)

Program Goals and Achievements

The CPUC's decision approving the program did not include formal goals for the number of audits to be completed or water savings to obtain through leak detection and repairs. When the program ended, comprehensive water audits had been completed at three water agencies, and actual water savings from leak repairs made during program period totaled to approximately 83 million gallons (255 acre feet) per year.⁴⁴

In addition, the contractor also completed a comprehensive secondary research report that included:⁴⁵

- Estimates of statewide water losses;
- A strategy for implementing a future water loss and energy reduction program in SCE territory;
- Best practices for water loss assessments and management; and
- A literature review of international studies linking water supply and energy consumption

This evaluation focused on the comprehensive audits and field leak detection that were completed for this program, and not the secondary research.

7.2 SCE LEAK DETECTION PROGRAM LOGIC MODEL AND PROGRAM THEORY

The following program theory for SCE's Leak Detection program builds on the program logic model and provides additional detail on program activities, outputs, and outcomes. (The logic model diagram follows the discussion of program theory.)

ACTIVITIES

Water agency recruitment

SCE identifies water agencies that want to understand and quantify their real water losses and pursue leak detection and equipment repair opportunities. A key goal of the program is to subsidize studies that will enable water agencies to economically reduce real water losses.

Water leak detection audits

An implementation contractor is hired to conduct comprehensive water usage audits. In addition

⁴⁴ In addition, potential water savings of 263 million gallons per year could also be achieved if the water agencies elect to conduct proactive leak detection and repair in the future. However, these potential water savings are only economically justified if water is valued at retail cost and not (lower) avoided production cost.

⁴⁵ *Secondary Research for Water Leak Detection Program and Water System Loss Control Study*. Water Systems Optimization, Inc. Final Report. December 2009.

to other components of water usage (e.g., authorized consumption), the audits identify both real water losses (physical leaks) and apparent water losses (unauthorized consumption, meter malfunctions, data errors, etc.). Relatively large real water losses can be detected through active leak detection, whereas low-level background leakage is estimated.

Project funding

SCE provides funding for the program, which includes the costs associated with the water audits and leak detection conducted by the contractor. The water agencies pay the costs of any leak repairs that are made.

Verification and QA

SCE conducts on-site visits to monitor leak detection activities by the audits contractor.

SHORT TERM OUTCOMES

Water agencies agree to water audits and leak repair assessment

The water agencies are convinced that the audit process and the water savings achieved through the Pilot will benefit themselves and their customers, and elect to participate in the program.

Audits identify potential water saving interventions; some leaks are identified and repaired, resulting in water savings

The audits quantify real and apparent water losses, overall leakage volumes, and provide intervention strategies to the water agencies. Actual leaks detected through fieldwork in specific districts are repaired by water agency staff, and the agencies realize water savings.

SCE staff confirms leak detection process

SCE staff conduct on-site visits and observe the work of the implementation contractor to confirm that the leak detection techniques are appropriate and the amount of leakage reduced through program interventions.

MID TERM OUTCOMES

Agencies implement selected interventions

Water agencies review the prioritized list of intervention strategies provided by the audits contractor and decide what they are able to implement. Their strategy may include addressing real water losses, apparent water losses, or both.

kW, kWh savings for water suppliers, reduced operating costs

When water agencies reduce their water leakage, they also realize indirect/embedded energy savings, by “saving” energy associated with surface conveyance, groundwater pumping, treatment, and distribution.

Improved understanding of embedded energy in water services

Analyses conducted by M&V contractors quantify the embedded energy savings that water suppliers are expected to realize. The findings are published so that the CPUC, SCE, and water agencies have an improved understanding of the embedded energy in water supply and treatment systems. Data from the evaluation are used to update the embedded energy calculator, which allows for simpler estimation of embedded energy savings for future programs.

LONG TERM OUTCOMES

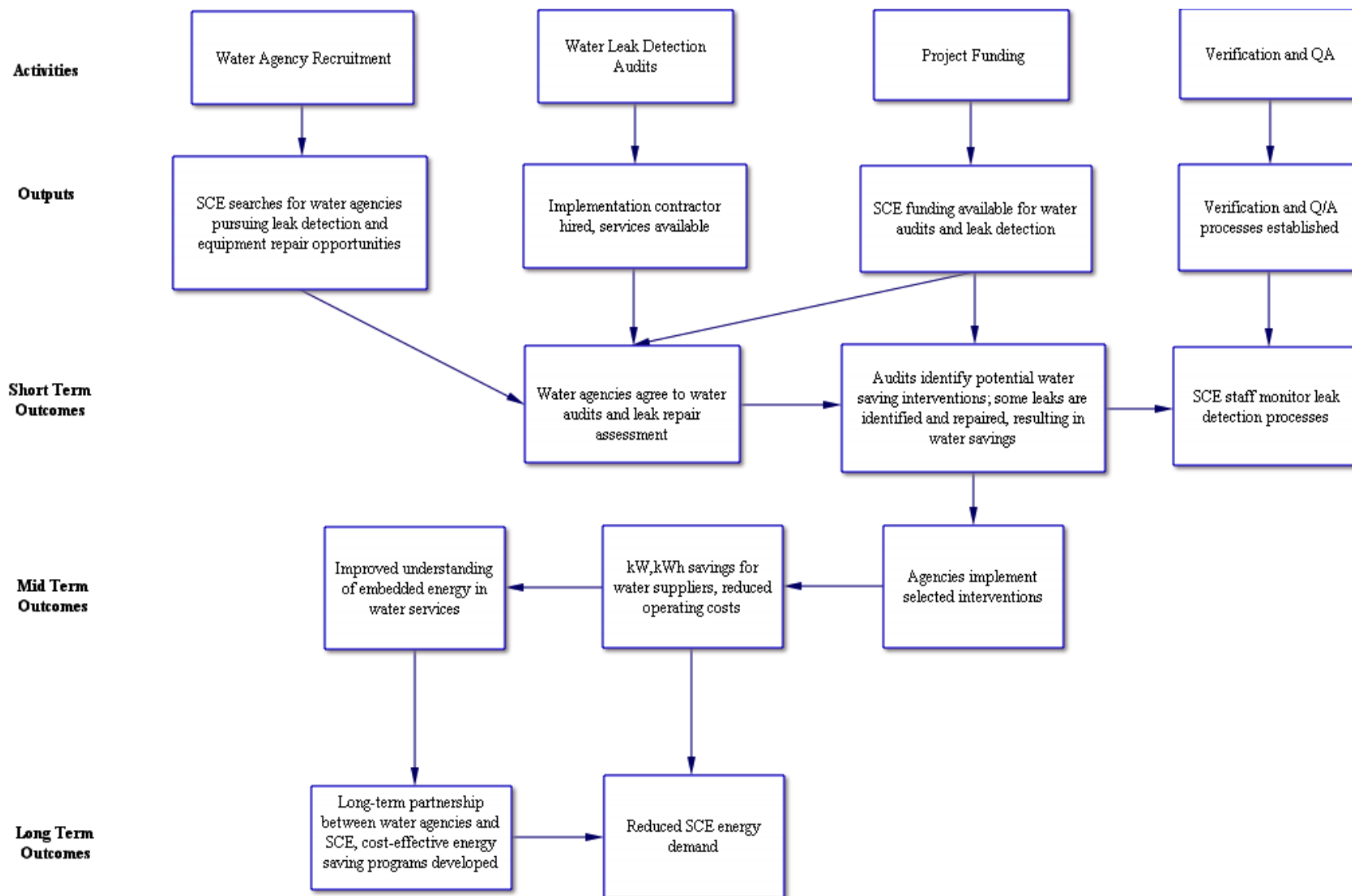
Long-term partnership between water agencies and SCE, cost-effective energy saving programs developed

The partnership program has successfully targeted and served water agencies and has achieved both water and embedded energy savings. If the implementation strategies for water leakage reduction are found to be cost effective to SCE based on the embedded energy savings, then they may be included as part of a longer-term partnership program between SCE and other water agencies.

Reduced SCE energy demand

Water agencies utilize SCE's new program, creating additional embedded energy savings. As a result, SCE achieves long-term energy savings and California's electric grid is positively impacted.

Figure 6: SCE Leak Detection Program Logic Model



7.3 SCE LEAK DETECTION PROGRAM EVALUATION OVERVIEW

For this program evaluation, in-depth interviews were completed with:

- 1) SCE's program manager
- 2) The project manager for the implementation contractor (WSO)
- 3) The program managers at the three water agencies that received comprehensive water audits and active leak detection

All of the interviews were completed between November 2009 and April 2010. Following are some of the topics that were discussed during the interviews:

- Success of water agency recruitment
- Ease of water agency participation
- Program implementation successes and challenges
- Water agency satisfaction with comprehensive water use audits and participation experience
- Water agency utilization of water audit findings and recommendations
- Success of program coordination and tracking activities
- Overall satisfaction among IOU staff, water agency staff, and program vendor

Detailed results of the data collection and analysis are discussed below.

7.4 SCE LEAK DETECTION PROGRAM EVALUATION RESULTS

Partnership Formation and Program Delivery

SCE's program manager initiated the participant recruitment by presenting the program scope at a monthly meeting of regional water conservation groups and individuals. After receiving contact information from agencies that were potentially interested in receiving audits and conducting leak detection, the manager emailed them to obtain additional information (e.g., water sources, length of distribution mains) to determine if they would be good candidates for the program. In particular, the manager wanted to focus on agencies with about 20,000 total service connections, which would make the audits more manageable to conduct. Both Apple Valley and Las Virgenes were recruited through this process, and a key decision factor was that SCE's program manager already had good working relations with the General Managers or their key assistants, who could apply appropriate pressure to keep staff focused on assisting the audits contractor within a short timeframe. Lake Arrowhead was included in the program later after another Pilot program planned for the community was cancelled (more details about the cancelled program are provided subsequently).

SCE's program manager was very involved in kicking off the program at the three agencies, to ensure that everyone understood the project scope and SCE's interest and role, and to build trust with the implementation contractor. After the audits commenced, the program manager yielded day-to-day project management to WSO, who was much more qualified to deal with the technical water system issues. As the program progressed, frequent informal communications with WSO were replaced with regular weekly status calls, which worked well for the program manager. The program manager also periodically shared program developments with the SCE account executives for the water agencies and public relations staff.

According to the SCE manager, the main program implementation challenge was obtaining data in specific formats that were new to the water agencies (e.g., water inputs, actual consumption). These data were needed to identify water theft, poorly functioning meters, and other elements of the audits. While the agencies generally had good data systems for customer billing purposes, the data did not always support analyses of actual water production and consumption, which require exact and consistent start/stop dates (i.e., not 60 day periods that end mid-month).

SCE's program manager was very satisfied with WSO's project management and work results, noting that staff were very knowledgeable, effective and good to work with. The SCE manager wanted the contractor to be their resident expert and deliver the program audits with minimal oversight, which WSO did successfully. Because WSO was also preferred to complete the secondary statewide research, SCE was able to achieve some economies of scale, as the secondary research could efficiently integrate results from leak detection conducted at the three program agencies (e.g., to filter out unreasonable data from other water agencies in the state).

The program manager considered the program to be a success, as it did actually find and repair leaks at all three agencies, and served to verify minimum possible levels of leakage in some areas (which would improve the credibility of future audits). All three agencies repaired the found leaks expeditiously, and worked well with SCE overall.

If SCE expands the program in the future, the SCE manager would want to target water agencies with higher leakage, as the program audits revealed that two of the participant agencies have low levels of leakage (and thus less potential embedded energy savings). As part of its secondary research, WSO was helping to scope out a "roadmap" for future program implementation, but the program manager also wanted additional direction from the CPUC and California Energy Commission, which were tracking a wide range of related impact evaluations, process evaluations and other statewide water/energy studies.

Vendor Experience, Satisfaction and Challenges

SCE hired Water Systems Optimization (WSO) to conduct the comprehensive water audits and leak detection, as well as the statewide secondary research. WSO also helped to target appropriate water agencies. The SCE program manager provided WSO with a list of potential participant agencies, and WSO analyzed agency characteristics to help prioritize the candidates. SCE was responsible for selecting and recruiting the participants, however. Audits were eventually completed at three water agencies selected by SCE for their diversity, and because the program manager understood that two agencies could provide usable data in a reasonable timeframe, which was a concern due to the late program approval:

- Las Virgenes - a public utility that imports all of its water and pumps at high pressure;

- Apple Valley - a private utility with several groundwater wells; and
- Lake Arrowhead – a small agency at high elevation with high water prices due to extensive pumping

The contracting process with SCE went well with no notable problems. WSO developed much of the program scope, so WSO knew what to expect during the course of the program.

WSO reported that interactions with the SCE’s program manager were good, and that SCE and WSO communicated well with each other. Initially, communications were very informal, consisting of ad hoc phone calls as issues arose. As the program progressed, they changed to regular weekly calls, as there were more activities and developments across the three agencies to discuss. According to WSO, SCE’s program manager was very involved in the program, attending several on-site meetings and observing fieldwork. WSO noted that it was not really necessary for SCE to be so involved in the process, although the program manager learned a lot about water agencies and systems, which enhanced their ability to work with water customers in the future. In addition, the utilities valued the program manager’s high level of involvement, which increased their level of comfort.

The greatest program delivery challenges were the quality and timeliness of the data from the utilities. One agency in particular, with a very small staff and older computer systems, had difficulty providing usable data in a timely manner, although they made a concerted effort to do this. Because actual water consumption could not be reliably obtained from the existing billing system (due to read date and estimation issues), the water agency had to implement a new online meter reading system, allowing them to read customer usage whenever they want to obtain true consumption values. One agency was generally able to provide good data and was very responsive, while the third agency was initially unresponsive until agency management intervened.

Overall, WSO was pleased to work on the project. The primary and secondary research work was very interesting to them, and working with unique water agencies to find unique solutions to conserve water was satisfying. In particular, WSO was somewhat surprised to learn that two water agencies had low levels of leakage, although improvements could still be made cost-effectively.

WSO perceived that the program was beneficial to the water agencies and recommended that it be continued in the future. Future participants should be utilities with the highest energy costs and suspected or known water losses. WSO stated there is no ideal agency size or age of infrastructure to target during recruitment; rather, how the infrastructure was originally installed and how it is managed and maintained matters the most in preventing leakage.

WSO would not change the scope of work, noting that it was very valuable to include fieldwork (i.e., leak detection) to complement the comprehensive audits. The results of the fieldwork can be used to validate elements of the data analysis, and can be an effective tool to demonstrate to agencies that their systems do in fact leak. If the program is continued, WSO recommends including 10 to 15 participant agencies. There were many uncertainties when the three agencies

were scoped, and the contractor could reduce risk and save budget if more agencies were audited as part of a single contract.

Participating Customer Experience, Satisfaction and Challenges

Apple Valley and Las Virgenes learned of the Leak Detection program because of their long-standing good relationship with the SCE program manager. SCE and the water agencies had discussed participating in such a program before the Pilot was approved, and SCE staff knew that these agencies were interested in such a program. Lake Arrowhead came into the program later when the program budget for primary research was increased. The agency had been targeted to participate in a different Pilot program, but that program had an ambitious scope and fast timeline that Lake Arrowhead would be unable to meet given its small staff size. The agency expressed its interest in this Pilot, however, and enough resources were available to include them in the program.

Initially the participating agencies all had a general understanding of the Leak Detection program, but they were not aware of the details—data requirements, staff time requirements, coordination logistics, and the timeline. All three agencies reported that the project managers at WSO and SCE provided a comprehensive work plan and a good explanation of the whole process at the kick-off meeting. In particular, the initial presentation for the program was very clear and thorough and the agencies developed high confidence in WSO.

The agencies were required to provide substantial amounts of data to WSO, such as customer information and water purchase data. To conduct district-level leak detection, they had to isolate subsystems by turning pumps on and off and read meters in the field. Although one agency was initially concerned about the required staff time, in retrospect they considered the time requirement to be reasonable. Staff time devoted to the project was an opportunity to learn about leak detection procedures, and it was time well spent.

All of the agencies reported that communication with SCE was very good throughout the program. The SCE program manager explained the program well and was easy and enjoyable to work with. He was able to get agency staff excited about the program and its goals.

The three agencies also gave very positive reviews of WSO staff. The project manager was very professional, provided advance notice of upcoming activities and required data, and managed the project very well. Two of the agencies noted that WSO was very skilled at tactfully managing communications with agency staff. Agency staff were initially resistant to the program, because they equated water losses with their own poor performance, and thus were reluctant to discuss leaks at all. But WSO was able to “win over” water agency staff with tact and humor, and clearly explain the impetus and the mechanics of the Leak Detection program. Ultimately staff came to look forward to WSO’s visits. One agency project manager said that an internal cultural shift had occurred, and now staff are more willing to address leaks.

All participating agencies reported a high level of satisfaction with the program, which went beyond its stated goal of detecting and repairing leaks. One agency noted that its audit changed the way it will review its systems in the future. It had completed four audits in the past, but the results were unusual and confusing. This program provided them with a better understanding of

their system and a new awareness about how to make changes in the future. The agency is rewriting some of its rules and regulations to minimize leakage. Whereas the agency used to dislike audits, it now wants to learn more about its system and how to improve it. The other agencies were also considering changes to their proactive leak detection policies, and had reduced water pressures in some areas and purchased equipment to improve meter testing.

There was also a high level of satisfaction with the quality of work performed by WSO. One agency explained that in the past, they had relied on AWWA protocols for audits. This program was based on the “European model”, which is ISO-based. It focused on the total system, including unaccounted water losses. The audit process required the agency to think differently about its system, but they now have tools to do this work in the future. Importantly, they learned how to effectively detect leaks, which will minimize water losses in the future.

7.5 SCE LEAK DETECTION PROGRAM ISSUES AND OBSERVATIONS

The participant water agencies had high satisfaction with the program because they received comprehensive, detailed and credible information about their water systems, and pragmatic guidance on how to improve their system operations. While some audit findings were surprising or looked at system operations in new ways, other findings validated existing perceptions of system performance and were equally valuable. All of the agencies noted that their system understanding is now strong enough that they can continue to conduct audit activities more regularly on their own. The agencies were also pleased that system leaks had been detected and repaired in the short-term.

It was possible to achieve these results in part because SCE’s program manager was highly involved, increasing the program’s credibility and agency staff interest. Similarly, the experienced contractor was able to clearly present and justify the project goals and tasks, which enhanced the perceived value of audits and reduced staff reluctance to assist with leak detection and data collection tasks.

If the program is continued in some form, participant recruitment will likely require more effort and consideration. Two of the water agencies for this Pilot Program were already “on board” with the concept before the program was fully designed and approved, and it could be more difficult to recruit participant agencies in the future. Furthermore, the program will not achieve significant embedded energy savings if it only attracts water agencies with low levels of existing leakage. Lastly, the program would need to strike a balance between providing comprehensive (and costly) water system audits and funding short-term leak detection and repairs, which would lead to short-term energy savings. This could require different funding/partnering strategies and a streamlining of program services.

Program Recommendations

Based on the evaluation results, the following are recommendations for the Leak Detection program if it continues in the future:

- **Efficiently screen prospective participants for (relatively) high expected leakage and/or high energy costs.** The agencies participating in this program received comprehensive water audits and system evaluations, in addition to demonstrations of

district leakage measurement techniques and active leak detection. Simplified screening methods and a structured approach are needed to identify and prioritize water agencies with more economically recoverable leakage, as not all water agencies will be optimal candidates for proactive leak detection. Future program offerings may primarily attract water agencies that are most inclined to proactively manage their infrastructure and have lower leakage, since both infrastructure maintenance and water audit participation require dedication of staff resources.

- **Have prospective participants provide information about their data and billing systems during the recruitment process.** This could help to screen out agencies with problematic data systems, or to allocate more program budget to these agencies to address data collection and cleaning issues.
- **Engage high-level water agency staff as project managers.** Agency engineers and operations staff can sometimes “downgrade” conservation staff priorities during busy operational periods. High-level project managers with broad oversight can help to keep all areas of the agency appropriately engaged in the audits process.
- **Discuss cultural issues with the agency project manager at the beginning of the project.** Water agency staff may perceive the audits and/or leak detection results as a criticism of their work. Eliminating or reducing these perceptions is essential to getting staff to cooperate with the program auditor and proactively utilize the results and recommendations in the future.
- **Inform water agencies about embedded energy data that will be required of them during recruitment.** Management staff at one water agency expected that water and energy data would need to be supplied to program evaluators, while operations staff at the other two agencies were not expecting to provide these data, though their managers may have been aware of the need (they did not know). Staff at all three agencies were surprised at the level of detail of the data requested and the amount of staff time needed to collect the data. The water agencies need to understand up front what types of data will be required from them, so that appropriate agency staff can plan accordingly.

8. SCE/SCG LAKE ARROWHEAD PROGRAM RESULTS

8.1 SCE/SCG LAKE ARROWHEAD PROGRAM BACKGROUND AND CANCELLATION

For this program, SCE and SCG planned to partner with the Lake Arrowhead Community Services District (LACSD) to deliver indoor water-conserving devices to year-round residents and outdoor landscaping retrofits to some of the largest residential consumers of water, as identified by LACSD. Indoor measures included High Efficiency Toilets (HETs), High Efficiency Clothes Washers, low-flow shower heads, and sink aerators, while outdoor measures include “smart” envirotranspiration (ET) irrigation controllers and sprinkler head retrofits. SCE and SCG planned to co-fund LACSD’s proposed program to expand the number of homes that can be served. LACSD’s role was to identify candidate homes, coordinate delivery of the program and provide funding to purchase the water conserving devices, with contributions from SCE and SCG to complete the purchase of the devices. Customers would then be responsible for the installations, and LACSD would verify that eligible customers had installed the equipment.

After being petitioned by SCE and SCG, the program was officially cancelled by the CPUC for three primary reasons:

- **LACSD could no longer support the initially approved program due to staffing changes and constraints.** Between the time the program was conceptually designed and the CPUC gave its official approval, LACSD replaced three of its five board members, including the chairperson who originally championed the approved program. The agency also changed some of its operational staff, including the general manager. These changes delayed implementation coordination with the IOUs, and then LACSD withdrew its support for the program citing limited staff resources and time constraints.
- **LACSD approved a new ordinance that significantly affected the approved program design.** In June 2008 the agency adopted a new ordinance that limited irrigation to Mondays, Wednesdays and Fridays, affecting the program’s outdoor conservation measures. First, it would change the baseline water usage used to calculate water savings and embedded energy savings. Secondly, the ET irrigation controllers would be rendered useless and unnecessary.
- **No alternative program designs were found to be viable.** After the new outdoor irrigation ordinance was passed, the IOUs and LACSD met in person and conducted several phone calls to consider three potential alternative program designs. One program would pay residents to replace grass turf with less water intensive landscaping. Another option was to incentivize commercial HETs and waterless urinals. The last alternative was to replace two school soccer fields with synthetic turf. The first two alternatives were dropped due to cost-effectiveness and timing concerns, while the third alternative was also dropped due to time constraints and concerns about school district and community acceptance.

9. SDG&E MANAGED LANDSCAPES PROGRAM RESULTS

9.1 SDG&E MANAGED LANDSCAPES PROGRAM BACKGROUND

The Managed Landscapes Program focused on increasing the efficient use of outdoor potable water used for aesthetic landscapes. According to the program planning documents, about 60 percent of all municipal and industrial water is used on landscaping in an average year, and thus the efficient management of this water use is critical to achieve water and energy savings. This is especially important since nearly half of all landscape water use takes place in May, June, July, and August when treatment and delivery systems are strained to meet demands. This time frame also coincides with the peak electricity demand period.

SDG&E solicited competitive bids from water management service companies to implement the program, and the contractor that was selected utilized proprietary equipment and software to convert conventional irrigation controllers into controllers that utilize daily evapotranspiration (ET) and weather information to automatically and dynamically control the amount of water used for irrigation. Under the final program design, SDG&E paid for the first year equipment and installation costs at each site. After that time, participants could sign a separate agreement with the contractor to provide continued services for an extended period. Water savings incentives were also available from through the Save a Buck Program offered by Metropolitan Water District of Southern California (MWD). The availability of these MWD incentives, however, was short-lived. Only 6 of the 13 participating sites received approval for the incentives prior to the program being discontinued.

The Managed Landscapes Program was conducted in the San Diego region and targeted multifamily apartment complexes, condominiums, office parks, commercial properties, homeowner associations, and estate properties. To participate in the program, properties had to have a minimum of four irrigated acres and five or fewer existing irrigation timers, and be approved by SDG&E and MWD.

Program Goals and Achievements

The program goal was to serve about 20 sites with 3 to 5 controllers each, for a total of 60 to 100 installed controllers. The goal was flexible by design to reflect variable service costs and hardware configurations that might be required to serve unique sites.⁴⁶

When the program ended, 71 controllers had been installed at 13 sites, which satisfied the terms of SDG&E's contract with the installation contractor.

According to customer tracking data submitted to the program by the contractor in May 2010, the 13 sites collectively saved 44.6 million gallons of water, and site-level water savings ranged from 21 to 49 percent of baseline consumption. Another site was also recruited into the program and the contractor initially installed the irrigation monitoring equipment. This site later dropped out of the program, however, as the homeowners association was unable to rectify existing

⁴⁶ For instance, different sites could require 18, 24, and/or 36-channel controllers.

irrigation problems in a timely manner, and never allowed the program contractor to activate their service for a sufficient period of time.

9.2 SDG&E MANAGED LANDSCAPES PROGRAM LOGIC MODEL AND PROGRAM THEORY

The following program theory for the SDG&E Water Pilots Managed Landscapes Program builds on the program logic model and provides additional detail on program activities, outputs, and outcomes.

ACTIVITIES

Partnership formed with water agency

SDG&E partners with San Diego County Water Authority (SDCWA) to develop a program to install irrigation controlling equipment at sites with high outdoor water usage. This equipment incorporates real-time weather data to monitor watering times, and tracks metered usage. The goal of the program is to achieve both water and energy savings due to the equipment installations.

Irrigation controls installations

A contractor is hired to recruit large outdoor water users and install/maintain irrigation controls equipment at participant sites. The program goal is to serve up to 20 sites with up to 100 irrigation timers.

Customer recruitment

The contractor identifies large outdoor water users that could potentially benefit from new irrigation controlling equipment. These users include: multifamily apartment complexes, condominiums, office parks, commercial properties, and homeowners associations. Candidate sites must have at least 4 irrigated acres, five or less existing irrigation timers and dedicated outdoor water meters.⁴⁷

Equipment and water savings incentives

SDG&E pays for the first year equipment and installation costs at each site. Water savings incentives are also available from Metropolitan Water District (MWD), equal to the lesser of total first year project costs or \$3.00 per 1,000 gallons of water saved for one year.⁴⁸

Verification and QA

SDG&E and MWD have established procedures to conduct post installation inspections for program participants.

⁴⁷ One exception was made to the requirement for dedicated meters.

⁴⁸ Due to the unanticipated termination of MWD's program, not all participants were able to apply in time to take advantage of the incentive.

SHORT TERM OUTCOMES

SDG&E customers informed of installs opportunity by contractor, water savings estimated

The contractor is able to successfully engage the appropriate decision makers at the large irrigation properties. These contacts understand the program opportunity and its potential benefits to them, and file a Statement of Interest application with MWD, which includes water savings estimates calculated by the contractor.

Irrigation controls equipment installed

After MWD and SDG&E approve the candidate sites, the contractor installs the irrigation controls equipment, which the properties can use at no cost for one year. (After that time, they may sign a separate agreement with the contractor to provide continued services for an extended period.)

Installations verified, partial water savings incentives paid to customers

MWD inspections staff visit participant properties and confirm only that the irrigation controls have been installed. After confirming that the equipment has been installed and is operational, MWD pays the property one-half of the total incentive payment. SDG&E inspections staff also conduct their own verification site visits to ensure that the irrigation controls have been installed.

MID TERM OUTCOMES

Water savings achieved, reduced customer water bills

After the irrigation controllers have been installed, properties have reduced water usage, which translate into reduced water bills. Some properties elect to sign extended contracts with the installation contractor based on their positive trial experience.

Remainder water savings incentives paid to customers, potential performance bonus payments to contractor

After the one-year trial/monitoring period, during which the contractor documents actual water savings, customers receive the second half of their incentives from MWD. The contractor may also receive a performance bonus payment if aggregate water savings are greater than 20 percent during the term of the contract. These savings can include customer-paid leak repairs necessary to make the new irrigation measures a worthwhile investment.

kW, kWh savings for water suppliers, reduced operating costs

When large irrigation properties reduce their water consumption, upstream water suppliers realize indirect/embedded energy savings, by reducing surface conveyance, groundwater pumping, treatment, and distribution.

Improved understanding of embedded energy in water services

Analyses conducted by M&V contractors quantify the embedded energy savings that water suppliers are expected to realize. The findings are published so that the CPUC, SDG&E, and

water agencies have an improved understanding of the embedded energy in water supply and treatment systems. Data from the evaluation are used to update the embedded energy calculator, which allows for simpler estimation of embedded energy savings for future programs.

LONG TERM OUTCOMES

Additional measures (previously considered not cost effective) are now considered cost effective

Irrigation controllers that were once considered not cost effective based on water savings alone may now pass the cost effectiveness test when embedded energy savings are also considered.

This may allow SDG&E to justify including irrigation controllers in other efficiency programs.

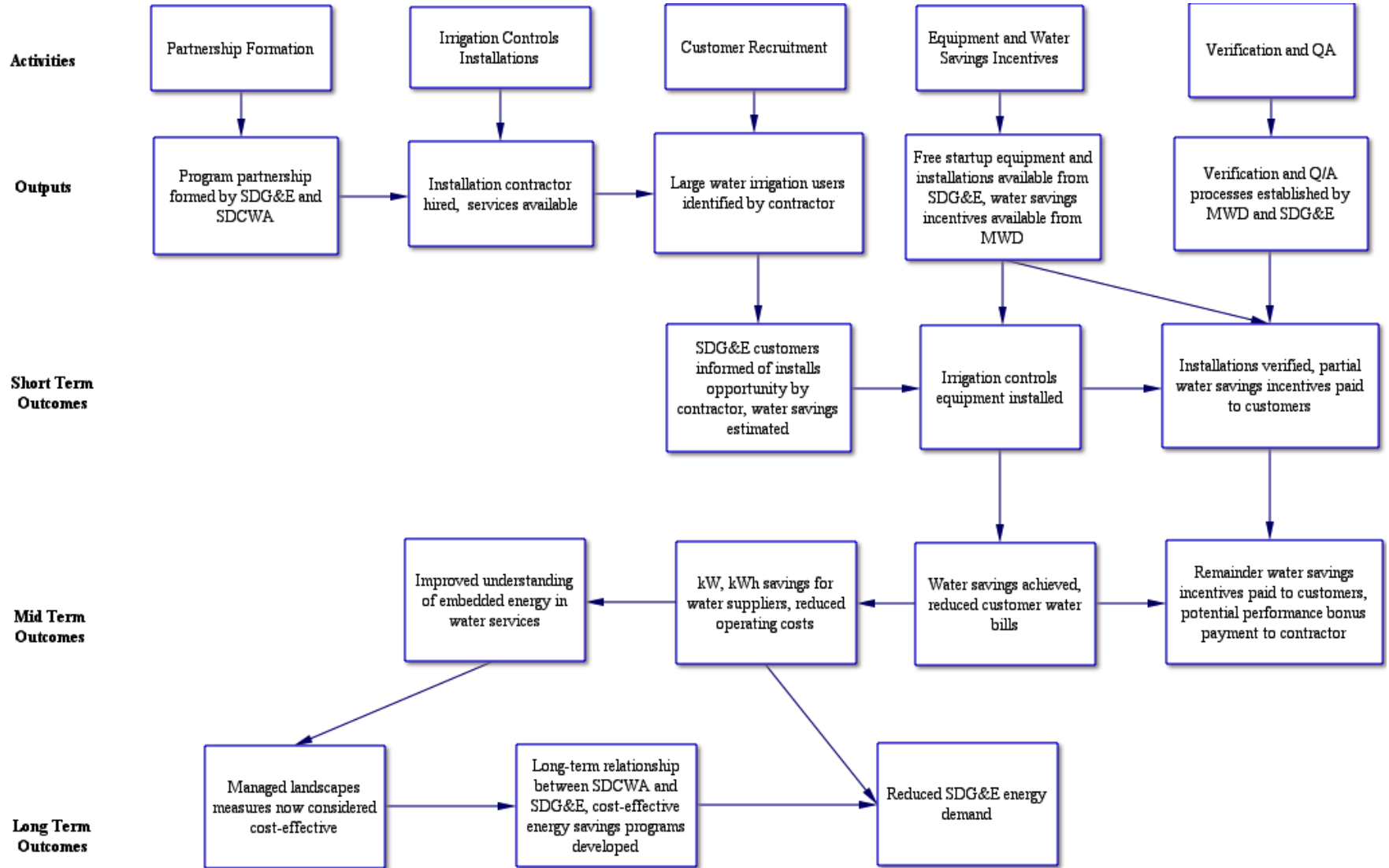
Long-term partnership between water agencies and SDG&E, cost-effective energy savings programs developed

The partnership program has successfully targeted and served large irrigation properties and has achieved both water and embedded energy savings. If the installed measures are found to be cost-effective to SDG&E based on the embedded energy savings, then they may be included as part of a longer-term partnership program between SDG&E and the water agencies.

Reduced SDG&E energy demand

Large irrigation properties utilize SDG&E's new program, creating additional embedded energy savings to upstream water suppliers. As a result, SDG&E achieves long-term energy savings and California's electric grid is positively impacted.

Figure 7: SDG&E Managed Landscapes Program Logic Model



9.3 SDG&E MANAGED LANDSCAPES PROGRAM EVALUATION OVERVIEW

For this program evaluation in-depth interviews were conducted with:

- 1) The SDG&E pilot program manager
- 2) The program manager at SDCWA
- 3) The program implementation contractor
- 4) Four program participants⁴⁹

All of the interviews were conducted between November 2009 and March 2010. Following are some of the topics that were discussed during the interviews:

- Ease of partnership formation
- Success of customer recruitment
- Ease of customer participation
- Program implementation successes and challenges
- Customer satisfaction with installed measures and participation experience
- Success of program coordination and tracking activities
- Overall satisfaction among IOU staff, water agency staff, customer participants and the program vendor

Detailed results of the data collection and analysis are discussed below.

9.4 SDG&E MANAGED LANDSCAPES PROGRAM EVALUATION RESULTS

Partnership Formation and Program Delivery

According to program managers at SDG&E and SDCWA, the Managed Landscapes program was fairly easy to establish and deliver. The two agencies had a Memorandum of Understanding to collaborate on the program, whereby SDG&E was responsible for contracting with a landscape management company and paying for participants' first-year expenses. (Participants could also receive incentives for actual water savings through MWD's Water Savings Performance Program.) SDCWA contributed \$25,000 to the program, helped to select the program contractor, and provided technical assistance to SDG&E staff, who are less familiar with irrigation and water conservation issues (e.g., SDCWA ensured that the contractor normalized water savings to account for weather data). SDCWA only became directly involved

⁴⁹ Other participants did not respond to interview requests.

with specific customer issues when “performance problems” arose, such as when MWD could not give incentives after its funding ended, or when delays were encountered in obtaining billing history data for the participant sites (described in more detail later).

The program contractor was responsible for customer recruiting, and it was assumed that they would utilize lists of current customers, property management companies and large water users identified by local water retailers. One of the reasons that the implementation contractor was selected was because they had already done preliminary analyses of some sites by assessing historical water usage data.

SDG&E was responsible for verifying that the monitoring equipment had been installed, and did so for all participant sites, noting that the site visits went smoothly.

According to the SDCWA program manager, a contractor performance incentive was introduced to ensure that the contractor not only installed, but also monitored and adjusted the “smart controllers” to ensure water savings were achieved. Observations from past programs showed that “smart” controllers were too often programmed incorrectly by the installation contractors, thereby diluting water savings attributable to the device. The implementation contractor for the program was specifically selected because their proprietary system is designed to overcome this deficiency, by remotely and automatically adjusting watering schedules in advance based on changing weather forecasts.

To ensure water savings, a contractor performance incentive was devised that was payable only if the program achieved 20 percent water savings overall (i.e., across all sites combined). If large leaks were discovered prior to the equipment installation, the landscaper was expected to make improvements first, and the contractor’s documented water savings would ultimately reflect savings from the leak repair too (since the leak would have increased baseline consumption).⁵⁰ While the SDCWA manager understood these terms of the contract, the SDG&E program manager did not at the time of the interview, and wondered if large interim savings were due to leak repairs or other factors. (The original program manager had left SDG&E, and this new manager was not very familiar with vendor’s contract, which was also not clearly worded.)

Both program managers stated that the biggest challenge for the program was obtaining variances to local watering restrictions that cities began implementing in June 2009. If these variances could not be obtained, the cities watering schedules would override the program intervention (the contractor’s customized watering schedules) and effectively nullify the program. While four sites did voluntarily adopt the required watering schedules, the other nine sites actively sought variances so they could continue with the contractor’s recommended schedule. The contractor was very helpful in trying to obtain these variances, but the contract required amendments to reflect this out of scope work and costs (\$100 per site).

The process to obtain waivers was sometimes complicated and lengthy, as the Pilot program was charting new ground and gaining traction at the same time that cities and water agencies were

⁵⁰ One site did in fact have a large leak repaired prior to installation of the controller equipment, which was noted on participant tracking information provided by the contractor.

instituting water restrictions due to drought conditions. In addition, the water agencies were concerned about public perception, and thus were very cautious in granting waivers so as not to give the appearance of favoritism. In November 2009 all of the requested variances were finally granted.

Communications between the program partners was described as being sufficient, requiring scheduled phone calls at the program outset but only infrequent coordination on contractor invoices later on (so SDCWA could provide technical reviews if needed). The partners valued the monthly participation/savings updates from the program contractor, but also wanted to know more about customer satisfaction and the condition of sites' landscaping. Overall, the SDG&E and SDCWA program managers were highly satisfied with the program outcomes, with one manager noting that the contractor should also be credited for carefully selecting only very engaged customer sites.

In the future, the managers suggested that water savings be measured by comparing program-served irrigation meters to a control group of meters at the same properties. As water prices, conservation education and punitive fines have all been increasing in recent years, both agencies were concerned that water use at the participating sites was already inclined to trend downward, and that program savings measured by a simple pre/post analysis might be overstated.

Vendor Experience, Satisfaction and Challenges

For this program, the implementation contractor essentially provided the same irrigation management services they would provide to non-program customers. Key tasks included: installing the irrigation monitoring equipment (which utilizes daily weather data), communicating with customer contacts to track emerging issues or problems, reviewing site water consumption and comparing water savings to projections, and delivering status reports to the customer contacts and program managers.⁵¹ The customers' water meters were not read in real-time; instead the contractor obtained monthly water bills as needed from local water suppliers. Other data utilized in the water savings calculations included:

- At least 3 years of historical water usage
- Site and local area average evapotranspiration (ET_o) data
- Satellite maps of property showing irrigated areas (to calculate irrigated area)

Twelve of the 13 properties already had existing irrigation control hardware, and only required the installation of an additional device that works with the contractor's proprietary software. The other site had to get a new irrigation controller, which was modified to accept additional hardware and the contractor's software. While the program goal was to achieve 20 percent water savings overall, the contractor hoped to realize these savings for each participant site.

⁵¹ Customer contacts were property management companies, contracted landscapers and homeowners association representatives.

To recruit participants, the contractor reviewed the company's extensive files on past prospect sites, reviewing historic water use and weather data to see if water savings were still likely. While many of these sites could not utilize the contractor's services earlier because water prices were too low, several projects became feasible due to recent price increases (the contractor was looking beyond the first year of service, which was free to program participants). The contractor also recruited participants by presenting the program at two regional workshops sponsored by SDCWA and via cold calls by company marketing staff.

According to the contractor, some recruits were initially skeptical about the free first year of service, wondering what happens afterward, and questioned the program's legitimacy. To allay these concerns, the contractor provided official program documentation confirming how the program worked (with one free year of service, and an option to continue at regular cost). The contractor also found that many smaller properties (less than 4 acres) were also interested in participating although they did not meet the site size criteria.

The contractor experienced several challenges helping to deliver the program, and one of these was submitting required paperwork on behalf of participants to MWD. The contractor did not initially understand that they were expected to provide this assistance, which required a significant amount of time and effort. While the initial participation/rebate applications were typically approved without any issues, subsequently providing certified water use history became onerous. Some participants gave the contractor spreadsheets with historic water use and others authorized the contractor to obtain water bills from their water providers. However, in all cases MWD required signed documentation from the water providers validating the submitted data.

Most of the water providers were able to provide billing data and certification letters within days of being asked. Some delays were experienced in obtaining water use data, however, due to the "pilot" nature of the program and complexities posed by ongoing water use requests to large institutions. In the case where delays were experienced, a work-around solution was identified (e.g., accessing alternative databases).

By agreement with MWD, the SDCWA program manager was allowed to certify the sites' water use records after conferring with the appropriate water department.

Responding to the differing watering restrictions imposed by local cities during the summer also created challenges for the contractor. Although the contractor's work scope did not require them to seek variances to the (unforeseeable) restrictions, they wanted to do this to maximize customer water savings and allow the program to measure "clean" results.⁵² According to the contractor, most of the water providers provided variances quickly.

Working with MWD also posed some challenges. MWD's site inspections for project verification were coordinated directly with the customer sites (and not the contractor) and sometimes caused project delays. More critically, MWD's irrigation incentives permanently

⁵² Some restrictions (i.e., allowable watering days) were perceived to be very arbitrary and would have no relationship to actual weather patterns.

ended in April 2009. Of the 13 final participant sites, six successfully signed up to get MWD incentives; the other seven sites chose to remain in the program without the incentives.

Regarding the program evaluation, the contractor said that that procedure to normalize water savings was not specified in the contract work scope, and there are several ways to do this, achieving different results.⁵³ The contractor had tested multiple methods and finally agreed with SDCWA to compare current ET rates to historic 3 to 5 year rates in the final savings calculations. In addition, the contractor initially had to respond to several questions and data requests from the impact evaluation team until a process was developed to provide regular program updates. This reporting (also given to other parties) had not caused any problems for the contractor.

Despite the aforementioned challenges, the contractor was mostly satisfied with their program experience. Communications with SDG&E staff regarding contract and payment issues went smoothly, and the contractor appreciated the program manager's efforts to maintain program momentum after the original program manager left SDG&E. The contractor also appreciated assistance from SDCWA staff in seeking solutions to customer billing data and watering variance issues.

Most importantly, the contractor was pleased to find that most of the customer sites had achieved respectable water savings, usually higher than projected. While the contractor sometimes hears of leakage, landscaping or water savings issues, he did not hear of significant problems with this program and believed that he was working with "good" properties with high quality landscapers. The contractor was disappointed, however, that one site dropped out of the program after multiple false starts related to existing irrigation problems.

Participating Customer Experience, Satisfaction and Challenges

ECONorthwest interviewed four participants in the Managed Landscapes program. Three of the interviewed participants represented home or condo owners' associations; the other interviewee worked for a country club. Each had participated in the program for about a year at the time of the interview.

Ease of Participation

The interviewed participants generally learned of the program through the program vendor. Two of the interviewed participants were contacted directly by the vendor, while another participant initiated contact with the vendor after hearing of the program through word of mouth. The fourth interviewee did not recall their initial point of contact.

Joining the program required few hours of the participants' staff time. The vendor covered the cost of installation, and none of the interviewed participants incurred financial costs for their first year of service. Each had to review and sign a document that allowed the vendor to access the interviewed participant's utility billing records. Three of the four participants had to get approval

⁵³ For instance, soil ET rates typically have low variance of 1 to 2 percent, whereas precipitation can have large variance.

from their organization's Board to allow this. One participant provided the vendor with utility bills from the last few months directly.

The vendor was responsible for ongoing daily operations, so the burden on the interviewed participants was low, except when problems occurred. The drawback of the vendor's responsibility for running the equipment was that the participants were reliant on the vendor to fix any problems that arose.

Satisfaction

Three of the four interviewees rated their experience with the program highly. The fourth was quite dissatisfied.

All of the interviewed participants had found participation in the program to be easy, and none had been required to make a large financial investment. All thought that their communications with the vendor had gone well. Because these aspects of the program were not problematic, their overall assessment ultimately depended on two types of results: vegetation health and actual water savings.

Three of the four interviewees said that the new watering equipment caused yellowing or browning of their grass. For one participant, the problem was quickly and easily remedied.⁵⁴ For another, coordinating the vendor's and the landscaper's response to the problem took some effort, but a good solution was eventually reached after the landscaper changed an equipment setting to allow the contractor to irrigate at higher flow rates when necessary. For the last participant, the problem was never satisfactorily addressed.

One of the four interviewees was very satisfied with their water savings. Two interviewees thought that there had been some savings, but did not know how much. In both cases, there were other changes on the property at the same time as the installation that could have also caused significant water savings—municipal water restrictions and landscaping changes. The last interviewee doubted that there had been much water savings, though they had not seen any actual water consumption data. Furthermore, they believed that the equipment was operated and maintained badly, noting that the irrigation system turned on in the rain and at other times when it should not have been on.

Even though three of the interviewees were satisfied with the program overall, it was unclear if any would continue their participation with the program in the future. For all the participants, receiving free services for the first year was a large factor in their choosing to join the program. Having to pay the vendor to run the equipment in the future changed their calculus considerably. However, only the dissatisfied customer had made a final decision to terminate the program. One of the interviewed participants had received an offer for five years of incentives from their municipal water district. After the interviewee had received approval from their management to accept the offer, the interviewee learned the offer had been rescinded because Metropolitan Water District had exhausted its funding. That interviewee was still considering participating despite the lack of incentives, but needed their management to reconsider the offer.

⁵⁴ The details of the solution were not described.

Only one of the four interviewed participants had been affected by program verification activities. That participant had participated in an on-site audit by a consultant sent by a local water agency. That interviewee did not mention this audit having been a burden on staff.

Suggestions

Interviewees' suggestions for improving the program included the following:

- Work with participants to allow them to make “apples-to-apples” comparisons with other water control equipment
- Give more information up front about how participation continues or terminates after the first year (although no participants stated that they were confused about this)
- Operate and maintain the systems better—work more closely with property managers to make sure their needs are being met
- Publicize the program better
- Provide longer-term incentives. Although the no-cost first year is enticing, the managers need ongoing incentives to justify continuing their participation

9.5 SDG&E MANAGED LANDSCAPES PROGRAM ISSUES AND OBSERVATIONS

One of the program partners believed that the program could have served more sites (i.e., closer to 20) if the final CPUC decision to approve the program had not been delayed and the contractor had more time to conduct additional recruitment. In hindsight, however, they believed that the program may have benefited from the delay, since MWD subsequently ran out of incentive funding, which could have increased program dissatisfaction.

From a delivery standpoint, the biggest program challenges pertained to obtaining authorized water consumption data and reacting to watering restrictions imposed during the program period. Fortunately for the program, the persistence of the contractor and SDCWA staff overcame these challenges and no sites were forced to drop out of the program. If the program is to continue, however, these issues should be anticipated and addressed proactively, particularly if drought conditions are expected to persist in the future.

On the administrative side, the contract language regarding the contractor's incentive payment was unclear and could be improved. While it suggests that the 20 percent savings requirement pertains to all sites combined (and this is what the agencies believed to be true), it could also be interpreted to pertain to each individual site. In addition, while the contract notes that the contractor's claimed savings cannot be negatively impacted by factors beyond their control (e.g., new plantings that require additional watering, new leaks that are not repaired by the property owner), it does not clearly define allowable claimed savings beyond normal irrigation management (e.g., major leaks that are repaired proactively *before* the equipment is installed). The contract does note that proactive leak repair and other site enhancements are permissible if purchased separately by the customer, and that these changes would be reported to SDG&E in the contractor's audit reports. However, it is not clear if or how these changes affect the savings calculated for incentive payments.

Despite the aforementioned challenges, the program partners were satisfied with the overall program delivery and outcomes, and according to SDG&E staff, this was the most “smooth running” of the SDG&E Pilot programs. Dividing the administrative and technical review functions between SDG&E and SDCWA worked well for both agencies, and did not seem to inconvenience the implementation contractor. In particular, the program partners thought that the contractor incentives were a valuable program feature (though there were difficulties with measurement) and improved past conservation initiatives by focusing more on achieving actual water savings.

Program Recommendations

Based on the evaluation results, the following are recommendations for the Managed Landscapes program if it continues in the future:

- **Improve program communication and coordination with water retailers.** Before program vendors and participant site are recruited in the future, SDG&E and/or SDCWA should work with local water providers to establish or understand their procedures for obtaining water consumption data, and document these procedures for implementation contractors (who might then share this information with participant sites, depending on the responsibilities defined in the vendor contract). Similarly, processes for obtaining water restriction variances could potentially be clarified before future program implementation.
- **Inform water agencies about embedded energy data that will be required of them.** One water agency that serves one customer site provided water and energy data after being contacted by the impacts evaluators, although they were not expecting to provide these data. Another water agency that serves multiple customer sites did not provide data until the spring of 2010 after multiple requests from the impacts evaluators and EEW Study 2.⁵⁵ At both agencies, multiple staff were involved in compiling the data, and multiple emails and phone calls were required to review and clean the data. In the future, the water agencies need to understand up front what types of data will be required from them, so that appropriate agency staff can plan accordingly.
- **Develop more detailed contracts with implementation vendors.** The contracts should explicitly define how savings goals are applied for incentive payments (e.g., aggregate savings versus site-specific savings), what types of water savings can be claimed or not (e.g., from leak repairs), and how water savings should be normalized. In addition, the contract should clearly describe the extent to which the vendor is expected to assist participant sites in completing program paperwork.
- **Consider multiple vendor incentive payments.** Under the program contract, the vendor’s equipment only had to be installed for 3 to 6 months for a site to be included in the calculation of water savings incentives, although most sites were expected to retain

⁵⁵ Other smaller water agencies were not asked to provide data, as their customer sites were not included in the impact evaluation sample.

the equipment for the full 12 months of free service. In the future, a portion of the incentive payment could be paid for a shorter installation period, with remainder payable upon completing 12 or more months of program participation.

- **Focus future targeting efforts on multifamily properties.** These properties appear to be the most sensitive to water prices, which are increasing along with fines for water misuse.
- **Monitor landscape condition and customer satisfaction periodically.** Either SDG&E or the vendor(s) should obtain formal feedback from participant sites at regular intervals to ensure that excessive drying and browning is not occurring, to reduce customer dissatisfaction.
- **Consider other approaches to measure program savings for the impact evaluation.** For example, water consumption for program-affected irrigation controllers could be compared to other irrigation meters at the same sites to see if water use is being reduced generally, so program water savings are not overstated.

10. SDG&E RECYCLED WATER RETROFITS PROGRAM RESULTS

10.1 SDG&E RECYCLED WATER RETROFITS PROGRAM BACKGROUND

This Pilot program increased the use of recycled water by assisting retrofit projects that switched from a potable water source to a recycled water source. To implement the program, the San Diego County Water Authority (SDCWA) and its member agencies identified sites with completed retrofit plans that would allow the customer to switch from potable water usage to recycled water usage during the program period. After the final program participants were selected by SDCWA, SDG&E provided matching capital funding to projects that completed installation and started operations during the program period.

Program Goals and Achievements

The program goal was to assist “about 6” retrofit projects that would be selected after the program was approved by the CPUC. Six projects were selected and all six were installed and operational before December 31, 2009 when the program ended. Based on fiscal year 2007 water consumption data submitted with the project applications, total potable water savings would be over 150 acre feet per year.

10.2 SDG&E RECYCLED WATER RETROFITS PROGRAM LOGIC MODEL AND PROGRAM THEORY

The following program theory for the SDG&E Recycled Water Retrofits Program builds on the program logic model and provides additional detail on program activities, outputs, and outcomes.

ACTIVITIES

Partnership formed with water agency

SDG&E partners with San Diego County Water Authority (SDCWA) to develop a program to convert potable water users to recycled water sources. By switching customers to a water source with lower overall energy requirements, the program will achieve energy savings.

Customer recruitment

SDCWA and its member agencies identify substantially complete retrofit plans that can be implemented within the program period.

Projects funding

SDG&E provides matching funding to pay for capital improvements, not to exceed \$50,000 per installation. (Some projects also obtain small funding amounts from Metropolitan Water District (MWD) to apply towards their local match, although MWD has no formal role in the Pilot program.)

Verification and QA

SDG&E has established procedures to conduct pre and post installation inspections for program participants.

SHORT TERM OUTCOMES

Program participants selected by SDCWA

SDCWA selects the final program retrofit sites considering customer type, readiness to proceed, projected potable water savings, total irrigation acreage and detailed capital cost estimates. SDG&E inspectors conduct pre-installation inspections to document baseline conditions.

Recycled water projects implemented at reduced cost to customers

Using their own construction staff or contractors, the project owners proceed to install the recycled water retrofits. The program pays for a portion of the capital construction costs.

Water savings and/or energy efficiency measures verified, incentives paid to customers

SDG&E inspectors conduct post-retrofit inspections. SDG&E pays its portion of the project capital costs (through SDCWA) pending verification that the new systems have been installed and are operating correctly.

MID TERM OUTCOMES

Potable water savings achieved, reduced customer water bills

After the recycled water retrofits are completed, customers have reduced potable water usage. In addition, customers have reduced water bills, as recycled water is typically less expensive than potable water, and because irrigation system improvements decrease overall water use (from any source).

kW, kWh savings for potable water suppliers, reduced operating costs

When retrofit sites reduce their potable water consumption, upstream potable water suppliers realize indirect/embedded energy savings by reducing surface conveyance, groundwater pumping, treatment, and distribution. Overall, these savings more than offset increased energy costs to the recycled water providers.

Improved understanding of embedded energy in water services

Analyses conducted by M&V contractors quantify the embedded energy savings that potable water suppliers are expected to realize. The findings are published so that the CPUC, SDG&E, and water agencies have an improved understanding of the embedded energy in water supply and treatment systems. Data from the evaluation are used to update the embedded energy calculator, which allows for simpler estimation of embedded energy savings for future programs.

LONG TERM OUTCOMES

Recycled water projects (previously considered not cost effective) are now considered cost effective

Recycled water projects that were once considered not cost effective may now pass the cost effectiveness test when embedded energy savings are also considered. This may allow SDG&E to justify including recycled water projects in other efficiency programs.

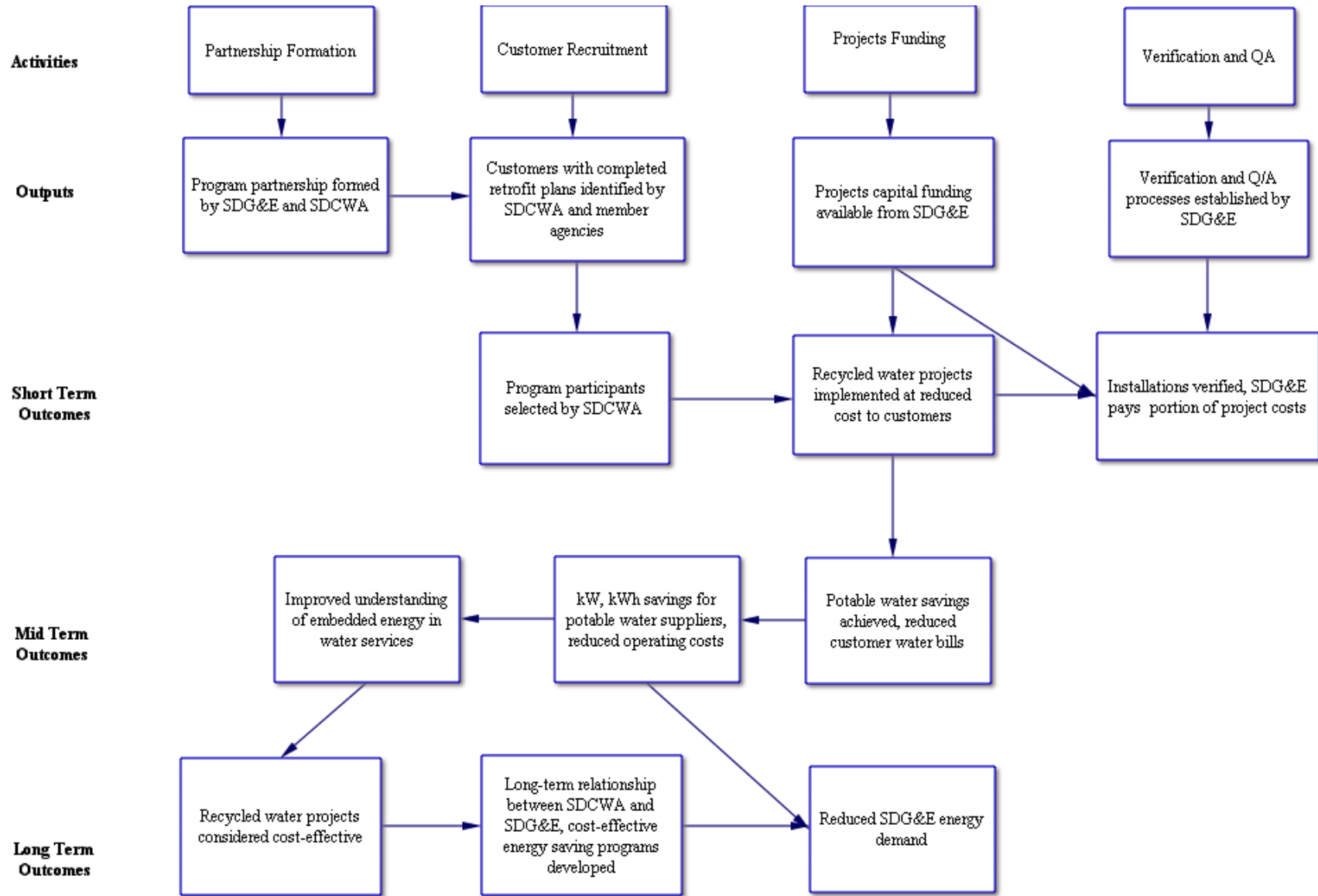
Long-term partnership between water agencies and SDG&E, cost-effective energy savings programs developed

The partnership program has successfully helped SDG&E customers to implement recycled water retrofit projects and has achieved potable water and embedded energy savings. If the projects are found to be cost-effective to SDG&E based on the embedded energy savings, then they may be included as part of a longer-term partnership program between SDG&E and the water agencies.

Reduced SDG&E energy demand

Other potable water users utilize SDG&E's new program to switch to recycled water, creating additional embedded energy savings to upstream water suppliers. As a result, SDG&E achieves long-term energy savings and California's electric grid is positively impacted.

Figure 8: SDG&E Recycled Water Retrofits Program Logic Model



10.3 SDG&E RECYCLED WATER RETROFITS PROGRAM EVALUATION OVERVIEW

The program evaluation for the Recycled Water Retrofits Program included in-depth interviews with the program managers at SDG&E and SDCWA, and the retrofit project managers at the three participating customer agencies (with six total projects):

- Caltrans
- City of San Diego
- City of Carlsbad

ECONorthwest conducted the interviews in September 2009 and January and February of 2010. Following are some of the topics that were discussed during the interviews:

- Ease of partnership formation
- Success of projects identification and selection
- Program implementation successes and challenges
- Public agency satisfaction with retrofit projects and participation experience
- Success of program coordination and tracking activities
- Overall satisfaction among IOU staff, SDCWA staff and agency participants

Detailed results of the data collection and analysis are discussed below.

10.4 SDG&E RECYCLED WATER RETROFITS PROGRAM EVALUATION RESULTS

Partnership Formation and Program Delivery

SDG&E and SDCWA staff members did not describe any problems pertaining to the general contracting between the partner agencies.⁵⁶ For this program, SDCWA also developed contracts with the individual participant agencies, obligating them to contribute matching funding, document project expenses, and complete projects within the program period. Initially, SDG&E did not want to be part of these contracts, but because they were providing project funding SDCWA included SDG&E in the contracts and required participants to return funds to SDG&E if their projects did not pass post-installation verification inspections within the program period.

To recruit jurisdictions, SDCWA emailed a notification of the program's matching funding to all its member agencies, a mix of special districts, water agencies, and community districts. In order to be selected, agencies had to show they could meet the Pilots deadline for installation

⁵⁶ One master contract addressed all three SDG&E Pilot programs.

(originally June 31, 2009) and could match SDG&E's funding. Many jurisdictions expressed interest in the program, but could not meet the installation deadline. SDCWA selected the participants on a first-come, first-served basis, but also tried to accommodate a diversity of end uses and geographic locations that would also generate higher potable water savings.

There were some difficulties tracking and administering the program after the final participant sites were confirmed. In particular, SDG&E staff desired more frequent updates on the projects status from SDCWA. Staff at SDCWA acknowledged that SDG&E was probably frustrated by the irregular updates, but noted that recycled water retrofit projects are inherently slow moving and take a long time to complete as unexpected problems often arise. Because the status of the projects changes slowly, providing updates more frequently than every quarter is not useful or necessary.

SDG&E also expressed frustration at the slowness of the retrofit projects. They noted that the San Diego projects were chronically behind schedule, and were unaware of the reasons why. During the evaluation, ECONorthwest learned that one reason for the project delays was that the City encountered unexpected budget problems and furloughed facilities staff for two weeks. This information was not initially conveyed to SDG&E. As the program progressed, SDG&E staff began contacting the participating agencies directly to get timelier project updates.⁵⁷

Staff at SDCWA perceived that SDG&E expected the projects to be done quickly, although recycled water projects frequently encounter unexpected delays, often during construction in the field or during the permitting process. For example, one project required that neighboring water lines be broken to eliminate potential cross-contamination, while another project required the construction of an earth berm. When it became apparent that some of the projects could not be completed within the original program period, SDCWA staff encouraged SDG&E to work with SCE and PG&E to request a program extension.

SDCWA staff also noted that it took awhile to finalize the process for documenting the projects in order to obtain reimbursement from SDG&E. SDG&E's original program manager did not provide clear instructions to SDCWA on what was required from the participant agencies in order to receive payment, and the documentation requirements had to be confirmed with subsequent program managers. SDCWA had wanted quick and clear resolution of the matter so that staff would not have to contact program participants multiple times to request information.

SDCWA, however, expressed satisfaction with the Pilot Program overall. Staff believed that the program would achieve embedded energy savings, and that SDG&E should continue to fund similar projects in the future. That said, SDCWA wished that they had asked for a higher number of participant projects when the program was conceived. They originally proposed to retrofit 'around six' sites and later tried to increase the figure to eight or ten to obtain a more robust sample of sites, but were informed by SDG&E that this would not be possible because the CPUC had finalized the program design. More sites would have provided more information for the evaluation and would have provided more flexibility if some projects were not completed on time.

⁵⁷ The impact evaluation team, who desired project status updates, also drove these information requests.

Participating Customer Experience, Satisfaction and Challenges

Three different agencies participated in the SDG&E Recycled Water Retrofits Program: Caltrans, the City of San Diego, and the City of Carlsbad. Caltrans and Carlsbad had one project each; San Diego had four projects. ECONorthwest interviewed staff at the three agencies to identify the successes and challenges of the Pilot program.

Participation Process

The three agencies all learned of the program through SDCWA. Agency staff reported that they have regular contact with SDCWA and staff there asked the individual agencies to prepare proposals for submittal to SDG&E.

All of the agencies had already identified sites to be retrofitted to use recycled water. Other funding sources were available to support the retrofit projects, but existing funding was not sufficient to fully fund them. The agencies used the funds from the SDG&E program in combination with funds from the agency itself, SDCWA, and/or Metropolitan Water District. The funding made available through the program reduced the costs to the agencies and moved the six retrofit projects to the top of the agencies' funding queues.

The agencies worked with SDCWA staff to identify sites that would be eligible for the funds from SDG&E. The proposals identified sites, water demand, estimated water savings, and estimated costs. Two agencies noted that they had already submitted costs for retrofit projects to SDCWA. SDCWA contacted those agencies to report that additional funds were available from SDG&E and recommended the agencies apply for those funds. The application process for the SDG&E funds was not onerous, and was a fairly simple add-on to the initial application to SDCWA.

One agency reported that they had already identified three sites to retrofit, and had entered into an agreement with SDCWA to move forward on those projects. Staff at SDCWA then informed the agency that additional funds were available from SDG&E through the Pilot program. Ultimately, the agency had one project selected for inclusion in the Pilot; staff did not know why one project was selected and the other two were not.

The City of San Diego reported that the submittal process was hurried and then it took a long time for SDG&E to confirm that the projects could move forward. The projects were given a year for completion, which initially appeared feasible to City staff. However, it took longer than expected to complete the contracting process with SDG&E and all the retrofit projects were placed on hold until the contract was signed. In addition, the City had a new and slower contracting process with its contractors and this process also took longer than expected. (The City has new administrative rules to ensure transparency, and the new rules slow down the contracting process.) The City noted that SDG&E was flexible and was willing to accommodate the slow schedule.

Satisfaction

The pilot program was relatively straightforward—SDG&E provided funds to support retrofit projects. SDG&E did not work directly with the agencies, and simply provided financial assistance to retrofit public projects that converted from potable water to recycled water. All three agencies reported they had minimal contact with staff at SDG&E.

All three participating agencies expressed satisfaction with the program. It reduced agency costs for retrofit projects, allowing those projects to be implemented. Retrofitting the facilities has reduced agency consumption of potable water.

SDG&E imposed no requirements regarding contracting for the actual work, and the agencies were able to conduct the work in their preferred manner. For example, Carlsbad used City staff to install the infrastructure, but the other agencies relied on private contractors. All agencies were satisfied with the work conducted to complete the retrofits.

All three agencies said that they were aware of the activities to measure actual water and energy savings. All three also reported that the monitoring and evaluation activities were reasonable and did not impose undue costs or demands on agencies staff.

The agencies all expressed appreciation for the funds because recycled water retrofits are costly. One agency reported that the support from SDG&E enhanced the perception that recycled water is supported by a variety of agencies. The financial support is an effective means to demonstrate that recycled water is a cost-effective and important source of water. Another agency reported that the SDG&E funds allowed staff to show management that they were being creative about funding projects and elevated the relative importance of the retrofit projects. Overall, all three agencies were satisfied with the Pilot program. The funds supported projects that the agencies wanted to implement, lowering agency costs.

10.5 SDG&E RECYCLED WATER RETROFITS PROGRAM ISSUES AND OBSERVATIONS

Schedule flexibility (i.e., a sufficiently long program period) is particularly important for recycled water projects, as each retrofit faces unique construction and permitting issues related to location, terrain, and facility uses. In addition, many public agencies have slow moving administrative processes and the program sponsors have no control over the project installation staff and third party contractors. For this Pilot, the program period extension of 6 months was critical in allowing two of the six projects to complete construction and commence recycled water deliveries (in December 2009). SDG&E staff were initially unfamiliar with the unique nature of recycled water retrofit projects, but have more knowledge now that the projects are completed.

All three agencies were satisfied with the pilot project, and appreciated SDG&E's schedule flexibility and efforts to extend the program period so they could resolve unforeseen issues. The program fundings supported projects that the agencies wanted to implement, which lowered agency costs. The SDG&E funds also elevated the priority of these projects within the agencies, enabling the projects to be completed sooner.

Program Recommendations

Based on the evaluation results, the following are recommendations for the Recycled Water Retrofits program if it continues in the future:

- **Make the program period long enough (e.g., at least 24 months) to accommodate likely project delays.** Many projects experience unique and unforeseeable obstacles unless they are entirely within their own easement, and projects with the potential for cross contamination often require remediation resulting in delays. Public agencies may

not be able to expedite projects due to staff constraints and/or adherence to outside regulatory staff inspection and approval schedules.

- **Include more private sector projects.** Some agencies have implemented recycled water retrofits at public facilities for a long time and there are few new retrofit opportunities. Including more private facilities in the program would expand potable water-saving opportunities. Some industrial users, for instance, have large cooling units that use potable water and would be good candidates to switch to recycled water.
- **Inform water and recycled water agencies about embedded energy data needs.** One recycled water provider was unaware of the need for production and energy data for the embedded energy calculations until contacted by the impacts evaluators, and ceased communications after initially providing partial data. Another recycled water provider was unable to provide sufficiently detailed data.⁵⁸ For potable water, one retail agency declined to provide data citing staff constraints and confidentiality concerns, and the other agency did not provide data until spring 2010 after multiple requests, although the need to provide data was clearly stated in the project agreements with the agencies receiving SDG&E funding. In the future, all potable and recycled water providers need to understand up front what types of data will be required from them, so that appropriate agency staff can plan accordingly.

⁵⁸ Specifically, energy consumption is needed for tertiary treatment, which is the incremental energy needed to bring treated wastewater up to recycled water standards.

11. SDG&E LARGE CUSTOMER AUDITS PROGRAM RESULTS

11.1 SDG&E LARGE CUSTOMER AUDITS PROGRAM BACKGROUND

In the past, SDG&E and SDCWA have conducted audits on large customers, but only focused narrowly on energy and water, respectively. To give customers more comprehensive recommendations for both water and energy usage and (potentially) reduce auditing costs, the two agencies formed a partnership to deliver combined water and energy audits to large water users through a two-phased Pilot program.

The first part of the program strategy (Phase 1) was to follow-up on recommendations provided in three large customer audits already completed by SDCWA contractors, upon which the customers had not acted. While these water audits had identified many water savings opportunities, there had been little movement to implement the recommendations due to a variety of customer-specific reasons, such as: lack of funding, competition with other customer priorities, long pay backs, etc. To move high priority, cost effective projects to implementation, SDCWA would research available funding from other water agency incentive programs, and SDG&E could provide supplemental capital funding to fill in funding gaps.

The second part of the program strategy (Phase 2) was to develop and implement an integrated water/energy audit for large customers, where water and energy savings can be significant. Working with an auditing contractor retained through an RFP process, SDG&E and SDCWA coordinated in the development of an integrated water/energy audit template that could be used to conduct water/energy audits of commercial, industrial and institutional high water users in San Diego County. Participant recruitment was conducted by SDCWA, the audits contractor and SDG&E account executives.

Program Goals and Achievements

The program goal was to complete 7 to 10 new, combined water and energy audits for large SDG&E customers (hopefully leading to measures installations). When the program ended, combined audits had been completed for 9 customer sites. For one customer, water savings opportunities were not found at either of two sites. For the other seven sites, potential water savings ranged from 1 to 19 million gallons per year, and totaled to 42.3 million gallons annually. Estimated energy savings from proposed energy conservation measures were not documented in the audits.

Before the program ended, four customers had installed the following measures through the program:

- Toilet flush timers (to prevent misuse and flooding at an institutional facility)
- Water saving toilets, urinals and showerheads
- A boiler water reuse system
- Autoclaves equipment and process changes

- Reverse osmosis process changes

In addition to these measures, the audits also identified other water saving opportunities such as cooling tower process changes (e.g., increased concentration cycles, switching to reclaimed water), changes to ultra-pure water treatment, spill containment equipment, replacing dynamometers with generator sets, and various water reuse processes.

11.2 SDG&E LARGE CUSTOMER AUDITS PROGRAM LOGIC MODEL AND PROGRAM THEORY

The following program theory for SDG&E's Large Customer Audits program builds on the program logic model and provides additional detail on program activities, outputs, and outcomes. (The logic model diagram follows the discussion of program theory.)

ACTIVITIES

Partnership formed with water agency

SDG&E partners with San Diego County Water Authority (SDCWA) to develop a program to provide comprehensive water and energy saving audits to large commercial, industrial and institutional customers. The goal of the program is achieve both water and energy savings due to measures installations and process changes resulting from the audits.

Customer recruitment

SDCWA identifies large water/sewer users that could potentially benefit from comprehensive audits and subsequent measures installations. SDG&E account executives also target large customers expected to have high water usage. Three SDG&E customers that received previous (Phase 1) water audits are also eligible to receive follow-up audits and/or installations funding.

Combined Water and Energy Audits

An audits contractor is hired to recruit from the list of large water users and complete 7 to 10 comprehensive water/energy audits.

Capital funding and water/energy savings incentives

SDCWA and SDG&E provide program funding to pay for the cost of the comprehensive audits, and to defray the cost of some measures installations. SDG&E also offers its standard energy efficiency rebates through its standard core programs. The Metropolitan Water District (MWD) offers incentives based on the amount of water saved through its various programs, and customers planning to install water saving measures are referred to MWD by SDCWA. The MWD incentives, however, are not part of the core program design and MWD has no formal role in the Pilot program.

Verification and QA

SDG&E and SDCWA receive copies of draft audits to provide comments and review potential project work scopes, before final audits are developed. SDG&E core programs have established verification procedures to verify installations of energy efficient measures. MWD has established procedures to verify the installation of measures eligible for rebates through its own separate programs.

SHORT TERM OUTCOMES

Large SDG&E customers informed of audits/installs opportunity by contractor

The contractor is able to successfully engage the appropriate decision makers at the large customer companies. These contacts understand the program opportunity and its potential benefits to them.

Large customers get combined water and energy audits at no cost, potential water and energy savings identified

Decision makers at the large customer companies desire to learn more about potential water and energy saving opportunities, and elect to participate in the program. SDG&E's audits contractor completes the water/energy audits at no cost to the customer.

Water and/or energy saving measures installed, processes changed

The customers receive their comprehensive audit results and understand the savings opportunities and recommended measures and/or process changes. Some companies choose to adopt the audit recommendations and proceed to install water or energy saving measures and/or change their production processes as their circumstances allow (e.g., available company budget, logistics constraints, etc.)

Water savings and/or energy efficiency measures verified, incentives paid to customers

MWD staff verifies the installation of water conservation measures eligible for rebates through its programs. SDG&E's core energy efficiency programs verify the installation of measures and pay out the standard customer incentives.

MID TERM OUTCOMES

Water/energy savings achieved, reduced customer water/energy bills

After the measures installations and process changes, customers have reduced water/energy usage, which translate into reduced water/energy bills.

kW, kWh savings for water suppliers and wastewater treatment, reduced operating costs

When large commercial customers reduce their water consumption, upstream water suppliers and downstream wastewater providers realize indirect/embedded energy savings, by reducing surface conveyance, groundwater pumping, treatment, distribution, as well as wastewater pumping and treatment.

Improved understanding of embedded energy in water services

Analyses conducted by M&V contractors quantify the embedded energy savings that water suppliers and wastewater providers are expected to realize. The findings are published so that the CPUC, SDG&E, and water agencies have an improved understanding of the embedded energy in water supply and treatment systems. Data from the evaluation are used to update the embedded

energy calculator, which allows for simpler estimation of embedded energy savings for future programs.

LONG TERM OUTCOMES

Additional measures (previously considered not cost effective) are now considered cost effective

Measures that were once considered not cost effective based on water savings alone may now pass the cost effectiveness test when embedded energy savings are also considered. This may allow SDG&E to justify including water measures in other efficiency programs.

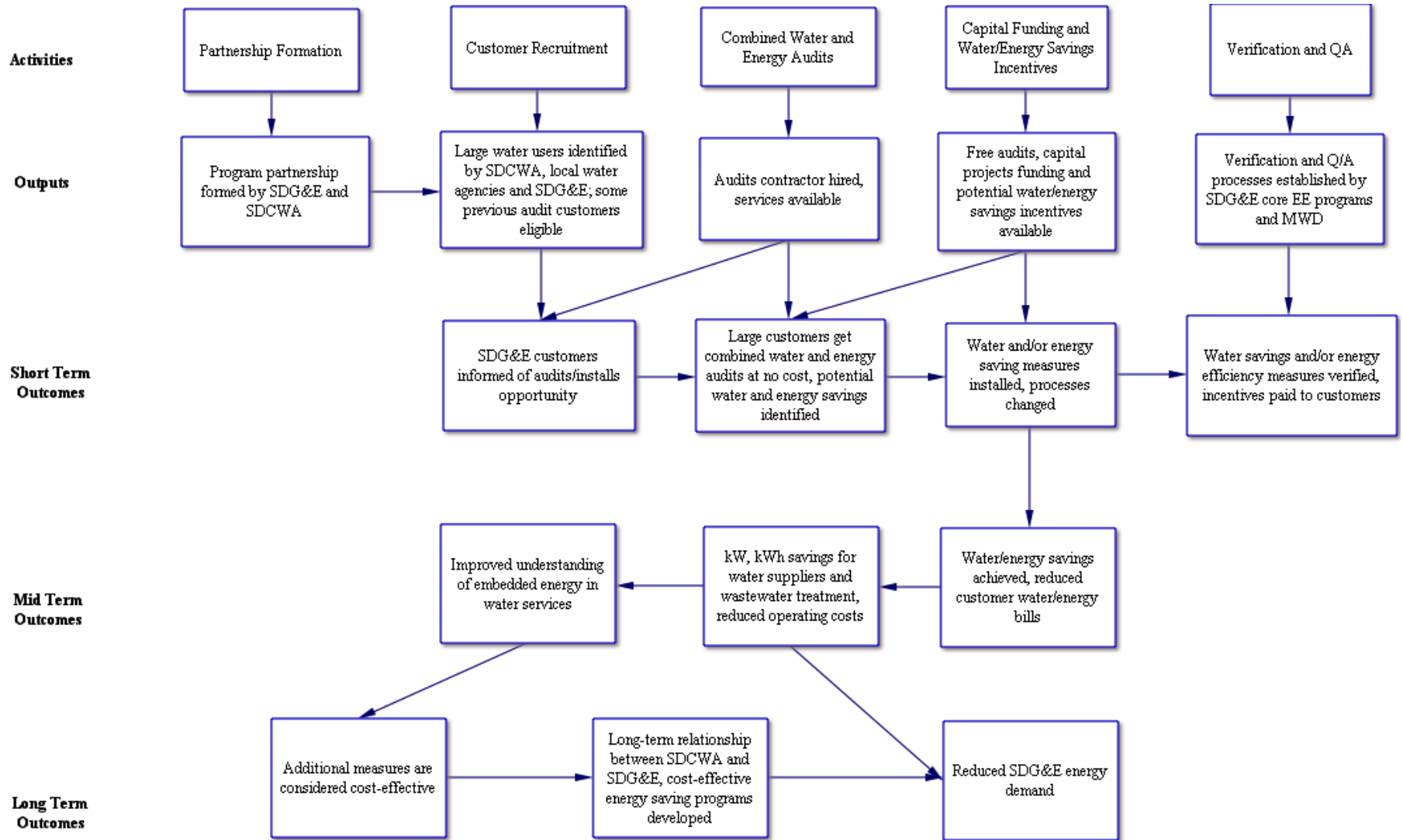
Long-term partnership between water agencies and SDG&E, cost-effective energy savings programs developed

The partnership program has successfully targeted and served large commercial customers and has achieved both water and embedded energy savings. If the installed measures are found to be cost-effective to SDG&E based on the embedded energy savings, then they may be included as part of a longer-term partnership program between SDG&E and the water agencies.

Reduced SDG&E energy demand

Large customers utilize SDG&E's new program, creating additional embedded energy savings to upstream/downstream water suppliers and wastewater providers. As a result, SDG&E achieves long-term energy savings and California's electric grid is positively impacted.

Figure 9: SDG&E Large Customer Audits Program Logic Model



11.3 SDG&E LARGE CUSTOMER AUDITS PROGRAM EVALUATION OVERVIEW

The evaluation activities completed for this program included in-depth interviews with:

- 1) The SDG&E final program manager and interim manager (who administered the program temporarily after the initial program manager left SDG&E)
- 2) The SDCWA program manager
- 3) One SDG&E account manager, representing four participating customers
- 4) Three contractors that participated in the program
- 5) Three customers that installed water saving measures after their audits, and one customer that only received an audit

All of the interviews were completed between November 2009 and March 2010. Following are some of the topics that were discussed during the interviews:

- Ease of partnership formation
- Success of customer recruitment
- Ease of customer participation
- Usefulness of the integrated water/energy audits
- Customer satisfaction with installed measures and participation experience
- Barriers to customer participation and installations
- Success of program coordination and tracking activities
- Overall satisfaction among IOU staff, water agency staff, program vendors and customer participants

Detailed results of the data collection and analysis are discussed below.

11.4 SDG&E LARGE CUSTOMER AUDITS PROGRAM EVALUATION RESULTS

Partnership Formation and Program Delivery

SDCWA's program manager reported that the contracting with SDG&E and contractor selection went smoothly, because the two agencies have collaborated on other programs before and SDG&E is "easy" to work with generally. The interviewed SDG&E program managers were not involved in the contracting for this program and could not comment.

Early in the program rollout, SDG&E's original program manager contacted the three customers that had received previous Phase 1 water audits, to see if they wanted to implement any of the water saving recommendations. One public detention facility wanted to install measures (e.g., toilet flush timers, low flow showerheads), but lacked funding to do so. To assist this customer, the program partners developed a custom cost-sharing plan to cover the capital and installation costs of the project, with SDCWA contributing a relatively small portion and SDG&E contributing the remainder (most of SDCWA's funding was used to pay for the new Phase 2 audits). Initially, the CPUC was not receptive to using program funds to pay for measures installations, and had reservations about the flush timers' potential impacts on inmate living conditions. After learning from SDG&E that similar timers have been deployed successfully at other detention facilities and that the flushing schedule can be manually overridden, the CPUC was confident that inmate living conditions would not be compromised and approved the installation funding. More details about this project are discussed subsequently in this program chapter.

To identify new program participants, SDCWA worked with its 24 member agencies and presented to regional business groups to identify large water users, and passed contact information to the audits contractor. All of the retail water agencies were enthusiastic to help, as this was an opportunity to improve customer service. To be eligible for the program, customers were required to use a minimum of 50 acre-feet of water per year. As the retail water agencies could not share their detailed customer data, actual water usage had to be confirmed with the customers. However, this was not a major obstacle to the program recruitment.

SDG&E also used its account executives to identify potential participants. At this stage in the screening, many large water users became ineligible for the program, as they had already received energy audits from SDG&E in the recent past.

Some customers were interested in receiving an audit, but were really only seeking to develop baseline water usage data. In contrast, SDCWA and SDG&E wanted to serve customers that were truly motivated to implement water saving measures, and it was a challenge to find these firms. As they interviewed potential participants, the auditors sought to understand individual firms' motivations, to increase the likelihood that participants would implement recommended projects.

While it was not hard to identify customers with high water usage, it was impossible to know which firms had funds available to invest in water saving projects, and several firms had no budget available when they were contacted about the program or subsequently audited. One SDG&E program manager noted that if the account executives had focused on this issue early in the program rollout, they could have encouraged their customers to reserve funds for implementation. The SDG&E manager was a new hire, however, and the program was already well underway when they joined SDG&E.

A key challenge for the partnership was the funding problem at MWD. At the start of the program, MWD had funds to pay incentives for a range of water conservation measures, although these incentives were not a formal component of the Pilot Program design and could

not be influenced by SDG&E or SDCWA . As the Pilot was implemented, MWD exhausted its program budget and those incentives were no longer available.⁵⁹ The program managers noted that a large agency like MWD is an important supplement to a program like this, because it can bring substantial funds to the incentive element, even as water prices continue to rise. These incentives are particularly valuable for expensive process change projects.

During the program implementation there were weekly coordination calls between the audits contractor and the program partners, and the auditors also maintained a spreadsheet file listing the customer firms, audit overview findings, and implementation decision status. Once the original program period ended and before the extension was granted, these program updates were briefly suspended. After the program period was extended by the CPUC in late June 2009, SDG&E did not initially receive continued updates from the auditors, but after prompting, their regular reporting resumed. SDG&E's interim manager noted that the program reporting probably stopped because most of the audits had been completed before June 2009 and team calls also ended in June until the program termination or extension was confirmed.

The partner agencies perceived that biotech firms are the most likely type of customer to be interested in the program. In addition, customers that want to be perceived as being 'green' were interested in the program. One such firm implemented measures that were not likely to be cost-effective because they had a corporate-wide directive to pursue environmentally friendly policies.

Both agencies were satisfied with water audits contractor overall, noting that realistic water savings opportunities were identified, and that they responded to requests for additional information quickly and thoroughly. The partner agencies believed that the participating customers received useful information and were probably satisfied with the program, and the only real problem was the lack of funding from MWD, although the program could not control this.

Staff at SDG&E noted that the program was more focused on water than energy—the energy audits were quite brief and lacked detail. The energy audits were done by a subcontractor to the primary auditor contractors, and in the future the audits could be better coordinated. If, for instance, the water and energy recommendations were truly integrated and showed combined water and energy savings (particularly for process changes), the audits might generate more traction with the customers.

Vendor Experience, Satisfaction and Challenges

SDG&E contracted directly with three implementation vendors, with three distinctly different roles:

- The firm that installed electronically controlled flush timers and low-flow toilets and urinals at a detention facility to prevent intentional flooding (this was a Phase 1 customer).

⁵⁹ SDCWA was able to provide "replacement" incentives for some smaller MWD programs (e.g., cooling tower improvements).

- The firm that conducted the Phase 2 water audits. This firm subcontracted with a different engineering firm to conduct the energy portion of the audits.
- A consultant who worked with both Phase 1 and Phase 2 program participants. For Phase 2, they recruited potential participants from among their industrial clients and referred contacts to the water audit vendor for technical follow up interviews. The consultant also knew of the Phase 1 audit results for the detention facility and the installation contractor's experience with prisons, and put all the parties together to update the Phase 1 audit and implement the water saving measures.⁶⁰

For the Phase 1 detention facility project, the installation vendor directly contracted with SDG&E and had a Memorandum of Understanding with San Diego County regarding access logistics and security provision. The contracting process, facilitated by the consultant, was slow because three large agencies (SDG&E, SDCWA, and San Diego County Department of Corrections) were involved and all agencies had their own protocols, which added complexity. Once the contracts were signed the project went smoothly.

The installation contractor reported that the County was highly motivated to complete the project. The County had implemented flush timer technology elsewhere and knew it would reduce water consumption at the site. In addition, the detention facility plumbers were already familiar with the flush timers and low-flow toilets from prior maintenance experience and were proponents of the measures. Due to a swine flu outbreak and other factors the installation process took longer than planned, but the contractor noted that unexpected delays are typical and they always build contingency time into their contracts. The contractor had frequent email and telephone communication with their contact at SDG&E, and they had a good working relationship.

In the Phase 2 portion of the program, the vendors reported that the contracting process went relatively smoothly. The auditing firm had to come to an agreement with SDG&E about the amount of work that could be completed for the allowed budget, and both parties were able to agree to an acceptable scope of work.⁶¹

Identifying customers that were eligible for both a water and energy audit proved difficult, as about half of the candidates had already completed energy audits through SDG&E's core programs. Furthermore, many firms wanted only a water audit or energy audit, and not both. The auditing firm reported that it was easier to find firms interested in a water audit, and they had to work with SDG&E account executives to identify firms interested in energy audits. The water auditor and the consultant assisting them did not perceive much value in the combined water/energy audits, and believed that the program should focus on water audits only. Just as the program had developed some recruitment momentum, MWD terminated its incentives, which reduced the pool of potential participants.

⁶⁰ The Phase 1 audit had focused on cooling and water towers.

⁶¹ Issues that required resolution were: whether or not to require engineering designs (which are expensive and may not be implemented), how many days to spend on-site for each audit, and what constitutes a single audit (e.g., not a large naval shipyard with numerous buildings).

Another challenge was obtaining useful site information during the audit process. The amount of available information varied across the participants. Detailed information was often readily available if the customer had engineers on staff, while other companies had less information about their water using processes, which made it more difficult to develop conservation recommendations.⁶² The auditor made concerted efforts to access the right staff at each firm to answer technical questions.

The auditing firm reported that it was not made clear to them at the beginning of the program who all the players were, and the communications processes were not solidified until later in the program. For instance, they were not aware that another consultant would be utilizing the audits to conduct an impact evaluation, and were surprised when the consultant contacted them seeking audit details and status updates. Furthermore, it was not made clear how the customers were to obtain rebates they were eligible for. Initially, the water auditor instructed customers to contact SDG&E since it was their program, and then subsequent audits included website links to MWD but not SDG&E's core rebate programs.⁶³ While it was not too hard to adjust to these mix-ups, a group call or meeting early in the program to confirm program processes and communications would have been valuable.

A key challenge of the program is that industrial water projects are very expensive, and the cost savings from implementing water conservation measures are relatively small. One vendor noted that potable water is relatively inexpensive, so conserving it is not a priority. Wastewater is a bigger issue for industrial customers than water costs. Not only do firms pay for the volume of wastewater they produce, they pay fines if the water quality does not meet certain standards.

The program goal was to complete between seven and ten audits. They met this goal, completing nine audits. Eight of the audits included an energy audit, but the potential energy savings were very small. The electric measures recommendations were also fairly general (with measures costed on a per-unit basis), as the program budget would not afford more detailed audits.

The vendors perceived that the customers were satisfied with the pilot program. Some customers were particularly motivated—they already had identified potential projects, provided useful background information, and allocated the right staff and adequate time to the audits. Those customers are particularly satisfied. The auditing vendor perceived that other, less motivated customers are unlikely to implement the recommended process changes.

All of the vendors reported that they worked well together and also with staff at SDG&E and SDCWA. SDG&E's interim and final project managers were responsive and flexible in responding to issues, and informal communications by email and phone were sufficient to keep the program progressing. The vendors involved with Phase 1 detention facility installations were particularly pleased that SDG&E strongly supported the project and successfully allayed CPUC's ethical concerns about the toilet timers.

⁶² At one company, the auditor's main contact worked in the accounting department.

⁶³ One customer called the impacts evaluator to inquire about rebates.

Participating Customer Experience, Satisfaction and Challenges

ECONorthwest interviewed four large SDG&E customers to understand their experience participating in the program. The interviews sought to assess: the ease of program participation, quality of interactions with SDG&E, the effectiveness of any measure installations or process changes, the quality of the water/energy audits, and overall satisfaction with the program.

All of the interviewees initially heard about the opportunity to participate in the program through sources outside of SDG&E. One representative of a transportation firm had experience with energy demand response audits in the past. The firm has a third party contact that links potential energy conservation project ideas to funding sources, and as the company was actively trying to reduce its utility costs by modifying manufacturing processes, this contact suggested receiving an audit through the program. A detention facility customer learned about the program from the installation contractor that would subsequently install their measures (they had worked together previously at another detention facility). A large research and manufacturing firm noticed promotions for the program on a website—possibly their county’s website—in addition to receiving program flyers. This firm eventually contacted SDG&E directly to get the latest program information.

The detention facility customer had initial questions about funding their installation projects: Where would the funding come from? Who would pay the upfront costs? How would costs be reimbursed? These and other project issues were ultimately resolved when contracts were developed with SDG&E and SDCWA, obligating the partners to pay the equipment and installation costs. One customer wanted to know which site equipment and processes would be audited, while another was mostly interested in MWD’s incentives. This customer never heard back from MWD after inquiring about the application process, but proceeded with their projects anyway for “ethical” reasons, as the company has a strong commitment to reducing environmental impacts from its operations. They were still disappointed, however, as the estimated incentives would have paid for one of their four projects. Another customer did not recall MWD incentives being available, but was not implementing their projects until 2010 anyway. The other Phase 2 customer believed they had no eligible project costs, but noted that the free audit was incentive enough to participate.

Regardless of their initial questions, all of the interviewees expressed satisfaction with the recruitment process and responsiveness of program contractors and/or SDG&E staff. Generally, firms were asked for documentation of water and electric usage, and SDG&E helped to collect these data. The representative of a manufacturing firm reported supplying as much water and electric data as possible, and facilitated a site visit for an SDG&E contractor to examine the processing equipment.

Three of the customers had installed water-saving equipment in 2009 while one was planning to implement recommended projects in 2010. One research and manufacturing firm changed the chemicals in their cooling towers after the audit confirmed staff estimates of water savings, and also tuned up their reverse osmosis system as recommended by the audit. The transportation firm reported that it was ramping up new installations including a boiler, steam piping, new lighting controls and fixture replacements. These new projects are important because the firm had recently purchased new wash tanks (1,200 gallons each) that will be used to heat water up to 165

degrees, thereby increasing overall demand for heated water. Another research and manufacturing firm implemented four large projects after the audit: (1) cooling traps for autoclave units, saving 3.6 million gallons; (2) reverse osmosis improvements, saving 1.3 million gallons; (3) cooling towers, saving 2 million gallons; and (4) clean steam generator re-piping, saving 750,000 gallons. Not all of the projects were spurred by the program audit; the changes to the cooling tower were recommended in a previous audit by another firm. The detention facility received water-saving equipment such as new valves for flushometer toilets, sensors, controller boxes and wiring and low flow toilets and urinals.

Overall, the interviewees were satisfied with their new equipment and operating procedures. The representative of one of the research and manufacturing firms was pleasantly surprised to save 20 million gallons of water in 2009, which exceeded initial estimates. The firm was very happy that the audit pointed them to the cooling tower project; the autoclaves project had also proven to be a big water saver (and both projects had reduced maintenance costs). The other research and manufacturing firm had reduced its potable water usage by 19 percent in 2009, due to its cooling tower installation and also cooperative weather. The detention facility reported that it now has effective water shut-off controls, which is critical to reduce flooding. Overall, the customer was very satisfied with the new technology; everything had worked as anticipated. They did not yet have an estimate of total water savings, but expected savings as regular flooding incidents had ceased.

All of the interviewees expressed satisfaction with their program experience and interactions with SDG&E and the implementation contractors:

- The detention facility customer reported that initially the installation contractor was using a sub-optimal method of installing valves at a facility with a unique water supply configuration. The contractor corrected the valve issue “agreeably and promptly”, however, and was easy to work with generally. The customer’s interactions with SDG&E staff were also positive—a staff member verified the projects through pre- and post-install visits, and was quick and easy to work with. Overall, the project implementation process went fairly smoothly.
- One of the research and manufacturing firms had good interactions with everyone associated with the program. This firm had few but effective communications with SDG&E, described as brief check-in phone calls. Coordination and data sharing with the auditor went fine, and after the installations were completed the auditor followed-up to ask how actual water savings were comparing to estimates. The audit was informative and especially helpful because this firm does not have the staff resources to conduct its own audits.
- The transportation customer said that interactions with SDG&E consisted of a brief conversation about program criteria and soon after they were working with the auditor. This firm’s experience with the auditor was positive—the on-site audit was completed quickly without any disruptions to normal operations, and the report was clear and comprehensive. The recommendations were comprehensive and useful. Overall, satisfaction with the program was high. The firm did not implement any projects in 2009 due to budget constraints, but was planning for implementation in 2010.

- The other research and manufacturing firm also had positive interactions with the auditor, however the interviewee was a little disappointed that no one at SDG&E followed-up with them after the audit. The interviewee found the auditor to be very professional and willing to work around the company's schedule. Overall, the interviewee was very satisfied with all of their program contacts, noting that the firm had received large benefits in return for little staff effort.

Interactions with the impact evaluation contractor also went well. According to the three customers that were having their projects assessed, the evaluator's sporadic visits only lasted a few hours and were not disruptive to operations due to advance scheduling and planning. The impact evaluators were very professional, courteous and flexible.

The customers noted the following as the most beneficial and useful aspects of the program:

- The water audit was free. Most large companies now have corporate requirements to perform water saving audits. For companies that would pay for these audits, receiving them for free is a major benefit. Few firms have water and energy saving expertise in-house.
- The audits uncovered more water saving opportunities than expected. One firm was pleased that the audit identified additional downstream impacts from the recommended installation projects. Another customer planned to use the audit report as a long-term capital projects planning resource.
- Having access to audit staff to answer additional questions during the project installations was very helpful to the firms.

Regarding potential program improvements, the customers offered the following recommendations:

- Program staff should clarify when projects can be started, and when water and energy savings measurements are needed. One customer was very excited to begin their installations, but then had to pause unexpectedly to accommodate impact evaluation activities.
- Focus more on in-place equipment in addition to water processes. One customer felt that the program should take a whole building approach and consider all technology that is in place, and not focus primarily on processes.

11.5 SDG&E LARGE CUSTOMER AUDITS PROGRAM ISSUES AND OBSERVATIONS

Participant recruiting was a key challenge for this program. In particular, many large water users had already received SDG&E energy audits in the past, and customer budgetary constraints in a poor economy reduced the number of companies that could feasibly consider expensive water

process changes. MWD's loss of incentive funding, although not part of the core program design, exacerbated the recruitment challenges.

The program was most successful at recruiting biotechnology customers, and other biotechnology and pharmaceutical firms are concentrated in the Oceanside and Carlsbad areas.⁶⁴ These firms, however, are often concerned about revealing trade secrets and have many restricted facility areas, making it difficult to conduct a complete audit. Food processing companies also use a lot of water and energy, and the program auditor serves many of these companies in other parts of the state. In the San Diego area, however, there are relatively few food processing companies, and few large industries in general compared to places like Los Angeles County. Going forward, it could be difficult to recruit enough customers to develop a robust program.

One key finding from the recruitment is that the combined water/energy audits should probably be separated. Some customers need water audits, others need energy audits, but few need or want both. In addition, lighting projects do not affect process water or energy at all, and they should not be coupled with audits that are focused on process improvements.

On the implementation side, SDG&E staff turnover and the CPUC's delayed program extension contributed to coordination problems. Participant tracking by the program auditor stopped for a period, and when it resumed it was unclear how to coordinate with the impact evaluation contractor, and who should give participation guidance to the customers. These issues were resolved quickly, however. Overall, SDG&E's program manager would have appreciated more frequent updates so they could proactively tell the impacts evaluator and core programs staff about any high customer interest.

Despite these challenges, the program accomplished its Phase 2 audit goals and also facilitated the installation of new plumbing equipment at a Phase 1 detention facility customer. Program satisfaction among the customers interviewed for this evaluation was very high, due to the high quality of audits, observed water savings after their installations, and positive interactions with SDG&E, SDCWA and contractor staff.

Program Recommendations

Based on the evaluation results, the following are recommendations for the Large Customer Audits program if it continues in the future:

- **Connect all the implementers and evaluators early in the program to confirm process and communications protocols.** The program should plan and document: who gets what information when and how (e.g., completed audit reports), how customers will be instructed to get incentives, if and when other consultants may conduct evaluation, and how customers' installation schedules should be managed.

⁶⁴ SDG&E instructed the program auditor to focus on other types of firms after three biotech audits were completed, to get more participation diversity.

- **Proactively contact potential participants early in the program implementation.** SDG&E account executives should contact their customers to inform them of the program opportunity, so they can reserve budget for water conservation projects. This is particularly important in a poor economy when capital budgets are being reduced.
- **Have customers contribute towards the audit costs.** This would increase their investment in the program, and increase the likelihood that they will dedicate appropriate staff to provide data and answer questions, and then go on to actually implement audit recommendations.
- **Continue to work with large trade associations in customer targeting.** SDCWA presentations to groups like the regional Industrial Environmental Association served to gauge company interest and identify key decision makers (and funding capacity). Local water agencies should also participate in these recruitment efforts, as they are familiar with the largest water users and have contacts at those companies.
- **Remove the energy portion of the audit.** There appear to be relatively few energy audit opportunities among large companies in the San Diego region, and it is more difficult (and expensive) to quantify potential energy savings than water savings. SDG&E would need to ensure that account executives and other sales staff can get credit for embedded energy savings from water conservation projects if they would be expected to market the program.
- **Inform water and wastewater agencies about embedded energy data needs.** One water agency declined to provide potable water data citing staff constraints and confidentiality concerns, and another agency did not provide potable and wastewater data until spring 2010 after multiple requests. Another wastewater agency was unaware of the need for production and energy data for the embedded energy calculations until contacted by the impacts evaluators, and ceased communications after initially providing partial data. In the future, all potable and recycled water providers need to understand up front what types of data will be required from them, so that appropriate agency staff can plan accordingly.
- **Continue to involve wastewater treatment agencies in the program.**⁶⁵ The program could also focus on promoting wastewater energy savings, as treatment and disposal costs are increasing, as well as fines for not meeting requirements. According to some interviewees, the energy and financial savings from reducing wastewater treatment are likely to be greater than savings from potable water.
- **Clearly communicate that financial incentives offered through other conservation programs may not be available through the IOU program cycle.** These incentives can be critical to the ROI for some water process projects, and customers need to understand

⁶⁵ Two firms were recruited through the City of Oceanside's wastewater department.

that these incentives may not always be available and that SDG&E has no control over the incentive levels or availability.

12. SCG GAS PUMP TESTING PROGRAM RESULTS

12.1 SCG GAS PUMP TESTING PROGRAM BACKGROUND

Many water agencies measure the efficiency of their natural gas pumps using assumptions based on standard product load curves, and not actual performance. This Pilot program was designed to conduct gas pump field-testing at Eastern Municipal Water District (EMWD) and Crestline-Lake Arrowhead Water Agency (CLAWA) to measure actual pumps performance and identify equipment maintenance and upgrades that would improve overall pumping efficiency at the water agencies. The program was also to integrate the results of the field-testing into a new gas pump testing protocol that would allow other water agencies to conduct similar testing and improve energy efficiency also. These testing protocols are envisioned to become the basis for future gas pump testing programs delivered by SCG or other gas utilities in California.

Program Goals and Achievements

The goal of the program was to conduct gas pump testing at two water agencies and then develop improved testing protocols to allow future (statewide) testing programs to obtain higher and more accurate energy savings. The program did not have a specific short-term energy savings goal.

While CLAWA dropped out of the program at the very start, the engineering contractor successfully completed gas pumps testing at EMWD and developed new testing protocols within the program period. The contractor was also able to utilize innovative testing techniques and equipment at EMWD, which was a secondary goal of the program. More specifically, a portable torque transducer was used to measure engine output shaft torque and actual mechanical horsepower (which is used to measure efficiency).⁶⁶

In addition, the engineering contractor developed and delivered technical training on the pump testing methods at the conclusion of the program. The training consisted of a morning presentation to SCG Account Executives and an afternoon field demonstration to SCG's service technicians at a water agency that did not participate in the Pilot program. This training was not part of the original program scope, but was added because the program had remaining funds at the conclusion of the testing activities.⁶⁷

⁶⁶ Horsepower can be calculated by knowing the output shaft dimensions, material properties and strain-torque.

⁶⁷ The evaluation team did not learn about this training until after the program-related interviews had been completed, and thus could not inquire about the effectiveness of the training.

12.2 SCG GAS PUMP TESTING PROGRAM LOGIC MODEL AND PROGRAM THEORY

The following program theory for SCG's Gas Pump Testing program builds on the program logic model and provides additional detail on program activities, outputs, and outcomes. (The logic model diagram follows the discussion of program theory.)

ACTIVITIES

Partnership formation

SCG partners with Eastern Municipal Water District (EMWD) to develop and implement a gas pump testing pilot program.⁶⁸ The goal of the program is to develop new gas pump testing protocols that will reveal opportunities for efficiency improvements and actual energy savings.

Gas pumps efficiency testing

Through an RFP process, a contractor is hired to conduct gas engine/pump testing activities, provide project management support and report on the findings of the testing procedures.

SHORT TERM OUTCOMES

Sample of gas pumps selected for testing

During the project scoping process, the implementation contractor, water agency staff and SCG engineering staff collaborate to select a representative sample of gas pumps to evaluate that will reflect a range of pump technologies and ages.

Gas pump testing completed at no cost to water agencies

Working with water agency staff, the contractor completes testing of the selected natural gas engines/pumps. Typically, third-party testing costs are \$2,500 per engine/pump, not including agency staff time.

Efficiency ratings developed, efficiency improvements recommended

Upon completion of the testing, the data are analyzed by the contractor and EMWD receives the efficiency rankings and recommendations for improving the pump and engine efficiencies (e.g., hydraulics changes, parts retrofits and replacement).

Efficiency improvements implemented, increased therm savings

EMWD implements some of the study recommendations in the short-term, achieving therm savings and reduced energy bills.

MID TERM OUTCOMES

⁶⁸ Crestline-Lake Arrowhead Water Agency (CLAWA) declined to participate in the program after being identified as a good program candidate.

New gas pumps testing protocol validated and documented

Further analysis of the data validates the testing procedures, and a new gas engine/pump testing protocol is published by SCG. The new testing protocol gives other water agencies an alternative to relying on product load curve assumptions to estimate efficiency, resulting in higher actual energy savings.

Development of new SCG gas pump testing program

The new testing protocol is adopted into a new SCG gas pump testing program, which incorporates the natural gas engine/pump efficiencies identified during the study, and also the range of potential improvements.

Development/improvement of other IOU gas pump testing programs

Other IOUs may use the results of the study and the new testing protocol to update their existing programs or develop new ones.

LONG TERM OUTCOMES

Therm savings for participating water agencies and SCG

Water agencies utilize SCG's new program (and potentially other IOU programs) and realize therm savings as a result of implementing the new testing procedures and making efficiency improvements. SCG may be able to claim these therm savings.

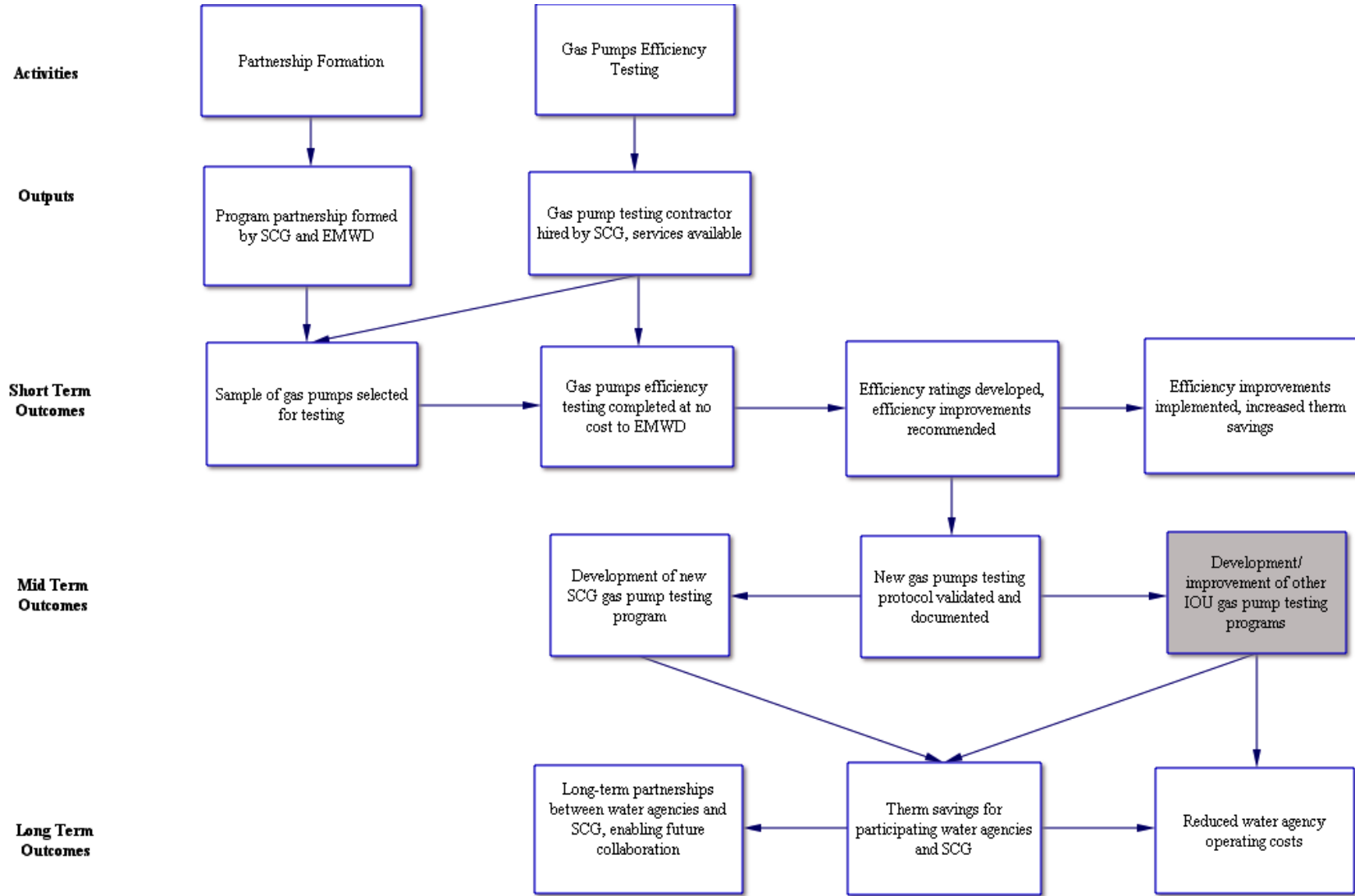
Reduced water agency operating costs

Water agencies that realize therm savings from participating in the SCG program also have reduced operating costs.

Long-term partnerships between water agencies and SCG, enabling future collaboration

SCG's water agency customers perceive value added from the gas pump testing study and new program and are receptive to future collaboration to identify other energy saving opportunities at their sites.

Figure 10: SCG Gas Pump Testing Program Logic Model



Shaded boxes indicate induced outcomes that are outside of the direct program influence

12.3 SCG GAS PUMP TESTING PROGRAM EVALUATION OVERVIEW

The evaluation activities completed for this program included in-depth interviews with:

1. The SCG program manager
2. SCG's senior account executive for water agency customers
3. The project manager at EMWD
4. The project manager for the engineering firm that conducted the pump testing

ECONorthwest conducted the interviews from September 2009 through February 2010. Following are some of the topics that were discussed during the interviews:

- Ease of water agency participation
- Program implementation successes and challenges
- Usefulness of the testing procedures and results
- Water agency utilization of testing recommendations
- Water agency satisfaction with report findings and participation experience
- Success of program coordination and tracking activities
- Overall satisfaction among IOU staff, water agency staff, and program vendor

Detailed results of the data collection and analysis are discussed below.

12.4 SCG GAS PUMP TESTING PROGRAM EVALUATION RESULTS

Partnership Formation and Program Delivery

The SCG Gas Pump Testing Program was planned as a partnership between SCG and two water districts: Eastern Municipal Water District (EMWD) and Crestline-Lake Arrowhead Water Agency (CLAWA). Both districts had already been identified when the pilot was approved by the CPUC. As EMWD is a large SCG customer and a large water district while CLAWA is a small district, the program was designed to develop testing protocols that would be useful to different sized water agencies.

CLAWA dropped out of the program at a very early stage. Agency staff did not attend the first kick-off meeting and did not participate in the program subsequently. Therefore, this evaluation focuses on the interactions between EMWD, SCG, and SCG's engineering contractor. We discuss issues relevant to CLAWA's early departure below, but this evaluation primarily focuses on the experience with EMWD.

Two key staff members at SCG were involved in the Gas Pump Testing pilot: the program manager (PM) and the Senior Account Executive (AE) for all water company accounts. The PM managed the pilot and the AE provided technical advice about water customers and handled most of the communication between SCG and EMWD. Both the AE and the PM stated that they were satisfied with the internal communication for the pilot program. Throughout the program they communicated regularly—many times a day during the initial planning phase of the program and once a week after the program was implemented, relying on a mix of email, telephone, and face-to-face conversations. It was valuable to have the AE directly involved in the program because they had a deeper understanding of water industry operations than the PM and were able to give valuable technical advice.

The program had already been planned and an RFP for engineering assistance had been issued when the PM took charge of the program. SCG received no bids on the first issue, so the new PM reworked the RFP and distributed it more broadly. SCG received three bids with the second issue, and selected an engineering firm. The contracting process went smoothly and none of the program participants noted any administrative problems.

The approved program was initially scoped to test over 90 pumps. Once implemented, however, the figure was reduced to 15 pumps representing different models and ages, and the program budget was also reduced. The PM was not sure why so many pumps were noted in the initial scope of work, and felt that reliable testing results could be obtained more cost-effectively with a smaller sample of pump combinations. Importantly, the program involved testing pumps that are regularly in use. This required substantial coordination on the customer's part to take pumps off-line, ensure that other pumps were working during the tests, and align these activities to the engineering contractor's schedule. Coordinating schedules was difficult, but the team successfully worked through these issues.

The partnership worked particularly well with this program. SCG staff reported that EMWD was engaged and enthusiastic about the program, and there was a significant amount of communication between the customer and SCG. In particular, the AE understood the customer's needs, constraints and operations very well and was responsible for most of the communication with EMWD. The high level of participation by the AE positively affected the program.

Overall, staff at SCG were highly satisfied with the pilot program, which yielded reliable data and a new and better approach to calculate energy savings. Additionally, it generated goodwill between the EMWD and SCG. SCG staff perceived that the Pilot was successful and the new testing procedures could easily be applied to any water agency customer.

The smaller water district, CLAWA, dropped out of the pilot program before it started. ECONorthwest was unable to contact the General Manager at CLAWA, but we did speak to the district's contract engineer, who believed that CLAWA never received notice from SCG or the engineering contractor about project initiation activities. However, staff at SCG reported that CLAWA chose to not participate, noting that interest in the program declined after CLAWA had made staffing changes.

Vendor Experience, Satisfaction and Challenges

SCG contracted with an engineering firm to plan and conduct the pump tests. According to the firm's project manager, the contracting process went smoothly and they encountered no problems. They also indicated that their scope of work was clear and that the SCG PM managed the contracting process and the program well. The engineering firm and SCG communicated regularly via email, telephone, and face-to-face conversations.

The engineering firm collaborated with EMWD to identify appropriate pumps to test, which needed to vary by age, size, and other factors. The biggest implementation challenge from the firm's perspective was coordinating the testing with EMWD. All the water agency staff working on the program were busy and it was difficult to coordinate staff schedules. The water pumps also had operating schedules that needed to be coordinated, and the firm had to work with EMWD to carefully identify appropriate times of the day to shut down various pumps. The engineering firm had initially assumed that they could test a certain number of pumps per day, but that proved to be impossible because the pumps deliver essential water almost continuously. The firm therefore had to learn how to work around EMWD's pumping schedule.

The pilot program was implemented during the summer months, which is EMWD's peak season for water delivery. The engineering contractor believed that it would be easier to implement similar programs in the future in seasons with lower water demand, which would allow more scheduling flexibility.

The engineering firm's experience in the pilot program was very positive and they would pursue similar programs again at SCG. They believed that EMWD was also very satisfied with the program.

Participating Customer Experience, Satisfaction and Challenges

EMWD reported that SCG approached the water district about participating in the program. SCG was aware that EMWD had many pumps fueled by natural gas and believed that they would be a good fit for the pilot program. EMWD understood the program goals and planned scope from the beginning and found participating in the program to be straightforward.

EMWD worked with the engineering firm to solve technical issues as they arose. As described by EMWD, they worked collaboratively with the firm as a team. EMWD provided information about their equipment in the field and the engineering firm researched what kind of technology could be applied to their equipment. The firm conducted site visits, met with staff, and identified sites to be tested and the testing schedule. EMWD provided feedback about technical and scheduling issues. At the end of the program the engineering contractor wrote a summary report and presented it to EMWD, which was well received by EMWD.

The Pilot has provided EMWD with data showing the actual efficiencies of its gas-powered pumps. In the past, engineers have had to estimate efficiency, so the data generated in this program was very useful to EMWD. A key benefit of the program to EMWD was that SCG funded the equipment testing, greatly reducing their costs.

EMWD reported that the program did not directly lead to immediate gas savings, but that all parties anticipated this outcome. The main goal of the program was to find out if they could accurately measure horsepower, instead of simply estimating it. Through this program, the engineering firm and EMWD found that they could accurately measure gas pump horsepower, which will be very useful to EMWD. Now that EMWD has accurate data about its engines, it can use that data to identify future gas savings opportunities. EMWD intends to continue testing pumps with new torque transducer technology in the future.

EMWD staff reported they were very satisfied with the program. Their interactions and rapport with SCG staff and the engineering firm were very good, and their communications were effective. The firm took the lead on the program, met its deadlines, and presented the findings in a useful report.

12.5 SCG GAS PUMP TESTING PROGRAM ISSUES AND OBSERVATIONS

The primary challenge, noted by all three parties, was that pump testing scheduling was more complicated than planned. The contractor needed to work with multiple individuals, all of whom had full schedules. In addition, the engineering firm had not fully understood how the pumps needed to be scheduled. The pumps are essential to delivering water, and coordinating when individual pumps could be taken out of service was more complicated than expected. The pilot program initially expected to test 90 pumps, and it became clear as the program was implemented that this figure was much too high. In the end, 15 pumps were tested through the program, representing a varied sample of pumps.

Despite the aforementioned scheduling challenges, all parties perceived that the program implementation went relatively smoothly. SCG's program manager believed that if the CPUC had approved the program earlier as planned, all of the testing and reporting would likely have been completed by June 2009.

The pilot program was clearly successful. Through this program, EMWD learned how to accurately measure the horsepower of gas pump engines, and planned to purchase new testing equipment so they could continue testing other pumps and identify energy saving opportunities.

Program Recommendations

Based on the evaluation results, the following are recommendations for the Gas Pump Testing program if it continues in the future:

- **Include smaller water districts as program participants.** While larger water agencies have more staff to dedicate to gas pump testing activities, smaller agencies may have older and more inefficient equipment, different equipment models, and will have fewer staff to conduct regular pumps maintenance to sustain pump performance. Currently it is not clear if this type of program is only suited to large water agencies with more staff capacity, or if smaller agencies can participate and derive benefits also.
- **Involve dedicated IOU staff that understand water production issues.** At SCG, the AE was the staff person who best understood water issues and the customer's needs. Their participation ensured that the utility had effective communication with the water

district and that water production would not be unduly compromised during the testing period.

- **Implement future gas testing programs during off-peak seasons for the water agencies.** The Pilot was implemented during the summer months when water demand is highest. The program's greatest challenge was coordinating the schedules of water agency staff and the pumping equipment. Conducting the tests in low-demand seasons would reduce these difficulties.
- **Provide pumping schedules and operating requirements to project contractors early in the project, or as part of scoping process.** This would allow contractors to initially develop more realistic testing plans and schedules and potentially reduce coordination activities with the water agencies, resulting in a faster program implementation.

13. OVERALL PROGRAM OBSERVATIONS

The IOUs initially filed their proposed program designs in January 2007, and it was originally intended that the programs would start in July 2007. After the initial filings were submitted, however, the CPUC led the IOUs through a workshop process in spring and summer of 2007 to refine the proposed plans, and several supplemental filings were requested and submitted (the last one in July 2007). The CPUC's final decision approving the modified Pilots was made in December 2007, and the implementation start date was moved to July 1, 2008, one year after the originally expected start date.

The delayed approval, in conjunction with the economic downturn and drought conditions, negatively impacted almost all of the programs, as the compressed schedule gave little leeway for recruitment challenges (including contractors), competing water agency priorities, projects planning and installations, and M&V activities. In this context, project management staff turnover at the IOUs, which often happens during program implementation, had more pronounced impacts for Pilot programs trying to implement novel program designs for the first time. At SDG&E, three program managers worked on the programs at various times, and they had to become familiar with the data required by water agency partners, the status of customer projects, and the details of vendor contracts. At PG&E, the original programs manager was assigned additional responsibilities towards the end of the programs, and other staff had to assume more responsibilities just as the impact evaluation activities were ramping up. This caused confusion for some of the partner water agencies and customers.

In addition, the Pilots with water agencies or public agencies as customer participants (e.g., PG&E Emerging Technologies, SDG&E Recycled Water) were most prone to project delays, which should be considered for future programs. Public sector projects can move more slowly due to competing staff demands and public process requirements, and future programs involving these agencies should build in additional schedule time.

On a day-to-day basis, the CPUC engaged with the IOUs periodically or on an as-needed basis during the program implementation, and status updates were generally provided to the impact evaluation team.⁶⁹ For some programs, the IOUs needed CPUC approval for additional project sites (e.g., multifamily HETs), qualifying measures (e.g., a recycled water project), or allowable expenditures (e.g., new meters). While some of the issues were resolved within a few days, others took up to a month to resolve, and the IOUs had mixed impressions of the CPUC's responsiveness.

In particular, the late approval of the Pilots schedule extension by the CPUC was problematic. Although the CPUC's project manager communicated that the extension was likely to be approved, the IOUs could not tell their water agency partners or customers if they should move

⁶⁹ CPUC's project manager did attend some weekly calls with the IOUs and evaluation team if available.

forward on projects or not with certainty, and some momentum was lost. Having the IOUs file jointly for the extension may have also slowed down the approval process.⁷⁰

MWD's funding problems caused recruitment problems for some of the southern California programs, and this needs to be addressed in the future if possible. Ideally, MWD's funding cycle would be synchronized with those of future electric IOU water programs, and MWD's program funding would be increased (or a higher percentage would be reserved to specifically supplement IOU incentives). If this is not possible, then future partnership programs must clearly and consistently communicate to prospective participants that MWD and/or other water agencies funding may only be available for a limited period. This is the most likely scenario, since it is highly unlikely that the electric IOUs would be able to synchronize their funding cycles with the hundreds of water agencies that exist in the state.

Collecting water and energy data from water agencies proved to be very challenging for both the water agencies and the impacts evaluators.⁷¹ Water agencies that were involved in conceptualizing the programs from an early stage (e.g., Sonoma County Water Authority, Apple Valley) expected that production and energy data would eventually be required in some form. Other water retailers, however, were not initially aware that they would need to provide data, even if their water wholesaler was a Pilot program partner. Similarly, wastewater and recycled water agencies that operate independently of water wholesalers and retailers did not know of the need for embedded energy data until they were contacted by the evaluators. Some of the agencies did eventually provide data, some started to and then ceased communications, while others politely declined to provide data citing staff constraints and/or confidentiality concerns. In some cases, water conservation managers may have been informed of potential data collection efforts, but the actual keepers of the data (e.g., operations staff) were not aware when contacted by the evaluators.

All of the water agencies were surprised at the very detailed level of data that was requested, and the amount of staff time required to collect and clean the data. The data collection survey requested the most detailed data available (preferably hourly) for water flows and associated energy use for all stages of the water supply chain—source water collection, conveyance, treatment and distribution. In addition, the survey asked for system schematics, details of the water treatment process, and a description of how operations could change under different conservation scenarios. The same data were requested if the water agency had only one participating customer or many.⁷²

⁷⁰ The IOUs reported that their coordination to submit a joint filing went well; there were several phone calls to discuss the programs status and additional time needed. Beyond this, the IOUs did not regularly coordinate or share programs information, and none noted a critical need to do so.

⁷¹ Email surveys were sent to 8 retail water agencies, and 3 responded. Some agencies that did provide data did not respond to the survey.

⁷² For the PG&E HETs program, for instance, water and energy data were only collected for one water agency, which serves the vast majority of many program participants. For other programs, however, there might only be one customer participant in each of multiple cities, and the evaluators generally tried to obtain data from each of these cities.

In the end, most of the agencies were only able to provide monthly water/wastewater production data, and detailed energy data was requested instead from the IOUs after collecting and confirming the energy accounts with the water agencies. Despite these steps to simplify the data collection, the water agencies sometimes had to involve up to five staff persons to collect data for different facilities or facility types, electric accounts, etc. Sometimes this required significant staff time, and then additional time was needed to carefully review the data with the evaluators. On the technical side, some water agencies were not able to easily disaggregate water flows (e.g., distribution and treatment) and all of the energy accounts had to be reviewed to omit ancillary uses (e.g., lighting, administrative offices) to the extent possible.

Future studies of embedded energy need to systematically inform *all of the agencies* from which data will be requested about the pending need, and also the staff that will be affected (i.e., not just the conservation managers). If new embedded energy data are required, the CPUC and/or the IOUs could make the data submission a prerequisite for programs partnering. In addition, all of the water agencies and participating customers need to be informed up front of any customer water metering or other data collection (e.g., laundry pounds cleaned) that will be required for evaluation, so they can allow for this in their planning.

In return, water agencies that provide program incentives, embedded energy data and/or other program assistance need to be clearly and regularly informed about planned M&V schedules and public review requirements, so they do not expect the final study results too soon and feel like genuine program partners. After providing data for the impact evaluation, some of the water agencies became very interested to know the energy intensities of their systems and also the water and energy savings of their customers. The CPUC should allow the impact evaluation team to share preliminary savings findings with the IOUs and water agency partners before the final reports are developed.

Despite the challenges that many of the programs experienced, there was generally high satisfaction among the participating water agencies, contractors and customers. Water agency customers highly valued the energy savings incentives, capital projects funding and other services (e.g., comprehensive water audits) provided by the IOUs, and the water agencies were pleased to serve their customers better and forge stronger relationships with IOU staff. Program contractors were able to learn more about available water conservation incentives, increase their revenues, and strengthen ties with existing and new clients, and IOU program managers.

14. APPENDIX: SURVEY INSTRUMENTS AND IN-DEPTH INTERVIEW GUIDES

14.1 PG&E LOW INCOME HIGH EFFICIENCY TOILETS PHONE SURVEY

(Note: Instrument also translated into Spanish)

Hello, my name is _____ and I'm calling from QMR, an independent research firm. We are talking to customers on behalf of Pacific Gas & Electric to improve the programs they offer to help households save energy, money, and help the environment. This is not a sales call. May I please speak with [NAME]?

CALL BACK IF NEEDED

We're conducting a brief study of households that recently received low-flow toilets through PG&E's programs. This should only take about XX minutes of your time and we'll keep your answers confidential. Is now a good time to answer a few questions?

RESCHEDULE IF NEEDED....

SCREEN 1: (If NAME did not answer phone) For verification purposes only, may I have your name?

1) Name: _____

88) Refused [TERMINATE]

99) Don't know [TERMINATE]

SCREEN2: Did you get a new low-flow toilet through PG&E or Energy Partners in the past year?

1) Yes [CONTINUE]

2) No [TERMINATE]

88) Refused [TERMINATE]

99) Don't know [CONTINUE]

IF NEEDED:

This would be a new toilet that uses less water per flush than regular models.

If YES: CONTINUE

If NO or Don't Know: TERMINATE

Terminate: Based on your answer, we don't have any more questions for you. Thanks for your help. Good bye.

SCREEN3: How many low-flow toilets were installed in your home?

_____ (record number)

88) Refused

99) Don't know

NOTE TO PROGRAMMER: ADJUST REMAINING PHONE SURVEY TO REFLECT SINGLE V. MULTIPLE HETS. IF MULTIPLE HETS INSTALLED, DO NOT ASK ABOUT EACH ONE SPECIFICALLY.

I. Awareness

First I'd like to talk to you about how you heard about the program.

Q 1. How did you learn that you could get a free low-flow toilet? (DO NOT READ, MULTIPLES ACCEPTED)

- 1) Energy Partners staff who visited my home
- 2) Mailed materials
- 3) Word of mouth/friend/relative
- 4) Local radio
- 5) Local newspaper
- 6) Religious institution
- 7) School
- 8) Non-profit agency
- 9) PG&E website
- 10) Energy Partners website
- 11) Santa Clara Valley Water District website
- 12) Other website
- 77) Other (Specify)
- 88) Refused
- 99) Don't know

Q 2. For each of the following possible reasons for getting a low-flow toilet, please say if the reason was Not At All Important, A Little Important, Somewhat Important, Very Important, or Extremely Important in your decision. [ROTATE REASONS]

- 1) The toilet was free
- 2) Wanted the latest technology
- 3) Wanted to save money on water bills
- 4) Wanted to save water
- 5) Wanted to help protect the environment
- 6) Needed to replace old or broken equipment
- 7) Program outreach staff said it was a good idea
- 8) PG&E created the program
- 9) Energy Partners was involved with the program

Q 3. Did you have another reason for getting a low-flow toilet?

- 1) Yes
- 2) No
- 88) Refused
- 99) Don't know

Q 4. (If Q 3 = YES) What was this reason?

_____ (record open end)

Q 5. (If response given for Q 4) How important was this reason? Would you say it was:

- 1) Not At All Important
- 2) A Little Important
- 3) Somewhat Important
- 4) Very Important
- 5) Extremely Important
- 88) Refused
- 99) Don't know

Q 6. (If Q 1 = 1, Ask:) How would you rate your interaction with Energy Partners program staff? Would you say you are:

- 1) Not At All Satisfied
- 2) A Little Satisfied
- 3) Somewhat Satisfied
- 4) Very Satisfied
- 5) Extremely Satisfied
- 88) Refused
- 99) Don't know

Q 7. (If RATING less than Very Satisfied) Why do you say that?

_____ (record open end)

II. Installation Process and Satisfaction

Now I'm going to ask you some questions about installation of the toilet.

Q 8. Were you actually in your home when the low-flow toilet was installed?

- 1) Yes
- 2) No
- 88) Refused
- 99) Don't know

Q 9. Did you have any problems setting up a time for the installation for your low flow toilet(s)?

- 1) Yes
- 2) No
- 88) Refused
- 99) Don't know

Q 10. (If Q 9= YES) What were these problems? (DO NOT READ, ACCEPT MULTIPLES)

- 1) Limited choice of days/times

- 2) Installed at inconvenient time for me
- 3) No/little advance notice of installation
- 77) Other (Specify)
- 88) Refused
- 99) Don't know

Q 11. Did the installer leave materials, debris or dirt in home after the installation?

- 1) Yes
- 2) No
- 88) Refused
- 99) Don't know

Q 12. Were there any problems with how the toilet worked right after the installation?

- 1) Yes
- 2) No
- 88) Refused
- 99) Don't know

Q 13. (If Q 12= YES) What were these problems?

_____ (record open end)

IF RESPONDENT WAS NOT PRESENT DURING INSTALLATION SKIP TO Q 18

Q 14. Were there any problems with how long the installation took to complete?

- 1) Yes
- 2) No
- 88) Refused
- 99) Don't know

Q 15. (If Q 14= YES) What were these problems? (DO NOT READ, ACCEPT MULTIPLES)

- 1) Took too long
- 2) Installer had to come back multiple times
- 77) Other (Specify)
- 88) Refused
- 99) Don't know

Q 16. How satisfied were you with the timeliness of the installer? That is, the time the installer actually arrived, compared to when you thought they would arrive. Would you say you were:

- 1) Not At All Satisfied
- 2) A Little Satisfied
- 3) Somewhat Satisfied

- 4) Very Satisfied
- 5) Extremely Satisfied
- 88) Refused
- 99) Don't know

Q 17. How satisfied were you with the politeness of the installer? Would you say you were:

- 1) Not At All Satisfied
- 2) A Little Satisfied
- 3) Somewhat Satisfied
- 4) Very Satisfied
- 5) Extremely Satisfied
- 88) Refused
- 99) Don't know

Q 18. Overall, how satisfied were you with the installation of the toilet? Would you say you were:

- 1) Not At All Satisfied
- 2) A Little Satisfied
- 3) Somewhat Satisfied
- 4) Very Satisfied
- 5) Extremely Satisfied
- 88) Refused
- 99) Don't know

III. Equipment Performance and Satisfaction

Now I have some questions about how your toilet is working.

Q 19. When you use your toilet, how often do you have to flush it more than once? Would you say it is...

- 1) Always
- 2) Often
- 3) Sometimes
- 4) Rarely
- 5) Never
- 88) Refused
- 99) Don't know

Q 20. Have you or any of your household members had any of the following problems using your low-flow toilet: (ASK ALL BELOW, RECORD YES/NO/DON'T KNOW/REFUSED)

- 1) Trouble with the toilet clogging, more than a regular toilet
- 2) Problems with the toilet leaking
- 3) The toilet does not stop running/refilling
- 4) (PG&E only) The handle not working correctly
- 5) (SCE only) The buttons not working correctly
- 6) (SCE only) Remembering which button to push

Q 21. Have you had any other problems?

- 1) Yes
- 2) No
- 88) Refused
- 99) Don't know

Q 22. (If Q 21 = YES) What were these problems?

_____ (record open end)

Q 23. (IF ANY PROBLEMS MENTIONED) Is the low-flow toilet still installed, or was it replaced?

- 1) Still installed
- 2) Replaced
- 77) Other (specify)
- 88) Refused
- 99) Don't know

Q 24. How satisfied have you been with how your low-flow toilet is working?

- 1) Not At All Satisfied
- 2) A Little Satisfied
- 3) Somewhat Satisfied
- 4) Very Satisfied
- 5) Extremely Satisfied
- 88) Refused
- 99) Don't know

Q 25. (If RATING less than Very Satisfied) Why do you say that?

_____ (record open end)

IV. Demographics

These last questions are for classification purposes only. All your answers will be kept confidential.

Q 26. Including yourself, how many people live in your home? Please include children.

_____ (record number)

If Number = 1 SKIP TO **Error! Reference source not found.**

- 88) Refused
- 99) Don't know

Q 27. How many of these people are children under age 5?

_____ (record number)

- 88) Refused
- 99) Don't know

Q 28. (Ask if $Q\ 27 + 1 < Q\ 26$) How many are children age 5 to 12?

_____ (record number)

- 88) Refused
- 99) Don't know

Q 29. (Ask if $Q\ 27 + Q\ 28 + 1 < Q\ 26$) How many people are age 65 or older?

_____ (record number)

- 88) Refused
- 99) Don't know

Q 30. How old are you?

_____ (record respondent age)

- 88) Refused
- 99) Don't know

Q 31. Which of the following best describes your racial or ethnic background?

- 1) African-American
- 2) Caucasian
- 3) Native American
- 4) Hispanic
- 5) Asian/Pacific Islander
- 6) Other (Specify)
- 88) Refused
- 99) Don't know

Q 32. [Interviewer: Record Gender.]

- 1) Male
- 2) Female
- 99) Don't know

Those are all the questions I have for you. Thank you very much for your time and good information.

14.2 SCE LOW INCOME HIGH EFFICIENCY TOILETS MAIL SURVEY



Phone • (503) 222-6060
FAX • (503) 222-1504
www.econw.com

Suite 1600
222 SW Columbia
Portland, Oregon 97201-6616

Other Offices
Eugene • (541) 687-0051
Seattle • (206) 622-2403

March 18, 2010
4 Roosevelt Street
Irvine, CA 92620

Dear Northwood Park Resident,

We are writing to ask for your help. Southern California Edison (SCE) has asked us to help evaluate a water saving program that took place in your apartment building. We need you to take just a few minutes to give us your feedback to help us improve this program.

Our records show that your apartment received two new two-button, dual flush toilet(s) in August of 2009. These toilets were installed because they use less water per flush than regular models.

Southern California Edison has asked us at ECONorthwest (an energy research firm in Portland, Oregon) to help with this research. We want to improve the programs SCE offers to help customers save water, energy, money, and help the environment.

Please take a few minutes to complete and return this survey in the enclosed return-addressed envelope. This should only take a few minutes of your time and your answers will be kept confidential.

We have included a small token of our appreciation with this survey. Thank you for helping us improve this important program.

If you have any questions about this study, please call me at (503) 200-5086.

Sincerely,

Alex Reed
Evaluation Manager

Dual Flush Toilet Survey

Southern California Edison (SCE) has asked us to help evaluate a water saving program that took place in your apartment building. Your feedback will help us improve the programs SCE offers to help customers save water, energy, money, and help the environment.

Our records show that your apartment received two new two-button, dual flush toilet(s) in August of 2009. These toilets were installed because they use less water per flush than regular models.

This survey should take less than five minutes of your time and your answers will be confidential.

1. Did you or a previous tenant have a new two-button toilet installed in the past year?

- Yes, me
- Yes, the previous tenant
- No

If NO, we don't have any more questions for you at this time! Thanks for your help. Please return this survey in the postage-paid envelope provided

2. How many two-button toilets were installed in your apartment?

_____ (#)

Skip to #12 if the toilet(s) were installed when the previous tenant was living in your apartment

3. Were you given any information from the installer on how to use your two-button toilet?

- Yes
- No
- Do not recall

4. Was this information helpful to you?

- Yes
- No
- Do not recall

If NO, why not:

- Instructions confusing/not clear
- Instructions don't describe fixing problems
- Instructions not in my preferred language
- Other (Specify)

5. Did the installer leave materials, debris or dirt in your apartment after the installation?

- Yes
- No
- Do not recall

6. Were there any problems with how the toilet worked right after the installation?

- Yes
- No
- Do not recall

If YES, what were these problems:

7. The next set of questions asks about your level of satisfaction with the installation process.

Were you at home during the installation?

- Yes
- No
- Do not recall

If NO or Do not recall, skip to question # 12

8. Were there any problems with how long the installation took to complete?

- Yes
- No
- Do not recall

If YES, what were these problems:

- Took too long
- Installer had to come back multiple times
- Other (Specify)

	Not At All Satisfied	A Little Satisfied	Somewhat Satisfied	Very Satisfied	Extremely Satisfied	Do Not Recall
9. How satisfied were you with the timeliness of the installer? That is, the time the installer actually arrived, compared to when you thought they would arrive.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. How satisfied were you with the politeness of the installer?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Overall, how satisfied were you with the installation of the toilet?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. The next set of questions are about how your toilet is working now.

How often do you have to flush the toilet more than 1 time?

- Always
- Often
- Sometimes
- Rarely
- Never
- Don't Know

13. Have you or any of your household members had any of the following problems using your two-button toilet (Check all that apply)

- | | Yes | No |
|--|--------------------------|--------------------------|
| Trouble with clogging, more than a regular toilet..... | <input type="checkbox"/> | <input type="checkbox"/> |
| Problems with the toilet leaking.. | <input type="checkbox"/> | <input type="checkbox"/> |
| The toilet does not stop running/refilling..... | <input type="checkbox"/> | <input type="checkbox"/> |
| The buttons not working correctly | <input type="checkbox"/> | <input type="checkbox"/> |
| Remembering which button to push..... | <input type="checkbox"/> | <input type="checkbox"/> |

14. Have you had any other problems?

- Yes No Do not recall

If YES, what were these problems:

15. Is the two-button toilet still installed, or was it replaced?

- Still Installed
- Replaced
- Don't Know.....
- Other (Specify)

16. How satisfied have you been with how your two-button toilet is working?

- Not At All Satisfied
- A Little Satisfied
- Somewhat Satisfied
- Very Satisfied
- Extremely Satisfied.....

If your satisfaction is less than Very Satisfied, why do you say that?

17. Do you prefer the new two-button toilet or would you rather have a toilet with just one button or a lever?

- New two button
- One button
- Lever
- Don't Know

If you answered one button or lever above, what do you dislike about the two-button toilet?

18. INCLUDING YOURSELF, how many people live in your home?

- _____ (#) children under 5
- _____ (#) children 5-12
- _____ (#) children 13-17
- _____ (#) adults 18 - 64
- _____ (#) adults 65 and older
- = _____ (#) TOTAL people in your home, including yourself

19. How old are you?

_____ (#)

20. Which of the following best describes your racial or ethnic background?

- African-American.....
- Caucasian.....
- Native American.....
- Hispanic.....
- Asian/Pacific Islander.....
- Other.....
- Don't Know.....

21. What is your gender?

- Male Female

Thank you very much for your help.

Please return your completed survey in the enclosed stamped envelope.

14.3 IN-DEPTH INTERVIEW GUIDES

Program Manager Interview Guide

September 2009

Programs _____

Name of Project Manager(s) _____

Telephone _____ email _____

1. Are there other program staff that need an interview?
2. Is there an implementation contractor?

Name _____

Telephone _____ email _____

Program Description and Goals

3. Please briefly describe how the program works.

Discuss:

- a. How is marketing done?
 - b. How are participants identified? (self-select, recruited?)
 - c. What are incentive levels, from whom?
 - d. When/how are incentives paid?
 - e. When/how does verification/QC occur?
 - f. How does IOU program tracking occur? How effective is this process? Do you always know what the implementation contactors are doing?
4. What are the overarching critical concerns, gaps or problems that the pilot is trying to address?

5. What are the program goals (#customers, water saved, etc.) and budget? What is the progress and expenditures to date?

	Overall	Progress to date
Goals		
Budget		

6. What barriers or issues might make it difficult to reach the program’s goals?
7. Are there any things that you think are working really well or not working really well that you would like to understand better?

Discuss:

- a. What is your perception of customer satisfaction for this program?
 - b. How about contractor satisfaction?
8. What types of customers are most likely to participate in this type of program? Is the program specifically targeting these customers?
9. How much coordination occurs between [IOU] and the partner water agencies for the program?
- a. How has this gone? (Probe on customer/measures eligibility, incentive payments process)
 - b. Could coordination be improved in the future? How?
10. Does the program coordinate with other programs, account managers or departments at [IOU]? How has this gone?

11. Are there any ways in which you think the program could work better with other programs offered by your utility?
12. How do you interact with the pilot program managers at the other utilities? Should there be more or less interaction?
13. How has it been working with the CPUC for the water pilots?
14. What are the biggest challenges facing the program?
15. Are there other entities, organizations or people who should be involved in these pilots? What would their role be?
16. Are there any changes to the program that you would like to make in the future but are unsure about?
17. Which pilots have the *strongest* likelihood of being developed into a full program? Why?
18. Which programs have the *least* likelihood of being developed into a full program? Why?

Other IOU Staff Interview Guide (e.g., Account Execs, Other Program Managers)

October 2009

Hello, my name is _____ and I work for ECONorthwest, an energy research firm based in Portland, Oregon. We are conducting a process evaluation of the [PILOT PROGRAM] and would like to conduct a brief interview with you to understand your interaction and experiences with the program, and identify ways the program could potentially be improved. The interview should only take about 20 minutes to complete. [SCHEDULE INTERVIEW AS NEEDED]

1. First, please describe how you have been involved with this pilot program.

Potential topics:

- a. Customer targeting
 - b. Data collection
 - c. Technical advising
 - d. Incentives determination/payment
 - e. Customer relations
 - f. Coordination with water agencies
 - g. Project verification/QC
2. What types of customers are most likely to participate in this type of program? Has the program specifically targeted these customers?
 3. How much interaction occurs between you and the pilot program manager?
 - a. How has this gone?
 - b. Could coordination be improved in the future? How?
 4. (If not discussed already) What information do you provide to the pilot program manager? In what formats? How often? How well has this process worked?
 5. Should the pilot program be working more closely with other programs, account managers or departments at [IOU]? In what ways?
 6. What have been your biggest challenges working with the pilot program?

Potential issues:

- a. Customer recruitment
 - b. Data collection (quality, timeliness)
 - c. Working with customers
 - d. Incentives issues
 - e. Coordination with program manager
 - f. Working with water agencies
7. Are there any things that you think are working really well with this program?
 8. What is your perception of customer satisfaction for this program?
 9. Have any customers had any specific problems that you are aware of?
 - a. If YES: How did you address this issue?

10. How satisfied are you with your overall experience participating in this program? Why do you say that?

11. Should this pilot program be developed into a full, ongoing [IOU] program? Why/why not?

12. Do you recommend any changes to the program if it continues in the future?

Thank you for your time and good information.

Water Agencies Interview Guide

October 2009

Hello, my name is _____ and I work for ECONorthwest, an energy research firm based in Portland, Oregon. We are conducting research on behalf of [IOU] to improve the energy efficiency programs they offer to help customers save energy, money, and help the environment.

[IOU] has asked us to help them better understand how well the [PILOT PROGRAM] is operating and how it could potentially be improved. As part of this study we are speaking with [IOU's] partner water agencies, to learn about your experience with the program.

I would like to conduct a brief interview with you, which should only take about 20 minutes to complete. Your answers will help [IOU] to improve these types of water and energy saving programs in the future. [SCHEDULE INTERVIEW AS NEEDED]

1. First, please describe how your water agency has been involved in this pilot program during the design and implementation stages.

Discuss (some may not apply):

- a. Customer targeting, marketing
- b. Eligibility determination
- c. Incentives or measures provided
- d. Incentives payment process
- e. Project verification/QC

2. What types of customers are most likely to participate in this type of program? Is the program specifically targeting these customers?

3. (If not mentioned) Did your water agency have any role in targeting participants for this program? If YES: What did you do and how has it gone?
4. How well did the program contracting process go with [IOU]?
 - a. Is there anything about your partnership agreement that is unclear?
 - b. Is there anything about the partnership that you would change? Why?
5. How do you interact with the program manager at [IOU]?
 - a. Should there be more or less interaction?
 - b. Could coordination be improved in the future? How?
6. (If not mentioned) How do you keep informed about customer participation or progress/status?
7. Are there any other water agencies that you work with for this program? Which ones, and how are they involved?

[GET CONTACT INFO]

8. How has it gone working with these other water agencies?
9. What have been your biggest challenges working on this program?

Potential issues:

- a. Customer recruitment (by them or others)
 - b. Eligibility determination
 - c. Implementation contractor issues
 - d. Incentives payments process
 - e. Verification/QC
 - f. Coordination with IOU
10. Are there any things that you think are working really well with this program?
 11. What is your perception of customer satisfaction for this program?
 12. Have any customers had any specific problems that you are aware of?

- a. If YES: How did you address this issue?
13. Are there other entities, organizations or people who should be involved in this program?
What would their role be?
 14. How satisfied are you with your overall experience participating in this partnership program?
Why do you say that?
 15. Do you recommend any changes to the program if it continues in the future?

Thank you for your time and good information.

Participating Customers Interview Guide

October 2009

Hello, my name is _____ and I work for ECONorthwest, an energy research firm based in Portland, Oregon. We are conducting research on behalf of [IOU] to improve the energy efficiency programs they offer to help customers save water, energy, money, and help the environment.

[IOU] has asked us to help them better understand how well the [PILOT PROGRAM] is performing and how it could potentially be improved. As part of this study we are speaking with program participants such as you, to learn about your experience with the program.

I would like to conduct a brief interview with you, which should only take about 20 minutes to complete. Your answers will help [IOU] to improve these types of programs in the future.
[SCHEDULE INTERVIEW AS NEEDED]

1. First, how did you hear about the opportunity to participate in this program?
2. Did you have any questions initially about the program?
 - a. If YES: To whom did you direct your questions? Were they answered satisfactorily?
3. What did you have to do to actually participate in the program? How well did this process go?

4. What services and/or equipment were provided to you?
5. Were financial incentives available to you?
 - a. If YES: What did you have to do to get these? How easy or difficult was this process?
6. (AUDIT CUSTOMERS) Have you installed any of the water saving measures recommended in your audit, or changed any procedures? Are you planning to change anything?
 - a. If YES: Which measures or procedures?
 - b. If YES: How important were program financial incentives in your decision to make these changes?
 - c. If NO: Why not?
7. (DO NOT ASK IF NO EQUIPMENT INSTALLED OR PROCEDURES CHANGE)
 - a. How satisfied are you with your new equipment and/or operating procedures?
 - b. (PG&E EMERGING TECH) How satisfied are you with any energy savings from your project?
 - c. (SCG GAS PUMPS) How satisfied are you with any gas savings you have realized?
 - d. (OTHERS) How satisfied are you with any water savings from your projects?
8. (SCE LEAK DETECTION) How satisfied are you with the findings from your top-down water audit?
9. Have you had any specific problems participating in this program?
 - a. If YES: How did you address this issue?
10. Have you had any interactions with [IOU] staff about your participation in this program? With whom, and regarding what? How did these interactions go?
11. Please describe your interactions with the program implementation contractor. How have these gone?
12. How satisfied are you with the work performed by the contractor for this program?

13. (DO NOT ASK FOR SCG GAS PUMP TESTING) As you may know, this program is also being studied to learn more about its actual water and energy saving impacts. Have you been affected by activities or requirements of this other impact evaluation? In what ways?
14. What would you say has been the most beneficial or useful aspect of this program?
15. How satisfied are you with your overall experience participating in this program? Why do you say that?
16. Do you recommend any changes to the program if it continues in the future?

Thank you for your time and good information.

Implementation Contractor Interview Guide

October 2009

Hello, my name is _____ and I work for ECONorthwest, an energy research firm based in Portland, Oregon. We are conducting research on behalf of [IOU] to improve the energy efficiency programs they offer to help customers save water, energy, money, and help the environment.

[IOU] has asked us to help them better understand how well the [PILOT PROGRAM] is operating and how it could potentially be improved. As part of this study we are speaking with implementation contractors such as you, to learn about your experience with the program.

I would like to conduct a brief interview with you, which should only take about 20 minutes to complete. Your answers will help [IOU] to improve these types of programs in the future.
[SCHEDULE INTERVIEW AS NEEDED]

1. First, please describe your role and responsibilities working for this program.

Discuss (some may not apply):

- a. Customer recruitment
- b. Eligibility determination
- c. Services offered and/or measures installed

- d. Agreed to goals (#customers, water saved, etc.)
 - e. Basis for compensation (e.g., flat fee, per audit, savings attainment, etc.)
2. (If not mentioned) Do you have any role in recruiting participants for this program? If YES: What have you done and how has this gone?
 3. How well did the contracting process go with [IOU]?
 - a. Is there anything in your Scope of Work or contract that is unclear?
 - b. Is there anything in your Scope of Work or contract that you would change? Why?
 4. How do you interact with the program manager at [IOU]?
 - a. Should there be more or less interaction?
 - b. Could coordination be improved in the future? How?
 5. How do you track information on customer participation or progress/status?
 6. (If not discussed already) What information do you provide to the program manager at [IOU]? In what formats? How often? How well has this process worked?
 7. What have been your biggest challenges working on this program?

Potential issues:

- a. Scope of Work confusion
 - b. Customer recruitment (by them or others)
 - c. Data collection problems (quality, timeliness)
 - d. Customer access/scheduling issues
 - e. Eligibility determination
 - f. Reporting
8. Have these issues affected your ability to reach your contractual goals?
 9. (DO NOT ASK FOR SCG GAS PUMP TESTING) As you know, this program is also being studied to learn more about its actual water and energy saving impacts. Has your work been affected by activities or requirements of this other impact evaluation? In what ways?

10. Are there any things that you think are working really well with this program?
11. What is your perception of customer satisfaction for this program?
12. Have any customers had any specific problems that you are aware of?
 - a. If YES: How did you address this issue?
13. (AUDITORS) Are there particular types of customers that the program should or should not be focusing on?
14. How satisfied are you with your overall experience participating in this program? Why do you say that?
15. Do you recommend any changes to the program if it continues in the future?

Thank you for your time and good information.

14.4 SUPPLEMENTAL QUESTIONS FOR PARTNER WATER AGENCIES

- 1) When your water agency was given the opportunity to participate in the Embedded Energy Water Pilot Program, were you aware that program evaluators contracted by CPUC would request detailed water production and energy data, in order to calculate energy savings impacts for the program?
 - a) If YES: How did you learn about this evaluation requirement?
- 2) When you learned about the required data, did you have any initial concerns?
 - a) If YES: What were these concerns?
 - b) To whom did you express your concerns?
 - c) Were your concerns addressed satisfactorily?

- 3) What have been your biggest challenges providing the water and energy data that has been requested?

- 4) Do you have any suggestions for changing the types of data requested, or the data collection approach (i.e., an emailed survey with follow up by evaluation staff)?
 - a) If YES: What would you change for future evaluations?

Thank you for your time and good information.