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California Public Utilities Commission (CPUC)
and
San Diego Regional Energy Office (SDREO)

Evaluation, Measurement & Verification of the 2004-2005 Local Government Energy Efficiency (LGEE) Program of the San Diego Regional Energy Office (SDREO)

CPUC Program #1301-04

Final Report

Submitted By:

Nexant

JULY 1, 2006

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Executive Summary

This document represents the Final Report of the Evaluation, Measurement, and Verification (EM&V) activities of the 2004-2005 San Diego Local Government Energy Efficiency (LGEE) program, CPUC No. 1301-04, an energy efficiency local program provided for by CPUC Public Goods Charge Energy Efficiency Rulemaking R.01-08-028. LGEEP is a standard performance contract style incentive program targeting energy efficiency retrofit projects of local government facilities within San Diego County. The program is sponsored by the San Diego Regional Energy Partnership (SDREP) and administered and implemented by the San Diego Regional Energy Office (SDREO).

The 2004-2005 LGEE program completed 68 energy efficiency projects, and an additional 29 energy management system (EMS) projects. The energy efficiency projects represent 373 kW of net demand savings (57% of the program demand reduction goal), 3.73 MWh of net annual energy savings (57% of the net annual energy savings goal), and 27,050 Therms (32% of the net annual natural gas savings goal). The program achieved significant electrical energy savings, although they were below the program goals. There was a much larger shortfall for natural gas savings. LGEE program results are given in Table ES-1. The CPUC Impact Table, which gives the yearly energy impacts due to the program, is provided in Appendix D.

Table ES-1 Comparison of Project Savings to Program Goals

Metric	Net Savings Goals	Project Savings		% of Goal
		Gross	Net	
Coincident Peak kW	650	466	373	57%
Annual kWh	6,499,574	4,662,034	3,729,627	57%
Therms	85,447	33,812	27,050	32%

The implementation of the LGEE program of the San Diego Regional Energy Office followed the original program design as outlined in the Program Implementation Plan. The program administrator and implementer (SDREO) received positive review comments from the participating local governments. Five of the six SDREP partners participated in the LGEE program, and each had multiple energy efficiency projects. An additional city who is not an SDREP partner also completed one project through LGEEP.

The partners identified the most valuable program offerings as the energy audits, technical assistance, and direct payment to contractors. The program achieved modest short-term results, and momentum built up during the program cycle will carry over into the near future, as other programs are implemented. It is unlikely, however, that permanent, long-term impacts will result from LGEEP.

The LGEE program anticipates its successful completion within the original projected budget of the program. The program remained cost-effective based on a TRC Test ratio of 2.28 and a

Participant Cost Test ratio of 11.7. The Participant Cost Test was very high due to generous incentive payments, particularly for the HVAC-Chiller measures.

Recommendations for improvement to the program include the following:

- Programs such as LGEEP should allow for an extended period of time for contract negotiations with the program administrator, IOU service provider, and the local government participants. A timeframe of at least three years, and preferably four, is recommended for this type of program, to maximize momentum that takes a year or two to build. This type of program should also take into account the fiscal calendar of the local governments, and plan program activities around fiscal year budgeting.
- Additional time should be provided following implementation for the M&V contractor to complete the M&V reviews. For complicated projects, energy savings are difficult to quantify accurately without actual post-installation monitoring over a period of time. With the financial mechanism of adjusting the incentive amount based on proposal performance removed for projects installed at the end of the implementation period, the importance of the post-installation performance period was minimized. At least two months should be provided following program implementation for the M&V contractor to complete the M&V activities.
- The project management offering could be reworked so that actual human resources are offered, rather than just project management money. And cities that choose not to take project management funds should have access to more funds in the form of incentives. Incentives should be available on an expanding scale, based on the types of services and program offerings requested.

The LGEE program has been a success, and some form of the program should be continued to leverage upon the momentum built from LGEEP.

Section 1 Introduction

This document represents the Final Report of the Evaluation, Measurement, and Verification (EM&V) activities of the 2004-2005 SDREO Local Government Energy Efficiency (LGEE) program. The report summarizes the results of EM&V activities that were conducted during 2004-2005 as specified in the CPUC-approved EM&V Plan (Appendix A), in compliance with the CPUC Energy Efficiency Policy Manual within the constraints of the allocated budget for EM&V tasks. The CPUC approved LGEEP on December 18, 2003, and on April 26, 2004, the Program Implementation Plan (PIP) was approved by the CPUC. On May 26, 2004, the LGEEP Program Contract between SDREO and SDG&E was signed.

The San Diego Local Government Energy Efficiency (LGEE) program is a standard performance contract style incentive program targeting energy efficiency retrofit projects of local government facilities within San Diego County. The program was designed to reduce local governments' up-front costs for upgrading or installing cost-effective high efficiency energy savings measures and energy management and information systems in local government-owned and tenant-occupied buildings, recreation centers, water facilities, and other high energy use facilities. LGEE is sponsored by the San Diego Regional Energy Partnership (SDREP) and administered and implemented by the San Diego Regional Energy Office (SDREO). SDREP members are local governments that can be both implementers and participants. LGEEP's M&V contractor is Alternative Energy Systems Consulting, Inc. (AESC). AESC was responsible for ongoing project M&V activities to provide due-diligence in determining final rebate amounts.

Through the LGEE program, incentives were provided for the installation of cost-effective, high efficiency energy savings measures such as lighting; heating, ventilating, and air-conditioning (HVAC); water heating; boiler replacements; and other customized gas and electric measures that save energy (kWh and Therms). Incentive rates for these measures were modeled on the 2004 Statewide Standard Performance Contract (SPC) program.

In addition, incentives were provided for the installation of centralized energy management systems (EMS), real-time metering equipment, and upgrades to existing EMS that enable local government agencies to track and manage energy consumption, electric demand (kW), and energy usage (kWh and Therms) at remote building sites, in order to enable them to participate in current and future San Diego Gas & Electric (SDG&E) Company demand response programs.

The SDREP portfolio was designed to provide a balanced array of programs that serve a cross-section of energy market segments and hard-to-reach populations. To facilitate energy program development and implementation, the San Diego Regional Energy Office (SDREO) has spearheaded a partnership among the City of San Diego, the County of San Diego, and the Cities of Carlsbad, Chula Vista, Escondido, and Oceanside to implement public goods charge energy efficiency programs during 2004-2005.

This partnership represents nearly 80% of the region's population and all of the region's cities that have power plants located within their borders. It also addresses local governments' desire to be more involved in regional energy program implementation and reinforces their connection to the region's citizens with SDREO's proven program development and implementation abilities.

This Partnership also represents the first step toward a fully regional partnership for energy efficiency program implementation. Given the short time available, it was not possible to mobilize all the jurisdictions in the San Diego region; however, the Partnership hopes to expand participation and will make all services available to all jurisdictions in the region.

Under the Partnership, SDREO developed program proposals and will provide overall program technical support and administration and conduct marketing and outreach with collaborating local governments. Participating local governments will assist in developing program designs and structures, provide program management input, conduct marketing and outreach through existing communication channels, and, in some cases, provide administration and direct implementation support.

The Program was designed to reduce the upfront costs of comprehensive energy efficiency retrofit projects in city- and county-owned buildings in the San Diego region. The rebate structure for the program is similar to the statewide Nonresidential Standard Performance Contracting (SPC) program; that is, project incentives are awarded based on calculated annual energy savings derived from traditional energy efficiency measures, including lighting, HVAC and operational upgrades. However, the Program also included incentives for installation of energy information systems, which allow the local governments to better track and manage energy consumption and demand, maximize the potential electricity and natural gas savings from the efficiency retrofits, and participate in current and future demand-response programs.

As local governments often encounter obstacles to participating in the statewide Nonresidential Standard Performance Contract (SPC) program, their alternative is to participate in programs for which rebates for limited energy conservation measures are provided, such as the Statewide Express Efficiency program. However, funding for the comprehensive retrofits envisioned for the program would not be possible. The successful Statewide Express Efficiency program is better adapted for smaller, piecemeal renovation efforts, rather than the comprehensive retrofits being targeted here. For example, one energy management strategy many local governments are interested in implementing is to integrate comprehensive energy information systems (EIS) concurrent with building retrofits. While energy management systems and energy information systems are conceivably eligible under the SPC program, they are not included with the Statewide Express Efficiency program.

In contrast to the Express Efficiency program, the LGEE program is designed to help facilitate comprehensive energy efficiency retrofits of the San Diego region's local government facilities. Without the support the program would provide, the current trend of limited, self-funded piecemeal replacements of existing equipment and lights would continue and the potentially significant demand response gains, achievable from installation of Energy Information Systems, could not be realized.

In addition, the member cities and county in this Partnership represent the owners of buildings, recreation centers, water pumping stations and many other activities the energy usage of which is recorded by thousands of electric and gas meters. The day-to-day operation of hundreds of sites is often loosely coordinated without a central theme or set of management objectives. A small number of technicians travel long distances to accomplish monitoring and repair of systems, usually at the request of the occupant. This program provides the opportunity to create the

framework for centralized energy monitoring systems that could record for analysis or remotely notify technicians when systems are operating out of specified limits. Because existing programs identify and provide incentives usually on a component basis, the overall control of daily operations is often underserved. This program represents a coordinated effort to obtain real time monitoring for the largest owners that represent the most significant load in the region.

Applications were required to be submitted by December 31, 2005, and projects must have been installed by March 15, 2006 to be eligible to receive a rebate.

Section 2 Evaluation Measurement & Verification (EM&V) Methodology

Evaluation, Measurement and Verification (EM&V) of the 2004-2005 SDREO LGEE program consisted of many activities performed during and subsequent to LGEE program implementation. The approved EM&V Plan is provided in Appendix A. The EM&V process was separate and distinct from ongoing project M&V activities, which were performed by the LGEEP M&V contractor, Alternative Energy Systems Consulting, Inc. (AESC).

The EM&V process consisted of the collection and review of information and data resulting from the following activities:

- Review of program documents and development of an LGEE Program Logic Chart
- Analysis of data in the Program Activity Tracking Database
- In-person and telephone interviews with local government partners
- In-person interviews with SDREO program managers
- Telephone interviews with program M&V consultant
- Site inspection and analysis of claimed energy savings of a sample of completed projects

The assessment of the effectiveness of the program was based on the results of in-person and telephone interviews and the quarterly review of data collected and inputted by SDREO and local government partners into the program activity-tracking database. Due to the limited budget, non-partners were not surveyed nor direct impacts tested beyond the sample of program participants. Details of the EM&V tasks are provided in the remainder of this section.

2.1 DEVELOPMENT OF PROGRAM LOGIC CHART

A 2004-2005 LGEE Program Logic Chart, provided in Appendix B, was created to document program theory and design (e.g., objectives, market barriers addressed, market sector and program strategy, program activities and outputs, and savings goals) and identified metrics to test the program theory and to gauge the performance of the program. The identified metrics delineated between short and longer term, as well as savings impacts and cost-effectiveness.

Development of the chart was based on input from several sources, including:

- Interviews with the program administrator,
- Review of program documents (e.g., proposal, PIP, budget worksheet, etc.).

The EM&V activities were subsequently designed to gather the information and data necessary to quantify and/or qualify program performance against the metrics identified in the program logic chart.

2.2 ANALYSIS OF DATA IN THE PROGRAM ACTIVITY TRACKING DATABASE

The program administrator designed and maintained a project activity-tracking database. The participating local government partners were responsible for documenting the status of projects as they moved through the various phases of the program.

The data in the program activity tracking database was aggregated and analyzed to quantitatively evaluate program performance, such as number and types of projects, total and end use-specific claimed annual gross savings (kW and kWh), project costs, incentives, average payback per project, etc.

For a sample of projects, information collected during the site inspections and represented on requests for incentive payment was compared for accuracy with the data in the program activity-tracking database.

2.3 INTERVIEWS WITH ADMINISTRATOR, LOCAL GOVERNMENT PARTNERS, AND M&V CONTRACTOR

Seven local governments participated in the LGEE program, although ultimately only six of the seven completed projects during the implementation period. The seven participating public agencies were:

- City of San Diego
- County of San Diego
- City of Chula Vista
- City of Carlsbad
- City of Escondido
- City of Oceanside
- City of Vista

All seven of the participants were contacted for an interview, either by phone or in person. The survey questions were selected to verify the program theory (e.g., market barriers, valued service offerings, etc.) and to assess program effectiveness, participant satisfaction, stipulated values in energy savings calculations, and net to gross estimates. Non-participants were not surveyed as part of the EM&V activities, due to the limited allocated budget for EM&V activities.

In-person interviews with the program administrator and the M&V contractor, AESC, were conducted at the beginning and end of the program. Results from the interviews are given in subsequent sections of this report.

2.4 SITE INSPECTIONS AND ANALYSIS OF CLAIMED ENERGY SAVINGS

SDREO conducted pre- and post-installation inspections of all projects to verify baseline information and the installation of project measures as specified in project documents (e.g., existing equipment inventories, proposals, work orders, project completion reports).

To test the accuracy of the information (e.g., claimed energy savings, installed measures, stipulated operating hours), EM&V activities included post-installation site inspection of a

sample of projects. Nine energy efficiency projects and 11 EMS projects, for a total of 20 projects, were inspected.

The site inspections had the following objectives:

- Verify installed equipment counts, types and capacities,
- Verify facilities were currently operating as specified,
- Assess the appropriateness of the stipulated hours of operation.

In addition, the analysis of the sample projects included a review of documents and claimed energy savings. An attempt was made to examine the credibility of baseline assumptions (e.g., existing equipment numbers, type, and rated kW), when possible.

The 20 sites were selected at random from the population of 68 energy efficiency projects and 29 EMS projects. The sites visited included a diverse mix of measures, including lighting, HVAC, and variable frequency drives. Results from the site visits are used to adjust the claimed (gross) energy savings, as discussed in Section 6.4. An inspection summary detailing each site visit is given in Appendix C.

Section 3 Process Evaluation Results: Analysis of Program Design

Process evaluation activities focused on assessing the LGEE program design and implementation. The LGEE program theory (e.g., objective, market barriers) and the elements of the program design (e.g., market sector, program strategy, program offerings, incentive pricing, etc.) were examined by reviewing program and project activity, characterizing program participation, and surveying local government participants.

3.1 OBJECTIVES

The LGEE program objective was to "increase comprehensive energy projects in local government facilities, and to increase local government energy management capabilities for centralized monitoring and energy management." The objective of the program did not change during the course of the 2004-2005 program.

The LGEE Program Implementation Plan identified the key objectives of the program:

- Increase comprehensive energy projects in local governments,
- Increase local government energy management capabilities,
- Cost-effectiveness,
- Long-term energy savings,
- Electric peak demand savings,
- Ability to overcome market barriers,
- Innovation, and
- Coordination with programs run by other entities.

3.2 MARKET BARRIERS

The program design lists the following market barriers that were to be targeted by the program:

- Long project approval timelines,
- Complicated procurement processes,
- High number of loosely coordinated sites and gas and electric meters,
- Inability to pursue comprehensive projects within requirements of traditional public benefit programs,
- Lack of capital for high start up costs, and
- Split incentives.

In the local government participant survey, partners overwhelmingly identified the leading obstacle to pursuing energy efficiency projects as technical expertise. Technical expertise was needed at all stages of energy efficiency projects, from identifying potential projects through installation and project commissioning. Other market barriers identified were lack of capital and staffing needs.

The design of the program effectively addressed the expected market barriers. By providing a portion of incentives upfront to local governments, the program helped public agencies develop and begin to implement capital-intensive projects. By having the program cater to only local governments, the longer project approval timelines associated with government projects will not hinder their ability to participate, as they do not have to compete with commercial entities and others for limited funding levels that are often fully subscribed early in the program cycle. The program also allowed local governments who own tenant-occupied buildings – like the buildings in San Diego's Balboa Park – to make necessary energy efficiency upgrades, thus overcoming the perennial barrier of split incentives.

3.3 TARGET PARTICIPANTS AND PROGRAM PARTNERSHIP

The program is designed for local governments in the San Diego region. The LGEE program was initially offered to the San Diego Regional Energy Partnership (SDREP); however, the SDREP represents only the first step toward a fully regional partnership for energy efficiency program implementation. The Partnership hopes to expand participation and will make all services available to all jurisdictions in the region. The SDREP includes the following local jurisdictions:

- City of Carlsbad
- City of Chula Vista
- City of Escondido
- City of Oceanside
- City of San Diego
- County of San Diego

The remaining cities in the region include:

- City of Coronado
- City of Del Mar
- City of El Cajon
- City of Encinitas
- City of Imperial Beach
- City of La Mesa
- City of Lemon Grove
- City of National City
- City of Poway
- City of San Marcos
- City of Santee
- City of Solana Beach
- City of Vista

The LGEE program local government participants include all six of the original SDREP members, and also added the City of Vista. Table 3.1 provides the breakdown of savings by participating city.

Table 3.1 Savings Breakdown by LGEEP Participant

	kWh	Therms	Rebate	EMS	kWh %	Therms %
Carslbad	424,179	16,647	$73,393	$17,600	9.1%	49.2%
Chula Vista	442,534	6,455	$20,797	$34,540	9.5%	19.1%
County of San Diego	1,792,619	6,529	$240,965	$53,900	38.4%	19.3%
Oceanside	41,743	0	$3,208	$0	0.9%	0.0%
Vista	40,440	0	$5,662	$0	0.9%	0.0%
City of San Diego	1,920,789	4,181	$209,366	$74,250	41.2%	12.4%
Escondido	0	0	$0	$0	0.0%	0.0%
Totals	**4,662,304**	**33,812**	**553,391**	**180,290**	**100%**	**100%**

3.4 TARGET ENERGY EFFICIENCY MEASURES

Both gas and electric measures were eligible for the program. Incentive rates were established for both gas ($ per Therm) and electric usage ($ per kWh) savings, and were based on the type of measure installed (lighting, HVAC, etc.).

Targeted eligible energy efficiency measures of the program included:

- T-8 fluorescent lamps
- Compact fluorescent lamps (CFLs)
- Lighting controls
- HVAC—chillers and packaged units
- Boiler and water heater improvements

Incentives for lighting and HVAC/chiller measures accounted for about 81% of the total program-wide incentives for energy efficiency projects.

3.5 PROGRAM SERVICE OFFERINGS

The program offered a turnkey approach involving:

- Incentives based on energy savings and varying by end use
- Incentives for energy management systems and real-time monitoring systems
- Site audit (via TAP)
- Technical assistance
- Project reviews
- Project planning and design

- Project measurement and verification (M&V) by the M&V contractor

The interviews with participating local government partners identified the program components that were found to be most valuable:

- The audits identifying energy efficiency projects with payback
- Labor reimbursement
- Great technical support
- Help in navigating the "alphabet soup" of rebate programs

The following were additional comments received regarding the LGEE program offerings:

- "The turnkey aspect of the program was very useful. It allowed us to take a 'hands off' approach, which saved us a lot of time."
- "We really liked the metrics provided in the audits, such as return-on-investment, payback, etc. Also, the metrics in lay language, such as 'tons of CO2 emissions saved' were useful in selling the projects to the non-technical people and the city council."

3.6 INCENTIVE PRICING AND PROJECT M&V

The program design provided incentives for eligible energy efficiency projects and for energy management system upgrades. Energy efficiency measure incentive payments were consistent with the levels employed in the Statewide Nonresidential Standard Performance Contract (SPC) program:

- $0.05 per annual kWh saved in lighting measures,
- $0.14 per annual kWh saved for HVAC measures,
- $1.00 per annual Therm saved for boiler and water heating measures, and
- $0.08 per annual kWh saved for other electricity savings.

The program also provided incentives for energy management systems (EMS) and real-time metering equipment. Incentives were initially set at $1,100 per point, with a limit of five point connections per building. Incentive rates were later modified to be paid at $1,100 for the first five points, and $550 for each additional point. The point connection could be used to establish actions in the existing building management system to reset temperatures or set current limits on chillers, etc. Several toggle-type control actions would be established that could be triggered remotely in response to alerts from the Independent System Operator or desired levels established by the City organizations. The point cost would fund a meter upgrade, establishment of a connection to the central management system, and several toggle action relays. EMS incentives were allocated for each local government partner, with separate caps established for each partner.

Once a government agency submitted a project to participate on the program, SDREO reviewed the project for qualification based on peak demand (kW) or annual energy (kWh and/or Therm) usage. If the demand and usage were sufficient, SDREO performed an audit through the

Technical Assistance Program (TAP) to determine the potential energy savings. If the energy savings was sufficient, SDREO accepted the project into the program.

After qualifying the project, SDREO provided design assistance for the project. SDREO ensured that there was an acceptable M&V plan in place to verify the estimated savings. Once the final plan was developed, the retrofit incentives were calculated. Participants had two payment options. One option paid 80% of the calculated retrofit incentive up-front, and the remaining 20% at the completion of the project installation and verification of the energy savings. The energy savings had to be at least 80% of the estimated savings to receive the full incentive. The second option, which was used for all but four projects, paid 100% of the calculated retrofit incentive upon completion of the project installation and verification of the energy savings.

SDREO's M&V contractor, AESC, was responsible for providing a reasonable measurement and verification plan at the beginning of the project to cost-effectively determine verified energy savings. The program employed the International Performance Measurement & Verification Protocol (IPMVP) Option C -- Whole Facility approach to M&V, to determine post-installation energy retrofit usage to verify realized energy savings. AESC was responsible for developing review forms, performing energy savings reviews, providing project M&V recommendations, and conducting final project M&V analysis.

AESC had previously been contracted to create the program database. To facilitate correspondence and project tracking, this platform was used to develop the project review forms. Project proposal database files were e-mailed to AESC with all engineering calculations and project related files. The project information was reviewed and, if necessary, a data request was sent to the program manager, at which time AESC's review was suspended.

Once all supporting documentation was received, the reasonableness of savings estimates was evaluated to minimize the risk of awarding savings that could be in error of more than 20%. In general, AESC used computer simulation and standard engineering references to compare to SDREO's estimates. If their findings were within 20%, then SDREO's estimates were approved. On occasion, AESC developed simplified computer simulation models to help SDREO approximate various HVAC measure savings. In total, AESC reviewed 15 of the 68 projects.

3.7 PROGRAM BUDGET

The budget for the LGEE program was fixed at $2,336,449, with $1,504,512 allocated to direct implementation. The final LGEE Budget Worksheet indicates that actual program expenditures will be $1,565,863, with $733,681 in incentives to participants. The above projected levels of effort were the basis of the approved program budget and did not change throughout the course of the program. The final LGEEP budget workbook indicates that there is $818,614 in unspent budget funds, with the largest portion of unspent funds in direct implementation ($476,536).

3.8 PROGRAM SAVINGS GOALS

The LGEE Program Implementation Plan (PIP) states that the program will realize 100% installation of measures that form the basis of claimed gross annual energy savings. In addition, the PIP assumes that 20% of the program participants would be "free-riders," participants who would have undertaken the project without the incentives and assistance of the LGEE program.

This level of free-ridership corresponds to a 0.80 net-to-gross ratio, the same ratio assumed for "other nonresidential programs" in the revised Policy Manual.

The target net demand and net annual energy savings goals were as follows:

- Net annual electrical energy savings: 6,499,574 kWh
- Net coincident peak demand savings: 650 kW
- Net annual natural gas savings: 85,447 Therms

Survey results were somewhat conflicting regarding the level of free-ridership in the program. For example, one of the larger partners commented that "We couldn't implement these projects without the project management funds and technical services [provided by LGEEP]. We don't have the qualified energy professionals in-house, and SDREO has provided the means to quantify and understand the effectiveness of the energy efficiency projects."

However, other participants suggested that some of the installed projects might have been installed in the absence of the LGEE program. Assuming this to be true, it is difficult to predict when the projects would have been installed without the financial incentives and technical assistance provided by the LGEE program. It is safe to say that the LGEE program was successful at identifying many energy efficiency projects that were eventually installed, and also expedited many other projects that may have been installed in later years without the LGEE program. In the absence of solid data on which to base a net-to-gross analysis, the original estimate of 0.80 appears reasonable, and has been used in this report to derive net savings.

Subsequent sections of this report address the analysis of gross savings and of net savings of the program.

3.9 PROGRAM COST-EFFECTIVENESS

The Program Implementation Plan projected program cost-effectiveness calculations for the Total Resource Cost (TRC) test ratio of 2.38, and a Participant Cost test ratio of 11.7.

Section 7 presents a discussion of the cost-effectiveness analysis.

Section 4 Process Evaluation Results: Analysis of Implementation

Program implementation was examined largely through telephone and in person interviews with local government partners, the program implementer, and the M&V contractor. The implementation process of the LGEE program followed the original program design; however, program implementation began four months late due to lengthy contract negotiations with SDG&E. Additional delays resulted from getting partners on-board. It took some partners one full year to get the contract signed, leaving only one year for program implementation. Additionally, requirements for city council approval further delayed many projects. Many of the LGEEP projects were completed just prior to the direct implementation deadline of March 15, 2006. Clearly momentum had built after two years. It appears that an extended program cycle would have resulted in many more projects, as existing momentum could have been positively leveraged.

4.1 LOCAL GOVERNMENT PARTNER OBSERVATIONS

An in-person or a telephone interview was conducted with each of the seven participating local government partners. The interviews reveal a very positive view of the LGEE program. Partners thought the program design was good, and they identified the most valuable components of the program as:

- The audits identifying energy efficiency projects with payback
- Comprehensive technical support
- Labor reimbursement
- Direct payment of contractors
- Personal attention from SDREO, such as help in navigating the "alphabet soup" of rebate programs

The following were additional comments received regarding SDREO, the LGEE program, and its offerings:

- "The turnkey aspect of the program was very useful. It allowed us to take a 'hands off' approach, which saved us a lot of time."
- "We really liked the metrics provided in the audits, such as return-on-investment, payback, etc. Also, the metrics in lay language, such as 'tons of CO2 emissions saved' were useful in selling the projects to the non-technical people and the city council."
- "Another important offering from SDREO was the ability to do presentations to individual departments affected by the projects."
- "SDREO's sponsorship of the projects continued through the approval process at all levels and added credibility to the projects that was far greater than a salesperson or contractor could offer."
- "LGEEP met our budget needs, and the audits saved us a lot of time."

- "SDREO was great to work with. They were very helpful and professional."
- "They didn't pressure you, even when they didn't agree with your decisions."
- "It was a great program for a city of our size."
- "The program taught us how to access public goods money [LGEE incentives], it gave us experience writing proposals and reports…, and it raised interest and awareness among our city administrators."
- "The program is making a positive impact to the community."

The most common complaint among the partners involved the personnel changes at SDREO. Frequent personnel changes can negatively affect program consistency, continuity and momentum. Additional complaints regarding the LGEE program were:

- "Having to wait in line behind the City and County for [EMS incentive] funds."
- "Initially, it was hard to figure out what we could do with the program."
- "We found many more [EMS] projects to do but couldn't because of limited [EMS incentive] funding allocated to us in the program."
- "The implementation period should be longer. The process from project identification to council approval to procurement to installation takes 18 months."

Partners overwhelmingly felt that the LGEE program was meeting, and often exceeding, expectations. Comments include:

- "The program exceeded our expectations—we found more eligible projects than we expected."
- "In helping us with labor costs, LGEEP exceeded our expectations, largely through Jason's help."
- "The program helped identify more potential retrofit options than we expected."
- "We didn't expect that we would be able to recoup any labor costs."
- "We got a good reception from the city council."
- "We always expected it to be a positive program, and it lived up to our expectations."

Program processes were generally viewed as flexible. SDREO was able to help the partners through the application process. The participants were also very satisfied with the technical support services provided by SDREO. All of the local government partners stated that they would participate in the LGEE program or a similar program if it were offered in the future.

Only a few suggestions were given on how the LGEE program could have been improved:

- "Don't focus on how much money will be given, but on how much technical support you'll provide. The technical support is more important to us than the rebate money."
- "Promotional materials at the jobsite would be useful (similar to 'your tax dollars at work' campaigns on public works projects."
- "The more turnkey, the better."

4.2 SDREO AND M&V CONTRACTOR OBSERVATIONS

Two SDREO administrators were interviewed in-person at different stages of the program. The M&V contractor, AESC Inc., was also interviewed. SDREO believes that market barriers were addressed by the LGEE program. By paying contractors directly, the cities are able to simplify the procurement process. It is understood that program technical assistance is a valuable offering to most of the partners. They also note that the mix of projects (about 60% large) resulting from SDREO audits is a good indication that program services are encouraging more comprehensive energy efficiency activities. They acknowledge that incentives have not necessarily helped reduce barriers associated with capital budgeting, as evidenced by the observation that few partners are exercising the option to take the 80% payment up front. In practice, the option to pay contractors directly (and not take the 80% pre-payment) is more valuable to the partners.

Something that was not anticipated by SDREO was the complication associated with the cities' fiscal year budgeting. All the cities budgets are tied to July 1st fiscal years, rather than calendar years, which has implications for the timing of activities such as when to roll out marketing materials. Budgets for contractors are also affected by fiscal year budgeting practices.

The SDREO administrator believes that the incentives work well, as they are perceived to be easier than alternatives such as Express Efficiency or SPC. The project management supplement also is useful, and using the Technical Assistance Program for energy auditing has worked great. SDREO is surprised that the 80/20 payment option has not been very popular among partners, but obviously the partners value direct payment to contractors more than receiving 80% of the incentive up-front. The M&V contractor noted that paying the contractor directly increased "financial efficiencies," as the local governments did not have to go through the invoicing process.

The program administrator identified a potential improvement in that the smaller local governments need a human resource to help them manage projects from auditing to rebate application to installation/contracting, etc. The project management money is not as useful to them. The partnership worked well, as resources can be focused on a few individuals. SDREO believes that free riders occurred only for smaller projects, and none for large ones.

4.3 PROGRAM DESIGN AND IMPLEMENTATION RECOMMENDATIONS

Several observations can be made regarding the LGEE program design. Overall, the program design was a success. The roles of SDREO, the local government partners, and the M&V contractor were well-defined, and generally worked well for the program. The program participants were generally very satisfied with the program offerings, especially the technical assistance and ability to pay contractors directly. They were appreciative of the attention that SDREO was able to give them, and the energy audits were found to be useful. Market barriers seem to be adequately addressed.

A major challenge to the LGEE program was timing. Any continuation of LGEEP should account for an extended period of time for contract negotiations with the local utility. More time is needed to bring the local governments on-board, and then to receive city council approval. As evidenced by some partners in the LGEE program, it can take well over a year before any projects are started. Two years after LGEEP began, a solid momentum has been achieved with

most of the partners. Unfortunately, that momentum cannot be sustained now that the program has ended. A timeframe of two years is too short. A timeframe of at least three years, and preferably four, is recommended for this type of program. Any continuation of the program should also take into account the fiscal calendar of the local governments, and plan program activities around fiscal year budgeting.

Additional time should also be provided following implementation for the M&V contractor to complete the M&V reviews. For complicated projects, energy savings are difficult to quantify accurately without actual post-installation monitoring over a period of time. With the financial mechanism of adjusting the incentive amount based on proposal performance removed for projects installed at the end of the implementation period, the importance of the post-installation performance period was minimized. At least two months should be provided following program implementation for the M&V contractor to complete the M&V activities.

An interesting component of the LGEE program is the payment structure options. One payment structure was an 80/20% arrangement. This structure provided 80% of the incentive to the partner before the project began, in order to supply the government entities the necessary cash flow to make projects move forward. The remaining 20% of the incentive was paid out after the project was installed and energy savings verified. The final 20% payment was only made if the verified post-installation savings were at least 80% of the estimated savings. Ultimately, only four projects took advantage of this payment option. Reasons for low participation include the risk of losing the final 20% if savings goals were not met, and difficulty in accounting for the incentive funds prior to project completion, and paying contractors upon completion.

A second payment structure provided 100% of the incentive after the project was installed. This option allowed direct payment to the contractor. Government agencies are held to very strict bidding and contracting restrictions, requiring them to put all projects over a certain amount out to bid. By paying incentives directly to contractors, the overall cost of a project to the government organization was able to remain low enough to avoid the bid process. This process resulted in saving time which would have been required if a bid process had been completed. Paying incentives directly to contractors and vendors was very popular among the partners, and it allowed projects to be implemented more cost effectively and in a timely manner.

The program administrator should focus on maintaining program continuity over time, understanding that personnel changes can negatively affect program momentum. The project management offering could be reworked so that actual human resources are offered, rather than just project management money. And cities that choose not to take project management funds should have access to more funds in the form of incentives. Incentives should be available on an expanding scale, based on the types of services and program offerings requested.

The LGEE program has been a success, and some form of the program should be continued to leverage upon the momentum built from LGEEP.

Section 5 Impact Evaluation Results: Analysis of Gross Savings

The analysis of the gross savings of the LGEE program consists of four steps:

1. Aggregate recorded project data in the LGEE program activity-tracking database to calculate claimed gross demand savings and claimed gross annual energy savings,

2. Analyze and adjust, if needed, the claimed gross kW reduction based on the results of site inspections and the review of project data for a sample of sites,

3. Analyze and adjust, if needed, the stipulated annual operating hours used in determining the claimed gross annual kWh savings based on the review of project data for a sample of sites, and

4. Extrapolate any adjustments to kW reduction from the sample of projects to the results of the program and calculate adjusted gross demand and annual energy savings.

The analysis and assessment of gross and net savings were based on a review of data in the project activity-tracking database, site inspections and data collection, and the survey of local government participants.

5.1 CLAIMED GROSS SAVINGS

Claimed gross savings, project costs, incentives, and other information were aggregated using data for the completed projects listed in the LGEE program activity-tracking database. Two types of projects were incentivized in the program: energy efficiency projects and energy management system (EMS) projects. Incentives for the 68 energy efficiency projects were based on energy savings. Incentives for the EMS projects were initially set at $1,100 per point, with a limit of five point connections per building. Incentive rates were later modified to be paid at $1,100 for the first five points, and $550 for each additional point. Energy savings claims were not made for the EMS projects due to the difficulty in accurately quantifying them; however, energy savings will definitely accrue from the EMS enhancements. SDREO estimates annual savings of around 500,000 kWh from the 29 EMS projects. The EMS projects had a total rebate value of $180,290.

Of the 68 completed energy efficiency projects, 60 resulted in electricity savings only, two had natural gas savings only, and six resulted in both electricity and natural gas savings. The results are presented below in Table 5.1. The "Average per Project" values take into account only the number of projects with each specific fuel type (e.g., only eight natural gas projects).

Table 5.1 LGEE Program Claimed Gross Savings (Energy Efficiency Projects Only)

# of Completed Projects	Claimed Gross Annual Electricity (kWh) Savings		Claimed Gross Annual Natural Gas (Therms) Savings		Incentives ($)	
	Total	Avg/Project	Total	Avg/Project	Total	Avg/Project
68	4,662,034	70,641	33,812	4,227	$553,391	$8,138

5.2 PROGRAM SITE INSPECTIONS

Pre-installation site inspections were performed for all the LGEEP projects. The purpose of the inspections was to verify baseline information, such as number and type of equipment, and baseline operating hours. Where appropriate, instantaneous or short-term monitoring was performed to verify equipment operation and schedules. The pre-installation inspections were rigorous, and add certainty to the calculated values of energy savings.

SDREO engineers, through audits and site surveys, generated savings estimates for all projects. Due diligence was performed by AESC, who was contracted to generate savings estimates for various projects as needed. In general, AESC reviewed the larger, more comprehensive projects. Incentive values were based on savings estimates produced by both SDREO and AESC.

Post-installation inspections were performed by SDREO on most of the LGEEP projects. However, many of the projects, representing over 2,000,000 kWh and 5,000 Therms, were completed just prior to the LGEEP direct implementation deadline of March 15th. For these projects, there was inadequate time to conduct post-installation M&V.

5.3 EM&V SITE INSPECTIONS

EM&V activities included post-installation site inspections on a sample of the completed projects to verify the accuracy of information used in the calculation of energy savings and incentive payments. For a sample of nine energy efficiency projects and 11 EMS projects, installed equipment was visually confirmed and compared to specified replacement equipment documented in project files.

The site inspections had the following objectives:

- Verify installed equipment counts, types and capacities,
- Verify facilities were currently operating as noted in project documents, and
- Assess the appropriateness of the hours of operation used in energy savings calculations.

The 20 site inspections were selected at random from the population of 68 energy efficiency projects and 29 EMS projects. The sites visited included a diverse mix of measures, including lighting, HVAC, and variable frequency drives.

The site inspections found very high levels of accuracy. No discrepancies were noted during any of the 20 site inspections. All the equipment listed in the project documents were in place and operating during the site visits, and the operating hours used in the energy savings calculations

appeared reasonable. A comprehensive lighting inspection was not performed for most projects, due to issues of accessibility and time constraints. However, spot checks of lighting equipment confirmed accurate counts. The EM&V site inspections found no discrepancies with the information contained in the project folders. In addition, the analysis of the sample projects included a review of documents and claimed energy savings. Project files were organized and located at SDREO's office. An EM&V inspection summary detailing each site visit is given in Appendix C.

5.4 ADJUSTMENTS TO GROSS SAVINGS

The EM&V inspection results suggest a high level of accuracy in equipment types, counts, and operating schedules as indicated in project documents and used in energy savings calculations. Nexant found no reason to question any of the gross savings calculations and, accordingly, no adjustments are being made to the claimed gross savings. The aggregate claimed gross annual energy savings recorded in the LGEE program activity-tracking database are accepted without revision. Gross energy savings are presented for each year of expected equipment operation in the CPUC Impact Tables, provided in Appendix D.

Section 6 Impact Evaluation Results: Analysis of Net Savings and Direct Impacts

The analysis and assessment of gross and net savings were based on a review of data in the project activity-tracking database, site inspections and data collection, and the survey of local government participants. The calculation of net savings involves estimating the "free-ridership" in the program and then calculating a net-to-gross ratio used to eliminate the savings claims associated with "free-riders." "Free-riders" are participants who would have undertaken some portion or all of their projects within a near-term timeframe without the incentives and assistance provided by the program. The Program Implementation Plan (PIP) assumed that 20% of LGEEP participants would be "free-riders," for a net-to-gross ratio of 0.80.

6.1 ESTIMATION OF "FREE-RIDERSHIP"

To assess the level of free-ridership in the program, participants were asked in the telephone survey whether they were likely to have completed the projects in the next two years if the LGEE program had not been available.

Survey results were somewhat conflicting regarding the level of free-ridership in the program. For example, one of the larger partners commented that "We couldn't implement these projects without the project management funds and technical services [provided by LGEEP]. We don't have the qualified energy professionals in-house, and SDREO has provided the means to quantify and understand the effectiveness of the energy efficiency projects."

However, other participants suggested that some of the installed projects might have been installed in the absence of the LGEE program. Assuming this to be true, it is difficult to predict when the projects would have been installed without the financial incentives and technical assistance provided by the LGEE program. It is safe to say that the LGEE program was successful at identifying many energy efficiency projects that were eventually installed, and also expedited many other projects that may have been installed in later years without the LGEE program. It is also known that several projects will be installed within a few months following LGEEP implementation. These projects were definitely inspired by LGEEP and benefited from program elements such as technical assistance, although the savings that will result from these projects cannot be included in the program savings. In the absence of solid data on which to base a net-to-gross analysis, the original estimate of 0.80 appears reasonable, and has been used in this report to derive net savings.

6.2 ADJUSTMENTS TO NET SAVINGS

Applying a net-to-gross ratio of 0.80 to the LGEE program gross savings results in the adjusted net savings of the program. Table 6.1 gives the resulting net program savings. Gross program-projected energy savings and net program-achieved energy savings are presented for each year of expected equipment operation in Table 6.2. This information is also provided in the CPUC Impact Table in Appendix D.

Table 6.1 LGEE Program Net Savings Summary

# of Completed Projects	Annual Electric Energy (kWh) Savings		Annual Natural Gas (Therms) Savings	
	Gross	Net	Gross	Net
68	4,662,034	3,729,627	33,812	27,050

Table 6.2 LGEE Program Energy Impacts

CPUC ID# 1301-04

San Diego Region Local Government Energy Efficiency Program

Year	Calendar Year	Ex-ante Gross Program-Projected Program MWh Savings	Ex-Post Net Evaluation Confirmed Program MWh Savings	Ex-Ante Gross Program-Projected Peak Program MW Savings	Ex-Post Evaluation Confirmed Peak MW Savings	Ex-Ante Gross Program-Projected Program Therm Savings	Ex-Post Net Evaluation Confirmed Program Therm Savings
1	2004	0	0	0	0	0	0
2	2005	0	212	0	0.0212	0	0
3	2006	8,124	3,138	0.8124	0.3138	106,809	22,814
4	2007	8,124	3,730	0.8124	0.3730	106,809	27,050
5	2008	8,124	3,730	0.8124	0.3730	106,809	27,050
6	2009	8,124	3,730	0.8124	0.3730	106,809	27,050
7	2010	8,124	3,730	0.8124	0.3730	106,809	27,050
8	2011	8,124	3,730	0.8124	0.3730	106,809	27,050
9	2012	8,124	3,730	0.8124	0.3730	106,809	27,050
10	2013	8,124	3,730	0.8124	0.3730	106,809	27,050
11	2014	8,124	3,730	0.8124	0.3730	106,809	27,050
12	2015	8,124	3,730	0.8124	0.3730	106,809	27,050
13	2016	8,124	3,730	0.8124	0.3730	106,809	27,050
14	2017	8,124	3,730	0.8124	0.3730	106,809	27,050
15	2018	8,124	3,730	0.8124	0.3730	106,809	27,050
16	2019	8,124	3,730	0.8124	0.3730	106,809	27,050
17	2020	8,124	3,730	0.8124	0.3730	106,809	27,050
18	2021	8,124	3,645	0.8124	0.3645	0	25,190
19	2022	3,717	3,254	0.3717	0.3254	0	25,190
20	2023	3,717	3,254	0.3717	0.3254	0	25,190
TOTAL	**2004-2023**	**137,425**	**65,717**			**1,602,135**	**477,080**

6.3 ANALYSIS OF DIRECT IMPACTS

The LGEE program resulted in short-term direct impacts on local government participants, successfully motivating participants to complete 68 energy efficiency projects and an additional 29 EMS projects. All of the participants completed multiple energy efficiency projects, although only four of the six completed EMS projects. As can be seen from Table 6.2, net energy impacts are expected for many years to come, as most of the installed measures have long equipment

useful life values. Substantial net electricity and net gas energy savings are expected to persist through 2023.

Some limited longer-term direct impacts may result from the LGEE program. Momentum built up by LGEEP will result in additional energy efficiency projects in the near term. The local governments involved in the program gained valuable knowledge on how to identify and complete energy efficiency projects. However, it is not certain whether that knowledge will translate into longer-term energy conservation projects in the absence of LGEEP. The local governments without dedicated energy efficiency staff will probably not be able to complete many, if any, additional energy projects without support. Often, immediate financial demands on local governments make it difficult for them to invest in energy efficiency even though it is cost-effective over the long-run.

In addition, the majority of the most cost effective projects have been completed by the participants. Since the "low-hanging fruit" have already been taken, economics of remaining projects (such as project payback) will experience diminishing returns, and may not be completed at all in the absence of financial incentives. Finally, it is unlikely that the direct experience gained by participants will be disseminated to other local governments. More abstract information, perhaps in the form of case studies, could be passed along through channels such as SDREP. It is unclear what potential benefits this information could achieve, yet without it little long-term market effects would be expected.

The LGEE program was completed within the original projected program budget. The program remained cost-effective based on an estimated Total Resource Cost (TRC) Test ratio of 2.28 and a Participant Cost Test ratio of 11.7. These values indicate the 2004-2005 LGEE program was successful from both a utility resource perspective and from a participant perspective. The cost-effectiveness values projected in the Program Implementation Plan were 2.384 and 1.7, respectively.

7.1 ANALYSIS OF BUDGET/ACTUAL EXPENSES

The budget for the LGEE program was fixed at $2,336,449, with direct implementation funds representing $1,504,512. The final LGEEP Budget Worksheet indicates that actual program expenditures will be $1,565,863, with incentives representing $576,758. The remainder of the budget that is unspent and uncommitted is $818,614. Direct implementation costs represent $476,536 of the unspent budget.

7.2 TOTAL RESOURCE COST (TRC) AND PARTICIPANT COST TESTS

The calculations of the Total Resource Cost (TRC) and Participant Cost Tests included in the Final LGEEP Budget Worksheet were reviewed and adjusted to estimate the cost-effectiveness of the program. The calculations were adjusted to include the net-to-gross ratio to 0.80. Table 7.1 presents these findings.

Table 7.1 TRC and Participant Cost Test Inputs and Results

Test	Costs	Benefits	Ratio
TRC	$1,399,538	$3,189,240	2.28
Participant Cost	$709,194	$8,289,441	11.7

While the program TRC is very close to the value projected in the PIP, the participant test is much higher than expected. Upon review of the LGEE program budget workbook, it is clear that the incentives paid out to the participants were a very high portion of the total project cost. The program incentives paid out for the HVAC-Chiller measure, in particular, had a large impact on the participant test cost-effectiveness. The HVAC-Chiller measure, which represents 76% of the total LGEE program savings, had a financial incentive of $438,271 and a gross incremental measure cost of $469,577.

San Diego Local Government Energy Efficiency (LGEE) Program No. 1301-04

Evaluation, Measurement & Verification (EM&V) Plan

Revised 9/27/04

Introduction

The San Diego Local Government Energy Efficiency (LGEE) Program, No. 1301-04 is a standard performance contract (SPC) style incentive program targeting energy efficiency retrofit projects of local government facilities within San Diego County. LGEEP is sponsored by the San Diego Regional Energy Partnership (SDREP) and administered and implemented by the San Diego Regional Energy Office (SDREO). SDREP members (local governments) are both implementers and participants. Program implementation includes the provision of contracted Measurement and Verification (M&V) services.

Meeting CPUC EM&V Objectives

The following is a summary of the how the EM&V plan will meet CPUC objectives, to the extent possible within the available budget:

1) Measuring level of energy and peak demand savings achieved: As discussed in detail below (Baseline Information, Energy Efficiency Measure Information, Measurement and Verification Approach, and Evaluation Approach sections), EM&V activities include reviewing program activity-tracking project and savings data, conducting pre-installation and post-installation site inspections of a sample of projects, including visual confirmation of project data and spot kW measurements, and survey of participants, including assessment of program assumptions that affect energy savings calculations.

2) Measuring cost-effectiveness: As discussed in detail below (Cost-effectiveness Analysis subsection of Measurement and Verification Approach section), EM&V activities include the review of and recommendation of adjustments to the TRC and PC cost-effectiveness test calculations as presented in the most current program budget workbook at the time of the drafting of the EM&V final report.

3) Providing up-front market assessments and baseline analysis: As discussed in detail below (Baseline Information section, Gross Savings subsection of Measurement and Verification Approach section), EM&V activities will include a review of program activity-tracking baseline data collected and entered project by project during the program implementation by the program implementer, and the review of program assumptions affecting baseline and energy savings calculations, including a literature search of relevant market studies and EM&V reports.

4) Providing Ongoing Feedback and Corrective, Constructive Guidance Regarding Implementation of Programs: As discussed in detail below (Energy Efficiency Measure Information and Reporting Schedule subsection of Evaluation Approach), EM&V activities will include a quarterly review and analysis of program activity tracking data to assess the level and

type of participation in the program, monthly EM&V reports on activities, and an annual EM&V progress report with preliminary findings. During the development of the program logic chart (as described in objective #5 below and in the Evaluation Approach section), EM&V activities will include feedback and constructive guidance to the program administrator on clarifying program objectives and performance tracking.

5) Measuring Indicators of the Effectiveness of Specific Programs, Including Testing of Assumptions that Underlie the Program Theory and Approach: As discussed in detail below (Evaluation Approach section), EM&V activities will include the development of a "program logic chart" to document the program theory and approach, and to specify the effectiveness and performance metrics and activities to measure performance metrics. As described in detail below, such EM&V activities include review of reported program activity (database, monthly progress reports) to assess the appropriateness of the level and type of program activities and participation, survey of participants to assess, among other aspects of the program, the validity of stated market barriers to energy efficiency and participant value of program elements and offerings, and interviews with program partners, administration staff, and implementation staff to assess the effectiveness of program implementation as planned or if different from plan.

6) Assessing the Overall Level of Performance and Success of Programs: As discussed in detail below (Evaluation Approach), the result of all the EM&V activities in the plan will be brought together in the EM&V final report to inform the assessment of overall level of performance and success. The assessment of overall performance and success of the program will be based on whether or not the program: was implemented as planned (or changed to address needs), completed program activities and outputs (e.g., participant workshops, collaboration with members of partnership, generated project proposals, conducted site inspections, completed installations), achieved the desired level and type of participation, achieved the target energy savings, and remained cost-effective.

7) Informing Decisions Regarding Compensation and Final Payments: EM&V activities will include the review of calculations of a sample of individual project incentive payments and the review of total program savings. EM&V activities involving the review of program assumptions, design of formulas for energy savings and incentive calculations, and the review and analysis of information in the program activity tracking database will provide the program administrator with cross-check information when responding to a request for incentive payment from the program implementer on a project by project basis. EM&V review of total program savings will provide the CPUC with information that can be included in the determination of administrator/implementer performance compensation.

8) Helping to Assess Whether There is a Continuing Need for the Program: The EM&V final report will include an assessment of the overall level of performance and success of the program. In addition, the final report will recommend improvements to the program, if any, to enhance future program performance and success, if possible. Recommendations will include an assessment of a continuing need for the program based on: consideration of the value placed on the program and its elements by participants, the level and type of participation, if there was excess demand for participation in the program, and, if there was insufficient demand for participation in the program, whether adjustments to the program would potentially enhance the level and type of participation.

The program will conduct the following EM&V activities:

1) Conduct of process evaluation based on the development of a program logic chart through:

- Review of program documents (e.g., PIP, budget workbook, website, marketing material, participation forms) (by Nexant)
- In-person interviews with SDREO program administrator-implementer staff (by Nexant)
- Telephone interviews with representatives of SDREP members (by Nexant) and
- Telephone interview with the M&V consultant (by Nexant)

2) Conduct of impact evaluation through:

- Collection and documentation of baseline equipment and operations information, energy efficiency measure information, and resulting estimated savings of projects, in a program activity-tracking database (by SDREO and SDREP member staffs)
- Development of M&V plans and review of estimated energy savings of all projects (by M&V consultant)
- Pre- and post-installation inspections of all projects (by SDREO)
- "Audit" of a sample of 11 projects including review of project documents and pre- and post-installation site inspections (by Nexant)
- Review and analysis of project information in the program activity-tracking database (by Nexant)
- Review of program activities in the monthly implementation progress reports (by Nexant)

3) Communication of EM&V findings through:

- Monthly EM&V progress reports (by Nexant)
- Annual EM&V progress report (by Nexant)
- EM&V Final Report (by Nexant)

Baseline Information

SDREP member staff will submit project applications and supporting documentation (e.g., baseline equipment, measured operating data, proposed measures, etc.) to the program and SDREO program implementation staff will input project and measure data into a program activity tracking database during program activities. SDREO program implementation staff will conduct pre-installation inspections of all project applications to verify the reported baseline equipment and operations data. The M&V consultant will develop M&V plans and review and analyze the estimated energy savings of all projects.

Nexant will review and analyze project baseline information and assumptions in the program database (referencing relevant published reports and studies, as needed). At the beginning of the program, Nexant will discuss approaches to verifying the accuracy of baseline information with

the M&V consultant. Nexant will review information in the program activity tracking database, including project baseline information, during program implementation, and communicate to the M&V consultant and SDREO implementation staff any concerns.

Nexant will verify the accuracy of the program implementer's project level baseline information verification activities through the conduct of pre-installation inspections of a sample of 11 projects. Sample results will be extrapolated to adjust, if warranted, the aggregate baseline information of the population of projects. The combination of data gathering and analysis efforts will document and verify baseline equipment and operations data and assumptions.

Energy Efficiency Measure Information

SDREO program implementation staff will input project and measure data into a program activity-tracking database during program activities. SDREO program implementation staff will conduct post-installation inspections of all project proposals to verify the installation of proposed measures as reported by SDREP members. Nexant will review and analyze project measure information and assumptions in the program database. Nexant will verify the accuracy of the program implementer's project level installed measure information verification activities through the conduct of post-installation inspections of a sample of 11 projects. Sample results will be extrapolated to adjust, if warranted, the aggregate measure information of the population of projects. The combination of data gathering and analysis efforts will document and verify installed measure data and assumptions.

After the third month of each quarter, Nexant will review, analyze, aggregate, and report (in the corresponding month's EM&V progress report) the measure data in the program activity-tracking database.

Measurement and Verification Approach

Measurement and verification of the claimed energy savings of the LGEE program will be based on the following EM&V activities:

- Development of M&V plans and review of the energy savings estimates of all project applications (by the M&V consultant)
- Verification of the baseline and measure data in project applications and completion reports through pre- and post-installation inspections of all projects (by SDREO)
- Review and analysis of project baseline and measure data in the program activity-tracking database (by Nexant)
- "Audit" of a sample of 11 projects including the review and analysis of the M&V consultant-approved estimated energy savings and verification of the accuracy of program implementer-conducted site inspections of project baseline information through pre-installation inspections and project installed measure information through post-installation inspections (by Nexant)
- Telephone interviews of all SDREP members to assess free-ridership and verify operating information (by Nexant)

The SDREO program implementation staff and the M&V consultant will review the energy savings estimates of all project applications. SDREO program implementation staff will conduct

pre- and post-installation inspections of all projects. The M&V consultant will develop M&V plans for each project using the IPMVP M&V option that is appropriate for each project (note: it is anticipated that Option C Whole Building, will be the predominant M&V approach).

In the annual progress report and the final report, Nexant will review, analyze, and recommend adjusting, if necessary, the program implementer's and M&V consultant's assumptions, calculations, and data verification approaches used in estimating project and program demand reduction and energy savings based on the review and analysis of the data in the program-activity-tracking database and of a sample of 11 projects. In addition, Nexant will include questions in the conduct telephone interviews with all SDREP members to confirm project information affecting the estimate of energy savings and to assess free-ridership. Both annual and lifetime savings impacts will be provided.

In the final report, Nexant will review, analyze, and recommend adjusting, if warranted, the program implementer calculations of the cost-effectiveness of the program based on the TRC and participant tests as presented in the latest version available of the LGEE program budget workbook.

Site Inspection Strategy

SDREO program implementation staff will conduct pre- and post-installation inspections of all projects (100% confidance/0% precision) to verify baseline information and the installation of project measures as specified in project documents (e.g., existing equipment inventories, proposals, work orders, project completion reports). Site inspections will include verification and/or assessment of the following information:

- Baseline equipment counts, types and capacities
- Facility operations, including operating hours
- Comprehensiveness of project proposals,
- Completion of the retrofit per the project proposal

In the first half of 2005, Nexant will "audit" the accuracy of program implementation staff's project level baseline information verification activities through the conduct of pre-installation inspections of a sample of 11 projects (80% confidance/20% precision, assuming a large population and 0.5 coefficient of variation). The audit will include a review of project documents and information in the program database, and an analysis of the energy savings of the project application. During the site inspections Nexant will confirm existing equipment types, counts, and rated capacities, and conduct interviews with facility personnel to confirm project information, such as estimated operating hours.

In the first half of 2005, Nexant will conduct post-installation inspections of the sample of 11 projects to "audit" the accuracy of the program implementer's project level installed measure information verification activities. During the site inspections Nexant will confirm installed measure types and counts, and confirm that the measures and facility remain in operation.

In order for pre-installation site inspections to be conducted, for the audit of program implementation verification activities, the sample of projects will be chosen randomly as project

applications are received and approved. A random "yes/no" number ("0"/ "1") generator will be used to determine whether or not a project will be included in the sample and subject to EM&V review, such that the probability of selection will result in a sample size of 11 (out of an estimated total population of projects). The sample will be selected over the course of the program. . The review and analysis of a sample of projects will include visual confirmation of baseline equipment and installed measures, and the review of program assumptions, program implementer and M&V consultant supplied work papers, and SDREP member-supplied project and measure documentation.

Gross Savings Analysis

SDREP members will submit project applications and supporting documentation to the LGEE program. The M&V consultant will review and analyze the estimated energy savings, and recommend adjustment, if warranted, to the information in the project applications. SDREO implementation staff will input the project and measure data from approved project applications into the program activity-tracking database, including the number and type of baseline equipment, the estimated operating hours of the equipment, the proposed retrofit measure types and numbers, and the estimate of project demand reduction and annual energy savings. SDREO program implementation staff will conduct pre- and post-installation site inspections to verify that the baseline equipment and installed measures are consistent with the information of the project application. SDREO program implementation staff will input any required revisions to the project information in the program activity-tracking database.

After the third month of each quarter, Nexant will review, analyze, aggregate, and report (in the corresponding month's EM&V progress report) the projected demand reduction and annual energy savings of the program for active (including completed) projects in the program activity-tracking database. In the final report, Nexant will recommend adjustments, if warranted, to the claimed gross savings of the program based on the review of program assumptions, the review and analysis of data in the program activity-tracking database, and the findings in the audit of a sample of 11 projects.

A primary aspect and goal of the program design is the promotion of comprehensive energy efficiency retrofit projects within local government facilities. Per the approved PIP budget workbook, HVAC/Chiller and lighting measures represent over 90% of the projected resource benefit (in dollar terms) of the program, with Boiler/Water heating making up most of the balance. Consistent with the program objective to promote comprehensive projects, the proposed approach to the M&V of project energy savings is the IPMVP Option C – whole facility. EM&V activities to review and analyze gross savings will include review of the approach to whole facility M&V analysis of the M&V consultant and the results of the participant, program implementer, and M&V consultant whole facility analyses for the 11 projects of the sample. As described above, Nexant will test the accuracy of program implementer and M&V consultant activities to verify baseline equipment and installed measure information through the conduct of pre and post-installation inspections of the sample of 11 sites.

The following table (from LGEEP Workbook worksheet "2- Projected EE Activities") presents the projected energy and demand savings by general measure type/end use for the program:

Measure Type/End Use	Gross Annual Savings		Net Annual Savings		Net Peak Coincident Demand Reduction (kW)
	kWh	therms	kWh	therms	
HVAC – Chillers and Packaged Units	3,436,605	--	2,749,284	--	275
Lighting Improvements	4,407,490	--	3,525,982	--	353
Boiler & Water Heater Improvements	--	106,809	--	85,447	--
Other Electricity Savings	280,373	--	224,298	--	22
Total	8,124,468	106,809	6,499,574	85,447	650

Net Savings Analysis

In the final report, an estimate of free-ridership, quantified in a net-to-gross ratio for the LGEE program, will be used to adjust gross savings to net savings. Nexant will include questions in the telephone interviews of SDREP members to assess the level of free-ridership in the program. The telephone interviews will determine whether participants would have proceeded with the installation of energy efficiency measures without participation in the program. The resulting estimate of net savings will represent the savings that are attributable to the program, meaning, the savings would not have been achieved without the program.

Cost-effectiveness Analysis

In the final report, Nexant will review the program administrator and implementer calculations of the cost effectiveness of the program based on the Total Resource Cost (TRC) and Participant Cost tests presented in the latest version available of the program budget workbook, including the comparison of the projected budget to the actual expenditures of the program. Nexant will advise on any issues and recommend any needed adjustments to the calculations based on our review of data in the program activity tracking database and resulting from interviews and site inspections.

Evaluation Approach

The evaluation of program process and implementation will be largely based on the following EM&V activities:

- In-person interviews w/ SDREO program administrator-implementer staff (by Nexant)
- Telephone interviews w/ representatives of SDREP members (by Nexant)
- Telephone interview w/ M&V consultant (by Nexant)

An emphasis will be placed on testing the program theory and design (objective, target market sector, market barriers addressed, program strategy, projected activities and outcomes), examining the appropriateness of different implementation roles (administrator, implementer, SDREP members, contractors), identifying what is working and not working, comparing actual implementation to design and plan, and assessing participant value of program elements and satisfaction with the program.

Nexant will create a program logic chart based on an examination of the program design including a review of objectives, program theory, targeted market barriers, marketing material, outreach activities, educational materials developed for the program, program activities, and implementation plan. Nexant will begin with a review of program documentation followed by interviewing program administrator and implementer staffs. The interviews will confirm the understanding of the program design and theory and identify appropriate performance metrics (e.g., process metrics, activity and participation data to be tracked and reported by SDREO and SDREP members) for the program.

Nexant staff will design all interview and survey instruments. Nexant will conduct telephone interviews with representatives of all SDREP members. Due to the limited budget, non-participants will not be surveyed nor direct impacts tested beyond the sample of program participants.

Questions that we will seek to answer during interviews, written survey, and reviews of materials, activities, and results of the program include the following:

- Was the program theory and approach, including the stated market barriers and the program elements to reduce the stated market barriers, an accurate reflection of target participant issues and needs?
- Was the program implemented as planned?
- Were the designated roles of the program administrator/implementer, SDREP members, M&V and contractor appropriate and effective?
- Did the program achieve the projected type and level of participation?
- Was the program a significant factor in building the centralized energy management capacity and in affecting the decisions of participants to implement the energy efficiency and demand reduction measures?
- What were the relative values to participants of the program elements/offerings?
- Were there any unanticipated outcomes/results?
- What changes/improvements would make the program better?

The assessment of the effectiveness of the program will be based on the results of in-person and telephone interviews, review of the monthly program progress reports, and review of data in the program activity-tracking database.

Telephone Survey Strategy

In the 4th quarter of 2005, Nexant will interview at least one representative from each of the six l SDREP members (100% confidance/0% precision) to assess program effectiveness, participant value of program elements/offerings, participant satisfaction with the program, and the level of free-ridership in the program (to inform net-to-gross estimates). If needed, follow-up interviews with another representative will be conducted to ensure that SDREP member input is obtained regarding their dual roles as both program implementer and participant. In addition, the telephone interviews will be used to solicit information on project comprehensiveness and

changes in participant energy management capabilities, and to confirm previous information, such as reported operating hours.

Reporting Schedule

Nexant will develop a standard reporting template and submit monthly EM&V progress reports. In the first quarter of 2005, Nexant will submit an annual EM&V progress report. In the first quarter of 2006 Nexant will submit a draft EM&V report and by April 15, 2006, Nexant will submit an EM&V final report.

Appendix B Program Logic Chart

2004-2005 Local Government Energy Efficiency (LGEE) Program Logic Chart

Objective	Increase comprehensive energy projects in local government facilities Increase local government energy management capabilities for centralized monitoring & energy management
Market Barriers Addressed	Long project approval timelines Complicated procurement processes High number of loosely coordinated sites and gas and electric meters Inability to pursue comprehensive projects within requirements of traditional public benefit programs Lack of capital for high start up costs Split incentives
Market Sector and Program Strategy	Eligible participants: Local government members of SDREP Eligible projects: Energy savings retrofits of local government facilities within San Diego County Project development & implementation by SDREP members (e.g., facility engineers, energy engineers, city staff) Standard Performance Contracting (SPC)-style program providing incentives per annual kWh or therm saved varying by end use Provision of technical assistance, including: Site audits (via TAP) Project review Project panning and design M&V Demonstration project & case study: Balboa Park Project
Program Activities/ Outputs	Marketing & Outreach (e.g., program brochure, presentations, newsletters, case studies, workshops) to SDREP members Technical assistance (e.g., audits, project review, planning and design, M&V) to SDREP members # Project proposals # Applications processed/approved # Completed installations Balboa Park Demonstration Project
Outcomes	
SHORT TERM (1 year)	Overall participation Increase in # of comprehensive projects Increase in # of energy management projects with centralized monitoring
LONGER TERM (2- 5 years)	Increased centralized energy management capability of local governments Increased SDREP involvement in regional energy program implementation
Outcome Metrics	
SHORT TERM (1 year)	Program participation documented in program activity tracking database # of comprehensive projects # of energy management projects with centralized monitoring
LONGER TERM (2- 5 years)	SDREP member participant reported anticipation of increased centralized energy management capability SDREP member participant reported level of involvement in regional energy program implementation
Savings Metrics: Annual Energy-Savings	FY-04-05: Gross: 8,124,468 kWh 106,809 therms Net: 6,499,574 kWh 85,447 therms Net Coincident Peak Demand Savings: 650 kW Program Cost-effectiveness Participant Test TRC

Appendix C EM&V Inspection Results

The purpose of the inspection conducted at various local government facilities across the city and county of San Diego from April 10 thru April 13, 2006 was to verify the installation and operational status of lighting efficiency upgrade, air handling units and pool pumps motors VFD retrofit, HVAC economizer retrofit, chiller compressor upgrade (Turbocor replacement), all-variable speed chilled water plant retrofit (Hartman loop), and EMS installation, as identified in the project site list submitted by the San Diego Regional Energy Office (SDREO) to Nexant as part of the Local Government Energy Efficiency Program Evaluation Measurement and Verification (EM&V) process. Present during the inspections were Jason Knight of SDREO, Tom Cartier of the City of San Diego Environmental Services, Tom Shaw of Alpha Mechanical, Paul Alesi of Alvarado Water Quality Lab, Dave McGrew of R.H. Fleet Science Center, and Joseph Lee Ong of Nexant.

BACKGROUND

As part of the EM&V process, Nexant randomly picked 9 sites to inspect in the City and County of San Diego to verify that the installed equipment is functioning properly and to the check operating status of each. The project sites inspected and their accompanying installed measure(s) are found in Tables 1A and 1B below.

Table 1A Incentive Projects

Project ID#	Bldg	Nexant Inspection date	HVAC kWh	Lighting kWh	Other kWh	Total therms	Total kWh	Notes
CNTY-2	Juvenile Hall	12-Apr-06	237,600				**237,600**	Turbocor installation (Phase 1)
CNTY-7	County Admin Center	12-Apr-06	711,000				**711,000**	Convert to all variable central plant, VFDs on chillers, pumps and fans
CNTY-8	Juvenile Hall (Ph.2)	12-Apr-06	175,455				**175,455**	Convert to all variable central plant, VFDs on chillers, pumps and fans
CSD-1	Tierrasanta, N. Clairemont Lib.; SE P.D.	10-Apr-06	48,516	26,136			**74,652**	Lighting upgrades at Tierrasanta and North Claremont Libraries, SE PD got a new package unit
CSD-2	Alvarado Water Treatment Laboratory	11-Apr-06	380,949	57,249	309,593		**747,791**	Comprehensive interior lighting upgrade and an all variable central plant, VFDs on pumps and fans, VFD on a scrubber fan
CSD-3	Casa del Prado	11-Apr-06	152,320	94,926		**2,400**	**247,246**	Comprehensive lighting upgrade and an all variable central plant, VFDs on pumps and fans, Turbocor installed on two liquid cooled chillers
CSD-10	R.H. Fleet	12-Apr-06	88,040			**560**	**88,040**	New air handler, CAV to VAV
CSD-11	Plaza Hall/CAB	11-Apr-06	264,300				**264,300**	Air side HVAC upgrade, VFDs on Air Handlers
CSD-12	Casa del Prado Boiler Upgrade	11-Apr-06				**1,221**	**0**	Installed new high efficiency boiler
CSD-14	Bud Kearns; Clairemont Public Pools	13-Apr-06			136,087		**136,087**	Installed VFD on pool pumps

Table 1B EMS Installation Projects

#	Bldg	Control points	Project completed	Nexant inspected	Notes
4	County Administration	**25**	x	12-Apr	Added controls points and internet capable data logging equipment
1	Balboa Park Activity Ctr.	**1**	x	11-Apr	Verified control points feedback to Ridgehaven
2	Central Library	**1**	x	11-Apr	Verified control points feedback to Ridgehaven
3	Chollas	**1**	x	11-Apr	Verified control points feedback to Ridgehaven
4	Police Headquarters	**3**	x	11-Apr	Verified control points feedback to Ridgehaven
6	Malcolm X Library	**3**	x	11-Apr	Verified control points feedback to Ridgehaven
7	Miramar Place	**2**	x	11-Apr	Verified control points feedback to Ridgehaven
8	Rancho Bernardo Library	**1**	x	11-Apr	Verified control points feedback to Ridgehaven
9	Ridgehaven Court	**8**	x	11-Apr	Tridium installed, other facilities feed back to ridgehaven
10	World Trade Center	**2**	x	11-Apr	
21	Casa de Prado	**10**	x	11-Apr	Tridium installed; checked feedback and operational status from SDREO
22	Casa del Prado (Ph 2)	**20**		11-Apr	
2	Heritage Park	**35**	x	13-Apr	iSys Automation conducted control system (i.Lon 100 E3) demo at SDREO

The site inspections were coordinated through SDREO's Jason Knight who made the arrangement to meet with the various parties involved in the LGEEP projects. The inspector was not initially aware that SDREO had aggregated some project sites by measure such as daylighting controls project, exit signs upgrade measures, while some were grouped together by similar facility type such as libraries, pools, and police departments. This made pre-arranging inspection schedules with the various facility personnel in an expeditious manner very difficult. Fortunately, many of the City projects were overseen by Mr. Tom Cartier from the Environmental Services department which allowed us to inspect sites in which he had access to. In addition, Mr. Tom Shaw of Alpha Mechanical who was the primary contractor for the Turbocor compressor installations and VFD retrofit projects enabled us to inspect sites that otherwise would not have been possible.

Tierrasanta and North Clairemont Public Libraries; SE Police Department

The Tierrasanta and N. Clairemont branches of the San Diego Public library involved lighting efficiency upgrade measures. A copy of the installed lighting fixture types, fixture and lamp counts for both sites were obtained from SDREO. The installed lighting fixtures, lamp, and fixture/lamp count were verified to be accurately reported. Access to SE PD was not possible for

security reason, however the installed packaged units were verified based on a copy of a project invoice dated 12/13/04 which indicated seven (7) 5-ton nominal cooling capacity Carrier 48HJL006C5 gas/electric package units were shipped to Police Substation on 7222 Skyline drive, San Diego. The unit nameplate data (from Carrier website) is as follow: 460-3-60; compressor RLA 9.0; outdoor fan FLA 0.8; Indoor fan FLA 2.6; combustion fan motor FLA .30.

Ridgehaven Court

A Tridium Vykon JACE-403 (hardware platform) EMCS controller was verified to be installed onsite. The site has 8 electrical meters (2 per wing, per floor) which monitors the building demand load and kWh energy consumption, while one meter monitors the PV electrical energy being generated. The monitored data can be viewed in real time via a web-accessible GUI program that is built on a Niagara software framework (built-in web server on the Tridium hardware). The controller monitors and receives pulse contacts from power/demand meters through on board I/O capability. This same system recognizes any communication protocol from other control devices such as VFD, lighting controls, HVAC controls which are integrated and the signals are processed and accessible thru Ethernet, TCP/IP, BACnet, XML, or http from anywhere once you login to the LAN or VPN from outside the firewall.

Ridgehaven uses the Tridium Vykon Energy web-based E^2 Profiler for monitoring building demand load and energy consumption not only of the 8 electrical meters located onsite, but on 8 other remote locations (see Table 1B above). These other sites were verified to be installed with the proper number of control points through remote monitoring.

Scanned PDF documents of screen captures showing the various control points at Ridgehaven Court and other sites can be found on the SFO server at \\Sfofps01\edm\projman\LGEEP\EM&V\Scans

City Administration Building/Plaza Hall

Four (4) new AHU supply and return fan motors (East and West) and VFD were verified to be installed and operational. Each supply fan AHU is also equipped with an economizer and associated actuators and sensors. During the inspection SFE VFD display showed it to be running at 32.5 Hz; 54.1% speed; 10.13A; 2.4 kW, while SFW VFD showed it to be running at 32.8 Hz; 54.7% speed; 10.4 A; 2.6 kW. The supply fan motors were verified to be 20-hp Baldor EM2334T Super-E motors. The return fan RFE VFD showed 27.9 Hz; 46.5%; 5.5 A; 1.46 hp, while RFW VFD showed 30.9 Hz, 51%; 6.2A; 1.85 hp. The return fan motors were verified to be 10-hp Baldor EM3774T Super-E motors. One economizer damper was fully closed, while the other was about 5% open. The actuator was found to be a Belimo model A F24-SR US. CO2 and RH sensors were also found adjacent to the economizers.

Casa Del Prado Community Theatre

Hartman loop all-VFD chilled water plant control algorithm implemented. Installed equipment consists of the following:

- High efficiency exterior and interior lighting upgrade.
- 390 MMBtu Raypak high efficiency boiler; 134 F water output temperature.
- Two (2) 3-hp hot water pump motor VFD (P1 on standby; P2: 60 Hz, 2.2 A)

- Two (2) Turbocor TT300A-80-A5-1-ST-P-R-NC oil free compressors with integrated VFD (one for each chiller, CH-1 and CH-3). CH-2 was not upgraded to Turbocor, and was observed to be a Trane RTWA0704YB01C1 2-stage rotary screw chiller.
- Three (3) CHWS pump VFD on 3 x 7.5-hp Yaskawa CVE 213TTFS6026FW pump motors (230/460; 14/7 FLA). #1 and #2 off; #3: 5.3A output.
- Two (2) CW pump VFD on 2 x 7.5-hp Yaskawa CVE 213TTFS6026FW motors. #1 off; #2: 26 Hz, 5.5A.
- Tridium Vykon EMCS. See Appendix for sample list of control points.

Hartman loop control sequence, also known as the "equal marginal performance principle" proprietary control algorithm is programmed into the EMS which also uses the Tridium Vykon JACE controller board to receive feedback signals from multiple control points within the facility which include compressor (Turbocor) and pump operating status, CW and CHW s/r temperatures, and cooling tower fan speed. The Hartman program module then calculates the proper operating speed for the various components of the chilled water system to enable it to operate at the at its optimum efficiency level. The project involved changing out a primary/secondary chilled water loop into a primary-only configuration and VFD retrofit of all existing pumps, fans, and compressors. More information on the Hartman loop can be found at www.hartmanco.com.

There was no comprehensive lighting audit conducted due to time constraint, instead a spot check of a few areas was conducted by the inspector. The following fixture type and count were found: Lunch room: 10 x 2F32T8 wraps ceiling mount; Conference room: 64 x 2F32T8 troffers; 72 Exterior 42W CFL.

Alvarado Water Treatment Laboratory

Hartman loop all-VFD chilled water plant control algorithm implemented. Installed equipment consists of the following:

- High efficiency exterior and interior lighting upgrade
- Two (2) CHWS pump VFD on 2 x 10-hp motors. P1 is a Marathon Electric 230/460V, 25/12.5 FLA, 89.5% NEMA Efficiency, 83.5 PF; P2 is a Magnatek 230/460V, 24/12, 89.5% NEMA, 85.5 PF. P1 VFD showed ~74% speed, 5.6A; P2 was off.
- Two (2) CW pump VFD on 2 x 10-hp motors. P4 is a US Electrical 208-230/460, 27.3-25.2/12.6, 87.5% NEMA, 82.7PF; P3 is a Baldor Super-E 230/460, 25/12, 89.5% NEMA, 83 PF. P4 was off, and P3 VFD showed 52.2% speed, 4.85A.
- Two (2) 180-ton centrifugal chillers VFD. CH-1 Yaskawa E7 VFD showed 52.7 Hz, 74.5A; CH-2 was not running. Both chillers were Trane model: CVHE025FA1F03BE2283L13H1C. Compressor: 1 x 460/60/3, 194 RLA; CHWS setpoint was 46.6 F, current CHWL = 47.1 F, CHWR = 52.5 F, CWL = 77.1 F, CWE = 69.6 F.

- Three (3) Exhaust fans (EF-8, 9 and 10) VFD on 3 x 25-hp motors (460V, 29 FLA). EF-8 VFD showed 76.3% speed, 11.8 A; EF-9 VFD showed ~78% speed, 15 A; EF-10 VFD showed 83% speed, 20 A.
- Two (2) hot water heater pumps VFD on 2 x 5-hp motors. P5 and P-6 both are Magnatek E-Plus 208-230/460, 14.8-14/7.0, 82.5% NEMA, 76.5 PF. P5 VFD showed 80% speed, 3.9 A; P6 VFD showed 80% speed, 3.8 A.
- Cooling tower fan VFD on a 40-hp motor. CT-1A VFD showed 49% power and 18 A.
- Air scrubber fan VFD on a 10-hp motor. VFD showed 37.2 Hz, 5.2 A.

There was no comprehensive lighting audit conducted due to time constraint, instead a spot check of a few areas was conducted by the inspector. The following fixture type and count were found: Industrial waste office: 14 x 3F17T8 wraps ceiling mount; Private offices (each) 2 x 3F17T8 recessed troffers; Bacteriology lab (M-10): 8 x 4F32T8 troffers.

Ruben H. Fleet Science Center

The theater supply fan (AH-1) was upgraded to a higher efficiency unit with a 20-hp inverter duty motor (200V/57 FLA), with VFD which showed 11.10 kW, 44.2A output. Normal operating hours are M-F 0900 to 2100; Saturdays 0900 to 2200.

County Administration Center

Hartman loop all-VFD chilled water plant control algorithm implemented. Installed equipment consists of the following:

- Two (2) 450-ton centrifugal chillers VFD. CH-2 Yaskawa E7 VFD showed 55.15 Hz, 161 to 169 A, 92% speed; CH-1 was not running. Both chillers were Trane model: CVHF055FAZ0O3UL2658W7E8TBC. Compressor: 1 x 460/60/3, 352 RLA; CHWL = 44.2 F, CHWR = 51.2 F, CWL = 78.9 F, CWE = 75.2 F, compressor RPM 3,323; VIGV 24.6% open, Line currents A: 49.3% RLA, 156 A, 471V, B: 50.7% RLA, 158 A, 472 V, C: 48.9% RLA, 156 A, 469 V.
- Three (3) CHWS pump VFD on 3 x 40-hp motors. All 3 motors were Baldor EM2539T 230/460, 92/46 FLA, 94.5% NEMA, 86 PF. P4 VFD showed 52Hz, 27A, 87% speed; P5 VFD showed 53 Hz, 29.2 A, 88.3%; P6 was off.
- Two (2) 50-hp CW pump motors with VFD and Two (2) 25-hp cooling tower fan motors with VFD. There was no easy access to the VFD, but were visually verified to be installed.
- Tridium Vykon EMCS. See Appendix for list of control points.

Juvenile Hall

Hartman loop all-VFD chilled water plant control algorithm implemented. Installed equipment consists of the following:

- Two (2) chillers were retrofitted with Turbocor oil-free compressors (3 per chiller). CH-1 was installed with 3 x 150-ton TT400-A7-1-ST-P-O-NC, 460/60/3 150 FLA Turbocor, while CH-2 was installed with 3 x 90-ton TT300A-90-A6-1-ST-P-R-NC,

460/60/3 135 FLA. CH-2 was not running at the time of the inspection. CH-1 Kiltech control display showed the compressors to be running as follows: C1 - 28 to 48 kW (ramping up); C2 - 23 to 48 kW; C3 - standby; CHWS = 45 F and CHWR = 52.7 F; CWE = 77 and CWL = 85 F; CHWS setpoint at 44.6 F.

- Three (3) cooling tower fan motors with VFD. CT1-A VFD showed 56.55% speed, 9.6 A, 2.1 kW; CT1-B 49.84%, 8.9 A, 1.7 kW; CT2 45.86%, 8.9 A, 1.6 kW.
- Two (2) condenser pump motors with VFD. CP-1 is a Baldor M4110T 40-hp 460/47A, while CP-2 is a Baldor M4103T 25-hp 460/30. CP-1 VFD showed 42% speed, 14.2 A, 2.0 kW; CP-2 was off (at 20% minimum speed).
- CHW pumps were located in restricted area and were not observed.
- Control points were integrated into their existing Johnson Controls EMS.

Claremont and Bud Kearns Public Pools

Claremont public pool installed an ABB VFD on their 40-hp Emerson R357 motor 208-230/460, 91/46 FLA, 94.5% NEMA, 86.2 PF. VFD showed an output of 45 Hz, ~20A. Flow meter reading was between 965 and 1,100 gpm at 12 psig discharge pressure.

Bud Kearns public pool installed an ABB VFD on their 50-hp Baldor JPM 2543T 230/460, 122/61 FLA, 91.7% NEMA, 84 PF. VFD showed an output of 52 Hz, 76.5 A, 199V, 18.4 kW. Flow meter reading was 1,068 gpm at 24 psig discharge pressure.

INSPECTION RESULTS

The inspections went well for the most part, and I was able to verify most of the installed measures at all sites inspected. However, we were not able to find someone to escort us through the police facility which has access restriction for security reason. Furthermore, almost all the inspections were scheduled at the last minute, and the problem was further magnified when we needed to get someone at a secure facility to escort us during entire inspection process. A thorough lighting inspection was also not possible at most sites because we simply did not have the time. Since a facility person needed to be with us the whole time and because the visit was short-noticed, a large amount of time could not be devoted for us.

All other incentive projects involving VFD retrofit, motor upgrade, Turbocor compressor installation, control system upgrade, and EMS projects were verified to be installed and operational. SDREO is continuing a post-installation monitoring of the Turbocor compressors at the Juvenile detention facility, as well as an ongoing study of the Hartman loop all-VFD chilled water system at various project sites.

Appendix D CPUC Impact Tables

This appendix contains the following:

- 2004-2005 Program Impact Net and Gross Evaluation Results
- SDG&E Program Energy Impact Reporting for 2004-2005 Programs

2004-2005 PROGRAM IMPACT NET AND GROSS EVALUATION RESULTS

Year	Gross annual MWh savings	Net annual MWh savings	Net cumulative MWh savings	Gross peak kW savings	Net peak kW savings	Gross annual therm savings	Net annual therm savings	Net cumulative therm savings
2004	0	0	0	0	0	0	0	0
2005	264	212	212	26	21	0	0	0
2006	3,923	3,138	3,350	392	314	28,518	22,814	22,814
2007	4,662	3,730	7,080	466	373	33,812	27,050	49,864
2008	4,662	3,730	10,809	466	373	33,812	27,050	76,913
2009	4,662	3,730	14,539	466	373	33,812	27,050	103,963
2010	4,662	3,730	18,268	466	373	33,812	27,050	131,013
2011	4,662	3,730	21,998	466	373	33,812	27,050	158,062
2012	4,662	3,730	25,728	466	373	33,812	27,050	185,112
2013	4,662	3,730	29,457	466	373	33,812	27,050	212,161
2014	4,662	3,730	33,187	466	373	33,812	27,050	239,211
2015	4,662	3,730	36,917	466	373	33,812	27,050	266,261
2016	4,662	3,730	40,646	466	373	33,812	27,050	293,310
2017	4,662	3,730	44,376	466	373	33,812	27,050	320,360
2018	4,662	3,730	48,105	466	373	33,812	27,050	347,409
2019	4,662	3,730	51,835	466	373	33,812	27,050	374,459
2020	4,662	3,730	55,565	466	373	33,812	27,050	401,509
2021	4,556	3,645	59,209	456	364	31,488	25,190	426,699
2022	4,067	3,254	62,463	407	325	31,488	25,190	451,889
2023	4,067	3,254	65,717	407	325	31,488	25,190	477,080
2024	4,067	3,254	68,970	407	325	31,488	25,190	502,270
2025	3,434	2,747	71,718	343	275	31,488	25,190	527,461
2026	0	0	71,718	0	0	0	0	527,461
2027	0	0	71,718	0	0	0	0	527,461
2028	0	0	71,718	0	0	0	0	527,461
2029	0	0	71,718	0	0	0	0	527,461
2030	0	0	71,718	0	0	0	0	527,461
2031	0	0	71,718	0	0	0	0	527,461
2032	0	0	71,718	0	0	0	0	527,461
2033	0	0	71,718	0	0	0	0	527,461
2034	0	0	71,718	0	0	0	0	527,461

SDG&E Program Energy Impact Reporting for 2004-2005 Programs

Program ID*:	1301-04							
Program Name:	San Diego Region Local Government Energy Efficiency Program							
	Year	Calendar Year	Ex-ante Gross Program-Projected Program MWh Savings (1)	Ex-Post Net Evaluation Confirmed Program MWh Savings (2)	Ex-Ante Gross Program-Projected Peak Program MW Savings (1**)	Ex-Post Evaluation Confirmed Peak MW Savings (2**)	Ex-Ante Gross Program-Projected Program Therm Savings (1)	Ex-Post Net Evaluation Confirmed Program Therm Savings (2)
	1	2004	0	0	0	0	0	0
	2	2005	0	212	0	0.0212	0	0
	3	2006	8,124	3,138	0.8124	0.3138	106,809	22,814
	4	2007	8,124	3,730	0.8124	0.3730	106,809	27,050
	5	2008	8,124	3,730	0.8124	0.3730	106,809	27,050
	6	2009	8,124	3,730	0.8124	0.3730	106,809	27,050
	7	2010	8,124	3,730	0.8124	0.3730	106,809	27,050
	8	2011	8,124	3,730	0.8124	0.3730	106,809	27,050
	9	2012	8,124	3,730	0.8124	0.3730	106,809	27,050
	10	2013	8,124	3,730	0.8124	0.3730	106,809	27,050
	11	2014	8,124	3,730	0.8124	0.3730	106,809	27,050
	12	2015	8,124	3,730	0.8124	0.3730	106,809	27,050
	13	2016	8,124	3,730	0.8124	0.3730	106,809	27,050
	14	2017	8,124	3,730	0.8124	0.3730	106,809	27,050
	15	2018	8,124	3,730	0.8124	0.3730	106,809	27,050
	16	2019	8,124	3,730	0.8124	0.3730	106,809	27,050
	17	2020	8,124	3,730	0.8124	0.3730	106,809	27,050
	18	2021	8,124	3,645	0.8124	0.3645	0	25,190
	19	2022	3,717	3,254	0.3717	0.3254	0	25,190
	20	2023	3,717	3,254	0.3717	0.3254	0	25,190
	TOTAL	**2004-2023**	**137,425**	**65,717**			**1,602,135**	**477,080**

*Please complete this form for the SDG&E program ID included in the evaluation.

**Please include the definition of Peak MW used in the evaluation.

Definition of Peak MW as used in this evaluation:

Coincident Peak MW

Note, change the Program ID Number on the worksheet tabs (below), so that it matches the Program ID Number of the program being evaluated.

1. Gross Program-Projected savings are those savings projected by the program before NTG adjustments.

2. Net Evaluation Confirmed savings are those documented via the evaluation and include the evaluation contractor's NTG adjustments.

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