California Summary Study of 2001 Energy Efficiency Programs

Final Report

Submitted to:

Southern California Edison

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The California Measurement Advisory Council

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REPORT SUMMARY

California faced an unprecedented energy crisis in 2001, with constrained supply, skyrocketing prices in its electricity market, and fear of massive summer blackouts. Through widespread media coverage, the energy crisis became one of the most discussed issues around water coolers and kitchen tables throughout the state.

In response, California launched an enormous effort to conserve energy and reduce electricity demand, including an ambitious public awareness campaign to capitalize on Californians' renewed interest in energy efficiency and conservation. The urgency to realize savings also spurred the state to support a number of innovative initiatives undertaken by a host of parties – some traditional, such as the investor-owned and municipal utilities and the California Energy Commission (CEC), and some new, such as other state agencies, local governments, and third party implementers. Besides the existing funding from the Public Goods Charge (PGC), additional funding was made available through special legislation and by emergency executive order. The latter, for example, funded Governor Gray Davis' notable 20/20 Rebate program. Altogether, over $890 million was spent on a total of 218 energy efficiency programs in California.[1]

How effective was California's collective response to the energy crisis in 2001? Perhaps the most telling indicator of success was that California averted the large-scale blackouts that many experts had predicted and feared. But beyond this observation, energy officials in the state sought to conduct a retrospective examination of California's experience with the energy crisis of 2001. To that end, the California Measurement Advisory Council (CALMAC), one of California's leading authorities on the evaluation of energy efficiency programs, engaged Global Energy Partners, LLC to determine the impact and cost-effectiveness of California's programs in 2001. The following table summarizes Global's accounting of program costs and savings impacts.

Table RS-1
Summary of California Program Accomplishments

Program Category [a]	Number of Programs Identified	Reported Cost ($millions)	Reported First Year Energy Savings (MWh)	Reported Demand Savings (MW)	Cost per First Year kWh Saved ($/kWh)	Cost per Lifetime kWh Saved [e] ($/kWh)
#1 PGC-Funded, IOU Administered	149	$ 294	1,254,539	323	$0.23	$0.03
#2 CPUC-Funded Summer Initiative	16	$ 70	266,556	132	$0.26	$0.03
#3 CEC Programs	8	$ 19	124,766	61	$0.15	$0.02
#4 Major Municipal Programs [b]	31	$ 30	60,660	104	$0.49	$0.06
#5 Locally Administered Programs [c]	10	$ 5	663	-	$8.21	$1.04
#6 Other Targeted State Programs	2	$ 60	na	152	na	na
#7 20/20 Rebate & Residual Effects [d]	2	$ 415	3,053,000	2,616	$0.14	$0.05
Total	218	893	4,760,184	3,389	$0.19	$0.03

na = Not Applicable
[a] For a complete definition of the program categories, please see Table ES-1.
[b] Los Angeles Department of Water and Power (LADWP) and Sacramento Municipal Utility District (SMUD).
[c] City of San Francisco and City of Berkeley.
[d] Includes 20/20 Rebate program (discounted for double counting), and residual effects, including the Flex Your Power public awareness campaign, free media coverage, and increasing rates
[e] Based on weighted average lifetimes of measures for each program category, and a discount rate of 8%.

[1] CALMAC defined applicable programs as those that promoted the sustained efficient use of energy promoted to the consumer and business market segments. As such, curtailment, peak shifting, low income, renewables, and codes and standards programs were excluded from consideration.

Despite emergency expenditures and a rush to launch programs, Global determined that California's record level of program funding did not reach a level of diminishing returns. California's programs collectively delivered a first-year energy savings of 4.76 million megawatt-hours (MWh). **Over the lifetime of their associated measures, these programs are estimated to deliver energy savings of $0.03 per kWh, a lifecycle cost consistent with that of prior years and competitive with energy generation costs**.

The 20/20 Rebate program was a remarkable story, accounting for 64% of first-year energy savings among the programs in scope. However, concerns about the accuracy of these savings due to double counting with other programs and the sustainability of these savings without the backdrop of an energy crisis mitigate the likelihood of repeated future success.

With so many disparate entities administering programs in 2001, there was a great deal of variability in the availability, quality and consistency of program documentation. California's Investor Owned Utilities (IOUs) and the California Energy Commission (CEC) provided the most consistently rigorous and conservative savings documentation, while most of the municipal, local government and private third-party administrated programs did not conform to the same documentation standards. This unevenness in documentation, as evidenced by differing conventions and assumptions for estimating savings and characterizing costs, made it a challenge to aggregate and compare the effects of programs on a meaningful, "apples-to-apples" basis. For example, due to the state's primary goal to avert blackouts by reducing peak load, some programs only measured and reported peak demand savings (MW) and not energy savings (MWh). If a consistent set accounting standards were applied to program costs and savings, the cost-effectiveness of many programs would change. As such, comparing the effectiveness of different programs and/or their administrators and implementers should only be done with extreme caution and with this caveat in mind.

The experience from the summer of 2001 should underscore for California policymakers and regulators the importance of refining and streamlining program savings conventions. In particular, this study recommends that policymakers and the California Public Utilities Commission (CPUC) do the following:

1. Establish a consistent set of reporting standards and evaluation protocols for energy savings and program costs across all entities administering energy efficiency programs, so as to enhance the comparability of programs;
2. Conduct a detailed review of the 20/20 Rebate program prior to automatically renewing the program, to assess the sustainability of savings and likelihood of similar success in the absence of a clear and present energy crisis.
3. Publish an annual statewide summary of energy efficiency programs, capturing program costs and energy savings based on data from all program administrators.

EXECUTIVE SUMMARY

Purpose and Scope of the Study

In 2001, facing a crisis of constrained supply, skyrocketing prices in its electricity market, and fear of massive summer blackouts, California launched an enormous effort to conserve energy and reduce electricity demand. This effort was primarily embodied in emergency legislation that provided additional funding and led to the rapid development and deployment of hundreds of energy efficiency programs administered and implemented by a variety of entities. The urgency to realize savings spurred the state to support a number of innovative initiatives undertaken by a host of parties – some traditional, such as the investor-owned and municipal utilities and the California Energy Commission (CEC), and some new, such as other state agencies, local governments, and third party implementers.

By most measures, the effort largely succeeded. California averted large-scale blackouts and administrators reported impressive energy and demand savings for their programs. California's experience in 2001 has been cited nationwide as a model for how multiple parties can create a "mosaic" of energy conservation and contribute to achieving supply/demand balance in the electricity market.

With that history in mind, the California Measurement Advisory Council (CALMAC) set out to review this experience by posing two questions:

> *How much energy did California's energy efficiency programs save in 2001?*
>
> *What was the cost of procuring these savings and how did they compare across the programs offered by the different administrators?*

To help answer these questions, CALMAC commissioned Global Energy Partners, LLC (Global), to conduct a study to summarize the impact of California's 2001 energy efficiency programs. The objectives of the "Summary Study" were to:

- Summarize, combine, and compare the energy savings estimates, and cost of obtaining those savings, of the many energy efficiency programs funded under these initiatives.

- Review and compare the methods used by the various administrators and implementers to estimate the savings, focusing on ones that reported large savings and relatively sparse supporting documentation.

- Recommend practices going forward for collecting and analyzing savings information, based on lessons learned from the review of these programs.

An advisory committee composed of CALMAC members representing the state's investor-owned utilities (IOUs), the CEC, and the Natural Resources Defense Council (NRDC) directed the project. The final deliverables for the Summary Study, this report along with an accompanying electronic database, together serve as a comprehensive reference document for much of California's energy efficiency program activity in 2001. CALMAC intends that California policy makers use the results of this Summary Study to build on the success of the 2001 programs so that future programs administered by all entities and their subsequent evaluations will be even more effective.

Summary of Program Savings and Costs

In conducting the Summary Study, we (Global) identified 218 energy efficiency programs for inclusion, following the criteria provided by CALMAC, which excluded curtailment, peak shifting, low income, renewables, and codes and standards programs. Programs were categorized by funding source and type of administrator to allow the kinds of comparisons that CALMAC sought.

For these programs, our tally of the reported results indicates that the state spent over $890 million to achieve a first-year energy savings of 4.76 million megawatt-hours (MWh). This averages out to a cost of approximately $0.19 per kWh saved in 2001 across all programs, loading all the cost into one year of savings.

Of course, the savings for many of the programs are expected to last well beyond one year. Applying broad assumptions about the effective useful lives of program measures installed in 2001, we have calculated an **overall statewide cost of $0.03 per kWh saved over the lifetime of these program measures**. This 3¢/kWh figure is consistent with the cost of prior-year energy efficiency programs, and is competitive with generation costs. It is remarkable that even in the face of an unprecedented energy crisis, and the ensuing urgency to bring energy efficiency and load management programs quickly to market, that the increased funding of programs in 2001 did not reach a level of diminishing returns.

Table ES-1 shows the aggregated results for the state and the six funding source/administrator type categories. It should be noted that the "Reported Cost" and "Reported Savings" values presented in Table ES-1 are taken directly from published and unpublished information provided by the program administrators or their implementers or evaluators. These values are, for the most part, unverified. The results of the in-depth reviews we conducted for a few programs are not reflected in this table, with the exception of the adjusted savings for the 20/20 Rebate, as noted.

While it is tempting to compare the calculated per-kW and per-kWh costs across categories, as presented in Table ES-1, we caution against making inferences from them because the values reported to us are not internally consistent. For example, some entities reported cost values that only include the cost of incentives paid to program participants, while others include all the costs incurred, from administrative overhead through verification. Similar disparities are reflected in the savings numbers. We have included these numbers in Table ES-1 to illustrate the need for standardized reporting protocols for publicly funded programs, as recommended in this report.

Table ES-1
Reported Results from California's 2001 Energy Efficiency Programs
by Funding Source and Administrator Type

	Program Category	Number of Programs Identified	Reported Cost ($millions)	Reported First Year Energy Savings (MWh)	Reported Demand Savings (MW)	Cost per First Year kWh Saved ($/kWh)	Cost per kW Saved ($/kW)	Cost per Lifetime kWh Saved [i] ($/kWh)
#1	**PGC-Funded, IOU Administered**	**149**	**$ 294**	**1,254,539**	**323**	**$0.23**	**$ 908**	**$0.03**
#2	**CPUC-Funded Summer Initiative [a]**	**16**	**$ 70**	**266,556**	**132**	**$0.26**	**$ 530**	**$0.03**
#3	**CEC Programs [b]**	**8**	**$ 19**	**124,766**	**61**	**$0.15**	**$ 304**	**$0.02**
#4	**Major Municipal Programs [c]**	**31**	**$ 30**	**60,660**	**104**	**$0.49**	**$ 288**	**$0.06**
#5	**Locally Administered SBx1 5 [d]**	**10**	**$ 5**	**663**	**-**	**$8.21**	**na**	**$1.04**
#6	**Other Targeted State Programs [e]**	**2**	**$ 60**	**na**	**152**	**na**	**$ 395**	**na**
#7	**20/20 Rebate & Residual Effects [f]**	**2**	**$ 415**	**3,053,000**	**2,616**	**$0.14**	**$ 159**	**$0.05**
	20/20 Rebate Program [g]	1	$ 350	3,053,000	2,616	$0.11	$ 159	$0.04
	"Flex Your Power" and other [h]	1	$ 65	na		na		na
	Total	**218**	**893**	**4,760,184**	**3,389**	**$0.19**	**$ 263**	**$0.03**

Notes

na = Not Applicable

Reported Savings and Reported Cost are the values made available to this study by the program administrators, implementers, or evaluators. We have not adjusted the reported values in Table ES-1, with the exception of the 20/20 Rebate program, which includes broad-brush adjustments for normal fluctuation and certain double counting.

[a] Combination of statewide or IOU-specific projects administered by either the IOUs or third-party implementers.

[b] Costs do not include administrative or evaluation costs, which were not available. Cost per first year kWh saved of $0.09 if only including costs of programs with efficiency savings.

[c] Los Angeles Department of Water & Power (LADWP), Sacramento Municipal Utility District (SMUD)

[d] City of San Francisco and City of Berkeley. The high cost per unit energy saved ratios are misleading, primarily due to the fact that the cities were unable to measure savings for certain programs and some funded programs did not begin implementation until after 2001.

[e] No energy savings were reported for these two programs: State Building and Facilities Retrofits (Department of General Services), and the Mobile Efficiency Light Brigade "PowerWalk" (California Conservation Corps).

[f] Includes the energy savings credited to the 20/20 Rebate Program and demand reduction attributed to the 20/20 Rebate program, Flex Your Power, and other "residual" effects as tracked by the CEC.

[g] Savings from 20/20 Rebate program have been adjusted to correct for double counting, per the analysis specified in Section 3.11 of this report. Program was funded through the California State Department of Water Resources.

[h] No energy savings were explicitly reported or attributed to this category of programs by any administering entity. "Flex Your Power" was funded through Department of Consumer Affairs. "Other" factors include rates and general media coverage of energy crisis in 2001.

[i] Based on weighted average lifetimes of measures for each program category, and a discount rate of 8%.

As part of this study, we assembled an electronic database with information about each of the 218 programs included. The database is described in this report and is available electronically from CALMAC. Program administrators, implementers, and evaluators provided the data contained therein.

Summary of Key Findings

From the more detailed review we conducted for 15 programs that reported high savings with little initial documentation, we made the following overall findings:

- We found credibility among all the program reports of savings. The efforts, some ramped up in a matter of months, are to be commended. It appears that all the entities made conscientious efforts to procure savings with their funding.

- After more than two decades of regulating IOU-administered programs, the California Public Utilities Commission (CPUC) and its IOUs[2] have developed protocols for savings documentation and reporting that are distinguished by their high overall availability, quality, and consistency.

- The CEC, and its independent reporting and verification contractor, provided exemplary program documentation, including how to better estimate and monitor savings in the future.

- Programs administered by entities other than the IOUs and CEC showed a much greater range of effort in their attempts to quantify energy savings, both in the level of documentation to support their reported savings and the rigor of the methods used to estimate the savings. In general, municipal utilities were the least rigorous in tracking activities and savings.

- For many of the 2001 programs, it was difficult to obtain information on the assumptions that went into the savings estimates. With enough effort, we were able to discern that the savings were usually estimated based on benchmarks or formulas.

The reported savings from broad state programs, in particular the 20/20 Rebate, are so large that it is nearly impossible to answer CALMAC's questions about total program savings and relative program performance without more rigorous estimation and attribution of their savings. Due to the unique conditions present in 2001, we recommend policy makers take a detailed look at the 20/20 program prior to deciding whether to renew it. The study committee questions whether similar success levels are achievable in the absence of the energy crisis and the extensive "free media" coverage that was provided. Additional thought is also needed in establishing an appropriate baseline level for calculating participant savings and rebate eligibility.

[2] Pacific Gas & Electric (PG&E), Southern California Edison (SCE), San Diego Gas & Electric (SDG&E), Southern California Gas (SoCalGas)

PGC-Funded, IOU-Administered Programs

The IOUs offered a wide variety of PGC-funded programs to customers of all classes, including information programs, surveys and audits, prescriptive rebates, custom rebates, and standard performance contracting.

Because of their decades of increasingly rigorous regulatory requirements to document energy savings, these IOU-administered programs set the standard for program cost and savings documentation. This is not to say that their estimation methods were necessarily better, but their documentation was among the clearest and most consistent. Because this study aimed to learn more about programs administered by entities with less historical record, the programs in this category were not reviewed in great detail. We did see that all four IOUs filed annual reports that presented program cost and savings information in a rather similar format.

The IOUs averaged a cost of $0.23 per reported kWh saved in 2001, and $0.03 per lifetime kWh saved. Despite the IOUs' mandate to address hard-to-reach markets with a number of their programs, which traditionally entail higher costs per unit of savings, the IOUs were still able to deliver energy savings cost-effectively in aggregate. The cost per first year kWh savings varied from $0.17 to $0.28 among the three electric IOUs, which suggests that reporting conventions may vary even within this tightly regulated group.[3]

The IOUs conducted ex-post evaluations and verifications of some, but not all, programs. Many of the IOU programs in 2001 were updated versions of established, long-running programs, most of which had been subjected to detailed ex post evaluations in earlier years.

Summer Initiatives

To respond to the energy crisis, the California Public Utilities Commission (CPUC) created the Summer Initiative (SI) in August 2000, inviting proposals from IOUs and third parties for projects that would quickly deliver energy efficiency and peak demand savings for the summers of 2000 and 2001. The CPUC approved four types of programs:

- Statewide third party initiatives (TPIs) – programs implemented by third parties across the IOU service territories
- Statewide Utility – programs implemented by each IOU in its respective service territory
- Utility TPIs – IOU-specific projects implemented by third parties with IOU administrative support
- Local – projects implemented by each IOU in its own territory

[3] SoCalGas programs were designed primarily for natural gas savings. Apart from the IOUs, all other administering entities in this study were focused on electric energy and demand savings. Therefore, we have elected to present energy savings only in terms of electricity in this document. Please refer to the Database for both electricity and natural gas savings per program.

Overall, these Summer Initiative programs delivered energy savings at a cost comparable to the IOUs: $0.26 per first year kWh saved and $0.03 per lifetime kWh saved. We note that, unlike the IOUs, the Summer Initiatives did not have a specific mandate to address "hard-to-reach" markets, which may have contributed to their relative cost-effectiveness.[4]

The SI programs administered by the IOUs seem to have followed much the same tracking and reporting as their PGC-funded programs. Given the urgency to realize savings, the CPUC did not require non-utilities to adhere to the IOU reporting and evaluation standards. For example, third party implementers were not required to provide independent verification of program savings; rather, the third parties themselves were asked to submit program evaluation reports. As a result, the quality and consistency of reported savings data varied considerably across TPIs.

CEC Programs

The CEC provided grants, loans and rebates to support the installation of measures to reduce peak load at many commercial, municipal, institutional, and agricultural sites.

The CEC's eight programs within our scope of coverage delivered demand reduction at an average cost of $304 per kW, and energy savings at a cost of $0.15 per first year kWh saved and $0.02 per lifetime kWh saved. These were primarily peak load reduction programs, which included many different types of projects that utilized both energy efficiency and curtailment measures. By only including the costs and impacts of programs for which energy efficiency savings were quantifiable, the cost-effectiveness improves to $0.09 per first year kWh saved and $0.01 per lifetime kWh saved. We do note, however, that CEC cost numbers only include the value of grants (incentives) paid, and do not include administrative or verification costs.

The CEC designed and carried out a very appropriate form of evaluation for its peak load reduction program portfolio – a large, one-time set of programs that required early verification of results. The CEC retained an independent consultant to verify installations and develop program savings estimates by conducting ex post measurements at a small sample of sites for each program. This procedure provided consistent, small-scale coverage across all programs. Further, the consultant developed recommendations on how to improve estimation, tracking, and evaluation of savings.

Major Municipal Programs

The two most prominent municipal utilities in California, Sacramento Municipal Utility District (SMUD) and Los Angeles Department of Water and Power (LADWP), each administered energy efficiency programs. While SMUD offered a balance of residential and non-residential programs, LADWP's programs were primarily focused on the commercial sector.

The municipal programs delivered savings at a higher cost relative to other types of programs: $0.49 per first year kWh saved and $0.06 per lifetime kWh saved. However, like the CEC

[4] One exception was the "Residential Hard to Reach Program, " a Summer Initiative program administered by all four IOUs in their respective service territories.

programs that were primarily focused on peak load reduction, the municipal programs delivered demand reduction at a competitive cost of $288 per kW.

SMUD and LADWP provided inconsistent program documentation. For example, some programs featured independent evaluations while others did not. Several factors may have contributed to the unevenness in program information, including lack of resources, absence of regulatory mandate, and differing program objectives. For example, all of LADWP's programs focused solely on demand reduction, so energy savings were not explicitly tracked.

Locally Administered Programs

The two local governments in our study, City of Berkeley and City of San Francisco, administered a small number of programs with minimal savings impact. The cities were unable to quantify energy savings for several programs, while other funded programs were not scheduled to begin implementation until after 2001. Due to these factors, the cost of delivered energy savings for this category of programs is highly misleading and not particularly meaningful.

These cities had scarce program administration budgets, and did not produce standardized program documentation or evaluation reports. Most of the program information, including cost and savings estimates, was obtained through interviews with program managers from each city. Furthermore, while these programs laid the groundwork for savings, many projects were not completed in 2001. Thus, their reported savings are low.

Other Targeted State Programs

Neither of the two programs in this category – the Department of General Services' retrofit of state buildings and the California Conservation Corps' "PowerWalk" CFL giveaway drive – measured or estimated energy savings. They did, however, report demand reduction at an average cost of $395 per kW.

20/20 Rebate & Residual Effects

This category included two of the most prominent programs in the history of the state: the 20/20 Rebate program and the "Flex Your Power" public awareness media campaign. In addition, this category attempted to include the "residual effect" of measures such as rate changes and general media coverage of the energy crisis. The sheer size of the 20/20 Rebate program's reported energy savings in 2001 dwarfed that of all other programs in the state *combined*.

The 20/20 Rebate program also posed a unique analytical challenge because some of the energy savings credited to the program likely overlapped with savings credited to other energy efficiency programs, resulting in double counted energy savings. For example, suppose a residential customer purchased an energy-efficient refrigerator in 2001 through a utility appliance rebate program, and the savings from that refrigerator contributed to the customer qualifying for a 20/20 rebate. In this example, the utility appliance rebate program and the 20/20 Rebate program would have each claimed the savings associated with the new refrigerator,

resulting in double counted savings. Moreover, it is difficult to allocate the impact of an action, such as our hypothetical customer's purchase of an energy-efficient refrigerator, among different programs that may have each influenced the customer to take the action. For example, the combination of Flex Your Power television ads promoting energy efficiency, a utility rebate, and the possibility of a 20/20 rebate together may have influenced the customer's decision to purchase an energy efficient refrigerator.

Even after our attempt to adjust the reported savings of the 20/20 Rebate program to discount the effect of double counting, the program was credited for achieving savings of over 3 million MWh, or approximately 64% of total savings from all programs in our scope of coverage. The program delivered energy savings at a relatively low cost of $0.11 per first year kWh saved. However, we estimate that the effective lifetime of 20/20's 2001 impact will only extend up to three years in the future, resulting in a $0.04 cost per lifetime kWh saved. In the absence of a continuing rebate program like 20/20 and without the unique backdrop of the 2001 energy crisis and the constant threat of rolling blackouts, the behavioral changes induced by the 20/20 Rebate program in 2001 are not sustainable, and would likely dissipate within a few years. Another complication to offering a 20/20-like program in future years is determining a useful and fair baseline. Using 2000 consumption levels as a baseline might perpetuate undesired free ridership.

Neither the 20/20 Rebate program nor Flex Your Power explicitly tracked demand (MW) reduction. As a proxy, however, we attributed a residual measure of Statewide demand reduction in 2001 to these two programs, based on data tracked by the CEC.

Recommendations to Facilitate Assessment of Future Program Results

The motivation to assess programs at the state level stemmed from both the special conditions in 2001 that led to an unusually intensive effort to save energy in California, and the influx of different types of entities to administer those initiatives.

From our detailed review of 15 programs and assembly of information about 200 more, we learned enough to say with confidence that the administrators worked diligently and had obvious success in reducing the amount of energy used by Californians in 2001. But, because there were so many different programs and disparate entities, there was not enough uniformity in the conventions and assumptions used in assessing results to allow a meaningful "apples-to-apples" aggregation of program effects or comparison of performance. Nonetheless, we gleaned lessons in the process of program review that are documented in this report. We also developed specific recommendations that can instruct future program efforts and aggregation studies. Chapter 4 focuses on the lessons learned and recommendations.

In summary, we recommend that the CPUC and CALMAC promote the following:

1. *Track both annualized and program-year savings and costs, and publish an annual statewide report.* Alternatively, we recommend that state policy makers and program administrators collaboratively select a convention in reporting savings to enable meaningful comparisons among programs. At the least, reported program savings should clearly indicate whether they use the annualized or program-year convention.

2. *Apply net-to-gross ratios that reasonably reflect the likely free ridership inherent in different types of programs.* Some program implementers included net-to-gross ratios and some did not, making cross-program comparison difficult. See Summary of Phase II for suggestions on how to accomplish this.

3. *Identify whether demand reduction (MW), energy savings (MWh), or both, are objectives in each program's proposal.* Document how programs of each type will be reported, prior to each program year. Furthermore, if policy makers deem both kinds of savings to be important, which the CALMAC committee strongly encourages, then all program administrators should be required to report both, unless it is not possible to meaningfully do so.

4. *Report both coincident peak and non-coincident demand reductions.* In addition, the definition of the peak period should be standardized or at least clearly defined.

5. *Produce specific documentation with all savings reports, supporting the derivation of those savings and including all key assumptions, data, and formulas of calculations used.* We consider the working paper format used by the IOUs to be a useful model. We also recommend advising program administrators to document sources for all savings assumptions and to use established benchmarks, such as the Database for Energy Efficiency Research (DEER), to the extent possible.

6. *Report and itemize program-related costs in a standardized manner, including administrative costs, incentives, and measurement and evaluation.* We also recommend breaking down costs by type of measure, if assessment of the persistence of savings is desired.

7. *Provide program summaries*. For the purpose of making comparisons among programs, each program should be required to provide a written summary with a checklist of standard items to be included. This would facilitate the assembly of a program results database annually, and is especially important if recommendation #5 is not adopted. We recommend that policy makers and program administrators work collaboratively to develop this checklist, and we offer some suggestions in the body of this report.

8. *Apply a robust analytical technique to address the double counting inherent in broad state programs (20/20 Rebate and Flex Your Power).* In 2001, it was not possible to fully understand which savings were already reported by other programs and to which programs savings should be attributed. We offer ideas on how to do this in the body of this report.

9. *Evaluate custom programs on a project-by-project basis, and group mass-market programs according to end-use categories.* For the former, the approach used to evaluate Standard Performance Contract programs could serve as a model. For the latter, compare similar programs to identify best practices and increase standardization of documentation and record keeping.

10. *Develop several standard measures of performance to enable high-level comparisons among projects and programs.* We suggest that policy makers and program administrators work together to define such measures. Some of the suggestions we make in this report include:

Energy Use Index (in Watts/ft^2 or kWh/ft^2-year) and unit cost and cost savings (in $/kW or ¢/kWh) for particular end-uses in particular types of buildings.

11. *Provide measurement and evaluation (M&E) plans prior to program initiation.* Policy makers should hold administrators to implementing those plans as submitted or with documented revision. Evidence of implementation should be provided with reported savings. We recognize that because of the urgency with which many of the Summer Initiative programs were launched in 2001, many of the steps that would normally have been taken to ensure more rigorous evaluation could not be taken. We also recognize that there is on-going debate about the trade-off between rigor and cost in evaluation. Without taking a stand on that issue, we note that if California wants to answer questions such as the one posed in this Summary Study - "How much energy was saved by efficiency programs in the state last year?" - some more systematic, comprehensive, and rigorous M&E activities will need to be (re)established.

Recommendations for Phase II Study

CALMAC also asked for recommendations on potential follow-up work to this Summary Study that could enhance its value. We recommend that CALMAC:

- Review all the programs to identify those lacking net-to-gross guideline estimates (to account for free ridership) so that CALMAC might expand its set of estimates. Having a ready set of appropriate net-to-gross ratios could encourage adoption of their use in future program years by all program administrators and facilitate more apples-to-apples comparison or aggregation.
- Apply our proposed more robust analytical approach to resolving the double counting issue inherent in broad programs such as 20/20 Rebate and Flex Your Power.
- Extend the effort to obtain the M&E plans and activities undertaken for all 15 of the programs we reviewed in detail. At this writing, some of the program administrators/ implementers had still not provided the requested documentation, so we could not tell what was done to develop or verify savings.
- Expand the number of detailed reviews beyond the 15 we conducted to include some programs from all of the administrative entities. We focused our reviews on programs that reported savings of the highest impact with little or no initially available supporting documentation. More than half of the Summer Initiatives were in this category. None of the PGC-funded/IOU administered were, however, and this group comprised 149 of the 218 program-year 2001 programs. Reviewing a few of them could provide contrasting or additional support to the findings from the other reviews.

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1 INTRODUCTION

Chapter 1 provides background information on the impetus for this project as well as its scope of coverage.

1.1 Project Background and Context

In 2001, facing a crisis of constrained supply, skyrocketing prices in its electricity market, and fear of massive summer blackouts, California launched an enormous effort to conserve energy and reduce electricity demand. This effort was primarily embodied in emergency legislation that provided additional funding and led to the rapid development and deployment of hundreds of energy efficiency programs administered and implemented by a variety of entities. The urgency to realize savings spurred the state to support a number of innovative initiatives undertaken by a host of parties – some traditional, such as the investor-owned and municipal utilities and the California Energy Commission (CEC), and some new, such as other state agencies, local governments, and third party implementers.

By most measures, the effort largely succeeded. California averted large-scale blackouts and administrators reported impressive energy and demand savings for their programs. California's experience in 2001 has been cited nationwide as a model for how multiple parties can create a "mosaic" of energy conservation and contribute to achieving supply/demand balance in the electricity market.

With that history in mind, the California Measurement Advisory Council (CALMAC) set out to review this experience by posing two questions:

> *How much energy did California's energy efficiency programs save in 2001?*
>
> *What was the cost of procuring these savings and how did they compare across the programs offered by the different administrators?*

To help answer these questions, CALMAC commissioned Global Energy Partners, LLC (Global), to conduct a study to summarize the impact of California's 2001 energy efficiency programs. The objectives of the "Summary Study" were to:

- Summarize, combine, and compare the energy savings estimates, and cost of obtaining those savings, of the many energy efficiency programs funded under these initiatives.

- Review and compare the methods used by the various administrators and implementers to estimate the savings, focusing on ones that reported large savings and relatively sparse supporting documentation.

- Recommend practices going forward for collecting and analyzing savings information, based on lessons learned from the review of these programs.

Implicit in these tasks was the need to identify a comprehensive set of programs and the presumption that program information from disparate sources could be evaluated in an "apples-to-apples" manner to allow meaningful aggregations and comparisons of program cost and savings impacts.

An advisory committee composed of CALMAC members representing the state's investor-owned utilities (IOUs), the CEC and the Natural Resources Defense Council (NRDC) directed the project. The final deliverables for the Summary Study, this report along with an accompanying electronic database, together serve as a comprehensive reference document for much of California's energy efficiency program activity in 2001. CALMAC intends that California policy makers use the results of this Summary Study to build on the success of the 2001 programs so that future programs administered by all entities and their subsequent evaluations will be even more effective.

We cataloged all of California's 2001 energy efficiency programs within our scope in the Summary Study Database, tallying reported savings and the cost per unit of savings.[5] These results are presented in Chapter 2.

We also analyzed the reported savings and persistence of 15 selected programs, to illustrate the challenges of, and potential solutions to, developing apples-to-apples comparisons. These analyses are presented in Chapter 3.

Finally, we developed a set of recommendations on how program results could be estimated and reported in future program years to facilitate the kind of aggregation and comparison that the was the original purpose of this Summary Study. These observations and recommendations are based on lessons learned in reviewing the programs and are presented in Chapter 4.

The remainder of this chapter addresses the scope of programs covered by the study and the development of the Summary Study Database.

[5] This meant all the programs we could identify, recognizing that some entities, such as the municipal utilities, might not issue complete lists of their programs. Also, the scope of the Summary Study excluded the following types of programs: low-income programs, load-shifting programs, and municipal utility programs other than LADWP and SMUD.

1.2 Scope of Coverage

The scope of programs under coverage included all energy efficiency programs implemented in the state of California in 2001 by the four major IOUs, two major municipal utilities (Sacramento Municipal Utility District and Los Angeles Department of Water and Power), state agencies such as the CEC, California Public Utilities Commission (CPUC), and Department of Water Resources (DWR), two city government offices (Berkeley and San Francisco), and a host of third party implementers. These programs were funded from a variety of sources, as shown in the Table 1-1.

Table 1-1
Summary of Funding Sources

Funding Source	Date Approved	Funding Level [1] ($millions)	Intent of Fund
Governor's Office (Flex Your Power)	January 2001	$ 65.0 [1]	Finance the *Flex Your Power* public awareness and media campaign, including print, TV and radio advertising.
Department of Water Resources (20/20)	January 2001	$ 350.0 [2]	Support the 20/20 Rebate Program, providing rebates to qualifying customers of the three electric IOUs.
Public Goods Charge (PGC)	*annual*	$ 250.0 [3]	Surcharge on electric and gas ratepayers' energy bills to fund energy efficiency programs in California.
Senate Bill 5 of the First Extraordinary Session ("SBx1 5" or "SB 5X")	April 2001	$ 654.6 [4]	Supplement selected PGC programs.
Assembly Bill 29 ("AB 29")	April 2001	$ 204.5 [4]	Expand CEC load reduction programs.
Assembly Bill 970 ("AB 970")	August 2001	$ 57.5 [4]	Supplement funding for existing load reduction programs targeting summer 2001

[1] Source: California Energy Commission, Sylvia Bender

[2] Source: Department of Water Resources

[3] Source: CALMAC

[3] Source: Pacific Gas and Electric, Chris Chouteau

As reported in the table, each funding source had a distinct purpose; some were created explicitly to fund peak load reduction and others to continue existing energy efficiency programs. Our objective was to capture the demand reduction and energy savings impact of all programs within our scope of coverage.

Programs explicitly outside the scope of our coverage included:

- Demand responsiveness programs (including curtailment programs)
- Load-shifting programs
- Low-income programs
- Renewables programs
- Programs administered by municipal utilities in California other than SMUD and LADWP
- Codes (new codes or changes to existing codes)

A number of programs included in this study have a demand responsiveness, curtailment, or load-shifting component in addition to an energy efficiency component. Because the mandate of this study was energy efficiency, every effort was made to identify the costs and savings attributed to the energy efficiency component of each of these programs. For programs that could not break-out cost or savings specific to the energy efficiency component, we included program totals. Footnotes to the data tables in Chapter 3 indicate whether the cost and savings data for multiple-component programs are specific to the energy efficiency component or to the total program.

1.3 Development of the Summary Study Database

We identified a total of 218 programs for inclusion in the Summary Study. At the Advisory Committee's request, we documented all the programs in the Summary Study Database. We solicited the following information from program sponsors, administrators, implementers, evaluators, and regulators for each program:

- Program description (eligibility, target market, incentive types, delivery mechanism, etc.)
- Source(s) of funds
- Budget (including break-down by major cost components; e.g., administrative, incentive, measurement & verification)
- Actual cost (including break-down by major cost components; e.g., administrative, incentive, measurement & verification)
- Forecasted savings (MW, MWh, therms)
- Reported savings (MW, MWh, therms)

The database is a centralized source of information on all of the energy efficiency programs operated in California in 2001 within our defined scope of coverage. This is the first time that such information has been compiled in a single, accessible source. Though it contains rudimentary information, it provides CALMAC and other interested parties with something of a data repository benchmark. The database is intended to serve as a foundation to guide and enhance the reporting of program information for future program years.

An extraction of the Summary Study Database is included as Appendix A, and is provided in electronic form as an Excel file.

2 ENERGY SAVINGS AND COST FINDINGS

Chapter 2 presents the savings impact and cost of each program, as reported by the corresponding administering entities. After a discussion of the quality of program savings documentation made available to us by each administrator, we present aggregated results for a big-picture view of statewide impact. This chapter goes on to explore each administering entity's program impacts in greater detail. The data in this section are based on the Summary Study Database, which is available electronically from CALMAC and an extraction of which is included as Appendix A.

2.1 Overall Observations

As we expected, there was a great deal of variability in the availability, quality, and consistency of program savings information across administrators and implementers. Because of their decades of increasingly rigorous regulatory requirements to document energy savings, IOU-administered programs set the standard for program cost and savings documentation. The CEC peak load reduction programs also featured extensive independent measurement and verification activities that were on par with, and in some cases even more exhaustive than, those of the IOUs.

The program documentation of the two major municipal utilities included in our study, Sacramento Municipal Utility District (SMUD) and Los Angeles Department of Water and Power (LADWP) was inconsistent. For example, some programs featured independent evaluations while others did not. Several factors may have contributed to the unevenness in program information, including lack of resources, absence of regulatory mandate, and different program objectives. For example, all of LADWP's programs were predicated on demand reduction, so energy savings was not explicitly tracked.

The CPUC did not require third-party initiatives (TPIs) implemented by non-utility organizations to adhere to the same standards of reporting and evaluation as comparable IOU programs. For example, the independent verification of program savings was not required and the implementers themselves were asked to submit program evaluation reports. As a result, the quality and consistency of reported savings data varied considerably across TPIs.

The two local governments in our study, City of Berkeley and City of San Francisco, which had scarce resources to administer their programs, did not produce standardized program documentation or evaluation reports. Most of the program information, including cost and savings estimates, was obtained through interviews with program managers from each city.

Finally, state programs with broad influence and scope such as Flex Your Power and 20/20 Rebate posed a unique analytical challenge, since savings credited to these programs inherently double-count the impact of other energy efficiency programs.

2.2 Summary of Key Findings

Table 2-1 below summarizes the costs and first-year[6] savings of each program, as reported by each program's administrator and/or evaluator. We have only provided an adjusted savings figure for one program, the 20/20 Rebate, which accounts for all of the energy savings associated with the Broad State category of programs and dwarfs the energy savings from all other programs combined. We performed a series of adjustments to discount the reported savings of the 20/20 Rebate program for such occurrences as double counting with other programs. The rationale for these adjustments is explained in detail in Section 3.11.

Table 2-1
Summary of Reported 2001 Program Costs and First-Year Savings

	Program Category	Number of Programs Identified	Reported Cost ($millions)	Reported First Year Energy Savings (MWh)	Reported Demand Savings (MW)	Cost per First Year kWh Saved ($/kWh)	Cost per kW Saved ($/kW)	Cost per Lifetime kWh Saved [i] ($/kWh)
#1	**PGC-Funded, IOU Administered**	**149**	**$ 294**	**1,254,539**	**323**	**$0.23**	**$ 908**	**$0.03**
#2	**CPUC-Funded Summer Initiative [a]**	**16**	**$ 70**	**266,556**	**132**	**$0.26**	**$ 530**	**$0.03**
#3	**CEC Programs [b]**	**8**	**$ 19**	**124,766**	**61**	**$0.15**	**$ 304**	**$0.02**
#4	**Major Municipal Programs [c]**	**31**	**$ 30**	**60,660**	**104**	**$0.49**	**$ 288**	**$0.06**
#5	**Locally Administered SBx1 5 [d]**	**10**	**$ 5**	**663**	**-**	**$8.21**	**na**	**$1.04**
#6	**Other Targeted State Programs [e]**	**2**	**$ 60**	**na**	**152**	**na**	**$ 395**	**na**
#7	**20/20 Rebate & Residual Effects [f]**	**2**	**$ 415**	**3,053,000**	**2,616**	**$0.14**	**$ 159**	**$0.05**
	20/20 Rebate Program [g]	1	$ 350	3,053,000	2,616	$0.11	$ 159	$0.04
	"Flex Your Power" and other [h]	1	$ 65	na		na		na
	Total	**218**	**893**	**4,760,184**	**3,389**	**$0.19**	**$ 263**	**$0.03**

Notes

na = Not Applicable

Reported Savings and Reported Cost are the values made available to this study by the program administrators, implementers, or evaluators. We have not adjusted the reported values in Table 2-1, with the exception of the 20/20 Rebate program, which includes broad-brush adjustments for normal fluctuation and certain double counting.

[a] Combination of statewide or IOU-specific projects administered by either the IOUs or third-party implementers.

[b] Costs do not include administrative or evaluation costs, which were not available. Cost per first year kWh saved of $0.09 if only including costs of programs with efficiency savings.

[c] Los Angeles Department of Water & Power (LADWP), Sacramento Municipal Utility District (SMUD)

[d] City of San Francisco and City of Berkeley. The high cost per unit energy saved ratios are misleading, primarily due to the fact that the cities were unable to measure savings for certain programs and some funded programs did not begin implementation until after 2001.

[e] No energy savings were reported for these two programs: State Building and Facilities Retrofits (Department of General Services), and the Mobile Efficiency Light Brigade "PowerWalk" (California Conservation Corps).

[f] Includes the energy savings credited to the 20/20 Rebate Program and demand reduction attributed to the 20/20 Rebate program, Flex Your Power, and other "residual" effects as tracked by the CEC.

[6] Most programs reported 2001savings in annualized terms, estimating the impact of installed measures for an entire year, regardless of when the measures were actually installed. This could be termed "first-complete-year" savings. Some programs reported 2001 savings as actual savings realized within the 2001calendar year.

[g] Savings from 20/20 Rebate program have been adjusted to correct for double counting, per the analysis specified in Section 3.11 of this report. Program was funded through the California State Department of Water Resources.

[h] No energy savings were explicitly reported or attributed to this category of programs by any administering entity. "Flex Your Power" was funded through Department of Consumer Affairs. "Other" factors include rates and general media coverage of energy crisis in 2001.

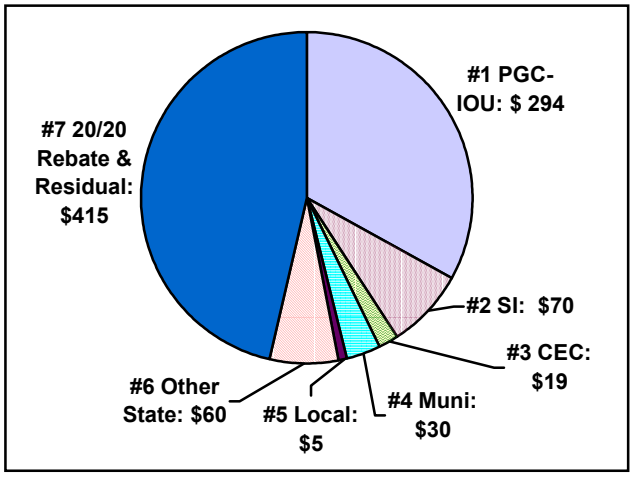
[i] Based on weighted average lifetimes of measures for each program category, and a discount rate of 8%.

As Table 2-1 indicates, the programs in our scope of coverage cost a total of approximately $893 million in 2001; they yielded first-year energy savings of over 4.76 million MWh and reduced demand by 3,389 MW. This resulted in an overall cost of $0.19 per first-year kWh saved in 2001 across all programs, loading all the costs into one year of savings.

Of course, the savings for many of the programs are expected to last well beyond one year. Applying broad assumptions about the effective useful lives of program measures installed in 2001, **we have calculated an overall statewide cost of $0.03 per kWh saved over the lifetime of these program measures**. This 3¢/kWh figure is consistent with the cost of prior-year energy efficiency programs, and is competitive with generation costs. It is remarkable that even in the face of an unprecedented energy crisis, and the ensuing urgency to bring energy efficiency and load management programs quickly to market, that the increased funding of programs in 2001 did not reach a level of diminishing returns.

Figures 2-1 through 2-5 illustrate each program category's contribution to overall cost and savings impact based on the data in Table 2-1.

Figure 2-1 illustrates that Broad State programs cost a total of $475 million in 2001, which constituted nearly half of the state's total cost of energy efficiency programs. Approximately $350 million of that cost was for rebates paid to customers through the 20/20 Rebate Program.



Total: $893 Million

Figure 2-1
Cost Summary ($millions)

Figure 2-2 illustrates each category's contribution to demand reduction.

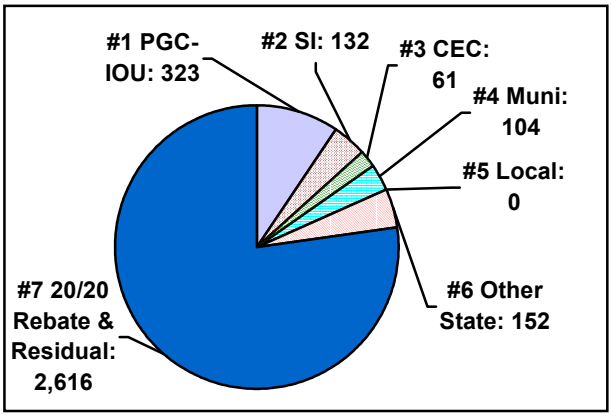


Figure 2-2
Peak Demand Savings by Major Category (MW)

It is important to note that most of the 2,616 MW of peak demand reduction attributed to the 20/20 Rebate & Residual Effects category, in addition to the 20/20 Rebate, implicitly includes the impact of the Flex Your Power public awareness campaign, free media coverage, and increasing rates. This is based on the CEC's tracking of peak demand savings for the month of September 2001, which attributes 2,616 MW of peak demand reduction to "Public Awareness, 20/20, Rates, and Other Voluntary DSM."

Figure 2-3 illustrates that the 20/20 Rebate program was responsible for 64% of the total first-year energy savings for all programs within our scope of coverage.

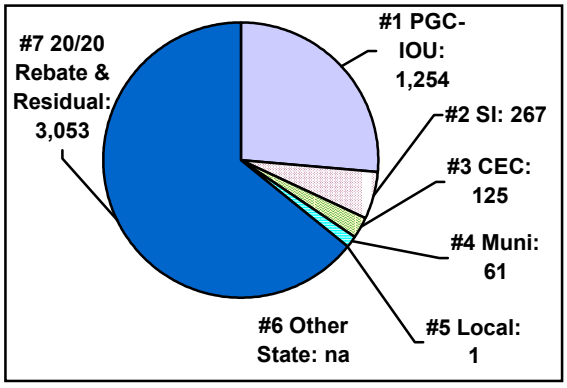


Figure 2-3
First Year Energy Savings by Major Category (GWh)

Figure 2-4 illustrates the relative cost per kW saved for each program category. The Broad State program category appears to have been very cost effective. However, the Broad State ratio is probably understated, since the cost (numerator) reflects the cost of the four programs in this category whereas the demand savings (denominator) represents a residual pool of savings that may include more programs.

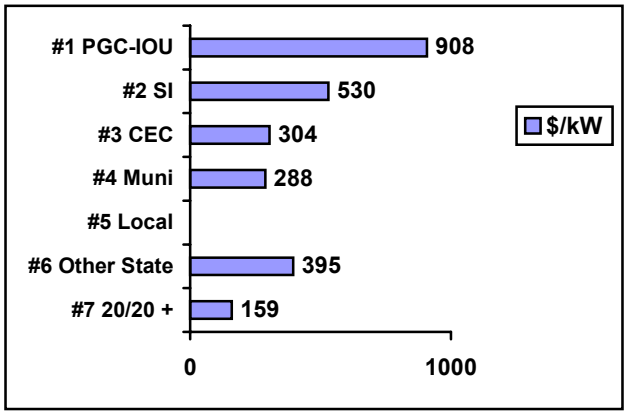


Figure 2-4
Cost per First Year kW Saved by Program Category

Note: Local (city government) administered programs reported negligible demand savings, rendering $/kW ratio not applicable.

The relatively high figure for the Public Goods Charge (PGC)-IOU category may owe to the PGC mandate to administer programs to "hard-to-reach" customers; such programs are typically not as cost-effective as other types of programs. The Local category did not report any significant demand savings.

Figure 2-5 illustrates the cost per kWh saved by program category. The CEC category appears to outstrip the other program categories for cost-effectiveness in energy savings, although the CEC's energy savings figures are the result of estimation since the CEC tracked only demand reduction. The PGC-IOU, Summer Initiative, and Broad State program categories also appear to be rather cost-effective. The Municipal and Local categories appear to have significantly higher costs per kWh saved.

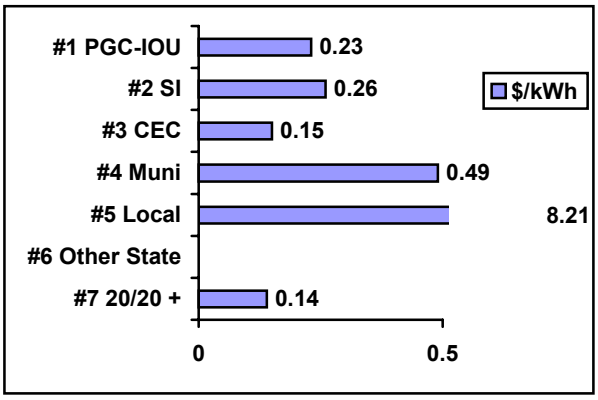


Figure 2-5
Cost per First-Year kWh Saved by Program Category

Note: The two Other Targeted State Programs did not report any first-year energy savings, rendering $/kWh ratio not applicable.

2.3 Lifecycle Cost Analysis

A lifecycle cost analysis was conducted to assess the long-term benefits associated with the 2001 energy efficiency programs. The analysis was conducted in a top-down manner, by attributing an average lifetime for all programs where a savings impact was reported. Lifetimes were based largely on a qualitative assessment of the typical life for the mix of energy efficiency measures that were offered for each program. The lifetimes for individual programs were aggregated to each of the six program categories using weights based on each program's savings impact relative to the total savings impact. A lifecycle cost calculation was performed discounting the 2001 first-year program cost (as reported in Table 2-1) over the lifetime of the programs, using an 8% discount rate. The results of this analysis are presented in Table 2-2.

Table 2-2
Lifecycle Cost of 2001 Energy Efficiency Programs

Program Category	Weighted Average Lifetime (years)	Lifecycle Cost ($/kWh)
#1 PGC-Funded, IOU Administered	12.4	0.029
#2 CPUC-Funded Summer Initiative	13.5	0.030
#3 CEC Programs	15.3	0.017
#4 Major Municipal Programs	12.7	0.060
#5 Locally Administered SBx1 5	11.6	1.039
#6 Other Targeted State Programs	12.0	na [1]
#7 20/20 Rebate & Residual Effects	3.0	0.051
OVERALL WEIGHTED AVERAGE	**7.7**	**0.031**

[1] Not applicable because there were no reported energy savings for this category

As can be seen, overall the 2001 programs have a weighted average lifetime of nearly 8 years, at an average lifecycle cost of 3.1¢ per kWh. These results compare favorably with past estimates for lifecycle costs attributable to California's energy efficiency programs.

2.4 CPUC-Funded, IOU-Administered Programs

California's four major IOUs (PG&E, SCE, SDG&E, and SCG) originally proposed their 2001 energy efficiency programs to the CPUC in November 2000. However, due to the energy crisis during that period, the CPUC ordered the utilities to redesign their programs in late January 2001 with a focus toward achieving immediate energy and demand savings and assisting customers to lower their energy bills. The CPUC also increased program funding by adding PGC funds available from previous years. In addition, the CPUC allocated funds from Senate Bill X1-5 (SBx1 5) to augment IOU funding of residential and small-commercial lighting and residential appliance programs.

Each IOU filed an annual report of its 2001 energy efficiency programs to the CPUC in May 2002. These reports included detailed information on each program, including descriptions, energy and demand savings, budget and cost, and technical appendices that specified the methodology and assumptions behind reported savings. In our assessment, these reports were very detailed and comprehensive, and provided a sound basis for reported savings. Moreover, the evaluation and verification activities standardized into every program category gave us sufficient confidence in the reported savings that no adjustment was necessary.

For reporting purposes, the IOUs group programs into standardized program categories, as stipulated by the CPUC. The first level of categorization is by sector, defined as Residential, Non-residential and New Construction. Within each category, the IOUs aggregate program results into the following sub-categories:

- Information programs (e.g., online information resources for customers, published energy guides, general public awareness, and end-use-specific awareness)
- Energy management services (e.g., customer surveys and audits, either online, phone, or on-site)
- Energy efficiency incentives (e.g., downstream prescriptive rebates and customized rebates)
- Standard performance contracting
- Upstream programs

Typically, the IOUs address particular end-use applications with a full complement of programs or program elements from each category. For example, PG&E has a set of "Residential Heating & Cooling" programs, which includes an Information program element, an Energy Efficiency Incentives program element, and an Upstream program element. As a convention, the IOUs ascribe no savings impact to the information programs, although these programs are intended to influence customers to participate in more tangible programs. PG&E's Residential Heating & Cooling Information program element is credited with zero savings impact, but its value in

getting customers to purchase energy-efficient HVAC equipment and participate is implicit, and assumed to be captured by the Energy Efficiency Incentives program element.

Table 2-3 presents the reported cost and savings of all PGC-funded, IOU-administered programs in 2001, aggregated at the sector level.[7] Tables 2-4 through 2-7 break out the corresponding cost and savings information by IOU. These tables are based on information contained in each IOU's annual report of energy efficiency programs, which is filed with the CPUC.

Table 2-3
IOU Aggregate Program Cost and Savings, PY2001

	Recorded Cost ($ million)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
Residential	$ 109.3	134.0	381,430	$ 816	$ 0.29
Non-residential	$ 126.0	133.9	712,772	941	0.18
New Construction	$ 58.1	55.3	160,336	1,051	0.36
TOTAL	**$ 293.4**	**323.2**	**1,254,538**	**908**	**0.23**

Table 2-4
PG&E Program Costs and Savings by Sector, PY2001

	Recorded Cost ($ million)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
Residential	$54.6	70.2	215,704	$ 778	$ 0.25
Non-residential	$62.6	66.8	363,063	936	0.17
New Construction	$28.4	21.6	49,150	1,315	0.58
TOTAL	**$145.6**	**158.6**	**627,917**	**918**	**0.23**

[7] Excludes Summer Initiative programs and programs funded by SBx1 5.

Table 2-5
SCE Program Costs and Savings by Sector, PY2001

	Recorded Cost ($ million)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
Residential	$27.7	51.2	119,657	$ 542	$ 0.23
Non-residential	$34.8	53.2	274,155	653	0.13
New Construction	$14.8	20.1	68,763	738	0.22
TOTAL	**$77.3**	**124.5**	**462,575**	**621**	**0.17**

Table 2-6
SDG&E Program Costs and Savings by Sector, PY2001

	Recorded Cost ($ million)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
Residential	$19.2	10.7	44,221	$ 1,789	$ 0.43
Non-residential	$14.9	12.9	70,958	1,160	0.21
New Construction	$7.5	7.5	34,182	1,002	0.22
TOTAL	**$41.6**	**31.1**	**149,361**	**1,339**	**0.28**

Table 2-7
SCG Program Costs and Savings by Sector, PY2001

	Recorded Cost ($ million)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Reported First Year Natural Gas Savings (Mtherms)
Residential	$ 7.8	1.9	1,848	2,953
Non Residential	$13.7	1.0	4,596	8,060
New Construction	$ 7.4	6.1	8,241	415
TOTAL	**$28.9**	**9.0**	**14,685**	**11,428**

Note: Since SCG only provides natural gas to customers, we have included a column for natural gas (therm) savings. Although SCG's programs reported MW and MWh savings, electricity savings were not the primary purpose of its programs. As a result, the resulting costs per MW and MWh are not comparable with those of other IOUs, and have therefore not been included in this table. Please refer to Appendix A for more information.

For each IOU, we have included summary information such as program descriptions, cost, savings, and cost effectiveness in the Summary Study Database (see Appendix A for a view of an extraction of this database).

2.5 CPUC-Funded Summer Initiative

The Summer Initiative was established in August 2000 in response to the energy crisis, drawing on unspent PGC funds from prior years. It involved the implementation of a wide range of energy efficiency programs administered by a combination of IOUs and third-party implementers.

We have segmented the Summer Initiative into four categories of programs:

- ***Statewide Third-Party Initiatives*** – This category includes Summer Initiative programs that were administered and implemented by third party administrators across multiple IOU service territories. Third-parties submitted project proposals to the CPUC, which approved projects for funding. The CPUC directed the IOUs to help facilitate the selected third-party administrators' projects in their respective service territories.
- ***Statewide Utility Initiatives*** – These Summer Initiative programs were administered and implemented by two or more IOUs in their respective service territories and were similarly structured and delivered. We note that there are variances in these programs among IOUs for parameters such as eligibility and incentive levels.
- ***Utility-Sponsored Third-Party Initiatives*** – This is a collection of Summer Initiative projects approved by an IOU for its own service territory and implemented by third parties. Third parties submitted proposals to individual IOUs for energy efficiency and demand reduction projects. Each IOU provided oversight for the projects in its service territory.
- ***Local Third-Party Initiatives*** – The IOUs implemented these individual Summer Initiative projects in their respective service territories.

2.5.1 Statewide Third-Party Initiatives

The four programs in this category were implemented across multiple IOU service territories by third parties and reported large energy savings, as shown in the Table 2-8.

Table 2-8
Summary of Statewide Summer Initiative Third-Party Initiatives

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
California Oil and Gas Pumping (COPE)	Non-res (Industrial)	3,202	3.6	29,553	$ 889	$ 0.11
"Beat the Heat" Halogen	Non-res (C&I)	544	4.0	7,182	$ 136	$ 0.08

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
Torchiere replacement with CFL torchieres						
UC/CSU Campus Efficiency Projects	Non-res (Institution)	5,468	9.7	22,393	$ 564	$ 0.24
Subtotal:	**Non-res**	**9,214**	**17.3**	**59,128**	**$ 533**	**$ 0.16**
ARCA Refrigerator Recycling	Res	7,859	9.1	50,922	$ 864	$ 0.15
TOTAL	**All Sectors**	**17,073**	**26.4**	**110,050**	**$ 647**	**$ 0.16**

Sources: IOU annual reports of 2001 energy efficiency programs, May 2002 filings.

The average cost-effectiveness of programs in this category was remarkably comparable to the overall statewide cost-effectiveness.

2.5.2 Statewide Utility Initiatives

The three programs in this category were similarly structured and deployed by multiple IOUs. However, we observed some variation in eligibility requirements and incentive levels across IOUs. The reported costs and savings of these programs are shown in Table 2-9.

Table 2-9
Summary of Summer Initiative Statewide Utility Initiatives

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW saved ($/kW)	Cost per First Year kWh saved ($/kWh)
Pool Pump Efficiency	Res	$ 7,609	69.8	21,147	$ 109	$ 0.35
Res Team Hard to Reach	Res	$ 12,253	9.3	25,969	$ 1,318	$ 0.47
Subtotal	**Res**	**$ 19,862**	**79.1**	**47,116**	**$ 251**	**$ 0.42**
LED Traffic Signals	Non Res	$ 22,524	16.3	95,381	$ 1,382	$ 0.23

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW saved ($/kW)	Cost per First Year kWh saved ($/kWh)
TOTAL	**All Sectors**	**$ 42,386**	**95.4**	**142,497**	**$ 444**	**$ 0.30**

Sources: IOU annual reports of 2001 energy efficiency programs, May 2002 filings.

These three programs are reviewed in greater detail in Chapter 3. The detailed reviews revealed interesting variations in savings assumptions among the IOUs for what ostensibly were identical programs.

2.5.3 Utility-Sponsored Third-Party Initiatives

California's three electricity IOUs oversaw a total of 25 Summer Initiative projects administered by a wide variety of third parties (PG&E, 13; SCE, 6; SDG&E, 6).

Table 2-10
Summary of Summer Initiative Utility-Sponsored Third-Party Initiatives

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
PG&E TPIs	Non Res	$ 8,748	5.0	1,505	$ 1,750	$ 5.81
SCE TPIs	Non Res	$ 920	2.4	3,479	$ 383	$ 0.26
SDG&E TPIs	Non Res	$ 817	1.4	6,797	$ 584	$ 0.12
TOTAL	**All Non Res**	**$ 10,485**	**8.8**	**11,781**	**$ 1,191**	**$ 0.89**

Sources: IOU annual reports of 2001 energy efficiency programs, May 2002 filings.

A number of these TPIs were targeted to hard-to-reach or historically underserved customer segments, likely a contributing factor to the slightly higher cost per kWh than observed for the statewide total. In addition, some of these projects were cancelled or dramatically downscaled, even through funding was already committed. This was the case for several of PG&E's TPI projects, which contributed to the misleadingly high cost per first year kWh saved.

The SDG&E TPIs are reviewed in greater detail in Chapter 3.

2.5.4 Local Third-Party Initiatives

PG&E and SDG&E each implemented several Summer Initiative projects on their own. PG&E conducted four projects for large commercial and industrial customers, while SDG&E conducted two residential programs.

Table 2-11
Summary of Summer Initiative Local Third-Party Initiatives

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
PG&E – Presidio Trust	Non-res	$ 503	0.1	885	$ 5,030	$ 0.57
PG&E – Humboldt Creamery	Non-res	$ 105	0.0	417	NA	$ 0.25
PG&E - City of Oakland: EE Design Assistance	Non-res	$ 329	0.0	89	NA	$ 3.70
PG&E - City of Oakland: Museum Chiller Replacement	Non-res	$ 298	0.1	300	$ 2,980	$ 0.99
Subtotal	**Non-res**	**$ 1,235**	**0.2**	**1,691**	**$ 6,175**	**$ 0.73**
SDG&E – Whole House Fans	Res	$ 104	2.0	149	$ 52	$ 0.70
SDG&E – Halogen Torchiere Turn in Event	Res	$ 32	0.0	388	NA	$ 0.08
Subtotal	**Res**	**$ 136**	**2.0**	**537**	**$ 68**	**$ 0.25**
TOTAL	**All Sectors**	**$ 1,371**	**2.2**	**2,228**	**$ 623**	**$ 0.62**

Sources: IOU annual reports of 2001 energy efficiency programs, May 2002 filings.

2.6 CEC Programs

The CEC received $330 million in funding (through AB 970 in August 2000 and ABx1 29 and SBx1 5 in April 2001) to create and augment grant, loan, and rebate programs with the objective of immediate peak load reduction. The CEC developed a number of new programs under the banner of Peak Load Reduction Programs (PLRP). The PRLP included demand responsive, meter installation and educational programs in addition to the efficiency programs that are the scope of this report. Additionally, $40 million of the funds were allocated for municipal utility peak load programs. Because the mandate of the funding sources was peak load reduction, all of these programs measured and tracked peak load reduction rather than energy savings. However, the CEC was able to generate energy savings based on recorded peak demand figures and assumptions on usage for some of the programs.

Table 2-12 summarizes the cost and efficiency savings impacts for the efficiency components of the programs, not including curtailment, load shifting and self-generation. The costs reflect the incentives for efficiency components implemented during calendar year 2001, the first year of the multi-year programs. The demand savings are those for efficiency components as reported by program managers as of December 31, 2001.

Table 2-12
Summary of CEC Programs

Program Name	Program Category	Reported Cost [1] ($ 000)	Reported Demand Savings [2] (MW)	Reported First Year Energy Savings [3] (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
Energy Conservation Assistance Act Loans (ECAA) [4]	Non-res	$ 2,100	5.3	18,000	na	na
LED Traffic Signals	Non-res	6,770	5.4	45,220	1,254	0.15
Cool Savings	Non-res	2,788	4.1	NA	680	NA
Innovative Peak Load Reduction Program	Non-res	2,119	9.4	NA	225	NA
Agriculture Peak Load Reduction Program: Peak Efficiency	Non-res	838	8.2	NA	102	NA
Agriculture Peak Load Reduction Program: Pump Repair	Non-res	241	na	2,546	na	0.09
Water Agency	Non-res	0	0	0	na	na

Program Name	Program Category	Reported Cost [1] ($ 000)	Reported Demand Savings [2] (MW)	Reported First Year Energy Savings [3] (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
Generation Retrofits						
Water/Wastewater Treatment Facilities Peak Load Reduction	Non-res	1,287	5.6	NA	230	NA
State Buildings	Non-res	2,581	23.4	59,000	110	0.04
TOTAL	**Non-res**	**$ 18,724**	**61.4**	**124,766**	**$ 304**	**$ 0.15 [5]**

Source: California Energy Commission, PLRP program managers and Nexant evaluation reports.

NA = Not Available

na = Not Applicable

[1] Cost of projects implemented during calendar year 2001; does not include costs of curtailment, load shifting, or self-generation components.

[2] Does not include peak savings from curtailment, load shifting, or self-generation components. Peak demand savings realized in 2001, verified by Nexant.

[3] Estimated first year annualized energy savings.

[4] ECAA provides money for loans that are repaid with interest over approximately 10 years to local government facilities, public schools, and other public or non-profit facilities. Loans totaling $14.4 million financed efficiency projects that achieved reported MW and MWh savings. Reported Costs represent administrative and other non-recoverable implementation costs provided in 2001.

[5] Cost is $0.09/kWh when only considering the three programs with efficiency kWh savings.

The CEC programs appear to have yielded a relatively low cost of $0.15 per first-year kWh saved. We do note, however, that **CEC cost numbers only include the value of grants (incentives) paid, and do not include administrative or verification costs.** If administrative costs were included, the costs per kW and kWh would likely be significantly higher.

It is important to note that the Innovative, Agriculture, Water Agency Generation Retrofit, Water/Wastewater, and State Buildings programs also included curtailment, load shifting, and self-generation components in addition to efficiency projects. The CEC was able to break out efficiency kW savings and associated costs for these programs based on program manager's data. Only a few programs had similar breakdowns for kWh savings.

The CEC's third-party evaluator, Nexant, is verifying the peak demand savings for 2001 and beyond. Realization rates for these programs ranged between 67% and 98% with a mean of 87% based on the 2001 evaluation work. No realization rates were available for the ECAA and Agriculture programs in 2001. The complete set of Nexant evaluation reports is available on the CEC's website, www.energy.ca.gov. Reports are produced for the Legislature on a quarterly basis. The CEC's LED Traffic Signals and State Buildings programs are reviewed in more detail in Chapter 3.

2.7 Major Municipal Programs

The two largest and most prominent municipal utilities were selected for inclusion at the outset of this study: SMUD and LAWDP.

2.7.1 Sacramento Municipal Utility District

SMUD administered 23 programs in 2001. Few of these programs had evaluation studies and most did not have adequate documentation to support reported savings figures. No net-to-gross ratios were applied, meaning that all reported savings figures are "gross" and do not account for the affect of free riders.

Table 2-13
Summary of SMUD Programs

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
Project Completion Incentives	Non-res (C & I)	$ 1,065	3.1	19,001	$ 345	$ 0.06
Prescriptive HVAC Replacement Incentives	Non-res (C & I)	116	0.3	754	406	0.15
Prescriptive Motor Replacement Incentives	Non-res (C & I)	3	0.0	37	387	0.08
Energy-Efficient Motor Systems	Non-res (C & I)	175	0.2	1,420	846	0.12
Agricultural and Water District Pump Testing	Non-res (C & I)	137	NA	NA	NA	NA
Small Commercial Prescriptive Lighting	Non-res (Sm C&I)	196	NA	NA	NA	NA
Small C/I HVAC/Refrigerator Tune-Up	Non-res (Sm Comm)	NA	0.3	1,430	NA	NA
Building Controls Retrocommissioning	Non-res (C & I)	100	0.0	807	2,632	0.12
Compressed Air Initiative	Non-res (Ind)	NA	NA	NA	NA	NA
Resource Conservation Management	Non-res (Schools)	NA	NA	NA	NA	NA
Cool Roofs	Non-res (C&I)	392	NA	NA	NA	NA
Vending Machine Control	Non-res (C&I)	153	0.2	2,374	954	0.06
Subtotal	**Non-res**	**2,337**	**4.1**	**25,823**	**$ 568**	**$ 0.09**
Home Auditing	Res	1,233	0.0	276	27,406	4.47

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
Program						
Residential HVAC Rebates	Res	355	0.9	402	390	0.88
Residential Equipment Efficiency Improvement	Res	709	1.7	1,844	429	0.38
Duct Improvement Program	Res	473	0.3	446	1,463	1.06
Residential Appliance Efficiency	Res	1,031	0.1	884	9,123	1.17
Refrigerator Recycling	Res	653	0.7	4,808	977	0.14
Residential Energy Star Lighting	Res	921	1.0	4,156	951	0.22
Solar Domestic Hot Water	Res	229	0.0	85	17,643	2.70
Shade Tree Program	Res	1,500	0.4	890	4,165	1.68
Subtotal	**Res**	**7,103**	**5.1**	**13,791**	**$ 1,405**	**$ 0.52**
C/I New Construction	New Construction (Non-res)	603	1.2	2,366.0	508	0.25
Residential New Construction	New Construction (Res)	840	5.2	5,464.0	162	0.15
Subtotal	**New Construction**	**1,443**	**6.4**	**7,830**	**$ 227**	**$ 0.18**
TOTAL	**All Sectors**	**10,883**	**15.5**	**47,444**	**$ 701**	**$ 0.23**

Source: SMUD, Warren Lindeleaf and Richard Oberg, September 2002.

2.7.2 Los Angeles Department of Water & Power

LADWP's programs consisted of six primarily commercial-focused programs as well as two shade tree planting programs. The primary objective of the first six programs was demand reduction. Accordingly, only demand reduction was reported and tracked; energy savings were estimated with assumed usage hours requested from, and provided by, LADWP. Few of these programs had evaluation studies and most did not have adequate documentation to support reported savings figures. No net-to-gross ratios were applied, meaning that all reported savings figures are "gross" and do not account for the affect of free riders. LADWP's reported figures are shown in Table 2-14.

Table 2-14
Summary of LADWP Programs

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
CLEO Lighting Program	Non-res (C&I)	$ 7,017	19.0	6,106	$ 370	$ 1.15
Refrigeration	Non-res (Sm Comm)	47	0.1	410	416	0.11
HVAC Incentives Program	Non-res	3,712	33.8	2,937	110	1.26
Chiller Efficiency Program	Non-res (C&I)	8,160	35.0	3,714	233	2.20
Cool Roofs	Non-res (Commercial) and multi-family residential property owners	238	0.4	36	564	6.64
Reflective Film Program	Non-res (Comm)	93	0.1	13	758	7.15
Subtotal:	**Non-res**	**$ 19,267**	**88.4**	**13,216**	**$ 218**	**$ 1.46**
Cool Schools	Shade Tree (Campus)	NA	NA	NA	NA	NA
Trees for a Green LA	Shade Tree (Res)	NA	NA	NA	NA	NA
Subtotal:	**Other**	**-**	**-**	**-**		

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
TOTAL	**All Sectors**	**$ 19,267**	**88.4**	**13,216**	**$ 218**	**$ 1.46**

Source: LADWP, Ed Petok, August 2002.

LADWP's HVAC Incentives program and Chiller Efficiency program both yielded cost-effective demand savings, while its Refrigeration program yielded the lowest cost per kWh saved.

2.8 Locally Administered Programs

2.8.1 City of Berkeley

The City of Berkeley administered seven energy efficiency programs in 2001 from a budget of $228,000, resulting in reported savings of 449 MWh and 8,000 therms. An additional small-business lighting program ("SmartLights"), for which $1.9 million in CEC funds was allocated in 2001, was excluded from consideration because no implementations occurred within the calendar year. The Municipal Energy Efficiency Retrofits program included over 180 MWh of energy savings that are already included in PG&E's LED Traffic Signals Replacement program. To avoid double-counting, these savings are excluded from the City of Berkeley's program and included in PG&E's program savings.

Actual program expenditures and energy savings were generally not reported or tracked for most programs. Peak demand savings was not tracked for any program. Any reported savings were based on estimated installation counts and assumed units savings from benchmark sources such as the *DOE Energy Efficiency Handbook* and PG&E. There were no evaluation or verification studies performed for any of these programs. Moreover, net-to-gross ratios were not assigned to any programs, meaning that all reported savings are "gross," since they are not adjusted to account for free riders. In our Summary Study Database, we apply standardized net-to-gross ratios approved by CALMAC to every program that only reports gross savings.

Based on the data made available for us to review, we are uncertain about the accuracy of installation numbers and unit savings assumptions. Accordingly, we recommend adjusting reported savings with ranges from 50% to 100% of reported savings. These adjusted savings ranges are included in Appendix A.

Table 2-15
Summary of City of Berkeley Programs

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW saved ($/kW)	Cost per kWh First Year Saved ($/kWh)
Berkeley Conservation and Energy	Res	NA	NA	96	Na	na
Residential Energy Conservation Ordinance (RECO)	Res	NA	NA	NA	na	na
California Youth Energy Services	Res	NA	NA	353	na	na
"Berkeley Unplugged"	Res	3 [2]	NA	0 [1]	na	$ 9.69
Subtotal:	**Res**	**$ 3 [2]**	**NA**	**449**	**na**	**na**
Commercial Energy Conservation Ordinance (CECO)	Non Res	NA	NA	NA	na	na
Municipal efficiency retrofits (LED Traffic Signals)	Non Res (Muni)	42	NA	NA	na	na
Subtotal:	**Non Res**	**$ 42**	**NA**	**NA**	**na**	**na**
Berkeley's Best Builders	New Construction	NA	NA	NA	na	Na
TOTAL	**All Sectors**	**$ 45**	**NA**	**449**	**na**	**$ 0.10 [3]**

Source: City of Berkeley, Neal DeSnoo and Alice LaPierre.

NA = Not Available; no data was provided

na = Not Applicable

[1] 0.258 MWh

[2] $2,500

[3] Value is not comparable, since it includes programs for which we have costs but no available savings estimates, as well as programs for which we have savings estimates but no available costs.

2.8.2 City of San Francisco

The City of San Francisco's Department of the Environment and the San Francisco Public Utilities Commission administered three energy efficiency programs in 2001, as shown in Table 3-14. Actual program expenditures and energy savings were generally not reported or tracked, and were based on estimates of program managers. The Mayor's Energy Conservation Act provided funding for energy efficiency retrofit projects at city facilities and agencies. Although three to four retrofits began in 2001, none of them were completed within the calendar year. Savings from these retrofits are expected in future years. The Green Buildings initiative was a San Francisco ordinance to make municipal buildings energy efficient. However, in 2001 the only implementation of this ordinance was the retrofitting of the City of San Francisco's Department of the Environment offices, for which no savings data were recorded or estimated.

Of these programs, only the Power Savers small-business lighting program implemented savings measures in 2001. Reported savings from Power Savers were based on actual installation counts and assumed units savings from the FACET Lighting Services Database. There were no evaluation or verification studies performed for any of these programs. Moreover, net-to-gross ratios were not assigned to any programs, meaning that all reported savings are "gross" since they are not adjusted to account for free riders. In our Summary Study Database, we apply standardized net-to-gross ratios approved by CALMAC to every program that only reports gross savings. We have performed a more detailed review of Power Savers in Chapter 4 of this report.

Table 2-16
Summary of City of San Francisco Programs

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
Mayor's Energy Conservation Act (MECA)	C&I (retrofits)	$ 5,000	0	0	na	na
Power Savers	C&I (lighting)	150	0.1	214	$ 1,500	$ 0.70
Green Buildings	C&I (bldg. code)	250	0	0	na	na
Total		**$ 5,400**	**0.1**	**214**	**$ 54,000**	**$ 25.23**

Source: City of San Francisco Department of Environment, Cal Broomhead; San Francisco Public Utilities Commission, Bill Peden.

Note the cost per kW and kWh savings figures are not meaningful due to expenditures on programs that were not implemented in 2001 and therefore did not realize savings in 2001.

na = Not Applicable

2.9 Other Targeted State Programs

We have included in this category a program sponsored by the Department of General Services to retrofit state buildings and facilities with energy efficiency retrofits, and the PowerWalk compact fluorescent lamp (CFL) giveaway program implemented by the California Conservation Corps.

2.9.1 Department of General Services – State Buildings and Facilities Retrofits

SBx1 5 appropriated $40 million to the Department of General Services (DGS) to retrofit state buildings and facilities with energy efficiency improvements. This program was related to, but distinct from, the CEC's State Building Retrofits project, which was separately funded through AB 970 and had different reporting and evaluation requirements. The only information on this program that could be reasonably obtained was funding, budget, and forecasted demand savings. The program did not forecast energy savings, and did not report either demand reduction or energy savings.

2.9.2 Mobile Efficiency Light Brigade / PowerWalk

Governor Davis' signing of AB 29X on April 11, 2001, allocated $20 million for the creation of the Mobile Efficiency Light Brigade (or PowerWalk) program, designed to distribute CFLs as giveaway items to lower income households in California. The dual goals of this program were to reduce energy consumption and demand while enabling lower income households to reduce their monthly energy bill. Target customers, who are typically classified as "hard to reach," generally cannot afford energy efficiency measures on their own, even though the potential savings from such measures could substantially improve their monthly cash flow.

The California Conservation Corps (CCC) was selected to implement this program by having its 1,300 members pass out CFLs to households and establishments within targeted neighborhoods in the state. In total, the CCC distributed over 1.96 million CFLs in 2001, exceeding the stated goal of 1.5 million. Neither the CCC nor the state reported either energy or demand savings. However, we have applied other secondary sources to analyze this program in more detail in Chapter 3, section 3.8.

Table 2-17
Summary of Other Targeted State Programs

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
State Building Retrofits [1]	Non-res	$ 40,000	30	NA	1,333	NA
Mobile Efficiency Light Brigade [2]	Res	20,000	122	NA	163	NA
Total	**All Sectors**	**$ 60,000**	**152**	**NA**	**$ 395**	**NA**

NA = Not Applicable

[1] Source: "The Summer 2001 Conservation Report." State of California.

[2] Source: "Phase 4 Market Effects Study of California Residential Lighting and Appliances Program." San Diego Gas & Electric. Prepared by Xenergy. April 26, 2002.

2.10 20/20 Rebate & Residual Effects

In response to the unprecedented energy crisis facing California in early 2001, Governor Gray Davis and the state legislature enlisted the cooperation and funding of several state agencies and organizations beyond the CEC and CPUC. As a result, several new programs were spawned, the most notable being the 20/20 Rebate and the Flex Your Power public awareness campaign.

2.10.1 20/20 Rebate

Initiated by Executive Order of Governor Gray Davis, the 20/20 Rebate program provided rebates to residential and small commercial/industrial customers of the state's IOUs for reducing monthly electricity usage from June through September 2001. Customers were offered a 20% rebate off of the electricity commodity portion of their energy bill for reducing their total monthly electricity use by at least 20% compared to the same month of the previous year.[8] In addition, large commercial/industrial customers with time-of-use meters received a 20% rebate off of their summer on-peak demand and energy charges for reducing on-peak electricity use by at least 20%.

Because customer participation was automatic, without the need for any program application, this program achieved remarkably wide participation. Table 2-17 summarizes the savings

[8] Customers of SDG&E were only required to reduce their usage by 15% because it was assumed that they had already partially reduced baseline energy use due to escalating electricity rates experienced in the summer of 2000, brought about because the CPUC had lifted its freeze on SDG&E's electricity rates in July 1999.

credited to the program based on the year-over-year difference in monthly energy bills for all customers who received a rebate during any of the months of the program, in aggregate.

Table 2-18
Reported Savings Impact of 20/20 Rebate Program in 2001

Customer Class	% of Customers Receiving Credit	Electricity Reduction (MWh)	Total Rebate Amount ($ Million)
Residential	33%	3,021,000	$134
Non-residential	26%	2,237,000	$153
Total	**32%**	**5,258,000**	**$286**

This savings figure of 5,258 GWh, however, contains the following inherent and significant flaws:

- Does not account for savings that would have occurred as a result of normal fluctuations
- Does not account for influence on customers who reduced usage because of the program but were unable save up to the required threshold level for a rebate for any of the program months
- Does not account for double counting of energy efficiency programs

There was no official program evaluation conducted for the 20/20 Rebate, nor was there any official documentation to confirm or adjust savings from bill credits. This program is reviewed in more detail in Chapter 3, section 3.11, where we adjusted the reported savings using secondary sources and our best judgment.

2.10.2 Flex Your Power

In January 2001, Governor Davis signed legislation authorizing the Department of Consumer Affairs (DCA) to conduct, by his decree, "the largest, most aggressive conservation effort ever launched by a single state."[9] The governor announced a goal to reduce California's summer 2001 peak by 5,000 MW, with Flex Your Power as the primary vehicle for statewide media and public awareness of conservation, peak use reduction and energy efficiency. The program featured many components, including mass media (TV, radio, print) public information campaign in six languages, online and telephone hotline information resources, conservation partnerships with businesses and other organizations, conservation education at schools, public demonstration projects, and promotion of other programs such as the 20/20 Rebate. The media campaign was launched on February 6, 2001, with statewide TV and radio spots.

[9] "Using Mass Media to Influence Energy Consumption Behavior: California's 2001 *Flex Your Power* Campaign as a Case Study." Sylvia Bender (California Energy Commission), Mirtha Moezzi (Lawrence Berkeley National Laboratories), Marcia Hill Gossard and Loren Lutzenhiser (Washington State University). 2002.

No organization has attempted to conduct a formal evaluation of Flex Your Power, perhaps because of the sweeping nature of the program and the inherent difficulty in trying to assess the participation in and impact of a comprehensive public information campaign. The only metric to quantify the program's effectiveness was the year-over-year reduction in California's overall summer peak demand from 2000 to 2001. However, it is not analytically possible to distinguish the impact of Flex Your Power from every other energy efficiency and demand reduction program implemented concurrently in 2001. This double counting is compounded by the fact the Flex Your Power itself promoted participation in state- and utility- sponsored programs, thereby creating a synergistic relationship between it and other programs. As a result, the isolation and quantification of the impact of Flex Your Power was deemed outside the scope of this project.

Accordingly, for the purposes of our database, we did not ascribe any explicit demand reduction value to Flex Your Power. An analysis of the change in California electricity demand from the highest peak day in June 2000 to the highest peak day in June 2001 indicates an overall peak reduction of 5,570 MW, a reduction that exceeded Governor Davis' stated goal of 5,000 MW. This reduction is illustrated by segment in Figure 2-6[10]. Although it was not possible to quantify Flex Your Power's individual contribution to this overall reduction in demand, we acknowledge the program's unquestioned role as a prime catalyst and contributor to the state's successful peak demand reduction in 2001.

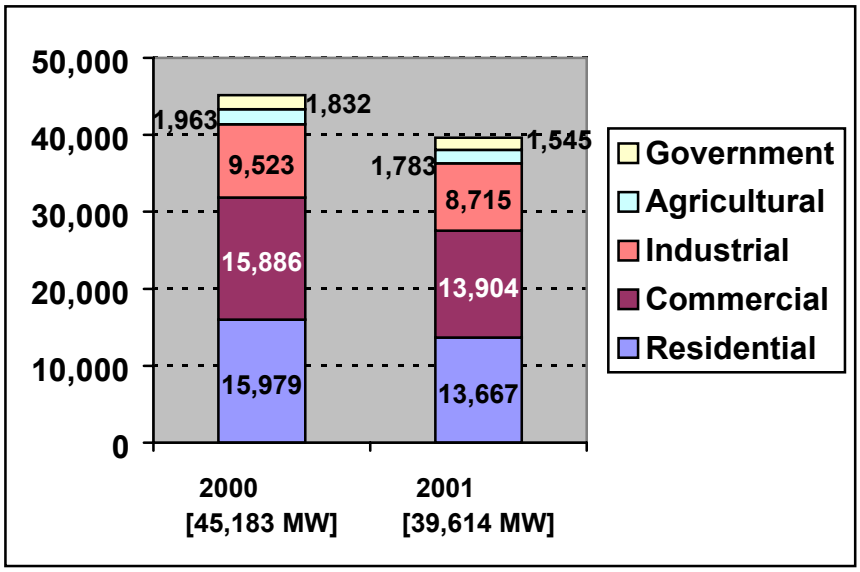


Figure 2-6
California Peak Day Demand (MW): 2000 and 2001

[10] Data from McGuire and Associates. "2001 Energy Savings Estimates by Sector." Facsimile transmission, July 12, 2002.

Table 2-19
Summary of 20/20 Rebate & Residual Effects

Program Name	Program Category	Reported Cost ($ 000)	Reported Demand Savings (MW)	Reported First Year Energy Savings (MWh)	Cost per kW Saved ($/kW)	Cost per First Year kWh Saved ($/kWh)
Flex Your Power [1]	Res & Non-res	$ 65,000	2,616 [3]	NA	$ 159 [5]	NA
20/20 Rebate Program [2]	Res & Non-res	350,000		5,258,000		$ 0.07
Total	**All Sectors**	**$ 415,000**	**2,616**	**5,258,000**	**$ 159**	**$ 0.08**

NA = Not Applicable

[1] Source: CEC, Sylvia Bender.

[2] Source: "California Customer Load Reductions during the Electricity Crisis: Did They Help to Keep the Lights On?" Lawrence Berkeley National Laboratories. Goldman, Eto, Barbose. May 2002.

[3] 2,616 MW represents "residual" peak demand reduction for September 2001 attributable to "Public Awareness (Flex Your Power), 20/20, Rates and other voluntary DSM." Source: California Energy Commission, California Energy Market Report, October 2001.

For Flex Your Power we assumed the following cost allocation across sectors:

- Residential 50% $ 32,500
- Non-residential 25% $ 16,250
- New Construction 25% $ 16,250

To allocate the cost of the 20/20 Rebate to sectors, we applied the share of rebate amounts for each sector[11]:

- Residential 47% $ 164,500
- Non-residential 53% $ 185,500
- New Construction 0% $ 0

To allocate the savings of the 20/20 Rebate to sectors, we applied the share of reported savings for each sector:

- Residential 57%
- Non-residential 43%
- New Construction 0%

[11] "California Customer Load Reductions during the Electricity Crisis: Did They Help to Keep the Lights On?" Goldman, Eto, Barbose. Lawrence Berkeley National Laboratories. May 2002.

3 DETAILED PROGRAM REVIEW

Chapter 3 provides a detailed review of 15 selected programs that were deemed to have significant reported savings impact with little to no initially available data to substantiate those savings. The rationale for program selection is explained in Appendix B. Performing these reviews entailed comparing programs to established benchmark references and with similar programs to understand the basis for key savings assumptions. Based on the available data, we adjusted the reported point savings of some programs with ranges to reflect our professional judgment of the "reasonableness" of reported savings, as well as our uncertainty about the precision of the reported savings.

3.1 Purpose of Detailed Program Review

As we assessed information on each program we observed that the availability, quality, and consistency of program savings documentation and verification varied considerably among administering entities. In addition, we also observed that administering entities sometimes employed different fundamental assumptions for the calculation of energy savings for the same types of programs. To better understand and illustrate these variations in savings assumptions and verification efforts, we reviewed a subset of programs administered by a cross-section of entities and deemed to have the greatest influence on the overall statewide total savings.

3.2 Selection of Programs for Detailed Reviews

We classified all programs according to two factors: the size of the reported energy savings and the extent to which data was available to support those savings estimates. The analysis effort focused on the 15 programs listed in Table 3-1. These programs were selected because they were administered by a cross-section of entities and reported large savings impact but provided little or no information during the first stage of data gathering. This selection was based on the belief that little would be learned from scrutinizing programs with good supporting information and that little would change in the overall savings total from scrutinizing programs with low reported savings.

Table 3-1
Programs Selected for Detailed Review

Program Group[1]	#	Program End-Use Category [2]	Program	Reported MWh Savings	[3]
#1 PGC-Funded, IOU-Administered					
	-	-	*none*	na	
#2 Summer Initiative					
Statewide TPI	1	[a] Residential Refrigerator Recycling	ARCA: Residential Refrigerator Recycling	64,960	*
	2	[b] C&I Lighting	ECOS: "Beat the Heat" Halogen Torchiere Replacement	7,183	*
	3	[c] Assorted C&I Projects	UC/CSU Campus Efficiency Projects	22,393	*
Statewide Utility	4	[d] Residential Pool Pumps	Residential Pool Pump Efficiency	21,147	*
	5	[e] Residential Hard to Reach (CFLs)	Res Team: Hard to Reach	25,969	*
	6	[f] LED Traffic Signals	LED Traffic Signals	95,382	*
Utility TPI	7	[c] Assorted C&I Projects	SDG&E: SI Third Party Initiatives (6 projects)	6,797	*
Local TPI	8	[g] Oil Pumping Efficiency	COPE: Oil Pumping Efficiency (PG&E & SCE service territories)	41,198	*
#3 CEC Programs					
CEC	9	[f] LED Traffic Signals	CEC: LED Traffic Signals	45,220	
	10	[c] Assorted C&I Projects	CEC: State Buildings	59,000	
#4 Major Municipal Programs					
SMUD	11	[c] Assorted C&I Projects	SMUD: Project Completion Incentives (Retrofit Measures)	19,000	
SMUD	12	[a] Residential Refrigerator Recycling	SMUD: Residential Refrigerator Recycling	4,808	
#5 Locally Administered SBx1 5					
San Francisco	13	[b] C&I Lighting	City of San Francisco: "Power Savers"	214	
#6 Other Targeted State Programs					
CCC	15	[e] Residential Hard to Reach (CFLs)	California Conservation Corps (CCC): Mobile Efficiency Brigade / "PowerWalk"	NA	
#7 20/20 Rebate & Residual Effects					
DWR	14	[h] 20/20 Rebate	20/20 Rebate	5,258,000	

Notes

na = Not Applicable

NA = Not Available

[1] Six program groups were specified in our Revised Research Plan submitted on June 21, 2002. The group "State Public Awareness" was split into to "Targeted Other State Programs" and "20/20 Rebate and Residual Effects" to more accurately describe the programs contained therein.

[2]These 15 programs can be grouped into eight distinct end-use categories, which are designated with letters from "[a]" through "[h]."

[3]Asterisk denotes that the corresponding program had been grouped in the *High Reported Savings & None (Available Data)* cell of the Figure B-1 in Appendix B.

For these 15 programs, we interviewed program managers, evaluation managers, and regulators to locate information that would help to explain the methodology and assumptions used to develop savings estimates. Some of these programs were comprised of many smaller projects, each of which was documented individually. Lack of consistency in the documentation and in the estimation methodologies used among the different projects and programs presented significant challenges to the effort.

3.3 Summary Results of Detailed Program Reviews

Table 3.2 summarizes the results of our analysis of each program, comparing energy savings as reported by each administering entity with our adjusted savings range. The table segments the 15 programs into 8 logical groupings of similar programs. The table also indicates whether savings are expected to persist in future years based on the expected useful life of the measure used in each program.

Table 3-2
Summary of Reported and Adjusted Savings for Selected Programs

Program	Reported Savings (MWh)	Adjusted Savings Range (MWh)	Persistence (% of first year savings)		
			Post 1 year	Post 6 years	Post 15 years
[a] Refrigerator Recycling					
#1: ARCA Summer Initiative	62,728	33,017 – 62,728	100%	100%	0%
# 12: SMUD	4,776	2,866 – 3,821	100%	100%	0%
[b] Commercial and Institutional Lighting					
#2: ECOS "Beat the Heat" Torchiere Replacement	8,844	1,539 – 2,166	100%	100%	0%
#13: City of San Francisco: "Power Savers"	214	107 – 214	100%	100%	0%

Program	Reported Savings (MWh)	Adjusted Savings Range (MWh)	Persistence (% of first year savings)		
			Post 1 year	Post 6 years	Post 15 years
[c] Assorted Commercial and Institutional Projects					
#3: UC/CSU Third Party Summer Initiative Campus Efficiency Projects	17,481	9,265	100%	100%	100%
#10: CEC State Buildings	59,000	59,000	100%	100%	100%
# 7: SDG&E Third Party Summer Initiatives	2,869	1,520	100%	100%	100%
#11: SMUD Project Completion Incentives	19,001	10,070	100%	100%	100%
[d] Residential Pool Pumps					
#4: Pool Pump Efficiency Summer Initiative – PG&E, SCE, SDG&E	21,147	50,151 – 67,462	100%	100%	100%
[e] Residential Hard to Reach (CFLs)					
#5: Res Team Hard to Reach Summer Initiative (four IOUs)	25,969	21,035 - 25,709	100%	100%	0%
#15: California Conservation Corps: “PowerWalk"	None Reported	42,504	100%	100%	0%
[f] LED Traffic Signals					
#6: IOU Summer Initiative	89,905	80,359 – 89905	100%	100%	100%
#9: CEC	45,220	36,176 – 45,220	100%	100%	0%
[g] Oil Pumping Efficiency Projects					
#8: COPE – Third Party Summer Initiative	29,553	24,004	100%	100%	0%
[h] 20/20 Rebate Program					
# 14: 20/20 Rebate Program	5,258,000	3,053,000	100%	0%	0%

The remaining sections of Chapter 3 explore each of the eight groupings of programs in greater detail.

3.4 Residential Refrigerator Recycling

Programs Reviewed

- Program #1: 2001 Statewide Summer Initiative – Appliance Recycling Centers of America (ARCA) Residential Refrigerator Recycling program. Implemented by ARCA in the service territories of PG&E and SDG&E, with SCE serving as contract manager. ARCA was responsible for evaluating and verifying energy savings.
- Program #12: SMUD Residential Refrigerator Recycling program. SMUD contracted with JACO Environmental to implement the program, and with Herschong Mahone (HM) to evaluate and verify program savings.

Benchmark References

- "Impact Evaluation of the Spare Refrigerator Recycling Program CEC Study #537 Final Report." This impact evaluation of SCE's 1996 Spare Refrigerator Recycling Program, published by Xenergy on April 30, 1998, is the most comprehensive and recent evaluation reference on refrigerator recycling in California. This report is hereafter referred to as "Xenergy 96."
- In 2001, ARCA conducted its Refrigerator Recycling program in the SCE service territory; it has been operating this program in the SCE territory since 1993. This was not a part of the 2001 Summer Initiative. SCE appears to have relied on Xenergy 96 for its savings estimates.

Adjusted Savings Results

Based on our analysis, we adjusted the reported savings of each program as shown in Table 3-3.

Table 3-3
Summary of Reported and Adjusted Savings – Residential Refrigerator Recycling

Program	Reported Savings (MWh)	Adjusted Savings Range (MWh)	Persistence (% of first year savings)		
			Post 1 year	Post 6 years	Post 15 years
SMUD	4,776	2,866 – 3,821	100%	100%	0%
ARCA Summer Initiative	62,728	33,017 – 62,728	100%	100%	0%

The remainder of this section provides a rationale for the adjustments applied to the reported savings of each program.

Summary of Key Assumptions

SMUD and ARCA each relied on a separate set of key assumptions to calculate energy savings, as summarized in Table 3-4. ARCA applied benchmarks established by Xenergy 96 and SCE for unit energy savings, demand reduction, and effective useful life, although it appears to have applied a less conservative net-to-gross ratio. SMUD, on the other hand, obtained its unit energy and demand figures from the Association of Home Appliance Manufacturers (AHAM) database and did not appear to explicitly discount savings for the affect of free-ridership (i.e., a default net-to-gross ratio of 1.0).

Table 3-4
Summary of Key Assumptions – Residential Refrigerator Recycling

	SMUD	ARCA [3a]	ARCA [3b]	Benchmarks	
				SCE	Xenergy 96
Unit Energy Savings (kWh/yr)					
Refrigerator	1,578 [1]	1,593	2,148	2,148	2,148
Freezer	1,498 [1]	1,593	2,058	2,058	2,058
Unit Demand Reduction (kW)					
Refrigerator	0.22 [1]	0.28	0.33	0.33	0.33
Freezer	0.22 [1]	0.28	0.31	0.31	0.31
Remaining Useful Life (of replaced appliance)	NA [2]	6 years	6 years	6 years	6 years
Net-to-Gross Ratio applied (no specified ratio = 1.0)	1.0	1.0	0.8	0.54	0.53 (ref) 0.57 (frz)
Are Reported Savings Annualized (Ann) or Program Year-specific (PY)? [4]	Ann	Ann	Ann	Ann	Ann

[1] SMUD figures are average unit savings and demand reduction figures. The SMUD program referenced the AHAM database to determine the savings for each replaced unit, rather than applying a single unit savings assumption for all replaced refrigerators or freezers. Demand reduction figures were based on the 2 – 6pm peak period.

[2] No Useful Life assumptions were provided; SMUD did not calculate life-cycle savings

[3] ARCA presented two sets of savings calculation methodologies.

[3a] Set one was based on assumptions furnished by ARCA in its proposal to the CPUC.

[3b] Set two conforms to the assumptions specified in the Xenergy report, with the exception of the net-to-gross ratio for which a factor of 0.8 was provided by the CPUC.

[4] Reported savings for energy efficiency programs are either presented in annualized terms (i.e., savings that would result over a year from recycling a refrigerator unit) or program-year terms (i.e., savings over the rest of calendar year 2001 from recycling a refrigerator unit on, for example, July 1, 2001). All of these programs apply annualized savings, since program-year savings would require taking into consideration the date of each individual replacement. It is outside the scope of this study to generate estimates of program-year savings where only annualized savings is reported, and vice-versa.

3.4.1 SMUD

SMUD has performed an admirable job of building a "bottoms-up" aggregate savings based on the actual models that were recycled, rather than by applying a uniform unit savings. SMUD and HM referenced the AHAM database to determine the energy consumption of each replaced refrigerator and freezer unit, based on manufacturer make, model number, and vintage. SMUD instructed its implementation contractor to record the make, model number, and vintage of each refrigerator and freezer unit that it picked up, and SMUD referenced the AHAM database for the corresponding energy consumption of each replaced unit. For units for which the implementation contractor was unable to record an equipment vintage, SMUD applied a default annual unit energy savings of 1,636 kWh, an average savings based on the SDG&E Statewide Saturation database. We do not have information on the number of units for which the SDG&E default figures were applied.

By multiplying the number of refrigerator and freezer units replaced by SMUD by the average unit energy savings we obtain gross and net energy savings, as shown in Table 3-5.

Table 3-5
Reported Energy Savings Data – SMUD

	[A]	[B] / [A]	[B]	[C]	[B] * [C]
	Number of Units	**Gross Unit Energy Savings (kWh)**	**Gross Energy Savings (MWh)**	**Net-to-Gross Ratio**	**Reported Net Energy Savings (MWh)**
Refrigerators	2,354	1,578	3,715	1.0	3,715
Freezers	708	1,498	1,061	1.0	1,061
Total			**4,776**	**1.0**	**4,776**

We have no prima-facie basis to adjust the energy consumption values provided in the AHAM database. Moreover, it is our assessment that AHAM, as a reputable industry association, is a reasonable source of energy consumption information at the model level. In addition, we also observe that SMUD's average unit demand and energy consumption (savings) figures are less than those used by ARCA or contained in Xenergy 96. This observation provides some reassurance that the gross savings estimates are not overstated. Therefore, we have not made any adjustment to the gross unit energy savings.

We do believe, however, that a net-to-gross ratio other than 1.0 ought to be applied to this program in order to account for free-ridership. In consideration of both the CPUC's guidance that ARCA use a net-to-gross of 0.8, as well as the detailed customer survey analyses which led Xenergy to determine the net-to-gross ratios shown in Table 3-4, we

believe it is appropriate to apply a net-to-gross range of 0.6 – 0.8. Table 3-6 shows our adjusted energy savings for the SMUD program.

Table 3-6
Adjusted Energy Savings Data – SMUD

	[A]	[B] / [A]	[B]	[C]	[B] * [C]
	Number of Units	**Adjusted Gross Unit Energy Savings (kWh)**	**Gross Energy Savings (MWh)**	**Adjusted Net-to-Gross Ratio Range**	**Adjusted Net Energy Savings Range (MWh)**
Refrigerators	2,354	1,578	3,715		
Freezers	708	1,498	1,061		
Total			**4,776**	**0.6 – 0.8**	**2,866 – 3,821**

3.4.2 ARCA Summer Initiative

The first set of ARCA assumptions (see footnote 3a of Table 3-4), as provided in its Summer Initiative proposal to the CPUC, appears to be within a reasonable range between the Xenergy 96 and SMUD unit consumption figures. However, the source of this set of assumptions is not specified in ARCA's documentation. Therefore, we will examine ARCA's second set of assumptions (see footnote 3b of Table 3-4), which largely conforms to SCE/Xenergy 96 assumptions. Based on ARCA's accounting of the number of refrigerator and freezer units it replaced, the SCE/Xenergy 96 benchmark of unit energy savings, and ARCA's own net-to-gross ratio, we can calculate the program's net energy savings, as shown in Table 3-7.

Table 3-7
Reported Energy Savings Data – ARCA Summer Initiative

	[A]	[B]	[A] * [B]	[C]	[C] * ([A] * [B])
	Number of Units	**Gross Unit Energy Savings (kWh)**	**Gross Energy Savings (MWh)**	**Net-to-Gross Ratio**	**Reported Net Energy Savings (MWh)**
Refrigerators	30,358	2,148	65,209	0.8	52,167
Freezers	6,327	2,058	13,021	0.8	10,561
Total			**78,410**	**0.8**	**62,728** [1]

Source: "The Multi-Megawatt Refrigerator/Freezer Recycling Summer Initiative Program – Final Report." ARCA.

[1] The reported figure is 62,569 MWh; discrepancy due to rounding error for Gross Unit Energy Savings

Xenergy 96 is an extremely comprehensive and well-researched study, and the adoption of its assumptions by ARCA appears entirely reasonable. However, because Xenergy 96 was based on 1996 data, we believe that applying its gross unit savings estimates in 2001 without adjustment will likely overstate gross savings. Five program years have elapsed since Xenergy 96, and over the course of those five years many older vintages of refrigerators and freezers may have ceased to operate. Therefore, it is reasonable to assume that the batch of refrigerator and freezer units replaced in 2001 would have a more recent "vintage distribution profile" than the batch of units replaced in 1996. Furthermore, it is reasonable to assume that a more recent vintage distribution profile translates to a higher average unit energy efficiency, and therefore lower unit energy consumption.

We therefore believe that the Xenergy 96 gross unit savings numbers represent an upper-bound of savings. Furthermore, we believe 1,500 kWh represents a reasonable lower bound for gross unit savings. This is based on the SMUD average unit savings figures, which were derived from a model-specific database. We assume that the vintage distribution profile in the SMUD territory is similar to those in the PG&E and SDG&E territories.

In consideration of both the CPUC's guidance that ARCA use a net-to-gross of 0.8, as well as the detailed customer survey analyses which led to Xenergy to determine the net-to-gross ratios shown in the Table 3-4, we believe it is appropriate to apply a net-to-gross range of 0.6 – 0.8.

Table 3-8 shows our adjusted energy savings for the ARCA Summer Initiative program, taking into account our adjusted gross unit energy savings range as well as our adjusted net-to-gross ratio range.

Table 3-8
Adjusted Energy Savings Data – ARCA Summer Initiative

	[A]	[B]	[A] * [B]	[C]	[C] * ([A] * [B])
	Number of Units	**Gross Unit Energy Savings Range (kWh)**	**Gross Energy Savings Range (MWh)**	**Adjusted Net-to-Gross Ratio Range**	**Adjusted Net Energy Savings Range (MWh)**
Refrigerators	30,358	1,500 – 2,148	45,537 – 65,209		
Freezers	6,327	1,500 – 2,058	9,491 – 13,021		
Total			**55,028 – 78,410**	**0.6 – 0.8**	**33,017 – 62,728**

Persistence

The benchmark references for this program category estimate a remaining useful life of six years for recycled refrigerator and freezer units. The supposition is that if these units were not recycled they would have operated, on average, for another six years before ultimately failing. As a simplifying assumption we shall treat the six-year useful life as a fixed value rather than as the mean of a probability distribution. Therefore, we estimate that the adjusted savings resulting from these recycled units will persist at 100% through the next six years and drop to 0% thereafter.

3.5 Commercial & Institutional Lighting

Programs Reviewed

- Program #2: Summer Initiative – ECOS Consulting "Beat the Heat" Halogen Torchiere Replacement
- Program #13: City of San Francisco Power Savers

Benchmark References

- U.S. Department of Energy, Office of Federal Energy Management Programs, "Energy Efficient Torchiere Swap Guide." February 2002.
- FACET Lighting Services, Table of Standard Wattages.
- "California SPC Program Table of Standard Fixture Wattages, 1999." CPUC.

Adjusted Savings Results

Based on our analysis, we adjusted the reported savings of each program as shown in Table 3-9.

Table 3-9
Summary of Reported and Adjusted Savings – Commercial & Institutional Lighting

Program	Reported Savings (MWh)	Adjusted Savings Range (MWh)	Persistence (% of first year savings)		
			Post 1 year	Post 6 years	Post 15 years
ECOS: "Beat the Heat" Halogen Torchiere Replacement	8,844	1,539 – 2,166	100%	100%	0%
City of San Francisco: "Power Savers"	214	107 - 214	100%	100%	0%

The remainder of this worksheet provides a rationale for the adjustments applied to the reported savings of each program.

3.5.1 Ecos "Beat the Heat"

Ecos Consulting (Ecos)'s "Beat the Heat" program involved replacing ubiquitous halogen torchieres with CFL torchieres in commercial and institutional settings, most notably college dormitories, across three IOU territories. Apart from significantly reducing demand and saving energy, CFL torchieres radiate substantially less heat than halogen torchieres, which have been blamed for causing fires in numerous cases.

In its final report on the program, Ecos reported a unit energy savings of 2,370 kWh for replacing a halogen torchiere with a CFL torchiere. Based on its count of the number of torchieres replaced in each service territory, Ecos reported first-year energy savings of 8,489 MWh, as shown in Table 3-10. There was no discussion of discounting savings for the affect of free-riders in Ecos'report, which equated to a default net-to-gross ratio, of 1.0.

Table 3-10
Calculation of Reported Energy Savings – Ecos "Beat the Heat"

	[A]	[B]	[A] * [B]	[C]	[A] * [B] * [C]
Service Territory	**Number of Torchieres Replaced**	**Gross Unit Energy Savings (kWh)**	**Gross Energy Savings (MWh)**	**Net-to-Gross Ratio**	**Reported Net Energy Savings (MWh)**
PG&E	1,116	2,370	2,645	1.0	2,645
SCE	1,609		3,813		3,813
SDG&E	857		2,031		2,031
Total	**3,582**		**8,489**		**8,489**

Source: "Beat the Heat Final Report." Ecos Consulting. April 15, 2002.

Based on Ecos's proposal to the CPUC and its final report on the Beat the Heat program, we have summarized salient energy-related data in Table 3-11.

Table 3-11
Summary of Key Assumptions – Commercial & Institutional Lighting

Attribute	Figure	Source
Power Draw		
Baseline Halogen Torchiere	300 W	[2]
Replacement CFL Torchiere	55 W	[1]
Wattage differential	245 W	Calculation
Hours of Use per Day		
On-Peak, Commercial	4	[2]
On-Peak, Institutional	1	[2]
Total, Commercial	6	[2]
Total, Institutional	4	[2]

Attribute	Figure	Source
Days of Use per Year		
Commercial	260	[2]
Institutional	365	[2]
Remaining Useful Life (years)		
Halogen Torchiere	5 years	[2]
CFL Torchiere	10 years	[2]
Net to Gross Ratio applied (no specified ratio = 1.0)	1.0	Default
Are Reported Savings Annualized (Ann) or Program Year-specific (PY)? [4]	Ann	Inherent in reported savings calculations

Sources:

[1] "Beat the Heat Final Report." Ecos Consulting. April 15, 2002.

[2] "Beat the Heat: A Proposal to Replace Halogen Torchieres in California's Commercial and Institutional Buildings." Ecos Consulting. July 21, 2000.

From Table 3-11, if we apply the 245 watt differential between a halogen and CFL torchiere, and apply the longer hours of use of a commercial application (6 hours per day) with the higher days of use of an institutional application, we obtain:

245 watts * 6 hours/day * 365 days/year = 536.6 kWh/year

This is lower than the assumed unit energy savings of 2,370 kWh/year by a factor of over four. In fact, even if we were to assume continuous operation (a highly unrealistic assumption) we would fail to meet the assumed unit savings:

245 watts * 24 hours/day * 365 days/year = 2,146.2 kWh/year

Although FEMP guidelines and Ecos's proposal assume a baseline halogen consumption of 300 watts, we may assume that there is a small stock of 500-watt units that were part of the installed base of torchieres that were replaced. Even under the generous assumption that half of the replaced torchieres were 500-watt, we calculate that each torchiere would need to be operated for 18.8 hours per day to achieve annual unit savings of 2,370 kWh:

(500 + 300 watts)/2 = 400 watts average baseline consumption

400 watts – 55 watts = 345 watts

(2,370,000 watt-hrs/year) / (345 watts) / (365 days/year) = 18.8 hours/day

We feel it is appropriate to assign unit savings based on a usage of 6 hours per day and a baseline range of 245 to 345 watts.

245 watts * 6 hours/day * 365 days/year = 537 kWh/year

345 watts * 6 hours/day * 365 days/year = 756 kWh/year

In addition, we have applied the standard net-to-gross ratio for lighting applications (0.8) to this program to take into account the impact of free-riders. The results of these adjustments are seen in the Table 3-12.

Table 3-12
Calculation of Adjusted Energy Savings – Ecos "Beat the Heat"

	[A]	[B]	[A] * [B]	[C]	[A] * [B] * [C]
Service Territory	**Number of Torchieres Replaced**	**Gross Unit Energy Savings Range (kWh)**	**Adjusted Gross Energy Savings (MWh)**	**Net-to-Gross Ratio**	**Adjusted Net Energy Savings (MWh)**
PG&E	1,116	537 - 756	599 – 844	0.8	479 – 675
SCE	1,609		864 – 1,216		691 – 973
SDG&E	857		460 – 648		368 – 518
Total	3,582		1,924 – 2,708		1,539 – 2,166

3.5.2 City of San Francisco "PowerSavers"

PowerSavers was introduced as a pilot program in 2001 – funded by the CPUC through SBx1 5 and administered by the City of San Francisco's Department of the Environment ("SF Environment") – to provide lighting retrofits to small businesses. Implementation staff and contractors made door-to-door visits to a number of commercial establishments in certain San Francisco neighborhoods to offer initial lighting audits, ultimately completing retrofits at 47 locations during the year.[12]

SF Environment reported annualized, first-year energy savings of 214 MWh – an average of 4,553 kWh per site – and assumed an average demand savings of 1.8 kW per site and an average peak demand savings of 1.37 kW per site (assuming coincident demand coefficients from PG&E.)[13]

Newcomb Anderson Associates ("Newcomb") implemented the audits and retrofits. Newcomb was instructed to maintain a record of all installed and replaced lighting equipment (fixtures, lamps, ballasts, sensors) at each retrofit site. SF Environment and Newcomb used the FACET database of lighting measures to provide standard wattages for each piece of lighting equipment removed and installed. Most of the wattage values in the FACET database are derived from a table of standard fixture wattages used for California's statewide Standard Performance Contracting program administered by the

[12] Source: City of San Francisco – Department of the Environment, Cal Broomhead.
[13] Source: City of San Francisco – Department of the Environment, Cal Broomhead

IOUs.[14] PowerSavers itself is structured as a performance contracting program, whereby the program administrator and/or implementer shares a portion of the customer's bill savings as compensation for the retrofit services.

Theoretically, one could multiply the difference in wattage between each piece of baseline equipment and its replacement by assumed hours of usage to estimate energy savings. However, we were unable to obtain any site-specific data from SF Environment that documented the inventory of replaced and installed equipment. Despite the fact that PowerSavers was designed to keep track of all retrofit measures at each site and that it references highly credible wattage benchmarks, we could not locate any meaningful data to substantiate the savings reported by SF Environment. As a result, we felt it prudent to err on the side of conservatism and adjust the reported savings by a range of 50 to 100% to account for our uncertainty, which equated to 107 – 214 MWh.

Persistence

CALMAC has endorsed an effective useful life for screw-in CFLs of 7.7 years, which we apply to both programs.[15] As a simplifying assumption, we treat the 7.7 year effective useful life as a fixed value rather than as the mean of a probability distribution. Therefore, we estimate that the adjusted savings resulting from these CFL torchieres will persist at 100% through the next 7.7 years and drop to 0% thereafter.

[14] "SPC Program Table of Standard Fixture Wattages." Appendix B of the California Standard Performance Contracting Handbook. 1999 values used by program administrator and implementer.
[15] "California Measurement Advisory Committee Public Workshops on PY2001 Energy Efficiency Programs." CALMAC. Page 56. September 2000.

3.6 Assorted Commercial & Institutional Projects

This group of programs includes a number of individual energy efficiency projects in commercial and institutional buildings. In general, these projects resemble those undertaken under the IOUs' standard performance contracting programs. Each project has been documented individually, and in most cases, some form of project report was filed, although standards for calculating savings and for verifying them vary.

One significant finding is that many of these projects utilize the objective of reducing coincident peak demand, rather than of saving energy, so that the evaluation methodology differs from the more usual energy efficiency monitoring and verification (M&V) protocols.

Programs Reviewed

- Program #3: University of California/ California State University (UC/CSU) Campus Efficiency Projects – Six TPI projects administered by the three investor owned utilities using summer initiative (SI) funds.
- Program #7: SDG&E Summer Initiative Third-Party Initiatives – Six projects administered by SDG&E.
- Program #10: CEC State and Public University Buildings Program – Projects funded under AB 970[16]
- Program #11: SMUD Project Completion Incentives

Benchmark References

- IOU standard performance contract (SPC) programs. No explicit review of SPC projects was conducted for this analysis, but the IOUs were asked how they compared the M&V on the Summer Initiative Third-Party Initiative projects they administered with their requirements for SPC projects.

Adjusted Savings Results

Based on our analysis, we adjusted the reported savings of each program as shown in Table 3-13.

[16] Combination of energy efficiency measures such as lighting and HVAC upgrades, as well as load curtailment at facilities such as California State University and University of California campuses, prisons and state buildings.

Table 3-13
Summary of Reported and Adjusted Savings – Assorted Commercial & Institutional

Program	Reported Savings (MW)	Adjusted Savings Range (MW)[1][2]	Reported Savings (MWh)[3]	Adjusted Savings Range (MWh)[1]	Persistence[4] (% of first year savings)		
					Post 1 yr	Post 6 yrs	Post 15 yrs
#3: UC/CSU Third-Party Summer Initiative Campus Efficiency Projects	7.9	3.6 – 4.2	17,481	9,265	100%	100%	100%
#7: SDG&E Third-Party Summer Initiatives	0.8	0.2 – 0.4	2,869	1,520	100%	100%	100%
# 10: CEC State Buildings	23.4	12.4	59,000	59,000	100%	100%	100%
#11: SMUD Project Completion Incentives	3.1	1.6	19,001	10,070	100%	100%	100%

[1] A net-to-gross ratio of 53% has been applied, consistent with the ratio used by Southern California Edison for its standard performance contract program.

[2] A number of projects apparently reported non-coincident demand reductions. Since the appropriate diversity factor for these projects could not be determined, the range of demand savings reflects the possibility that demand savings from these projects occur entirely off-peak vs. entirely on-peak.

[3] All energy savings for these projects were reported on an annualized (rather than program year) basis. CEC data, provided by Sylvia Bender, represents savings attributable to energy efficiency measures only.

[4] Reference: Table 2 of Appendix C2 of the report "California Measurement Advisory Committee Public Workshops on PY 2001 Energy Efficiency Programs." CALMAC. September 2000.

Note: No adjustments, other than as noted in [1] and [2] were made to the reported savings, regardless of the varied levels of confidence the documentation afforded. See program discussion for details.

The remainder of this section provides a rationale for the adjustments applied to the reported savings of each program.

3.6.1 UC/CSU Summer Initiative Campus Efficiency Projects

3.6.1.1 PG&E

The PG&E campus efficiency summer initiative consisted of three projects that were administered by PG&E at the University of California at Davis, Cal Poly San Luis Obispo, and California State University at Hayward. We did not receive any information about the CSU Hayward project, so our discussion is limited to the former two projects.

At UC Davis, previous to implementing this project, a single central chilled water plant provided cooling to most of the campus. During the hottest part of the summer days, the chillers were fully loaded, incurring maximum demand and cost during system peak. This project added a second chilled water plant,[17] and a 5.2-million-gallon, 40,000 ton-hour thermal storage tank, as well as associated cooling towers and pumps. The thermal energy storage (TES) system enables UC Davis to efficiently generate chilled water at night, during off-peak hours when electricity is more abundant and cheaper, and then use it the next day to provide cooling, reducing peak electrical demand. In addition, recharging the tank at night enables the chillers to operate fully loaded.

Cal Poly SLO was intended to provide 1,011 kW of peak demand reduction, 39 kW from HVAC retrofits and 972 kW from lighting retrofits. Time-of-day controllers were also installed on HVAC equipment throughout the campus. Lighting retrofits, including ballast and lamp changeouts, and delamping, were performed for over 27,000 fixtures in approximately 60 buildings. No description was found of the HVAC retrofits.

Evaluation:

M&V reports were prepared by Comfort Systems USA for the UC Davis project and by Energy Resource Associates for the CSU Cal Poly SLO project. In general, the evaluations of these projects utilize verification of equipment installation together with engineering calculations of the energy savings.

For the chiller and TES installation at UC Davis, PG&E conducted an inspection to verify installation, but the system was not fully operational at the time (March 2002). Engineering calculations were used to estimate the savings, although a third-party evaluator (ESS Engineering), has been contracted to conduct a more rigorous M&V. The proposed method for conducting the M&V is short-term, continuous post-installation metering. M&V activities are comprised of a post-installation inspection to verify the efficiency of the installed chiller(s) and capacity of thermal storage tank, post-installation monitoring of the chillers, pumps, and TES tank, estimation of baseline energy consumption, and generation of M&V reports. It appears that only the peak reduction due to the TES system has been established for this project and that any energy savings due to the installation of an efficient chiller have not been counted. The focus on peak reduction

[17] Four 1,000-ton chillers, rated with an ARI nominal efficiency of 0.54 kW/ton.

is consistent with the objectives of the Summer Initiative. (Technically, demand saving and shifting projects, such as TES, are beyond the scope of the present analysis.)

In the case of the lighting retrofits at Cal Poly SLO, detailed accounting was kept of all fixture and lamp change-outs. The savings calculation used "generally accepted pre- and post-retrofit wattages … to establish the watts saved per fixture" and "operating hours … stipulated based on commonly accepted values for types of occupancy from observation or engineering estimates." The report cites the International Performance Measurement and Verification Protocol (IPMVP), specifically LE-A-01, as the approach employed.

According to Dave Hickman of PG&E, who oversaw the evaluations of these projects, the evaluations were comparable but somewhat less rigorous than would have been required for a standard performance contract (SPC). For example, an SPC requires more actual measurement of operating hours for lighting. Nevertheless, Mr. Hickman is generally satisfied with the savings reported. The apparent reason for using engineering calculations based on deemed values for key parameters was to reduce the time and expense required for the evaluation.

3.6.1.2 SCE

The SCE campus efficiency summer initiative consisted of two projects at California State University at Long Beach and Cal Poly Pomona. Facility managers prepared project reports at each of these institutions.

The Cal State Long Beach project included retrofit of all lighting, including selective delamping and installation of occupancy sensors, in 12 of the campus buildings, and installation of new, high-efficiency motors with variable speed drives (VSDs) in 3 buildings.

The Cal Poly Pomona project installed a central chilled water plant with TES to serve 11 campus buildings (about 50% of the total campus floor space), replacing dedicated chillers, pumps, and towers for each building.

Evaluation:

For the lighting retrofit portion of the project at CSU Long Beach, detailed accounting was kept of all fixture and lamp change-outs and sensor installations. Savings were estimated from engineering calculation based on rated wattage of exiting and replacement lamps and on assumed annual operating hours without and with sensors. There does not appear to have been any monitoring of operating hours to confirm these estimates. The demand savings calculation does not appear to apply any diversity to the load reductions, implying that the demand reduction must be regarded as non-coincident rather than coincident with system peak load.

The CSU Long Beach project report does not document the procedure used to estimate the savings attributable to the motor and VFD change-out portion of the project.

Apparently, demand was monitored before and after the project installations for the entire campus and for several buildings (or distribution feeders, it is not clear which). In each case, monitoring took place over a one-month period, although the pre- and post-monitoring does not appear to have occurred in the same month. In any case, although charts showing the measured demand are attached in the project report, no explanation of the monitoring or its results is included.

For the chiller and TES installation project at Cal Poly Pomona, the report provides little explanation of how the demand and energy savings were calculated. The energy savings calculation is apparently based on a "baseline" which has been "adjusted" and then "readjusted," but none of these calculations is explained, nor are the sources of the data.

According to Gary Suzuki of SCE, SCE acted only as an administrator for these projects, and M&V was limited to an on-site inspection after installation to verify that the equipment had been installed. The CPUC was responsible for reviewing and accepting the project proposal. Mr. Suzuki also believes that, had these projects been accepted under Edison' SPC program, they would have required a pre-installation site inspection and savings calculation using an approved methodology. There would also have been a post-installation inspection and an as-built report of the measures. Generally speaking, the IOUs selectively monitor SPC projects to verify operational assumptions but in many cases accept savings calculations based on standard values for operating parameters such as bulb wattages and operating hours.

3.6.1.3 SDG&E

The SDG&E campus efficiency summer initiative consisted of two projects at the University of California at San Diego and at the California State University at San Marcos. A project report for UC San Diego prepared by a third-party evaluator was made available for this analysis, as was a summary for CSU San Marcos.

The UC San Diego project installed variable frequency drives (VFDs) and motor controls in six campus buildings, efficient lighting in one building, and efficient chillers in two buildings. The VFDs were installed on air supply and exhaust fan motors and on natural gas compressors in the central plant. In addition, variable air volume (VAV) systems were installed in several buildings to replace existing constant volume systems.

The CSU San Marcos project installed a chilled water thermal energy storage (TES) system and VFDs on the charge/discharge pumps.

Evaluation:

For the UC San Diego project, an M&V report was prepared by a third-party verifier, Johnson Controls, a summary of which was reviewed for the present analysis. Although the summary lists assumptions used in the evaluation, several aspects of the evaluation methodology are not clear, such as how the baseline was determined. The energy and

demand savings were apparently computed based on measured data collected from a Johnson Controls energy management system installed on the campus prior to the project.

For the CSU San Marcos project, the project report includes monitoring data that indicates that the project is meeting its objective to shift the entire chiller load out of the on-peak rate periods. However, the only documentation that could be obtained was a progress report that included monitoring data for a three-day period in the winter immediately prior to the report date. According to SDG&E personnel familiar with the project, the test method originally required running the TES system during the summer to verify the avoided on-peak demand. The TES system, however, was not completed until fall, so the summer demand test could not be performed.

To validate that the TES system was working as designed and would achieve demand savings, a separate test was performed to monitor TES tank performance. Tank discharge flow and temperature, as well as return temperature, were monitored over time to confirm the storage system cooling capacity. During the TES discharge mode, temperature sensors located vertically in the tank were monitored to observe the thickness of the thermocline (between warmer return and cold discharge) over time. The thermal storage capacity of the tank was verified and the thickness of the thermocline confirmed that the storage capacity could be maximized.

Although no further monitoring is planned, a brief monitoring period under summer conditions would probably provide more rigorous confirmation of the demand savings achieved.

According to Lyn Roppe of SDG&E, who oversaw the evaluations, the methodology and documentation for both projects conform to the standards set for the company's SPC program, to the point of using the SPC worksheets for these projects. Ms. Roppe indicated that SDG&E was satisfied with the validity and the rigor of the evaluation procedure used for both projects.

3.6.1.4 Impact Summary

Table 3-14 summarizes the reported savings and costs of the UC/CSU campus efficiency projects.

Table 3-14
UC/CSU Campus Efficiency Programs – Reported Savings and Costs

Utility	Project	Measures	Total MW Savings	Total MWh Savings	Total Cost ($000s)
PG&E	UC Davis [5]	Chiller; TES	3.340	NA	$ 1,125 [1]
PG&E	Cal Poly San Luis Obispo [6]	Lighting	1.131	4,242	NA

Utility	Project	Measures	Total MW Savings	Total MWh Savings	Total Cost ($000s)
PG&E	CSU Hayward [2] [7]	NA	NA	NA	NA
SCE	Cal Poly Pomona [8]	Chiller	1.232	3,117	$824
SCE	CSU Long Beach [9]	Lighting, Motors, VFDs	1.089	4,306	$3,440
SDG&E	UC San Diego [10]	Lighting, VFDs, Chiller	0.715 [3]	5,815	$5,169 [4]
SDG&E	CSU San Marcos [11]	TES	0.400	NA	NA

[1] Not clear whether cost is total for project.

[2] No information available.

[3] Coincident summer peak demand savings.

[4] Summer Initiative paid 22% of project costs.

[5] Source: Comfort Systems USA, University of California at Davis – Electric Energy and Demand Savings Performance Report, March 2002, obtained from David Hickman, PG&E.

[6] Source: Energy Resource Associates, Inc., Measurement and Verification of Campus Summer Initiative Energy Retrofit Program Results at California Polytechnic University San Luis Obispo, (no date), obtained from David Hickman, PG&E.

[7] No documentation was located for this project.

[8] Source: Harmick H. Marcarian, California State Polytechnic University Pomona, Final Report Energy And Demand Savings Performance Contract Summer Energy Efficiency Initiative, (no date), obtained from John Nall, SCE.

[9] Source: Tim Ball, California State University Long Beach, Final Report Energy And Demand Savings Performance Contract Summer Energy Efficiency Initiative, (no date), obtained from John Nall, SCE.

[10] Source: Johnson Controls, Inc., Final Report UCSD Summer Initiative 2000 Project, December 21, 2001, obtained from Linda Linderman, SDG&E.

[11] Source: Bill Mahoney (via e-mail to Lyn Roppe), Final Report for CSU San Marcos – TES Measurement and Verification, February 28, 2002, obtained from Linda Linderman, SDG&E.

3.6.2 SDG&E Summer Initiative Third-Party Initiatives

This program consists of six individual projects. Except as noted below, we believe that SDG&E's M&V requirements for these projects are similar to those used in its SPC program, as discussed for SDG&E's campus efficiency projects..

U.S. Postal Service Sellers Processing and Distribution Center:

There were two projects at USPS Sellers Processing and Distribution Center: lighting controls retrofits and air compressor energy efficiency improvements.

For the lighting controls project, demand measurements were made for each lighting panel before and after installation. Since the lights run 8,760 hours per year, demand and energy savings were calculated from these measurements.

For the air compressor project, savings were estimated from engineering calculations of the load used by pressure boosters prior to the installation and by the dedicated compressor afterward. Since the system operates 8,760 hours per year, demand and energy savings were calculated from these measurements. The project report notes that equipment to monitor operational performance had been ordered but was not installed.

U.S. Navy Region Southwest:

This project replaced 250-watt high-pressure sodium (HPS) lights (54 units), 400-watt HPS lights (1,265 units), metal halide, and mercury vapor lights, as well as installed on/off and bi-level lighting control systems to reduce operating hours.

The project report tracked each individual fixture type and recorded pre- and post-installation kW and operating hours. The sources of these data are not documented, but appear to be lamp specifications and estimated operating hours rather than direct measurements. The demand savings calculation does not appear to apply any diversity to the load reductions, implying that the demand reduction must be regarded as non-coincident rather than coincident with system peak load.

Solatube:

Virtually no documentation was available on this project, and none seems to have been required by the contract, save for one summary table. We believe the project installed lighting controls to reduce operating hours at six locations.

The summary table tracks controls installed by fixture type and provides data on operating hour reductions. There is no documentation to suggest that these reductions were based on measurements, and it is reasonable to assume that they are engineering estimates, the basis of which is unknown. The demand savings calculation does not appear to apply any diversity to the load reductions, implying

that the demand reduction must be regarded as non-coincident rather than coincident with system peak load.

Davis Energy Group:

This project was a pilot that installed an evaporative pre-cooler for condenser and ventilation air for packaged rooftop cooling units (RTU). The unit was installed on a single 13-ton RTU.

The evaluation used a combination of measured data and engineering calculations. It developed a full-year savings projection by summing anticipated annual use of each energy-consuming RTU component with and without the pre-cooler installed. Operating data (15-minute interval) was collected for a single day: pre-cooled air temperature into the condenser, ambient outdoor air temperature, and RTU load. These data also included information on what equipment was operating, and was combined with annual hourly weather data and annual runtime data supplied by the host facility to project operating loads throughout the year using an engineering calculation.

Proctor Engineering:

This project focused on commercial rooftop HVAC tune-up and repair. The program recruited and trained technicians working for established contractors and provided a standardized audit form and online analysis software.

Program documentation was very sparse, apparently because no project report was required under the contract. We reviewed a progress report for the final month of the program and a very brief summary of cost-effectiveness. The latter cites an E-Source report and two CADMAC studies as the basis for savings estimates for individual units, but no direct measurements were made. None of the documentation reviewed indicates either the total demand or energy savings attributable to the program. The progress report indicates that 723 audits were performed and 452 were rechecked after the tune-ups had been performed, but the report focuses on documenting program activity rather than on energy savings performance, and it is hard to determine to what extent, if any, savings were actually checked against field performance.

Impact Summary of SDG&E Summer Initiative Third-Party Initiatives

Table 3-15 summarizes the reported savings and costs of SDG&E's Summer Initiative TPI projects, based on available documentation.

Table 3-15
SDG&E Summer Initiative Third-Party Initiatives – Reported Savings and Costs

Project	Measures	Total MW Savings	Total MWh Savings	Total Cost ($000s)
USPS #1 [4]	Lighting controls	0.301	706.9	$182.0
USPS #2 [5]	Air compressor	0.026	227.7	$20.0
U.S. Navy [6]	Lighting and controls	0.442 [1]	1,913.9	$300.0
Solatube [7]	Lighting controls	0.023 [1]	5.3	NA
Davis Energy Group [2][8]	Evaporative pre-cooling for rooftop packaged HVAC systems	0.006	14.9	NA
Proctor Engineering [9]	Repair of rooftop packaged ACs	NA	NA	$5,169 [3]

[1] Non-coincident demand.

[2] Pilot project.

[3] No evaluation done.

[4] Source: Ben Hough, Summer 2000 Energy Efficiency Initiative – Final Project Report, U.S. Postal Service High Intensity Discharge Lighting Controls Project, June 26, 2002, obtained from Lyn Roppe SDG&E

[5] Source: Ben Hough, Summer 2000 Energy Efficiency Initiative – Final Project Report, U.S. Postal Service Sellers Compressed Air Energy Efficiency Project, March 29,2002, obtained from Lyn Roppe SDG&E

[6] Source: US Navy Region Southwest Final Report, December 21, 2001, obtained from Lyn Roppe SDG&E

[7] Source: Solatube International, Inc. (via fax), Project Activity Report SDG&E/ Solatube International Demand Reduction Project, February 12, 2002, obtained from Lyn Roppe SDG&E

[8] Source: Davis Energy Group, Inc., Dual Cool Performance Projection Report, December 31, 2001, obtained from Lyn Roppe SDG&E

[9] Source: Tom Downey, Proctor Engineering Group, Report, June 13, 2001, obtained from Lyn Roppe SDG&E

3.6.3 CEC State and Public University Buildings Program

In contrast to the programs described earlier in this section, which each consisted of one or more individual projects, the CEC State and Public University Buildings program consisted of several programs, each of which comprised multiple projects (note that this buildings element is itself just one among a number of program elements administered by the CEC). The following is a list of the CEC programs in this category:

- California State University system (CSU) – lighting upgrades, variable-speed drives and controls on fans, replacement of rooftop air conditioners with chilled water system at six campuses
- Department of Corrections (DOC) – curtailment plans for Stage III emergencies
- Department of General Services (DGS) – emergency curtailment plans and web-enabled utility meters for monitoring purposes
- Grueneich – curtailment plans for Stage II and III emergencies
- University of California system (UC) – lighting upgrades, heat exchangers and controls to connect buildings to an existing chilled water loop

These programs were the subject of an extensive, independent evaluation conducted by Nexant. The data in Table 3-16 summarizes the preliminary results of that evaluation.

Table 3-16
CEC State and Public Buildings – Summary of Reported and Verified Savings and Costs

Project	Measures	Number of Sites	Verified Demand Savings (MW) [2]	Total MWh Savings [2]	Total Cost [1] ($000s)
CSU	Lighting upgrades, VFDs, central chiller	6	0.97	3,500	
DOC	Emergency curtailment	33	0.00	0	
DGS	Emergency curtailment; efficiency measures	174	21.89	53,000	
Grueneich	Load aggregation and emergency curtailment	27	0	0	
UC	Lighting, central chiller	2	0.58	2,500	
TOTAL		**236**	**23.44**	**59,000**	**$ 2,581**

Source: "AB 970, AB 29X, and SB 5X Peak Load Reduction Programs: Annual Report, December 2001." California Energy Commission. Nexant. December 10, 2001.

[1] All programs were funded through AB 970. **Administrative and verification costs not included; if such costs were accounted for, then the resultant cost per first year kWh saved would be higher.**

[2] Efficiency savings only, as verified by Nexant.

The programs provided demand savings due to energy efficiency improvements, as indicated in the table, as well as due to curtailments under emergency conditions. These reductions are consistent with the objectives of the programs, although savings produced

by emergency curtailments are beyond the scope of the present analysis. Furthermore, the evaluation did not produce estimates of the energy savings achieved by the programs; again, while this evaluation is consistent with the program objectives, it differs from the methods applied in evaluations of other energy efficiency programs, which focus on energy savings.

Nexant conducted a detailed review of all of the projects in this program element, testing and verifying the claimed demand savings and adjusting them as necessary to take account of differences between the planned and actual installations and operations. In summary, Nexant concluded that the original (planned) savings estimate of 80 MW should be revised downward to 57.1 MW to account for planned projects that were not implemented, and that 51.2 MW were actually realized. Of this, Nexant verified 23.44 MW of peak demand savings for energy efficiency measures; this figure is included in our analysis. Based on the verified demand savings for energy efficiency measures, Nexant estimated a first year energy savings of 59,000 MWh. We have no basis to adjust this savings figure.

The Nexant report and its appendix discuss in detail the verification procedures used for particular types of efficiency measures, such as lighting, central chiller plants, VFDs, etc. In general, they involve combinations of methods including on-site inspections, spot metering, bill analysis, etc. The thorough nature of this verification implies that the verified savings represent reliable measurements of the actual savings achieved.

Persistence

It is assumed that the savings associated with efficient equipment will persist undiminished through the effective useful life of the equipment and then disappear completely. We used average effective useful life (EUL) data for broad categories of equipment in making our analysis, shown in Table 3-17.

Table 3-17
Effective Useful Lives of Measures

Measure	Effective Useful Life (years)
Lighting, all measures (Occupancy sensors and similar controls have EUL of 8 years)	16
Motors and Variable Frequency Drives	15
Chillers (Cooling towers, evaporative coolers, packaged HVAC systems, and A/C packaged units have EUL of 15 years)	20

Source: "California Measurement Advisory Committee Public Workshops on PY 2001 Energy Efficiency Programs." CALMAC. September 2000. Appendix C2, Table 2.

In view of these data, the projected persistence of all savings reported for these projects is essentially 100% at 1, 6, and 15 years.

3.6.4 SMUD Project Completion Incentives

Project completion incentives were targeted to contractors rather than end users in an effort to transform markets by stimulating suppliers to promote energy-efficient equipment and services. The projects included retrofits of lighting, HVAC, process controls, and other end uses.

According to SMUD, in 2001, the incentives were $250 per average kW for lighting projects and $750 per average kW for HVAC and process projects. In addition, energy incentives of $0.04/kWh for lighting controls and $0.08/kWh for HVAC and process controls were added in an effort to stimulate the market for energy-saving technologies that operated during peak periods.

The project completion incentive was paid to contractors for eligible energy efficiency projects pre-approved by SMUD. The incentive was calculated on the average kW saved during the peak summer demand period (1 p.m. – 9 p.m.). Incentives were based on the difference between existing load and the retrofit load. For projects requiring Title 24, incentives were based on the difference between the Title 24 and the retrofit load. To be eligible for incentives, the projects had to operate for at least 2 hours in the 1 – 9 p.m. time period on weekdays during the summer, meet SMUD eligibility requirements for products and installation standards, and comply with all program requirements.

An impact evaluation for this program is currently underway by the Heschong Mahone Group. It should be completed by the second quarter of 2003. There are no preliminary results available for this study. The lighting component of the Project Completion Incentives was evaluated in 1996. According to SMUD, the results of this study were an 8% reduction of demand and a 6% reduction in energy use, based on engineering estimates. Free-ridership was found to be between 15 and 19%.

Table 3-18 shows the expenditures and impacts of these programs in 2001, based on data provided by SMUD. These data indicate that SMUD believes that the program has reduced demand more than expected but saved less energy than expected.

Table 3-18
SMUD Project Completion Incentives – Expenditures and Impacts

	Project Completion Incentives		
	PGC Funds	SB5X Funds	Total
Budget	$ 405,000	$ 403,509	$ 808,509
Actual	$ 559,416	$ 505,155	$ 1,064,571
Forecasted Energy Savings (kWh)	8,200,000	3,900,000	12,100,000
Forecasted Demand Savings (kW)	2,100	1,300	3,400

	Project Completion Incentives		
	PGC Funds	**SB5X Funds**	**Total**
Methodology	History/ Budget Levels/ Engineering Estimate	Budget Levels/ Engineering Estimate	N/A
Reported Energy Savings (kWh)	10,358,517	8,642,049	19,000,566
Reported Demand Savings (kW)	1,085	2,004	3,089
Methodology	Engineering Estimate	Engineering Estimate/ Impact Evaluation [1]	N/A

Source: SMUD

[1] Impact evaluation for all SB5X funding (2001-2002) will be completed in 2003 by HMG/RLW Analytics.

3.7 Residential Pool Pumps

Programs Reviewed

- Program #4a: PG&E Summer Initiative – "(Residential) Pool Efficiency Program"
- Program #4b: SCE Summer Initiative – "(Residential) Pool Efficiency Program"
- Program #4c: SDG&E Summer Initiative – "(Residential) Pool Efficiency Program"

Benchmark References

- "Evaluation of Year 2001 Summer Initiatives Pool Pump Program – Program Effects Assessment Report." ADM Associates, under contract to PG&E. April 2002.

  This report, hereafter referred to as "ADM Report" was commissioned to evaluate the market impact of the PG&E, SCE, and SDG&E Summer Initiative Residential Pool Efficiency Program. Though the basic program structure was the same across the IOUs, each IOU independently implemented the program in its respective territory and determined its own eligibility requirements, incentive levels, and savings assumptions. This study confirmed participation rates, timers installed, and pumps replaced/upgraded.

Adjusted Savings Results

Based on our analysis, we adjusted the reported savings of each program as shown in the Table 3-19.

Table 3-19
Summary of Reported and Adjusted Savings – Residential Pool Pump Efficiency

Program	Reported Savings (MWh)	Adjusted Savings Range (MWh)	Persistence (% of first year savings)		
			Post 1 year	Post 6 years	Post 15 years
Residential Pool Pump Efficiency Summer Initiative – PG&E, SCE, SDG&E					
PG&E	95 [1]	31,472	100%	100%	100%
SCE	3,500 [2]	17,646 – 18,566	100%	100%	100%
SDG&E	17,552 [3]	1,033 – 17,424	100%	100%	100%
Total	21,147	50,151 – 67,462	100%	100%	100%

[1] Source: PG&E Energy Efficiency Programs Annual Report for Program Year 2001. July 2002. (Reported savings are only for Pump Replacement Component, not Timer Component).

[2] Source: SCE Energy Efficiency Annual Report – Summary Report 2001 Results. May 2002. (Reported savings are only for Pump Replacement Component, not Timer Component).

[3] Source: SDG&E Energy Efficiency Programs Annual Summary and Technical Appendix – 2001 Results. May 2002.

Discussion and Analysis

Swimming pools require daily filtration to maintain cleanliness and safety. Pool pumps perform the task of filtration. Every pool has a pool pump assembly, which includes a pool pump motor, as well as a manual timer that sets the hours for pump use. Pool pumps do not need to be on constantly and, depending on the size of the pool and the power of the pool pump, are typically operated for a few hours each day. For homes with swimming pools, pool pumps operated during peak periods can be the second highest contributor to residential peak demand, with HVAC being the highest. There is no reason why pool pumps should be operated during peak hours. Thus, this program was proposed with a primary objective of reducing peak demand through providing cash incentives to shift pool pump operation to off-peak hours as deemed by each respective IOU. In addition, the IOUs offered cash rebates for residential customers who purchased qualifying energy-efficient pool pumps to replace their existing, less efficient pumps.

Each IOU's program involved two components:

- Timer Component – provided a cash incentive for customers to adjust their pool pump timers, which are primarily manually operated.
- Pump Replacement Component – provided a cash incentive for customers to purchase energy-efficient (one- or two- speed) pool pump motors and assemblies to replace their existing pool pump units.

3.7.1 PG&E

3.7.1.1 Timer Component

PG&E paid an incentive of $20 to residential program participants who set their swimming pool pump timers to operate only during off-peak hours between 8 pm and 10 am. A total of 30,500 customers participated in this component, according the ADM Report.

ADM conducted hourly demand profiles for a sampling of customers pre- and post participation in this program component. Through this measurement, ADM determined that participation in the timer component program not only reduced peak demand but also reduced the average daily energy consumption from 7.962 to 4.432 kWh.[18] We can estimate the gross energy savings impact of this component on an annualized basis by multiplying this daily energy savings by 365 days and the number of participants, as computed in the equation below:

$$(7.962 - 4.432 \text{ kWh/day}) * (365 \text{ days/yr}) * (30{,}500 \text{ participants}) = 39{,}297{,}725 \text{ kWh/yr}$$

$$= 39{,}298 \text{ MWh/yr}$$

[18] ADM Report, Table 4-6.

Because the daily energy reduction was based on actual measurement of demand at a sampling of participant pools, we have no basis to adjust this figure.

3.7.1.2 Pump Replacement Component

Fifty-three customers participated in the two-speed pump/motor replacement component of the PG&E program, which offered a $250 rebate for replacing an existing single-speed pump with a qualified, energy-efficient two-speed pump. This program component was implemented from September 1 through December 31, 2001.

The average kW demand for the existing stock of pool pumps was determined as 1.445 kW, based on baseline research conducted by ADM Associates. A two-speed pump that replaced a single-speed pump was sized so that its power draw at high speed would equal the same weighted average draw of 1.445. The advantage of a two-speed pump is that it can be operated at a lower speed sufficient for most hours of operation, while it can be switched automatically to high speed operation for less frequent "pool sweeping." ADM Associates determined that, on average, high-speed operation was only necessary for 1 hour each day per pool, as opposed to running entirely at high speed during all hours of operation, or an average of 4.11 hours per day. ADM also determined that the average kW draw at low speed operation for a two-speed pool pump was 0.3175 kW. ADM then used engineering calculations to determine that the average two-speed pool pump must be operated for 7.4 hours per day at low speed if operated at high speed for only 1 hour per day to deliver the same total volume throughput of the average single-speed pool pump operating an average of 4.11 hours per day. The savings calculations are summarized below:

Single-speed motor: 1.445 kW x 4.11 hrs/day = 5.94 kWh/day

Two-speed motor: 1.445 kW x 1 hrs/day + 0.3175 kW x 7.4 hrs/day = 3.79 kWh/day

On this basis, the average daily energy savings for replacing a single-speed pool pump with a two-speed pool pump is 2.15 kWh. Aggregate savings was then calculated in the following manner:

2.15 kWh/day-pool x 365 days/year x 53 pools = 41,592 kWh/year ~ 41.6 MWh/year

We believe that the savings methodology explained in ADM Report is thorough and reasonable, and have no reason to adjust their estimates. We note, however, that PG&E documented savings for this component as 95 MWh/year.[19] The source of this savings figure is not clear.

[19] PG&E Energy Efficiency Programs Annual Report for Program Year 2001.

3.7.1.3 Combined Impact and Net to Gross Discussion

PG&E did not appear to perform any net-to-gross adjustment. In the absence of any explicitly determined value, we apply a default net-to-gross ratio of 0.80.

Based on this net-to-gross ratio and the analysis in 3.7.1.1 and 3.7.1.2, the combined gross and net energy savings impact of the both components of the PG&E pool pump program are summarized in the table below:

Table 3-20
Summary of PG&E Pool Pump Program Energy Savings (MWh)

Timer Component (Gross)	Pump Replacement Component (Gross)	Total Gross	Total Net
39,298	42	39,340	**31,472**

[1] Total Gross multiplied by 0.80

Therefore, we estimate the total net impact of this program as 31,472 MWh.

3.7.2 SCE

3.7.2.1 Timer Component

SCE offered incentives to customers who agreed to run their pool pumps anytime between 6:00 p.m. and noon from June 1 through September 30, 2001. Customers enrolling in the program by April 30, 2001, received a $40 incentive, while customers enrolling thereafter received a $20 incentive. A total of 47,044 customers participated in this program component.

ADM conducted hourly demand profiles for a sampling of customers pre- and post participation in this program component. Through this measurement, ADM determined that participation in the timer component program not only reduced peak demand but also reduced the average daily energy consumption from 7.238 to 6.332 kWh.[20] We can estimate the gross energy savings impact of this component on an annualized basis by multiplying this daily energy savings by 365 days and the number of participants, as computed in the equation below:

$$(7.238 - 6.332 \text{ kWh/day}) * (365 \text{ days/yr}) * (47{,}044 \text{ participants}) = 15{,}556{,}980 \text{ kWh/yr}$$

$$= 15{,}557 \text{ MWh/yr}$$

[20] ADM Report, Table 4-6.

Because the daily energy reduction was based on actual measurement of demand at a sampling of participant pools, we have no basis to adjust this figure.

3.7.2.2 Pump Replacement Component

Approximately 8,200 customers participated in pump/motor replacement component, which offered a $100 rebate to customers who purchased a qualifying energy efficient pool pump between January 1 and September 30, 2001. Customers who only replaced the motor of their existing pool pump with a qualifying energy efficient motor received a $50 rebate.

Table 3-21
Savings Summary for SCE Pool Pump Replacement Component

	kW Demand per Horsepower	Horsepower per gall/min filtered	Gall/min filtered per pool	Number of Participants (Pools)	Hours of Use per Day	KWh Use per Day
Pre-participation	0.9817	0.03446	47.439	8,200	4.4	57,927
Post-participation	1.2633	0.02079	47.439	8,200	3.62	36,974
Savings						20,953

Note that this table is based on Table 6-8 of ADM Report.

Assuming 365 days of operation this yields an annualized savings of approximately 7,648 MWh, or nearly 7,650 MWh. ADM applied this methodology to SDG&E's program data (for which motor nameplate information was used to more precisely determine savings) and calculated a 15% overstatement factor. Accordingly, ADM discounted its calculated number by 15% to arrive at a range of 6,500 – 7,650 MWh.

3.7.2.3 Combined Impact and Net to Gross Discussion

SCE did not appear to perform any net-to-gross adjustment. In the absence of any explicitly determined value, we apply a default net-to-gross ratio of 0.80.

Based on this net-to-gross ratio and the analysis in 3.7.2.1 and 3.7.2.2, the combined gross and net energy savings impact of the both components of the SCE pool pump program are summarized in Table 3-22.

Table 3-22
Summary of SCE Pool Pump Program Energy Savings (MWh)

Timer Component (Gross)	Pump Replacement Component (Gross)	Total Gross	Total Net
15,557	6,500 – 7,650	22,057 – 23,207	**17,646 – 18,566**

[1] Total Gross multiplied by 0.80

Therefore, we estimate the total net impact of this program as 17,646 – 18,566 MWh.

3.7.3 SDGE

3.7.3.1 Timer Component

SDG&E offered $20 incentive rebates to residential customers to: (a) shift their pool pump operation away from on-peak hours (defined as noon – 6pm Monday through Friday); and (b) reduce their daily filtering by at least two hours each day. Only customers who operated their pool pump for at least two peak hours each day were eligible to participate in SDG&E's timer component program. (PG&E and SCE did not require any baseline usage parameters). A total of 9,655 SDG&E customers participated in this program component.[21]

The ADM Report states that the average baseline kW draw for SDG&E's program participants was 1.531938 kW, a figure that SDG&E cites in its computation of the energy savings associated with this component. First, we can compute the peak demand savings of the timer component as follows:

1.531938 kW * 9,655 participants = 14,791 kWh = 14.79 MWh.

Any energy savings associated with this component would be based on a reduction in the average daily pool pump usage. As part of this program component, SDG&E promoted conservation in pool filtration, advising participants to operate their pool pumps for fewer hours each day. ADM and SDG&E data suggest that participation in the timer component (and pump replacement component for that matter) affected the amount of time customers used their pool pumps each day. Perhaps participants became more conscious of their daily pool filtration habits (previously an afterthought for most people) as a result of this program, and changed their behavior accordingly. However, the direction of this change is unclear, and dependent on the data sources used as summarized in the Table 3-23.

[21] Data provided by Mary Wold of SDG&E.

Table 3-23
SDG&E Hours of Usage, Baseline and Post-Program

	Daily Hours of Usage		
	Case 1	Case 2	Case 3
Baseline Usage	3.64 [1]	5.53 [3]	5.53 [3]
Post-Program Usage	4.11 [2]	3.65 [3]	4.11 [2]
Reduction in Usage Induced by Program	(0.47)	1.88	1.42

[1] Source: ADM Baseline study of SDG&E pool owners

[2] Source: ADM Post-assessment on-site visits

[3] Source: Participant self-reports

In Case 1, the baseline is the average daily usage for a sampling of the SDG&E service territory, as measured by ADM. Similarly, the post-program usage was also measured by ADM at a sampling of participant locations. Ironically, Case 1 indicates that pool pump usage actually increased by an average of 0.47 hours per day per participant as a result of program participation. One explanation this possibility is that participants, realizing that they were saving money by shifting at least two hours from on-peak to off-peak, increased their pool pump usage during off-peak hours to better filter their pools.

SDG&E asked program participants to self-report their pool pump usage patterns both pre- and post-program. These results are shown as Case 2. This data indicates that the average program participants reduced daily pool pump usage by 1.88 hours. SDG&E regards Case 2 as a more reliable set of usage figures because: (a) the baseline represents participants rather than a larger sampling of households with pools, and (b) both the pre- and post- figures are recorded in the same consistent manner – by the participants themselves. On the other hand, self-reported participant usage is likely not based on precise measurement and may be exaggerated to produce an outcome perceived to be desired by the program sponsor, in this case, showing a reduction in usage.

Case 3 features the baseline usage of Case 1 and the post-program usage of Case 2. While Case 3 may represent a compromise of sorts, its drawback is using two different sources for the baseline and post-program usage figures.

SDG&E computed gross energy savings for the timer component on an annualized basis, based on Case 2, as shown below:

(1.531938 kW) * (1.88 hrs-saved/day) * (365 days/year) = 1,051.2 kWh/yr-participant

(1,051.2 kWh/yr-participant) * (9,655 participants) = 10,149,336 kWh saved in 2001.

Given the conflicting data in Table 3-19, we have applied a conservative range of 0 to 1.88 hours as the daily usage reduction as a result of this program. As a result, we credit the SDG&E timer component with between 0 and 10,149 MWh of gross energy savings for program year 2001.

3.7.3.2 Pump Replacement Component

SDG&E had 4,910 customers participate in its pump/motor replacement component, which offered a $200 rebate to customers who replaced their existing pool pump motor and pump assembly with a qualifying energy efficient motor and pump assembly. The new assembly was required to be half the horsepower of the existing assembly. (However, if the existing motor + assembly was only 1 hp the replacement could be ¾ hp.)

SDG&E tracked the actual nameplate horsepower of each existing and replaced pool pump unit. For the 4,910 program participants the collective baseline kW demand was determined as 7,900 kW, while the adjusted demand for the new stock of pool pumps was determined as 6,296 kW.

To derive energy savings, it was then necessary to apply appropriate daily hours of usage to the baseline and replacement pumps. One might not expect the replacement of an existing pool pump with a more efficient pool pump to affect the daily hours of usage. A straightforward default approach to calculating energy savings would apply the baseline hours of use to difference in kW draw resulting from the replacements. However, as noted in Table 3-19, program participation in both the timer component and pump replacement component changed as a result of the replacement, perhaps owing to the increased attention that participants paid to their pool pumps as a result of this program (i.e., pool pumps may have been an afterthought to most customers prior to participating in this program, but participation may have altered usage behavior beyond the actual equipment replacement).

For our purposes in examining this program we had no basis to prefer one case over another, since all have validity. In the spirit of conservatism, we have elected to select Case 1 to provide a lower bound for savings and Case 2 to provide an upper bound for savings. The resulting calculations are as follows:

Lower Bound:

(7,900 kW * 5.53 hrs/day – 6,296 kW * 3.65 hrs/day) = 20,706.6 kWh/day

20,706.6 kWh/day * 365 days/year = 1,050,996 kWh/year ~ 1,050 MWh/year

Upper Bound:

(7,900 kW * 3.64 hrs/day – 6,296 kW * 4.11 hrs/day) = 2,879.44 kWh/day

2,879.44 kWh/day * 365 days/year = 7,557,909 kWh/year ~ 7,558 MWh/year

Therefore, we estimate the gross energy savings range as 1,050 – 7,558 MWh/year.

3.7.3.3 Combined Impact and Net to Gross Discussion

SDG&E computed an overall net-to-gross ratio by conducting on-site inspections on a sampling of participant sites to determine the proportion of sites that had already been filtering off peak. The result of this inspection indicated a net-to-gross ratio of 0.984.

Based on this net-to-gross ratio and the analysis in 3.7.3.1 and 3.7.3.2, the combined gross and net energy savings impact of the both components of the SDG&E pool pump program are summarized in the Table 3-24.

Table 3-24
Summary of SDG&E Pool Pump Program Energy Savings (MWh)

Timer Component (Gross)	Pump Replacement Component (Gross)	Total Gross	Total Net
0 – 10,149	1,050 – 7,558	1,050 – 17,707	**1,033 – 17,424**

[1] Total Gross times net-to-gross ratio of 0.984

Therefore, we estimate the total net impact of this program as 1,033 to 17,424 MWh.

Persistence

CALMAC has endorsed an effective useful life for motors of 15 years, which we apply to pool pumps for this set of Summer Initiative programs.[22] As a simplifying assumption, we treat the 15-year effective useful life as a fixed value rather than as the mean of a probability distribution. Therefore, we estimate that the adjusted savings resulting from these pool pump replacements will persist at 100% through the next 15 years and drop to 0% thereafter.

[22] "California Measurement Advisory Committee (CALMAC) Public Workshops on PY2001 Energy Efficiency Programs." Page 56.

3.8 Residential Hard to Reach

Programs Reviewed

- Program #15: California Conservation Corps (CCC) Mobile Efficiency Light Brigade "PowerWalk" program
- Program #5a: PG&E Summer Initiative: Res Team Hard to Reach
- Program #5b: SC&E Summer Initiative: Res Team Hard to Reach
- Program #5c: SDG&E Summer Initiative: Res Team Hard to Reach
- Program #5d: SCG Summer Initiative: Res Team Hard to Reach

Benchmark References

- "Phase 4 Market Effects Study of California Residential Lighting and Appliance Program." San Diego Gas & Electric. Prepared by Xenergy. April 26, 2002. ("Phase 4 Study").
- Database of Energy Efficiency Research (DEER).

Adjusted Savings Results

Based on our analysis, we adjusted the reported savings of each program as shown in Table 3-25.

Table 3-25
Summary of Reported and Adjusted Savings – Residential Hard to Reach

Program	Reported Savings (MWh)	Adjusted Savings Range (MWh)	Persistence (% of first year savings)		
			Post 1 year	Post 6 years	Post 15 years
Res Team Hard to Reach Summer Initiative – all four IOUs	25,969	21,035 - 25,709	100%	100%	0%
California Conservation Corps: Mobile Efficiency Brigade / "PowerWalk"	NA [1]	42,504 [2]	100%	100%	0%

[1] NA = Not Available; CCC did not report any energy savings for PowerWalk.

[2] On Program Year 2001 basis. Adjusted savings on annualized basis is 84,777 MWh.

The remainder of this section provides a rationale for the adjustments applied to the reported savings of each program.

3.8.1 California Conservation Corps Mobile Efficiency Light Brigade "Powerwalk"

The CCC distributed a reported 1.96 million CFLs between May 19 and August 31, 2001, to approximately 475,000 low-income residents in California. Neither the CCC nor the state reported energy or demand savings, although a press release from the Governor's Office did claim a demand reduction of 122 MW for the program.[23]

Our approach to determining the program's energy savings was to fill in the components of the following equation:

Energy saved = (# CFLs) x (unit demand reduction) x (installation rate) x (hours of use)

A press release from the Governor's Office indicates that the CFLs that were distributed "…consume only 25 percent of the energy used by a regular incandescent lightbulb to produce the same amount of light." From experience, 60 is the most prevalent wattage for a typical incandescent lightbulb. On this basis, a replacement CFL would have 25% of the wattage, or 15 watts. Since 15-watt CFLs are commercially available, our assumption is that all distributed CFLs were 15-watt replacements for 60-watt incandescents, for a unit demand reduction of 45 watts.

We also sought to determine what share of distributed CFLs were actually installed. Program experience has shown that not all distributed CFLs end up being installed, due to a range of reasons including customer neglect or dissatisfaction.

The Phase 4 Study of residential lighting and appliances programs in California in 2001 provides survey results that indicate that 77% of CFLs distributed through the PowerWalk were actually installed by customers[24].

Through surveys, the Phase 4 Study also determined that CFLs distributed through the PowerWalk program were operated an average of 3.8 hours per day.

To estimate savings on an annualized basis, we assumed 365 days of operation, yielding the following calculation:

1.96 M CFLs x 45W x 77% install x 3.8 hrs/d x 365 d/yr x = 94,197 MWh

To estimate savings for the 2001 program year, we assumed 183 days of operation, or approximately six months. Because all of the CFLs were distributed between May 19 and August 31, it was a reasonable simplifying assumption to calculate 2001 savings as if all CFLs were installed at the end of June. The resulting calculation is as follows:

1.96 M CFLs x 45W x 77% install x 3.8 hrs/d use x 183 d/yr x = 47,227 MWh

[23] "Two Million Light Bulbs Distributed During Statewide Power Walk Effort." Press Release: Office of the Governor, State of California. August 31, 2001.
[24] "Phase 4 Market Effects Study of California Residential Lighting and Appliance Program." Prepared for San Diego Gas & Electric. Prepared by Xenergy. April 26, 2002. ("Phase 4 Study"). Page 8-17.

Finally, we sought to apply a net-to-gross ratio to discount the impact of free-rider participation in the PowerWalk program. We believe this ratio should be very high (i.e., close to 1.0) because the low-income residents targeted by this program would not, in general, be likely to purchase CFLs on their own. According to the Phase 4 study, 54% of PowerWalk program participants had no awareness of CFLs prior to receiving CFLs through PowerWalk. Of those who did express awareness of CFLs prior to program participation, 39% indicated that they perceived CFLs as being too expensive, while others cited difficulties in locating CFLs in stores. The accepted net-to-gross ratio used by IOUs for residential CFL rebates and giveaways is 0.8. However, this net-to-gross ratio applies to the residential segment in general and is not specific to the low-income segment. Lower income residents are less likely to be free-riders; therefore, programs that specifically target the low-income segment warrant high net-to-gross ratios. In our judgment, 0.9 is an appropriate net-to-gross ratio for PowerWalk.

Our adjusted savings for PowerWalk are summarized in Table 3-26.

Table 3-26
Adjusted Savings Summary, PowerWalk

Basis	Gross Savings (MWh	Net to Gross Ratio	Net Savings (MWh)
Annualized	94,197	0.9	**84,777**
Program Year	47,227	0.9	**42,504**

3.8.2 Residential Hard to Reach Summer Initiative

As part of the Summer Initiative, all four IOUs administered a program to target residential customers in multi-family dwellings with energy efficiency measures. Eligible sites included common areas and dwelling units of multifamily apartment complexes, mobile home parks, and condominium complexes. IOUs have historically encountered difficulties in implementing energy efficiency programs at these types of sites. The inherent challenge in implementing programs in multi-family dwellings is influencing multiple parties (e.g., owners, managers, tenants), each with their own priorities and agendas – hence the "hard to reach" moniker. As a result, utilities have historically underserved these types of sites with energy efficiency programs.

The following energy efficiency measures were eligible for incentives under this program in all IOU service territories:

- Electric and gas water heating measures, including timers and controls, high-efficiency water heaters, low-flow showerheads, water heater blankets, and faucet aerators.

- Lighting measures, including: Energy Star® fixtures, compact fluorescents, torchieres, and exit signs; other fluorescent fixtures; occupancy sensors and delamping.
- Appliances, including Energy Star® refrigerators, clothes washers and dishwashers.
- HVAC equipment, including: high efficiency air- and water-cooled packaged air conditioning; high efficiency air- and water-cooled chillers; high efficiency heat pumps; Energy Star® room air conditioners; variable speed drives on HVAC fans; high efficiency gas boilers and gas boiler controls.
- Thermal shell measures, including: ceiling, floor and wall insulation; duct testing and sealing; weather-stripping; and high performance windows.

Third parties implemented the project – each IOU selected projects from among many proposals submitted by third parties. For each unit of each measure that it installed, an implementer was compensation by a pre-specified incentive. To verify the installation and operation of measures, the IOUs either conducted on-site inspections during the installation process or post-installation, or reviewed project invoices. Implementers were required to submit a project site installation schedule five days prior to the installation of measures. In addition, an implementer was required to submit a project installation report that detailed all of the measure installed, which the IOU reviewed. Because implementers are required to provide detailed counts of measure, and since an IOU can verify these counts, we have a high degree of confidence that all measure counts are accurate.

The IOUs applied a consistent set of energy and demand savings assumptions per measure, referred to as "deemed savings."[25] IOUs and implementers derived aggregate savings for each project and by multiplying the count of every measure by its respective deemed savings.

We were unable to obtain summary reports that identified measure counts per project. Therefore, we are unable to perform a bottom-up calculation of program-level savings for each IOU territory. Therefore, we took a more directional approach in our analysis of these programs. We compared deemed savings values for the program against values from DEER for a sampling of measures. The more conformance and consistency we observed between the deemed savings and DEER values, the greater the confidence we placed on the savings reported in each IOUs annual report of energy efficiency programs.

We found that the IOUs' deemed savings for weather-sensitive measures adhere very closely to the DEEM benchmark values. Both the deemed savings and DEER savings values for weather-sensitive measures were modeled for all 16 CEC climate zones and calibrated using DOE-2 computer simulations.

Table 3-27 compares a small sample of non-weather-sensitive measure unit savings assumptions between the IOUs deemed savings and DEER. In our estimation, we saw a fairly good deal of comparability between both sets of measure unit savings.

[25] "Deemed Savings Estimates for the Summer Initiative Program." CPUC. November 2000.

Table 3-27
Sampling of Measure Assumptions: Deemed Savings and DEER

	Deemed Savings Value		DEER Benchmark	
Lighting Measure	**Assumed kW Savings**	**Note/ Assumption**	**Assumed kW Savings**	**Note/ Assumption**
25 watt CFL [1]	0.033 [2]	--	0.083	100W baseline
Water Heating Measures	**kWh/year savings**	**Note**	**kWh/year savings**	**Note**
Low Flow Showerhead [3]	162 [4]	From 3.5 to 2.5 gallons per minute	148	--
Faucet Aerator	33	From 3.5 to 2.2 gallons per minute	58	--

Sources: "Deemed Savings Estimates for the Summer Initiative Program"; DEER

[1] Representative lighting measure

[2] Deemed Savings, Table 3.2

[3] Electric water heater assumed.

[4] Deemed Savings, Table 2.4

[5] Deemed Savings, Table 2.5

To quantify our small uncertainty in the accuracy of the deemed savings, we feel it is prudent to apply an adjustment factor of +/- 10% to the savings reported by each IOU in its annual report of energy efficiency programs. In addition, we note that the implementers to do not appear to discount savings for the effect of free ridership – implying a default net-to-gross ratio of 1.0. We would expect a net-to-gross ratio very close to 1.0, because we would not expect a significant free ridership effect in the multifamily segment. For the sake of conservatism, we have elected to apply a net-to-gross ratio of 0.9. The results of our adjustments to the reported savings are summarized in Table 3-28.

Table 3-28
Summary of Reported and Adjusted Savings for Summer Initiative Hard to Reach Program

	[A]	[B]	[C]	[A]*[B]*[C]
	Reported Gross Savings (MWh) [1]	**Adjustment Range**	**Net-to-Gross Ratio**	**Adjusted Gross Savings (MWh)**
PG&E	8,507	+/- 10%	0.9	6,891 – 8,422
SCE	15,000			12,150 – 14,850
SDG&E	2,183			1,768 – 2,161
SoCalGas	279			226 – 276
Total	**25,969**			**21,035 - 25,709**

[1] As reported in each IOUs' annual report of energy efficiency programs for 2001.

We note that the savings associated with these programs are reported on an annualized basis.

Persistence

CALMAC has endorsed an effective useful life for screw-in CFLs of 7.7 years, which we use as a proxy for lighting measures.[26] For the other types of measures involved in the Summer Initiative Hard to Reach program, we apply a weighted average effective useful life of 10 years. As a simplifying assumption, we treat effective useful life as a fixed value rather than as the mean of a probability distribution. Therefore, we estimate that the adjusted savings resulting from these programs will persist at 100% through the next 7 to 10 years and drop to 0% thereafter.

[26] "California Measurement Advisory Committee (CALMAC) Public Workshops on PY2001 Energy Efficiency Programs." Page 56.

3.9 LED Traffic Signals

Programs Reviewed

- Program # 6:Utility LED Traffic Signals (Summer Initiative) – Summer initiatives implemented by SCE, PG&E, and SDG&E. The program data were provided by each utility and it was clear on review that they estimated savings using different assumptions. So these are treated as three separate programs:
  * SCE Summer Initiative
  * PG&E Summer Initiative
  * SDG&E Summer Initiative
- Program # 9: CEC LED Traffic Signal Program – California Energy Commission's program provided grants to public agencies; focus is on reducing peak period demand. CEC operated the program and provided the data for this review, except as noted.

Benchmark References

- "Statewide LED Traffic Signal Saturation Study" – prepared by Quantum Consulting in December 2001. The report includes per-unit estimates of kW and kWh savings and duty cycles for LED signals used in California, based on analysis of California usage data and estimates from CEC, ACEEE, E-Source, and 11 California IOU programs. This report is hereafter referred to as "QC Study."
- SCE operated a non-Summer Initiative program and provided detailed per unit estimates of savings to show how its program savings were calculated. These data are referred to as "SCE non-SI."

Adjusted Savings Results

Based on our analysis, we adjusted the reported savings of each program as shown in Table 3-29.

Table 3-29
Summary of Reported and Adjusted Savings – LED Traffic Signals

Program	Reported Annual Savings (MWh)	Adjusted Annual Net Savings Range (MWh)	Persistence (% of first year savings)		
			Post 1 year	Post 6 years	Post 15 years
CEC Traffic Signal Program	45,220	36,176 – 45,220	100%	100%	0%
SCE Summer Initiative	42,277	33,822 – 42,277	100%	100%	0%
PG&E Summer Initiative	34,676	0 – 34,676	100%	100%	0%
SDG&E Summer Initiative	12,952	10,361 – 12,952	100%	100%	0%

The remainder of this section provides a rationale for the adjustments applied to the reported savings of each program.

Summary of Key Assumptions

Table 3-29 summarizes the key assumptions of LED traffic signals programs.

Table 3-30
Summary of Key Assumptions – LED Traffic Signals

	CEC	SCE SI	PG&E SI[d]	SDG&E SI[e]	Benchmarks	
					QC Study	SCE non-SI[g]
Unit Energy Savings (kWh/yr)						
12" Red Ball		602[b]	670	600	670	578
Red arrow		na	988	982	988	na
12" Green Ball		460[b]	497	456	497	449
Green arrow		na	244	110	244	na
Yellow Flashing		33[b]	561	29	561	504
Pedestrian Hand		986[b]	414	970	414	410
Ped. Hand/Walk Combo		1095[b]	473	1077	473	482
Average, all units	367[a]	558[b]		563		558
Unit Demand Reduction (kW)						
12" Red Ball		0.125[c]	0.077	0.068	0.077	-
Red arrow		na	0.113	0.112	0.113	-
12" Green Ball		0.125[c]	0.057	0.052	0.057	-
Green arrow		na	0.028	0.013	0.028	-
Yellow Flashing		0.125[c]	0.064	0.003	0.064	-
Pedestrian Hand		0.125[c]	0.047	0.111	0.047	-
Ped. Hand/Walk Combo		0.125[c]	0.054	0.123	0.054	-
Average, all units	.044[a]	0.125[c]		.064		
Effective Useful Life (years)[f]	≥5	None estimated	10			5
Net-to-Gross Ratio applied *(no specified ratio = 1.0)	1.0*	1.0	0.8	1.0*		1.0
Are Reported Savings Annualized (Ann) or Program Year-specific (PY)?	Ann	Ann	Ann	Ann	Ann	Ann

[a] CEC calculated savings for each project individually using the difference between the actual pre-existing incandescent signal wattage and installed LED wattage; average over all units calculated and included here for comparative purposes.

[b] Per-unit estimates inferred from total savings estimate for this type of unit divided by total number of units of this type. Data from files provided by Tory Weber of SCE 9/23/02.

[c] Same per-unit savings assumed for all types of signals, using 100% duty cycle, documented in QC Study and confirmed in data provided by Tory Weber of SCE 9/23/02.

[d] All data from "Pacific Gas and Electric Company Energy Efficiency Programs Annual Report – May 2002." Report references use of QC Study to estimate savings.

[e] Individual signal assumptions provided by Michael Guin of SDG&E in correspondence 10/15/02. Aggregate per unit savings inferred using the savings and approximate number of signals installed, as reported in SDG&E's Annual Summary.

[f] Additional estimates of EUL: the EPRI Journal article "LEDs Give Traffic Signals a Green Light for Efficiency" states 5-7 years and the EPA ENERGY STAR website states "can last up to 10 years."

[g] Source: "SCE 2002 AEER Tables and Backup" spreadsheet, provided by Pierre Landry of SCE. Data for SCE's non- Summer Initiative LED Traffic Signals program included in Express Efficiency. Note: this program was part of the QC Study but its use of 100% kW duty cycle for all signal types is shown as a clear outlier and was not used by that study in developing its per unit kW values. Since it would be misleading to suggest the SCE values as a benchmark, they have been excluded here as well. SCE's kWh duty cycle assumptions are completely in line with the other programs in the QC Study. It is not known why SCE uses different kW and kWh duty cycle assumptions.

3.9.1 CEC

The CEC reported energy and demand savings for its LED Traffic Signals program as shown in Table 3-31.

Table 3-31
Reported Savings Data – CEC

	[A]	[B]	[C]	[D] = [B] * [C]	[E]	[E] ÷ [D]
	Number of Signals Installed[1]	**Reported Total Savings[1]**	**Reported Net-to-Gross Ratio**	**Reported Net Savings[1]**	**Reported Program Cost[1]**	**Cost per Unit Saved**
Energy Savings	123,096	45,220 MWh/yr	None applied	45,220 MWh/yr	$6.8 million	$0.15 /kWh
Demand Reduction	123,096	5.375 MW	None applied	5.375 MW	$6.8 million	$1,270 /kW

[1] This is an ongoing program. These numbers reflect CEC's estimate of installations completed in 2001 and associated annual savings. Data provided by Virginia Lew of CEC, September 2002. Cost reflects grant funding only, not administrative and M&V expenses.

Under the CEC program, projects were completed by 43 public agencies. Worksheets were prepared for every one of the projects, covering the 123,096 signals, using the following formula for each type of signal:

Demand Reduction = # Units Installed x Percent On x (pre-install kW – LED signal kW)

Energy Savings = 8760 hours x kW Reduction

While the program does specify maximum LED signal wattages for program eligibility, each signal type for each project could have a different pre-install wattage. The resulting per-unit savings, when compared with the other programs and the benchmark savings, appear rather low. The "percent on" figures used by the CEC are almost identical to those recommended by the QC study and do not explain the low per-unit estimates. Closer inspection of the detailed data provided by the CEC revealed that as much as one-quarter of the signals installed were yellow balls or arrows. None of the other programs or benchmarks noted this. The only yellow signal installations they reported were flashing beacons, which are on half the time. Since yellow ball and arrow signals are on for much shorter periods of time that the others, their savings are much lower. Recalculating the savings without them suggests an average per-unit savings more in line with the other programs and benchmarks.

It should be noted that the CEC engaged Nexant Consulting to assemble information about all the programs. As part of that, Nexant conducted a billing analysis of selected intersections from 33 of the projects and conducted field inspections of 14 sites, confirming that the installations were made exactly as proposed. From the billing analysis, they concluded that 94% of the CEC's estimated energy savings were realized with a range ±57% at the 80% confidence level.[27] That the analysis included about 0.5% of the almost 10,000 intersections modified under the program could account for the rather large confidence interval on the results. Without further investigation, we cannot confidently apply the results to this entire program. Nonetheless, they suggest a high level of realized savings and commendable verification effort.

The CEC did not consider free ridership in this program, implicitly using a net-to-gross ratio of 1.0. It seems unlikely that all the installations would have occurred in the absence of the program. The full set of programs operating throughout the state, including the CEC and the utility SI programs, have, however, had the effect of creating enough demand for LED fixtures that the prices have come down considerably. According to Ms. Lew at the CEC, this drop in prices is stirring additional interest in the LED signals. This could engender significant spillover, meaning additional projects precipitated by the programs but conducted without program aid. Nonetheless, it is hard to believe that none of the agencies would have made these installations without the program. Perhaps the 0.8 net-to-gross ratio, meaning 80% were induced by the program, used in one of the other studies is unreasonably low for this type of program but it is beyond the scope of this study to make this assessment. Rather, to apply some uniformity in assumptions across programs, we use it to provide a lower bound on this and the other studies, as shown in Table 3-32.

[27] "AB(&), AB 29x andSB 5x Peak Load Reduction Programs December 2001 Annual Report."

Table 3-32
Adjusted Savings Data – CEC

	[B]	[C]	[D] = [B] * [C]	[E]	[E] ÷ [D]
	Adjusted Total Savings	**Adjusted Net-to-Gross Ratio**	**Adjusted Net Savings**	**Reported Program Cost [1]**	**Adjusted Cost per Unit Saved**
Energy Savings	45,220 MWh/yr	0.8 – 1.0	36,176 – 45,220 MWh/yr	$6.8 million	$0.18 – $0.15 /kWh
Demand Reduction	5.375 MW	0.8 – 1.0	4.300 – 5.375 MW	$6.8 million	$1,588 – $1,270 /kW

[1] Reflects grant funding only, not program administrative and M&V expenses. Data provided by Virginia Lew of CEC, September 2002.

In summary, the approach to estimating savings appears careful and the attempt to capture the savings likely to accrue using project-specific inputs (rather than a fixed per-unit savings estimate) seems meticulous and sound. This program was the only one, including all the Summer Initiative programs and the benchmark studies, to have any kind of post-installation evaluation of savings. While it is not clear what to make of the findings, the level of scrutiny and follow-up measurement makes the CEC program exceptional.

While CEC and Nexant seem to both be keeping track of the program, it was difficult to pin down how much energy and demand savings the program achieved in program year 2001. For the purposes of this study, we chose to use the data provided directly by the CEC since we could see the completion dates of the projects. The Nexant report, while thorough and systematic in its review, contains several different sets of estimates with no mention of the discrepancies. Having a single report that contains the year-end results would enhance its usefulness in making an accurate assessment of program-year savings.

3.9.2 SCE Summer Initiative

SCE's reported energy and demand savings impacts for its Summer Initiative LED Traffic Signal Replacement program as summarized in Table 3-33.

Table 3-33
Reported Savings Data – SCE Summer Initiative

	[A]	[B]	[C]	[D] = [B] * [C]	[E]	[E] ÷ [D]
	Number of Signals Installed [1]	**Reported Total Savings [1]**	**Reported Net-to-Gross Ratio**	**Reported Net Savings [1]**	**Reported Program Cost[1]**	**Cost/Benefit Ratio**
Energy Savings	75,785	42,277 MWh/yr	1.0	42,277 MWh/yr	$7.0 million	$0.17 /kWh
Demand Reduction	75,785	9.463 MW	1.0	9.463 MW	$7.0 million	$743 /kW

[1] Data slightly different from SCE's 2001 Annual Report of Energy Efficiency Programs, reflecting cancellations that occurred after that filing. The assumptions used for both totals are identical. Per Tory Weber of SCE, September 2002. Cost reflects rebates only, not program administrative and M&V expenses.

The SCE Summer Initiative used per unit kWh and kW savings estimates filed prior to the onset of this program. It is interesting to note, though inconsequential to the total program impact estimates, that SCE filed different per-unit kWh savings estimates for the individual signal types in its Summer Initiative program than in its non Summer Initiative program. The average per-unit savings across all signal types are the same. And these values, when taken across all signal types, are in line with the QC Study estimates. The resulting total, gross program energy savings can be legitimately compared with the other programs.

The SCE per unit kW savings estimate of 0.125 kW is problematic. In a marked departure from any of the programs reviewed in the QC Study, SCE developed kW savings that assume each signal is on a 100% duty cycle. This cannot be true because intersection signals cycle; most studies assume duty cycles of approximately 55% for red signals, 40% for green signals, 50% for yellow beacons, and about 90% for pedestrian walk signals for both kW and kWh savings. SCE evidently used duty cycles similar to these to develop its per unit kWh savings. It is not clear why they were not also used for the kW savings. As a result, the total demand reduction for the program is overstated — almost double what seems reasonable. An adjustment that makes the SCE demand reduction assumptions comparable to the other programs can be accomplished by building the kW reductions from the energy savings. For simplicity, we made this adjustment at the program level, essentially applying the program-wide kWh duty cycle to the demand reduction. We divided the reported annual energy savings of 42,277 MWh, by 8760 hours of annual operation to obtain the adjusted demand reduction of 4.826 MW.

SCE used a net-to-gross ratio of 1.0, assuming that all the measures installed were induced by the program. Using the same logic as we stated above for the CEC program, we use 0.8 as a lower bound on the adjusted gross savings, as shown in Table 3-34.

Table 3-34
Adjusted Savings Data – SCE Summer Initiative

	[B]	[C]	[D] = [B] * [C]	[E]	[E] ÷ [D]
	Adjusted Total Savings	**Adjusted Net-to-Gross Ratio**	**Adjusted Net Savings**	**Reported Program Cost[1]**	**Adjusted Cost/Benefit Ratio**
Energy Savings	42,277 MWh/yr	0.8 – 1.0	33,822 – 42,277 MWh/yr	$7.0 million	$0.20 – $0.17 /kWh
Demand Reduction	4.826 MW	0.8 – 1.0	3.861 – 4.826 MW	$7.0 million	$1,821 – $1,457 /kW

[1] Reflects rebates only, not program administrative and M&V expenses. Data provided by Tory Weber of SCE, September 2002.

In summary, the approach SCE used in reporting impact estimates for its Summer Initiative is straightforward. The energy savings assumptions are in line with those used in other studies. For the demand reduction, using the same kW reduction across all types of signals is perhaps simplistic, but the consistently overstated value is the real concern, one that affects the SCE non-SI program as well. Using the same duty cycle values for kW and kWh savings would be consistent with what other programs do and provide greater comparability of savings and program cost-effectiveness. Alternatively, data loggers could be used to monitor the actual duty cycles of the different types of signals and better inform all the estimates.

3.9.3 PG&E Summer Initiative

PG&E's reported energy and demand savings impacts for its Summer Initiative LED Traffic Signal Replacement program as summarized in Table 3-35.

Table 3-35
Reported Savings Data – PG&E Summer Initiative

	[A]	[B]	[D]	[D] ÷ [B]
	Number of Signals Installed [1]	**Reported Total Savings [2]**	**Reported Program Cost [3]**	**Cost per Unit Saved**
Energy Savings	NA	34,676 MWh/yr	$12.0 million	$0.34 /kWh
Demand Reduction	NA	3.958 MW	$12.0 million	$3,036 /kW

[1] NA = Not Available; no data provided by PG&E.

[2] The report indicates that the savings are as reported from contractors. It is not clear whether the contractor applied the NTG ratio prior to reporting the savings to PG&E. As a result, it is not clear whether the reported savings is gross or net. We assume here that the savings are gross. Source: "Pacific Gas and Electric Company Energy Efficiency Programs Annual Report – May 2002," pp. 7-17 to 7-18.

[3] Source: "Pacific Gas and Electric Company Energy Efficiency Programs Annual Report – May 2002." Cost includes implementation, market assessment & evaluation, and program administration costs. It is not clear how much of this was for rebates but $13 million was originally budgeted for implementation alone.

The workpapers included in the technical appendix of PG&E's 2001 Annual Report of Energy Efficiency Programs show the approach that was to be used in estimating energy savings, demand reduction, and persistence for the PG&E LED programs.[28] They indicate that the program used the per-unit kW and kWh savings assumptions recommended in the QC Study. The workpapers also indicate that the reported numbers use the pre- and post-retrofit wattages reported by the individual cities that made the installations. If so, the approach used is identical to that used by the CEC to calculate savings, since the two use the same basic formulas for calculating annual savings: demand reductions calculated based on pre/post wattage differences and signal duty cycle; energy savings calculated as demand reductions over 8760 hours.

Unfortunately, we were unable to locate any documentation that demonstrates what assumptions were used or how many installations were made under this program. And, while we expect that this documentation exists, we have no way to confirm the total energy savings numbers, which were the only numbers reported in the annual report. Since trying to second guess what was used in any of the programs is well beyond the

[28] Source: "Pacific Gas and Electric Company Energy Efficiency Programs Annual Report – May 2002," Technical Appendix, p. TA-3-20.

purview of this study, it has been agreed that a simple lower bound of zero would be applied. We can feel confident that the actual savings is between this and the reported amounts.

We were unable to determine whether or not a net-to-gross ratio has been applied to the reported savings. Since nothing in the reported savings figures indicates that it was, we have assumed not. We wish to note that, of all the LED programs reviewed for this study, only the PG&E Summer Initiative indicated that it would use a net-to-gross ratio other than 1.0. The workpapers show that PG&E would use the default value of 0.8 established in the CALMAC Public Workshops on PY 2001 Energy Efficiency programs for this program. Since, as noted above, we think it unlikely that all measures were induced, applying a net-to-gross ratio of less than 1.0 is appropriate. In keeping with our adjustments for the other LED programs in this review, we have applied a net-to-gross range of 0.8 to 1.0. Since the established lower bound is less than the lower adjustment, it has no effect on the final savings adjustment in this study, as shown in Table 3-36.

Table 3-36
Adjusted Savings Data – PG&E Summer Initiative

	[B]	[C]	[D] = [B] * [C]	[E]	[E] ÷ [D]
	Adjusted Total Savings	**Adjusted Net-to-Gross Ratio**	**Adjusted Net Savings**	**Reported Program Cost [1]**	**Adjusted Cost per Unit Saved**
Energy Savings	0 – 34,676 MWh/yr	0.8 – 1.0	0 – 34,676 MWh/yr	$12.0 million	≥ $0.34 /kWh
Demand Reduction	0 – 3.958 MW	0.8 – 1.0	0 – 3.958 MW	$12.0 million	≥ $3,036 /kW

[1] Cost includes implementation, market assessment & evaluation, and program administration costs. It is not clear how much of this was for rebates, but $13 million was originally budgeted for implementation alone.

3.9.4 SDG&E Summer Initiative

SDG&E's reported energy and demand savings impacts for its Summer Initiative LED Traffic Signal Replacement program as summarized in Table 3-37.

Table 3-37
Reported Savings Data – SDG&E Summer Initiative

	[A]	[B]	[C]	[D]	[D] ÷ [B]
	Number of Signals Installed [1]	**Reported Total Savings [1]**	**Reported Net-to Gross Ratio [2]**	**Reported Program Cost[1]**	**Cost/Benefit Ratio**
Energy Savings	>23,000	12,952 MWh/yr	1.0	$3.2 million	$0.24 /kWh
Demand Reduction	>23,000	1.48 MW	1.0	$3.2 million	$2,162 /kW

[1] Source: "Energy Efficiency Programs Annual Summary and Technical Appendix—2001 Results." SDG&E, May 2002, section 7.

[2] Per Michael Guin of SDG&E, a net-to-gross ratio of 1.0 is implicitly assumed.

SDG&E's Annual Summary states that 21 agencies completed installations in 2001. That same report quotes what must be the agreed upon monitoring and evaluation procedure, stating, "The performance indicator 'Track and audit the number of traffic signals installed and calculate energy and demand savings using engineering estimates' was satisfied. There were over 23,000 LED traffic lamps installed."

Despite the lack of detail provided, it was possible to calculate the overall per-unit kW and kWh savings recorded by the program. To do so, we used the reported demand reduction and reported energy savings and divided these by 23,000. Both values, 0.064 kW/yr and 563 kWh/yr are in line with the values used by the other programs and benchmarks.

SDG&E's Annual Summary makes no mention of having applied any net-to-gross adjustment. We take this as an implicit assumption that SDG&E believed all the installations were induced by the program. As noted above, we believe this likely overstates the savings truly attributable to the program and we apply the same net-to-gross range to the savings for this program as to the others, as shown in Table 3-38.

Table 3-38
Adjusted Savings Data – SDG&E Summer Initiative

	[B]	[C]	[D] = [B] * [C]	[E]	[E] ÷ [D]
	Adjusted Total Savings	**Adjusted Net-to-Gross Ratio**	**Adjusted Net Savings**	**Reported Program Cost [1]**	**Adjusted Cost/Benefit Ratio**
Energy Savings	12,952 MWh/yr	0.8 – 1.0	10,361 – 12,952 MWh/yr	$3.2 million	$0.31– $0.24 /kWh
Demand Reduction	1.48 MW	0.8 – 1.0	1.18 – 1.48 MW	$3.2 million	$2,711 – $2,162 /kW

[1] No information was found on what activities are included in the cost.

Persistence

Most studies estimate the effective useful life for LED signals to be five to seven years. Others, including EPA Energy Star, suggest an upper bound of 10 years, which was adopted in by PG&E's Summer Initiative program. Ten years seems overly optimistic, especially for the red lights and pedestrian signals, which are on more than half the time. Therefore, as depicted in Table 3-29, we estimate that the adjusted savings resulting from LED signals will persist at 100% through the next six years and will drop to 0% thereafter.

3.10 Oil Pumping Efficiency Projects

Programs Reviewed

- Program #8: COPE Third-Party Summer Initiative – Oil Producers Fluid Pump Efficiency Program (OPFPEP) implemented by the California Oil Producers Electricity Cooperative (COPE). COPE implemented this program in PG&E and SCE service territories. PG&E administered the CPUC-funded initiative. All information about this program comes from the report and supporting appendices, "Oil Producers Fluid Pump Efficiency Program (OPFPEP)—Evaluation Report," January 2002, prepared for COPE by Nexant as part of the contractual agreement between COPE and PG&E.

Benchmark References

Unlike many of the other programs in 2001, OPFPEP addressed the specialized energy uses of oil pumping. We found no counterpart programs to provide benchmark estimates of savings. But also unlike many of the other programs, this one was has something of a post-installation evaluation. ASW, an oilfield services company, conducted some field inspection and monitoring. Then Nexant conducted a full review of the documentation and even some utility bills to assess the reasonableness of the results that COPE and ASW reported. Our review here leans heavily on the Nexant evaluation.

The Nexant evaluation report does cite several earlier studies that included field tests of similar energy efficiency measures. We repeat those citations here to underscore the findings of the Nexant evaluation.

- Friedman, R., N., R. Neal Elliott, Bruce Meberg, Jeffery Dowd, Carl A. Burrell and John F. DeKorte, March, 1996, "Electric Motor System Market Transformation", American Council for an Energy-Efficient Economy, Washington, DC. (referred to hereafter as "Friedman")
- Rocky Mountain Oil Field Testing Center (RMOFTC), 1995, "Project Test Results: D-Jax Pump Off-Controller", FC9510. (referred to hereafter as "RMOFTC")

Adjusted Savings Results

Based on our analysis, we adjusted the program's reported savings as shown in Table 3-39.

Table 3-39
Summary of Reported and Adjusted Savings – Oil Pumping Efficiency Projects

Program	Reported Savings (MWh)	Adjusted Savings Range (MWh)	Persistence (% of first year savings)		
			Post 1 year	Post 6 years	Post 15 years
COPE – Third-Party Summer Initiative	29,553	24,004	100%	100%	0%

The remainder of this section provides a rationale for the adjustments applied to this program's reported savings.

Summary of Key Assumptions

The key assumptions that COPE used to derive its reported savings are summarized in Table 3-40.

Table 3-40
Summary of Key Assumptions – COPE Measures

	Pump-Off Controllers	Water Pump Optimization	Resize Pump Motor	VSD and Controls	Increased Tankage	Other Peak Reduction	All Measures	Benchmarks[4]	
								Friedman	RMOFTC
kWh Energy Savings[1]	42%	24%	57%	26%	0%[1a]	37%	36%	<40%[4a]	<68%[4b]
Realization Rate[2]	1.41	0.60	0.71	0.40	1.00	1.00	1.02	--	--
Remaining Useful Life (years) [3]	10	10-15	10	15	15	10	--	--	--
Net to Gross Ratio [4]	0.8	0.8	0.8	0.8	0.8	0.8	--	--	--
Annualized (Ann) or Program-Year (PY)? Reported Savings	Ann	Ann	Ann	Ann	Ann	Ann	--	--	--

[1] These were not assumed but were calculated from reported total savings for the purpose of comparison with the benchmarks.

[1a] This was strictly a load shifting measure, not reduction. By design, eliminated peak period demand and shifted it to off-peak period. Peak demand reduction 100%.

[2] Calculated or assumed by Nexant as the ratio of Nexant-estimated savings to COPE-reported savings. Source: worksheets provided by Glen LaPalme, Nexant.

[3] Values assumed by Nexant in calculating cost-effectiveness for the Nexant evaluation report.

[4] As reported in the Nexant evaluation report.

[4a] "…energy consumption attributable to industrial process pumping can be reduced by as much as 30-40%."

[4b] "…operation of oil pumping equipment can be reduced by as much as 68% using the technologies deployed within the OPFPEP."

Discussion and Analysis

This program was implemented by COPE. ASW developed the measurement and evaluation (M&E) plan, which prescribed pre- and post-installation monitoring of amperage, kW demand, and run time for the measures. The program was evaluated by Nexant in late 2001. The Nexant evaluation report indicates that their staff reviewed data provided by COPE to make an assessment of the accuracy of the savings.

All the data we received about this program was provided by Nexant. Their evaluation was more detailed and in-depth than we could perform within the scope of this project. Their report focuses on the same issues as our review: look at the assumptions used and post-installation evidence to support or refute them, identify shortfalls in the implementation or reporting of the proposed M&E plan, and make recommendations to improve the impact and cost-effectiveness of the program. The figures in Table 3-41 are the COPE-reported figures shown in the Nexant report.

Table 3-41
Reported Energy Savings Data – COPE Third-Party Initiative

	[A]	[B]	[C]	[D]	[D] ÷ [C]
	Number of Units [1]	**Reported Peak Demand Reduction (kW) [1][2]**	**Reported Energy Savings (kWh) [1][2]**	**Reported Program Cost [2]**	**Cost per kWh Saved**
Pump-Off Controllers	435	1,046	9,167,300	NA	NA
Water Pump Optimization	8	237	2,078,190	NA	NA
Resize Pump Motors	1723	197	1,723,086	NA	NA
VSD/PLC Controls in Process Plants	9	376	3,291,739	NA	NA
Increased Tankage	5	186	0	NA	NA

Other Peak Demand Reduction Measures	69	1,517	13,292,308	NA	NA
Total		**3,560**	**29,552,623**	**$3,202,623**	**$0.11/kWh**

NA = Not Available

[1] COPE-reported data in worksheets provided by Glen LaPalme, Nexant. The kW reductions appear to have been calculated as kWh ÷ 8,760.

[2] Source: "Oil Producers Fluid Pump Efficiency Program (OPFPEP)—Evaluation Report," p. 14. Note: the worksheet cost data showed slightly different costs so only the reported total is included here.

Nexant appears to have conducted a careful, project-by-project review of OPFPEP. The evaluation report is clear in supporting the measurement and verification work that was performed by COPE and ASW. The report provides an excellent recap of those activities, carefully comparing the post-installation results with assumptions upon which the awards were made. It discusses each measure, indicating where the follow-up was conducted fully and well, and providing specific examples of where proposed measurement either was not conducted (mostly because of the strict installation deadline) or does not support the pre-installation assumptions.

Nexant cited the very strict CPUC deadline of only counting savings from installations made prior to June 1, 2002, as having contributed significantly to the compromises made in implementing the M&E plan – which appears not to have been issued until May 2001, well into the program year. Because the installations had to be made in a very tight time period to be credited in the program, much of the planned baseline (pre-installation) measurement of loads on the affected equipment had to be foregone. This made it impossible to conduct many of the pre/post comparisons of usage that were proposed in the plan.

Nexant took a number of factors into consideration and made an assessment of the most likely impacts from the 2001 program installations. Table 3-42 shows the adjustments in the savings that would result from applying Nexant's realization rates and net-to-gross ratio.

Table 3-42
Adjusted Energy Savings Data – COPE Third-Party Initiative

	[A]	[B]	[C]
	Reported Energy Savings (kWh) [1]	**Realized Savings (kWh) [2]**	**Net Energy Savings (kWh)[3]**
Pump-Off Controllers	9,167,300	12,925,893	10,340,714
Water Pump Optimization	2,078,190	1,246,914	997,531
Resize Pump Motors	1,723,086	1,223,391	978,713
VSD/PLC Controls in Process Plants	3,291,739	1,316,696	1,053,356
Increased Tankage	0	0	0
Other Peak Demand Reduction Measures	13,292,308	13,292,308	10,633,846
Total	**29,552,623**	**30,005,202**	**24,004,161**

[1] See Table 3-41 above.

[2] Calculated using Nexant's realization rates shown in Table 3-40.

[3] Calculated using Nexant's net-to-gross ratio of 0.8 shown in Table 3-40.

Nexant concluded that while the overall program delivered at least as much savings as reported by COPE, a realization rate of 1.02, there is considerable variation across the measures and there is room for improvement in both measurement and reporting. Among their recommendations[29]:

- "…certain SPC procedures should be considered for future programs offered to oil producers… As an example, the installation of a VSD on a motor of a certain size in a specific application will yield a fixed incentive amount that is based on sound and thorough analysis of similar systems. This approach reduces the likelihood of participants successfully receiving incentives for projects where savings have been overstated. A future version of the OPFPEP could easily include a calculated approach for a pump-off controller incentive package. An applicant to such a program would indicate the motor size, depth, and production rate of the well and a pre-determined energy savings figure and its accompanying incentive contribution would automatically be generated for incorporation into a project application."
- "…it is further suggested that any future evolution of the OPFPEP incorporate more rigorous requirements for the collection and submittal of raw, equipment-based operational data for both baselines and post-installation periods."

[29] "Oil Producers Fluid Pump Efficiency Program (OPFPEP)—Evaluation Report." Prepared by Nexant, January 2002, pg. 19.

We voice our support of the constructive and instructive review that Nexant provided. To this, we can add a recommendation of our own: that the impacts of achieving one objective (having all the measures for the program year producing savings by June 1, in this case) on the ability to achieve others (e.g., conducting the rigorous evaluation recommended in the plan which was not issued until May 10) need to be considered as part of the program design. This is not to say that multiple objectives cannot be achieved, only that the potential for conflicts in achieving them needs to be foreseen and accommodated to achieve them. Implementation of these suggestions would make two important contributions to assessing the total impact of California's programs in future program years: an increased level of confidence in the implementer-reported savings, and an increased degree of consistency in rigor and reporting across programs operated in California.

Persistence

While the Nexant report does not specifically address persistence, it invoked some reasonable effective useful life values in developing the cost-effectiveness calculations that are in the report. The program measures are part of industrial equipment not subject to easy change out. These assumptions are included in Table 3-40. The measures that account for most of the savings are rated at 10 years; the remaining measures, accounting for about 18% of the savings, are assumed to have a 15-year life. For our purposes in looking at snapshots 1, 6, and 15 years after the program year, we project that the savings from this program will persist at 100% after year 1, will remain at 100% after year 6, and by the end of 15 years will have declined to zero. Approximately 18% of savings would persist up to the beginning of year 15.

3.11 20/20 Rebate Program

Programs Reviewed

- Program #14: The Governor's 20/20 Rebate Program

Benchmark References

- "Phase 4 Market Effects Study of California Residential Lighting and Appliance Program." San Diego Gas and Electric. Prepared by Xenergy. April 26, 2002. ("Phase 4")
- "California Customer Load Reductions during the Electricity Crisis: Did They Help to Keep the Lights On?" Goldman, Eto, Barbose. Lawrence Berkeley National Laboratories. May 2002. ("LBNL")

Adjusted Savings Results

Based on our analysis, we adjusted the reported savings of 20/20 Rebate as shown in Table 3-43.

Table 3-43
Summary of Reported and Adjusted Savings – 20/20 Rebate Program

Program	Reported Savings (MWh) [1]	Adjusted Savings Range (MWh)	Persistence (% of first year savings)		
			Post 1 year	Post 6 years	Post 15 years
20/20 Rebate Program	5,258,000	3,053,000	100%	0%	0%

[1] Source: LBNL

The remainder of this section provides a rationale for the adjustments applied to 20/20 Rebate's reported savings.

Discussion and Analysis

Initiated by Executive Order of Governor Gray Davis, the 20/20 Rebate provided rebates to residential and small commercial/industrial customers of the state's IOUs for reducing monthly electricity usage from June through September 2001. Customers were offered a 20% rebate off of the electricity commodity portion of their energy bill for reducing their total monthly electricity use by at least 20% compared to the same month of the previous year.[30] In addition, large commercial/industrial customers with time-of-use meters

[30] Customers of SDG&E were only required to reduce their usage by 15% because it was assumed that they had already partially reduced baseline energy use due to escalating electricity rates experienced in the summer of 2000, brought about because the CPUC lifted its freeze on SDG&E's electricity rates in July 1999.

received a 20% rebate off of their summer on-peak demand and energy charges for reducing on-peak electricity use by at least 20%.

Because customer participation was automatic, without the need for any program application, this program achieved remarkably wide participation. Table 3-44 summarizes the savings credited to the program based on the year-over-year difference in monthly energy bills for all customers who received a rebate during any of the months of the program, in aggregate.

Table 3-44
Reported Savings Impact of 20/20 Rebate Program – Unadjusted[31]

Customer Class	% of Customers Receiving Credit	Electricity Reduction (MWh)	Total Rebate Amount ($ Million)
Residential	33%	3,021,000	$ 134
Non-residential	26%	2,237,000	$ 153
Total	**32%**	**5,258,000**	**$ 286**

This savings figure of 5,258 GWh, however, contains the following inherent and significant flaws:

- Does not account for savings that would have occurred as a result of normal fluctuations
- Does not account for influence on customers who reduced usage because of the program but were unable to save up to the required threshold level for a rebate for any of the program months
- Does not account for double counting of energy efficiency programs

A research team at Lawrence Berkeley National Laboratories (LBNL) performed an analysis[32] of the 20/20 Rebate program in an attempt to resolve these issues. To account for normal fluctuations, LBNL relied on an analysis of billing data by PG&E[33] that estimated that 21% of residential customers would reduce their usage by 20% or more during at least one summer month. A similar analysis by SCE[34] cited by the LBNL study, put the figure at 16% for the month of June. The LBNL study concludes that "By extrapolating this effect to all residential customers in the state, and assuming the effect was half as large for non-residential customers, we estimated that approximately 2,000 GWh, or 38%, of the electricity savings paid for by the 20/20 program was unrelated to conservation efforts."

[31] Adapted from LBNL Table 5, Page 13.
[32] Goldman, C. A., J. H. Eto, and G. L. Barbose, "California Customer Load Reductions during the Electricity Crisis: Did They Help to Keep the Lights On?" LBNL-49733, May 2002. http://eetd.lbl.gov/ea/EMS/EMS_pubs.html
[33] Bell, Andrew (2002). Private correspondence to the LBNL authors, January 4, 2002.
[34] Lutzenhiser, Loren. (2001). "An Exploratory Analysis of Residential Electricity Conservation Survey and Billing Data: Southern California Edison, Summer 2001," prepared for the California Energy Commission, December 6.

LBNL also provided an adjustment to account for energy savings attributable to customers who were induced to conserve because of the lure of 20/20 Rebate but who did not achieve the 20% threshold necessary in a given month to receive a rebate. LBNL analyzed historical billing data to determine that customers who did not reduce their usage in a given summer month by at least 20% compared the previous year, would, in aggregate, consume about 2,000 GWh more than in the previous summer.[35] In contrast to this finding, LBNL cited CASIO data indicating that the total increase in usage among such customers during the summer months of 2001 was only 300 GWH. This suggested a 1,700 GWh reduction in consumption. LBNL cited customer awareness surveys to attribute approximately 30% of this energy reduction to the 20/20 program, for a total of 500 GWh.

LBNL's adjustments to the 20/20 Rebate reported savings are summarized in Table 3-45.

Table 3-45
Summary of LBNL Adjustment to Reported 20/20 Rebate Energy Savings

Description	Impact (GWh)
Starting point: Aggregate energy savings for all IOU customers who received bill credit for any month during the June – September 2001 period, (compared to previous year energy usage for corresponding months)	5,258
Adjustment 1: Discounting for savings due to normal fluctuations (i.e., unrelated to conservation)	(2,000)
Adjustment 2: Added credit for savings from customers who were influenced by 20/20 to reduce energy usage but who did not qualify for rebate for any particular month	500
LBNL Net 20/20 Savings	**3,758**

LBNL used a credible approach to refine the savings of the 20/20 Rebate program, and demonstrated the power of statistical analysis for evaluating a large-scale program. Although a more extensive analysis of billing data could yield a more precise estimate, we believe that LBNL provided an excellent foundation for refining the savings impact of the 20/20 Rebate to a more realistic and meaningful value.

However, LBNL acknowledged, but did not attempt to resolve, the issue of double counting between the 20/20 Rebate and other IOU programs. It is quite possible that the 20/20 Rebate program participants reduced their usage by participating in other programs available to them. Theoretically, there may have been strong synergies between the 20/20 Rebate and IOU programs. In other words, it stands to reason that for many

[35] LBNL assumed that aggregate electricity use over the entire population would be comparable in consecutive years with similar weather and ignored the effects of changes in economic activity.

customers, the lure of a rebate through the 20/20 Rebate program alone or an IOU rebate program alone would not have been sufficient inducement to implement an energy-efficient action (i.e., conservation behavior, purchasing an Energy Star appliance, etc.), but the presence of both programs together provided sufficient inducement. For the purposes of this Summary Study, we made a series of assumptions to roughly approximate the impact of the 20/20 Rebate program net of participant involvement in IOU programs. These simplifying assumptions are as follows:

- No synergy between 20/20 Rebate and IOU programs. Even in the absence of the 20/20 Rebate the savings from IOU and Summer Initiative programs would not have been adversely impacted. In actuality, we do suspect synergy between 20/20 Rebate and other IOU programs. However, as stated by LBNL: "…accounting for such synergistic effects is a complicated and data-intensive analytical exercise that is beyond the scope of this [LBNL] paper."
- 100% overlap between savings resulting from IOU residential and non-residential programs and those credited to 20/20 Rebate during the months for which 20/20 Rebate was in place.
- 100% of savings that overlap between 20/20 Rebate and IOU residential and non-residential programs discounted from 20/20 Rebate savings. This is the most conservative assumption that can be applied from the perspective of not over-stating the impact of 20/20 Rebate.
- Savings from IOU residential and non-residential programs regarded as occurring in the program year 2001, rather than as annualized savings. In reality, most programs reported savings in annualized terms rather than as savings actually captured in 2001.
- Savings from IOU Residential and Non Residential programs for the four months of June through September 2001, represented 40% of total savings for the year. Since California is a summer peaking state, we assume that a greater share of usage, and therefore savings, occurs during the summer months in which 20/20 Rebate was in effect. As a result, we believe it is reasonable to apply a factor of 0.4 rather than 0.33 to the IOUs aggregate residential and non-residential program savings.
- 100% overlap between savings resulting from Summer Initiative programs (267 GWh) and those credited to 20/20 Rebate during the months for which 20/20 Rebate was in place. In actuality, we know that not all of the Summer Initiative projects were completed prior to June 2001 and that some savings would therefore not overlap.
- 100% of savings that overlap between 20/20 Rebate and Summer Initiative programs discounted from 20/20 Rebate savings. This is the most conservative assumption that can be applied from the perspective of not over-stating the impact of 20/20 Rebate.
- 0% overlap between savings resulting from IOU new construction programs and those credited to 20/20 Rebate. New construction did not have year 2000 baseline usages to which 2001 usages could be compared; therefore, we assume no 20/20 Rebate savings were credited to new construction.

- 0% overlap between savings from 20/20 Rebate and savings from all CEC and other state programs.

From Table 2-3 we see that the electricity savings for all residential and non-residential IOU energy efficiency programs was approximately 381 and 713 GWh, respectively, for a total of 1,094 GWh. To this sum, we apply a factor of 0.4 to derive a savings of about 438 GWh that we believe is double counted in the 20/20 Rebate program from June through September 2001.

From Tables 2-8 through 2-11 we observe that the total impact for all Summer Initiative programs was approximately 267 GWh. We believe that this savings is also double counted in the 20/20 Rebate program.

The application of these assumptions yields an adjusted savings of 3,053 GWh for 20/20 Rebate, as shown in Table 3-46.

Table 3-46
Global Adjustment to 20/20 Rebate Savings

Description	Impact (GWh)
Starting point: LBNL Net 20/20 Savings	3,758
Adjustment 1: Discounting fully for savings that overlap with IOU Residential and Non Residential programs for the June – September 2001 period	(438)
Adjustment 2: Discounting fully for savings that overlap with Summer Initiative programs.	(267)
LBNL Net 20/20 Savings	**3,053**

Therefore, for the purposes of this study, we adjusted the net impact of the 20/20 Rebate program to 3,053 GWh. This remarkably large savings indicates that 20/20 Rebate had a large impact in influencing customer's energy usage patterns and conservation behaviors.

We assume that the contributions to adjusted savings from the residential and non-residential sectors were proportional to their respective contributions to credited savings. Based on data from LBNL we obtain the results shown in Table 3-47.

Table 3-47
Allocation of 20/20 Rebate Savings to Residential and Non-residential Sectors

Sector	Reported Savings (GWh)	Share of Total Savings	Adjusted Savings (GWh)
Residential	3,021	57.5%	**1,755**
Non-residential	2,237	42.5%	**1,298**
Total	5,258	100.0%	**3,053**

We propose, as a phase II recommendation, a more analytically rigorous approach to resolving the issue of double counting between 20/20 Rebate and other programs. This approach would examine utility billing data and program records to classify eligible customers into three categories:

1. Received a 20/20 rebate and participated in another program

2. Received a 20/20 rebate but did not participate in any other program

3. Participated in another program but did not receive a 20/20 rebate.

Clearly, the savings are unambiguously attributable to one or the other of the programs in categories 2 and 3. Category 1 represents the double count, which could be arbitrarily allocated between the two programs. More interestingly, category 1 can be interpreted as representing the synergistic effect of the two programs together, and the amount of savings in that category, when compared with the other two categories, would indicate the magnitude of synergistic effect, useful information for future program design. Further investigation, by surveying customers in that category, could indicate the degree to which the two programs are actually linked in customers' decisions, versus simple coincidence. The billing analysis suggested above could be conducted on a sampled basis and combined with the fluctuation analysis used in the LBNL study.

Persistence

The 20/20 Rebate program had an enormous impact on customers' energy usage behavior. According to the Phase 4 study, a survey of 20/20 Rebate participants revealed the following five most popular actions that customers took to reduce their bills:

- turning off lights when not in use
- turning down/up thermostats when going out of the house or to bed
- cutting down on appliance use
- using CFLs
- using appliances off peak (load shifting, not energy efficiency)
- hanging clothes out to dry instead of using clothes dryer

Behavioral changes, however, are much less likely to persist compared to installation of energy-efficient fixtures or equipment. In our judgment, only a small percentage of savings from the 20/20 Rebate program in 2001 can be expected to persist without a recurrence of the program in future years. Since 20/20 Rebate was also offered in 2002, we assume 100% persistence in savings after the first year. However, in the absence of a recurring 20/20-like program, we do not expect savings to persist in future years.

4 LESSONS LEARNED AND RECOMMENDATIONS

Chapter 4 presents the lessons that we learned as we gathered and assessed program information, and the recommendations that we offer to promote the standardization of program impact information to facilitate future studies in the same vein.

Overview

The Summary Study represents a first-ever attempt to compile and assess program information from multiple types of entities that administer energy efficiency programs in California. In conducting this study, we developed a compendium of energy efficiency program results for California's programs for 2001. Because there were so many different programs and disparate entities that administered and implemented them, there was not enough uniformity in the conventions and assumptions used to allow an "apples-to-apples" aggregation of program effects or comparison of performance. These challenges are instructive for future efforts.

This chapter highlights the major issues identified during the course of this study related to the availability, consistency, and quality of information on the assumptions and savings methodology across administrators/implementers and programs. For each issue, we indicate the lesson(s) learned and suggest recommendations that would enable a future study to deliver a meaningful aggregation and assessment of program impacts for the state.

About the Issues

Each of the nearly one dozen issues discussed below presented an obstacle to making a meaningful aggregation and assessment of energy savings at the state level, precluding an answer to the question that motivated this CALMAC Summary Study: "What was the impact of California's energy efficiency programs in 2001?"

We categorized the challenges into four areas, based on the kind of difficulty they posed to our attempt to aggregate and assess the reported savings and costs:

- The information we needed was **difficult to find**.
  - We could not find the information we needed or it took a lot of investigation and correspondence with the program administrators or implementers to do so.
- The information we obtained was **difficult to interpret**.
  - We could not understand what the numbers or information provided meant; e.g., we could not tell if net-to-gross ratios were applied or if reported program costs reflected all operational costs or only incentives.
- The reliability of the reported results was **difficult to assess**.

  - We did not see enough information, especially post-program measurement of savings, review of assumptions used to develop pre-installation estimates, or even verification of installations, to develop a sense of whether the reported savings are reasonable or defensible. This is not to say they are not, only that we cannot make an assessment.

- The incompatibility of conventions and methods used made the reported results **difficult to aggregate meaningfully**.
  - Each type of issue contributed to the overall difficulty in making a meaningful aggregation of the savings of the 2001 programs.

Table 4-1 summarizes the 11 primary issues.

Table 4-1
Summary of Issues and Contribution to Difficulties for Program Results

	Difficult to Find	Difficult to Interpret	Difficult to Assess Reliability	Difficult to Meaningfully Aggregate
1. Program-Year vs. Annualized Reported Savings		X		X
2. Inconsistent Application of Net-to-Gross Ratios		X		X
3. Some Programs Only Reported Demand Reduction and Not Energy Savings	X			X
4. Some Programs Did Not Specify Whether Reported Demand Reduction is Coincident with Peak		X		X
5. Some Programs Reported Energy Savings but Provided Little/No Methodological Support	X	X	X	X
6. Ambiguous Reporting of Program Costs		X		X
7. Inconsistent or Missing Program Summaries	X	X		X
8. Inherent Double Counting in Broad General Awareness Programs	X			X
9. Differences Between Mass-Market and Custom Programs	X			X
10. Insufficient Standard Measures of Performance		X		X
11. Not Enough Measurement & Evaluation (M&E)			X	X

About the Lessons Learned

We collected basic information about all 218 programs we identified as having operated in program-year 2001 within our scope of coverage. While some of our lessons learned were gleaned from cataloging these 218 programs, most of our lessons learned were based on our detailed reviews of the 15 programs described in Chapter 3. Our primary lessons relate to differences in program savings estimation and reporting practices across the administrative entities. We believe that these issues and lessons can be found in the larger set of programs. Nonetheless, we do not wish to drag the brush too broadly: we do not mean to say that all the programs administered by any one entity adhere to the exact practices we identified in the sample of programs we looked at closely.

About the Recommendations

Where we stipulate a "requirement" in the recommendations that follow, we mean that motivation should be provided to incline program administrators to conform with the recommendation.

In addition to recommendations to improve the tracking, evaluation, and reporting of future programs, we include several recommendations on activities that were beyond the scope of this study but could help address some of the original and still relevant questions that motivated this study. We call these Phase II recommendations.

4.1 Program-Year vs. Annualized Reported Savings

Issue

Most programs reported program-year 2001 savings in annualized terms, while some reported savings in program-year terms. Annualized savings quantify the impact of all installed measures, improvements, or equipment as if they were in place for a full year. Program-year savings, on the other hand, capture only the savings attributable to the part of the calendar year in which the program was implemented. For example, a measure installed on December 1, 2001, that saves a uniform 100 kWh per month would have a reported savings of 1,200 kWh in annualized terms but only 100 kWh in program-year terms. Among the program-year 2001 programs, annualized savings reporting predominates, probably for two reasons: because it does not require detailed tracking or reporting of the date in which each installation of each measure occurred, and because many of the reported savings are calculated using standardized annual per-unit savings formulas. The benefit of this type of reporting is that it puts all programs on the equal footing of seeing a full year of impacts, which facilitates cross-program comparison and estimation of future year savings (persistence). The big problem with using an annualized savings convention is that many of the program measures in a given program year are taken well into the year, so that reporting savings for a full year overstates the savings for the program year, perhaps significantly. We detected this inconsistency in reported savings conventions not only across administering entities but also from program to program within the same administering entity.

Lessons Learned

- Annualized savings can significantly overstate the savings impact that occurred during the year of program's implementation. Since many, perhaps most, of the administrative entities reported their program-year 2001 savings on an annualized basis, these savings overstate what was realized in California during 2001.
- It is very difficult to make apples-to-apples comparisons among programs that differ in the application of annualized and program-year savings with respect to both savings impact and cost effectiveness (program cost per unit of energy saved).
- The combination of some programs reporting annualized and others reporting program-year savings makes it meaningless to aggregate the savings to the state level for 2001. But, while it was a keen blow to the goal of creating a state total for 2001, it is a problem that can be rectified by program administrators with relative ease for future years.
- Few programs explicitly stated whether their reported savings are annualized or program-year savings. In many cases, only our probing of the savings methodology revealed the underlying convention used. This is a concern because it is too easy to misinterpret and too easy for parties to misuse the published savings numbers.
- If program savings were reported only on a program-year basis, it would be difficult to project the savings that will accrue in future years (persistence), since there would be no full-year basis for the projection.

Recommendations

- We recommend required tracking and reporting of both annualized and program-year savings to enable aggregation of savings realized in the program-year and comparisons of programs on both bases.
- Alternatively, policy makers and program administrators could collaboratively select a convention for reporting savings to enable meaningful comparisons of program savings.
- At the least, documents furnished by administrators that report program savings should clearly indicate whether reported savings are in annualized or program-year terms. If annualized savings are derived from program-year savings, or vice versa, the administrator should disclose the conversion assumptions.

4.2 Inconsistent Application of Net-to-Gross Ratios

Issue

The IOUs in California have a long history of experience in estimating and applying factors to discount the affect of free riders. These factors, termed net-to gross ratios, are used to adjust total (gross) savings by the percentage of savings that would have occurred even without the program (free riders), to produce savings "net" of the free riders. In program-year 2001, many of the IOUs drew on their previous experience or used net-to gross ratios agreed upon in the CALMAC Public Workshop on PY 2001 Energy Efficiency programs. These ratios are typically 0.7 or 0.8, but can vary from 0.5 to 1.0 depending upon the exact nature of the program, including the delivery mechanism employed and end-use measures or technologies addressed. By contrast, most municipal utilities, third-party administrators, state agencies, and local governments did not perform any analysis to determine appropriate net-to gross ratios. Moreover, whether net-to gross ratio adjustments are considered or not, savings from many programs, including IOU Summer Initiatives, were not explicitly identified as either gross or net when reported.

The CPUC has not historically recognized or credited programs with inducing additional actions taken by program participants outside the program. And perhaps IOUs have abandoned arguing that these "free driver" savings should be counted. But non-IOU entities seem aware of these likely effects and at least one thought these could partially offset the discounting of free riders. This could confound the issue of whether and what net-to gross ratio to apply for some program administrators.

Lessons Learned

- An apples-to-apples comparison of the savings impact and cost effectiveness of programs in California is complicated by the fact that some programs (mostly the IOU programs) have been discounted by net-to-gross ratios and some programs (more often the non-IOU programs) have not been similarly discounted.

Recommendations

- Require all program administrators to apply net-to gross ratios that reasonably reflect the likely free-ridership in those programs.
- Consider allowing programs to take credit for free drivers the programs induce, requiring post-program evaluation to assess both free ridership and free driver-ship.
- A Phase II recommendation is to review all of the programs to draw up a list of those types of programs that do not have any net-to gross ratio guideline estimates so that CALMAC might expand its set of estimates. Having a ready set of appropriate net-to gross ratios could encourage adoption of the their use in future program years and facilitate more apples-to-apples comparison or aggregation.

4.3 Reporting of Demand Reduction and Not Energy Savings

Issue

Traditionally, California has focused its program objectives on producing kWh savings and its evaluation efforts on measuring those energy savings. However, in the last couple of years, as price spikes and emergency conditions became major concerns, the program objectives of some of the newer programs, especially those not administered by the IOUs, have turned to peak demand reduction. The result was a grab-bag of programs in 2001 with different objectives and different emphases on what was reported. For example, many of the Summer Initiatives, the CEC demand reduction programs, and LADWP programs only reported demand savings but not energy savings.

Lessons Learned

- Differing program priorities are reflected in what types of savings are and are not reported by programs. While it appeared that some of the programs that focused on peak demand savings were not monitoring the energy savings, more probing revealed that the energy savings were monitored more often than not, but they were simply not reported.

Recommendations

- Policy makers and program administrators should determine whether demand reduction, energy savings, or both will be the objective of programs prior to each program year and address how programs of each type will be reported.
- If policy makers deem that both kW and kWh savings are important, then require all program administrators to track and report both peak demand reduction and energy savings. If a program focuses on only one type of savings, it is fine to note there were zero or unverified savings for the other. This would serve both to clarify the reported savings and underscore the program objective(s) for subsequent users of the reported savings.
- We believe that both types of savings have a place in program evaluation and recommend that in the future both be reported for all programs. This might be done without adding much more complexity to the reporting. For measures that do not have 100% duty cycles, it will be necessary to estimate diversity factors for non-coincident loads; for load-shifting measures, the energy savings will be recognized as zero.

4.4 Inconsistent Specification of Whether Reported Demand Reduction is Coincident with Peak

Issue

This issue is closely related to the preceding one. As is well known, the amount of kW load reduction a measure produces does not necessarily have the same impact on system peak, because of differences in timing. Some programs reported the measure's load reduction without regard to timing (i.e., non-coincident demand reduction) while others reported the demand reduction that occurs during the system peak period (i.e., coincident peak reduction). Furthermore, while most programs reporting coincident peak reductions documented the procedure used for calculating them (including the definition of the peak period), other programs did not make the distinction in their reports.

Lessons Learned

- If only peak period demand reduction is to be credited to programs, it is necessary to separate coincident and non-coincident demand. While this distinction was observed in some of the programs reviewed, in others the distinction was not made when it should have been; e.g., lighting demand impacts where computed as the difference in nameplate wattage before and after retrofitting, ignoring the fact that changes in operating hours may have more impact off-peak than on. This problem was observed in a number of the UC/CSU Summer Initiative projects, which installed lighting retrofits and occupancy sensors. One evaluation study that appears to have observed this distinction rigorously was the Nexant report on the CEC programs.
- Many programs report demand reduction figures but do not indicate the extent to which the demand reduction is coincident with system peak. As a measure of performance, only demand reduction that is coincident with system peak is meaningful from a capacity planning standpoint.
- For the purposes of this study, we did not consider demand reduction figures to be coincident with peak unless the figures were explicitly reported as "peak demand reduction" and the documented calculation methodology confirmed that interpretation.

Recommendations

- The focus of demand reduction should be clarified and all program administrators should be required to specify coincident and non-coincident peak demand reduction for their programs.
- The definition of the peak period for calculating coincident peak demand reduction should be standardized.

4.5 Energy Savings with Little or No Methodological Support

Issue

Some municipal utility-, state agency-, local government-, and third party- administered programs and utility summer initiatives did not produce standardized worksheets that document the basis for reported program energy savings similar to technical appendix material included in some of the IOU annual reports of energy efficiency programs. In many cases, it was not possible to locate the underlying sources for reported savings (i.e., engineering calculations, benchmark unit energy savings, usage assumptions, etc.). A dearth of descriptive or explicative documentation makes it difficult to understand and compare programs. It means that either the reviewer cannot make a comparison or cannot understand the implications of making a comparison across programs.

Lessons Learned

- Many of the non-IOU programs seem to have lacked the mandate or resources to produce standardized documentation to support their reported savings. For many programs, IOU and non-IOU alike, we found that individual program managers or evaluators had considerable information in personal documents or spreadsheets, but they had no single repository or standardized template for this type of information.
- We found the working papers in the technical appendix of PG&E's Energy Efficiency Programs Annual Report useful. They spell out the assumptions and formulas or approach to calculating savings in a clear way. It was not as clear how that information actually generated the savings numbers that were reported, meaning we could not tell if those assumptions were actually used to generate the savings reported for those programs. Since these were not the focus of our detailed reviews, we did not look into how prevalent this missing link is; our point in mentioning the papers is to laud their clarity.

Recommendations

- Require all program administrators to produce specific documentation to support the derivation of reported energy savings, including all key assumptions (e.g., per-unit savings, hours of use, effective useful life, net-to-gross), and basic formulas or calculations used to derive the reported kW demand and kWh savings estimates.
- Consider using PG&E's working paper format and showing how the information has been applied to actual program data to generate the reported savings as a reporting requirement for all programs.
- Require all programs to report all kW and kWh program results in terms of annualized and program-year savings, gross and net savings, and coincident and non-coincident demand reduction will help ensure that these assumptions are explicit and will be more readily available. This recommendation will address quite a few of the other issues discussed in this section.

- Advise program administrators to document the sources for all savings assumptions, including measure unit savings and operating hours. Recommend the inclusion of established benchmarks such as those in the DEER database, and an explanation if alternative benchmarks or assumptions are employed.

4.6 Ambiguous Reporting of Program Costs

Issue

Most PY 2001 program documentation included something on program cost. Among the programs we looked at in depth, almost all provided cost information that includes both administrative costs and incentive costs. Quite a few, however, only reported financial incentives as program cost. For reports of "total cost," it was not always clear how much, if any, contracted implementation M&E costs were included. It also appears that there are differences in what was included in administrative costs; if some administration or marketing was contracted out, this might not be in the total cost. In addition, some programs identified the components in the total cost and some did not. Clearly some did and some did not include M&E costs; in some cases this is because none was conducted and in others the cost was just not included. Moreover, the IOUs documented M&E costs on an aggregated basis, making it difficult to allocate on a program-specific basis.

For many programs implemented by third parties in conjunction with or under the sponsorship of utilities, we often observed variances in reported costs based on the perspective of the reporting entity. For example, COPE reported a program cost of $3.5 million for the Oil Pumping Efficiency Summer Initiative. But the two sponsoring utilities for the program, PG&E and SCE reported a combined program cost of $4.0 million, presumably factoring in each utilities administrative costs of facilitating the program. Given these types of variances, the choice of which cost figure to use is not always clear.

It is important to distinguish mass-market from custom programs in this context. Marketing and administrative costs are much more of an issue for mass-market programs, which often focus on a single measure or a family of closely related measures, while custom projects frequently include multiple measures.

Lessons Learned

- The lack of uniform conventions across administrators in specifying and allocating program costs leads to some ambiguity. Because some programs capture more cost categories than others, a computation of program-cost-per-savings achieved does not yield a ratio that can be suitably compared across programs on an apples-to-apples basis.
- Where a program implements multiple types of efficiency measures (e.g., efficient lighting and HVAC), it is important to breakout costs by measure type. Otherwise, it is difficult to assess the cost effectiveness of the individual measures.

Recommendations

- Require all program administrators to break out costs in a standardized manner, including administrative costs (staff labor, contract labor, other overhead), incentive costs and measurement and evaluation costs.
- Require administrators to break out costs by type of efficiency measure.

4.7 Inconsistent or Missing Program Summaries

Issue

There is no standardized program summary information across major program administrators and implementers in California, including IOUs, major municipalities, local governments, and third parties.

Lesson Learned

- Part of what made the job of even cataloging basic information about all the program-year 2001 programs was that it was so difficult, time consuming, and sometimes fruitless to search the information out. Some entities were unable to provide annual reports. The reports of many others were very incomplete.
- Even where such information was available, it was frequently presented in different ways for different programs, making it difficult to assemble information in a consistent manner across programs.
- For the purpose of comparing projects, it would be desirable to have analogous cost, units, and savings information. A standardized format or a checklist for summarizing each project would help.

Recommendations

This recommendation for more standardized summaries supports the findings and incorporates the recommendations of the previous issue. We propose that the summary include the following information, but we also recommend that that the exact items be discussed with rather than imposed on the program administrators:

- A brief description of the energy- and demand-saving measures implemented; e.g., "efficient lighting and ballast retrofits with occupancy sensors and delamping where appropriate" or "chilled water loop from a central chiller plant with thermal energy storage replacing dedicated rooftop air conditioning units."
- A measure of the scale of the installation; e.g., "20,000 fixtures" or "2,000-ton chiller with 20,000 ton-hours of storage."
- A measure of the scale of the host site or sites; e.g., "400,000 sq. ft. in 50 buildings."
- The type of host facility; e.g., "university campus," "office building," or "retail store."
- A brief description of the differences between the "as specified" and "as built" installation; e.g. "Although a 2,000-ton chiller was originally specified, it was decided during installation to increase the size to 2,500 tons to accommodate planned construction at the host facility."
- A brief description of the evaluation methodology; e.g., "Detailed records were kept of the lighting fixtures retrofitted and their pre- and post- retrofit wattages, derived from their nameplate ratings or the DEER database. Operating hours were monitored for a representative sample of fixtures using data loggers for a period of two weeks before

replacement and two weeks after, while classes were in session at this university. Operating hours were extrapolated to annual values using each building's operating schedule and records from the EMS."

- A breakdown of the planned and verified energy and demand savings by measure; e.g., "As planned, the lighting portion of the project was expected to reduce summer on-peak demand by 100 kW and annual energy use by 500 MWh. M&V undertaken after the installation indicates that peak demand savings are 115 kW and annual energy savings are 555 MWh. The TES portion of the project was expected to shift 1250 kW of summer peak demand to off-peak hours, and M&V after installation confirmed that was the case. No credit was taken for energy savings from the chiller/TES portion of the project." These should also be stated as a percentage of their pre-installation values; e.g., "The retrofits have reduced annual lighting energy consumption by 20% relative to the pre-installation value."
- The total cost of the project (not just the portion paid by utility rebates or state grants), broken down by measure; e.g. "The lighting portion of the project cost $450,000 and the chiller/TES portion cost $1,500,000." Ideally, it would be beneficial for program administrators to document both total cost and the portion subsidized by rebates or grants. This distinction would enable the application of standard cost-effectiveness tests, as well as help assess free ridership. However, in the absence of conducting extensive cost-effectiveness testing, this recommendation would not need to be implemented.
- The expected useful life of the measures by type.
- Standard measures of performance that enable comparison with other projects. This is discussed in section 4.10.

4.8 Inherent Double Counting for Broad General Awareness Programs

Issue

Programs like the 20/20 Rebate (discussed in detail in Chapter 3) and Flex Your Power undoubtedly had a major influence on Californians' conservation behaviors and choices in 2001. However, it is extremely difficult to isolate the impact of these types of broad, sweeping programs from existing energy efficiency programs, since there is a synergistic relationship between these types of programs.

Lessons Learned

- It is extremely difficult to isolate the impact of these types of broad, sweeping programs from existing energy efficiency programs, since there is a synergistic relationship between these types of programs. Thus, it is difficult to determine the cost effectiveness of the individual programs and the extent to which the synergy creates more impact than the individual programs alone.

Recommendations

- A Phase II recommendation is to flesh out and apply a robust analytical approach to resolving the double counting issue inherent in broad programs such as 20/20 Rebate and Flex Your Power. In Chapter 3, we describe how such a study might be structured for 20/20 Rebate.

4.9 Differences Between Mass-Market and Custom Programs

Issue

These two types of programs have fundamental differences in the way they are implemented and evaluated. These differences imply that summary evaluation and aggregation cannot be done in the same way for both.

Lessons Learned

Mass market programs, such as refrigerator recycling or compact fluorescent bulb promotions, generally involve a single efficiency measure or a family of closely related measures. The number of items involved typically ranges from thousands to hundreds of thousands. The per-unit item impacts, if not nearly identical for all items, follow statistical distributions that permit generalized extrapolations from a comparatively small set of data. Furthermore, data on these programs are typically collected on an item basis.

On the other hand, custom programs, such as those reviewed for this analysis or the utilities' standard performance contracts, typically involve a small number of large projects, typically tens to hundreds, each of which may involve multiple measures and each configured in a manner that is unique to the host facility. The total impacts generally cannot be determined from per unit impacts because other scale factors are involved as well. Furthermore, data on these programs are typically collected on a project rather than item basis.

Recommendations

- Custom programs must be evaluated on a project-by-project basis, since diversity among projects within a program generally makes aggregate analysis difficult. The M&E plans for these programs should define how this will be done for each measure/program. We recommend that the SPC approach be applied for all custom programs.
- Mass market programs across administrators can be grouped into several end-use categories such as lighting and appliances. Administrators and regulators should cross reference similar mass market programs periodically to identify best practices in program administration, including increased standardization in documentation and record keeping.

4.10 Insufficient Standard Measures of Performance

Issue

When comparing custom programs on a large scale, detailed auditing of individual projects is very labor intensive and time consuming. For example, as discussed in Chapter 3, the review of commercial and institutional programs included about 25 individual projects and groups of projects. Just one of those projects, say CSU Long Beach, involved lighting retrofits in 12 buildings with many hundreds of individual fixtures, each of which was documented in the project's work papers. The effort required to check the reasonableness of the savings figures for just that project would far exceed the value of doing so. Therefore, some summary measures of performance would enable quicker and less labor intensive checking of individual projects and comparisons among them.

Total energy savings or demand reduction is not always the best measure of performance with which to gauge or compare program effectiveness.

Lessons Learned

- Because the scale of a project and the mix of measures strongly influence the savings due to the efficiency measures, it is meaningless to compare projects based on savings alone. For example, to say that one project saved 500 MWh in lighting and another saved 200 MWh really says nothing about how effective each project was; differences in floor area and mixture of lamp sizes and fixture types between the projects would account for most, if not all of the difference. However, the information necessary to account for these differences is difficult, if not impossible, to find in most project reports.

Recommendations

We recommend developing several standard measures of performance that would enable comparisons among projects. These figures should be fairly easy to compute from readily available information and should not require either additional data collection or complicated data analysis. We offer the following examples, although this list is not exhaustive and the issue deserves further study:

- Energy Use Index (EUI) – Total demand or energy use (for a particular end-use in a particular building type) divided by the floorspace over which it is consumed; e.g. "1.0 W/sq. ft. and 5.5 kWh/sq. ft./yr. for lighting in colleges." These figures should be computed both before and after installation.
- Unit cost and cost savings – Total cost and cost savings of the project (for a particular end-use in a particular building type) divided by total demand and energy savings; e.g., "$80/kW and 6¢/kWh cost for lighting retrofits in colleges."

4.11 Not Enough Measurement & Evaluation

Issue

Some programs were clearly tracked quite closely. Some even had some post-program verification. The recent trend away from extensive evaluations for the IOU programs and the increase in programs operated by other entities, which were never subject to any M&E requirements, has resulted in a set of programs operated in program-year 2001 for which there is relatively little documentation, quite little verification, and almost no post-program evaluation of program effects. As a result, it is impossible to assess whether the reported savings are accurate or even reasonable.

Lessons Learned

- California has devoted considerable time and effort to developing evaluation methods for many common types of efficiency measures. Indeed, the investor-owned utilities' standard performance contracts require following these protocols. For some of the other programs, IOU and non-IOU alike, we feel that lip service was paid to M&E. Examples of this have been discussed and will not be reiterated here. Nonetheless, if the state wishes to ever be able to answer the question: "How much energy was saved by programs last year?," some more systematic, more comprehensive, and more rigorous measurement of activities and evaluation of their effects will need to be (re)instated. While we feel that the structures of the SPC protocols might be too restrictive for all programs, their use provided a measure of confidence to the savings reported for those programs. The spirit of those protocols might serve the state and administrators of future programs.
- Some of the Summer Initiatives were apparently under a strict deadline to have program measures taken by June 1, 2001. This, no doubt, had at least two adverse effects: it limited what the programs could achieve by shortening the action period to less than half the year and it increased the challenge of conducting pre/post measurement of energy use. A post-program review of at least one program, a third-party initiative, indicated that much of the program's M&E plan was not implemented because the installation deadline precluded doing the amount of pre-installation demand and energy monitoring planned.

Recommendations

- Policy-makers need to work with program administrators to ensure that program objectives are clear and that the M&E to determine whether the objectives have been met at the end of the program year can be implemented under the terms of the program. This can involve adjusting timelines, eligibility requirements, approval processes, and reporting requirements. If a commitment to do this is not made, then the actual achievements of the programs may never be known.
- Require all program administrators to provide M&E plans prior to initiation of the program and hold them to implementing them as outlined. To the extent possible, try to use similar evaluation plans for similar measures. Especially in the case of widely implemented types of measures, such as C/I lighting and HVAC retrofits, take advantage of the experience gained

over many years of evaluating these types of measures to provide guidelines for effective and efficient M&E.

- A Phase II recommendation is to extend the search to obtain the M&E plans and activities undertaken for all 15 of the programs we reviewed. At this writing, some of the program administrators/implementers had still not provided the documentation we requested, so we could not tell what was done to develop or verify savings.

4.12 Summary of Phase II Recommendations

We offer the following recommendations for a Phase II Study to build on the work of the Summary Study.

- Review all of the programs to draw up a list of those types of programs that do not have any net-to-gross ratio guideline estimates so that CALMAC might expand its set of estimates. Having a ready set of appropriate net-to-gross ratios could encourage adoption of the their use in future program years and facilitate more apples-to-apples comparison or aggregation.
- Flesh out and apply a robust analytical approach to resolving the double counting issue inherent in broad programs such as 20/20 Rebate and Flex Your Power. In Chapter 3, we describe how such a study might be structured for 20/20 Rebate.
- Extend the search to obtain the M&E plans and activities undertaken for all 15 of the programs we reviewed. At this writing, some of the program administrators/implementers had still not provided the documentation we requested, so we could not tell what was done to develop or verify savings.
- Expand the number of detailed reviews beyond the 15 we conducted to include some programs from all of the administrative entities. We purposely focused our reviews on programs with reported savings in the highest category and little to no supporting documentation. As a result, we reviewed more than half of the Summer Initiatives and none of the 145 CPUC-funded/IOU-administered programs. Reviewing a few of them could provide contrast or additional support to the findings from the other reviews.

A APPENDIX A: PROGRAM DATABASE

The following tables present a partial extraction from the Summary Study Database for the 218 programs compiled for our study. The electronic version of this database in Excel format contains additional data fields and annotations for most data entries, which cannot be viewed in this document.

Summary of Major Abbreviations Used in Database Tables

- NA = Not Available; data was not provided
- na = Not Applicable
- EE = Energy Efficiency or Energy Efficient
- "-" = zero

PGC-Funded/IOU-Administered: PG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
PG&E 01	RHCS - Targeted Information Delivery	Res - Heating and Cooling Systems (RHCS)	Provided information to raise technical awareness and knowledge of the benefits of energy efficient HVAC equipment. Targeted "hard to reach" segments, including rural and non-English speaking households.	318	-	-	NA	NA
PG&E 02	RHCS - Technical Support to Trade Allies	Res - Heating and Cooling Systems (RHCS)	Training on EE HVAC targeted to HVAC contractors, technicians, installers, architects, engineers, building code officials, and trade school instructors; conducted at PG&E Energy Training Center in Stockton and Sierra Energy Center in Tuolumne County.	244	-	-	NA	NA
PG&E 03	RHCS - Emerging Technologies	Res - Heating and Cooling Systems (RHCS)	Support for the identification, development and commercialization of new HVAC technologies, applications, and best practices appropriate for the California market.	173	-	-	NA	NA
PG&E 04	RHCS - Linked HVAC Financial Incentives	Res - Heating and Cooling Systems (RHCS)	Financial assistance to influence manufacturers' technology commercialization plans, distributors' stocking decisions, contractors' stocking and promotion strategies, and customers' purchasing decisions.	5,044	3,502	5.9	1.440	849.2
PG&E 05	RHCS - Regional and National Initiatives	Res - Heating and Cooling Systems (RHCS)	Support of national and regional initiatives that promote EE HVAC technologies, practices and industry infrastructure. Focus on upstream developments in the HVAC market to accelerate adoption of EE HVAC technology and practices into codes and standards.	7	-	-	NA	NA
PG&E	Res Lighting -	Res -	Promoted installation of	206	-	-	NA	NA

PGC-Funded/IOU-Administered: PG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
06	Targeted Information and Market Facilitation	Lighting	Energy Star labeled lighting to customers and multifamily property operators, and promoted stocking of such lighting to retailers. Also focused on improving market recognition of benefits of EE lighting.					
PG&E 07	Res Lighting - Improved CFL and Emerging Technologies	Res - Lighting	Accelerated the introduction of, and increased demand for, sub-CFLs through cooperative efforts with retailers (mass and individual), manufacturers.	7,047	140,955	41.1	0.050	171.6
PG&E 08	Statewide Residential Lighting Program	Res - Lighting	Manufacturer and customer incentives, education and outreach to retailers and manufacturers, field services, salesperson training, and paid advertising to promote Energy Star lighting products.	1,716	7,129	2.1	0.241	805.6
PG&E 09	Res Appliances - Targeted Information Delivery	Res - Appliances	Promotion of Energy Star labeled appliances with emphasis on improving market recognition of their benefits. Targeted customers, multifamily property owners and operators, and retailers/manufacturers.	377	-	-	NA	NA
PG&E 10	Statewide Residential Appliance Program	Res - Appliances	Promotion of Energy Star labeled appliances to residential customers, retailers, and manufacturers.	13,169	28,413	5.4	0.463	2,443.2
PG&E 11	RR&R: Promotion and Facilitation of Comprehensive, Discretionary Retrofit Services	Res - Retrofit & Renovation (RR&R)	Promotion of whole-house approaches to retrofit activities while increasing market penetration of EE products and services.	14,241	23,758	13.4	0.599	1,065.1
PG&E 12	RR&R: Facilitation of Efficiency Retrofit and Renovation at Time of Sale (TOSER)	Res - Retrofit & Renovation (Res R&R)	Promoted the benefits of EE-related retrofits and renovations during home buying and selling. Emphasis on one-stop services for financing with EEM's and support of HERS, particularly CHEERS.	1,067	2,755	0.7	0.387	1,641.5
PG&E 13	RR&R: Energy Efficiency Centers	Res - Retrofit & Renovation	Enabled PG&E's Energy Training Center (ETC) in Stockton and	601	-	-	NA	NA

PGC-Funded/IOU-Administered: PG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
		(Res R&R)	Sierra Energy Center (SEC) in Tuolumne County to conduct residential demonstrations, training and other technical support.					
PG&E 14	RR&R: General Information, Education, Labeling and Alliances	Res - Retrofit & Renovation (Res R&R)	EE information and services to all residential customers, K-8 students, residential contractors, trade organizations, manufacturers, governmental and environmental organizations.	8,269	-	-	NA	NA
PG&E 15	RR&R: Energy Information /Management Services	Res - Retrofit & Renovation (Res R&R)	EE surveys or audits offered via direct mail, phone, and/or Internet to inform and educate customers on specific energy uses in their homes and offer energy saving recommendations and program referrals.	2,122	9,192	1.7	0.231	1,286.1
	SUBTOTAL	**RES**		54,601	215,704	70.2	0.253	777.9
PG&E 16	Non Res - Lrg Comp. Retrofit (SPC), Financial Incentives	Non Res - Lrg Comp. Retrofit	Helps businesses demand in excess of 500kW or natural gas usage of more than 250 Mtherms/year replace inefficient equipment of a variety of efficient types.	26,341	145,929	23.1	0.181	1,139.3
PG&E 17	Information and Education	Non Res - Lrg Comp. Retrofit	Print and electronic information materials through Business Customer Center, field representatives, presentations and trade shows, toll-free phone support - all targeted at owners and operators of large customers, including community colleges, as well as trade allies.	855	1,196	0.2	0.715	4,275.0
PG&E 18	Tools, Demonstrations, and Design Assistance	Non Res - Lrg Comp. Retrofit	Technical activities to link the design (e.g. architect, engineer, etc.) and EESP communities to support EE technologies.	90	-	-	NA	NA
PG&E 19	Non Res - Sm. Comp. Retrofit (SPC), Financial Incentives	Non Res - Sm. Comp. Retrofit	Helps businesses with monthly peak demands under 500kW or natural gas usage less than 250 Mtherms/year replace inefficient equipment of a variety of efficient types and offers other financial incentives.	6,984	47,158	8.7	0.148	801.8

PGC-Funded/IOU-Administered: PG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
PG&E 20	Non Res - Sm. Comp. Retrofit (SPC), Information and Education	Non Res - Sm. Comp. Retrofit	Information through print literature, in-person visits, phone and on-line media. Energy surveys a major component.	4,350	16,097	3.1	0.270	1,421.6
PG&E 21	Tools, Demonstrations, and Design Assistance	Non Res - Sm. Comp. Retrofit	Solicited proposals from third party implementers on EE retrofit projects for small, hard to reach commercial establishments. Direct mail and brochure campaign, conducted seminars and presentations to businesses and community based organizations.	825	-	-	NA	NA
PG&E 22	LED Traffic Signals	Non Res	Program was folded into Large Customer SPC program	NA	NA	NA	NA	NA
PG&E 23	HVAC Turnover	Non Res	Incentive program targeted at distributors of package ACs; incentives applied to equipment purchased and installed as part of a normal or emergency replacement process.	2,711	7,129	4.7	0.380	579.3
PG&E 24	Non Res - Motor Turnover: Financial Incentives	Non Res - Motor Turnover	Financial incentives to equipment distributors stocking and selling premium efficiency motors.	334	1,287	0.2	0.260	1,670.0
PG&E 25	Non Res - Motor Turnover: Design Assistance	Non Res - Motor Turnover	Pilot program, which offered testing, monitoring and evaluation services to non residential customers, was discontinued. Funding was shifted to non residential incentive programs.	12	-	-	NA	NA
PG&E 26	Non Res - Process Overhaul: Info & Educ.	Non Res - Process Overhaul	Targeted EE in commercial food service industry through Food Service Technology Center (FSTC) and Energy Training Center (ETC) in Stockton. Provided seminars to help designers and users of commercial food service equipment improve energy efficiency.	280	-	-	NA	NA
PG&E 27	Non Res - Process Overhaul: Design Assistance	Non Res - Process Overhaul	Compressed Air Management Program (CAMP) provided system analysis and information to participating customers, who in-turn agreed to implement no-	1,788	-	-	NA	NA

PGC-Funded/IOU-Administered: PG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
						MW		**$/kW**
			cost and low-cost measures identified in the analysis. Capital-intensive measures were eligible for financial assistance through SPC program.					
PG&E 28	Non Res - Remodeling & Renovation: Financial Incentives	Non Res - Remodeling & Renovation	Express Efficiency and Savings by Design provided financial incentives for this program element.	15,577	144,269	26.9	0.108	580.1
PG&E 29	Non Res - Remodeling & Renovation: Design Assistance	Non Res - Remodeling & Renovation	Discontinued in 2001, with funding transferred to non residential incentive programs.	2,411	-	-	NA	NA
	SUBTOTAL	NON RES		62,558	363,065	67	0.172	936.2
PG&E 30	Targeted Consumer Promotion and Information	Res - New Const.	Information to consumers and homebuilders on the benefits of purchasing EE homes through television, newspaper, Internet advertising, direct mail, and bill inserts.	4,218	-	-	NA	NA
PG&E 31	Infrastructure Development	Res - New Const.	Sales training on promoting Comfort Home and Energy Star Showcase to builder sales agents as well as subcontractors, building suppliers, energy consultants, CHEERS raters, and architects.	643	-	-	NA	NA
PG&E 32	ENERGY STAR New Homes	Res - New Const.	Promotion of Energy Star new homes to builders within PG&E's service territory. Results from CHEERS ratings used to calculate energy savings.	385	-	-	NA	NA
PG&E 33	Capability Development	Res - New Const.	Training and technical assistance to builders and HVAC contractors through statewide training calendar coordinated with other IOUs.	42	-	-	NA	NA
PG&E 34	Market Leader Incentives ("Comfort Home", etc.)	Res - New Const.	Redesign of Comfort Home program in response to new AB 970 building standards. Focus on multifamily new construction market, targeting hard-to-reach. Incentives offered to contractors/construction companies.	6,390	7,232	4.8	0.884	1,328.5
PG&E 35	Local Government Planning	Res - New Const.	Support to local governments to encourage residential new construction that exceeded current state EE standards and that	63	-	-	NA	NA

PGC-Funded/IOU-Administered: PG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
			qualified for PG&E residential new construction incentive programs.					
PG&E 36	Savings By Design	Comm - New Const.	Fostered integrated building design techniques and practices that contributed to EE facilities.	11,104	41,917	16.8	0.265	660.6
PG&E 37	Energy Design Resources	Comm - New Const.	Integrated package of design and performance tools, techniques, information and educational resources promoting the design and construction of high-performance buildings.	1,706	-	-	NA	NA
PG&E 38	Targeted Information	Ind & Ag - New Const.	Energy Design Success (EDS) program provided site-customized reports to customers looking to expand their existing facilities or build new facilities.	2,269	-	-	NA	NA
PG&E 39	Financial Incentives	Ind & Ag - New Const.	EE pilot program providing financial incentives for the efficient construction and operation of refrigerated warehouses .	6	-	-	NA	NA
PG&E 40	Codes and Standards Support	New Const. - Other	Studies developed for promising design practices and technologies and presented to standards/code-setting bodies.	1,595	-	-	NA	NA
PG&E 41	Local Government Initiatives	New Const. - Other	Training sessions targeted at local governments whose constituents received gas or electricity from PG&E and who paid the PGC.	11	-	-	NA	NA
	SUBTOTAL	New Const.		28,432	49,149	22	0.578	1,315.1
	TOTAL	All Sectors (not including Summer Initiative)		145,591	627,918	159	0.232	917.8

PGC-Funded/IOU-Administered: SCE								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
SCE 01	Mass Market Information	Res-Information	Interactive energy efficiency service that provides residential and small business customers with tools to manage their energy costs. Includes on-line service that provides energy-saving tips and information about energy-efficient appliances and equipment.	2,736	-	-	NA	NA
SCE 02	Residential Energy Surveys	Res EMS	Information; (includes In- Home, Telephone, Mail-In, and On-Line survey modes?)	1,683	9,261	3.6	0.18	474
SCE 03	Single Family Residential Contractor Program (RCP)	Res EE Incentives - RCP	Promotion of whole system approach, emphasizing certain comprehensive measure packages, such as a set of HVAC measures. Delivered through approved contractors.	4,717	3,589	1.1	0.27	3,546
SCE 04	Multifamily Residential Contractor Program (RCP)	Res EE Incentives - RCP	Performance based Standard Performance Contract (SPC) similar to the Small Business SPC, targeted to dwelling units and common areas of apartment and condominium complexes and mobile home parks.		13,631	0.3		
SCE 05	Home Energy Rebate Program (HER)	Res EE Incentives - Prescriptive Rebates	Rebates on wide range of end-use equipment and measures. Supports nationwide DOE/EPA Energy Star Program	5,073	9,465	9.8	0.54	520
SCE 06	Refrigerator/Freezer Recycling	Residential	Program provides incentives to encourage customers to dispose of operable, old, inefficient refrigerators in an environmentally responsible manner	7,500	53,613	9.1	0.14	825
SCE 07	CHEERS	Res Upstream	Information; energy rating audit/verification tool for new and existing homes	296	63	-	4.70	NA
SCE 08	Energy Star Labeling (Appliances)	Res Upstream	SCE provided: (a) funding to appliance manuf's to promote Energy-Star qualified	NA	-	-	NA	NA

PGC-Funded/IOU-Administered: SCE								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
			products, (b) special labeling materials for retailers, (c) collateral and training for retailers					
SCE 09	Lighting	Res Upstream	Rebate	3,339	30,035	27.5	0.11	121
SCE 10	Mobile Education Unit	Res Upstream	Information	400	-	-	NA	NA
SCE 11	Third Party Initiatives	Res Upstream (TPI)	Multiple projects targeting upstream market actors, implemented by third parties	2,003	-	-	NA	NA
	Subtotal	Residential		27,747	119,657	51.2	0.23	542
SCE 12	Customer Technology Application Center (CTAC) & Agricultural Technology Application Center (AgTAC)	Non Res Info	PG&E, SCE, and SCG operate Energy Centers, which use training, outreach, education, and tool development to support delivery of statewide programs. Energy Centers address peak demand reduction and promote energy savings directly. CTAC = Commercial Technology Application Center; AgTAC = Agricultural Technology Application Center	1,784	-	-	NA	NA
SCE 13	Mass Market Information	Non Res Info	Information and education program designed to give customers the power to better manage their business energy costs. Provides general energy efficiency information to customers and other market actors through the following intervention strategies: Internet, statewide energy guide, and action plan for distribution, and possibly a statewide mass market communications plan involving radio or print.	1,289	-	-	NA	NA
SCE 14	Statewide Business Energy Guide	Non-Res Information	Provides energy information and education to customers to better manage their business energy costs; Provides energy information for office buildings, grocery stores, restaurants,	NA	-	-	NA	NA

PGC-Funded/IOU-Administered: SCE								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
			retail outlets and manufacturing facilities; Brochure currently available in English, Spanish and Chinese. Target markets includes commercial businesses, business trade/vendor shows, Small Business Associations, Chambers of Commerce, building permits and government offices.					
SCE 15	Agricultural/Pumping Services	Non Res EMS	Intended to influence water agencies, municipalities, agricultural, and other pumping customers to adopt preventative maintenance practices that should ultimately improve the overall efficiency of their pumping systems. Hydraulic test specialists provide pump efficiency tests that determine overall plant system efficiency, electrical motor performance, pump hydraulics and water well characteristics.	1,971	10,977	3.3	0.18	597
SCE 16	Small Business Energy Survey / Sm/Med Energy Management Services	Small & Med C&I	Small C/I Do-It-Yourself Energy Survey - hardcopy, on-line, or CD ROM; provides customers with EE'y info to help reduce energy bills, introduces other EE'y products and services, such as rebates and retail outlets that feature ENERGY STAR®-rated products. Augments other utility NR programs, providing special services to "under served" market segments, including minority and women owned businesses. Promotes awareness of EE'y benefits and utility NR programs to businesses, customer trade and ethnic associations.	645	739	0.8	0.87	796

PGC-Funded/IOU-Administered: SCE								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
SCE 17	Large Commercial and Industrial (EE Information) Services	Non Res EMS (Large C&I)	provides information on EE programs, options and services	1,038	-	-	NA	NA
SCE 18	NR Express Efficiency (Large and Small/Med)	Non Res - Prescriptive Rebates	Educates and provides standard direct incentives to NR customers for the elimination of specific highly inefficient electrical products from use in their businesses. Uses a combination of customer representatives, vendors, and contractors to deliver the program to customers; includes rebates on LED traffic signals; small business segments and some climate zones were targeted with specific measures (e.g., window film).	12,433	188,864	34.2	0.07	364
SCE 19	LED Traffic Signal Rebate	Non Res - cities and counties	(Lumped in as part of Express Efficiency)	3,467	31,300	7.0	0.11	495
SCE 20	Large Nonresidential Standard Performance Contract	Large NR	Performance based program that offers incentives (posted price) to customers or Energy Efficiency Service Providers (EESPs) for installation of energy efficient equipment at customer facilities.	6,527	33,647	6.2	0.19	1,049
SCE 21	Small /Medium NR Standard Performance Contract	Sm/Med NR	Performance based program that offers incentives (posted price) to customers or Energy Efficiency Service Providers (EESPs) for installation of energy efficient equipment at customer facilities.	1,943	7,770	1.5	0.25	1,262
SCE 22	Third Party Initiatives	Non Res - TPIs	Several projects targeted at the Non Res sector administered and/or implemented by third parties (apart from Summer Initiatives). Projects included: Vending Machine Retrofits, Duct Testing, "Green Schools" high school education	2,721	-	-	NA	NA

PGC-Funded/IOU-Administered: SCE								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
			program, "LivingWise" elementary school education program, CFL distribution, CFL torchiere replacement, etc.					
SCE 23	Emerging Technologies	Non Res - Upstream	demonstrating energy efficiency options not widely adopted by various market actors; program makes detailed designs of efficiency options and their performance information widely available.	300	-	-	NA	NA
SCE 24	Premium Efficiency Motor Distribution Incentives	Non Res - Upstream (Industrial) --> Motor Dealers	seeks to transform the market for premium efficiency three phase electric motors; seeks to sustain long-term market effects by both adapting to, and changing certain industry practices and attitudes pertaining to the distributors' method of motor acquisition, stocking, ready availability and final sale of premium efficiency electric motors through traditional motor distribution channels; uses an upstream financial incentive strategy for non-OEM motor distribution channel members to encourage stocking of qualifying motors.	363	858	0.2	0.42	2,015
SCE 25	HVAC Contractor Program	Non Res - Upstream (Commercial) --->HVAC installation contractors	Seeks to transform the market for nonresidential central air conditioners (a/c) and central heat pump units through an upstream financial incentive strategy for HVAC installation contractors. At the point of the equipment replacement market event, the program focuses on creating a "market pull" condition to increase penetration rates of a/c units at least one EER above Title 24 building codes, installed at small and	270	-	-	NA	NA

PGC-Funded/IOU-Administered: SCE								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
			medium nonresidential customer locations.					
	Subtotal	Non Residential		34,750	274,155	53.2	0.13	653
SCE 26	Residential New Construction Program	Res NC	Rebate	5,237	6,997	9.8	0.75	534
SCE 27	Savings By Design	Non Res New Construction	Statewide IOU program encouraging EE commercial building design and construction. Seeks to permanently reduce the transaction costs associated with developing and evaluating energy efficient design alternatives. Seeks to improve the comfort, efficiency, and performance of buildings by promoting an integrated team approach to design. The NR Retrofit and Renovation program is also covered under the SBD program although implementation may differ by utility.	7,573	61,031	9.4	0.12	803
SCE 28	Energy Design Resources	Non-Res New Construction	Integrated package of design tools and information resources that promote the design and construction of high-performance buildings. Website offers interactive resources and downloadable tools. Complements and generates project leads for Savings By Design. Validates and provides peer recognition for designers (architects, engineers, lighting designers, energy consultants) and developers of exemplary EE projects.	101	-	-	NA	NA
SCE 29	Third Party Initiatives	Non-Res New Construction	Several projects targeted at the New Construction (NC) sector administered and/or implemented by third parties (apart from Summer Initiatives). Projects included: EE	774	-	-	NA	NA

PGC-Funded/IOU-Administered: SCE								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
			initiatives at new manufactured houses, "E-Quest" design software, and local gov't NC initiatives.					
SCE 30	New Construction Codes & Standards	Code-setting bodies; standards- & ratings-setting bodies; stakeholders to specific codes; code enforcers	Objective to bring about energy efficiency upgrades in standards and codes. Develop and present a case for improvements for promising design practices and technologies to standards and code setting bodies. Eligibility: Code-setting bodies (e.g. CEC, DOE, FTC); Standards-setting, rating-setting, and research support organizations (e.g., ASHRAE); Stakeholders to specific code enhancements (e.g., BOMA); Code enforcers and enforcement organizations (e.g., California Building Officials), and managers of energy efficiency programs.	739	NA	NA	NA	NA
SCE 31	Local Government Initiative	Local governments	Support for local government initiatives to advance EE new construction at the community level. Initiatives may include the municipal planning and development approval processes, and the establishment of institutions or programs to mobilize and link community resources (e.g. local financial institutions, contractors, business organizations, service clubs, and non-profits, etc.) to form self-sustaining partnerships. Advise local governments on policies such as street width, tree canopies and building orientation that impact energy efficiency.	384	735	0.8	0.52	469
	Subtotal	New		14,807	68,763	20.1	0.22	738

PGC-Funded/IOU-Administered: SCE								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
		Construction						
	TOTAL	ALL SECTORS (not including Summer Initiative)		77,304	462,575	124.5	0.17	621

PGC-Funded/IOU-Administered: SDG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
SDG&E 01	Residential Statewide Energy Guide	Res - Info	Information guide for residential customers on energy efficient technologies, products, services and behavior modifications. (English and Spanish).	36.3	-	-	NA	NA
SDG&E 02	Information & Education	Res - Info	Info & educ. through exhibits at community events (e.g. Del Mar Fair), brochure distribution, and in-store displays	1,428.3	-	-	NA	NA
SDG&E 03	In-Store Energy Efficient Demonstration Co-op	Res - Info	In store kiosk program (at Dixieline and Home Depot) to provide information on various energy saving appliances.	90.8	-	-	NA	NA
SDG&E 04	Schools	Res - Info	Energy awareness program for K-6 students promoting benefits of energy conservation.	621.1	-	-	NA	NA
SDG&E 05	Energy Information Center	Res - Info	Trained representatives who answer customer calls on energy usage and efficiency.	216.6	-	-	NA	NA
SDG&E 06	Energy Management Services (EMS)	Res - EMS	Energy audits offered in three forms: In-Home, Mail-In, and On-Line. Direct CFL giveaway for participation	770.1	212	0.02	3.63	38,506
SDG&E 07	Downstream Appliance Incentives	Res - EE Incentives	Customer rebates to promote Energy-Star and DOE compliant appliances; over 80 participating retail outlets	1,488.6	1,294	0.11	1.15	13,533
SDG&E 08	Downstream Lighting	Res - EE Incentives	Replacement of halogen torchiere fixtures and/or incandescent bulbs with qualified, energy efficient lighting. Free promotion targeted at hard to reach lower income and elderly customers.	192.6	-	-	NA	NA
SDG&E 09	Multi-Family Rebate (MF Residential Contractor Program - RCP)	Res - EE Incentives	Rebates to MF property owners, managers or contractors who install efficiency measures in their rental units and/or complex common areas	3,113.3	9,069	0.4	0.34	7,783
SDG&E 10	Single-Family Rebate	Res - EE Incentives	Direct rebates and incentives to residential	3,416.3	1,983	6.55	1.72	522

PGC-Funded/IOU-Administered: SDG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
	(consolidated with SF RCP)		homeowners. Allows for customer to use utility-provided contractor, or contractor of their choice, or "do it yourself" option for installation					
SDG&E 11	Statewide Upstream Lighting	Res - upstream	Statewide program where utilities jointly participated in co-op projects with three manufacturers to promote ES torchieres and CFL bulbs to retailers. Incorporates SDG&E Lighting component, whereby SDG&E augmented statewide program with additional lighting manufacturer buy-downs.	2,123.3	31,133	2.76	0.07	769
SDG&E 12	Statewide Upstream Appliances	Res - upstream	Leverages relationships with appliance manufacturers and retailers to promote awareness and interest in Energy Star qualified appliances	53.4	-	-	NA	NA
SDG&E 13	Targeted Third Party Initiative	Res - upstream	Hard to Reach: fixed income and elderly senior citizens living in mobile homes, non-English speaking also a focus	589.8	486	0.89	1.21	663
SDG&E 14	Small complex self-sponsorship (SCSSP)	Res - MF	Small complex self-sponsorship (SCSSP)	5,052.0	44	-	114.82	NA
	Subtotal	Res		19,192.3	44,221.0	10.7	0.43	1,789
SDG&E 15	Information	Non Res - Info	Information on EE'y to introduce customers to state of the art EE technology through workshops and seminars	440.6	-	-	NA	NA
SDG&E 16	Energy Efficiency Financing (Energy Cents)	Non Res - Info	Cooperative effort between SDG&E and SAFE-BIDCO offering low-cost financing to small business customers for EE projects.	10.8	-	-	NA	NA
SDG&E 17	Building Operator Certification	Non Res - Info	Trains and certifies facility managers of commercial or governmental buildings to increase professional competence in EE building operation and	63.5	-	-	NA	NA

PGC-Funded/IOU-Administered: SDG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
			maintenance.					
SDG&E 18	Small Comprehensive Technical Assistance	Non Res - Info	Technical consulting to small and medium business customers from a pool of independent consultants for specific end use applications.	145.6	-	-	NA	NA
SDG&E 19	Process Technical Assistance	Non Res - Info	Provides customers with on-site information and support to make decisions regarding EE retrofits for process applications.	360.4	-	-	NA	NA
SDG&E 20	Building Efficiency Rating Tool	Non Res - Info	Pilot project "EnVINTA" tested on large business customers - offering building efficiency rating tool	68.0	-	-	NA	NA
SDG&E 21	Statewide Energy Guide	Non Res - Info	Printed resource providing energy information and education to customers to better manage their energy costs. Available in English, Spanish and Chinese	0.0	-	-	NA	NA
SDG&E 22	Energy Information Center	Non Res - Info	Expert hotline to assist customers with specific issues related to EE'y.	83.9	-	-	NA	NA
SDG&E 23	Energy Audits	Non Res - EMS	Comprehensive energy analysis and identification of EE opportunities for small and medium non-res customers following an on-site or on-line energy audit.	555.5	-	-	NA	NA
SDG&E 24	Emerging Technologies	Non Res - EE Incentives: Custom Rebates	Demonstration projects to showcase emerging EE technologies to large customers. In conjunction with Emerging Technologies Coordinating Council (ETCC), comprised of IOUs	79.5	-	-	NA	NA
SDG&E 25	Peak Load Reduction (TPI)	Non Res - EE Incentives: Custom Rebates	Solicitation of innovative ideas and technologies from large non-res electric customers or third parties for peak demand reduction projects. Targeted at large customers with peak demand over 500 kW.	1,230.5	7,646	1.42	0.16	867
SDG&E 26	Nonresidential Remodeling and Renovation (Tenant	Non Res - EE Incentives: Prescriptiv	Statewide program encouraging high performance non-res building design and	856.2	5,092	1.14	0.17	751

PGC-Funded/IOU-Administered: SDG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
	Improvement) (Savings By Design)	e Rebates	construction for facilities undergoing remodeling or renovation.					
SDG&E 27	Express Efficiency	Non Res - EE Incentives: Prescriptive Rebates	Statewide program providing standard rebates to customers for the installation of energy efficient equipment. Implemented through alliance of trade allies (contractors and distributors) and targeted to small and medium commercial customers.	2,397.9	29,956	6.04	0.08	397
SDG&E 28	Commercial Horizontal Washers Program	Non Res - EE Incentives: Prescriptive Rebates	Promotion of EE coin-operated horizontal clothes washers for laundromats and common-use laundry rooms in apartments, dormitories, and barracks.	289.5	168	NA	1.72	NA
SDG&E 29	"EZ" Turnkey Program	Non Res - EE Incentives: Prescriptive Rebates	Rebates to the smallest commercial customers with peak demand less than 50 kW, with special emphasis to customers in Enterprise-Zones.	647.4	1,743	0.41	0.37	1,579
SDG&E 30	Large Nonresidential Standard Performance Contract	Non Res - EE Incentives: B/C SPC	Helps businesses with monthly peak demands of 500kW or more replace inefficient equipment of a variety of efficient types. Fixed price, performance management protocols, payment terms and other operating rules of the program specified in the program procedure manual.	5,558.7	18,421	2.23	0.30	2,493
SDG&E 31	Small Business Standard Performance Contract	Non Res - EE Incentives: B/C SPC	Helps businesses with monthly peak demands under 500kW or more replace inefficient equipment of a variety of efficient types and offers other financial incentives. Fixed price, performance management protocols, payment terms and other operating rules of the program specified in the program procedure manual.	1,445.4	6,600	1.29	0.22	1,120
SDG&E 32	Building Recommissioni	Non Res - upstream	Demonstration of energy savings	202.5	502	NA	0.40	NA

PGC-Funded/IOU-Administered: SDG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
	ng TPI		potential for commissioning building systems to attain efficiencies intended by designers and equipment manufacturers.					
SDG&E 33	Retrofits in Leased Space TPI	Non Res - upstream	Demonstration of energy savings potential from retrofitting a leased space in at least one facility with multiple tenants to the tenants and building owners.	118.2	402	0.09	0.29	1,314
SDG&E 34	Midstream HVAC	Non Res - upstream	Incentives to contractors to promote and install high efficiency HVAC units.	264.3	212	0.21	1.25	1,258
SDG&E 35	Upstream Motors	Non Res - upstream	Financial incentives designed to improve the current stocking practices and installation of motors by local motor dealers by increasing the inventory stock of premium efficiency motors.	103.0	216	0.03	0.48	3,432
	Subtotal	Non Res		14,921.4	70,958	12.9	0.21	1,160
SDG&E 36	Home Energy Partnership Program (HEPP) - Appliances	Res - New Construction	Rebates for the purchase of qualifying Energy Star appliances in newly constructed single- or multi-family homes through participating design centers.	490.9	491	0.05	1.00	9,818
SDG&E 37	HEPP - Single-Family	Res - New Construction	Design assistance, advertising/marketing support, and incentives to builders, developers and design teams to encourage the design and construction of highly EE homes and duplexes.	884.6	1,380	0.57	0.64	1,552
SDG&E 38	HEPP - Multi-Family	Res - New Construction	Design assistance, advertising/marketing support, and incentives for the incorporation of EE features in multi-family residential buildings with three or more units.	1,010.6	2,272	0.91	0.44	1,111
SDG&E 39	Industry & Consumer Information and Promotion	Res - New Construction	Marketing support for all residential new construction programs, including HEPP, to encourage awareness of energy efficient housing.	184.5	-	-	NA	NA

PGC-Funded/IOU-Administered: SDG&E								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
SDG&E 40	California Home Energy Rating System (CHEERS)	Res - New Construction	Statewide standardized certification of new and existing constructions as a tool to assure quality of EE measures and validate (resale) value.	31.1	-	-	NA	NA
SDG&E 41	CEC Public Interest Energy Research (PIER)	Res - New Construction	Supports efforts in testing and demonstrating new EE technologies. Funding discontinued in early 2001, with funds redirected to HEPP - MF and to Builder Training.	0.0	-	-	NA	NA
SDG&E 42	Builder Training	Res - New Construction	Training seminars offered to builders, architects, and other members of the new construction industry. Training coordinated with Building Industry Association (BIA) and American Institute of Architects (AIA).	0.0	-	-	NA	NA
SDG&E 43	Savings By Design	Non Res - New Construction	Statewide program that provide information, technical assistance and financial incentives to building owners, architects, engineers, and design teams to promote the design and construction of EE facilities.	3,297.7	30,039	5.96	0.11	553
SDG&E 44	Energy Design Resources	Non Res - New Construction	Integrated package of design tools and information resources designed to work in concert with Savings By Design.	344.3	-	-	NA	NA
SDG&E 45	Industrial and Agricultural Process	Non Res - New Construction (Ag & Ind)	Folded into "Savings By Design" since SDG&E's ind & ag mkts are small	752.7	-	-	NA	NA
SDG&E 46	Codes and Standards Support & Local Government Initiatives	Other New Construction	Statewide program; cooperation with state and local governments to facilitate, educate, train and support people who implement and develop energy codes, standards and initiatives.	508.1	-	-	NA	NA
	Subtotal	New Construction		7,504.5	34,182	7.5	0.22	1,002
	TOTAL	All Sectors		41,618.2	149,361	31.1	0.28	1,339

PGC-Funded/IOU-Administered: SoCalGas								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**		**$/kW**
SCG 01	Energy Facts	Res - Info	Provides energy efficiency information to residential customers through SoCalGas website.	100.0	544	0.45	0.7	889
SCG 02	Statewide Residential Energy Guide	Res - Info	Distribution of Statewide Energy Guide print copies as well as management of online information resource. Available in multiple languages.	300.0				
SCG 03	Home Energy Fitness Program	Res - EMS	Individualized assessments of residential customers' home energy usage and recommendations for energy efficiency. Direct mail campaign was outsourced and online audit service was launched.	783.0	81	0.1	9.7	7,830
SCG 04	Residential Contractor Program	Res - EE Retrofit	Rebates/incentives provided to single- and multi-family customers for the installation of high-efficiency furnaces, water heaters and windows. Rebates also provided for ceiling and wall insulation, duct testing and sealing, programmable thermostats, and low-flow showerheads. Multifamily efforts centered on installation of water heater and boiler controllers.	5,457	598	0.7	4.8	4,198
SCG 05	"Livingwise" Schools Program	Res - EE Incentive	School to home effort designed to educate homeowners and provided elementary school students and their families with energy efficiency information.		544	0.6		
SCG 06	Upstream High Efficiency Water Heater Program	Res - EE Incentive	Incentives provided to distributors and retailers to encourage the stocking of high efficiency gas water heaters	624	-	-	7.7	6,568
SCG 07	CHEERS	Res - Upstream	Support for home energy ratings		-	-		

PGC-Funded/IOU-Administered: SoCalGas								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**		**$/kW**
SCG 08	Energy Efficiency Renovation Service - "Performance 4"	Res - Upstream	Promotion of whole house conservation approaches through formal certification process to validate the value of energy efficiency improvements		81	0.1		
SCG 09	Residential Upstream Gas Air Conditioning Program	Res - Upstream	1) Promotion of the replacement of existing, older, inefficient 2-5 ton natural gas air conditioning units; 2) support for the development of natural gas heat pump; 3) support for continued commercialization of energy efficient natural gas air conditioning units		-	-		
SCG 10	Emerging Technologies Residential Appliances	Res	Commercialization of emerging, high-efficiency, gas-fired residential technologies.	57	-	-	NA	NA
SCG 11	Statewide Residential Appliances Program	Res	Rebates for high efficiency clothes washers and dishwashers	526	-	-	NA	NA
	Subtotal	Residential		7,847	1,848	1.9	4.2	4,034
SCG 12	Non Residential Information Program	Non Res - Info	Support Center Hotline and the Equipment and Services Directory (online).	2,981	-	-	2.7	NA
SCG 13	Energy Resource Center	Non Res - Info	Space to demonstrate benefits of high-efficiency technologies.		-	-		
SCG 14	Non Residential HVAC Training	Non Res - Info	Train HVAC contractors in the proper installation of gas cooling systems.		-	-		
SCG 15	Coin Laundry and Dry Cleaner Program	Non Res - Info	Awareness among laundry and dry cleaner owners and operators, for efficient boilers, washers, and dry cleaning equipment. Rebates for high-efficiency clothes washers.		-	-		
SCG 16	Lodging Industry Education Program	Non Res - Info	Promote EE awareness among small hotel and motel owners and operators. .		-	-		
SCG 17	Mobile Energy Clinic	Non Res - Info	Energy efficiency evaluations and maintenance to hard-to-reach small commercial customers		1,098			

PGC-Funded/IOU-Administered: SoCalGas								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**		**$/kW**
SCG 18	Statewide Business Energy Guide	Non Res - Info	Distribution of Statewide Energy Guide print copies as well as management of online information resource. Available in multiple languages.					
SCG 19	Commercial Energy Management Services Program	Non Res - EMS	During 2001, 539 Commercial Standard Audits and 51 "Super Audits" - more extensive. Audits performed either when new customers come on-line or upon significant change in a customer's plant operations.	3,662	-	0.2	1.1	3,980
SCG 20	Industrial Energy Management Services Program	Non Res - EMS	During 2001, 329 Industrial Standard Audits and 49 "Super Audits" - more extensive. Audits performed either when new customers come on-line or upon significant change in a customer's plant operations.		-			
SCG 21	Energy Edge	Non Res - EMS	Third-party implemented project to provide evaluation of EE retrofit options available to customers. SCG shares cost of services with customers.		3,372	0.7		
SCG 22	Commercial Equipment Replacement Program	Non Res - EE Incentives	Comprised of four components: (1) Integrated Food Service Retrofit; (2) Comprehensive Space Conditioning Efficiency Improvement; (3) Advanced Water Heating Systems; (4) Advanced Engine Technology.	5,567	-	-	NA	NA
SCG 23	Industrial Energy Efficiency Incentives Program	Non Res - EE Incentives	Comprised of two components: (1) Furnace/Kiln/Oven (targets - industrial process equipment); and (2) Process Energy Conservation		-	-		

PGC-Funded/IOU-Administered: SoCalGas								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**		**$/kW**
SCG 24	Statewide Express Efficiency	Non Res - EE Incentives	Prescriptive rebates for a variety of high efficiency gas equipment and retrofit measures offered to small- and medium-sized non res customers. 463 applications processed in 2001, of which 219 were for storage water heaters.		-	-		
SCG 25	Emerging Technologies Program	Non Res - Upstream	Supports deployment of new, advanced technologies, applications and best practices available for sale in California.	1,522	-	-	12.1	16,911
SCG 26	Small Commercial Upstream Gas Air Conditioning	Non Res - Upstream	Promoted awareness of qualifying efficient natural gas AC engine-driven and absorption units. Qualifying units minimum 5 tons and min COP of 0.62. In 2001, 392 tons of unitary gas cooling projects were installed.		126	0.1		
SCG 27	High Efficiency Medium Tonnage Natural Gas Cooling Field Demo	Non Res - Upstream	Targeted TPI aimed at finding and implementing medium-tonnage (25-200 ton) gas cooling projects with COP of 1.0 or above. In 2001, 462 tons of gas cooling installed as a field demonstrations.		-	-		
	Subtotal	Non Residential		13,732	4,596	1.0	3.0	13,596
SCG 28	New Energy Advantage Home Program	Res - New Construction	Primary focus on promoting the installation of high performance duct systems in new single family homes. In 2001, SCG had enrolled 24,732 production builder lots in the program.	6,062	4,857	4.3	1.2	1,406
SCG 29	Statewide Savings By Design	Non Res - New Construction	Statewide program promoting high performance commercial building design and construction. Emphasis on reducing transaction costs associated with developing and evaluating EE design alternatives.	1,089	3,359	1.7	0.3	626

PGC-Funded/IOU-Administered: SoCalGas								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**		**$/kW**
SCG 30	Statewide Codes and Standards Programs	New Construction - upstream	Support for AB 970 emergency rulemaking processes for both California Title 24 & 20. Activities included participation in public workshops and meetings, support and advocacy for code change through the end of Phase II of the rulemaking, and training for code officials, contractors, T-24 consultants and other groups.	297	NA	NA	11.9	NA
SCG 31	Local Government Initiatives	New Construction - upstream	Support for local government initiatives to transform EE markets at community level. For 2001, implemented 3rd party to solicit targeted public housing authorities. Targeted low-income new construction.		25	NA		
	Subtotal	New Construction		7,448	8,241	6.1	0.9	1,231
	TOTAL	ALL SECTORS		29,027	14,685	9.0	2.0	3,223

Summer Initiatives								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**		**$/kW**
	STATEWIDE SUMMER INITIATIVE							
SI 01	California Oil and Gas Pumping (COPE)	Industrial	Incentives for high-efficiency pump and motor retrofits for large oil and gas producers and pipelines. SCE and PG&E territories.	4,028.3	41,198	6.0	0.70	3,785
SI 02	"Beat the Heat" Halogen Torchiere replacement with CFL torchieres	C&I	CPUC Statewide Summer Initiative. TPI - administered by Ecos Consulting across IOUs. SDG&E was the contract manager	544.1	7,183	4.0	0.09	90
SI 03	ARCA Refrigerator Recycling	Res	CPUC Statewide Summer Initiative. TPI - administered by ARCA across IOUs. SCE was contract manager. Cash incentive for refrigerator recycling (must be 10 cu. ft. or larger and in working condition); ARCA picks up old appliance at no charge to customer and recycles in environmentally safe manner;	7,859.0	50,922	9.1	0.17	612
SI 04	Pool Pump Efficiency	Res	CPUC Statewide Summer Initiative. Administered by each IOU in its service territory. Financial incentives to residential pool owners for the purchase and installation of high efficiency pool pumps and the re-set of pool pump timers to run during summer off-peak hours. Program Components: (a) high efficiency pool pumps; (b) time-of-day controls; (c) information to build awareness of pool energy consumption and shifting to off-peak hours	7,609.0	21,147	69.8	0.24	2,143
SI 05	UC/CSU Campus Efficiency Projects	C&I	CPUC Statewide Summer Initiative. Administered by each utility in its service territory.	5,301.2	22,393	9.7	0.63	2,060
SI 06	LED Traffic Signals	Muni Gov't		22,524.3	95,382	16.3	0.47	1,314
SI 07	Res-Team:	Res	CPUC Statewide	12,253.4	25,969	9.3	0.25	7,500

Summer Initiatives								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**		**$/kW**
	Hard to Reach		Summer Initiative. Administered by each utility in its service territory.					
	INDIVIDUAL UTILITY SUMMER INITIATIVES						3.70	15,667
SI 08	SDG&E - Whole House Fans	SDG&E - Res	Promoted use of whole house fans instead of central ACs. Incentives? Typical energy bill savings of $100 per year.	104.2	149	2.0	0.99	4,967
SI 09	SDG&E - Halogen Torchiere Turn In Event	SDG&E - Res	Turn in event for halogen torchieres at nursing homes.	32.4	388	0.0	0.12	592
SI 10	PG&E: Presidio Trust: Energy Efficiency Measures	residential and commercial	PG&E; lighting and motor retrofits	503	885	0.1	0.26	383
SI 11	PG&E: Humboldt Creamery: Energy Efficiency Measures	Industrial	PG&E; installation of energy efficient pumps and motors	105	417	0.0	5.81	1,741
SI 12	PG&E: City of Oakland: EE Design Assistance	commercial buildings	PG&E; energy efficient recommendations for improved building designs for new construction and existing buildings being renovated	329	89	0.0	NA	NA
SI 13	PG&E: City of Oakland: Museum Chiller Replacement	commercial building	chiller replacement at Oakland Museum	298	300	0.1	NA	NA
SI 14	SDG&E Third Party Initiatives	Commercial	Six peak load reduction projects at commercial locations	816.6	6,797	1.4	NA	NA
SI 15	SCE Third Party Initiatives	Res and Non Res	6 projects/sub-programs designed to solicit innovative strategies and technologies from the marketplace. For 2001, there was a greater focus on cost-effectiveness and on projects aimed at achieving energy savings and demand reductions beginning in the summer of 2001.	919.6	3,479	2.4	NA	NA
SI 16	PG&E Third Party Initiatives	One residential program, 12 commercial programs	PG&E in its service area; 13 contracts with various vendors for energy efficient equipment installation	8,748	1,505	5.0	NA	NA

CEC								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
CEC 01	ECAA Energy Efficiency Financing: Public Agency 3% Loans and Grants	Business/ Commercial	3% loans to public agencies and non-profits for projects that reduce peak period demand	2,100	18,000	5.3	na	na
CEC 02	LED Traffic Signals	Cities and Counties	Grants provided to replace standard traffic signal lights with LEDs for demand savings.	6,770	45,220	5.4	0.15	1,254
CEC 03	"Cool Savings" or "Cool Roofs"	Business/ Commercial	Incentives for low-energy building roofing materials or other energy saving materials	2,788	NA	4.1	NA	680
CEC 04	Innovative Peak Load Reduction Program	Business/ Commercial	Third parties compete for incentives to implement innovative measures reduce peak demand. Broad range of projects accepted.	2,119	NA	9.4	NA	225
CEC 05a	Agriculture Peak Load Reduction Program: Peak Efficiency	Agriculture	Assists agriculture and food processing industries in reducing peak demands. High-efficiency equipment; retrofit gas to alternative fuels; manure methane power grants; anaerobic digestion of biosolids and animal wastes	838	NA	8.2	NA	102
CEC 05b	Agriculture Peak Load Reduction Program: Pump Repair	Agriculture	Assists agriculture and food processing industries in reducing peak demands. High-efficiency equipment; retrofit gas to alternative fuels; manure methane power grants; anaerobic digestion of biosolids and animal wastes	241	2,546	na	0.09	na
CEC 06	Water Agency Generation Retrofits	Water/Wastewater	Financial Assistance for water and wastewater agencies to retrofit generators	0	0	0	na	na
CEC 07	Water/Wastewater Treatment Facilities Peak Load Reduction Program	Water/Wastewater	Financial Assistance for water and wastewater agencies to retrofit generators	1,287	NA	5.6	NA	230
CEC 08	State Buildings	Non Res (Gov't)	Energy efficiency improvements and demand responsiveness measures at: (a) six	2,581	59,000	23.4	0.04	110

CEC								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
			CSU campuses; (b) 3 UC campuses; (c) demand curtailment at 31 UC/CSU campuses; (d) demand curtailment at Dep't of Corrections facilities; and (e) emergency demand response at 174 State building sites					
	TOTALS			18,654	124,766	61.4	0.15	304

Municipal: LADWP								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
LADWP 01	CLEO Lighting Program	Non Res (C&I)	Cash incentives for the installation of qualifying lighting products for small to medium-sized commercial customers; rebate of $400 per peak kW reduced with lighting system retrofits	$7,017	6,106	19.0	$1.15	$370
LADWP 02	Refrigeration	Non Res (Sm Comm)	Free tune-ups of refrigeration equipment for small commercial customers (e.g. small grocery stores, florist shops, small restaurants); performed by contractors	$47	410	0.1	$0.11	$416
LADWP 03	HVAC Incentives Program	Non Res	(1) Rebates on AC Tune-Ups performed by pre-qualified contractors - $60 co-pay per commercial unit and $40 co-pay per residential unit; (2) Contractor incentives for installing Energy-Star rated heat pump and AC units	$3,712	2,937	33.8	$1.26	$110
LADWP 04	Chiller Efficiency Program	Non Res (C&I)	Cash incentives and consulting for owners and operators of buildings and manufacturing plants to purchase water-cooled or air-cooled chillers	$8,160	3,714	35.0	$2.20	$233
LADWP 05	Cool Roofs	Non Res (Commercial) and MF residential property owners	Administered by CEC and LADWP; incentive payments to building owners or property managers: $0.15/sqft for cool rooftop ducts;	$238	36	0.4	$6.64	$564

Municipal: LADWP								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
			$0.20/sqft for refrigerated bldgs; $0.15/sqft for non-res and MF-res bldgs; $0.05/sqft for roof insulation (if pre-existing <= R-5 and if R-2 or greater insulation is added in conjunction with qualifying cool roof)					
LADWP 06	Reflective Film Program	Non Res (Comm)	Cash incentives to window-firm installers for the installation of qualifying reflective film to interior surface of non-North facing, non-shaded, exterior single pane windows enclosing electrically air-conditioned spaces during July - Sep 2001	$93	13	0.1	$7.15	$758
	Subtotal:	Non Res		$19,267	13,216	88.4	$1.46	$218
LADWP 07	Cool Schools	Tree Shading (Campus)	Shade tree planting at schools	$-	NA	NA	NA	NA
LADWP 08	Trees for a Green LA	Tree Shading (Res)	Distributing trees for shade planting to residential customers, along with an promotional campaign	$-	NA	NA	NA	NA
	Subtotal:	Other		$-	-	-	NA	NA
	TOTAL	All Sectors		$19,267	13,216	88.4	$1.46	$218

Municipal: SMUD								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh		**$/kWh**	**$/kW**
SMUD 01	Project Completion Incentives	Non Res (C & I)	Customized incentives for various energy efficiency retrofit measures	$1,065	12,100	3.4	$0.06	$345
SMUD 02	Prescriptive HVAC Replacement Incentives	Non Res (C & I)	Incentives for high-efficiency HVAC equipment installations	$116	400	0.2	$0.15	$406
SMUD 03	Prescriptive Motor Replacement Incentives	Non Res (C & I)	Incentives for motors that meet CEE standards	$3	20	0.01	$0.08	$387
SMUD 04	Energy-Efficient Motor Systems	Non Res (C & I)	Recommendations & tech support to promote use of efficient motors	$175	1,300	0.19	$0.12	$846
SMUD 05	Agricultural and Water District Pump Testing	Non Res (C & I)	Pump testing and recommendations to encourage improved pump performance and reduced energy requirements	$137	NA	NA	NA	NA
SMUD 06	Small Commercial Prescriptive Lighting	Non Res (Sm C&I)	Installation of prescribed lighting efficiency measures	$196	NA	NA	NA	NA
SMUD 07	Small C/I HVAC/Refrigerator Tune-Up	Non Res (Sm Comm)	Check and correct refrigerant charge and air flow, perform cleaning of refrigeration systems, rooftop A/C	NA	NA	NA	NA	NA
SMUD 08	Building Controls Retrocommissioning	Non Res (C & I)	Identify low-/no-cost operational improvements to building controls, train building operators	$100	600	0.04	$0.12	$2,632
SMUD 09	Compressed Air Initiative	Non Res (Ind)	Provide customers with skills and tools needed to identify air compressor inefficiency and misapplication, reduce leakage, and recommend system improvement	NA	NA	NA	NA	NA
SMUD 10	Resource Conservation Management	Non Res (Schools)	Resource Conservation Managers at school districts identify opportunities for energy, water, and waste disposal savings in school facilities	NA	NA	NA	NA	NA
SMUD 11	Cool Roofs	Non Res (C&I)	Provides rebates for application of reflective roof coating that reduces A/C load	$392	NA	NA	NA	NA
SMUD 12	Vending Machine Control	Non Res (C&I)	Provide peak load reduction and energy savings by controlling	$153	NA	NA	$0.06	$954

Municipal: SMUD								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh		**$/kWh**	**$/kW**
			beverage vending machine operation					
	Subtotal: Non Res			$2,337	14,420	3.84	$0.09	$568
SMUD 13	Home Auditing Program	Residential	Provide energy efficiency recommendations via in-home, CD-ROM, web-based, and paper questionnaire energy audits	$1,233	NA	NA	$4.47	$27,406
SMUD 14	Residential HVAC Rebates	Residential	Provides consumer rebates for purchase of Energy Star rated central A/C & heat pump units	$355	NA	NA	$0.88	$390
SMUD 15	Residential Equipment Efficiency Improvement	Residential	Provides rebates & financing for purchase of energy efficiency measures--included incentives to distributors of central A/C & heat pumps	$709	NA	NA	$0.38	$429
SMUD 16	Duct Improvement Program	Residential	Provides rebates on diagnostic testing and sealing of residential HVAC ducts	$473	NA	NA	$1.06	$1,463
SMUD 17	Residential Appliance Efficiency	Residential	Provides rebates for Energy Star rated clothes washers & room air conditioners & refrigerators	$1,031	NA	NA	$1.17	$9,123
SMUD 18	Refrigerator Recycling	Residential	Provides incentives to consumers who relinquish operational older refrigerators & freezers	$653	NA	NA	$0.14	$977
SMUD 19	Residential Energy Star Lighting	Residential	Utilizes various incentives and partnerships with retailers and manufacturers to promote increased use of Energy Star lighting products	$921	NA	NA	$0.22	$951
SMUD 20	Solar Domestic Hot Water	Residential	Provides rebates to promote solar water heating as a replacement for electric water heating in single-family homes	$229	NA	NA	$2.70	$17,643
SMUD 21	Shade Tree Program	Residential	Provides free trees for planting in locations that effectively shade dwellings	$1,500	NA	NA	$1.68	$4,165
	Subtotal: Non Res			$7,103	0	0.00	$0.52	$1,405
SMUD 22	C/I New Construction	New Construction (Non Res)	Provide education & technical assistance to encourage increased energy efficiency in	$603	NA	NA	$0.25	$508

Municipal: SMUD								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh		**$/kWh**	**$/kW**
			new commercial construction					
SMUD 23	Residential New Construction	New Construction (Res)	Provides incentives to production home builders for improvements in Title 24 cooling budgets	$840	NA	NA	$0.15	$162
	Subtotal: New Construction			$1,443	0	0	$0.18	$227
	TOTAL	ALL SECTORS		$10,883	14,420	3.84	$0.23	$701

Local: City of Berkeley								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
BRK 01	Berkeley Conservation and Energy	Res	Retailing Energy Efficiency Products (Farmers Markets, etc.)	NA	96	NA	NA	NA
BRK 02	Residential Energy Conservation Ordinance (RECO)	Res	10 measures required at point of sale or major renovation	NA	NA	NA	NA	NA
BRK 03	California Youth Energy Services	Res	Youth-based home weatherization	NA	353	NA	NA	NA
BRK 04	"Berkeley Unplugged"	Res	Residential Energy Conservation Contest	3	0	NA	9.69	NA
	Subtotal:	Res		3	449	-	0.01	NA
BRK 05	Commercial Energy Conservation Ordinance (CECO)	Non Res	32 measures required at point of sale or major renovation (whole bldg, not just renovated area)	NA	NA	NA	NA	NA
BRK 06	Municipal efficiency retrofits (LED Traffic Signals)	Non Res (Muni)	In 2001 LED traffic signals were installed. Measures change each year (Phase 2 of 3-phase green conversion)	42	NA	NA	NA	NA
	Subtotal:	Non Res		42	-	-	NA	NA
BRK 07	Berkeley's Best Builders	New Constructio n	Custom green building design assistance for new construction	NA	NA	NA	NA	NA
	TOTAL	All Sectors		45	449	-	0.10	NA

Local: City of San Francisco								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
SF 01	MECA (Mayor's Energy Conservation Account)	C&I	Funding for energy efficiency capital cost projects at city facilities and agencies – no implementations completed in 2001.	5,000	-	-	NA	NA
SF 02	Power Savers (Commercial Lighting)	C&I - Small Business	Small business energy efficiency audits at no charge. CPUC funded	150	214	0.1	25.23	83,864
SF 03	"Green Buildings"	C&I	A SF ordinance (code) for resource-efficient municipal buildings	250	NA	NA	NA	NA
	TOTAL			5,400	214	0.06	NA	NA

Targeted Other State Programs								
Code	**Name**	**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
	Department of General Services (DGS)							
OTH 01	State Building Retrofits	C&I	Energy efficiency retrofits at state buildings and facilities	40,000	NA	30	NA	1,333
	California Conservation Corps (CCC)							
OTH 02	Mobile Efficiency Brigade	Res	17-week campaign providing CFLs to residents in "working class neighborhoods" door-to-door	20,000	NA	122	NA	164
	TOTAL			60,000	NA	152	NA	395

20/20 Rebate & Residual Effects								
Code		**Area**	**Description**	**Cost ($000s)**	**Reported Savings**		**Cost per Reported Savings**	
					MWh	**MW**	**$/kWh**	**$/kW**
	California Department of Consumer Affairs							
FYP	Flex Your Power	All	Mass media campaign promoting conservation behavior and load shifting (away from peak hours).	65,000	NA	2,616	NA	159
	Department of Water Resources							
20-20	The "20/20" Program (public awareness & rates)	All	Rebate applied to energy bills of IOU customers who reduced monthly energy use compared to same month in 2000.	350,000	5,258,000		0.07	
	TOTAL			415,000	5,258,000	2,616	0.08	159

B APPENDIX B: SELECTION OF PROGRAMS FOR DETAILED REVIEW

Program Segmentation Framework

Within our defined scope of coverage (see section 1.2) we identified 218 programs, which were administered by a number of different entities and funded through a variety of sources. Given the sheer number of programs under coverage and the resource constraints of the project, the project team decided to perform two levels of analysis:

- A faithful collection and assessment of information for all 218 programs, including energy and demand savings and costs as provided by program sponsors, administrators, and/or implementers. For program costs, we noted the budgeted and reported actual cost of each program in 2001. To the extent that it was documented, we indicated the components of cost that are included in these reported cost figures. These components could include: administrative cost, marketing cost, incentive cost, and measurement and evaluation cost.
- A detailed review of a selected subset of programs, including careful comparisons of savings estimates among similar programs or measures across multiple implementers or evaluators. In particular, a comparison of assumptions, such as net-to-gross ratios and unit-savings estimates across comparable programs and against benchmarks accepted and used in California, such as the DEER database and other evaluative studies. As deemed appropriate, we suggested adjustments to the reported savings that would "normalize" them using a consistent set of assumptions, resulting in savings ranges. In addition, we estimated the anticipated persistence of savings from these programs, based on the effective useful lives of the measures installed, at three future points: 1 year, 6 years, and 15 years after the installation or implementation year.

Working with the Advisory Committee, we developed a framework to determine a manageable number of programs most appropriate for detailed review. We classified all programs according to a segmentation scheme along two dimensions: (1) size of reported energy (MWh) savings, and (2) the amount of data that seemed to be available to support those savings. Figure B-1 shows the distribution of 218 programs across the segments we created along these two dimensions.

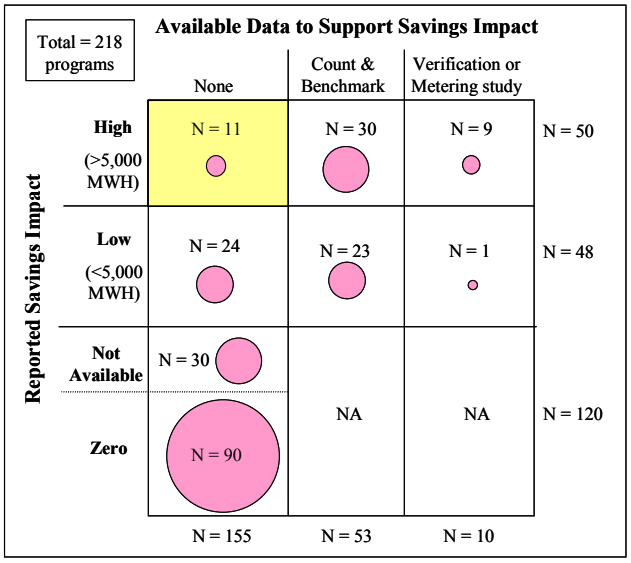


Figure B-1
Program Distribution Matrix

Selection of Programs for Review

We focused our detailed review on those programs that reported large energy savings (in our segmentation, greater than 5,000 MWh), for which we had not located documentation to substantiate those savings claims after two months of investigation. As stated in section 3.2, this selection was based on the belief that little would be learned from scrutinizing programs with good supporting information, and that little would change in the overall savings total from scrutinizing programs with low reported savings.

As a starting point, we considered the 11 programs in the upper left cell of Figure B-1 for which reported first-year savings exceeded 5,000 MWh and for which we were not able to locate substantive backup information. These 11 programs are listed in Table B-1.

Table B-1
High Impact, No Data Program Set (as of September 9, 2002)

Administrator	Program	Reported MWh Impact
MUNI		
SMUD	Residential New Construction	5,464
SMUD	C&I Incentives for Retrofit Measures	19,000
Summer Initiative		
ARCA (TPI)	Residential Refrigerator Recycling	64,960
ECOS (TPI)	"Beat the Heat" Halogen Torchiere Replacement (C&I)	7,183
UC/CSU (TPI)	UC/CSU Campus Efficiency Projects	22,393
C.O.P.E. (TPI)	Oil Pumping Efficiency – PG&E service territory	29,223
C.O.P.E. (TPI)	Oil Pumping Efficiency – SCE service territory	11,975
IOUs	Residential Pool Pump Efficiency	21,147
IOUs	LED Traffic Signals	95,382
IOUs	Res Team: Hard to Reach	25,969
Various (TPIs)	Third Party Initiatives – SDG&E service territory	6,797

We then modified this list as follows:

- Added the **20/20 Rebate** program, which carries a massive reported savings of 3,800,000 MWh.[36] Our treatment of the 20/20 Rebate assumes:
    - 100% overlap (i.e., full double counting) between the impact of 20/20 Rebate and IOU energy-efficiency programs.
    - Credit IOU programs 100% and 20/20 Rebate 0% for overlapping savings.
- On this simplified basis, we estimated the energy savings for these IOU programs during the months in which 20/20 Rebate was in place and subtracted this number from the 20/20 Rebate total to arrive at a "net" savings impact for 20/20 Rebate. We also discuss a more analytically rigorous approach to resolving the 20/20 Rebate double-counting issue that could be applied in a Phase II study.
- Collapsed the California Oil Producers Electricity Cooperative (COPE) Oil Producers Fluid Pump Efficiency program in the PG&E and SCE territories into one program, since they were both implemented in the same manner by COPE.
- Added the **SMUD Residential Refrigerator Recycling** program to allow for comparison with the ARCA-administered program and other relevant benchmark programs and unit savings assumptions. This program also reported energy savings of 4,808 MWh, which approaches the 5,000 MWh cut-off for "high" impact in our program mapping.

[36] Adjusted savings figure provided by Charles A. Goldman et al of Lawrence Berkeley National Laboratories. "California Customer Load Reductions during the Electricity Crisis" Did They Help Keep the Lights On?" May 2002.

- Set aside **SMUD Residential New Construction Incentives** with the assumption that underlying savings assumptions will be comparable to those of IOU residential new construction programs
- Added **City of San Francisco "Power Savers"** small-business lighting program to represent the local government set of programs
- Added **CEC LED Traffic Signals** program to represent the CEC set of programs and to provide a comparison to the LED Traffic Signals Summer Initiative program.
- Added **CEC State Buildings** program to represent another CEC program and add another program to the Assorted Commercial & Institutional Projects category.
- Added **California Conservation Corps "Mobile Efficiency Brigade" / "PowerWalk"** to represent the set of broad state programs. This program was somewhat comparable to the Hard-to-Reach Summer Initiative program, inasmuch as compact fluorescent light bulbs were one of primary measures included in the Hard-to-Reach program

Table B-2 lists the 15 programs that we ultimately selected for detailed review. Programs from every type of administrative entity are included in this list, although none of the CPUC-funded IOU programs are included. This is because, although these programs together accounted for the lion's share of the reported savings (not counting the 20/20 Rebate savings), they generally had more complete documentation of savings. As a result, they were not among the original 11 programs in the "High Reported Savings & None (Available Data)" cell of the Program Distribution table.

Table B-2
Programs Selected for Detailed Review

Program Group[1]	#	Program End-Use Category [2]	Program	Reported MWh Impact	
#1 PGC-Funded, IOU-Administered					
	-	-	*none*	na	
#2 Summer Initiative					
Statewide TPI	1	[a]Residential Refrigerator Recycling	ARCA: Residential Refrigerator Recycling	64,960	*
	2	[b]C&I Lighting	ECOS: "Beat the Heat" Halogen Torchiere Replacement	7,183	*
	3	[c]Assorted C&I Projects	UC/CSU Campus Efficiency Projects	22,393	*
Statewide Utility	4	[d]Residential Pool Pumps	Residential Pool Pump Efficiency	21,147	*
	5	[e]Residential Hard to Reach (CFLs)	Res Team: Hard to Reach	25,969	*
	6	[f]LED Traffic Signals	LED Traffic Signals	95,382	*

Program Group[1]	#	Program End-Use Category [2]	Program	Reported MWh Impact	
Utility TPI[4]	7	[c]Assorted C&I Projects	SDG&E: SI Third Party Initiatives (6 projects)	6,797	*
Local TPI[4]	8	[g]Oil Pumping Efficiency	COPE: Oil Pumping Efficiency (PG&E & SCE service territories)	41,198	*
#3 CEC Programs					
CEC	9	[f]LED Traffic Signals	CEC: LED Traffic Signals	45,220	
	10	[c]Assorted C&I Projects	CEC: State Buildings	59,000	
#4 Major Municipal Programs					
SMUD	11	[c]Assorted C&I Projects	SMUD: Project Completion Incentives (Retrofit Measures)	19,000	
SMUD	12	[a]Residential Refrigerator Recycling	SMUD: Residential Refrigerator Recycling	4,808	
#5 Locally Administered SBx1 5					
San Francisco	13	[b]C&I Lighting	City of San Francisco: "Power Savers"	214	
#6 Targeted Other State Programs					
CCC[5]	15	[e]Residential Hard to Reach (CFLs)	California Conservation Corps (CCC): Mobile Efficiency Brigade / "PowerWalk"	NA	
#7 20/20 Rebate and Residual Effects					
DWR[6]	14	[h] 20/20 Rebate	20/20 Rebate	5,258,000	

Notes

[1]These six program groups were specified in Global's Revised Research Plan submitted on June 21, 2002. The group "State Public Awareness" was changed to "Broad State Programs" to more accurately describe the programs contained therein.

[2]These fifteen programs can be grouped into eight distinct end-use categories, which are designated with letters from "[a]" through "[h]."

[3]Asterisk denotes that the corresponding program had been grouped in the *High Reported Savings & None (Available Data)* cell of the Program Distribution table shared with the Advisory Committee on September 9, 2002.

[4]TPI is an acronym for Third Party Initiative

[5]CCC is an acronym for the California Conservation Corps

[6]DWR is an acronym for the California State Department of Water Resources; the 20/20 program was funded through DWR

We considered several factors in the development of this list of 15 programs, including:

- Representation of as wide a variety of program groups (i.e., local, municipal, CEC, third-party, broad state, etc.) as feasible.
- Capturing as many programs as feasible from the "High Reported Savings & None (Available Data)" cell of the Program Distribution Matrix (Figure B-1) shared with the Advisory Committee on September 9, 2002, reflecting programs with reported savings in 2001 in excess of 5,000 MWh and with no supporting underlying data received as of September 9, 2002. Programs accounted for in this cell are denoted with an asterisk on Table B-2.[37]
- Selecting programs that fall into logical groupings by end-use application to facilitate comparison of assumptions between chosen programs, in addition to comparisons to benchmarks established by the IOUs and recognized databases such as DEER and the Xenergy Commercial Potential Study.[38]

Here is a brief explanation for the inclusion of each program on the review list:

#1 ***ARCA Residential Refrigerator Recycling (Summer Initiative)***

- high profile, statewide Summer Initiative TPI implemented in SCE, SDG&E and PG&E service territories
- large reported savings
- opportunity to compare TPI assumptions with Muni assumptions (see #12) and other established IOU and database benchmarks

#2 ***ECOS Consulting "Beat the Heat" Halogen Torchiere Replacement (Summer Initiative)***

- high profile, statewide Summer Initiative TPI implemented in SCE, SDG&E and PG&E service territories
- large reported savings
- opportunity to compare TPI assumptions with Local (see #13) assumptions and other established IOU and database benchmarks

#3 ***UC/CSU Campus Efficiency Projects (Summer Initiative)***

- high profile, statewide Summer Initiative TPI implemented in SCE, SDG&E and PG&E service territories
- large reported savings
- opportunity to compare TPI assumptions with IOU (see #7) and Muni (see #11) assumptions and other established IOU and database benchmarks

#4 ***Residential Pool Pump Efficiency (Summer Initiative)***

[37] This cell was composed of 11 programs, of which 9 are represented in our list of 15. There are only eight asterisks because the COPE program, which had been listed as two programs in the cell (one for the PG&E territory and one for the SCE territory), have been collapsed into one program in Table B-1.

[38] "California Statewide Commercial Sector Energy Efficiency Potential Study - Study ID #SW039A." Xenergy. Oakland, CA. July 9, 2002.

- high profile, statewide Summer Initiative implemented by SCE, SDG&E and PG&E
- large reported savings

#5 ***Res-Team Hard to Reach (Summer Initiative)***

- high profile, statewide Summer Initiative implemented by SCE, SDG&E, PG&E and SCG
- large reported savings
- opportunity to compare IOU assumptions with Broad State (see #15) assumptions and other established IOU and database benchmarks

#6 ***LED Traffic Signals (Summer Initiative)***

- high profile, statewide Summer Initiative implemented by SCE, SDG&E and PG&E
- large reported savings
- opportunity to compare IOU assumptions with CEC (see #9) assumptions and other established IOU and database benchmarks

#7 ***SDG&E Sponsored Third Party Initiatives (Summer Initiative)***

- utility-sponsored TPI comprised of six commercial and institutional retrofit projects
- large reported savings
- opportunity to compare IOU assumptions with TPI (see #3) and Muni (see #11) assumptions and other established IOU and database benchmarks

#8 ***COPE Oil Pumping Efficiency (Summer Initiative)***

- high profile TPI administered in SCE and PG&E service territories
- large reported savings

#9 ***CEC LED Traffic Signals***

- opportunity to represent a CEC-sponsored program
- large reported savings
- opportunity to compare CEC assumptions with IOU (see #6) assumptions and other established IOU and database benchmarks

#10 ***CEC State Buildings***

- opportunity to represent a CEC-sponsored program
- large reported savings
- opportunity to compare CEC assumptions with IOU (see #6) assumptions and other established IOU and database benchmarks

#11 ***SMUD Project Completion Incentives (C&I Retrofit Measures)***

- opportunity to represent a Muni-sponsored program
- large reported savings
- opportunity to compare Muni assumptions with TPI (see #3) and IOU (see #7) assumptions and other established IOU and database benchmarks

#12 ***SMUD Residential Refrigerator Recycling***

- opportunity to represent a Muni-sponsored program
- reported annual savings of nearly 5,000 MWh; bordering on "high" savings on our scale
- opportunity to compare Muni assumptions with TPI (see #1) assumptions and other established IOU and database benchmarks

#13 ***City of San Francisco "Power Savers" Small Business Commercial Lighting***

- opportunity to represent a local government-sponsored program
- opportunity to compare local government assumptions with TPI (see #2) assumptions and other established IOU and database benchmarks

#14 ***The 20/20 Program (sponsored by DWR)***

- very large reported savings that dwarfs that of all other programs
- opportunity to represent a Broad State government program
- opportunity to discount "double-counting" inherent in reported savings of 20/20 vis-à-vis all other concurrent IOU energy efficiency programs

#15 ***The Mobile Efficiency Brigade / "PowerWalk" (sponsored by CCC)***

- opportunity to represent a Targeted Other State program
- opportunity to compare Targeted Other State assumptions with IOU (see #5) assumptions and other established IOU and database benchmarks

The overall findings from these reviews are included in Chapter 3 of this report. The detailed program reviews are described in Chapter 4.

C APPENDIX C: REFERENCES

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