# Dispatches from the Front:
# The Campaign to Reduce California's Peak Demand

*Julia Curtis, Nexant, Inc.*
*Monica Rudman, California Energy Commission*

**ABSTRACT**

The winter of 2000 and 2001 produced the most prolific and severe electricity service disruptions in the history of California. In December 2000 and January 2001 alone, there were 40 days of declared electricity emergencies, including 3 days when rotating outages were required to maintain power system stability. The situation was so severe that Governor Gray Davis declared an energy State of Emergency on January 17, 2001. In response to the crisis, the California State Legislature approved AB970, AB 29x, and SB 5x, which in total provided nearly $900 million dollars to reduce peak demand within the state. Of this total, approximately $537 million went to the California Energy Commission, with $336 million earmarked for demand reduction projects and the remainder to be used to promote renewable energy sources. This paper will summarize the savings from this historic and unique campaign to reduce peak demand and give some indication of the future program evaluation activities planned.

## Introduction

This paper focuses on assessing those peak demand reduction projects that the Energy Commission (CEC) developed based on the $336 million of funding. Looking at projects in terms of their initial engineering estimates of savings and comparing them to the actual measured savings based on fieldwork, the evaluation process also includes participant and administrative audit results, case studies, and sophisticated data analysis. This paper also examines indices regarding participant satisfaction and includes a section on the lessons learned from this massive efficiency effort, both in terms of program design as well as administrative insights.

This paper summarizes this historic and unique campaign's anticipated peak savings and the savings documented by Nexant, the CEC's Measurement and Verification (M&V) contractor. The CEC developed eleven program areas or "elements" to reduce peak demand by a goal of 1025 MW by Summer 2002, developing an impressive portfolio of activities designed to address this 'crisis'. This paper examines eight of the eleven CEC program elements. These are agriculture, the Energy Conservation Assistance Act (ECAA), innovative efficiency, cool roofs, LED traffic signals, water/wastewater, state buildings, and demand responsive building systems. Table 1 summarizes the eight program elements.

**Table 1. Program Element Summaries**

| Program Element and Funding Source | Project Description | Contracted Participants as of November 1, 2001 | Documented Peak Demand Savings as of November 1, 2001 |
|---|---|---|---|
| Agriculture Peak Load Reduction (5X) | Provide incentives for installation of more efficient processing operations and alternative fuel projects | Installed efficient equipment at 141 sites. | No documented savings to date |
| Cool Roofs (970) and Cool Savings (5X) | Provide incentives to increase reflectivity of roofs and other surfaces thereby reducing cooling (air conditioning) loads | Installed over 9 million square feet of cool roofing material. | 3.2 MW |
| Demand Responsive Building Systems (970 and 5X) | Install real-time metering and communications systems, test for the level of load reduction that they facilitate by 7/1/2001 | Demand-responsive systems for HVAC and lighting systems installed at 654 sites. | 104 MW |
| Energy Conservation Assistance Act (ECAA) Loan (29X) | Provide 3% interest loans to local government and schools pursuant to the Energy Conservation Assistance Act | Loans granted to 84 sites. | No documented savings to date |
| Innovative Peak Load Reduction Proposals (970 and 5X) | Provide cash for innovative methods of reducing peak demand not provided for by any other program element, also for renewable energy development | Efficiency and demand-reduction measures installed at over 253 sites. | 23.6 MW |
| LED Traffic Signals (970) | Provide incentives to municipalities, CalTrans, and other maintainers of public traffic signals to install low-energy light emitting diode traffic signals | LED traffic signals installed at 9,757 intersections throughout the state. | 3.6 MW |
| State Buildings (970) | Provide incentives to public universities and other state facilities to install energy efficiency improvements and peak reduction measures | Efficiency and demand-reduction measures implemented at 242 sites. | 40 MW |
| Water and Wastewater Treatment (970) | Provide incentives for pumping efficiency and other related retrofits | Efficiency and demand-reduction measures installed at 53 sites. | 44.3 MW |
| **TOTAL Peak Demand MW** | | | 218.7 MW |

We have focused on assessing demand reduction projects—i.e., those that were funded by the $336 million, investigating projects in terms how their estimated expected savings and initial engineering estimates compare with their savings documented after the fact. The goals of this program were to achieve peak demand reduction as quickly as possible. As a result, energy impacts were not really considered, because decision makers were almost entirely concerned with preventing blackouts in this crisis mode. The focus of the evaluation has been on the ability to produce and verify near-term peak demand impacts. Based on this analysis of program impacts, this paper provides specific program observations and recommendations.

We used four key performance metrics to evaluate the success of these programs, however, specific measurements were only taken for certain developed projects (such as lighting, demand responsive buildings and HVAC equipment):

1. The original peak savings goals as stated in the legislation and defined by the CEC for their programs.
2. The total peak demand savings reported by program participants at the completion of their projects.
3. The total peak demand savings documented through Nexant's independent measurement and verification activities.
4. The cost per kW of demand reduction—of each program element.

## Measurement and Verification Methodology

The Measurement and Verification (M&V) methodologies used on these programs are based on detailed approaches for determining demand and energy savings that result from installing efficiency and peak load reduction measures. These methods include: regression/mathematical analysis, direct measurement of equipment, surveys, utility bill analysis, and engineering analysis/nameplate information. Since at this time it is not possible to measure exactly what *would have been* in the absence of a program, demand and energy savings can only be determined by comparing a baseline case to a measured post-retrofit case.

The M&V process defines the project specific baseline through techniques that may include pre-retrofit measurements, equipment surveys, analysis of historical metering and weather data, or developing computer simulation models. Post-retrofit performance is typically measured through direct monitoring of energy consumption.

## Program Peak Demand Savings

The Peak Load Reduction Program's goal for the 8 program elements evaluated for the summer of 2001 was to achieve 465 MW of demand reduction. A substantial portion of the goal was achieved.[1] AB 970 authorized the first $50 million of funding. The Energy Commissions' goal using these funds was to reduce peak demand by 198 MW by July 1,

[1] Note that the Peak Load Reduction Program was launched in two phases: the first phase began with the passage of AB 970 in the late fall of 2000, while the second phase, authorized by emergency legislation SB 5X and AB 29X, did not begin until May 2001.

2001. Program participants reported that they achieved 245.5 MW of peak demand savings during the summer of 2001; and measurements suggest that the AB 970 programs actually achieved a combined savings of 218.5 MW by November 1, 2001. The combined peak reduction goal for the subsequently funded SB 5x and AB 29x programs was 267 MW, with 80.9 MW savings reported installed as of November 1, 2001.

**Table 2. Program Evaluation Results**[1]

| **Program Element** | **Summer 2001 savings goal (MW)** | **Nexant documented savings (MW)**[2] | **Savings reported by participants (MW)** | **Savings realization rate (documented/ reported)** | **Total savings expected by June 1, 2002** |
|---|---|---|---|---|---|
| Cool Roofs | 25 | 3.1 | 3.2 | 98% | 9.8 |
| Demand Responsive | 65 | 103.93 | 115.9 | 90% | 115.9 |
| Innovative and Renewables | 32 | 23.6 | 31 | 76% | 36.4 |
| LEDs | 6 | 3.6 | 4 | 90% | 5.6 |
| State Buildings | 50 | 40 | 40 | 100% | 108.2 |
| Water/Wastewater | 20 | 44.3 | 51.4 | 86% | 51.9 |
| Subtotal AB 970 | 198 | 218.5 | 245.5 | 89% | 327.8 |
| | | | | | |
| Agriculture | 22 | 2.44 | 4.7 | 51% | 27.3 |
| Cool Savings | 15 | 0 | 0 | 0 | n/a |
| Demand Responsive | 120 | n/a1 | 69.7 | n/a | n/a |
| Innovative Peak Load | 90 | n/a | 4.5 | n/a | 226.5 |
| Subtotal SB 5X | 247 | 2.4 | 78.9 | n/a | 253.8.7 |
| | | | | | |
| ECAA Loans | 20 | n/a | 2 | n/a | 8.9 |
| Subtotal AB 29X | 20 | n/a | 2 | n/a | 8.9 |
| | | | | | |
| Totals | 4656 | 220.9 | 326.4 | n/a | 590.5 |

[1] An "n/a" indicates missing or incomplete data as of November 1, 2001.
[2] When using a weighted average for all six AB 970 program elements, the precision of both the realization rate and the total documented savings is 4% at the 80% confidence level.

## Method for Calculating Realization Rates

The realization rate is the ratio of the verified potential peak demand savings to the reported potential peak demand savings.

The importance of the realization rate is twofold. First, it is a useful comparison of engineering estimates to documented results. Second, it allows the results of measurements of a representative sample of projects to be generalized to the entire population of projects. A random sample of representative sites was identified and their savings at these sites were verified because directly monitoring the demand savings associated with every project site in the Peak Load Reduction Program was impractical and not cost-effective.. Realization rates from individual sites were aggregated into an overall realization rate, which was used to infer the peak savings impacts of the entire population of projects.

Comparable impact evaluation results for commercial retrofit programs range from 36% to over 200% of engineering estimates (i.e., reported savings). Most evaluations of commercial demand side management programs report realization rates between 55% and 155%[2]. It should be noted that the closer the realization rate is to 100%, the more accurately the participant estimated their own peak savings. The CEC's accomplishment of an overall 84% realization rate for the AB 970 programs falls in the middle of this range and indicates that, for the most part, participants were accurate in their estimation of demand savings to be achieved at the planning stage. The realization rate is a useful tool to extrapolate results for the whole population from a sample. However, its use as a measurement of overall program success is limited because the realization rate is affected by so many variables such as the method used by the participant to estimate savings and changes in the participant's energy use not associated with the project.

## Comparing Peak Savings Goals and Measurements

In the crisis climate, these projects had an accelerated timeline of approximately four months (roll-outs for similar programs usually require 9-12 months[3]), with more than $200 million in contracts executed under the Peak Load Reduction Program. The program includes numerous peak load reduction initiatives for both the public and private sectors using a full range of technologies, many of which are new to the marketplace. To put these contracting achievements in context, the California's Public Goods Charge (PGC) funds for energy efficiency programs total $270 million annually, and primary implementation responsibilities for these funds are shared between the state's four major utilities and a host of other entities, and the California Public Utilities Commission.

The programs exceeded their goals in aggregate, but the composition of the total savings achieved was derived from the individual program elements in different proportions than were originally expected. Some elements exceeded their goals while others fell short. However, the amount by which some programs exceeded goals more than made up for the shortfall caused by those that did not, allowing the program to surpass its overall goal.

The enclosed figure 1 shows the savings goal set in August of 2000, the participants' reported savings in the summer of 2001, and the documented savings (as of November 1, 2001) by AB 970 program. SB 5X and AB 29X results are omitted from this section as savings documentation is still in progress. The CEC will publish the savings for SB 5X and AB 29X in December 2002.

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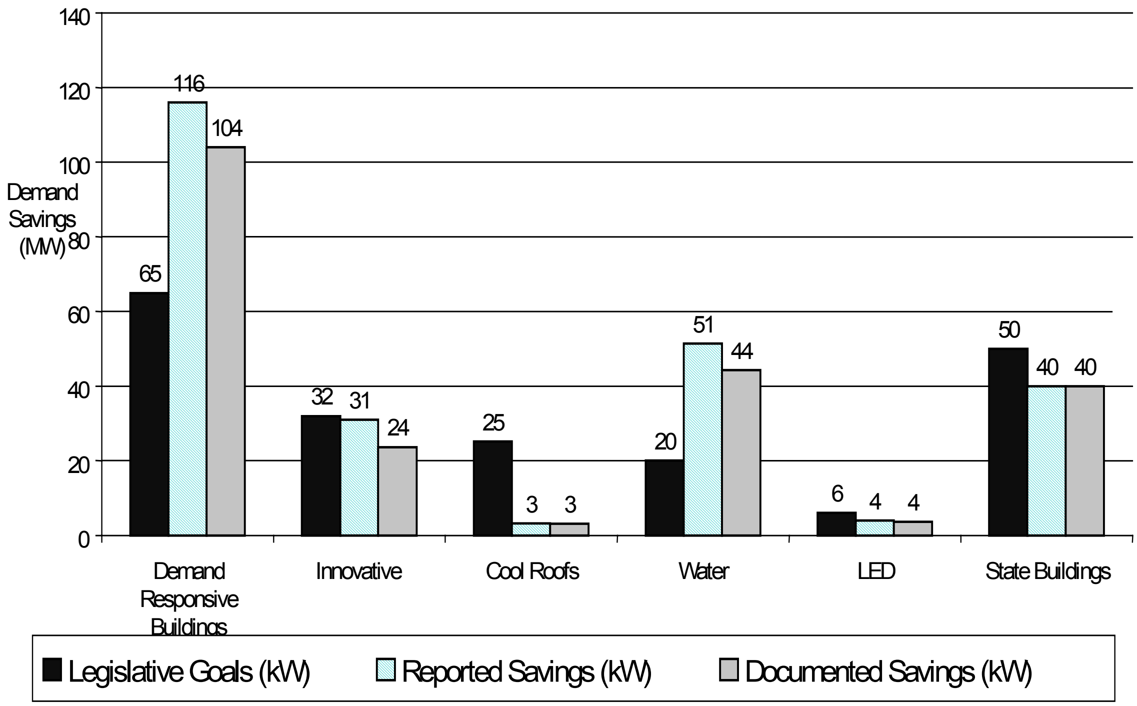
[2] Coates, Brian and Lilly, Patrick. Long-Term Energy Savings in a Commercial Efficiency Program. Seattle City Light, 1998. Brown, M. and Mihlmester, P. Summary of California Demand Side Management Impact Evaluation Studies. California Demand Side Management Measurement Advisory Committee, 1994.

[3] Based on the average time noted by the California Public Utilities Commission for successful roll out time needed for utilities' energy efficiency projects funded by the Public Goods Charge.

**Figure 1. Program Element Goals, Contracted Impacts, and Documented Savings**




## Over- and Under-Subscribed Program Elements

Many program elements were over subscribed in terms of reaching their demand savings goals. Participants in the AB 970-funded Innovative, LED, and State Buildings elements each reported savings totals that were within the range of their respective savings goals. Participants in the AB 970-funded Demand Responsive and Water/Wastewater elements reported savings that significantly exceeded the program goals. Though there were no official curtailments in 2001 testing DR programs, pilot tests were analyzed to ascertain and verify these potential savings results. However, administrators in the AB 970 Cool Roofs element reported savings that were significantly below the program's goal, and participation has been slow in the SB 5X Agriculture Program as well.

There may be several factors that influenced the differences between savings goals and reported savings for each of these elements. For example, it was not originally anticipated that the Cool Roofs Element would require a longer market development period to build awareness of the product. This marketing problem was exacerbated by a slower than expected start to the contracting process, even further shortening the program's performance period. On the other hand, the reported savings of the Demand Responsive element, which exceeded its goal by nearly 40 MW, may be attributable to aggressive recruiting on the part of the CEC and the program's contractors as well as to a fear of blackouts, a sense of duty to society on the part of building owners, and/or the allure of subsidized equipment, enabling participating building owners to partake in interruptible rate programs. Notably, the success of the Water/Wastewater Element in surpassing its legislated goal is largely due to a single grant project: the Metropolitan Water District of Southern California. This project's grant achieved the potential to curtail 35 MW of pumping-related demand, an amount in excess of the goal for the entire element.

Many of the program elements funded by both SB 5X and AB 29X were still recruiting participants in November 2001, and most of the participants already involved by November had not had sufficient time to install their peak reduction projects.

**Cost per kW of Demand Reduction**

For each of the program elements, we calculated two indicators of per-unit savings: (1) the simple cost per kW and (2) the levelized cost per kW per year.[4] Table 1 describes the results for each AB 970 program element.[5] These costs are based on the peak demand savings in place by November 1 as well as the amount of cash incentives the CEC has paid or plans to pay for the savings. (Not all incentives for installed projects had been paid as of November 1, 2001, but they are included to give a more accurate estimate of actual costs.)

Simple costs per kW are presented here for comparison with the CEC's programmatic and legislative goal of obtaining peak demand savings at a cost of not more than $250/kW, taking into account the CEC's contractual and administrative costs only. Levelized costs, in contrast, are useful for comparing the costs of market alternatives potentially available during periods of peak load constraints (e.g., self generation, spot-market purchases). Other potential measures of cost-effectiveness, such as avoided outage costs, are beyond the scope of this report.

Overall AB-970 program average cost figures represent impact-weighted averages. Simple cost per kW is an impact-weighted average of all program element cost/kW values; levelized costs per kW/year are based on average project lifetimes of 10 years for cool roofs projects, one year for demand-responsive projects[6], and five years for all other program elements' projects. These variations are based on the expected lifespan of the respective technologies utilized in these program elements. For example, LEDs have the highest cost per kW, but the program clearly transformed the market much more quickly than if municipalities did not have this incentive to implement LEDs in a timely fashion to address the power crisis. Further analysis should include a greater benchmarking study of these programs, comparing their values with other energy efficiency, demand reduction, or supply-side alternatives available at the time.

[4] Levelized costs, defined in the *Standard Practice Manual: Economic Analysis of Demand-Side Management Programs, (October 2001),* amortize project costs over the expected useful lifetime of equipment or impact.

[5] The cost-effectiveness indicators used represent the marginal cost per kW/year incurred in stimulating the market. These estimates are most closely analogous to marginal supply costs of generation capacity, which provide an appropriate reference point. Although many program also feature significant energy impacts, it is inappropriate to estimate cost of conserved energy, as it is too soon to accurately assess the seasonal variations in energy savings that many projects' measures are expected to have.

[6] For Demand Response the capacity for demand savings is being measured and in theory we are making a conservative assumption that this capacity may not be maintained beyond 2002. It is likely that programmatic persistence will be one year, and Nexant will be performing this analysis in 2003.

**Table 3. Cost per kW of Demand Reduction by AB 970 Program**

| Program element | Simple cost per kW | Levelized cost per kW-year |
|---|---|---|
| Cool Roofs | $503 | $50 |
| Demand Responsive | $76 | $76 |
| Innovative and Renewables | $258 | $42 |
| LEDs | $1695 | $367 |
| State Buildings | $97 | $44 |
| Water/Wastewater | $66 | $32 |
| Overall program average | $130 | $40 |

## Specific Program Element Highlights

### Agriculture Peak Load Reduction (SB 5X)

- The June 2001 program start date apparently reduced program participation rates and the completion of many projects due to the coincidence of the program's roll out with the peak agricultural production season.
- In July 2001, two curtailment projects involving low cost and easy to install advanced metering and telemetry equipment participated in demand response curtailments. Due to time limitations and low cost technologies, this was the easiest project category for demand reductions.
- Based on the present project data, we expect that load shifting or curtailment activities will provide a majority of the future demand savings associated with this program. At this time, however, this assumption cannot be validated because few projects are far enough along to complete the sampling selection to needed for the evaluation process.
- As of March 1, 2002, this element (with a total of 107 projects) reported 66.2 MW of savings. As of March, 2002 it has been documented that 38 of these projects are complete with a reported demand reduction of 30 MW, representing a large increase in completed projects.

### Cool Roofs (AB 970, SB 5X)

- There are fewer participants in this program than originally estimated, due to a late program start and a slower early adoption rate. The reasons behind the slowed adoption rates will be investigated and included in a future evaluation of the SB 5X Cool Savings Program Element.
- Present estimates show a slow increase over time in the market penetration rate of cool roof technology. Twice as much square footage will be covered in the next few months as in the first five months of the program. Over 22.5 million square feet of cool roofs were contracted by November 1, 2001.

- In this program, the number of participants each program administrator enrolled is directly proportional to the size of the service area they represent. Non-governmental organizations (NGOs) excelled in recruiting participants.
- As of March 15, 200s, the CEC and its program administrators have recruited 237 potential projects, totaling over 6 million square feet with estimated peak savings of about 2.1 MW.

**Demand Responsive Building Peak Load Reduction (AB 970, SB 5X)**

- The program was successful in attaining its peak savings goals and verifying them through pilot tests in the summer of 2002 but the program's ability to provide the same level of load reductions during sustained power shortages over consecutive days is unknown. Although test curtailments indicate that the program element was successful, program performance cannot be verified until the state experiences a substantial heat storm with calls for load curtailments on several consecutive days.
- In several cases, the level of demand savings reported after curtailment signals were sent during pilot tests was greater than what the program administrators had originally contracted to provide at the beginning of the program. This was due to either: more customers recruited that originally forecast, or larger curtailment signals savings per customer.
- Suspension of the ISO's Demand Responsive Program (DRP) incentives, and questions surrounding the Department of Water Resources (DWR) replacement program, appeared to frustrate program participants and lower the probability that they would participate in future curtailments calls. This frustration caused was noted as the reason for a lower participation rates in the July 3rd curtailment response.
- As of March 15, 2002, the SB 5X funds were fully subscribed; however, the issue of getting credit for permanent curtailments (as opposed to demand responsive curtailments) may result in some participants dropping out of signed contracts. SB 5X contractors are still expanding their participant base, and most have already begun their pilot test to verify savings capability. The small commercial and residential participants (new to the 5X DR element) are in the beginning stages of implementation, and will be evaluated with unique M&V methods.

**ECAA Loans (AB 29X)**

- Loans were successful in facilitating energy conservation projects that otherwise would probably not have been undertaken. By providing loans to municipalities and non-profits, this program enabled facilities to implement measures that resulted in considerable demand savings.
- About 20% of the projects were rejected during the application and loan approval process. Subsequently, 4 projects out of the 77 approved dropped out. It would be helpful to survey the hosts of these projects to determine why, and when, they decided to discontinue. Possible reasons include that the applicant decided to use internal funding, or could not get governing board to approve the CEC required resolution or other priorities.

- The original objective of the ECAA program, which has been in operation for many years, is to save energy through both gas and electric efficiency projects. AB 29X focuses only on peak electricity reductions. It is difficult to assess the impacts of these projects based on the application alone, however, for two reasons: (1) measures to conserve natural gas do not easily result in peak demand reductions and (2) the data required for justifying the loans are not sufficient for determining peak load reductions.

**Innovative Peak Load Reduction (AB 970, SB 5X)**

- Two of this element's goals are in potential conflict with one another: (1) achieving consistent, reliable peak demand savings in a short-term period and (2) achieving peak demand savings by funding innovative (and relatively untested) technologies. Sometimes these goals can be achieved simultaneously, but, in practice, when awarding program funds, the goal of achieving peak savings took precedent. Furthermore, the CEC defined innovative as technologies that didn't fit into the other program elements rather than completely new technologies.
- Commissioning of new renewable generation projects, which constitute a large portion of the Innovative Program's demand savings, does not necessarily yield the desired savings at the onset. This is largely due to the need for the new equipment to become fully operational, which takes a matter of months. Older plants that are refurbished may require up to six months in a stop-and-start commissioning process before they operate at their full capacity. Therefore, expected timelines for generation projects should account for start-up delays.
- Project implementation is successfully underway. However, generation projects funded in the program are now facing regulatory risk and reduced financial attractiveness of projects.

**Light-Emitting Diodes (LED) Traffic Signals (AB 970)**

- This program has been vital in transforming the LED traffic signal market. Program funds have helped offset the initial high purchase price of the LED traffic signals, and has provided municipalities with valuable experience with this new technology, while considerably lowering municipal energy and maintenance costs in the process depending on the specific city/county schedule and contracting costs (with the average replacements being performed once a year).
- In general, the combined benefits of LED traffic signals result in a simple payback period of only two years. This program has accelerated the deployment of LED technologies that otherwise may not have been implemented for several years when cities would have otherwise installed them. Denominating its cost-effectiveness in terms of $/kW of peak power reduction masks its effectiveness in reducing energy costs in all operating hours of the year.

**State Building Peak Load Reduction (AB 970)**

- This program leveraged some energy management projects already in existence. In the future, the Department of General Services could streamline the bidding process or keep selected contractors on retainer that would better leverage resources to save time and potentially improve implementation.
- Curtailment exercises require that major reductions in peak load be made upon receipt of a signal. The Department of Corrections (DOC) had difficulty, for safety reasons, complying with Stage 2 events during operation of the program. Some of the DOC's load reduction strategies (e.g., interruption of vocational training classes) should be reviewed prior to consideration in any future programs of this type, as they appear inappropriate.
- The available, standard non-disclosure agreement was not sufficient in several cases to meet participants' concerns over releasing their energy use data to confidentiality concerns. The result was delays in acquisition of load data required to complete some M&V analyses. This situation was apparent also in the Demand Responsive and Innovative program elements.

**Water/Wastewater (AB 970)**

- This program exceeded the original goal of providing 20 MW of demand relief by more than 100%. This achievement was largely due to the programs success in encouraging savings through a single project run by the Southern California Metropolitan Water District.
- A common problem associated with water/wastewater-aggregated loads was that not all participants fulfilled their obligation to shed load as stipulated in their contract. We suggest a more thorough investigation of the circumstances under which these facilities can and cannot shed load.
- Waste energy recovery systems can be effective in generating peak period power. Using free waste methane from digester gas or landfill gas to generate electricity eliminates the uncertain operating costs associated with fossil fuel-fired generation like natural gas and diesel.

## Suggestions for Improvement

Due to the singular objective of reaching peak demand savings, several aspects of the program's implementation suffered. However, given the crisis situation, it is unknown whether the following recommendations would be appropriate and applicable in such a context:

- **Program measurement, verification and evaluation are not yet complete because of a lack of cooperation from some customers, and late project start dates.** Two changes to the MV&E process may prove helpful in future programs: (1) clearly specifying in the contract and initial data disclosure requirements, including the specific measurements needed of program savings. Despite the CEC's website posting data requirements, there seems to be a general lack of willingness to submit data to the M&V contractor. (2) There is the need to add the assessment free-rider/free-driver [7] impacts on the overall gross savings. It should be noted that the definition of a "free rider" may be different for this program, even if an applicant would have eventually undertaken a project without assistance. If it was not going to be done by summer, it may not provide the necessary benefits.

- **Some program elements would have benefited by more marketing and improved communications.** As mentioned in the section titled "Over and Under Subscribed Program Elements", the cool roofs and agricultural program elements may have failed to achieve their desired goals because there simply was not enough time to educate and advertise the benefits of the technologies involved. However, many other program elements were over subscribed and successful in getting their projects up and running in such a short period of time. The CEC is initiating a more aggressive marketing campaign, developed and implemented by professionals, to get higher participation rates as well as greater understanding of the CEC's novel programs.
- **Program designs were done in haste.** The program was designed and implemented quickly in response to the states' emergency. In retrospect, it would have been better to solicit program administrators and participants' involvement in the early stages of planning.
- **Program implementation efficiency could be improved.** Because of the emergency time crunch, planning and implementation sometime fused together. At times, implementation often coinciding with program planning meaning only the most critical information was communicated to stakeholders. As a result, the program rollout may have been less efficient than if there had been more time to develop a detailed matrix for communication and understanding among program administrators, the CEC and their M&V contractors.
- **Load shifting and curtailment programs focused on quick labor-intensive solutions rather than investing in controls or more efficient equipment**. When swift reduction of peak demand is the primary objective, curtailment and load-shifting projects are the most suitable. Turning off equipment manually is not always more labor intensive, however, it requires less materials and is therefore has a lower first costs.
- **Curtailment projects may not be as likely as energy efficiency measures to provide long-term savings, but they are better at providing immediate impacts to capacity constraints.** Energy efficiency projects provide additional improvements that load shifting typically do not, as they provide long-term economic and environmental benefits and the reduction in the use of non-renewable natural resources.
- **The programs may have provided funds to many free riders, e.g. firms that would have invested in more efficient equipment with the program.** This issue should be more thoroughly explored, as it is very complicated. Since the results of these programs had to be obtained quickly, a free rider is someone who would have

[7] Free riders are defined as participants who would have taken similar peak reduction actions even in the absence of the affected program. Free drivers are participants who, as a direct result of program implementation, put into practice *additional* peak reduction measures that are not accounted for within the established program parameters.

completed the project by Summer 2001 (or Summer 2002 at the latest), not someone who would eventually complete a project on their own. Consumers were influenced by multiple factors in their decision-making (including the media, 20/20 program, utility energy efficiency, voluntary initiatives from the State, etc.) To date, program MV&E activities have focused on the gross impacts or the differences between the participants' usage patterns prior to the programs and after program implementation; however, it is challenging to isolate impacts from this one program separately from all other activities. Any expected free rider and/or free driver effects are not independently quantified from the programs' gross impacts. It is recommended that the magnitude of both types of effects be determined.

- **Coordination with other program providers is inconsistent and often incomplete**. Where incentive levels are linked to programs provided by utilities, other state agencies, and/or the private sector, roles and responsibilities should be defined clearly and early on in the process so that disputes over payment amounts and/or timing are avoided. For example, responsibility for demand responsive incentives for curtailment performance shifted from the ISO to the Department of Water Resource, and this is one of several projects where there has been an almost constantly moving target, due, in part, to uncertain electricity markets. This unreliability results in a negative impact on the participants' motivation to respond to curtailment signals. Though difficult to evaluate in quantitative terms, understanding program administrators' and participants' perceptions of and responses to incentive programs that will contribute to more effective policy decisions and program design. It is particularly important to understand the behavior of program participants who are "curtailment-ready," but who may elect not to respond to an emergency curtailment signal. It is also important to acknowledge and promote the longer term role of different entities within the state who administer energy efficiency and demand reduction programs which will hopefully maintain a longevity that these legislative, funded one time only programs cannot.
- **Actual demand response during emergencies remains untested**. In the Demand Response program the lack of emergencies during the summer of 2001 means that the actual response of all the participating customers during a future emergency is unknown. It is particularly important to understand the behavior of program participants who are "curtailment-ready," but who may elect not to respond to an emergency curtailment signal.

## Conclusion

The primary objective of the CEC's campaign was to reduce as much peak demand as possible and as quickly as possible given the crisis at hand. Despite the brief timeframe available for the design and implementation of the programs, the CEC and the program's participants were able to exceed the summer 2001 peak demand goals for the AB 970 program, and obtain a notable part of the demand savings goals for the SB 5X/AB 29X programs.

## Next Steps

Nexant, under guidance from the CEC, will continue its M&V activities for SB 5X and AB 29X, and verify program persistence for AB 970. These activities will include fieldwork to increase the sample sites visited for selected programs. Additionally, an audit will be performed of both the administrators' and participants' performance. Reports to be published in December of 2002 that will address causes of variance between reported and documented peak reduction impacts. It will also include a more in-depth cost-effectiveness analysis. Observations of program planning, implementation, and completed project performance among program administrators and participants will provide essential information for making improvements to the evaluation process, as well as future planning of peak load reduction programs. With these future reported savings, Nexant and the CEC will be planning a workshop to address the lessons learned from this crisis efficiency effort, both in terms of program design as well as administrative insights.

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