Zero to 60 Megawatts in 8.4 Seconds: How to Rapidly Deploy a Peak Load Reduction Program

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ABSTRACT

Urgency legislation during the California electricity emergency called the California Energy Commission (Energy Commission) to the task of rapidly launching a variety of peak load reduction programs in September of 2000. Significant demand savings were needed within months in order to reduce the risk of rolling blackouts and sky-rocketing peak power costs. This paper illustrates some of the strategies pursued to meet this challenge through one example program: the Innovative Peak Load Reduction Program (Innovative Program).

The Innovative Program, the broadest program in the Energy Commission's portfolio of peak load reduction programs, was designed to tap the creative forces in the marketplace. Two rounds of the program were launched between November 2000 and May 2001. The first round was expected to secure 32 megawatts (MW) of electric demand savings by the summer of 2001—within nine months of authorization. In April 2001, as the peak demand outlook for the summer worsened, more funding was authorized to secure an additional 120 MW of peak savings, but only a few months remained to achieve significant peak savings in time to help us through the summer of 2001.

Since only preliminary program evaluation results (Nexant, 2001) were available as of May 2002, this paper focuses on the administrative and procedural aspects of the Innovative Program. The paper describes how the program was designed and launched in five weeks and how the program targeted a diverse set of markets and delivery agents to achieve maximum demand reduction in a short period of time. Since this program utilized three diverse administrative and program design approaches, we compare the relative success of these approaches. The paper also presents the lessons learned that may be transferable to future programs when there is a need to rapidly secure load reduction during times of urgent electricity shortfalls.

Introduction and Background

During the summer of 2000, California was experiencing Stage 2 electricity alerts signifying that operating reserves had dropped below 5 percent. Forecasts for the summer of 2001 were looking bleak. In September, the California State legislature and the Governor approved Assembly Bill 970, which provided funding for peak demand reduction programs and streamlined the power plant siting process (AB 970, 2000). The goal of these measures was to improve the electricity supply/demand balance for the coming summer. The first round of funding provided $50 million to the Energy Commission for programs to reduce peak demand by 200 MW, including $8 million for the Innovative Peak Load Reduction Program. The legislature expected that demand reductions would be in place in time to reduce the summer peak for 2001. This allowed only eight months to develop programs and complete projects that could reduce peak load by a total of 32 MW. Round 1 of the Innovative Program was launched within 5 weeks.

Faced with forecasts of deteriorating summer reserve margins during the month of April, the Legislature and the Governor acted again in extraordinary session, approving Senate Bill 5X (SBX1 5, 2001) and Assembly Bill 29 (ABX1 29, 2001). These bills provided an additional $859 million in funding for statewide programs to reduce electricity demand and increase supply. SB 5X earmarked $40 million to augment the Innovative Program. Round 2 of the Innovative Program was launched in May, 2002 with a goal of capturing an additional 120 MW.

Perceptions of the state's energy situation continued to deteriorate and by May 2001, Michael Zenker of Cambridge Energy Associates forecasted hundreds of hours of rolling blackouts in California for the coming summer (Said, 2001). The National Electric Reliability Council forecasted that California would experience about 260 hours of rolling blackouts during the hot summer months (NERC, 2001). The Energy Commission's March 2001 forecast estimated that the state would need 5000 MW of new electricity supply and/or demand reductions to sufficiently stabilize the California grid (CEC, 2001). As it became clear that most new generation could not be online in time, more attention was directed to demand side programs to avert these dire outcomes.

AB 970, SB 5X and AB 29X directed the Energy Commission to administer ten peak load programs totaling $363 million, which are compared in Table 1. Most of these programs targeted specific technologies or end users. The Innovative Peak Load Reduction Program was unique in that it was intended to capture all qualified projects that did not fit into one of the end-use categories specifically defined in the legislation. The goal of the Innovative Program was to let the creative forces of the private market go to work and propose creative or unanticipated ways to meet our peak reduction goals.

Table 1. Portfolio of Peak Load Programs Administered by the California Energy Commission as Directed by AB 970, SB 5X and AB 29X

Measure	AB 970	SB 5X/ AB 29X	Cost ($ Mil.)	MW Goal
LED Traffic Signals	✓		$10.0	10
Demand Responsive Buildings	✓	✓	$48.2	214
Cool Roofs	✓	✓	$23.9	62
State Bldgs. and Public Univ.	✓		$5.5	50
Water/Wastewater	✓		$16.3	50
Municipal Utilities		✓	$40.0	50
Agriculture		✓	$87.1	105
Local Government Loans		✓	$49.5	50
Real Time Meters		✓	$35.0	500
Innovative Program	✓	✓	$47.7	152
Totals			**$363.2**	**1108**

Program Design and Implementation

Round 1 of the Innovative Peak Load Reduction Program was authorized by AB 970 on September 7, 2000 with an $8 million budget. The Innovative Program posed unique challenges compared to the other peak load programs. The range of potential technologies and approaches in this "catch-all" program was extremely broad, making it difficult to predict the number of potential projects, how complicated the projects would be to evaluate and manage, and whether or not the most cost-effective projects would come in first or take longer to materialize.

Implementing the various peak load programs quickly required both rapid administrative processes and easily implemented designs. Like many public agencies, the Energy Commission’s normal program development processes allow ample time for stakeholder education and participation. The contracting process, mandated by state law, includes steps to promote fair competition among as many bidders as possible. The downside is that these processes require months to complete.

The State of California faced an emergency and could not afford to compromise speedy implementation. Since AB 970 provided no exemptions for the time-consuming state contracting process and grant approval process, program staff ruled out the option of hiring a contractor for program administration and used the less burdensome grant process to administer projects in house. Round 1 grants were limited to applications that promised at least 500 kW of peak savings in order to minimize the number of grants and preserve scarce staff resources. Round 1 offered a competitive solicitation in which applications were ranked based on cost per kW of demand reduction, reliability of the savings, and the probability of project success. These strategies allowed the program to be launched in mid-November of 2000, just five weeks after commencement of program planning. Grant awards were made by the first week of January despite following the requirement to publicly notice the awards four weeks in advance of consideration at a Commission business meeting.

Fortunately, when SB 5X was passed in April 2001 authorizing Round 2 of the program, it contained language that relieved the Energy Commission of numerous administrative and competitive bidding requirements. The governor issued an executive order two weeks later with additional administrative exemptions, such as the ability to delegate approval of grants and contracts to a committee of two commissioners. This reduced the time required to approve grant awards from four weeks to one day. The time required to select a contractor and execute a contract decreased from six months to four weeks.

With the new administrative flexibility, staff added two new elements to the Innovative Program. A contractor was hired to administer a grant solicitation for smaller projects between 20 kW and 400 kW. The Innovative "Small Grants" Program allowed end-users to aggregate facilities to reach the minimum project size. A third party program was also added, modeled after the California utilities' Third Party Initiatives. Ten contractors were selected that proposed diverse approaches for finding and securing peak demand savings, including residential air conditioning tune-ups, landfill gas generation, commercial HVAC equipment, daylighting and off-peak industrial battery charging.

In addition to these two new elements, a portion of the budget was reserved for a second large grant solicitation administered by the Energy Commission with some modifications. In Round 2, applications were accepted on a “first come, first served” basis with a fixed incentive of $250 per average peak kW delivered since the competitive solicitation in Round 1 failed to yield projects with lower costs. Because time was even more precious by the time Round 2 was issued, we offered a bonus incentive for projects that could be operational before the end of summer 2001.

Table 2 compares key variables between the three elements of the Innovative Program.

Table 2. Comparison of Three Approaches Used in the Innovative Program

	Large Grants[1]	**Small Grants**	**3rd Party Programs**
Administration	Administered in-house using state grant procedures	Administered by contractor	Administered by 10 contractors
Budget[2]	$15.3 million	$13.7 million	$21.4 million
Time to Field Programs	5 weeks	8 weeks[3]	12-14 weeks[3]
Response Time for Delivering Peak Savings	Earliest: 2 mos. Median: 12 mos. Latest: 20 mos.	Earliest: 3 mos. Median: 12 mos. Latest: 18 mos.	Earliest: 2-9 mos. Median: 9-12 mos. Latest: 9-18 mos.
State Staff Requirements	5 FTE (full-time equivalent)	0.5 FTE	2 FTE
Project Size Limitations	Projects with peak savings over 400 kW [4]	Projects with peak savings between 20-400 kW	None. (Project size ranged from 0.25 kW to 300 kW)
Participants	Large commercial, industrial and local government	Small-medium com./industrial, local government	Residential, small com./indust., office, wastewater, local gov, munic. landfills
Projected Demand Savings[5]	39 MW	37 MW	68 MW
Projected Cost of Savings($/kW)	$90-833/kW[6] Avg: $237	$187-250/kW Avg: $260	$183-393/kW Avg: $254
Number of End-user Participants	33	185	>500,000

Source: Innovative Program project tracking database

[1] Includes the original $8 million under Round 1 plus an augmentation of $7.3 million under Round 2.

[2] Excludes costs for CEC staff and overhead, which were provided out of the Energy Commission's regular operating budget. These costs will be quantified in the M&V results.

[3] Includes time to select and hire contractors using streamlined state contracting procedures authorized by Governor executive order. The normal State of California competitive bidding process takes 6 months.

[4] In Round 1 under AB 970, the lower limit was set at 500kW.

[5] Based on engineering estimates of savings. Verification of actual savings will not be complete until early 2003.

[6] In the Round 1 competitive solicitation, only three of 13 selected projects exceeded $250/kW. The Round 2 incentive was capped at $250/kW.

The range of technologies and approaches encountered indeed turned out to be quite broad. Successful energy efficiency projects included lighting retrofits, HVAC retrofits, process modifications to industrial facilities load shifting projects, and pumped water storage to enable off-peak pumping in municipal water facilities. Renewable generation projects included the recommissioning of a mothballed biomass plant, ethanol-fired generators, and the largest rooftop photovoltaic installation in the U.S at the Santa Rita Jail in Alameda County.

Lessons Learned

Consider a Portfolio Approach at Multiple Levels of the Program

The state implemented a wide variety of strategies including public awareness campaigns, incentive programs, demand responsive programs, acceleration of permitting for generators and emergency improvements in building energy efficiency standards. Taken together this "portfolio" of approaches leveraged unique advantages in each program while diversifying the risk of having "all eggs in one basket." For example, the "Flex Your Power" public awareness campaign, which achieved an immediate but short-term response was complemented by conservation incentives that took months longer to deliver peak savings but locked in substantial reductions for the long term.

Applying the portfolio concept at various levels *within* a program can capture similar benefits. The Innovative Program used three different strategies, which each had distinct advantages and disadvantages, as shown earlier in Table 2. Administering large grants directly was the most staff-intensive approach, but was the fastest at getting projects under construction. Conversely, it was simply impossible to serve the large number of smaller projects below the 400 kW threshold. The contractor who administered the Innovative Small Grants Program efficiently handled over 300 applications. This market segment would have gone untapped by the program without this program element. Furthermore, the 10 programs within the Third Party Program element each used quite varied approaches to address their unique market segments.

By pursuing a variety of approaches simultaneously, we were able to maximize early peak savings, pursue a more diverse array of measures, and serve a more diverse base of end-users—in particular, smaller businesses and homeowners.

Strive for a Simple Program

Designers of emergency peak load reduction programs should keep simplicity foremost in their mind in all phases of design and implementation. It was a difficult task to strike a balance between designing a simple and straightforward program and designing a program that included sufficient controls and safeguards to ensure the selection of quality, legitimate projects. As a result, even though we exceeded our participation goals, some applicants complained that the application and program rules were too cumbersome, particularly the requirements to document their estimates of peak savings and submit a 12 month electricity billing history.

Interviews with participants, non-participants, and program staff indicated that participation would certainly have been higher and application failure rates reduced if we had done a better job of bridging the gap between the needs of the application evaluation team and the ability of applicants to supply the information in the time allowed. In the future, this might be accomplished by staging the evaluation process: Stage 1 would screen simple applications based on the merits, feasibility, and applicability of the project concept; Stage 2 would require additional technical documentation of the finalists. Technical assistance should be made available to finalists who lack the resources to assemble the required technical documentation.

Increase Your Risk Tolerance

The degree of administrative streamlining required for rapid response has risks. Many of the normal checks and balances were eliminated. This increased the risk of overlooking the most qualified firm for a contract or paying higher costs than might be possible with a competitively selected contractor. Additional safeguards were put in place, such as a third party process evaluator to assess the administrative performance of the Energy Commission and contractors. Also, Energy Commission contract managers closely monitored the progress of third party program administrators, and under-performing contracts and grants were canceled.

Despite these efforts, 30 percent of grant projects and one contract failed before yielding peak savings. Although only a small monetary investment was lost without commensurate peak savings, approximately 20 percent of the program funds and significant staff time were tied up in these projects and unavailable to support more successful ventures.

However, in light of the fact that the alternative was a cumbersome bureaucratic process that would have delayed initial peak savings by at least six months, these risks were found acceptable. Simply put, the risk of harm to human health and the economy from potential rolling blackouts far outweighed the risk that public funds might not be optimally spent.

Our advice to other states when faced with an electricity emergency is to immediately perform a risk analysis that compares the risk of expedited administrative procedures with the risks of delaying results using the slow, safe and familiar process. Get agreement among all affected decision makers on the level of nonperformance risk you are willing to tolerate. Then agree on the specific administrative relief you are willing to provide the organization and actions or policies that can be included to mitigate the additional risk that administrative relief provides. Offering to make frequent status reports to fiscal control agencies and retaining a third party verification contractor can make administrative relief more palatable to legislators and other decision makers.

Take Full Advantage of Existing Program Infrastructure

In a programmatic response to an emergency, it is critical to use any pertinent existing resources and available examples. The Innovative Program staff borrowed elements from existing energy efficiency, renewables, and demand side bidding programs by the Energy Commission, utilities, and other state energy offices. We plagiarized and borrowed program guidelines, applications, and brochures from wherever we could. We consulted program staff from many sources and received invaluable advice from experienced program designers.

The existing market infrastructure was also invaluable. After two decades and several billion dollars of investment in energy efficiency programs, California has developed an extensive and stable infrastructure for delivering energy efficient goods and services. There is no doubt that the integrated conservation efforts and tremendous public response, most of it voluntary, could not have been achieved without this infrastructure.

Utilize Third Party Contractors with Established Client Relationships

The wide variety of end-users served by the program could not have been reached without the participation of trade allies such as heating and cooling contractors, vendors of energy efficient products and energy services companies that had established relationships with extensive client bases. Staff in the Innovative Small Grants worked closely with these allies, who recruited end users into the program, assisted them with the application process, and served as aggregators to help smaller customers reach the minimum project size. This relationship greatly expanded the reach of the program in the available time.

Balance Expediency with Equity Issues

In the first round of the Innovative Program prior to the Governor's executive order, we lacked the ability to expeditiously hire contractors. Due to staffing constraints, we were forced to exclude smaller customers because of the large number of grants that would have resulted. In this environment we realized that all customer classes would benefit if rolling blackouts could be averted, so it was more important to focus on ways to deliver fast peak savings than to ensure that all customer classes were eligible for incentives.

It is important to state clear rules and timetables and then adhere to your policies. Although it is no fun to be the hard-nosed bureaucrat, applicants will take as much time and as many chances to comply with your program rules as you give them. For faltering projects it is better to cancel the project at the earliest possible date and reallocate the funds to a project with a better chance of delivering peak savings in the desired time frame. Invariably, these projects had a high chance of failing eventually, and negative impacts were reduced when these projects were cut off early in the project.

Coordinate with Other Programs

It was important to coordinate with ongoing utility programs, other emergency peak load efforts, and the Flex Your Power public awareness campaign to avoid sending conflicting signals to the market. We also compared lists of program participants with the utilities to safeguard against participants claiming incentives from two different programs for the same project.

Coordination is also important where efforts of multiple agencies are necessary to obtain program benefits. For example, the Energy Commission provided incentives for installing load control equipment to reduce loads during peak periods. Yet other institutions were responsible for programs to pay for the load curtailments, and many of these programs were discontinued. Without careful coordination between agencies, the load reductions achieved will not come up to the levels envisioned by planners on either side of the institutional divide.

Redefining Free Riders

Historically, energy efficiency programs attempted to minimize "free riders," program participants who would have installed the desired efficiency measures even without the incentive. We quickly realized that most purely "new" peak saving and energy efficiency opportunities that had not yet been entertained by the end-user would take too long to identify and evaluate. We made a strategic choice to target projects that were identified at some level, but would not likely be complete during the time frame when peak savings were urgently needed. In other words, an acceptable purpose of the incentive was to accelerate the schedule for project installation rather than exclusively to motivate customers to undertake the project at all. Therefore, this required redefining free riders as participants that would have completed a project *within the required time frame*.

This contradicts the usual view of free riders held by evaluators of year-to-year energy efficiency programs. But given the urgency of the capacity shortage, peak savings delivered by the summer of 2002 were significantly more valuable to the state than if they naturally occurred one or two years later. The potential cost to the economy and risks to public safety from wide-ranging blackouts dwarfed program costs.

Bonus Incentives

In Round 2 of the Innovative program, we added a $1 per kilowatt early completion incentive to the $250 per kilowatt base incentive for each day before October 1, since summer savings was so critical. The incentive was only effective at motivating 10 out of 68 participants to complete their projects within the four months necessary to claim the incentive. These tended to be small, simple projects with a short lead-time. Bonus incentives averaged $50 per kilowatt. Recipients of the bonus incentive, however, did cite the incentive as a major motivator to complete the project 1-3 months sooner than without the bonus incentive.

This evidence suggests that bonus incentives can be effective for a larger population of projects if given sufficient time to work, such as six to nine months. More conclusive evidence on the effectiveness of bonus incentives will be gathered as part of the program evaluation work.

Set Firm and Imminent Deadlines

The threat that funds would run out quickly had virtually no impact on the applicant. Even during the "first-come first-served" solicitation, 90% of applicants waited until the last two days before the application deadline to submit their application. Applicants typically needed 4-6 weeks to complete the application process, but allowing more time than that only seemed to delay the evaluation and implementation of projects.

We concluded that an application deadline or some other incentive for completing applications by a certain date is necessary when time is of the essence. If funds are not fully subscribed after the deadline passes and time permits, the solicitation period can be extended.

Monitor Project Progress Continuously

A solid grant agreement was not enough to ensure timely progress on projects. The only deterrent against slow progress was to withhold payment. During Round 1, several projects were canceled right at the deadline. These cancellations too late to reallocate dollars to alternative projects and still reap peak savings in time.

In Round 2, the Energy Commission grant managers closely monitored project progress and recipients were required to submit monthly reports detailing the progress to date on the approved work statement. If a project got behind schedule, the grant manager required a recovery plan from the grant recipient. The recovery plan included new interim milestones so that the grant manager could measure progress and periodically assess the likelihood that the project could meet the completion deadline. These procedures proved invaluable for making "go/no-go" decisions about a project at an early enough stage that the funds could be put to better use in another project in time to make a difference.

Efficiency Retrofits Take Time

We learned that there are limits to how much you can shorten certain parts of a particular process in a peak load reduction program, and you must set expectations accordingly. One of these is the length of time required to identify and install permanent peak load reduction measures.

There was intense pressure to yield peak savings during the summer of 2001. The Energy Commission committed to an ambitious peak savings of 1,025 megawatts that assumed half of the projects savings from funded projects would be in place by June 1, 2001 (California Energy Commission, February 2001). Yet major energy efficiency retrofit projects typically take one year or longer to complete. One to three additional months are required on the front end if efficiency projects have not yet been identified and quantified large facilities. Despite the variety of incentives and rules that were implemented to speed up projects, the Energy Commission managed to get only 454 megawatts on line by June 1, 2001.

While it is important to trim program schedules wherever possible, program administrators should set realistic expectations and plan adequate time for project implementation.

Measurement and Verification

The Peak Load Reduction Program was designed to provide significant load impacts in less than one year. The Energy Commission was expected to provide independent verification of progress toward achieving desired program impacts by early 2001 as well as verification that funds were being spent appropriately.

The Energy Commission hired a measurement and verification contractor to conduct a form of "real time" or concurrent monitoring and verification. The feedback from the contractor has been very helpful in identifying and troubleshooting problem projects.

Real-time evaluation can be problematic; it requires developing evaluation samples while new participants are still in the process of joining the program. There is a high probability that projects in the sample may later be canceled. The sampling plan must be flexible, and the evaluation budget must take into account the added cost of revising samples and collecting data on projects that are later canceled. This aspect of the program has been challenging, yet the ability to see program results confirmed as each project is completed was valuable to grid planners and gratifying for program staff.

Unfortunately, we were not able to hire the Measurement and Verification contractor in time to have them participate in the design and early implementation phases of the program. This could have provided evaluation results early enough to be used by program staff in making midcourse corrections in program design.

Summary

It is worth reiterating the primary reason California averted rolling blackouts in the summer of 2001: more than twenty years of heavy investment in energy efficiency programs and market delivery channels. The best protection any state can make is to ensure that a robust market exists for the delivery of energy efficient goods and services and that consumers have a basic understanding of the value of efficiency investments and how to capture this value. This will be a difficult argument to make in states that have never experienced an energy shortage, but we hope others will learn from California's experience.

States should also develop a contingency plan for electricity and other energy emergencies that can be quickly executed when activated. A plan should include sample bill language to fund emergency programs and streamline administrative mechanisms. It may also require the development of basic infrastructure for demand responsive hardware and software, consistent regional demand responsive incentives, and real time tariffs and meters. California had previously established interruptible tariffs and demand responsive programs, although these mechanisms were insufficient in dealing with the severity of the recent peak emergency and are currently being revamped. They did provide a strong starting point to build new programs.[7]

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[7] After interruptible customers suffered dozens of hours of curtailment or high penalties during the summer of 2000, the PUC froze enrollment to prohibit participants from fleeing the program after receiving lower rates for years with no curtailments. The program was redesigned in April 2001 and customers were allowed to opt out.

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