

CALIFORNIA
ENERGY
COMMISSION

**AB29x and SB5x Program Evaluation
Final Second Quarter Report**
(March 2 to May 1, 2002)
Executive Summary

CONSULTANT REPORT

October 2002
400-02-027CR



Gray Davis, Governor

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AB 29X and SB 5X Program Evaluation

Final Second Quarter Report

Executive Summary

(March 2 to May 1, 2002)

Submitted to:

California Energy Commission

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Contract #400-00-070

October 1, 2002

Executive Summary

INTRODUCTION

This report presents the results of Nexant's evaluation of the California Energy Commission's (CEC) Peak Load Reduction Programs (PLRP) for the months of March and April 2002. It also incorporates material provided by the CEC on implementation activities and funding allocations for the months of March, April, and May 2002.

The body of this report discusses the six program elements that are funded by California Senate Bill 5X (SB 5X) and California Assembly Bill 29X (AB 29X). These elements (and respective funding sources) are as follows:

- Agriculture Peak Load Reduction (SB 5X), which provides incentives for installation of more efficient processing equipment, pump repair, and alternative fuel projects.
- Cool Savings (SB 5X), which provides incentives for installation of roofing materials that are highly reflective and emissive to reduce building cooling (air conditioning) loads.
- Demand Responsive Building Systems (SB 5X), which funds the installation of control, metering, and communications systems that enable facilities to curtail load in response to emergency electricity shortage notices.
- Energy Conservation Assistance Act (ECAA) Loan (AB 29X), which allows the CEC to issue 3 percent interest rate loans to local governments, schools and colleges, hospital, special districts, and public care facilities.
- Innovative Peak Load Reduction Proposals (SB 5X), which provides grants for projects to reduce peak demand not covered by any other program element (includes renewable energy development).
- Water Agency Generation Retrofits (SB 5X), which offers incentives to retrofit diesel and natural gas generators to reduce NO_x emissions and payments to municipalities for kilowatts saved as a result of new generation, load shifting, and energy efficiency projects at water and wastewater treatment facilities.

In the following section of this Executive Summary, the tables reflect the activities, savings, expenditures, and cost-effectiveness associated with program elements funded not only by SB 5X and AB 29X, but also by California Assembly Bill 970 (AB 970), which was passed in April 2001. Many of the figures associated with AB 970 program elements are from Nexant's December 2001 report to the CEC.

The AB 970-funded program elements are as follows:

- Cool Roofs, which is being continued under SB 5X as Cool Savings.
- LED Traffic Signals, which provided incentives to local governments and the California Department of Transportation for the installation of low-energy light emitting diode (LED) lamps.

- Innovative Efficiency and Renewables, which is continued under SB 5X as Innovative Peak Load Reductions.
- State Buildings, which provided incentives to public universities and other state-owned facilities for the installation of energy efficiency measures and demand-response systems.
- Water and Wastewater Treatment, similar projects are being funded under SB 5X as part of the Water Agency Generation Retrofit Program.
- Demand Response, which funds the installation of control, metering, and communications systems that enable facilities to curtail load in response to notice of emergency electricity shortages.

Discussions and tables that summarize Nexant's recent evaluation activities for the SB 5X and AB 29X program elements are presented later in this Executive Summary.

SUMMARY OF ACTIVITIES WITHIN THE OVERALL PEAK LOAD REDUCTION PROGRAM

Table ES-1 summarizes the activities within the program elements between March 1, 2002, and May 31, 2002. The information in this table was provided to Nexant by the CEC in early June of 2002.

Table ES-1: Implementation Activities between March 1, 2002, and May 31, 2002

Program Element	Activities
Agriculture Peak Load Reduction	<ul style="list-style-type: none"> ▪ Conducted 45 pump tests, repaired 20 pumps, installed two VFD systems at irrigation districts ▪ Issued 10 new contracts with agricultural customers ▪ Conducted three presentations to market program
Cool Roofs/Cool Savings	<ul style="list-style-type: none"> ▪ Installed over 4.3 million square feet of cool roofs ▪ Signed up over 8.5 million square feet of cool roofs for rebates ▪ Published ad in 10 weekly business journals and in Western Roofing Insulation and Siding Association publication ▪ Wrote articles and press releases for publication ▪ Marketed the Cool Roof program at 9 conferences, meetings, and trade shows
Demand Responsive Building Systems	<ul style="list-style-type: none"> ▪ Installed demand-responsive systems for HVAC and lighting systems at 162 sites ▪ Recruited an additional 100 customers to the program ▪ Detailed energy audits completed for 27 customers in the San Diego area ▪ Signed an agreement with one small business chain to participate in the small business demand responsiveness program ▪ Marketed the small business demand responsiveness program to several chain stores ▪ Completed installation of 76 pulse interval meters
Energy Conservation Assistance Act (ECAA) Loans	<ul style="list-style-type: none"> ▪ Awarded loans to 2 new applicants ▪ Completed 7 projects ▪ Provided technical assistance to 5 customers ▪ Marketed program at 7 conferences, meetings, and trade shows

Program Element	Activities
Innovative Peak Load Reductions	<ul style="list-style-type: none"> ▪ Completed 23 projects for a peak load reduction of 2.4 MW ▪ Augmented 3 third-party contracts that were performing well ▪ Canceled 9 under-performing grant projects ▪ Recruited 26 new grant projects with potential peak savings of 5 MW ▪ Installed 300,000 square feet of solar shade screens ▪ Trained 401 HVAC technicians, and conducted 23,938 HVAC diagnostic runs ▪ Installed 164 daylighting systems
LED Traffic Signals	<ul style="list-style-type: none"> ▪ Completed two projects, representing LED traffic signals installed at 406 intersections for a peak load reduction of 456 kW
State Buildings	<ul style="list-style-type: none"> ▪ Extended the term of University of California Santa Barbara's grant to 12/31/02 so that a lighting project could be completed ▪ Extended the term of the Department of Corrections grant to 12/31/02 to allow them to use unspent funds on three new projects
Water and Wastewater Treatment/Water Agency Generation Retrofits	<ul style="list-style-type: none"> ▪ Modified HDR's program administration contract to extend application deadline and project completion dates to 6/30/02 and 6/1/03, respectively ▪ Completed 8 new projects ▪ Marketed the DG Program at 5 conferences and workshops throughout the state. ▪ Issued two grants totaling 1,232 kW

Table ES-2 presents the amount of funding allocated and dispersed for various components of the program elements under AB 970, SB 5X, AB 29X, and SB 84XX since the beginning of the PLRP in June of 2001 (Nexant is not evaluating projects implemented under SB 84XX, and activities associated with this legislation are not discussed in this report). The figures in Table ES-2 were provided to Nexant by the CEC in early June of 2002.

Table ES-2: Funding Allocations and Disbursements Cumulative to May 31, 2002

Program Element	Funds Allocated					Funds Awarded by CEC	Funds Invoiced by Participants
	AB 970	SB 5X	AB 29X	SB 84XX	Total		
Agriculture Program		\$39,678,834			\$39,678,834	\$39,678,834	\$22,703,383
Classroom Outreach		5,000,000			5,000,000	5,000,000	5,000,000
"Cool Savings" Low Energy Use Building Materials	9,444,000	14,522,500			23,966,500	23,966,500	4,540,766
Demand Responsive Building Systems	11,591,446	32,279,902			43,871,348	43,871,348	16,373,516
Municipal Utilities		43,517,180			43,517,180	43,517,180	41,400,000
Public Agency 3 percent loans/grants			49,990,000		49,990,000	49,170,098	19,355,629
Innovative Peak Load Reduction Proposals	5,584,092	45,814,232			51,398,324	51,398,324	24,448,908

Program Element	Funds Allocated					Funds Awarded by CEC	Funds Invoiced by Participants
	AB 970	SB 5X	AB 29X	SB 84XX	Total		
LED Battery Backup				10,000,000	10,000,000		0
LED Traffic Signals	11,916,208				11,916,208	11,847,292	6,978,860
Real Time Meters			34,089,000		34,089,000	34,089,000	29,386,796
State Buildings	5,500,000				5,500,000	5,500,000	4,813,675
Water and Wastewater Treatment/Water Agency Generation Retrofit	4,764,694	9,750,000			14,514,694	14,514,694	5,455,372
Evaluation	1,199,560	4,048,875			5,248,435	5,248,435	2,092,600
Marketing		1,280,000	720,000		2,000,000	2,000,000	1,693,837
Other Administrative		608,475	201,000		809,475	809,475	809,475
Totals	\$50,000,000	\$196,499,998	\$85,000,000	\$10,000,000	\$341,499,998	\$340,611,180	\$185,052,818

Table ES-3 presents the demand impacts of each program element since the beginning of the PLRP and up to May 1, 2002. For the program elements that were not extended by the SB 5X or AB 29X legislation, numbers from Nexant's December 2001 report are used. For program elements that were extended from AB 970, the figures reflect the combined impacts of AB 970-funded activities and the SB 5X- or AB 29X-funded activities. The installed demand figures represent the demand reductions verified by Nexant under AB 970 plus the demand reductions reported by participants under SB 5X and AB 29X.

Demand reductions verified by Nexant to date represent the results of Nexant's independent verification of savings. For SB 5X and AB 29X funded projects, the verification process is not complete and, in many cases, has not started; therefore, the values are preliminary and they should increase as Nexant receives more savings data to verify from program administrators.

Table ES-3: Overall Savings Goals and Accomplishments (Cumulative to May 1, 2002)

Program Element	Total demand reduction goal by 6/1/03 (MW)	Installed demand	Demand reduction verified by Nexant by May 1	Total demand reduction contracted to date
Agriculture	105	38.7	0	74.5
Cool Roofs/Cool Savings	62	6.19	4.17	10.75
Demand Response	164	193.3	109.1	261.4
ECAA Loans	50	6.9	0	16.0
Innovative	152	58.8	23.6	175.0
LED Traffic Signals*	10	5.9	5.9	6.6
State Buildings **	50	40	40	108.2
Water	50	52.7	42.9	56.9
Totals	645 MW	402.49 MW	226.67 MW	709.31 MW

*Numbers for this program element reflect numbers that the CEC has updated from Nexant's December report.

**Numbers for this program are current as of November 1, 2001 (Nexant's December Report).

Table ES-4 presents the total number of participating sites in each program element along with the number of sites that have been sampled and that remain to be sampled as part of Nexant's measurement and verification efforts.

Table ES-4: Participating Sites and Sampled sites (Cumulative to May 1, 2002)

Program element	Total sites	Sampled sites by May 1, 2002	Remaining sites to sample**
Agriculture	624	3	36
Cool Roofs/Cool Savings	1221	68	55
Demand Response	1112	653	40
ECAA Loans	84	NA	13
Innovative	69,826	120	8
LED Traffic Signals*	9,757	63	NA
State Buildings*	242	78	NA
Water	66	7	NA

*Numbers for these programs are current as of November 1, 2001 (Nexant's December report).

**Sampling numbers may change if future projects drop out or are rejected.

For the program elements that were not extended by the SB 5X or AB 29X legislation, numbers from Nexant's December 2001 report are used. For program elements that were extended from AB 970, the figures represent the number of sites in both AB 970-funded program elements and the SB 5X- or AB 29X-funded program elements, combined. Figures for these latter program elements, as well as for those created with the recent legislation are current as of May 1, 2002.

Table ES-5 presents both the up-front cost per kilowatt (simple) and the annualized cost per kilowatt (levelized) for each program element. 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 or impact lifetimes per program element.

For the program elements that were not extended by the SB 5X or AB 29X legislation, the cost-effectiveness values shown here are from Nexant's December 2001 report. Cost-effectiveness values are not yet available for most of the program elements extended from AB 970 or created with the passage of SB 5X or AB 29X, as implementation and data collection are not far enough along for projects funded by these bills. Where cost-effectiveness values for such programs are shown, the values are current as of May 1, 2002. For the ECAA loans program the cost-effectiveness calculation will involve determining levelized costs of the State's program investments.

Table ES-5 Program Element Cost-effectiveness (Cumulative to May 1, 2002)

Program element	Simple (\$/ kW)	Levelized (\$/kW-yr)
Agriculture	NA	NA
Cool Roofs/Cool Savings*	\$503	\$50
Demand Response	\$173.94	NA
ECAA Loans	\$2577	NA
Innovative	\$201	\$23**
LED Traffic Signals*	\$1695	\$367
State Buildings*	\$97	\$44
Water*	\$66	\$32

*Cost-effectiveness values for these programs are current as of November 1, 2001 (Nexant's December report).

**This figure represents the cost-effectiveness for AB 970 only.

Table ES-6 shows the number of project installations for the program elements funded by SB 5X and AB 29X. For the program elements that were also funded under AB 970 (all except Agriculture and ECAA), the data reflect cumulative installations since the beginning of the PLRP in June of 2001.

Table ES-6: Project Installations for SB 5X and AB 29X Program Elements (Cumulative)

Program element	Number of projects installed as of		
	Nov 1, 2001	March 1, 2002	May 1, 2002
Agriculture	16	100	112
Cool Roofs/Cool Savings	262	510	672
Demand Response	647	759	759
ECAA Loans	16	30	35
Innovative	9	To come	22,466

	Number of projects installed as of		
Water	36	36	40
Totals	986	1435	24,084

In subsequent progress reports, Nexant hopes to have sufficient data to put a graphic together that will portray the rate of project installations and compare them across the various program elements.

DETERMINING STATISTICAL ACCURACY

Calculating average values from a representative sample of program participants is commonly used to estimate the performance of an entire program population. Statistical uncertainty is associated with the process of extrapolating results from a sample to the population from which it was drawn. All the MV&E plans for SB 5X peak load reduction program elements use this statistical sampling technique. The plans call for a minimum *confidence* level of 80% and statistical *precision* of 20%. A confidence interval indicates the probability that the stated sample estimate and its precision interval are true in relation to the overall program population. A precision interval indicates that the actual (unknown) mean value for a program population will fall within a range of plus or minus 20% of the calculated mean value for the sample group.

For example if these statistical parameters were applied to determining demand savings, there would be an 80% certainty that the average demand savings calculated from sampled sub-populations would be within 20% of the actual average for the population at large.

The sites are selected randomly, allowing for smaller sample sizes to be used to maintain acceptable levels of statistical reliability. However, it is often desirable to relax this requirement. For example, sampling may target sites with the largest demand savings, because these results will account for the majority of actual demand savings in the program population.

PEAK SAVINGS VERIFICATION METHODOLOGY

Due to variations between the program elements, different techniques were needed to analyze the data for each technology and end use. The verified savings, presented in Table ES-3, are taken from field verification techniques that include detailed measurements, surveys, and calculations of program impacts. Sampling methods, as discussed above, were used to characterize representative segments (such as building type, end-use equipment, and control strategy of each program element).

Peak savings verification methods are based on approaches used to determine demand and energy savings. Since it is impossible to measure what *would have happened* 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. This verification process involves defining the baseline using various techniques including pre-retrofit measurements, equipment surveys, analysis of historical meter and weather data, or developing computer simulation models. Post-retrofit

performance is typically measured through site visits and direct monitoring of energy consumption.

In the following sections the verification methods used for each program element is summarized. A detailed MV&E plan for each program element is available for more detail.

Agriculture

Nexant's approach to verifying the savings from the Agricultural Peak Load Reduction Program varies by the four project categories. A sample of projects from each category is chosen for analysis, and the findings from that sample are extrapolated to the population of the category as a whole.

For category 1 projects, installations of high efficiency equipment demand savings are determined by calculating the difference between peak load before the equipment was installed (the baseline load) and the peak load after the equipment was installed (post-installation load).

For category 2 projects, pump repairs and retrofits, Nexant analyses utility bills from both the baseline summer irrigation period and the post-installation summer irrigation period, after accounting for other factors that may have affected pump run-time (such as crop type and weather).

For category 3 projects, demand response projects, Nexant compares curtailed loads—i.e., loads reduced in response to either an actual energy shortage or a system test—with baseline loads.

Category 4 projects, the retrofit of equipment to allow for alternative fuel burning, do not result in peak electrical savings. Nexant's verification effort involves post-installation site visits to confirm that subject equipment does have the capability of burning alternative fuel.

Cool Savings

Nexant's approach to verifying the savings for the Cool Savings program element involves sampling the population to get average values for key variables of the engineering equations established by Lawrence Berkeley National Laboratory and extrapolating these findings to the entire program population. The sample population must be large and diverse enough to meet the 80/20 statistical confidence and accuracy levels required by the CEC.

The collected data includes roof area and insulation levels (if identifiable), air-conditioning system size and age, indoor temperatures, roof reflectivity levels, and other building characteristics.

Demand Responsive (DR)

Nexant's approach to verifying the savings for the DR program element involves comparing curtailed loads—i.e., loads reduced in response to either an actual energy shortage or a system test—with baseline loads, which represent what the load would have been without the

curtailment. A sample of projects is chosen for analysis, and the findings from that sample are extrapolated to the population as a whole.

The sample must be representative of the entire population and large enough to meet the statistical confidence and accuracy levels required by the CEC. Nexant selects projects for inclusion in the sample based on facility and load data submitted to Nexant by the program administrators. Under AB 970, Nexant received data for a large and diverse number of participants such that 80% of all sites were included in the sample. Under SB 5X, Nexant has not yet received data from enough of the administrators to establish a valid sample. Nexant predicts that, for SB 5X, a sample size of 40 will be necessary to meet the statistical requirements.

Energy Conservation Assistance Act (ECAA)¹

Nexant's approach to verifying savings for the ECAA program element involves calculating the difference between the peak load of equipment that has received an energy efficiency retrofit with that equipment's baseline peak load, which is what the load *would have been* had the retrofit *not* been performed. A sample of projects is chosen for analysis, and the findings from that sample are extrapolated to the population as a whole. The sample population must be large and diverse enough to meet the statistical confidence and accuracy levels required by the CEC.

To establish baseline conditions, Nexant visits the sample sites to confirm (a) the presence and type of existing equipment, (b) the load (kW demand) of the existing equipment, and (c) the hours of operation of the existing equipment.

After a sample project has been reported complete, Nexant again visits the site to confirm (a) the completion of the project, (b) the load of the new equipment, and (c) the hours of operation of the new equipment. The same approaches used for establishing the baseline parameters are used to establish the post-installation parameters.

Using the baseline and post-installation data, the baseline peak demand and post-installation demand, respectively, are calculated. The difference between the two is the verified peak demand savings.

Innovative

Nexant's approach to verifying the savings for the Innovative program element varies by project type. In general, Nexant calculates the difference between peak demand before a project is installed (the baseline demand) and the peak demand after the project is installed (post-installation demand). Nexant collects the data necessary to make these calculations during site inspections and from load metering conducted both before and after installation.

¹ The ECAA program is not focused on peak demand savings, but on energy savings. Projects are qualified on their energy savings; peak demand savings are a beneficial result.

A sample of projects from each project type is chosen for analysis, and the findings from that sample are extrapolated to the population as a whole. The sample population must be large and diverse enough to meet the statistical confidence and accuracy levels required by the CEC.

Water Agency

This program element has both generation and load reduction projects, and Nexant approaches the savings verification for each type of project differently. In general, however, the peak load or generation capacity at a site before the project is installed (the baseline conditions) is compared to the peak load or generation capacity at the site after the project is installed (post-installation conditions). Site visits are made to confirm the installation and operation of equipment and to gather information on plans for future operation. Given the limited number of projects scheduled for completion before the end of by July 2002, Nexant is verifying the performance of as many projects as the budget allows.

SUMMARY OF SECOND QUARTER MV&E RESULTS AND ACTIVITIES

This section summarizes the results of Nexant's measurement, verification, and evaluation (MV&E) activities during March and April of 2002; it pertains only to the program elements funded by SB 5X and AB 29X. The savings figures presented here (and in the sections that follow) are based on data received by Nexant from the CEC and from participants in the PLRP as of May 1, 2002.

As shown in Table ES-7, Nexant has so far verified a total of 8.14 MW of demand savings out of 164.39 reported demand savings. The verified savings based on Nexant's analysis were achieved by projects within the Demand Response program element; and as such, they are *potential* savings, that would be realized during emergency curtailments. The reported savings represent the demand reductions associated with projects that have so far been completed, as reported by the respective grantees, contractors, or administrators. The individual sections of this report provide findings in more detail.

Table ES-7: Summary of Demand Impacts for SB 5X and AB 29X as of May 1, 2002

Program element	Reported savings (MW)	Verified savings (MW)
Agriculture Peak Load Reduction*	38.7	NA
Cool Savings	1.9	NA
Demand Response Building Systems*	77.1	8.14
ECAA Loans	6.9	NA
Innovative Peak Load Reductions*	35.2	NA
Water Agency Generation Retrofits*	4.59	NA
Totals	164.39	8.14

*All or a portion of the savings from these program elements are realized during load curtailments in response to emergency electricity shortages (and are therefore considered *potential* savings).

Nexant's MV&E efforts are in various stages of development and implementation. The CEC has approved MV&E plans for the Innovative and Cool Savings program elements, and implementation of these plans is underway. Nexant has also begun to implement measurement and verification activities for the Demand Response program element. In the ECAA program element, which comprises a number of MV&E plans, Nexant has begun to implement some plans and is still developing others.

Table ES-8 summarizes by program element (funded by SB 5X and AB 29X) Nexant's MV&E activities for the second quarter (up to May 1, 2002). The table also presents Nexant's expected activities for the third quarter (plus the month of May). These and other evaluation activities are discussed in more detail in the individual report sections.

Table ES-8: Recent and Expected MV&E Activity for SB 5X and AB 29X Program Elements

Program element	2nd quarter activity (up to May 1)	Expected 3rd quarter activity (plus May)
Agriculture Peak Load Reduction	Ongoing development of sampling plans for projects of the two program administrators Completion of pre-installation inspections for six projects of Onsite Energy (a direct contractor)	Deliver to the CEC the sampling plans for the administrators' projects Receive approval from the CEC of the sampling plans Begin post-installation inspections and savings analysis for administrator projects
Cool Savings	The CEC approved Nexant's sampling plan	Begin post-installation site inspections
Demand Response Building Systems	Nexant verified savings for one contractor and one grantee Nexant submitted and had approved MV&E plan for sub-elements 1,2, and 3	Continue pilot test savings verification analysis Receive approval from CEC of the MV&E plan for sub-element 4 Begin administrator and participant audits
ECAA Loans	The CEC approved Nexant's sampling plan, general MV&E plan, and 3 LED traffic signals M&V plans A lighting project was inspected, but was later dropped Ongoing development of 10 of the 13 remaining project-specific M&V plans	Complete post-installation inspections for LED traffic signals projects Finalize the remaining project-specific M&V plans Conduct pre- and post-installation inspections and begin on-site metering and monitoring of data
Innovative Peak Load Reductions	Nexant completed most pre-installation site inspections and began some post-installation inspections Slight changes were made to the sample population as a result of cancellations	Complete pre-installation site inspections Conduct more post-installation site inspections and begin analyzing savings
Water Agency Generation Retrofits	Nexant received comments for the general MV&E plan from the CEC Ongoing development of project-specific M&V plans	Nexant to resubmit and get approval on general MV&E plan Finalize project-specific M&V plans for CEC approval Conduct any necessary pre-installation inspections and begin post-installation inspections

