California Renewable Energy Program

Preliminary Evaluation

Prepared for:

The Governor and the California State Legislature

Prepared by:

Regional Economic Research, Inc.
11236 El Camino Real, Suite A
San Diego, California 92130

October 30, 2000

DISCLAIMER

SB 160, the Governor's Budget Act of 1999/00, mandated an independent evaluation process reviewing the status of the Renewable Energy Program and making recommendations concerning its continuance beyond the present statutory authorization. This consultant report was produced by Regional Economic Research, Inc. (RER) independently of the California Energy Commission and transmitted directly by RER to the Legislature and the Governor. It is being provided to the public for informational purposes on the Energy Commission's website.

California Renewable Energy Program

Preliminary Evaluation

Volume I: Overall Program Summary Report

Volume II: Existing Renewable Resources Account

Volume III: New Renewable Resources Account

Volume IV: Emerging Renewable Resources Account

Volume V: Customer Credit Subaccount

Volume VI: Consumer Education Subaccount

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Volume I

1 Introduction

This report provides an overview of the Independent Evaluation of the State of California's Renewable Energy Program, as provided by AB 1890 which was enacted September 23, 1996. The Renewable Energy Program (Program) is funded by the ratepayers of the three largest California investor-owned utilities through the Renewable Resource Trust Fund. The California Energy Commission (Commission) administers all components of the Program.

In 1998, Regional Economic Research, Inc. (RER) was selected by the Commission in a competitive bid process to perform this Preliminary Program Evaluation, along with related market research/assessment and other general program support. The primary objective of this Preliminary evaluation effort is to further the Program's goal of *supporting the development of a fully competitive and self-sustaining California renewable energy supply* through early feedback on its performance and impacts on the state's renewable energy market. In this report, RER offers recommendations for evolving each of the Program's four key accounts. In addition, this Overall Evaluation Report considers the interrelated evaluation aspects of all the accounts implemented under the Program.

This assessment of the Renewable Energy Program consists of six separate evaluation reports prepared by RER for the State of California and the Commission. These program assessment documents include the following:

- Overall Preliminary Evaluation Summary Report (this document)
- Existing Account Preliminary Evaluation Report
- New Account Preliminary Evaluation Report
- Emerging Account Preliminary Evaluation Report
- Customer Credit Subaccount Preliminary Evaluation Report
- Consumer Education Subaccount Preliminary Evaluation Report

This current Preliminary Evaluation Report is intended to summarize the key conclusions and recommendation of the five individual Program account assessments and provide a set of recommendations from an *overall Renewable Energy Program* view point.

The structure of this Summary Report includes the following. Section 2 provides a brief discussion of the enabling program legislation (AB 890 and SB 90) and a brief description of each Program account. Section 3 provides a discussion summary of the Preliminary

Evaluation methodology implemented for the Renewable Energy Program. Section 4 provides an overview of the Preliminary Evaluation results and conclusions drawn by RER in this assessment. Section 5 addresses the broader overall program perspective and individual Program account and subaccount recommendations drawn from these initial assessments.

Volume I

2 Program Background

2.1 Overview

This section presents a brief background of the development and structure of the State of California's Renewable Energy Program. This background summary includes: 1) an overview of the enabling legislation (AB1890) as it pertains to renewable technology support and the ensuing policy implementation legislation (SB 90), and 2) a succinct summary description of each of the four principal funding accounts established under the Renewable Resource Trust Fund.

2.2 Enabling Legislation

Assembly Bill 1890 (AB 1890),[1] enacted on September 23, 1996, provides $540 million for the support of renewable electricity generation technologies. These funds will be collected from the ratepayers of the three largest investor-owned utilities in California from April 1998 through March 31, 2002, to support existing, new and emerging renewable electricity generation technologies. As part of the requirements of the AB 1890, the California Energy Commission submitted a Policy Report[2] to the Legislature with recommendations for allocating the $540 million.

Senate Bill 90 (SB 90),[3] enacted on October 12, 1997, places the $540 million into the **Renewable Resource Trust Fund**, and contains explicit directions for distributing this fund through four distinct accounts: the Existing Renewable Resources Account, the New Renewable Resources Account, the Emerging Renewable Resources Account and the Customer-Side Renewable Resource Purchase Account. Table 2-1 identifies the percentage funding allocations by year.

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1 Chapter 854, Statues of 1996

2 **Policy report on AB 1890 Renewables Funding**, published March 1997, publication number 500-97-002.

3 Chapter 905, Statues of 1997

Table 2-1: Yearly Allocations to Renewable Technologies[4]

Account	1998	1999	2000	2001	Period Overall	Total 4 Years (In Millions)
Existing Technologies	57%	49%	41%	33%	45%	$243
New Technologies	24%	28%	32%	36%	30%	$162
Emerging Technologies	10%	10%	10%	10%	10%	$54
Customer-Side	9%	13%	17%	21%	15%	$81

2.3 Renewable Energy Program Overview

The Renewable Energy Program was designed to address key elements of the renewable energy market in California through both a: 1) supply-side push, and 2) consumer-side pull. The Program encompasses the following supply-side and Consumer oriented program accounts:

Supply-Side Accounts

- Existing Renewable Resources Account
- New Renewable Resources Account

Customer-Side Accounts

- Emerging Renewable Resources Account[5]
- Customer Credit Subaccount
- Consumer Education Subaccount

The overall goal of the Program is to facilitate market and infrastructure development in such a way as to allow for a fully competitive and sustainable market to function effectively on its own near the end of the electric industry restructuring transition period. The two supply-side accounts address, through electric production incentives, both the significant level of existing

[4] These percentages apply to $135 million dollars annually for four years as assumed in the **Policy Report on AB 1890 Renewables Funding**. Due to the fact that $135 million will not be collected in the early years, it may be necessary to borrow funds from one account to make payments in another account equal to the absolute amounts expected annually. This will be done only if the account from which the money is borrowed is not adversely affected. All funds borrowed will be returned to the appropriate account.

[5] Note that as the Emerging Buydown Program includes primarily small-scale on-site generation, as such, it also clearly contains some supply-side characteristics and benefits.

renewable electric energy generation resources,[6] and the relatively new generation resources implemented through this program in the late 1990s.

On the customer-side of the program, the Emerging Renewable Resources Account is structured to support both consumers and retailers/wholesalers of qualified emerging renewable technologies. This is accomplished by providing a substantial capital cost *Buydown* (or rebate) directly to the consumer following purchase and installation of the approved on-site generation system. In addition, the Emerging Account provides various forms of infrastructure support, including market assessment and technical analysis/review of installations, and system installation, performance certification and warranty requirements.

The Customer Credit Subaccount is designed to support through a *volume-based energy incentive credit* (per kWh), the initial development of the renewable energy purchase or "green power" consumer market in California. The program is designed to minimize the potentially high transaction costs, by providing the consumer credits directly to the Electric Service Providers (ESP) and power marketers that acquire and sell the renewable energy to their residential and business customers. These recipients of the Customer Credit are then required to identify and pass-through some portion of the incentive onto their customers. The Consumer Education Subaccount is designed to increase general consumer awareness and effect attitudes and purchase patterns of both the Emerging Renewable Technologies and the Renewable Energy (green power) markets.

The following discussion below provides a summary of each of these Program Accounts.

Existing Renewable Resources Account

Funds from the Existing Account Program are distributed to renewable suppliers through a simple cents per kilowatt-hour (kWh) payment. The production incentive payment is based on the **lowest** of three possible calculations: 1) the difference between a target price and the market clearing price; 2) a pre-determined cents per kWh cap for the respective technology tier; or 3) the funds-adjusted price for your particular technology. The value of the market clearing price used in calculating the payment is currently the weighted seasonal average short-run avoided energy cost (SRAC) specific to each of the three utility service areas (Pacific Gas & Electric [PG & E], Southern California Edison [SCE], and San Diego Gas & Electric [SDG&E], or, in the future, the generation-weighted monthly average unconstrained hourly day-ahead California Power Exchange (CalPX) price. This market clearing price will change over to the *energy price paid by the CalPX* for all facilities, once the California Public Utilities Commission (CPUC) issues an order determining that the CalPX is

[6] Most of the existing renewable resources were developed over the 1980s and early 1990s following the enactment of PURPA in the late 1970s, and the California IOU Standard Offer power purchase agreements approved by the California Public Utilities Commission in the early 1980s.

functioning properly for the purposes of determining the short-run avoided cost energy payments that are provided to non-utility power generators by electrical corporations.

Existing renewable technologies are divided into three tiers. Tier 1 contains biomass, waste tire and solar thermal electric technologies. Tier 2 contains wind power generation technologies. Tier 3 contains geothermal, small hydro (hydro with a capacity of 30 megawatts or less), digester gas, landfill gas, and municipal solid waste. The target prices and incentive caps for each tier are shown in Table 2-2. For a more detailed explanation of the rationale behind tier assignments, target prices, or caps, please review the Energy Commission's **Policy Report on AB 1890 Renewables Funding (P#500-97-002)**.

Table 2-2: Existing Account Target Prices and Incentive Caps (cents/kWh)

Tier/Technology	(Cents/kWh)	1998	1999	2000	2001
Tier 1 (Biomass, Waste Tire, Solar Thermal)	Target Price Cap	5.0 1.5	4.5	4.0	4.0
Tier 2 (Wind)	Target Price Cap	3.5 1.0	3.5 1.0	3.5 1.0	3.5 1.0
Tier 3 (Geothermal, Small Hydro, Digester Gas, Landfill Gas and Municipal Solid Waste	Target Price Cap	3.0 1.0	3.0 1.0	3.0 1.0	3.0 1.0

Renewable Supplier Registration. To qualify for registration as a Renewable Supplier, the facility must use one (or more) of the following energy sources to generate electricity: solar, wind, geothermal, solid-fuel biomass, waste tire, municipal solid waste, digester gas, or hydropower with a generating capacity of 30 megawatts or less.[7] The facility can not use more than 25 percent fossil fuel.[8] (The facility may be located in California or out-of-state.)

New Renewable Resources Account

Thirty percent of the AB 1890 funds, or approximately $162 million, is allocated to the New Renewable Resources Account, intended to provide support to prospective new renewable energy electricity generation projects. Participating projects compete by submitting bids in

[7] The 30 megawatt limitation applies to the sum capacity of all hydroelectric turbine generators employed at a facility.

[8] The content of all fossil fuels used, in the aggregate, may not exceed 25 percent of the total energy input of the facility during a given calendar year (Title 18 or CFR, section 292.204(b)).

an auction to receive fixed, generation-based production incentive.[9] The auction(s) will determine winners and losers based upon the simple cents per kilowatt-hour incentive requests in the qualified bids received. Bids will be ranked in order of lowest incentive request to highest. Beginning with the lowest request, bids will be accepted as winners until funds are depleted or all bids have been accepted. The incentive requests and the amount of estimated generation (over a five-year period) in the bids received have been used to determine when or whether funds in the account are fully allocated.

Winners of the auction become eligible to receive incentives for generation produced and sold during the first five applicable years of operation after a project is developed. Winners must receive approval of their awards from the Energy Commission and proceed through a series of milestones leading to completing construction of their projects and coming on-line as an eligible renewable generator.

Winning projects must come on-line as an eligible generator prior to receiving any incentive payments. Projects that include a fossil-fuel component will not be considered to be on-line as an eligible renewable generator until they meet the requirement of using no more than 25 percent fossil fuel in their operation.[10]

After coming on-line, winning projects provide monthly invoices to the Energy Commission documenting their generation and sale for each month. Winning projects that come on-line prior to receiving their award will submit invoices and receive incentive payments during the first five years after receiving their awards. Under the initial auction held in mid-1988, any winning projects are expected to come on-line as an eligible renewable generator prior to January 1, 2002; those who come on-line later than this date may have their awards terminated by the Energy Commission, and in no case will they receive incentive payments of generation after the end of 2007. In short, late projects, will not receive payments beyond their on-line date, but might for some period less than that, and run the risk of receiving no payments at all.

Prospective bidders were constrained to bid for a limited production incentive amount (not to exceed 1.5 cents per kWh) rather than for the entire revenue compensation for a proposed project. Winning projects are expected to sell the electricity they generate for whatever price it can command in the electricity marketplace. Operational projects are not entitled to incentive payments without proof of electricity generation and sale.

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[9] The production incentives will be paid in terms of nominal cents/kWh

[10] The content of all fossil fuels used, in the aggregate, may not exceed 25 percent of the total energy input of the facility during a given calendar year (Title 18 of CFR, section 292.204(b))

Emerging Renewable Resources Account

The Emerging Buydown (Buydown) Program is a multi-year program providing rebates (or a system "buydown") on the installed cost to buyers, sellers, lessors or lessees of eligible emerging renewable electric generating systems. The payments from the Emerging Account are intended to substantially reduce the current costs of generating equipment using emerging renewable technologies. The major premise of the Buydown Program is to reduce the net cost to the end-user of these generating systems and, thereby, stimulate substantial sales of such systems during a period of at least four years, which began in early 1998. The increased sales of on-site renewable generating equipment resulting from the Buydown Program are expected over time to encourage manufacturers, sellers and installers to expand their operations/ target markets and in due course reduce their installed costs to consumers.

To ensure that the costs of these systems decrease over time, the level of the Buydown payment is currently structured to decline in five steps, from $3 per watt down to $1 per watt during the course of the program. Each level of "Buydown" is tied to a "Funding Block" or specific portion of the Program's $54 million in account funding. These five funding blocks vary in size from $10.5 to $12 million. Once the available funds in the first block ($3.00 per watt) have been completely committed, the next block of funds (at $2.50 per watt) with a lower level of Buydown payment become available, and so on if market development allows, until the final funding block of $1.00 per watt Buydown incentive is fully committed.

In order to be eligible to receive a Buydown incentive, however, specific systems in each of the four technology categories must meet the requirements contained in the Emerging Account Guidebook. These equipment participation requirements include *system level* specifications,[11] and must be met before the Commission can approve a Buydown Application.[12] The State's Buydown Program is also intended to foster the siting of small, reliable generating systems throughout California at locations where the electricity produced is both needed and consumed, thereby unloading the local utility's distribution system. This particular approach is known as *"distributed generation."* In order to be eligible for the Buydown Program, the generating system must: 1) be on the premises of the customers of California's electrical corporations, and 2) be of a such a size that the electricity produced is expected to primarily offset part or all of the customer's annual electrical needs at their premises. To maintain minimum standards of quality and safety, the Buydown Program also requires:

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[11] For example, meeting of either standards or one-year Performance, full warranties, permits and contractor installation.

[12] The Commission recognized that there may be individual systems employing each of the four technologies that may not be able to meet these requirements because of the system's stage in its research, development and demonstration. And therefore will not qualify such system for the Buydown incentive in spite of the eligibility of their underlying technology.

- A minimum of a full five year warranty on the entire generating system;
- Installation by an appropriately licensed contractor and in compliance with appropriate electrical codes: and
- Certain key system components, or the entire generating system, be certified to meet certain established standards, where available.

The amount of Buydown payment an eligible system will receive is dependent on:

1. The specific funding block available to provide a Buydown at the time the system buydown is reserved and/or installed;
2. The size or rated electrical output (Watts) of the system; and
3. The total eligible costs of the system.

Customer Credit Subaccount

The Customer Credit Subaccount is designed to allow end-use customers to receive a rebate from the **Renewable Resource Trust Fund** (14 percent of the overall funds are allocated to this subaccount, for a total of $75.6 million). The funds are paid to registered renewable providers that deliver power from registered, in-state renewable suppliers or wholesalers in direct-access contracts or contracts for differences. The providers in turn pass the rebate along to customers, who will see it on their electricity bill. Renewable wholesalers may also participate in the program, but will not receive funds since wholesalers do not sell directly to end-users.

Funds are distributed through a cents-per-kilowatt (kWh) credit. Providers will be reimbursed for credit they pass onto consumers based on the cent-per-kWh credit level for eligible renewable power. For the first 20 months of the program, the credit level remained at 1.5 cents-per-kWh (the maximum allowable) in order to provide a stable market signal. As a result of higher subscription of green power purchases, the credit level was reduced to 1.25 cents-per-kWh in December 1999. In June 2000, the credit level was further reduced to 1.0 cents-per-kWh for the same reason. The Renewables Program Committee of the Energy Commission (Committee) will continue to hold public proceedings to reassess the credit level near the end of each six-month period.

The Program has a cap of $1,000 that any one non-residential or non-small commercial customer may receive in one year. Further, the combined non-residential and non-small commercial classes may not receive more than $15 million in total incentives from the Customer Credit Subaccount.

The funds available for the Customer Credit Subaccount increase over time from 1998 through 2001 to reflect the anticipated market growth. Annual funding allocations will be further allocated by month, and any unused funds will remain in the Customer Credit Subaccount for use in later months. At the end of the year 2001, any unused funds from all accounts will be reallocated to any one or more of the accounts within the **Renewable Resources Trust Fund**, based on market conditions at that time.

Consumers may receive funding from this account via their ESPs. ESPs and wholesalers interested in participating in the rebate must first apply to the Commission for registration as a renewable energy service provider or wholesaler. Those who register receive a certificate stating they are a registered provider and eligible to receive funds from the Customer Credit Subaccount or that they are a wholesaler supplying energy that is eligible for incentive funds. The ESP must then report to the Commission information about electric product purchases and Customer Credits passed on to consumers in order to receive reimbursements from the Customer Credit Subaccount. Registered wholesalers must submit information documenting that the power they sell or broker is eligible for funding from the Customer Credit Subaccount. Only power generated by an "in-state renewable electricity generation technology" as defined by Public Utilities Code section 383.5(a) qualifies for the rebate.

Volume I

3 Evaluation Methodology

3.1 Introduction

The evaluation of public programs such as the Renewable Energy Program ordinarily involves assessing the extent to which these programs meet their stated objectives. Consequently, the development of the evaluation framework for the Program logically begins with the consideration of the goals and objectives underlying the Program. This review includes a variety of aspects, including:

- AB 1890 and SB 90 legislative implementation goals and SB160 legislative evaluation goals,
- The Commission's AB 1890 Policy Report and the Program Guidebook response to these stated legislated goals and objectives, and
- The Renewable Energy Consumer Education (RECE) Campaign goals and objectives.

The objectives identified in the AB 1890 Renewables Funding Policy Report to the Legislature (P#500-97-002) include:

1. Facilitate the development of a self-sustaining consumer-driven renewables market in California,
2. Facilitate consumers' choice of renewable power,
3. Encourage market-based development of new and emerging renewable resources, and
4. Maintain the benefits and diversity of the renewables industry and move it towards market competitiveness with the broader electricity industry.

The stated policy goal of Senate Bill 90 is *to Maximize the effectiveness of the AB 1890 renewable funds in facilitating the development of a competitive renewable industry*. This statement implies that the program be implemented in the most cost-effective manner – given the current and expected future market conditions for these renewable technologies in California.

3.2 Preliminary Program Evaluation Work Plan

The Program Evaluation Work Plan, developed by RER under Work Authorization No.6 of Contract No. 500-97-022, addressed primarily the broader performance evaluation aspects.

In general terms, this evaluation process for the Program and each account is structured along the following lines:

Program Performance Questions

1) What was the problem being addressed with this Program element?
2) What remedy did the Program employ to address the problem?
3) What was the expected outcome of the Program?
4) What might have happened in the absence of RTP support? (Free-ridership/Free-drivership issues)
5) What actually occurred?
6) Comparison of 4) and 5) above, assessing whether the incentive was a causative, or at least significantly contributing, factor in any indicated impact (or other appropriate measure).
7) What did the Program element cost the public?
8) Was it an "appropriate and effective" use of ratepayer expenditures"? What do the evaluation findings suggest regarding continuance or alteration of this Account?
9) In retrospect, within the confines of AB 1890, could this RTP Account now be better-designed? What are the key factors that would improve the program?
10) If the Commission were no longer bound by the requirements of AB 1890, how would the RTP and its various accounts be optimally designed?

The work scope of this Program evaluation effort encompassed eight major tasks:

- Review the current status of the Program (and its major accounts and subaccounts);
- Collect data relating to the Program and energy markets;
- Evaluate the effectiveness of the Existing Account;
- Evaluate the effectiveness of the New Account;
- Evaluate the effectiveness of the Emerging Account;
- Evaluate the effectiveness of the Customer Credit Subaccount;
- Evaluate the effectiveness of the Consumer Education Subaccount; and
- Prepare interim, draft and final Preliminary Evaluation reports.

For each Account and subaccount above, the evaluation method included: 1) an assessment of progress towards meeting Account goals through the development of a set of proximate indicators for the Program, 2) market survey analyses, 3) an impacts review, 4) cost-effectiveness analyses, and 5) Program conclusions and recommendations.

In evaluating the Program, no one indicator exists that can address the effectiveness of the impacts. This evaluation must rely on a number if sources of internal Program and external market information, some of which are impacted by self-report bias.

Nonquantified Benefits

There are a number of other benefits derived from the implementation of renewable energy projects that could not be considered in this evaluation. Overall, these benefits can be classified as environmental, energy and economic. Environmental benefits include the reduction of air emissions, such as nitrogen oxides, volatile organic compounds, and the reduction of greenhouse gases (carbon dioxide, methane and others). Nonquantified energy benefits include improved system reliability and reduced transmission losses. Economic benefits include the creation of jobs, reduction of waste disposal and the attraction of new industry.

A complete description of the above tasks and the measures of performance considered in this evaluation are provided within the Work Authorization No. 6 Phase I work plan deliverable submitted to the Commission in final form in October of 1999. These series of six preliminary evaluation reports represent the culmination of the above evaluation work plan activities.

Legislative Issue Caveat: It must be noted at this point that during this evaluation process, RER was unaware of the details regarding the legislative activities in progress (i.e., AB 995) that have since extended the utility ratepayer funded Public Purpose Programs in California. This report may therefore contain recommendations that are not fully consistent with this recently enacted legislation affecting the Program.

Volume I

4 Overview of Results and Conclusions

4.1 Introduction

This section of the Overall Evaluation Report presents our assessment results in a high level summary form. Included here are the key results and our conclusions regarding each of the Renewable Energy Program operating accounts, and separately from the broader overall Program perspective. The more detailed information, including the various survey results and related assessment results for each account/subaccount, are available within the appended individual Program evaluation reports, that are included with this overall assessment.

4.2 Conclusions of Overall Program Assessment

Nearly all of the 262 projects representing 4,283 MW of existing resources appear to have benefited effectively from the Existing Account production incentives, keeping nearly all of these facilities operational to date. These resources have also received lower production incentives over the past year due mostly to the design of the Program, because of higher market prices. There is still at least one additional major hurdle for many of the existing facilities to address – making the transition from monthly short-run avoided energy cost pricing to the real-time hourly PX market.

The first New Account competitive bid auction has generated the most substantial amount of incremental renewable facility development since the CPUC implemented Standard Offer No. 4. Currently, 52 in-state renewable generation projects representing over 543 MW and 2,609,000 MWh per year are currently either operational or under various stages of development.

On the customer side of the renewables market, the Emerging Buydown Program has initiated an entirely new grid-connected distributed generation market in California, primarily with solar photovoltaic (PV) conversion technology. Of the 761 project reservations received to date, 688 are associated with PV systems, representing 85% of the Buydown Program funds reserved through August 2000. Small wind systems have played a minor role to date, with 4% of the currently reserved Buydown Funds. The potential market for small wind is significantly greater than demonstrated to date with the Buydown incentives. Based upon the current low awareness levels and moderate to good cost-effectiveness, bio-gas fueled fuel cells may yet provide greater levels of energy and environmental benefits to a small number target markets in the near future. This market is limited currently by the lack of any significant level of commercial operating facilities.

Increased awareness of the technology and the Buydown Program funding with owner/operators of new or expanded wastewater treatment facilities should be initiated through the Buydown or Consumer Education program elements.

The Customer Credit Program has from this perspective been highly successful to date, limited primarily by the overall competitive structure of the electric industry and its related implementation rules. Green power purchasers have accounted for the vast majority of switches (and in increasing proportions over time when compared to the number of nongreen switchers) that have occurred since the market first opened in April of 1998. Most of this activity has been determined to be a direct result of the Customer Credit itself and also to the Renewable Energy Consumer Education (RECE) campaign efforts. The Consumer Education campaign has been somewhat effective on the renewable energy side of the market, particularly given its significant resource and administrative structure limitations. There have been limited implementation efforts to date on the emerging technology aspects of the Consumer Education Program.

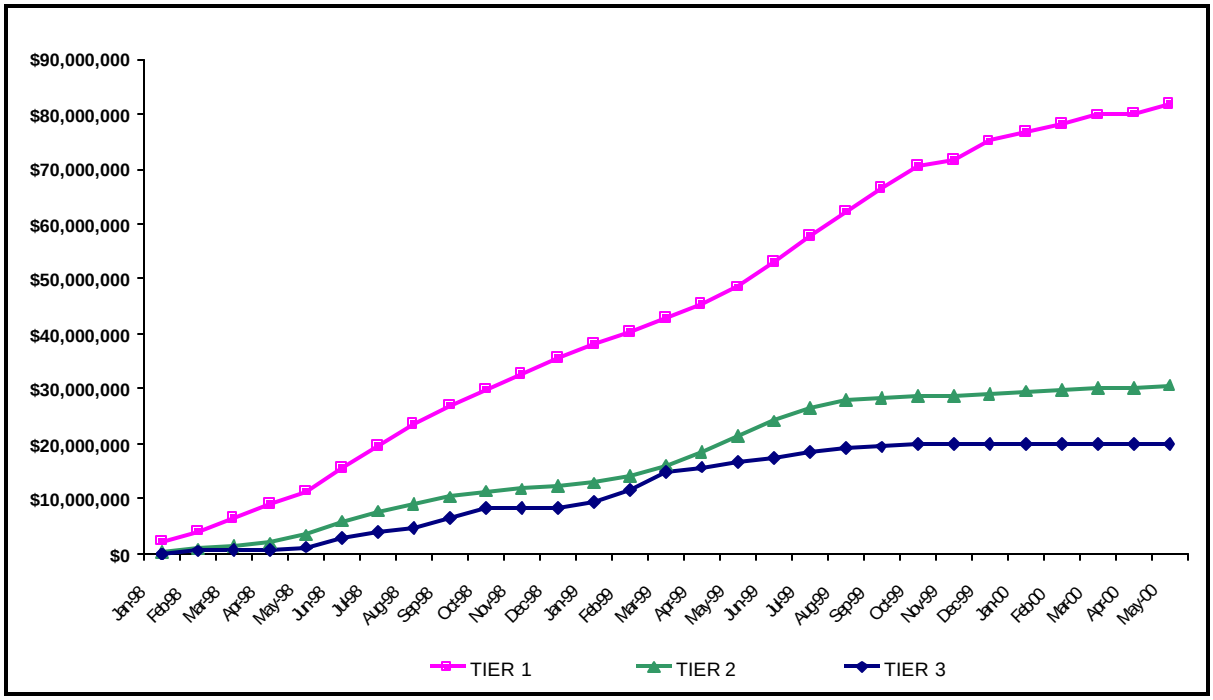
4.3 Existing Account Results and Conclusions

The results and conclusions of the Existing Account Preliminary Evaluation are summarized below in terms of Program Effectiveness, Program Incentive Structure, and Program Duration.

4.3.1 Program Effectiveness

As previously stated, the main policy goal set by AB 1890 was to keep renewables on-line throughout the transition period and enable them to remain competitive after the transition period. The Existing Account Program has financially assisted the 262 projects representing 4,283 MW of existing renewable-fueled generators with approximately $133 million in production incentive distributions paid out through May of 2000. Figure 4-1 summarizes these payments made to participants to date. Based on the survey of renewable facility owners and managers, nearly half of the respondents indicated that they would have reduced their output or shut down completely without the program. Taken at face value, this is a good indication that the program has been effective in achieving its primary goal of keeping existing renewable generators on-line. This is further reinforced by the examination of program impacts earlier in this report. There is some evidence that the program halted an initial decline in the number of active renewable facilities starting with the passing of AB 1890.

Figure 4-1: Cumulative Existing Account Production Incentives Paid



What remains to be seen is whether these renewable resources will remain on-line after the transition to a fully competitive market. The largest reported problem with operating renewable generation facilities in California concerns revenue. Survey respondents stated that either the revenue stream was insufficient or there was too much volatility in the market. This translates to the conclusion that at least for generators in Tiers 1 and 2 the market price alone these facilities have been receiving for their energy production has not been adequate to remain in business. The survey did indicate that the majority of generators thought that the program has improved their chances of remaining competitive after the program ends. Several survey respondents indicated that the incentives have enabled them to perform equipment upgrades and improve facility maintenance. Others indicated that the incentives provided some revenue protection during periods of low market prices. By keeping these facilities operating through the transition period and providing revenues (which, in part, have been used to make facility operations more efficient), the lives of many existing renewable resource projects have been extended through the Program's support. Therefore, these projects are more likely to continue operations in the future.

Participants have expressed high regards for the Existing Account Program, with very few suggestions for improvement or change. The overwhelming majority experienced no problems applying to the program or in receiving payments. Many survey respondents complemented the streamlined application process of the Program.

4.3.2 Program Incentive Structure

The incentive structure of the Existing Account was designed to give those technologies with higher operating costs greater support and those with lower operating cost less support. Other technologies have higher costs, but are less likely to become competitive, and therefore do not receive higher incentives. Overall, the design is intended to achieve a balance between supporting certain industries while still encouraging all renewable resource technologies to make the transition to a competitive market. The program has been successful in distributing funds as designed. Tier 1 technologies have been receiving the greatest level of funding and Tier 3 the least. The incentives by design are responsive to participant market prices and they have been tapering off within the last year.

About one-quarter of the owners and managers of renewable facilities surveyed believe the target prices used in calculating incentives are too low. Even though these are the opinions of participants, it is very suggestive that the levels of incentives are not too low. A small percentage of those surveyed indicated that the incentives were too high. These respondents were all Tier 3 participants. This finding also gives some credence to the predominant survey result. When asked about the program price caps, most felt that they have had no effect on the incentives. When participants were asked to recommend changes to the program, only one respondent made a suggestion concerning the structure of the incentive mechanism.

Based on the relative levels of satisfaction of the survey respondents, one might think that Tier 1 prices should have been a little higher and the Tier 3 prices should have been a little lower. If incentive prices were too low and market prices were too low, then one would expect to see attrition in the number of program participants. The only technology/fuel that has showed any decline since the start of the program is the direct combustion of waste tires. This technology appears to have a solid waste regulatory-related fuel delivery infrastructure problem that REP incentives alone are not likely to solve. Given that these two facilities were (at least temporarily) shut down at the time of this evaluation, no action may be necessary. Several Tier 3 facilities have not reported any production in several months. It has not been confirmed if they have shut down or if they are just not reporting, since they have not been receiving any incentives due to high market prices.

There is some evidence that the Tier 3 incentives could have been lower, at least for some of the technologies. Those survey respondents that said that they thought the incentives were too high all came from Tier 3 participants. About half of the Tier 3 respondents also indicated that they didn’t believe that the incentives had any effect on their operations, but by the same token about half said that they did have an effect. This may be in part due to the variation in incentive prices across IOU service territories. Since SRACs are IOU-specific,

the incentive paid in one area can be significantly different from another for the same month. The assumptions used to place technologies into Tier 3 were of two different sorts (triage approach) making it difficult to draw general conclusions that apply to them all.

The overall conclusion is that the incentive structure is acceptable to the participants, but it does not appear to optimally provide incentives based on need. It seems that the incentives for Tier 3 are too great and those for wind projects under Tier 2 have been about right. The incentives for Tier 1 appear to have been effective in the first and second year, but may not be high enough anymore given that a few facilities have shut down in the beginning of year 2000.

We next address the question of whether the allocation of funds across the three tiers is most effective from a public purpose perspective.

4.3.3 Program Duration

The program was initially designed to give assistance for a certain period of time – the four-year transition to full competition, or *Transition Period*. The support received during this time would allow facility owners to: 1) make improvements to their operations, and 2) learn how to operate under more volatile market pricing thereby improving their chances of being competitive following the Transition Period. The timing of when many of these facilities come off their fixed-price (price cliff) contracts is staggered over several years. As a result, not all of the renewable projects started receiving energy production incentives at the same time. In fact, some renewable energy facilities will not come off the price cliff for a number of years (i.e., until after the current program term).

The perception by the majority of the participants surveyed for this evaluation is that the program needs to be extended. Respondents were naturally positive regarding an extension of the duration of the program when asked. Going beyond the obvious strategic bias of these responses, many cited ways in which their projects could be made more efficient and/or competitive if the program were extended. The unanswered question here is why have these changes not been made (or planned for) during the four years of the current incentive program. Others noted changes in transmission and distribution costs imposed on renewable generators and would like to keep the program in effect to help with these additional transition elements. Some other participants noted that the transition from SRAC to PX pricing is still underway, and felt that the program should be in place until the effects of this change actually take place. The ISO4 contracts vary significantly in duration. Although the fixed energy portion of these contracts was ten years, the total term of these agreements varies from 15 to 30 years. The balance of the term (beyond the fixed energy price period) provides for variable energy pricing at SRAC levels and with other fixed and variable capacity payments. Some facilities already face open market prices, or they will very soon.

Others will not see their ISO4 contracts end for approximately 15 more years. If market prices should decline over time, it may be difficult for many existing renewable generators to remain competitive, but there is no way to reliably predict that prices will fall to such levels – making it uneconomic for them. The uncertainty and volatility of market prices is best demonstrated by the unusual and significant rise of the PX prices during the summer months of this year (Program Year 2000).

It may benefit the success of the program to extend the duration for one or more tiers, if possible, without allocating more funds. Given that SRAC prices have been higher than forecasted and are likely to be higher than originally forecasted during the summer of 2001, more rollover funds will likely be available at the conclusion of the program term than expected, if they are not used by other accounts in the Program. Extending the program would give the Commission more time for program effects to reveal themselves and allow the necessary time to respond to these effects if necessary. No additional funding would be necessary, as the available funds can be reallocated to extend the overall program length. The combination of falling target prices and rising SRAC prices have created a surplus of available rollover funds that was not originally forecasted. Making these funds available by extending the program would provide for a longer period of assistance and allow some of the as yet unseen uncertainties of the market to make themselves more apparent. On the other hand, there may not be enough of a compelling reason to do this. If more generators exercise the option to switch to PX-based prices over the coming year, and if PX prices climb again during mid-2001, the increased revenue that they may receive would exceed what the Program incentives would provide during all of the non-summer months combined.

4.3.4 Conclusions of the Existing Account

The overall conclusion resulting from this evaluation is that the Existing Renewable Resources Account is having a positive effect on the renewable energy market in California. The program is successful to date in assisting existing California renewable electricity generators to remain in operation. There is evidence that owners and managers are taking actions to better insure their survivability following the full transition to a competitive power market. There is also evidence that the creation of the Program with the approval of AB 1890 halted the declining trend in operational renewable capacity in the State.

On a tier specific basis, the program appears to have been too generous to many of the Tier 3 participants. In fact, depending upon the future price volatility in the PX/APX markets, the need for incentives for Tier 3 may not be warranted any longer. Tier 1 on the other hand has shown some evidence that the level of incentives is not sufficient and either the target price or the price cap has been lowered too far. If incentive levels are increased for Tier 1, it will be necessary to increase the level of funding or the incentives paid will be restricted by the level of generation.

4.4 New Account Results and Conclusions

The results and conclusions of the New Account Preliminary Evaluation are summarized below in terms of the awarded Projects under the first auction, the cost-effectiveness of these projects, and the conclusions drawn to date.

4.4.1 Results of First New Account Auction Process

The first New Account competitive bid solicitation was held in mid-1998. Over 550 MW of capacity with projected energy output of over 2.6 million kWh/year by way of 55 projects were awarded in the first New Account Program auction process. Table 4-1 summarizes these selected projects, sorted by their fuel type. Three of these projects have since been either cancelled or withdrawn. From the standpoint of the program as a whole, these cancelled projects represent less than three percent of the awarded capacity and output.

Table 4-1: All Awarded and Cancelled Projects - Generating Characteristics by Technology

Technology/ Fuel Type	Awarded Projects	Awarded Capacity (kW)	Awarded Output (Year 1 kWh)	Cancelled Projects	Cancelled Capacity (kW)	Cancelled Output (Year 1 kWh)
Biomass	2	11,600	94,959,000	1	7,800	63,039,000
Digester Gas	1	2,050	16,521,000	0	0	0
Geothermal	4	156,900	1,228,760,000	0	0	0
Landfill Gas	23	70,125	473,652,400	2	1,597	11,907,850
Small Hydro	1	1,000	7,342,000	0	0	0
Wind	24	310,550	862,603,103	0	0	0
Total	**55**	**552,225**	**2,683,837,503**	**3**	**9,397**	**74,946,850**

A final indicator of program impact is how successful the program is in encouraging consideration of additional renewable resource projects in the future. Based on both the participant and non-participant surveys, interest in developing additional renewable resources is high, especially if another New Account auction becomes available in the near future. Current participants have already identified additional projects about equal to double the size of the current level of award that they would like to possibly develop. Others, in both the participant and non-participant surveys indicated an interest in participating in future resource development without specifying any specific future project or concept.

Cost-Effectiveness

The June 1998 New Account Program auction resulted in the awarding of 55 projects. The award process was efficient in allocating all of the available $162 million. The average

weighted incentive award was about $0.0116 per kWh, which compares very favorably to the allowable maximum award of $0.015 per kWh. If an auction process had not been used and the program was instead designed to provide a flat $0.015 per kWh incentive, about 600,000 MWh per year less would have been funded through the program. In addition, applying the estimated 12 percent free-ridership to the average weighted incentive award, the New Account program unit cost increases only slightly to $0.0132/kWh, still below the maximum established award level. In terms of the program management and administrative costs, the total Commission cost for the New Account is just under $400,000. This line item is only 0.25 percent of the $162 million award fund, and therefore is considered cost effective from an administrative oversight perspective.

Conclusions

The conclusions reached at this point are preliminary, as few of the projects are currently on-line. However, based on the review of the proximate indicators, assessment of the participant and non-participant surveys, and appraisal of the program impacts and cost effectiveness, it appears that the New Account Program is highly effective, well received, and well managed. The only caveat to these conclusions is some projects will likely not be on-line by December 31, 2001 and therefore will not receive a full five years of funding.

Budgetarily, all of the $162 million set aside for New Account incentives were awarded. Although six different renewable technologies are represented in the group of projects given awards, wind, geothermal, and landfill gas projects make up the bulk of the projects receiving New Account Program awards with over 97 percent of the awarded capacity. Only three small projects have been cancelled to date and only moderate milestone slippage has occurred. Most of the funds from the three cancelled projects have already been re-allocated to another project.

Program participants are, in general, very satisfied with the program and most look forward to participating in future New Account Program bid auctions. Program participants perceive the program as being vital for the current development of new green energy resources that are needed to support a growing *consumer-driven* green power market and believe such development would be very difficult, if not impossible, without the program. This view is supported by a review of historical levels of renewable resources over the past ten years, prior to the existence of the New Account Program, that found little change in the overall size of the renewable resource over this time period.

4.5 Emerging Account Results and Conclusions

The results and conclusions of the Emerging Account Preliminary Evaluation are summarized below in terms of interim Program implementation status, cost-effectiveness and

conclusions. The primary objective of the Emerging Account's Buydown Program is to facilitate sales of qualifying emerging technologies by substantially reducing the installed costs to purchasers/lessees of these four types of on-site generation systems. The eligible emerging renewable technologies included within the initial program include: photovoltaic (PV), solar thermal-electric, fuel cells that are powered by a renewable fuel, and small wind turbines less than 10 kW. SB90 required that the Buydown Program provide such funding through a competitive, market-based process that shall be in existence for at least four years. In addition, the Program incentives shall be based upon the rated electrical generation capacity of the system (measured in watts); and the incentive levels shall decline over the term of the Program, in order to stimulate reductions in installed cost.

Based upon the market research and program results to date, summarized in Table 4-2 by number of projects and technology and Figure 4-2 over time, providing a financial incentive to offset the capital cost of Emerging renewable on-site generation systems has, to a limited degree, begun to stimulate a new market for these technologies in California.

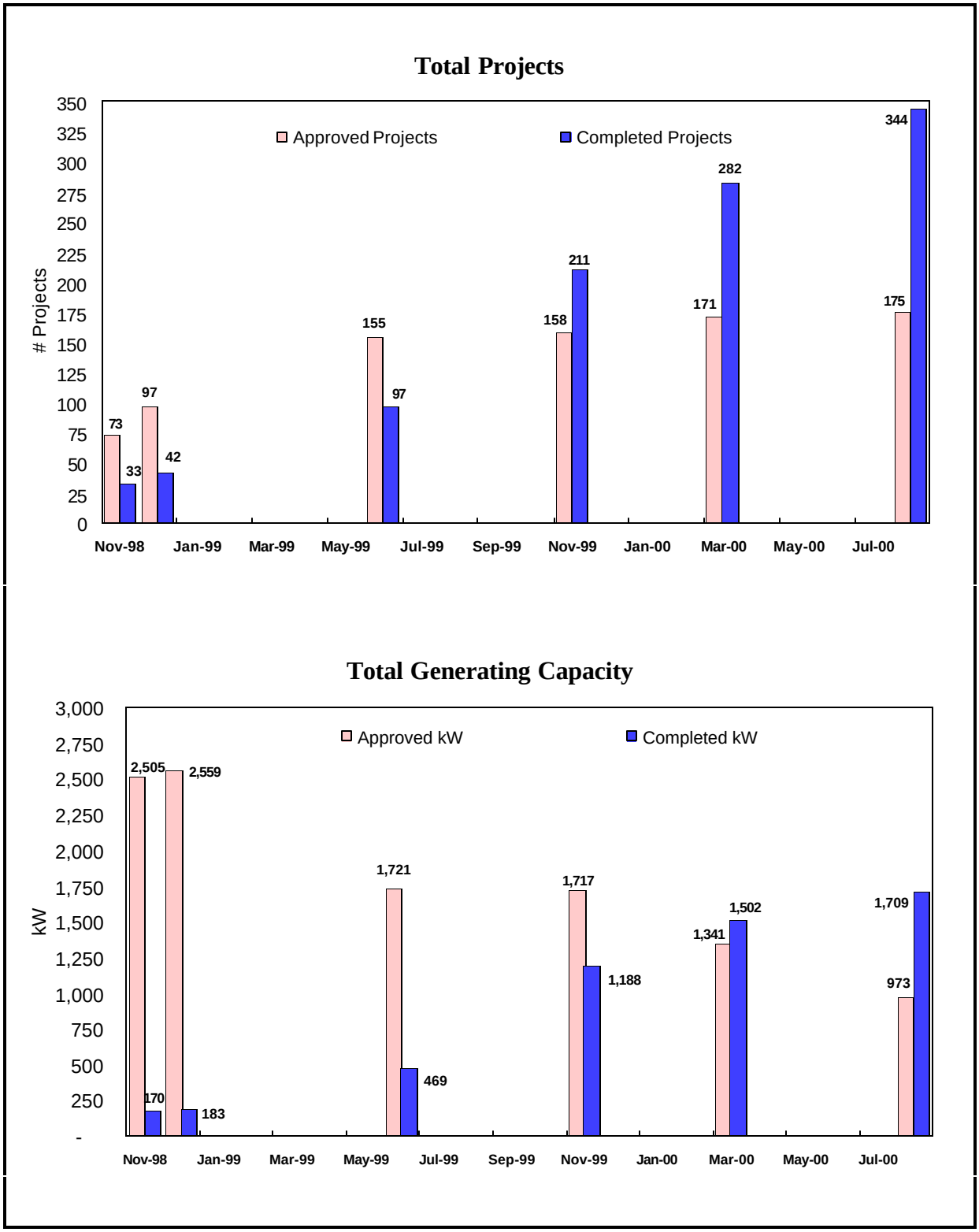
Most PV and small wind system manufacturers and retailers/installers interviewed for this assessment reported that the program had been effective in stimulating sales to customers in California. The conclusions drawn concerning this matter are necessarily restricted, due to the limited sample size of supply channel interviews.

Table 4-2: Buydown Program Reservation Status

Technology	Size Category*	Status as of August 14, 2000							Total Projects
		Received	Approved	Disapproved	Extended	Warning Letter	Project Completed	Cancelled	
Fuel Cells	Small	0	0	0	0	0	0	0	0
	Medium	0	0	0	0	0	0	0	0
	Large	0	0	0	0	0	2	4	6
	Unknown	0	0	0	0	0	0	0	0
	Total	**0**	**0**	**0**	**0**	**0**	**2**	**4**	**6**
Photovoltaic	Small	41	143	36	5	8	300	11	544
	Medium	0	10	104	0	0	15	4	133
	Large	2	1	2	2	0	1	2	10
	Unknown	0	0	1	0	0	0	0	1
	Total	**43**	**154**	**141**	**7**	**8**	**316**	**17**	**688**
Small Wind Turbine	Small	2	21	5	2	0	26	3	59
	Medium	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Large	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Unknown	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Total	**2**	**21**	**5**	**2**	**0**	**26**	**3**	**59**
Solar Thermal Electric	Small	0	0	0	0	0	0	0	0
	Medium	0	0	1	0	0	0	0	1
	Large	0	0	0	0	0	0	0	0
	Unknown	0	0	7	0	0	0	0	7
	Total	**0**	**0**	**8**	**0**	**0**	**0**	**0**	**8**
All	Small	43	164	41	7	8	326	14	603
	Medium	0	10	105	0	0	15	4	134
	Large	2	1	2	2	0	3	6	16
	Unknown	0	0	8	0	0	0	0	8
	Total	**45**	**175**	**156**	**9**	**8**	**344**	**24**	**761**

* Projects in the "unknown" size category are those for which applications have been received but net yet approved for the ERBP, or projects that were disapproved.

Figure 4-2: Number of Projects and Total kW Capacity



4.5.1 Buydown Program Cost-effectiveness

Buydown program impacts and costs are combined in this section to yield measures of program cost-effectiveness from several perspectives. Program cost-effectiveness is expressed in terms of dollars ($) per unit of impact (kWh). Perspectives covered include Participant, Energy Commission, and Society. This interim analysis of Emerging Buydown Program cost-effectiveness covers projects that either had been completed or were in progress as of August 14, 2000.

Energy cost-effectiveness results were calculated as the ratio of levelized cost ($/Year) to annual energy production (kWh/Year). Results of the cost-effectiveness analysis for Completed and Approved projects are presented in Table 4-3 and Table 4-4, respectively.

Table 4-3: C-E Results for Completed Projects

		Cost-Effectiveness ($/kWh)		
Technology	**Size**	**Participant**	**CEC**	**Society**
Wind	Small	0.24	0.13	0.26
Fuel Cell	Large	0.05	0.03	0.07
Photovoltaic	Small	0.75	0.22	0.67
	Medium	0.43	0.14	0.48
	Large	0.21	0.15	0.35
	All Projects	*0.57*	*0.18*	*0.56*
All Tech.	*All Projects*	*0.26*	*0.09*	*0.28*

Table 4-4: C-E Results for In-Progress Projects

		Cost-Effectiveness ($/kWh)		
Technology	**Size**	**Participant**	**CEC**	**Society**
Wind	Small	0.27	0.16	0.30
Fuel Cell	Large	----	----	----
Photovoltaic	Small	0.71	0.22	0.65
	Medium	0.33	0.13	0.34
	Large	0.39	0.15	0.40
	All Projects	0.47	0.16	0.45
All Tech.	*All Projects*	0.46	0.16	0.45

On a $/kWh basis, the large fuel cell projects are substantially more cost-effective than the other technologies. From the CEC perspective, this is due in part to the fact that fuel cells typically operate with high capacity factors to satisfy base load requirements. Solar and wind resources exhibit seasonal and daily variability, which results in lower capacity factors. This influences cost-effectiveness results because CEC per-Watt incentive payments were

identical for all eligible technologies and were based on equipment capacity rather than expected average energy production rates.

4.5.2 Conclusions of Emerging Buydown Program Assessment

Most PV and small wind system manufacturers and retailers/installers interviewed for this assessment reported that the program had been effective in stimulating sales to customers in California. Conclusions concerning this matter are necessarily restricted, due to the limited sample size of supply channel interviews.

As less than 0.01 percent of California consumers have installed qualifying grid-connected emerging technologies through the Buydown Program at this time, this market is clearly still in its most infant stages of development. Given this premise, the following key findings from this assessment are vital for the future planning and implementation of the Emerging Account.

- ***Reduction in Installed Costs of Medium and Large PV Systems.*** Based upon the limited data from the combined medium and large PV system reservations in Funding Blocks 1 and 2 to date, there is evidence that the installed costs have decreased by about $2 per watt since the beginning of the program.
- ***Low Consumer Awareness of Emerging Technologies.*** Approximately 60% of residential and 75% of nonresidential customers surveyed are not well aware of PV as an on-site electric generation option. Residential and business consumers are even less informed about the other three emerging technologies. As consumer demand is an important element in the development of a long-term sustainable market, these market research results indicate that much work needs to take place with consumer education surrounding the emerging technologies.
- ***Installed PV System Performance.*** Monitored electric output of a select number of systems installed under the program to date have indicated that system performance in terms of inverter AC output is lower than expected, especially for smaller systems with battery storage.[1] It appears that the Buydown incentive, as currently determined via certified module efficiency at PTC and peak inverter efficiency is not directly representative of most system's peak performance, as verified/monitored in field tests to date. Either a further overall PV system de-rating procedure is needed, or at a minimum, customers need to be further informed of the expected peak and annual performance of the system before making their purchase decision. This performance issue also has implications upon the level of the Buydown incentive.
- ***Low Buydown Program Awareness.*** One year after the program was launched, 9.5 percent of residential and business consumers were aware of the

[1] Small system with battery storage performance was reduced by an average of 25% to 35% below expected output levels.

Buydown Program's substantial purchase cost incentives. Nearly one year later, the residential awareness had risen about five percentage points to 14 percent, while business consumers' awareness levels remained nearly constant at 9 percent. Awareness of Commission Buydown Program promotional materials is much lower, at about 4 percent for residential and 1 percent for commercial respondents.

- ***Lack of Solar Thermal-Electric and Fuel Cell Market Activity.*** PV (and to a lesser degree small wind) reservations have dominated the Buydown Program to date, with only two large fuel cell projects (but with a combined generating capacity of over 400 kW) and no approved Solar Thermal-Electric applications. There may be a need to target market the wastewater treatment industry with program informational materials, if appropriate based upon the experience with these two operating units to date, using the existing Buydown Program customer as a "case study" for others to learn from and follow.

- ***Reported Willingness to Pay a Premium for Financed Emerging Systems.*** The greater majority of customers reported they would not be willing to pay any premium (over and above their electric/energy bill savings) for a financed on-site renewable generation system.[2] Thirty percent of the residential respondents were willing to pay $1 to $25 per month (or more) for an emerging system. Only 10 percent were willing to pay an additional $25 or more per month, and 1.5 percent stated that they were willing to pay $75 per month. This Willingness to Pay profile for general consumers is notably different from the current end users surveyed for this assessment, and therefore has a significant impact on the future of the Buydown Program. Either incentives will need to increase (coupled with reductions in installed prices to consumers) or retail electric prices will need to rise substantially in order to transform the market for these high cost generation systems into a sustainable mode. Under nearly every scenario, significant levels of financial incentives are needed in the near-term to continue to assist in the development of this market.

- ***High Variability in Participant Cost-effectiveness.*** Based upon completed project costs and performance to date, there is a great level of variance in the cost-effectiveness of the Emerging Technologies. Fuel Cells are clearly the lowest cost, at $0.05 /kWh, but have demonstrated very limited fuel applicability coupled with low consumer awareness. Small wind ranks second overall at about $0.24/kWh and PV the highest at $0.43/kWh for medium-size projects. There is no direct Buydown Program data for solar thermal electric. Given the highest level of participation is with PV, consumers are clearly valuing other benefits beyond simple cost-effectiveness (i.e., environmental ethic, back-up/reliability, leading edge technology ownership, etc.).

- ***Dual-Inverter & Owner-Installation System Performance.*** Performance of systems with dual-power inverters has been in question in a number of on-site verification and monitoring cases to date. Overall, owner-installed system

[2] Over 50% of the residential respondents indicated that they would expect to see a net savings of $1 to $25 or more per month from a leased system.

performance has also been somewhat lower than the average contractor-installed systems. Technical support to address system installation and subsequent trouble-shooting issues should continue to be provided by the Commission to support further development of the emerging technology infrastructure.

4.6 Customer Credit Program Results and Conclusions

The results and conclusions of the Customer Credit Subaccount Preliminary Evaluation are summarized below in terms of interim Program implementation status, cost-effectiveness and conclusions.

4.6.1 Program Results vs. Key Objectives

In accordance with AB 1890, the Customer Credit Program is designed to meet the following objectives:[3]

- To reduce the cost premium for renewable energy that customers pay, thus encouraging them to buy renewable power,
- To help build a green market infrastructure by helping renewables become competitive with nonrenewable generation technologies, and
- To facilitate consumer choice of renewable power.

The first objective of the program is to reduce the premium paid for renewable energy. This is realized when participant ESPs pass the credit through to their customers, in effect lowering their prices for green power to the end-user. During the in-depth interviews, half of the participant ESPs interviewed reported that their prices were a function of the credit and that, if the credit was reduced, their prices would increase. This result does not imply, however, that the remaining ESPs do not pass the credit through to their customers; only that this information was not reported in the interviews. In fact, only one participant ESP reported that their prices were not a function of the credit. These results suggest that at least some ESPs are reducing their green power prices to customers because of the program.

The second objective, to help build a green power infrastructure, was assessed by evaluating selected indicators of market growth. Evidence that the market has grown since its inception in early 1998 can be seen in the following market indicators:

- ***Customers Switching to Green Power.*** Program records show an upward trend in the number of customers switching to green power during the period of April 1998 through April 2000, as illustrated in Figure 4-3 by major customer class. Small commercial customers experienced the highest average monthly

[3] *Policy Report on AB1890 Renewables Funding*, California Energy Commission, March 1997.

growth rate to date at 31%; residential customers increased on the average by 16% per month, and customers in the Other segment by 24%. Moreover, when those customers who were aware of the program and knew they were in it were asked if it had influenced their decision to buy green power, approximately half indicated that it had. It should be noted, however, that this group represents a small proportion of total program customers, as most were not aware they were in the program.

- ***ESPs Offering Green Power Products.*** The number of ESPs participating in the program grew from two to fifteen during the period of April 1998 through April 2000. From the in-depth interviews with ESPs, it was learned that the program has strongly influenced their activities in the market. When asked what the impact would be to them when the credit abates, six of the participant ESPs explained that they would raise their prices and see how customers react. Two stated that they might leave the market, and one stated that they would leave the market. Three ESPs reported that they would stay in the market selling green power regardless of when the program ended, although one clarified that they would reduce the percentage of green power in their mix after the program ended.
- ***MWh Sales of Eligible Green Power Reported Through the program.*** MWh of green power delivered through the program have been increasing since the program began as illustrated in Figure 4-4. Eligible green power sales in the program appear to have peaked in January 2000 at 214,083 MWh, as the customer credit incentive level declined slightly in December 1999. As noted here, more than half of this energy has been delivered to residential customers.
- ***Program Funds.*** The program disbursed approximately $34 million since its inception through April 2000, leaving a balance in program funds of roughly $41 million for the remainder of the program. The incentive payments to ESPs by segment for each month to date are shown in Figure 4-5.

Figure 4-3: Customers Served Under the Customer Credit Program

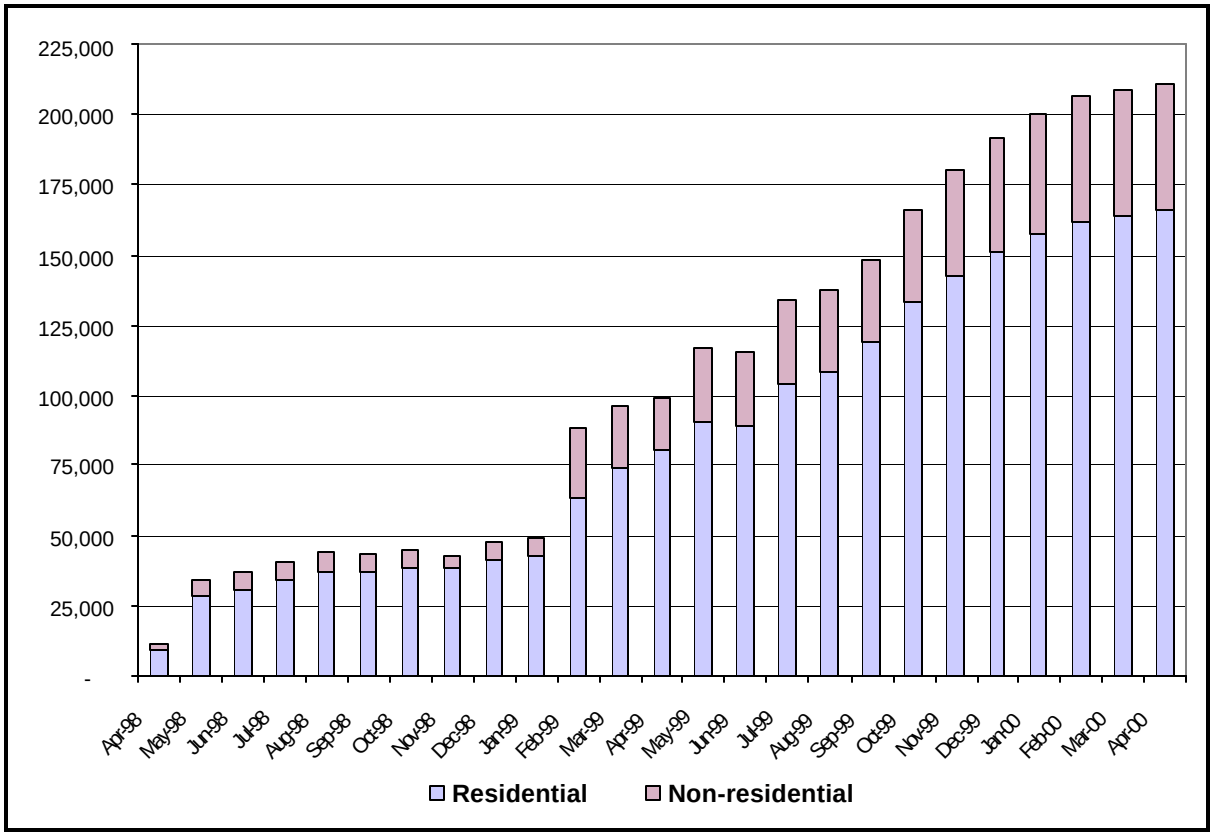


Figure 4-4: Monthly MWh Provided by Participant ESPs

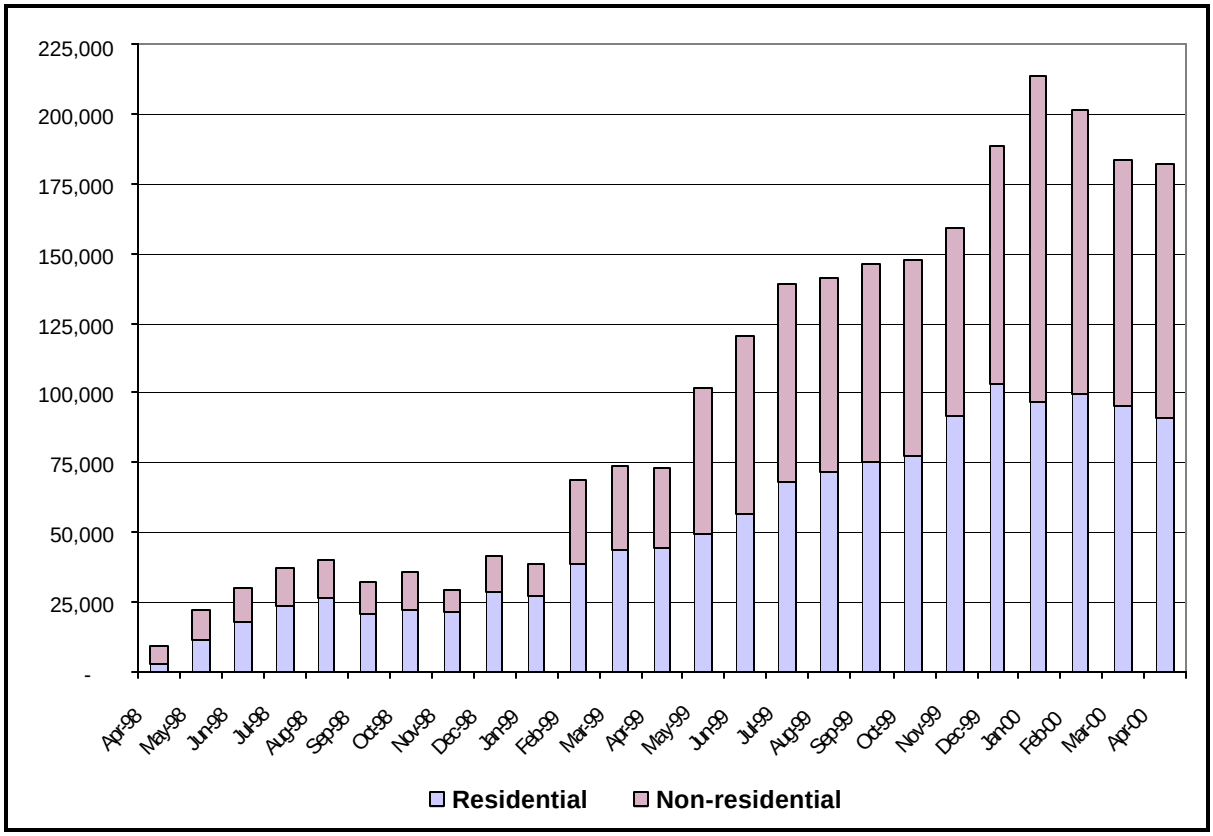
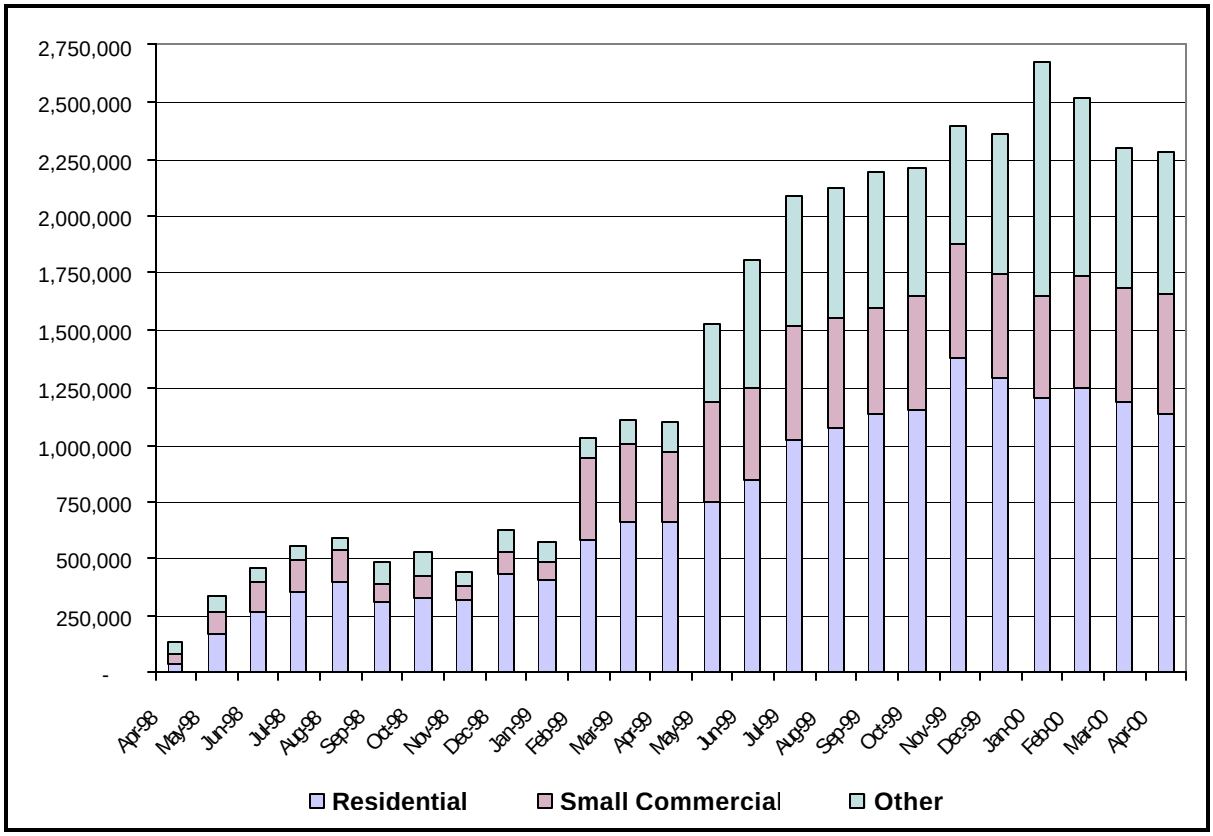


Figure 4-5: Program Incentive Payments to ESPs by Sector



The third objective, facilitating consumer choice of green power, is difficult to assess. In particular, the results of the consumer surveys show that most end users who benefit from the Program are unaware of it, and some are even unaware that they are buying green power. Additional research is being done in another portion of this study to determine the effect of consumer education efforts funded by the Program.

Results of In-depth ESP Interviews

The following are some key findings from the Energy Service Provider interviews:

- Slightly more than one-third of the ESPs interviewed offer green power products exclusively; 18% sold just conventional products; the remainder sold both green and conventional products.
- Most ESPs who serve residential customers also serve small commercial customers. One-third of the ESPs interviewed served all three customer classes.
- Only two ESPs reported emphasizing pricing in their marketing messages.
- Two ESPs reported selling green power at a discount, making it less than the PX price; most sold their green power products at a premium.

- ESPs mentioned the premium price of green power, the lack of a competitive wholesale market, the lack of consumer awareness, and the shortage of generation facilities as barriers to developing a competitive green power market in California.
- ESPs mentioned the premium price of green power, the lack of understanding the power grid, the lack of understanding what renewable power is, and problems with billing and customer service as major concerns of customers in California concerning switching to green power.
- Participants reported no concerns with the program's monthly reporting requirement; however, the annual audit requirement was reported to be complex.
- ESPs differed on their opinions of the variability of the credit incentive. Many reported they needed the credit to stay where it was in order for them to remain competitive and stay in business.

Results of Customer Surveys

The key findings from the participating customer survey assessment include:

- Residential customers who buy green power tend to be more educated and have lower electric bills.
- Only 15% of the residential customers who receive the Customer Credit are aware of it. The percentage is slightly higher for nonresidential customers at around 16%.
- Nonresidential customers who buy green power tend to lease rather than own their facilities. Furthermore, they typically have larger buildings and higher electricity consumption than do businesses who do not buy green power.
- Small businesses reported they were more willing to pay a premium for green power than were large businesses.
- Large businesses report more interest in the Customer Credit Program than do small businesses.

4.6.2 Conclusions of Customer Credit Program Assessment

By providing a financial incentive for the purchase and delivery of green power, the program has reduced the cost of green power for participant ESPs. In addition, it has reduced the retail price of green power for at least some consumers.

ESPs interviewed for this research on average reported that the program had influenced the development of a retail green power market. Evidence of the development of the California market can be seen in 1) new market entrants and 2) in increasing the growth rates of the number of customers switching to green power and the associated delivered green energy. The program has assisted this market growth by providing incentives to ESPs, thus encouraging new firms to enter the market and existing firms to offer green power products.

Conclusions concerning this matter are necessarily restricted due to the limited availability of program data at this time (due to the relatively short timeframe the Program has been in effect).

As less than two percent of California consumers have switched to green power at this time, the market is understandably still in its early stages of development. With this in mind, the following key findings from this research are important for future planning of programs and, as appropriate, incentives that will continue to assist the development of the market.

- ***Lack of Consumer Awareness.*** Approximately 40% of residential and 72% of nonresidential customers in the program are unaware that they are buying green power. Furthermore, the majority of customers (approximately 85%) who buy green power under the program are unaware that they are receiving an incentive. As consumer demand is an important element in the development of a long-term sustainable market, these preliminary Program assessment results indicate that much work remains to be done with consumer education.
- ***Reported Willingness to Pay a Premium for Green Power.*** Most customers (83% to 92%) reported they would buy green power if it were the same cost as conventional power. Furthermore, 35% of residential customers currently not buying green power reported they would pay a premium of 5% or more to buy green power. In addition, 32% of nonresidential customers currently not buying green power reported they would pay a premium of 5% to 10% to buy green power. On average, small businesses are more willing to pay a premium than large businesses. This finding is particularly important, considering that some customers in the program are buying green power at a discount rather than a premium. If the credit incentive continues to diminish and retail prices rise, this reported willingness to pay will be tested.
- ***Ineffectiveness of Power Content Label.*** Most green power consumers (63% of residential and 91% of nonresidential) are unaware of the power content label. In addition, many ESPs reported that their customers are not interested in it. These results seem to indicate the need to reassess the effectiveness of this tool for consumer education.

4.7 Consumer Education Results and Conclusions

As a result of Senate Bill 90, one percent of the Renewable Resource Trust Fund of $540 million are allocated to the Consumer Education Subaccount. The purpose of the consumer education subaccount, as noted in the guidelines,[4] is to support a consumer education and marketing campaign:

[4] California Energy Commission (2000) Renewable Energy Program Volume 5 Consumer Education Subaccount Guidebook, 2nd Edition. P500-97-011V5. July 2000.

- To promote renewable energy;
- To disseminate information on renewable energy technologies;
- To help develop a consumer market for renewable energy and small-scale emerging renewable energy technologies

Commission staff convened a public process to develop a strategy for consumer education beginning in October 1997. During 1997 and 1998 through workshops and public comment, Commission staff developed a marketing plan outlining a strategy to accomplish the goals of the Consumer Education Subaccount.

The Renewable Energy Consumer Education (RECE) Marketing Plan was adopted March 17, 1999 and an initial allocation of $1.2 million funding to execute a portion of the marketing plan was made to the Renewable Energy Marketing Board (REMB) on the same date. The RECE Marketing Plan set out the goals of raising awareness of renewable energy and increasing purchases of both renewable energy from the grid and "emerging renewables" that are installed on customer premises. The plan further set forth a goal of leveraging the value of the education campaign by 4:1 so that the campaign would have sufficient momentum to continue after the four year funding was gone.

A key component of the RECE Marketing Plan was the decision to rely on grassroots organizations to promulgate the consumer education method. This approach had been strongly supported in the public workshops and offered a means for leveraging what all parties felt were limited consumer education funds. Another key component of the Plan was the recognition that the Renewable Energy Market and the Emerging Renewable Technologies Market were different and would likely require different strategies. Table 4-5 displays the distribution of the 5.4 million in funds as of September 30, 2000.

Table 4-5: Funding Allocation for Consumer Education Projects[5]

Type of Allocation	Renewable Energy Market ($1,000)	Emerging Technologies Market ($1,000)	Total ($1,000)
Initial Allocation	$4,320	$1,080	$5,400
Contracts	$1,200	$0	$1,200
Grants	$0	$375	$375
Technical Support	$0	$300	$300
Remaining	$3,120	$405	$3,525

[5] Transcript. Staff Workshop Before The California Energy Resources Conservation and Development Commission, Docket No. 98-REN-EDU. Thursday, August 17, 2000.

Data for this program review were collected from:

- In depth interviews with members of the REMB team and Commission staff between October 4 to 20, 2000
- Review of REMB team monthly reports and the REMB contract
- Data collected for the Emerging Technologies Market Research as baseline data for the Consumer Education evaluation.
- Data collected for the Customer Credit Program as post campaign impact evaluation.
- Comparison data from Northwest Energy Efficiency Alliance betterbrick.com education campaign.
- Switches to green power.

The evaluation of Phase 1 is primarily formative in nature. The purpose is to provide information for mid-course correction of the Program's Consumer Education effort to ensure that Phase 2 is as effective as possible.

4.7.1 Conclusions of the Consumer Education Assessment

The RECE effort between March 1999 and September 2000 can be characterized as both a period in which some successful outreach occurred for the renewable energy market and a learning period for both markets.

Outreach in the Renewable Energy Market was Successful

With very few resources a group of grassroots renewable energy organizations were able to amplify their efforts to educate consumers about the opportunity for choice and green power. Are there other ways they could have spent the resources? (Clearly yes.) Could more have been accomplished using other approaches? (Probably yes.)

However, these are difficult questions to answer with certainty. All members of the REMB Team tout the effectiveness of the city switch and Earth Day campaigns. The evaluation effort around the Santa Barbara Earth Day campaign confirms this view and the trend in green switches during the 15-month REMB project also confirms this view. Yet, the areas targeted by the REMB Team were small relative to the entire state of California. Comparable changes in willingness to switch are unlikely to be observed across the state based on the 15-month phase 1 effort. In addition, all members of the team believe that market research is needed to further understand and clarify the appropriate target market for future efforts and few believe that the city switch strategy will work beyond the next year.

Nonetheless, their efforts demonstrated that if one can generate a newsworthy event then earned media can be effectively used to gain increased exposure for the message. They also demonstrated that having contacts in different parts of the state facilitated the earned media approach, with local contacts available for radio and television when needed. But if newsworthy events cannot be generated, commercial advertising will become necessary.

Many Lessons Were Learned

The other major conclusion to be drawn from this period is that it was a time of learning. The contracting mechanism proved difficult for the REMB Team and CEC. Because Team members were being asked to leverage the dollars and were being given additional resources to do work they were already doing, all parties concluded that a grant mechanism would have worked better than a contract mechanism.

In the emerging technologies market the 15-month period was primarily a learning period, with no major outreach efforts. The CEC contracted for a market research effort to help them identify current awareness and attitudes of residential and business consumers and end-users towards emerging technologies and to identify the target market for emerging technologies. While waiting for the results, the Commission did some small projects to develop tools that could be used in the future: brochures and fact sheets, a guidebook for PV, a logo and booth. The result of this learning period was the completion of the emerging technology consumer education focussed market research and a successful solicitation for $375,000 in consumer education projects for emerging technologies using a grant mechanism.

Volume I

5 Program Evaluation Recommendations

In September 1996, the enactment of AB 1890 directed the collection of $540 million from the ratepayers of California's investor-owned utilities to support the existing, new and emerging renewable electric generation markets in California. Based upon this legislation and subsequent policy development, the California Energy Commission with public input conceptualized and designed the State of California's Renewable Energy Program. Having begun implementation of some accounts in March 1998, the program as a whole has now been in operation for nearly two and a half years. The intention of this preliminary evaluation of the Program is to provide results, conclusions and recommendations that might lead to mid-course corrections, thereby improving the effectiveness of the Overall Program maximizing the use of these limited public resources.

The organization of our evaluation recommendations in this report first includes a summary of the recommendations for each Program Account/Subaccount, followed by high level Overall Program guidance.

5.1 Existing Account Recommendations

Based upon our review of the program and survey data, the qualitative analysis and conclusions drawn from the assessment of the Existing Account, the following recommendations relevant to this account include:

- Consider reallocating the funds across all the tiers starting with program year 2001. Some of the rollover funds originally intended for Tier 3 should be made available to Tier 1. Tier 3 is the least in need of incentives and its rollover funds should be wholly redistributed elsewhere;
- Change the basis for incentives to PX pricing for all program participants rather than continuing to base incentives on SRACs. This change should be made for program year 2001 to effectively allow participants to begin to experience the effects of PX prices before the current program ends.
- Extend the duration of the program for at least Tier 1 and Tier 2 participants. Tier 3 participants may also need to receive some continued assistance, depending upon market conditions;

The first recommendation will simply reallocate funds to where they are most beneficial, namely Tier 1. Tier 3 generators are already in a better position to survive in a competitive

electricity market. If the recommendation to extend the program for a year within Tier 1 is accepted, the rollover balance from all tiers at the end of program year 2001 should be combined and used to fund the incentives. This would require that a forecast of rollover funds be developed, based on a new SRAC forecast, a new PX price forecast, and an estimate of the number of participants electing to receive PX based pricing in the future. If this analysis reveals that very few rollover funds will be left at the end of the four years, then the extension of Tier 1 for another year will not be effective and therefore unnecessary. As a note, the California Public Utilities Commission is currently examining [R99-11-022] whether to have all QFs switch to PX-based pricing. This determination is expected sometime before the end of 2000.

The second recommendation may provide an incentive for more renewable generators to switch to PX based pricing if they can. If a generator was receiving energy payments based on SRACs and the incentive was based on PX prices, it is theoretically possible for no incentive to be paid out even though the SRAC was less than the target price. This may give generators enough of an incentive to switch so as not to miss incentives based on PX prices. If a generator switches to PX based energy prices then its incentives will be based upon PX prices as well. If nothing else, basing incentives on PX prices will begin to expose the generators to a greater amount of real market conditions.

The third recommendation will serve to continue the assistance that the Existing Account has provided to Tier 1 and Tier 2 during the period covered by this evaluation. The renewable generators are not only staying on-line, but they are reporting that they are using some of the funds to improve their operations. Extending the program will improve the chances of a greater number of Tier 1 and 2 renewable energy facilities (i.e., biomass, solar thermal, and waste tire and Wind) being competitive without the production incentives in the future.

5.2 New Account Recommendations

Interest in the New Account Program is high, it has been well received by the renewable energy developers in California, and to date it is cost-effective and has demonstrated positive program impacts. Based on these findings, the primary recommendations are to keep the program operational and if possible with the available funds, initiate another round of New Account auction bids.

Several of the recommendations provided in the participant and non-participant surveys merit consideration and should be reviewed. Three specific survey recommendations are particularly noteworthy dealing with other governmental organizations, the bid bond requirement, and providing more long-term security for renewable generation.

Each of the auction bid award recipients who were government entities mentioned the bid bond requirement as being especially difficult to accommodate. Primarily this is because government agencies are unfamiliar with the bid bond process and also have difficulty obtaining funds on relatively short notice through their budgetary process. To help overcome the unfamiliarity, RER recommends that the CEC provide up-front technical assistance and training. This training should not only be for government entities, but all potential bid submitters that helps identify the barriers to securing a bid bond and evaluate the options available.

The last specific recommendation was echoed by a large number of survey respondents. This is the desire to have a mechanism in place in California that provides more long-term security for the sale of renewable electric generation. Among the several different suggestions for attaining this long term security was the idea to require that a certain percentage of generating capacity in California be green power. Other ideas included establishment of an emissions credit trading mechanism to value the externalities of renewable power source, and tax exemptions for certain technologies. However, implementation of many of these ideas to establish long term security would likely need legislative action. In addition, the current incentive levels are being fully utilized and evidence does not overwhelmingly support changing these current levels. RER recommends that if changes are made to the incentive mechanism that these changes be made in a fashion that promotes equal treatment of competing technologies. Alternate incentives, such as tax credits for certain technologies, should be reviewed to insure that other green power alternatives are not disadvantaged. Further, benefits accruing from positive externalities, such as reduced air emissions and solid/liquid/hazardous waste streams should be considered when developing incentive levels and length of time for incentive payments for green power alternatives.

5.3 Emerging Account

Based upon the above conclusions from this assessment and input from market research, on-site verification, short- and long-term monitoring and infrastructure training activities implemented under the Buydown Program over the last two years, the following Program recommendations are provided for the Commission and industry stakeholders to consider. Our Emerging Account recommendations are segmented into two categories: Legislative and Regulatory.

5.3.1 Legislative Recommendation

Implementation of this first recommendation may require a change in existing legislation, which requires that the Buydown Program rebate level not exceed it currently established dollar per watt limit.

- **Revise the current Program incentive structure to enable capture of a more significant portion of the current California consumer market.** Based upon the recent monitored performance, installed costs, retail rates, net metering benefits, and willingness to pay information, it is clear that at current incentive levels only a very small fraction (<1%) may be willing to actually purchase an emerging renewable generation system. Based upon our analysis of the current market and PV performance data, if the Commission wanted to potentially be capable of eventually capturing a maximum of two percent of the residential consumer market, then the Buydown incentive should be increased to about $3.50 per watt. In order to potentially capture 10 percent of the current PV market over a period of time (with no change in installed cost), the Buydown may need to increase to about $6.30 per watt, or essentially *double* the current Block 1 incentive level.

  Since there would likely be installed cost reductions over this period for the smaller PV systems similar to what has been seen to date for the medium and large PV systems, it is estimated that $4.50 per watt (still with a maximum of 50 percent of eligible installed cost) may be sufficient to develop the required self-sustaining momentum in this market. In order for the market to gain any self-sustaining momentum that will reduce overall installed costs of the smaller systems in the long term, it appears evident that the Buydown incentive will need to be substantially increased in the short- term.

5.3.2 Regulatory/Guideline Recommendations

The following recommendations are of a regulatory or operations nature, some of which may require changes to the Emerging Buydown Program Guidelines.

1. ***While increasing the volume of Program participation, per AB 1890/SB90 incorporate a greater level of market-driven competitiveness elements to increase the incentive for price reductions at the manufacturer/wholesaler and retailer levels.*** This market-based competition element could take a number of forms, including a simple monthly (or quarterly) auction of Buydown Incentives for a given amount of available funding each period -- with a pre-established yet higher "bid price cap" that is consistent with Recommendation #1. Although this approach could be harmful for any one individual or retailer in terms of delaying a project, it could potentially benefit the industry and consumers on the whole by driving costs downward more quickly over time as market volume increases due to the higher initial incentive levels.

   A second, though probably less effective alternative to consider, involves increasing the level of retailer/installer and wholesaler market competition through a feedback- incentive approach that would provide financial rewards for a "top tier" of retailers and/or wholesalers that sold their systems at the lowest (or pre-determined target) installed price. A potential concern with this approach is that of

gaming the incentive mechanism to the point of harming the financial being of the retailers or reducing the quality of ancillary system components and installations.

2. ***Implement further actions to target and improve consumer's informed awareness of emerging technologies installed costs and benefits (environmental, energy savings, utility system back-up/reliability).*** Consumer Education efforts and related funding need to be expanded in the near term, supported by both the industry participants and the Renewable Energy Program. General awareness of the emerging technologies low to moderate. However informed awareness of the technology applicability, costs and benefits is still considered low overall.

3. ***Require installation of (and financially support to either some degree; i.e., such as 50% of incremental cost) or fully support to a maximum dollar limit a very basic level of system performance measurement (simple A/C watt-hour cumulative output meter) for the consumer to be able to verify whether their system is operating adequately under optimal environmental conditions.*** In most instances during on-site verification of the first 69 Buydown participants, it was evident that the vast majority roof system owners were not aware of how much energy their emerging system was producing – either on an instantaneous (kW) basis or a cumulative KWh basis. This information is the key to understanding how well the system is functioning over time. Both at the time of installation (to verify that the system is generating the kW that was actually purchased under standard environmental conditions) and over the course of ownership. Without this basic system performance monitoring capability, owners may have their emerging systems operating at very low levels of efficiency on a single component (such as an inverter or battery charge controller) for an extended period of time without any knowledge of a performance problem.

4. ***Increase installation training support activity for retailers/installers, owner-installers, and code compliance support for building inspectors/local permitting agencies and electric local distribution companies.*** Some of the performance issues identified through the verification, monitoring, and troubleshooting efforts to date have been traced to proper installation issues for certain key components and ancillary items, such as wiring and fuses, etc. Improving the emerging technology infrastructure support in these key areas will impact the future performance of the systems installed under the Program and provide a better opportunity for a self-sustaining market to occur. Improved familiarity of the emerging systems with local building department inspectors and electric utility metering/parallel inspection personnel will help reduce existing barriers reported by some of the current participants.

In summary, there are a number of areas where the Emerging Account can be improved upon to provide additional benefits to all of the stakeholders in this growing California renewable generation market. Some of these efforts are already underway, or in the process of being considered for implementation.

5.4 Customer Credit Program

A forecast of green power sales growth, based on the most recent months of complete program data, as described in the Customer Credit Preliminary Evaluation Report (Section 5), suggests that additional program funding will be needed by midyear 2001. One should note however, that this scenario was developed using data only through April 2000. As additional data becomes available, particularly after July 2000, that includes the effect of the incentive change from the current $12.50 per MWh to $10 per MWh, this issue will need to be revisited again.

Concerning the design of the Customer Credit Program, ESPs interviewed for this research reported that they were happy with the program, considered it well administered, and certainly wanted it to continue. The program appears to be working as intended and no recommendations for changes in its overall design are recommended at this time. However, should credit level drop further (e.g., below $10/MWh), it is currently unclear whether the success of the Program experienced to date will continue.

The market for green power is growing; however, as less than two percent of California consumers are purchasing green power at this time, and many of them are unaware they are doing so, the market is at a critical stage. Should the Program end in the near future, increased retail prices would probably follow, resulting in consumers switching away from green power and ESPs leaving the market. Therefore, continuation of the program is recommended. However, additional data is needed to determine whether and/or how much supplementary program funds will be needed to successfully operate the Program through its intended completion.

5.5 Consumer Education Program

From the findings about the project and the conclusions noted above, we make the following recommendations to facilitate increased effectiveness in the RECE efforts for the next implementation period.

Program Design and Implementation

Planning and Strategy Coordination Are Invaluable

There was an overall vision and strategy for the implementation of the REMB Team project. All members of the Team had specific activities they were working on toward the larger vision of facilitating city switches and community member switches and Earth Day awareness. In the future, if the CEC chooses to be program administrator there will have to

be either a requirement for coordination and planning among grantees or the CEC might consider creating a task force or committee to conduct strategic planning for the overall RECE effort. Members of the task force could be from the grantee organizations or could be a mix of grantee and nongrantee interested parties. Mostly likely, task force members will need to be compensated for their time and effort and associated direct costs.

Market Research is Needed for Renewable Energy Market

One of the first lessons learned in the REMB Team effort was that the assumptions about the target market were incorrect. The emerging technologies market had already benefited from conducting market research at the outset and the renewable energy market now requires the input of market research data to facilitate better project focus in the future.

Continue to Follow Through on Current City Switch Effort

The city switch campaign is only partially completed. Some cities are in the midst of deciding and still require the combination of technical and policy level support that the REMB Team offered. Facilitating the completion of these efforts will ensure that lost opportunities are not created by the change in funding approach. However, it is important to recognize that new barriers have emerged. With the recent passage of cities can no longer claim the customer credit benefit for a switch to green power. Only by working with the key cities now, who have been actively thinking about switching, can the CEC clarify the effect of this recent change and determine what solutions are required.

Continue to Build on Earned Media Efforts

The REMB Team members accomplished a significant amount of *earned media* from the city switches and Earth Day events. Efforts should be undertaken to continue these efforts to maintain the momentum and understand what tactics are required to keep the green power story familiar to media contacts and one they are willing to cover. A strategic planning task force for RECE should necessarily include media experts.

Fit the Contracting Mechanism to the Project

All parties we spoke with thought that the contract mechanism had created problems for the REMB Team. They could not pay for media buys up-front, they had to provide extensive documentation of their activities on a monthly basis and they often found themselves having do redo invoices and progress reports to meet the CEC requirements. While many concluded that grants would have been the preferred strategy, that may not always be the case. Grants and contracts have specific purposes and should be used for those purposes in future RECE efforts. Based on our understanding of the project requirements we recommend the CEC:

- Use grants to support organizations with ongoing activities that support RECE campaign activities
- Use contracts for specific tasks with expected deliverables and milestones

Program Administrators Must Know the Market

Program administrators must be familiar with the market. REMB was a good choice for program administrator of the renewable energy market because they know and work with all the players in the renewable energy market. However, they felt they could not use contract dollars to oversee and manage the project, but had to use their leveraging dollars to do that function. As a consequence, they did not allocate sufficient resources to run the effort as a program administrator, and in the end opted to no longer fulfill that role.

As the CEC is now choosing to be the program administrator for all RECE efforts, it will be necessary for the CEC to conduct all functions that a program administrator fulfills. This includes the planning and strategy function as well as knowing the market and the various grass roots players in the market. We recommend that the CEC staff actively meet with green power marketers and emerging technology implementers as well as grass roots organizations by attending their conferences and trade meetings on a regular basis. We also recommend that members of these markets be included on the task force for planning and strategy decisions as well.

Continue to Walk the Line Between Consumer Education and Marketing

Consumer education and marketing are different sides of a coin. One seeks to educate one to persuade. In the case of the renewable energy market, the marketing aspect is clearly a private sector function for the green power marketers. In the emerging technologies market, the specific sale of a PV or small wind system is best left in the hands of the implementers. However, the need to promote and educate consumers about the basic technology benefits and the program itself requires the CEC to go beyond consumer education and to actually market the program. In so doing, consumers will become both aware that emerging technologies are an option (the education function) and also aware that the CEC offers a program to support investment in emerging technologies (the program marketing function).

Funding Allocations

The 1% allocation to consumer education will not be satisfactory to get the two messages of renewable energy and emerging renewable technologies out to the residential consumer and to commercial businesses. A multi-faceted approach is being recommended in this evaluation and being developed by the CEC. Eventually, commercial media purchases will be required to reach consumers throughout California about renewable energy. In order to be effectively reached, the emerging technologies market requires both education and program

marketing materials. The 20% allocation made previously to emerging technologies also will not be sufficient. These are niche markets located throughout the state. They can be leveraged in some geographic areas with city switches and with special events such as Earth Day and Solfest, but it will take a deeper campaign to reach the majority of the market.

5.6 Overall Renewable Energy Program Recommendations

From the perspective of the entire Renewable Energy Program and the original goals of AB1890, the Renewable Energy Program have as of this Preliminary Evaluation met most all of the directives of this enabling legislation. This includes supporting the operations of existing facilities, and the development of new and emerging in-state renewable electric energy resources, incorporating competitive market-based fund allocation mechanisms. In addition, AB 1890 directed the Commission to include Program options/implementation mechanisms that:

1) Reward the most cost-effective renewable generation,
2) Devise a process to certify renewable resource providers,
3) Allow customers to receive a rebate from the renewables fund,
4) Allocate at least 40% of the total funds to both the existing renewable generators and at least 40% to new and emerging renewable resources, and
5) Incorporate financing and other mechanisms to maximize the effectiveness of the available funds.

Based upon the overall evaluation results and individual Program account conclusions and recommendations, the first and foremost recommendation offered here is to continue the operation of the Renewable Energy Program. Nearly all of the 262 projects representing 4,283 MW of existing resources have benefited effectively from the Existing Account production incentives, keeping nearly all of these facilities operational to date. These resources have also received lower production incentives over the past year due mostly to the design of the Program, because of higher market prices. There is still at least one additional major hurdle for many of the existing facilities to address – making the transition from monthly short-run avoided energy cost pricing to the real-time hourly PX market.

The first New Account competitive bid auction has generated the most substantial amount of incremental renewable facility development since the CPUC implemented Standard Offer No. 4. Currently, 52 in-state renewable generation projects representing over 543 MW and 2,609,000 MWh per year are currently either operational or under various stages of development.

On the customer side of the renewables market, the Emerging Buydown Program has initiated an entirely new grid-connected distributed generation market in California, primarily with solar photovoltaic (PV) conversion technology. Of the 761 project reservations received to date, 688 are associated with PV systems, representing 85% of the Buydown Program funds reserved through August 2000. Small wind systems have played a minor role to date, with 4% of the currently reserved Buydown Funds. The potential market for small wind is significantly greater than demonstrated to date with the Buydown incentives. Based upon the current low awareness levels and moderate to good cost-effectiveness, bio-gas fueled fuel cells may yet provide greater levels of energy and environmental benefits to a small number target markets in the near future. This market is limited currently by the lack of a significant level of commercial operating facilities. Increased awareness of the technology and the Buydown Program funding with owner/operators of new or expanded wastewater treatment facilities should be initiated through the Buydown or Consumer Education program elements.

The Customer Credit Program has from this perspective been highly successful to date, limited primarily by the overall competitive structure of the electric industry and its related implementation rules. Green power purchasers have accounted for the vast majority of switches (and in increasing proportions over time when compared to the number of nongreen switchers) that have occurred since the market first opened in April of 1998. Most of this activity has been determined to be a direct result of the Customer Credit itself and to some degree the Renewable Energy Consumer Education (RECE) campaign efforts. The Consumer Education campaign has been somewhat effective on the renewable energy side of the market, particularly given its significant resource and administrative structure limitations.

Our overall Renewable Energy Program recommendations are summarized as follows.

1) At a minimum, the Program should be continued at its existing funding levels of approximately $135 million per year for at least the full duration of the electric restructuring transition period[1].
2) In terms of targeting individual account funding levels with the current Program resources, the only recommended change includes the Customer-side accounts: Consumer Education and possibly the Customer Credit subaccount. The entire Consumer Education effort is vital to the eventual success of the Emerging technologies and the renewable energy markets and is currently under-funded to meet its intended objectives. All implementers of these efforts to date have been unable to leverage outside funding at the targeted 4:1 ratio. The funding allocation for the Consumer Education subaccount should be increased from the current 1% of Program funds. At the current rate of expenditure growth, the Customer Credit subaccount will use all available funds before the end of the current Program -- in

[1] As the transition period is ultimately defined and funded for meeting public purpose goals and objectives.

early to mid-2001. Reducing the credit any further (below $10 per MWh) may have a significant detrimental effect on the green power market in the longer term. This funding allocation issue will need to be addressed further within the next three to six months, once the full market effect of the latest credit decrease (from $12.50 to $10 per MWh) has been realized.

3) The Rollover funds currently accumulating in the Existing Account element of the RRTF should be reallocated between the New Account and the Customer Credit/Consumer Education Subaccounts, as needed, in order to most effectively stimulate the demand for new in-state green power resources.

4) Any unallocated/returned production incentive funds from the New Account implementation process, should be returned to the New Account for use in a future competitive bid auction, if practical. If these funds cannot be effectively used for this purpose, they should be made available to either the Emerging Account or the other Customer-side accounts, including Consumer Education.

5) The incentive levels for the Emerging Account need to be reconsidered in light of the overall level of Account activity and due to the performance of installed PVsystems monitored to date under the Program. Revising the incentive structure s to become technology-specific is one option, while increasing the Buydown $/watt level overall, with a greater maximum percentage Buydown limit may be necessary.

Renewable Energy Program

Preliminary Evaluation

Volume II

Existing Renewable Resources Account

Prepared for:

The Governor and the California State Legislature

Prepared by:

Regional Economic Research, Inc.
11236 El Camino Real, Suite A
San Diego, California 92130

October 30, 2000

Volume II – Existing Renewable Resources Account

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Volume II

1 Introduction

The Renewable Energy Program (REP) was developed by the California Energy Commission (CEC or Commission) as a result of AB 1890, which enabled the restructuring of the electricity industry. The Existing Renewable Resources Account is one of four accounts in the Renewable Resource Trust Fund (RRTF or Fund) created and funded through AB 1890 to support existing, new and emerging renewable generation technologies. With respect to the Existing Account, AB1890 specified that at least 40% of the total renewable program funds be used to support the operation of existing renewable resources, including biomass and solar thermal resources.[1]

The Commission's Policy Report on AB 1890 Renewables Funding was the Commission's road map in developing the renewable technology support programs enacted by AB1890. This legislation set forth both broad guidelines and specific funding limitations that the Commission then was responsible for implementing. AB 1890 established a funding mechanism through which $540 million was to be collected from investor-owned utility (IOU) ratepayers during the transition from regulated to market-based pricing of generation resources (1998 to 2001).

The Policy Report was subsequently incorporated into law through legislation enacted in 1997, SB 90. This legislation took the Commission's recommendations and established a Renewable Resource Trust Fund consisting of four accounts: Existing Technologies, New Technologies, Emerging Technologies, and a Customer-side account.

The Existing Account started in January 1998 and, the current program being evaluated is scheduled to expire at the end of December 2001. The program was designed to help maintain in-state existing renewable technologies during the first four years of the electric industry restructuring by providing power generation (production) incentives to qualified renewable resource facilities. The intent is to assist them in adjusting to the "price cliff" resulting from the expiration of fixed energy prices under Interim Standard Offer No. 4 and from the expected reductions in market prices resulting from the deregulation of the electric power industry in California. The production incentives may also be used to upgrade existing renewable generation equipment, thereby increasing plant competitiveness now and in the future, after Existing Account incentives are no longer available.

[1] AB 1890, Article 7, Section 383.a.

The existing account was allocated 45% of the funds, or $243 million divided among three tiers:

- Tier 1 (biomass, waste tire, and solar thermal) was allocated $135 million,
- Tier 2 (wind) was allocated $70.2 million, and
- Tier 3 (geothermal, small hydro, digester gas, landfill gas and municipal solid waste) was allocated $37.8 million.

Funding for the program is collected from ratepayers of the state's investor-owned utilities companies under authority from Assembly Bill 1890 and Senate Bill 90. The amount of funds available in each tier declines each year as renewable generation facilities are expected to become more cost effective and therefore require less financial help to compete in an unregulated market. The funds from the existing account are distributed monthly to renewable suppliers though a cents/kWh payment for eligible renewable electricity generation. Any funds not distributed rollover to the following month within the same tier[2]. The incentive price depends on tier-specific target prices, caps, funds available, and the amount of monthly generation, and on either short-run avoided costs calculated monthly for each utility or on an average monthly PX price.

1.1 Stated Goals and Objectives for the Existing Renewables Account

The Commission's stated Existing Account goal in the Policy Report was "To maintain the benefits and diversity of the renewables industry and move toward market competitiveness with the broader electricity industry."[3] Movement toward market competitiveness was encouraged by ramping down support over the four-year transition period. Thus the overall allocation of 45% was broken down over four years starting at 57% in 1998 and declining to 33% in 2001. The funds were to be paid out in the form of production incentives when the price the generator receives falls below a specified "*Target Price*." The subsidies were capped at either 1.5 or 1.0 cents per kWh, depending upon the technology/tier and the program year. The Existing Account Fund was subdivided into three tiers that determined the target price, the cap, and the allocation of funding. Tier 1 included biomass and solar thermal technologies. Tier 2 included only wind generation. Tier 3 included all other technologies (geothermal, small hydro, digester gas, landfill gas, and municipal solid waste. The funding allocation among the tiers was set at 56% for Tier 1, 29% for Tier 2, and 16% for Tier 3. The intention of this split was to "…maintain the benefits of the renewable industry by providing support which reflects industry needs and expected benefits..."[4]

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[2] The CEC may, pursuant to the Policy Report, reallocate funds to other purposes at appropriate times.

[3] Policy Report, page 9.

[4] Policy Report, page 14.

Targets and payment caps were established as shown in the following Table 1-1.

Table 1-1: Target Prices and Payment Caps for Existing Technologies[5] (cents per kWh)

	Price	1998	1999	2000	2001
Tier 1 (Biomass, Solar Thermal, and Waste Tire)	Target	5.0	4.5	4.0	4.0*
	Cap	1.5	1.5	1.0	1.0
Tier 2 (Wind)	Target	3.5	3.5	3.5	3.5
	Cap	1.0	1.0	1.0	1.0
Tier 3 (Geothermal, Small Hydro, Digester Gas, Landfill Gas [LFG], and Municipal Solid Waste (MSW)	Target	3.0	3.0	3.0	3.0
	Cap	1.0	1.0	1.0	1.0

* This target was changed from the Policy Report by SB 90.

The Policy Report further specified efficiency criteria in renewables funding. The specified mechanisms were intended to "Improve the effectiveness of the available funds by limiting assistance to those existing facilities that are already competitive and those unlikely to become competitive (i.e., using the triage principal)."[6]

These efficiency criteria were implemented in the design of the target prices and caps shown in Table 1-1. Tier 1 targets were initially set high to reflect the high cost of these technologies and gradually decline as they are encouraged to find ways of becoming competitive (5.0 cents declining to 4.0 cents per kWh). Tier 2 wind generators were viewed as already more cost-competitive and thus were assigned a lower target price throughout the four transition years. Tier 3 technologies were viewed as the most cost-competitive and therefore were assigned the lowest target price (3 cents per kWh).

Eligibility criteria were established by the Commission that excluded the following projects:

- Those receiving fixed energy payments under a long term contract with an IOU,
- Receiving above market cost payments through the CTC (Competitive Transition Charge) (this excludes IOU-owned renewable generation facilities),
- Any energy produced and used on-site, and
- Generators selling to customers not paying into the public benefits fund (excludes sales to non-IOU customers).

Further goals specified in the Policy Report included:[7]

5 Ibid. Table ES-3, page ES-9.

6 Ibid. Page 10.

7 Ibid. page 19-20.

- Keeping distributions as simple and flexible as possible to minimize administrative overhead,
- Including simple safeguards such as caps and flexibility to adjust to changes in market conditions,
- Respecting industry representatives and stakeholders, and
- Minimizing the chance of triggering changes in federal tax credits that may be received by projects.

The Policy Report explains the rationale for the allocation among the tiers. In general, the Tier allocation was intended to reward the most cost-effective generation, support specific renewables mentioned in AB 1890 (biomass and solar thermal) and to encourage all renewables. Tier 1 is allocated the greatest amount of funds initially because it is viewed as having the greatest initial need. Furthermore, the support for biomass and solar thermal generation was specifically mentioned in AB 1890. Later during the transition period, Tier 1 need was expected to decline due to cost shifting and operation and maintenance improvements and the reduction in Tier 1 targets and caps. However, more facilities will become eligible over time as these projects lose their fixed energy pricing under their SO4 contracts. Tier 3 was allocated the least funds because it was believed that most Tier 3 technologies do not need as much additional support. Other higher cost technologies in Tier 3 were viewed as being likely to survive transition.[8]

[8] Ibid., Pages 28-29. These higher cost technologies were not specified in the Policy report.

The account allocation by tier per year is shown in Table 1-2.[9] For each year, percentages indicated in the table are with respect to total annual RRTF funding for the four accounts.

Table 1-2: Account Allocation by Tier

	1998	1999	2000	2001	Overall 1998-2001
Tier 1 (Biomass, Solar Thermal)	32%	27%	23%	18%	25%
Tier 2 (Wind)	16%	14%	12%	10%	13%
Tier 3 (Geothermal, Small Hydro, Digester Gas, MSW, LFG)	9%	8%	6%	5%	7%
ALL Existing Technologies	57%	49%	41%	33%	45%

The following presents additional program information:

- An electricity generating facility utilizing a renewable resource technology or fuel is only eligible if it was in operation prior to September 26, 1996 in addition to meeting several other requirements specified by the program.[10]
- Production incentive funding for each Tier is based on the difference between the Target Price and the short-run avoided cost of the local utility and is subject to a price cap.
- Incentive amounts vary by Tier and over the life of the program based on a schedule of Target Prices and Price Caps. These amounts will be reduced should the number of eligible facilities grow to the point where the calculated incentive exceeds the available funds. Any allocated funds not paid out in a given month are carried forward and made available in future months.
- The CEC intends to use the market clearing price in place of short-run avoided costs in determining incentive prices when the CPUC determines the market is functioning properly for this purpose.
- Renewable suppliers must submit a monthly invoice report indicating the quantity of eligible generation based on a statement from an independent third party.

[9] Reproduced from Policy Report Table 3-1, page 28.

[10] *Existing Renewable Resources Account Guidebook, Volume 1*. pp. 3-5. California Energy Commission. January 1998.

1.2 Evaluation Objectives

The objectives of this evaluation are to develop measures of performance for the period beginning January 1, 1998 and including all generation in the program through May 31, 2000. In general, these measures fall into four major categories:

- Proximate indicators of program implementation,
- Indicators of program impacts, and
- Measures of cost-effectiveness

In evaluating the program's benefits, no one indicator exists. Instead, the evaluation must rely on a number of sources of information. In the end, the determination of impacts will come from the evaluation of numerous indicators based on program data, self-reported information from owners and managers of renewable resource facilities, and secondary sources of information however imperfect.

1.3 Non-Quantified Benefits

There are numerous other benefits derived from promoting and sustaining renewable energy projects that are not considered in this evaluation. In general, these can be classified as environmental, energy, and economic. The environmental benefits include the reduction of emissions of criteria pollutants such as nitrogen oxides (NO_x) and volatile organic compounds (VOCs) and the reduction of emissions of greenhouse gases such as carbon dioxide (CO_2) and methane. The energy benefits include the benefits associated with distributed generation; improved system reliability and reduced transmission losses. The economic benefits include the creation of wealth from the productive use of wastes. This translates to job creation, the reduction in the cost of waste disposal, and the attraction of new industry. These benefits cannot be accurately quantified in the evaluation timeframe of this program

1.4 Report Organization

The remainder of this evaluation report is organized as follows:

- Proximate Indicators,
- Survey Results,
- Qualitative Assessment,
- Program Impacts,
- Program Cost-Effectiveness, and
- Conclusions and Recommendations.

Volume II

2 Proximate Indicators

This evaluation is designed to focus on the net impact of the Existing Account's production incentives on sustaining, for the long term, the existing renewable projects that were developed prior to the implementation of the Renewable Energy Program (REP). To some degree, the success of the program is dependent on the extent to which the components of the program are implemented. Implementation progress can be monitored by tracking indicators that are directly related to program implementation activity. These indicators of performance are referred to here as "proximate" indicators.

Specifically, this evaluation has looked at three broad categories of proximate indicators:

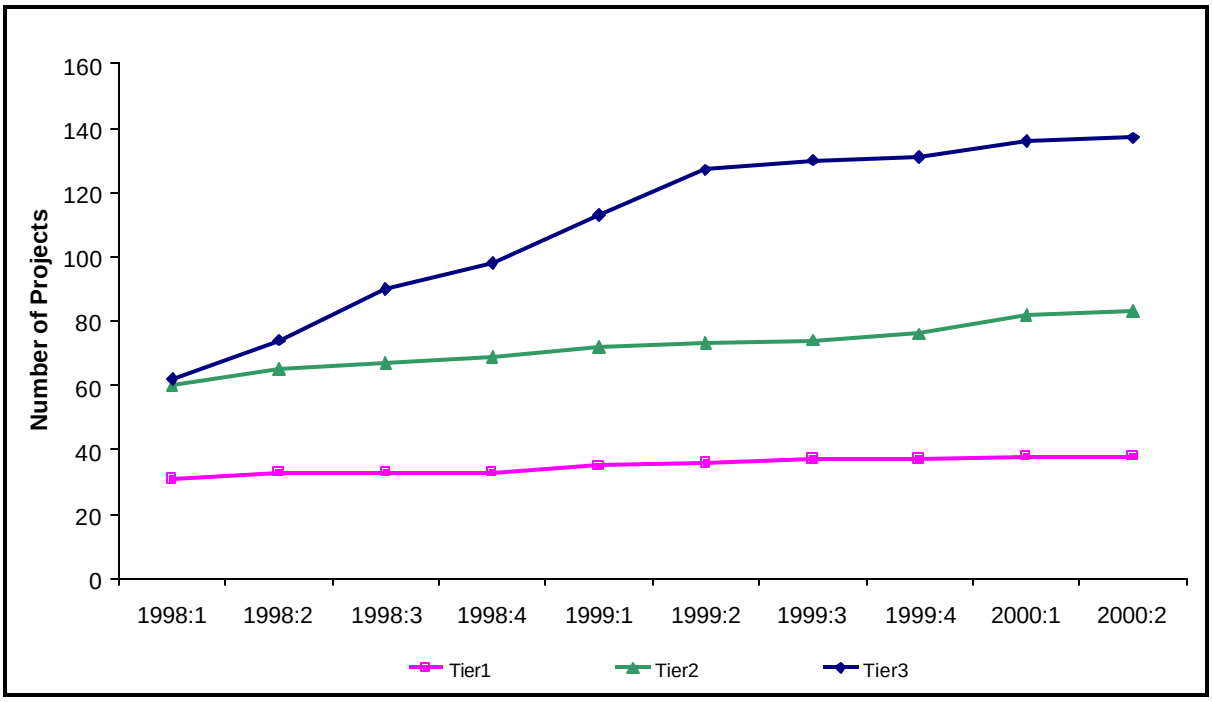
- Participation in the Existing Account,
- Energy production by participating renewable facilities, and
- Incentives paid out by the program.

2.1 Program Participation

Program participation is dependent on whether the renewable technology facilities are still under a fixed energy price contract and whether the owners are willing to break any existing contracts. Overall participation (number of facilities) in the program grew from 154 to 262 over the period January 1998 through May 2000. Figure 2-1 illustrates how the number of participating facilities has grown steadily through the period, with growth tapering off in the last half of 1999. Tier 1 and Tier 2 participation grew slowly and steadily over the period, while Tier 3 participation grew more rapidly over the first six quarters and then at a slower rate beginning in the third quarter of 1999. The steady growth in program participation is closely tied to facilities coming off of the fixed price portion of their energy supply contracts and becoming eligible to participate in the program.

Two factors account for the early, more-rapid growth in Tier 3. First, Tier 3 contains the small hydro technology. Small hydro stakeholders were not as aware of the program during its very early stages. Knowledge of the program quickly spread, however, which resulted in increased rates of program participation.. Tier 1 and Tier 2 facilities were more aware of the program, so growth in these tiers results comes primarily from facilities becoming eligible at the end of the fixed price period in their Standard Offer contracts. Second, Tier 3 also contains the geothermal technology. Several geothermal participants were utility owned when the program began. When these facilities were divested, they became eligible to participate and joined the program.

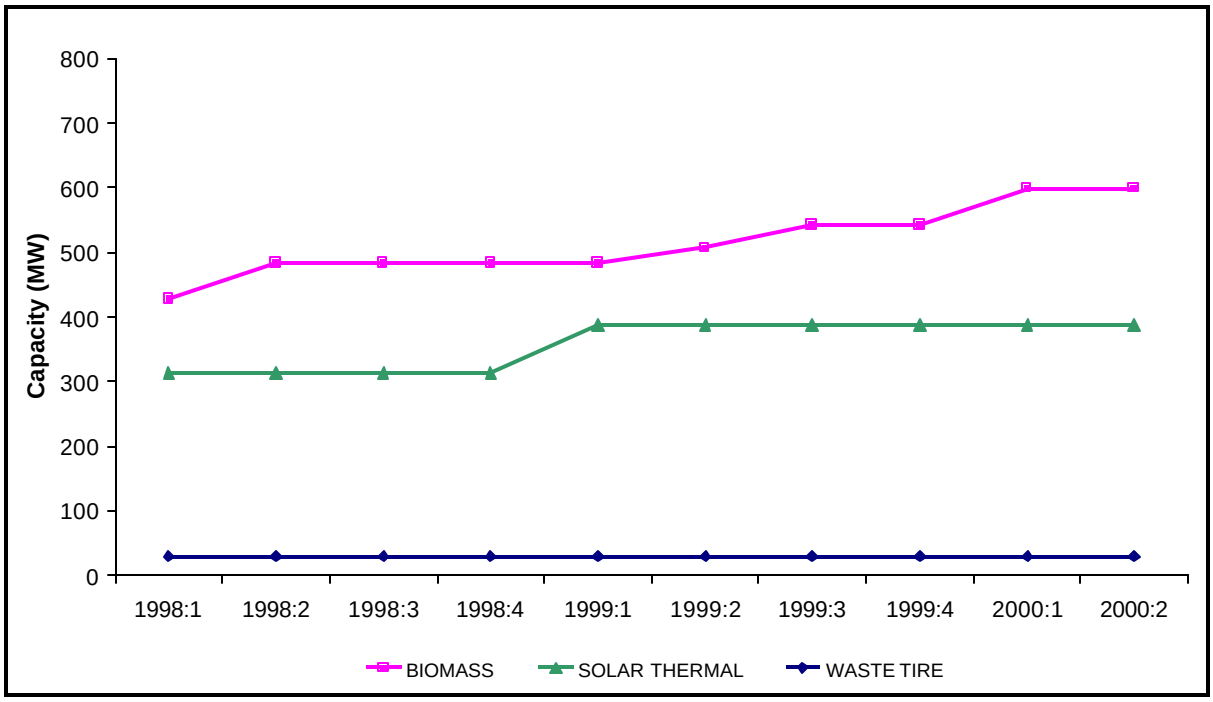
Figure 2-1: Existing Account - Number of Projects



2.1.1 Tier 1 Participation - Capacity

There was strong participation from the start and the program has experienced steady growth. The majority of Tier 1 participants are biomass facilities. There are only two facilities fueled by waste tires and eight representing solar thermal. As seen in Figure 2-2, enrolled capacity gradually increased over the next nine quarters. Participation of waste tire facilities has remained steady at two for the entire period (though both of these facilities ceased generating near the end of the evaluation period). The number of biomass-fueled facilities increased from 23 to 28 and the number of solar thermal facilities increased from six to eight over the period. Biomass capacity increased from 428 MW to 599 MW. Solar thermal electric capacity increased from 313 MW to 387 MW. The capacity for waste tire facilities remained a constant 30 MW for the entire evaluation period. In total, the Tier 1 capacity grew from 751 MW at the end of the first quarter of 1998 to 1,016 MW by the end of May 2000.

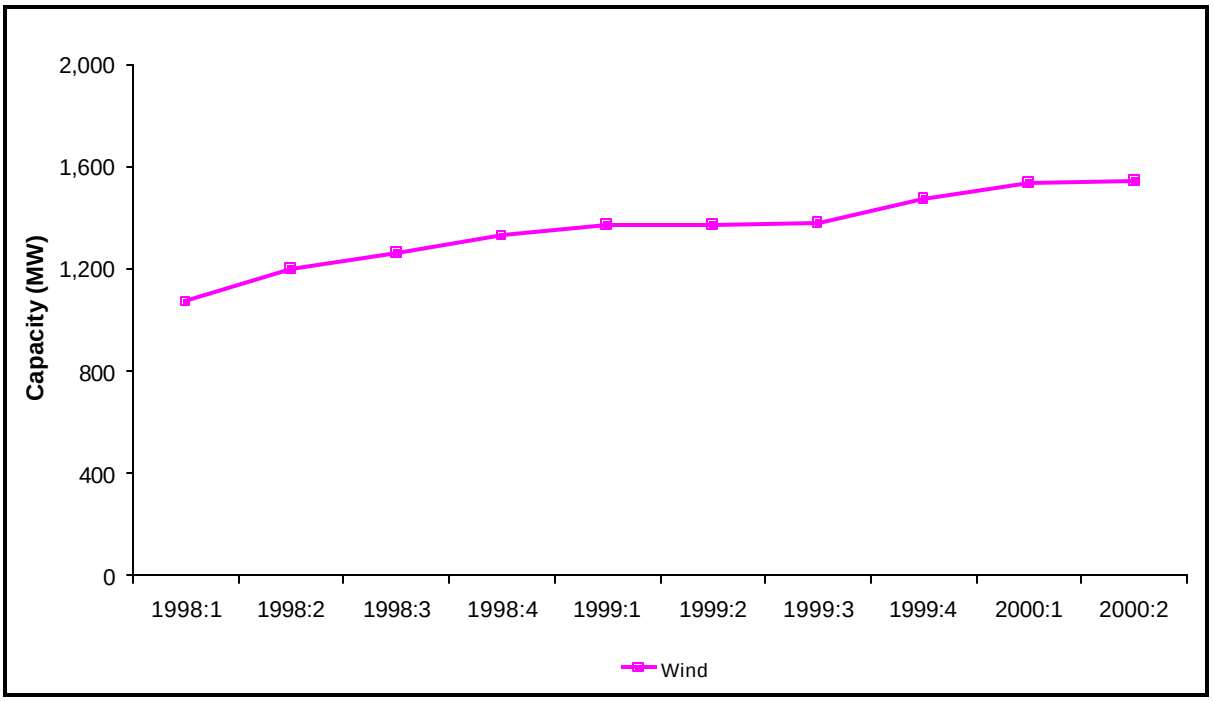
Figure 2-2: Tier 1 – Capacity (MW) of Projects



2.1.2 Tier 2 Participation - Capacity

Tier 2 had significant participation at the start as well. The number of Tier 2 projects grew at an average rate of nearly four percent per quarter in the first two years. As illustrated in Figure 2-3, Tier 2, wind, capacity has gradually increased over the entire evaluation period. The number of wind-powered generators increased from 60 facilities to 83 facilities and capacity increased from 1,071 MW to 1,544 MW during the period ending May 2000.

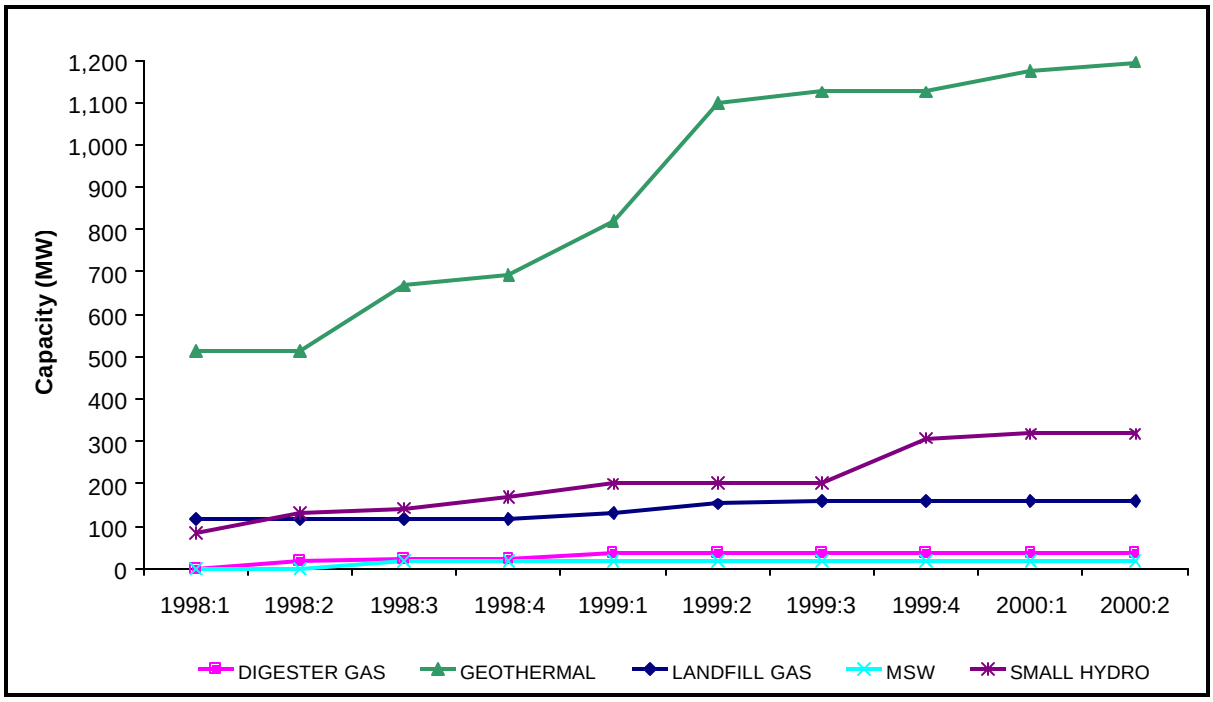
Figure 2-3: Tier 2 – Capacity (MW) of Projects



2.1.3 Tier 3 Participation - Capacity

The growth in participation in Tier 3 was much more rapid than that observed for either Tiers 1 or 2. This growth was due mostly to the enrollment of small hydro and geothermal facilities. Small hydro grew from 24 to 68 facilities and geothermal grew from 15 to 36 facilities during the period January 1998 through May 2000. Their capacities increased from 84 to 318 MW and 513 to 1195 MW respectively. The large increase in geothermal capacity between the first and second quarters of 1999, as seen in Figure 2-4, was a result of PG&E selling a large amount of geothermal capacity. Digester gas fueled facilities have increased from four to seven facilities and landfill gas has increased from 19 to 25 facilities over the evaluation period. Their capacity increased from 0 to 38 MW and 117 to 160 MW respectively. There is only one municipal solid waste fueled facility participating in the program at present with a capacity of 18 MW. Figure 2-4 displays these patterns in capacity for the Tier 3 technologies.

Figure 2-4: Tier 3 – Capacity (MW) of Projects



2.2 Electricity Produced Under the Program

Overall, power generation in this program receiving incentives reached a cumulative 27,840 GWh for the period ending May 2000. Many of the technologies in the Existing Account, solar thermal and wind, for example, have definite seasonal weather-related production patterns. This is illustrated in Figure 2-5. Monthly Tier 2 wind generation has an early- summer peak period in May/June each year, with a trough in the wintertime. Solar

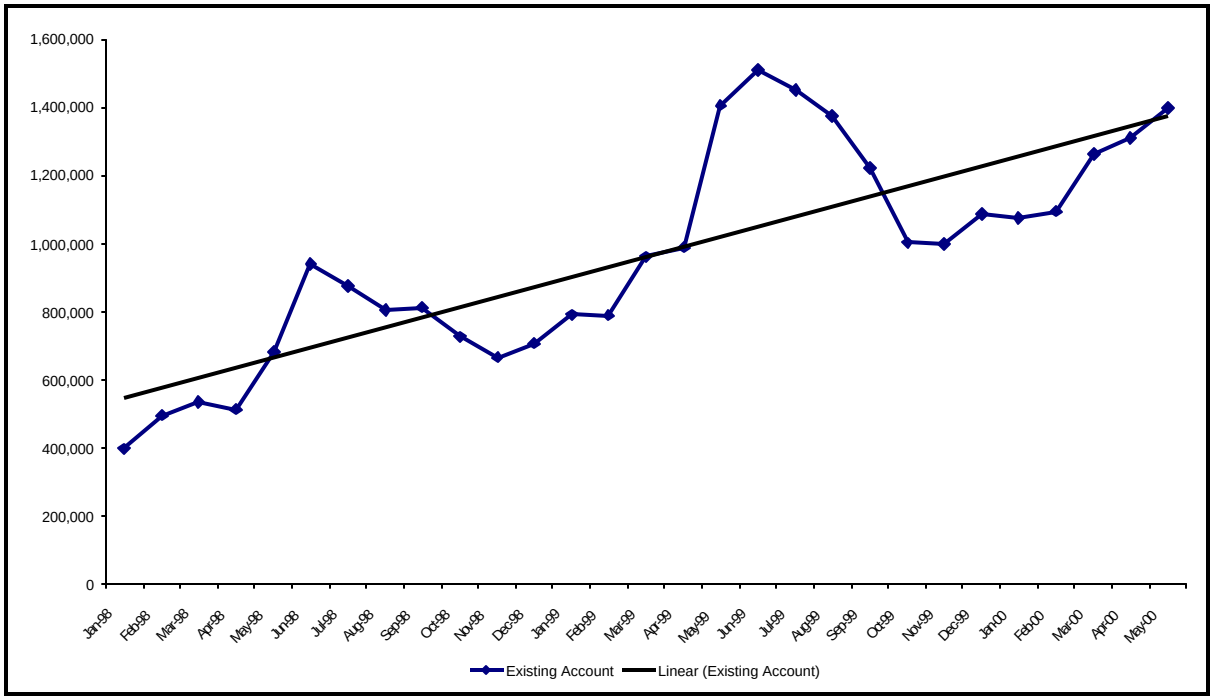
thermal, in tier 1, provides a seasonality to this tier's generation pattern, with a peak in the summertime and trough in the wintertime.

The previous growth patterns identified in number of facilities and capacity can also be seen in the generation data. Figure 2-5 shows the more rapid increase in generation in Tier 3 through the first half of 1999, then the leveling off of generation consistent with the reduced growth seen in that Tier. Tiers 1 and 2 also show trends toward increasing generation over time, as expected, though these trends are somewhat masked by the seasonality of generation in these Tiers.

Overall, the monthly generation in the program shows a solid increasing trend over the evaluation period, when factoring out the seasonality. Figure 2-6 illustrates monthly generation from the beginning of the program through May 2000, along with a trend-line showing average growth. Program growth does not show an appreciable leveling-off. One reason for this, as seen earlier, is the continued increase in facilities participating, as more facilities become eligible. However, this factor has been leveling off, and the number of additional facilities that may join the program in the future is quite limited.

Other factors may explain continued growth in energy production from participating facilities. First, many participating wind facilities have "repowered" with new turbines over the last two years. Repowered projects will tend to produce more generation for the same amount of capacity. Second, some biomass and perhaps other types of facilities may have operated at less than full capacity at the beginning of the program, since energy prices were low at that time. The additional incentive per kWh that the program provides may have induced some of these facilities to increase their operations. Finally, the evaluation period may be too short to show a leveling off of energy production, given the increases in participation during the period.

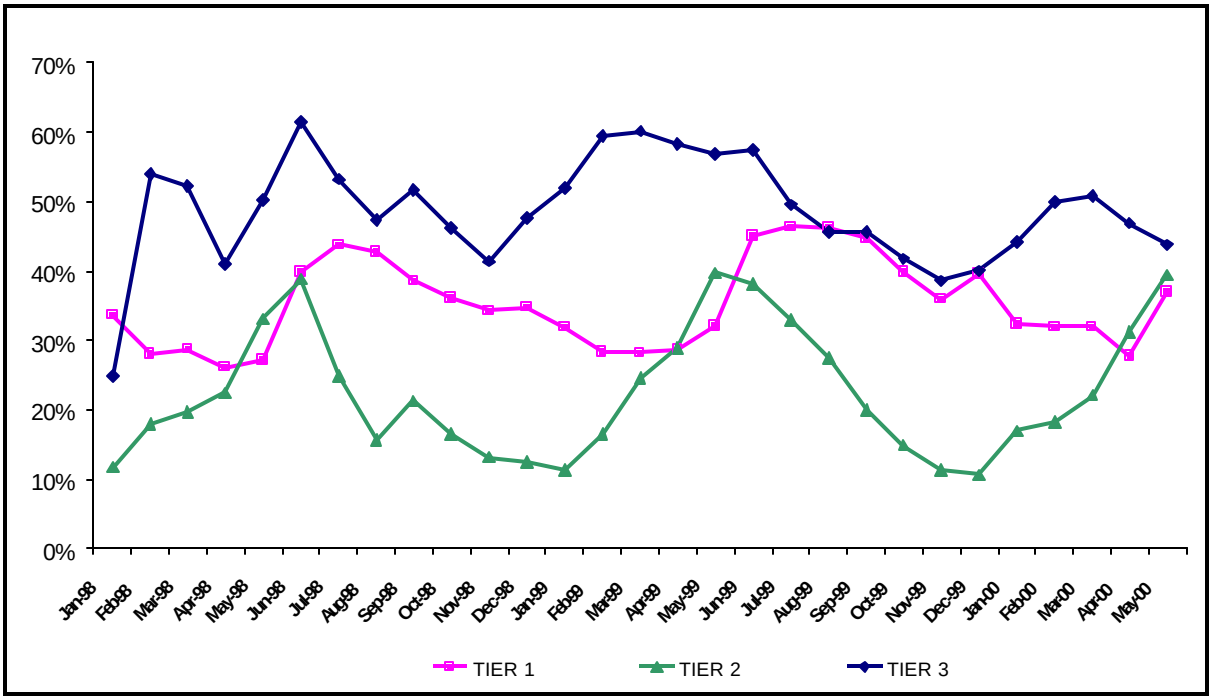
Figure 2-5: Monthly MWh Generation under Existing Account



Capacity factor (average production per hour per month divided by installed capacity) is one measure of whether production incentives are increasing MWh production overall. Figure 2-6 illustrates the monthly average capacity factors for each tier. Tiers 1 and 2 show possible slight increases in capacity factors, on top of the general cyclic production behavior. Tier 3 appears to show some sign of capacity factors declining. The trends in Tiers 1 and 2 may reflect wind repowerings in Tier 2 and more intensive operation of facilities in Tier 1. The trend in Tier 3 appears to arise from generators either ceasing production, on a short-term or long-term basis, or ceasing reporting to the Commission.

Given that market prices have been high enough in the last seven months of the evaluation period to result in no payments for Tier 3 facilities, some participants may have concluded that it is not worthwhile to continue reporting their monthly generation. If facilities are actually going off-line, however, it may be an indication that the program is not providing sufficient assistance. Without more data about facility status, it is difficult to relate the capacity factor trends seen with program effectiveness.

Figure 2-6: Monthly Average Capacity Factor by Tier



Market prices have been rising during the last several months of this evaluation period, which has reduced incentives but not revenue. Market prices and therefore incentives do not appear to be responsible for the decline in average capacity factors. Figure 2-7 and Figure 2-8 illustrate the capacity factor trends for the individual technologies in Tiers 1 and 3, respectively.

Figure 2-7: Tier 1 Monthly Average Capacity Factor by Technology

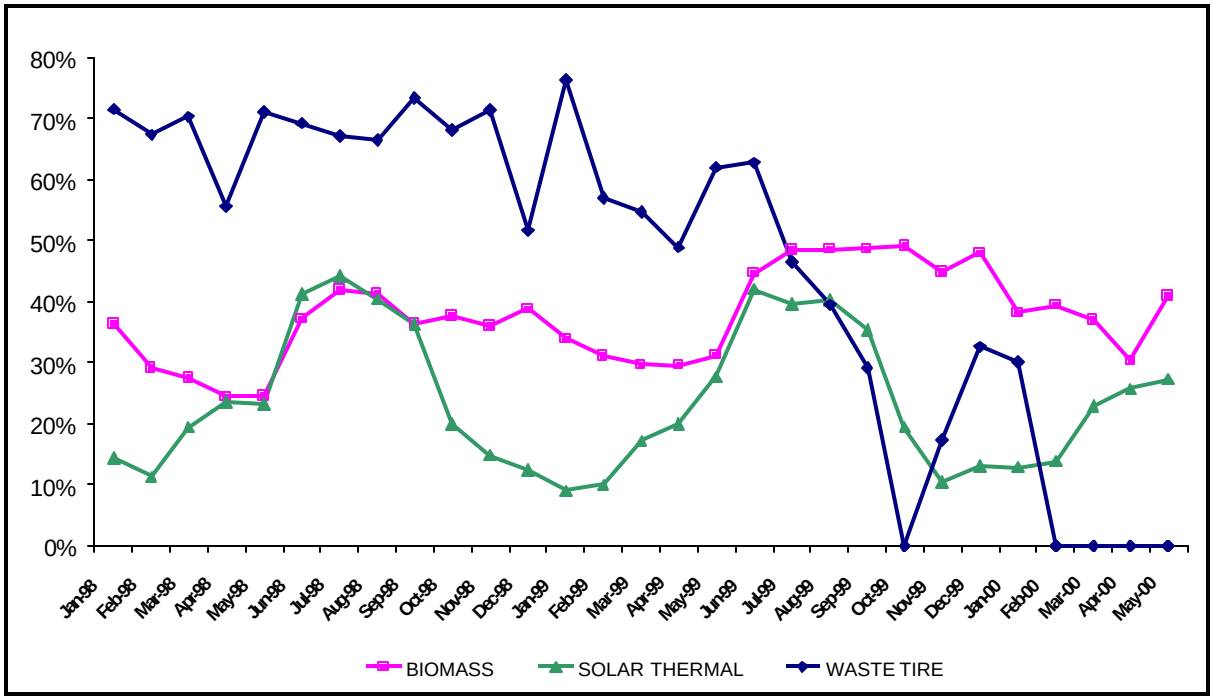
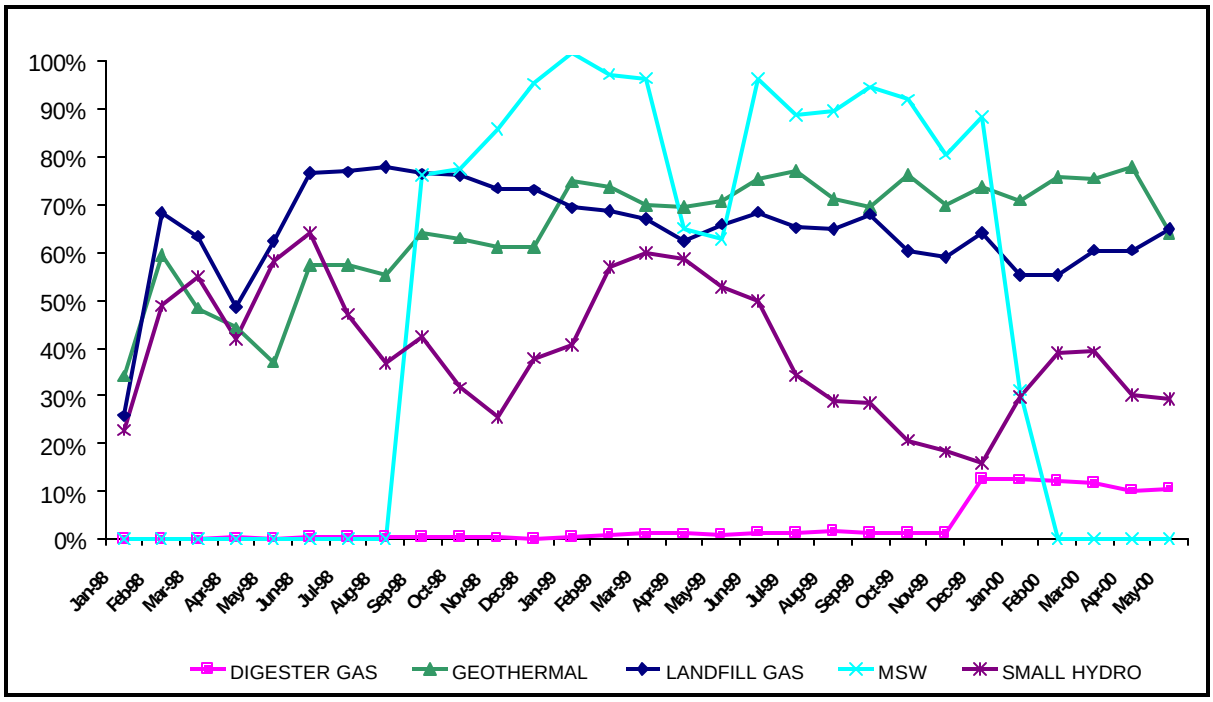


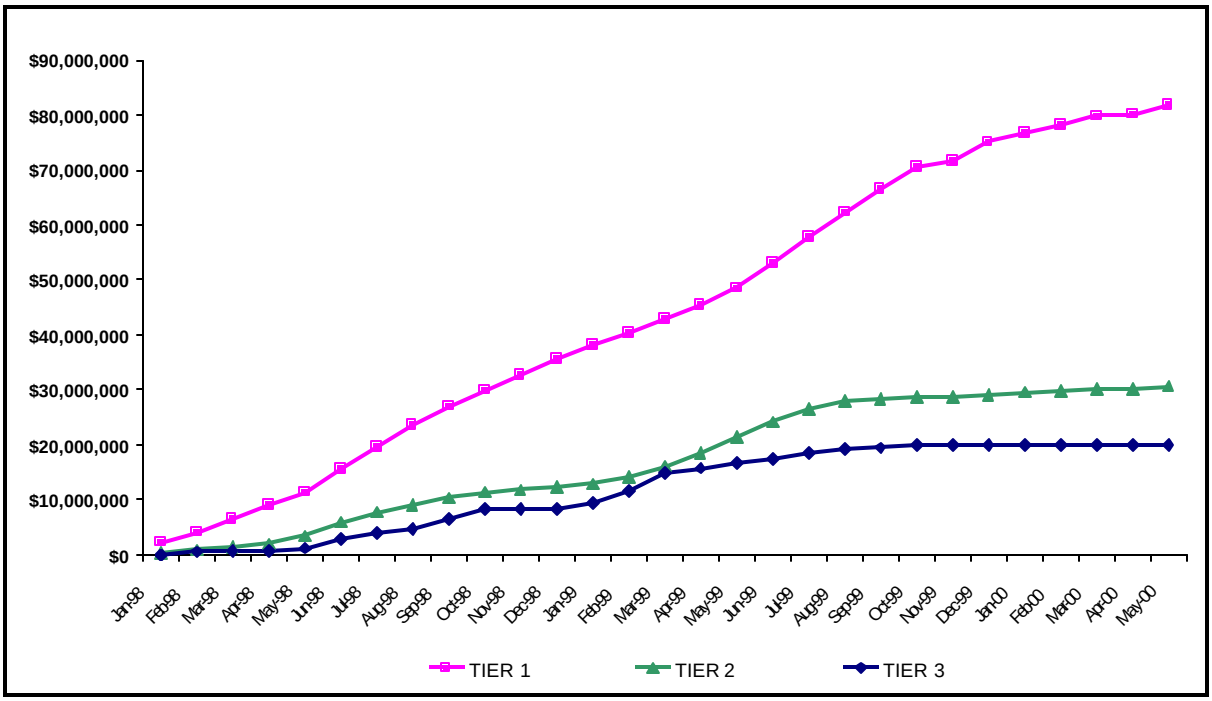
Figure 2-8: Tier 3 Monthly Average Capacity Factor by Technology



2.3 Program Incentive Payments

Cumulative incentive payments over the evaluation period exceed $132 million as illustrated in Figure 2-9. Total funds allocated for the period exceed $170 million. This means that the program has paid out nearly 78% of the allocated funds through May of 2000. Because the design of the program built in an inverse relationship between incentive payments and market prices, there is no explicit goal for incentives to be paid out through the Existing Account. The goal is to provide financial assistance to support a viable industry in the short run, and this happens through incentive payments when market prices are low, and the industry presumably needs the support. Since funds rollover within each Tier, however, the program is designed to make all unpaid funds in a given month available for future use[1].

Figure 2-9: Cumulative Incentives Paid Out



Each tier has been allocated a percentage of the available incentive funds. Each tier's performance is illustrated in Figure 2-10. The data for this graph are shown as a rolling average to smooth out monthly variations and make the trends in the data more apparent. Tier 3 reached its peak of 100% of incentives paid out during the first and second quarters of 1999 but fell off in the remaining months of the evaluation period. Tier 1 peaked in the last quarter of 1999 and Tier 2 peaked in the third quarter of 1999.

[1] Though funds typically rollover within each Tier, the Commission may reallocate funds to other purposes pursuant to the Policy Report.

The tapering off in the last few months is a function of higher than expected short run avoided costs (SRAC) from the last quarter of 1999 through the evaluation period; this reduced incentive payments to all three tiers. Low seasonal generator output and the tapering off of enrollment also contributed to the reduced amount of incentives paid out. The downward trend in incentives paid compared to allocations, as seen in the last seven quarters, was expected by the program designers when market prices were high.

One of the program goals was to decrease average incentives over time while maintaining or even increasing participation. This is an implication of reducing the allocations over time, and the target prices and incentive caps for Tier 1. So far, this program goal is being achieved. It remains to be seen, however, whether participation will continue through the rest of the program timeline.

The incentive price per MWh for each technology tier varies depending on the schedule of target prices and price caps for each tier as well as the monthly SRACs for each of the utilities in the state. Table 2-1 shows the schedule of target prices and price caps for each of the technology tiers for each tier, the incentive price is calculated monthly as the lesser of three values: 1) the price cap; 2) the difference between the applicable target price and applicable market price (a utility SRAC or the monthly average PX price); and 3) the amount of generation in the tier for that month divided by funds available (the actual calculation of this is slightly more complicated). Figure 2-11 illustrates how the actual calculated incentive price varies between tiers.

In the case of Tier 1, the difference between the target price and the SRAC was greater than the price cap until the last half of 1999, so incentive payments were limited by the price cap. Tier 2 incentive payments have been limited by the price cap about 25% of the time in 1998 and the first half of 1999, but have been determined by the difference between target price and SRAC from the last half of 1999 through the evaluation period. The Tier 3 incentive price has for the most part been determined by the difference between the target price and the applicable SRAC price. For this tier, the incentive price has never been determined by the price cap. This is also the only tier for which the incentive price has been determined by dividing the amount of generation by the available funds.

Figure 2-10: Four-Month Rolling Average - Cumulative Incentives Paid as a % of Allocated Funds

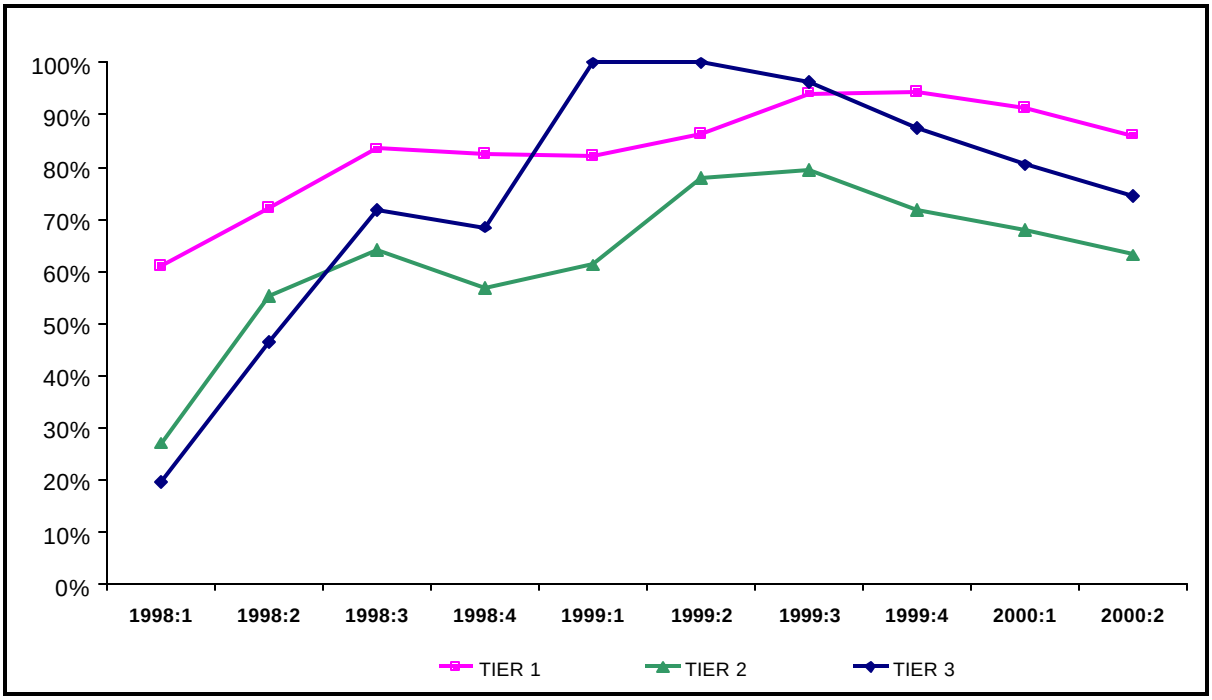
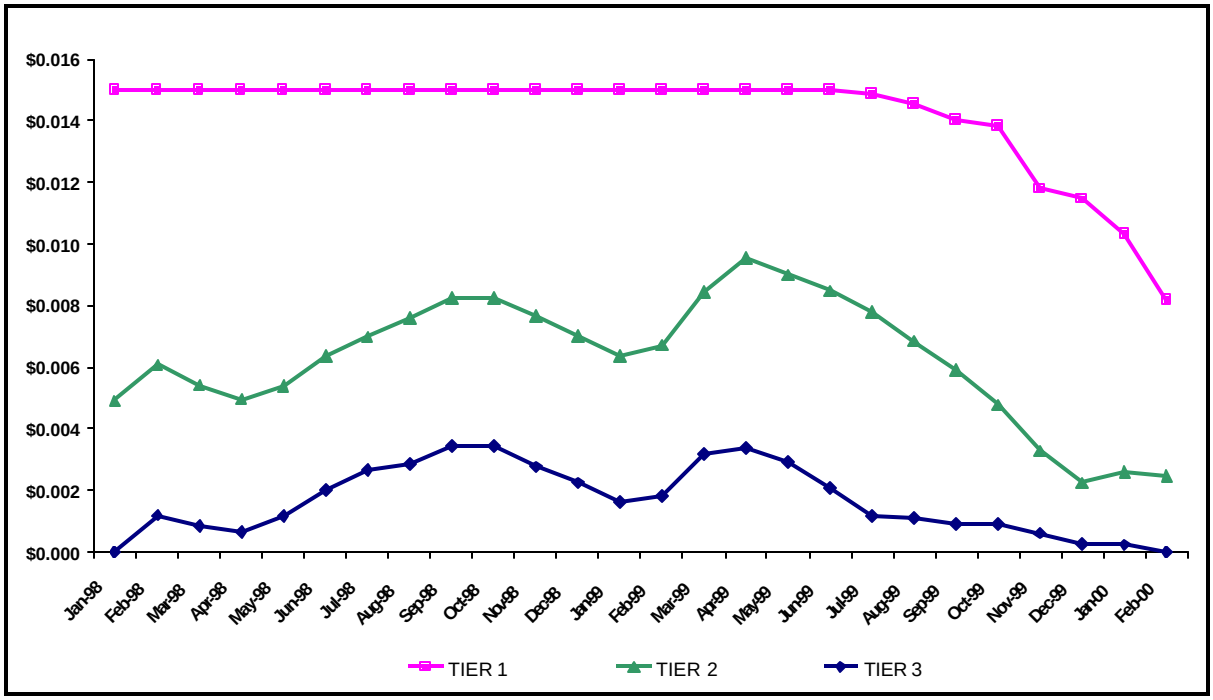


Table 2-1: Basis for Production Incentives ($/MWh)

Tier	Price	1998	1999	2000	2001
1 – Biomass, Waste Tire, Solar Thermal	Target	$50.00	$45.00	$40.00	$40.00
	Cap	$15.00	$15.00	$10.00	$10.00
2 – Wind	Target	$35.00	$35.00	$35.00	$35.00
	Cap	$10.00	$10.00	$10.00	$10.00
3 – Geothermal, Small Hydro, Digester Gas, Landfill Gas, and Municipal Solid Waste	Target	$30.00	$30.00	$30.00	$30.00
	Cap	$10.00	$10.00	$10.00	$10.00

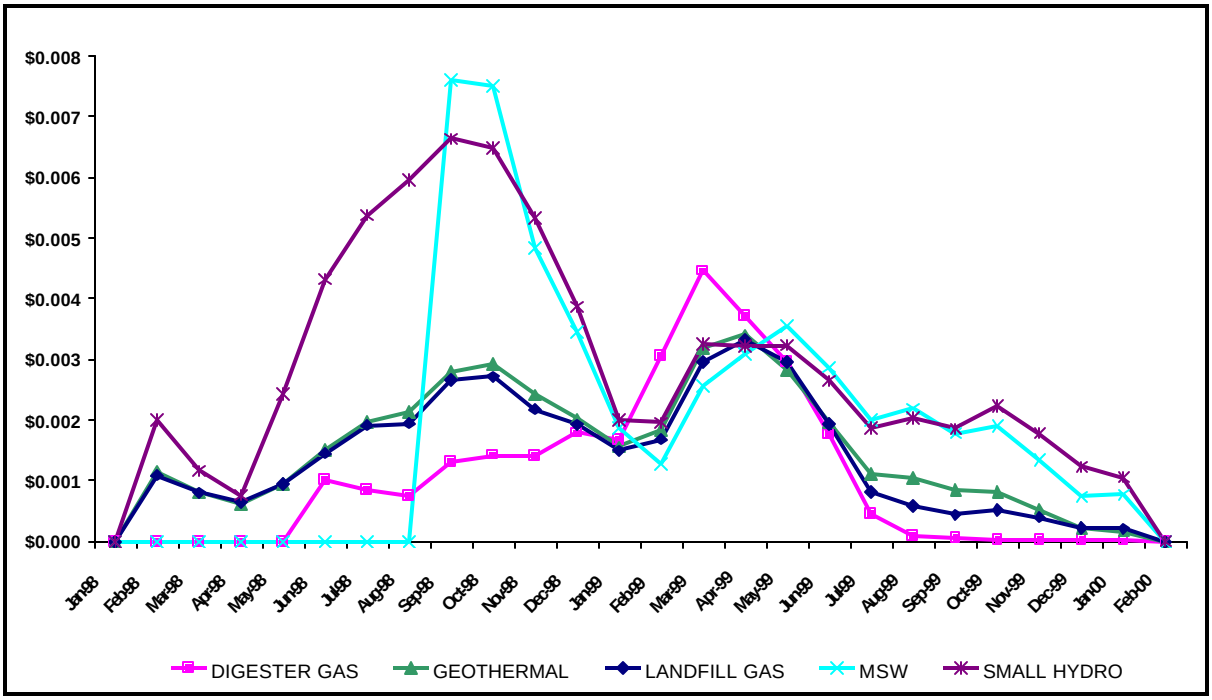
Figure 2-11: Four-Month Rolling Average Incentive Price by Tier



Tier 1 participants experienced a very steady incentive price until the last half of 1999 because during this period, the price was determined solely by the price cap. After mid 1999 the price cap has been less important because SRAC prices have increased and the target price was reduced (to 4.5 cents in 1999 and 4 cents in 2000). Tiers 2 and 3 have experienced much more price volatility because with their lower target prices, the price cap did not come into play very often, leaving the incentive prices fluctuating inversly with SRAC.

The actual incentive paid out within a given tier in a given month will depend on how much electricity is produced in each IOU service territory, the level of the SRAC price for each IOU, the level of the target price, and the level of the price cap. The effect of all these factors are illustrated for Tier 3 technologies in Figure 2-12. Incentives fall as SRAC prices climb, once the difference between the SRACs and the target prices have fallen below the price cap. For a given technology, concentrations within one IOU service territory can create significant average price variations for the tier as a whole from month to month depending on production levels and the SRAC price for the IOU.

Figure 2-12: Tier 3 Four-Month Rolling Average Incentive Price Per MWh



What is most evident from examining all of the proximate indicators is that the Existing Account of the REP is functioning as designed. What is not as apparent from these indicators is whether the program is yielding the intended effect on the existing renewable energy market. Participation in the program has continued to increase since its beginning. If one were to assume that had the REP not existed, there would have been a decline in the number of existing renewable energy facilities between 1999 and 2001, then it would be safe to say that the program has had a positive effect. What these indicators do not tell us is, what would have happened in the absence of the program.

Volume II

3 Survey Results

3.1 Purpose of Survey

As part of the Commission's ongoing efforts to evaluate the Renewable Energy Program a survey of the Existing Renewable Resource Account participants and nonparticipants was conducted by Regional Economic Research, Inc. (RER). The overall purpose of the survey is to evaluate the effectiveness of the program in improving the viability of existing renewable generation technologies.

The specific purposes of this survey were:

- To learn more about the operations of entities receiving incentives,
- To find out how electricity industry restructuring has impacted these entities,
- To determine how the program design has been perceived by the recipients,
- To assess the degree to which renewable generators have been assisted by the program,
- To ascertain how recipients have adapted to the changing markets,
- To get participants' feedback on experiences with the program and suggestions for improvements, and
- To determine why nonparticipants have not used the program.

3.2 Survey Population and Procedure

Sampling Procedure. The survey consisted of a random sample of Existing Account participants and nonparticipants. Respondents were contacted by telephone during April through June 2000. The respondents consisted of renewable energy companies, companies which existing renewable generation is a secondary business area, and a few public agencies (water districts and sanitary districts).

The sampling plan is shown in Table 3-1. The samples within each technology and utility service territory were randomly selected. The objective was to design a small sample that was relatively representative of the technologies and utility service territories within each tier.

Table 3-1: Existing REP Owner / Manager Survey Sample Design

Tier	Technology	Utility Service Territory			Technology Subtotal	Tier Subtotal
		PG&E	SCE	SDG&E		
1	Biomass	3	1	0	4	8
	Solar Thermal	0	2	0	2	
	Waste Tire	2	0	0	2	
2	Wind	2	5	0	7	7
3	Small Hydro.	4	2	0	6	18
	Geothermal	1	2	0	3	
	Landfill Gas	2	2	1	5	
	Digester Gas	1	1	1	3	
	Solid Waste (MSW)	1	0	0	1	
	Participants	16	15	2		33
	Non Participants	3	3	0		6
	Grand Total	19	18	2		39

The questions on the interview guides were asked of an individual at the company or agency who was involved in the initial decision to participate in the incentive program. In a few cases when that individual was not available, another person knowledgeable about the program was contacted.

Thirty-two completed responses were obtained, of which 30 were for entities participating in the Existing Account incentive program. All but one of the program participants selected for the sample was contacted,[1] however, several respondents selected for sampling were found to be from the same company. Only one response per company was recorded. In cases where the company had more than one facility of the technology selected for the sample, the response was elicited for all facilities. If the sampled firm had facilities for more than one renewable generation technology, the responses were elicited for only the technology selected in the sample. If the firm contacted managed more than one facility or a group of facilities under different ownership, the responses were elicited only for the ownership specified in the sample.[2]

The nonparticipant sample proved more difficult to obtain. Although 22 entities were contacted, two of the entities were found to be ineligible for the program, and thus not bona fide nonparticipants and therefore not interviewed.

[1] That program participant could not be reached by telephone.

[2] For example if a parent company was named in the sample selected, all facilities under that parent were included. But if the company selected was a subsidiary with other renewable facilities, only the subsidiaries' facilities were included in the response.

The reasons for ineligibility included ownership by a municipal electric utility or the renewable facilities were located outside of California. Only two respondents were found who were apparently eligible for, but not enrolled in, the program. The remaining entities were found to be participants and interviews with them were attempted.

Sample Composition (Q.1). Of the 32 completed surveys, 25 % (n=8) were Tier 1, 16% (n=5) were Tier 2, and 59% (n=19) were Tier 3. Of the eight Tier 1 respondents, two utilize solar thermal generation, four use wood waste biomass, and two use waste tires and/or agricultural waste as a biomass fuel. All five of the Tier 2 generators use wind turbine technology. Of the 19 Tier 3 respondents, six utilize landfill gas, three utilize digester gas, six utilize small hydroelectric generation, and four utilize geothermal energy. The composition of the sample by Tier is illustrated in Figure 3-1. The composition by generation technology is shown in Figure 3-2.

Figure 3-1: Sample Composition by Existing Account Tier

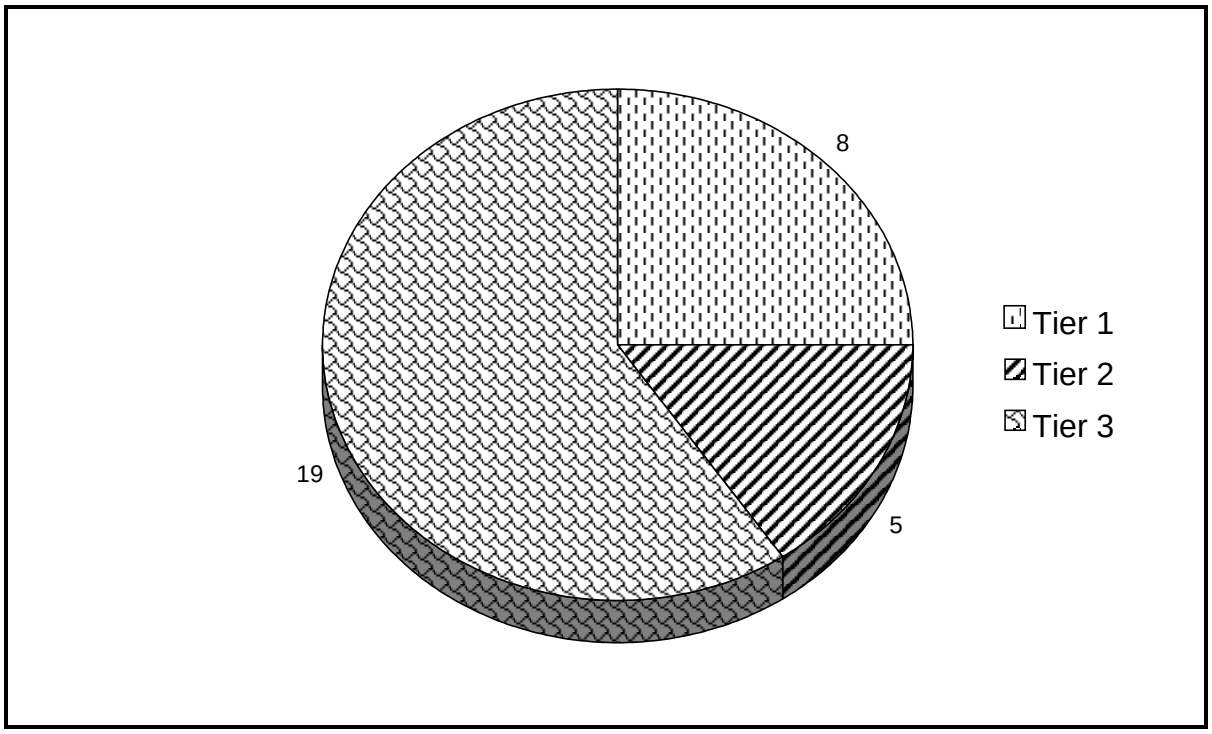
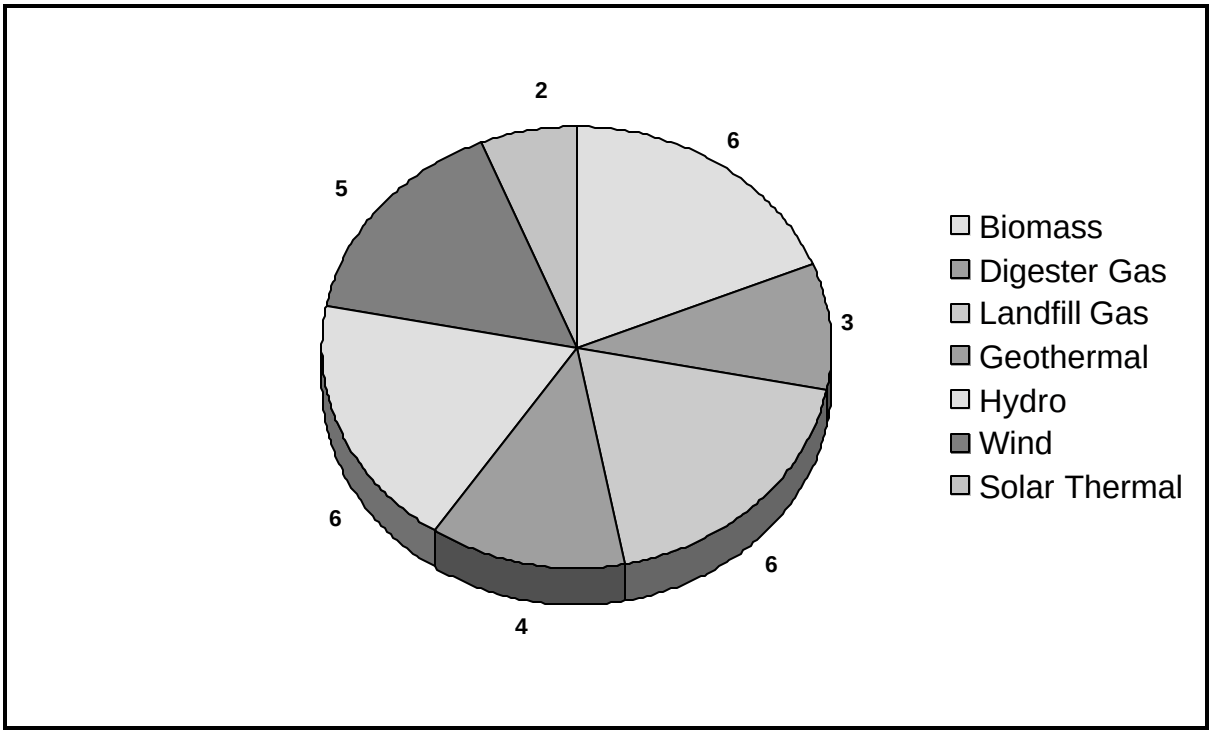


Figure 3-2: Sample Composition by Technology



3.3 Business/Operations Background

Information was gathered to determine how renewable generation activities related to other company activities. Information gathered included the public or private ownership of the entity, its control of other renewable generation facilities within and outside of California, and whether the generation facilities are the sole revenue of the entity. Other information used to place the renewable generation activities in context included the length of time renewable generation had been in operation and the capacity factor of the facilities.

Ownership and Other Revenue Sources (Q.4). Five of the 32 respondents are county or municipal government entities (two water districts utilizing hydroelectric generation and three sanitary districts using digester asgas fuel). The remaining 27 respondents represented private companies.

Revenues from Electric Generation (Q.10). For the private companies, more than half were entirely dependent on renewable generation (n=16). Of the non-governmental entities for whom renewable generation was a co-product, the main business was lumber (1), waste disposal (2), cattle raising (1), and ranching (1). Two companies reported that the renewable generation sampled was part of their company's portfolio of renewable generation facilities. Overall, revenues from renewable generation represented 65% of total revenues (70%, 70%, and 61% of revenues from Tiers 1, 2, and 3, respectively).

Duration of Renewable Energy Generation (Q.2). Only seven of the sampled entities had been generating with renewable fuels for less than 10 years. These include two wind, and one each of biomass, waste tires, digester gas, landfill gas and hydro generators. The sample mean duration of renewable operations was 14.3 years (18, 11 and 14 years for Tiers 1, 2, and 3, respectively). The median duration of renewable operations was 14.0 years (13, 12 and 14 years for Tiers 1, 2, and 3, respectively).

Other Renewable Facilities Within and Outside of California (Q.6, 7). Thirteen of the 32 sampled entities had only one facility in California. Among all entities, the mean number of renewable generation facilities in California was 4.2 (2.4, 9.3, 3.7, for Tiers 1, 2, and 3, respectively). Half of all entities sampled have renewable generation facilities outside of California (3, 4, and 9 for Tiers 1, 2, and 3, respectively). Differences between conditions in California and elsewhere included the presence of California's Standard Offer contracts (4 of the entities with facilities outside of CA), California's deregulated market, green power markets in California, and the absence of a renewable portfolio requirement in California (compared with Texas). California's stringent environmental regulatory climate, high market price volatility, and transmission congestion problems were each cited by two respondents.

Months of Operation (Q.8). The only facilities that did not operate year round were hydroelectric facilities. All of the hydro facilities were limited by the availability of water, although one facility said it had generated in every month of the year occasionally. Both waste tire facilities are presently shut down due to limited availability of economically viable tire supplies. Other biomass supplies (rice straw and gas from animal wastes were also presently shut down due to unavailability of fuel (the rice straw operation) and uneconomic feedlot conditions (animal waste, digester gas).

Capacity Factors of Renewable Generation Facilities (Q.10). Renewable generation facilities exhibit a wide range of capacity factors (actual energy generated versus nameplate capacity). Overall, capacity factor of respondents' facilities averaged 69% (n=25). Capacity factors averaged 62%, 29% and 81% for Tiers 1, 2, and 3, respectively.[3]

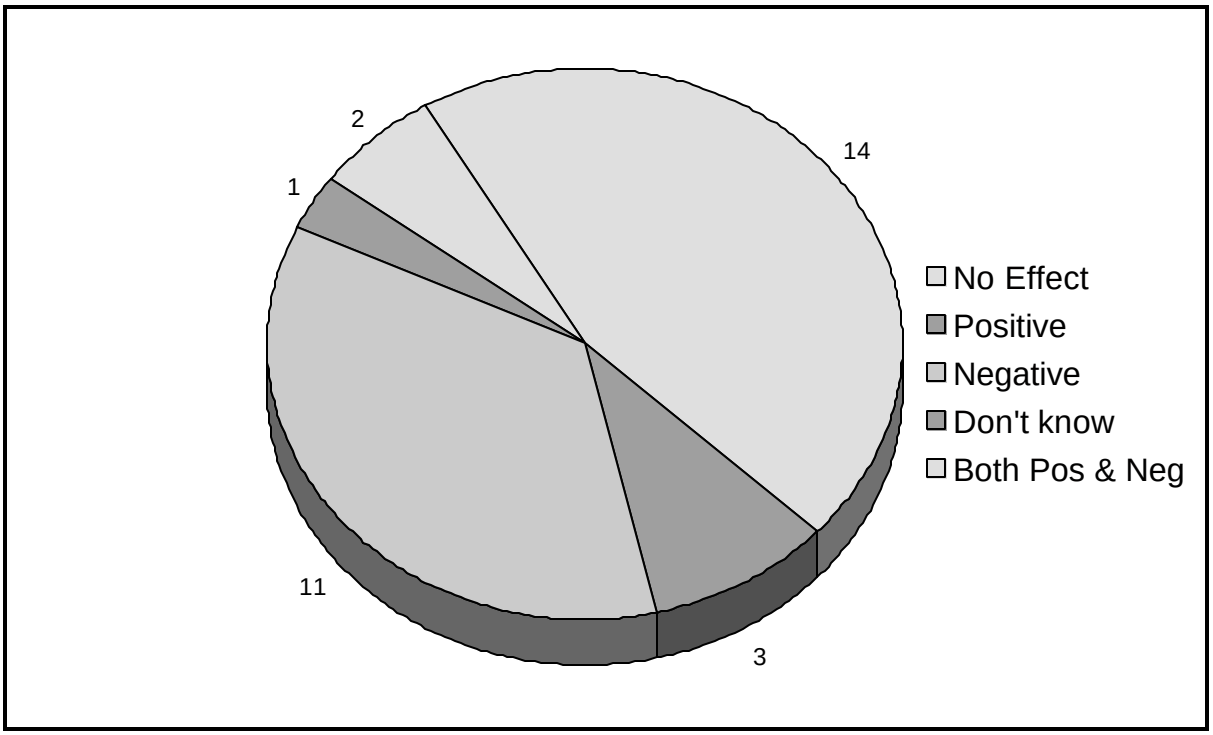
3.4 Restructuring Impacts and Other Operating Challenges

As the large majority of the existing renewable generation project operations began well before the restructuring of California's electric industry was envisioned, it is interesting to note how restructuring has affected these generators, how the electricity is sold in the market, and what other challenges renewable generators face.

[3] Note that capacity factors were calculated for the times when the facilities are in operation for hydroelectric plants with seasonal water supplies and biomass plants with intermittent fuel supplies. Wind facilities reported their year-round capacity factors. All capacity factors included scheduled and unscheduled maintenance outages.

Challenges Associated With Restructuring (Q.6). Almost half of all respondents (14 out of 31) answering this question did not notice any effect on their operations due to restructuring. Ten out of the 19 Tier 3 respondents felt this way. Of the 16 respondents who noted some effect, three thought the effect was positive, 11 thought the effect negative and two saw both positive and negative effects. Seven out of the 19 Tier 3 respondents believe the effect to be negative. Positive effects included the opening of expanded marketing opportunities and increased choices. Negative effects included exposure to price fluctuations through PX defined SRAC (short run avoided cost) pricing, or uncertainty about future revenues (n=7). Two respondents noted greater difficulties with transmission access and line loss compensation disadvantages. Other negative effects mentioned by one entity included the loss of capacity payments, less stable energy supplies, and the requirement by their utility to generate continuously. Interestingly, none of the respondents noted that the Existing Account incentive program was a direct result of restructuring (through AB1890, which initiated the restructuring process).

Figure 3-3: Perceived Effects of Restructuring



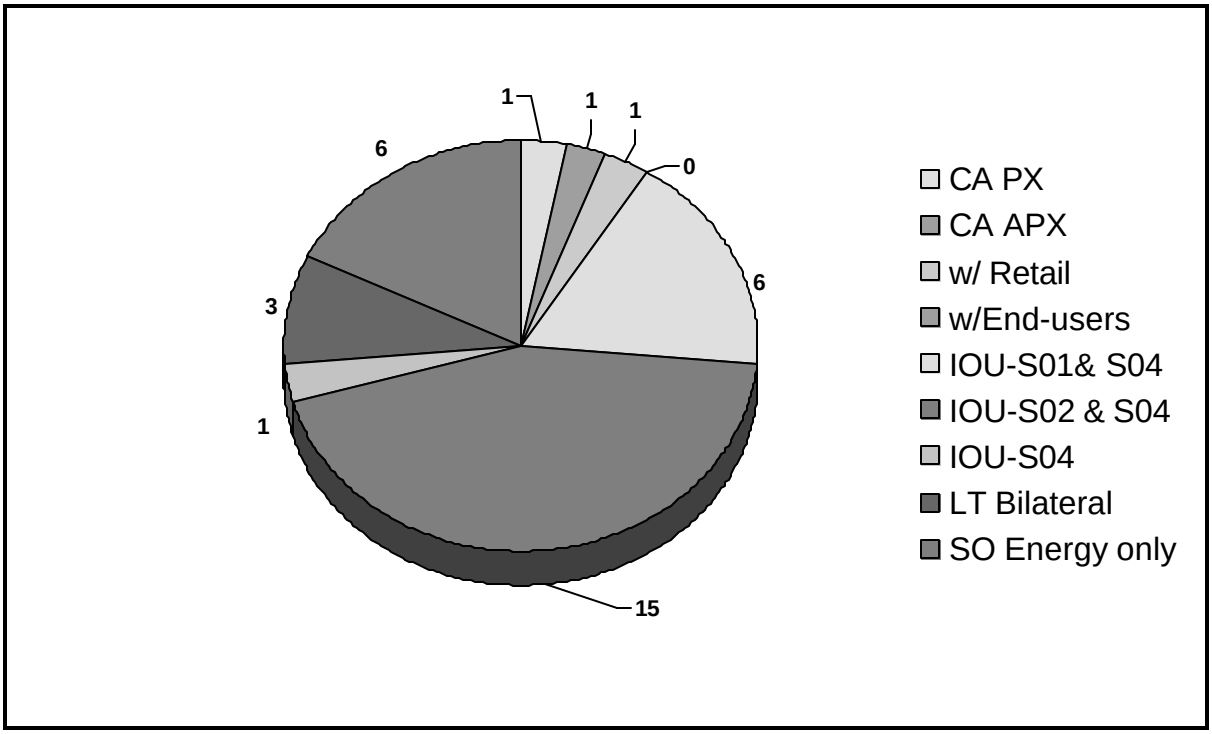
Challenges Faced in Operating Facilities in California (Q.9). Thirteen facilities (out of 29 respondents) reported that the greatest problem in operating their facility in California was revenue insufficiency or uncertainty. Regulatory compliance and environmental restrictions and uncertainties were the second next most commonly mentioned problems (n=7). Several technology types have experienced fuel supply problems. Biomass

generators experience problems obtaining economical fuel (3 out of 6). Geothermal generators identified geothermal resource management as a problem (2 out of 4). Hydroelectric generators identified obtaining adequate water and/or water storage for generation (2 out of 6). Facility maintenance presented difficulties for digester gas and landfill gas generators (3 out of 9). Wind turbine maintenance was mentioned as a major problem by two of five wind generators. Corrosion problems were identified by two of four geothermal respondents. Other major problem areas included difficulties in raising capital, insurance costs, and transmission access.[4]

How is Generated Electricity Sold (Q.11). Respondents were permitted more than one response to this question. Twenty-two of the entities sampled (n=31) sold some or all of their energy to investor owned utilities (IOU) through Standard Offer (SO) Contracts. Of the SO contracts, six receive variable energy and variable capacity pricing, 15 receive variable energy and firm capacity prices, and one reported receiving firm energy and firm capacity prices. Only one entity sold to the APX (under the green energy market) and one sold directly to the PX. The other 10 entities reporting had some other form of contract. Of these "others," six receive variable energy and no capacity payment. Of the remaining four "others," three reported selling through long-term bilateral contracts (of which one was sold as green power). The disposition of energy sold by survey respondants is illustrated in Figure 3-4.

[4] Totals of responses do not add due to multiple responses by some respondents.

Figure 3-4: Renewable Energy Sales



3.5 Program Design Issues

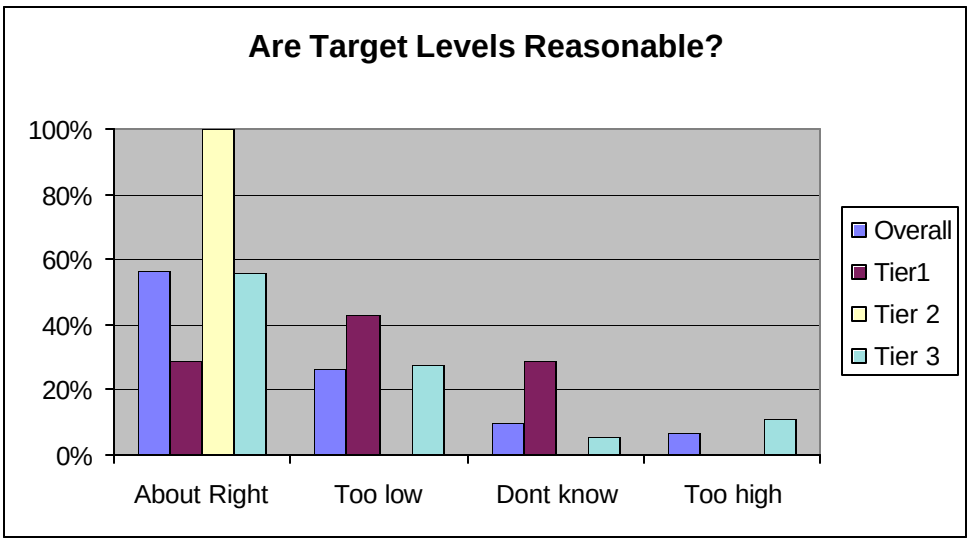
The respondents were asked for their opinions about several aspects of the Existing Account incentives program design. Issues explored included the allocation of the program funds among the technologies, target prices and price caps, the duration of the program, and what changes could be made to the program to provide additional services they felt were needed and how the current program could be improved.

Allocation Among Tiers (Q.14). Respondents' belief that their technology has been allocated and is receiving an appropriate share of Existing Account funds varied markedly by tier. Overall, 12 of the 23 respondents who expressed an opinion on this question agreed with the allocation. Four out of the six responding Tier 1 generators agreed with the allocation (Tier 1 receives 56% of the funds), while only two out of the six responding Tier 2 generators agreed (Tier 2 receives 29% of the funds). Oddly, among the Tier 3 generators, who receive only 15% of the funds, five out of nine agreed with the allocation, which is higher than the sample average.

Two of the respondents thought that all tiers should receive an equal allocation. Two landfill gas generators thought they should be in the same tier as biomass (Tier 1 instead of Tier 3). One wind generator argued that because their technology was the closest to being economic it should receive the most. Two small hydro generators argued that they needed the most help and should, therefore, receive the most funds.

Target Price Adequacy (Q.19). Target Prices are set for each Existing Account tier. When the market price received is above the Target Price for the tier, no incentive payments are distributed. The respondents (n=30) were asked if they thought that the Target Price set for their technology tier was too low, too high, or about right. Overall, 17 thought the target was set about right, eight thought it was too low, two thought it too high, and three did not know.

Again, the responses varied widely by tier. Among Tier 1 respondents (n=7), two thought the target was set about right, three thought it was too low, none thought it too high and two didn't know. Tier 2 wind generators (n=5) were unanimous that the Target Price was about right. Ten of Tier 3 respondents (n=18) thought the target was set about right, five thought it was too low, two thought it too high, and one didn't know. Although they have the highest Target Price, Tier 1 generators are the least satisfied with their Target Price. The perceived reasonableness of the Target Price levels by tiers is shown in **Error! Reference source not found.**.



Term of Program (Q.20). Almost all (26 out of 30) of the respondents thought that the duration of the program was too short. The remaining four thought it was about right. None thought the term of the program was too long. Several respondents thought that the duration was too short to allow renewable generators to pay back their investments (n=3) or to adjust to the restructured market (n=6). Other generators expressed the general need for more revenues (n=4). Some comments supporting the position that the program duration is too short cited the need for fuel cost supports (biomass), support through the expiration of the SO4 contracts, and support after the termination of Section 29 tax credits in 2002.

Barriers to Participation (Q.21). The respondents (n=31) were asked if they perceived any barriers to participation in the Existing Account incentive program. Most thought that there were no barriers (n=22). Three respondents (biomass, waste tire, & digester gas) thought that the Target Prices were too low and were a discouragement to participation. A program nonparticipant cited this as a reason not to bother with the paperwork. Two respondents cited lack of knowledge about the program. One of these respondents was the other program nonparticipant.[5]

Other Programs or Support that State Could Provide (Q.22). Eighteen of the 31 respondents had offers about other support or programs that the State could provide to promote renewable generation. These suggestions ranged widely. Biomass, tire fuel generators, and landfill generators had several suggestions for making their operation more economic. One suggested that a disposal fee be levied on the purchase of tires to fund their proper disposal thereby offsetting the cost of transporting tires to the generation facility. One suggested that non-generation burning of agricultural wastes be taxed or restricted. Another proposed that landfills be held to higher gas disposal standards to encourage landfill gas generation. Suggestions by non-waste based generators included tax incentives and exemptions for renewable generators, increased consumer education about renewables or green energy (n=3), streamlining of environmental regulations for renewable generators, and greater publicity about the renewable incentives programs.

Two generators suggested increased renewable generation R&D and another suggested that the state sponsor training for employees of renewable generation facilities. Three generators requested regulatory relief or economic assistance with high transmission access costs faced by variable capacity facilities (wind generation), and/or assistance with distribution cost allocations. One suggested that the Commission limit volatility of PX pricing for renewables under the day-ahead or hourly markets and pay renewables on a monthly weighted average basis.

Recommended Changes To Program (Q.23). Only 11 of the respondents suggestspecific changes in the design of the Existing Account Program incentives; most thought the program was working well. Suggestions included several (n=5) that related to the reallocation among the tiers. Two respondents thought that the allocation should be equal among all tiers. Another suggested that any surplus in one tier be allocated to the other tiers. One suggested that landfill gas be considered the same as biomass (Tier 1). Elimination of the Target Price limitations was suggested by one generator. Two respondents suggested increased incentive revenues. Two suggested that the term of the program be extended, or that new programs receive additional funding or lump sum grants.

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[5] This firm, which managed a digester gas facility in California, was not aware of the program.

Program Changes To Increase Competitiveness (Q.34). When asked what changes they would recommend to the program to increase the likelihood of being competitive in the market, the most common suggestion was to extend the term of the program (n=7). Other suggestions included adjusting the tier allocations, raising target prices, and increasing incentive revenues. Other suggestions included imposing requirements for renewables (portfolio standard) for all energy service providers (n=3), educating customers on the benefits of green power, imposing waste disposal fees to cover the cost of transportation to generation sites, and making capital available to renewable generators at a reasonable cost.

3.6 Market Impacts of the Program

A crucial area of concern in evaluating the Existing Account Program is the extent to which it has influenced the ability of renewable generation resources to compete in the marketplace. It is important to know if the generators' operations and competitiveness have been enhanced by the program and to what extent they might be further helped if the program were to be extended. A related issue is green power incentives and the extent to which these two programs might have synergistic effects. This section summarizes responses to questions on these issues.

Program's Effect on Renewable Businesses (Q.15). Eight of the respondents (n=29) felt that the program had had little or negligible effect on their business, mainly because the target prices were below the market price received. Six of these were from Tier 3. Those believing the program benefited their business noted that it helped them negotiate the transition to the competitive market (n=7), itenabled equipment upgrades, and maintenance improvements that will enhance future competitiveness (n=5). Others noted that the program helped reduce losses or maintain revenues during periods when prices were low (n=4). Some respondents simply noted that the revenues were helpful.

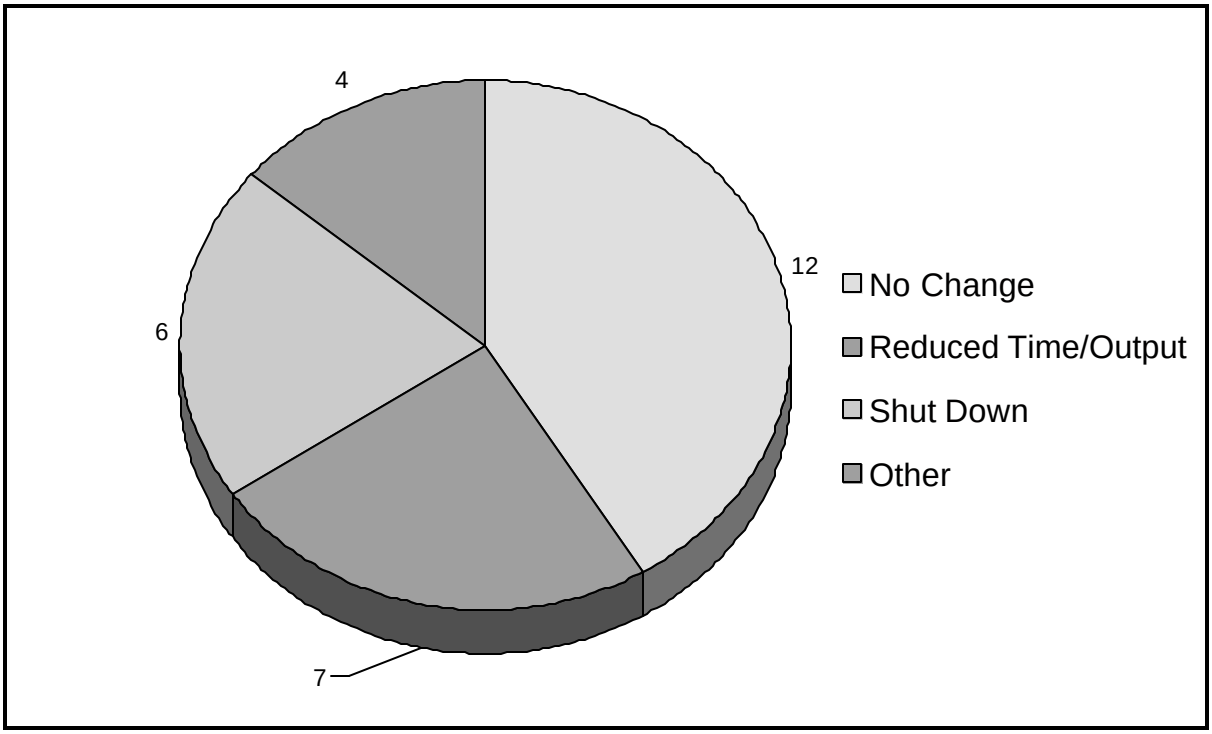
Program's Effect on Post Program Competitiveness (Q.33). When asked whether the program had enhanced post-program competitiveness, 18 out of 29 respondents reported that it had. This generalization was true of all tiers (5/7, 4/5, and 9/17 for Tiers 1, 2, and 3, respectively). The most frequent comment was that the program permitted increased investments to improve the plant and/or its efficiency (n=6). Three respondents referred to enhanced revenues, and two thought the effects were minimal. Two others commented that the program bought time to evaluate the facility's ability to survive the transition to competition.

Impact of Program Extension to 2003 (Q.16). The majority (19 out of 29) thought that extending the term of the program from the end of 2001 to the end of 2003 would have a positive effect on their operations. The other respondents thought that there would be no effect (n=7) or did not know (n=3). Six of the seven respondents indicating no effect are

from Tier 3. The most frequent comments (n=9) noted that the extension would enhance revenues and help maintain project viability. Three of these are from Tier 1 and five are from Tier 3. Several felt that the extension would help increase operating levels, upgrade equipment, or improve efficiency (n=6). Three respondents thought that an extension would generally ease the transition to the competitive market. One noted that it would help to cover high insurance costs.

Change In Operation Due To Program (Q.17). When asked whether their facilities would have operated differently if the program had not existed, the majority (17 out of 29) thought that operations would be different while 12 thought that operations would not be different. Of those who would have operated differently, several said they would have reduced the operating time or output (n=7). Several reported they would have or might have ceased operations completely (n=6). Other comments referenced reduced maintenance and shorter payback perspective for improvements. These effects are illustrated in Figure 3-5.

Figure 3-5: Change in Operations Without Program



Effects Of Price Cap (Q.18). When asked whether a $10 per MWh price cap had any effect on their incentive levels, 21 out of 29 reported that it did not. Among the remaining respondents, five thought it had a negative effect while two thought it had a positive effect. Of the five that felt it had a negative effect, four are from Tier 1 and one is from Tier 3. Many of the respondents who thought it had no effect noted that the cap was never binding in their situation. The negative effects were explained as reducing the incentive to a point

where they were of little help. The positive effect noted by one respondent was that it helped to extend the funds.

Awareness Of Green Power Incentives (Q.36). Of the respondents (n=30), 23 were aware of the green power customer credit incentive offered by the State. All of the Tier 2 generators (n=5) and six of the seven Tier 1 respondents were aware of the program, but only 11 of the 17 Tier 3 generators were aware of it.

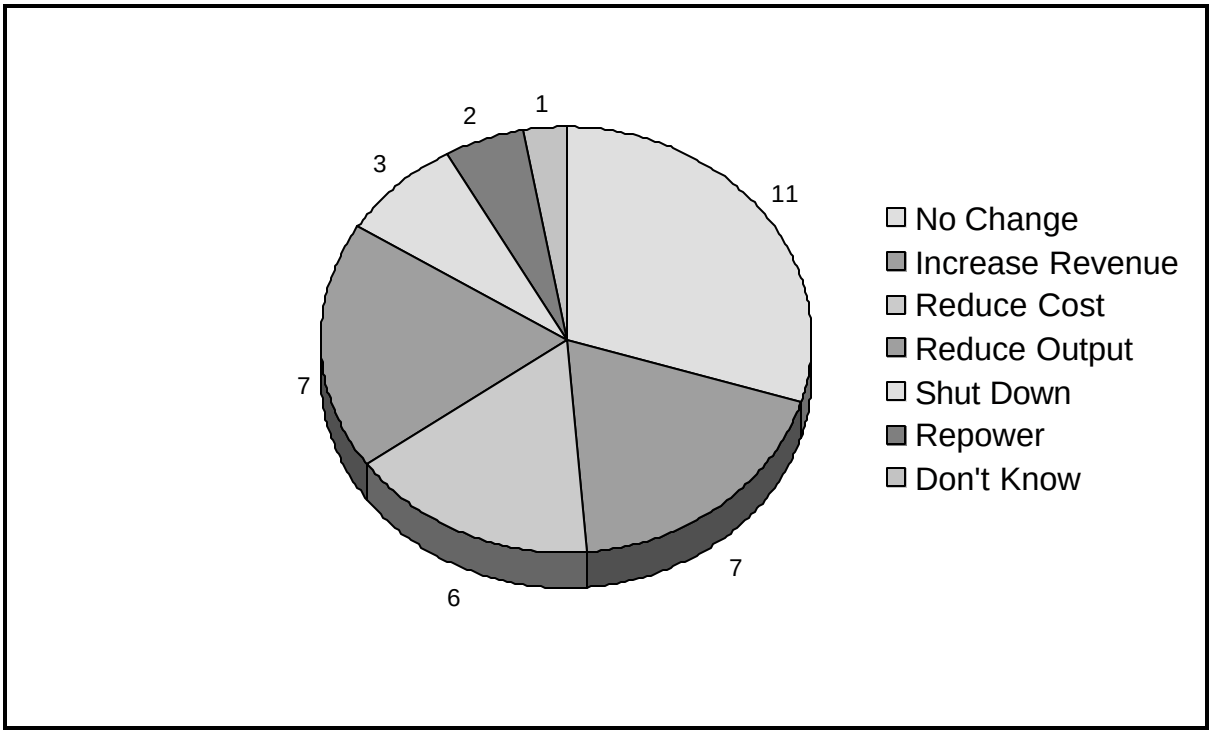
Program's Impact On Developing Green Power Markets (Q.35). When asked whether the Existing Account incentives were helping to develop the green power market, 13 out of 29 thought that the incentive did help. Six thought that the Existing Account incentives did not have any effect on the green power market primarily because the generators are selling through Standard Offer contracts, therefore their power is not eligible for the green power incentive. A large group (n=10) did not know if there has been an effect.

3.7 Changes In Operations Past And Future

Renewable generators were asked about changes in their operations over the past four years and their outlook for the next four years. Especially interesting are their plans for remaining competitive once the Existing Account incentive program ends.

Post-Incentive Program Strategies (Q.24). The respondents (n=31) had a wide range of strategies and sometimes more than one for remaining competitive after the program terminates. The largest plurality (n=11) will not change their operations. Finding ways to increase revenues (n=7) or reduce costs (n=6) is planned by another group. Several plan to reduce generation during less profitable times or reduce maintenance (n=7). Some plan to shut down completely (n=3). Finally, two plan to repower their facilities. These strategies are displayed in Figure 3-6.

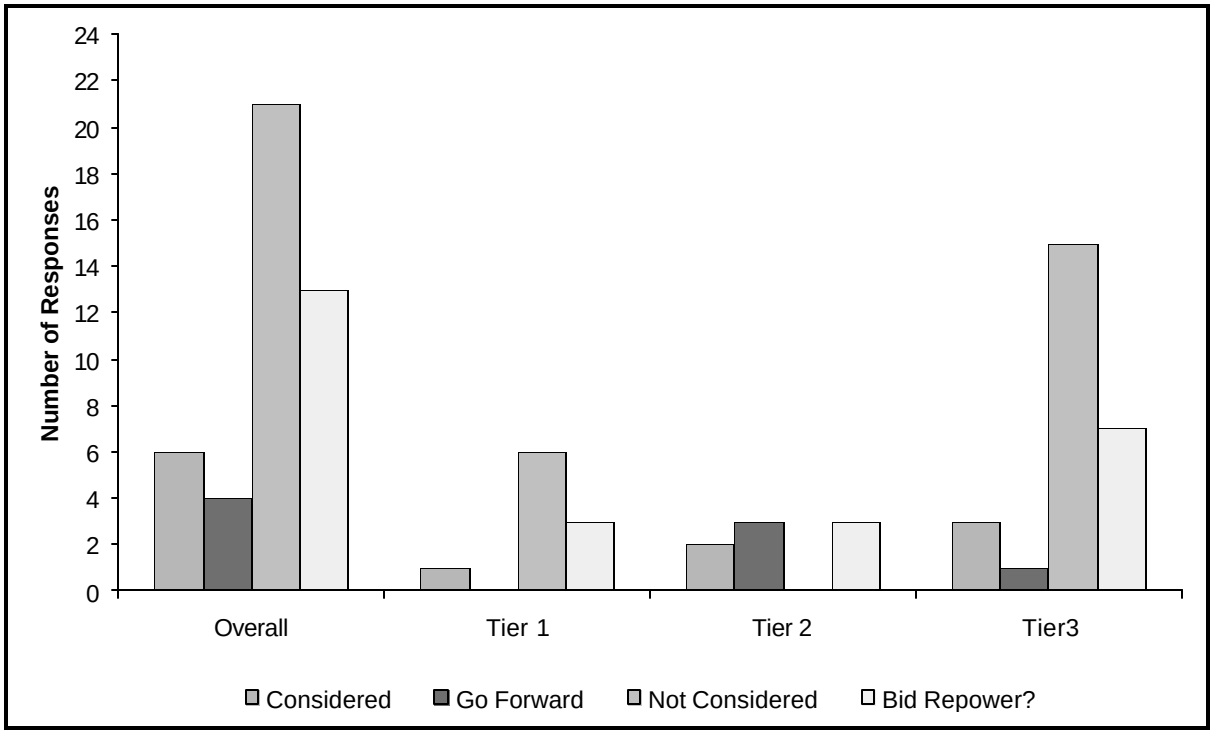
Figure 3-6: Post-Program Strategies



Consideration of Repowering (Q.5 & 37). Respondents were asked if they had already considered repowering their facility or facilities. They were also asked if they might consider a New Account auction for a new or repowered facility in the future. Overall, six had considered repowering but were not proceeding forward with it, four were proceeding forward and 21 had not even considered it. Tier 2 generators were most active with two having considered repowering and the remaining three proceeding forward with it. For Tier 1 generators, only one had considered repowering and none were proceeding forward. For Tier 3, three had considered repowering and one was proceeding forward. The consideration of repowering is illustrated by Tier in Figure 3-7.

Looking to the future, 13 respondents said they would consider participating in a New Account Auction. Again, Tier 2 is the most active, with three willing to consider new or repowered facilities. Only one Tier 2 respondent specified a prospective bid price, in the amount of 1 cent per kWh. Within Tiers 1 and 3, future auction participation would be three out of five and seven out of nineteen, respectively. Tier 1 respondents could not specify a bid price, but reported Tier 3 bid prices averaged 1.15 cent per kWh (n=5).

Figure 3-7: Consideration of Project Repowering



Planned Changes in Operating Hours (Q.25). Respondents (n=31) were asked to report changes in their operating hours planned for the next two years. The majority (n=25) had no plans to change (6/7, 4/5, and 15/19 for Tiers 1, 2, and 3, respectively). Among those planning to change operating hours, three Tier 3 generators planned to increase hours. One Tier 2 generator planned to shut down if repowering plans do not work out. One waste tire generator (Tier 1) thought they might resume operations if profit margin could be improved. One digester gas generator planned to reduce operation eliminating use ofsupplemental natural gas.

Change In Energy Production By 2001(Q.26). Generators were asked if they planned to change their energy production at the currently proposed end of Existing Account incentives. Overall, eight planned to change their production (3/6, 2/5, and 3/19 for Tiers 1, 2, and 3, respectively). All except one Tier 1 generator planned to decrease production. The generator planning to increase production was a solar thermal facility that planned to improve its equipment.

Changed Operating Practices (Q.27). Within the past four years, nine respondents (n=31) have changed operating practices (5/7, 2/5, and 2/19 for Tiers 1, 2, and 3, respectively). Changes involved maintenance practices (n=3), increased production in response to Existing Account incentive payments (n=3), increased production due to better

response to outages (n=1), decreased output due to aging for one wind producer, and facility shut down by one waste tire plant.

Six generators planned to change their operating practices in the next four years (1/5, 2/5, and 3/18 for Tiers 1, 2, and 3, respectively). These changes include increased production by a biomass plant if economic conditions improve, output reductions or shut down for two solar thermal facilities if economic conditions are unfavorable, increase output of one wind plant due to aging and the possible increased output of another if repowering proves feasible. Three small hydro facilities plan to increase production; one in response to improved intake, one due to peaking sales, and one due to off-peak generation.

Change Maintenance Practices (Q.28) And Changed Maintenance Costs (Q30). Eight out of thirty respondents reported changed maintenance practices within the past four years (2/7, 1/5, and 5/18 for Tiers 1, 2, and 3, respectively). These changes included improved efficiency by both solar thermal and one wind generator, extended intervals between maintenance by one geothermal generator, reduction in overtime by performing maintenance only during straight time (by two landfill gas and one geothermal generator), increased maintenance due to aging by one hydro plant and one landfill gas plant.

Twice as many respondents (n=16) reported changes in maintenance costs as reported changes in maintenance practices (3/7, 3/5, and 10/19 for Tiers 1, 2, and 3, respectively). The additional costs are in part due to plant aging in three wind plants and one biomass plant, and one landfill gas plant. Two digester gas facilities reduced maintenance costs by implementing SCADA automation in one case and replacing a generating unit in the other case. Maintenance costs were reduced by various means in one solar thermal, one landfill gas, and three geothermal facilities. The magnitude of the change in costs was not estimated by most of the respondents, but those who did estimate the change reported an increase of 15% for one wind, an increase of 33% for one landfill gas facility, and an increase of between 20% to 30% for one hydro facility. This was all due to aging.

Looking to the next four years, increasing maintenance activities were expected by six out of thirty with increasing costs expected by eight of the respondents. Decreased maintenance with concomitant decreases in costs due to continued efficiency improvements were anticipated by both solar thermal facilities, one wind, and one landfill gas facility. One digester gas expected decreased maintenance and maintenance costs due to automation. Aging equipment is expected to continually increase maintenance activities and costs at one wind and one hydro facility.

Operating Cost Changes (Q.29) And Fuel Cost Changes (Q32). Overall operating costs have changed in the past four years for 16 of the respondents (5/7, 2/5, and 9/19 for Tiers 1, 2, and 3, respectively). In addition to the changes in maintenance costs already

discussed, operating costs have increased due to increased fuel costs for two of the biomass generators (one estimated a 1/3 increase) and one waste tire generator. One other wood waste biomass generator experienced a fuel cost reduction of 7%. Operating cost decreases were realized by one wind facility through decreasing the number of units on line by cannibalizing parts from failing units. All geothermal generators decreased operating costs by increased efficiencies and improved materials.

Future operating cost changes essentially track with the expected maintenance cost changes described above; seven out of nineteen overall (1/7, 2/5, 4/19 for Tiers 1, 2, and 3, respectively). Biomass and waste tire producers could not predict how their fuel costs might change over the next four years.

3.8 Experience With Existing Account Program

The incentive program participants' experiences with the program as well as their perceptions regarding whether the fund has been spent according to AB 1890, are important indications of the program's performance. As seen below, the feedback in these areas is quite positive.

Experiences With Application Process (Q.39). The approval process went smoothly for 26 out of 29 respondents. Ten of those made positive comments including remarking on how easy and streamlined and fast the approval process went. Of the three who experienced problems, one had problems because the plant is in the Sierra Pacific service area and one because of difficulties reaching Commission staff by phone. One company that was initially rejected was eventually accepted by the program, although that process could have been improved by a staff site visit.

Experiences With Receiving Incentive Payments (Q.40). All but one respondent had no problem receiving payments (n=27). Several complimented Commission staff for prompt responses and alerting them when they were late with their documentation. The one suggestion offered was that the recipients should be notified by staff when funds are exhausted.

Have Funds Been Distributed In Accordance With AB 1890? With the exception of three respondents who were not familiar with AB 1890 (two of whom were program nonparticipants) all of the respondents agreed that the Renewable Energy Program Funds have been distributed in accordance with the stated design of the program, as set out in AB 1890.

Volume II

4 Qualitative Assessment

4.1 Introduction

This section is intended to provide a qualitative assessment of the performance of the Existing Renewable Account incentive program. The relationship between planned level and distribution of the funding and that actually distributed to date is evaluated first. The overall success of the program in keeping existing renewable generation on-line during the *transition period* is then evaluated. The cost-effectiveness of the fund expenditures for keeping the renewable projects on-line during the transition period is evaluated using a triage model suggested in the Policy Report.[1] The Tier systems, the target prices and price cap mechanisms are evaluated in this context. Finally, the advisability of extending the life of the Fund and other related policy questions are considered.

The success of the Existing Account incentives can best be evaluated in terms of the stated goals and objectives for the program as numerated in Chapter 1 of this report. This can be translated into the following specific criteria:

- Were the funds distributed in accordance with the intended allocations?
- Did the program succeed in keeping renewables on-line through the transition period and enable them to remain competitive after the transition period?
- Was the tier allocation approach and the established target prices and price caps successful in promoting the specified technologies in an efficient and cost effective manner?

These questions will be addressed in the following sections.

[1] Commission , Policy Report on AB 1890 Renewables Funding: Report to the Legislature. Report P500-97-002, March 1997.

4.2 Levels of Funding – Planned Versus Actual

The analysis of the payout of Existing Account funds (cumulative disbursements to date as a percentage of available funds) indicates that actual payout has tracked planned payouts fairly well through the first quarter and into the second quarter of 2000. Overall, through the end of 1999, 87% of the allocated funds have been paid out to eligible Existing Account generators. By the end of May 2000 the payout percentage had dropped to 77%. This has occurred because the program was designed to react to factors such as market prices and strong enrollment. For example, if market prices are high enough then no incentive payments are made and the funds not paid out are rolled over and made available in the future. The fact that not all the available funds are paid out is one indicator that the objectives of the program are being achieved without having to distribute as many incentives.

On a tier-by-tier basis there have been some significant differences. The funding allocations allow funds not previously used to be carried into the future within each tier. During the program period, Tier 1 cumulative payout percentages rose from around 60% in first quarter 1998 (the starting period) to 94% during the last quarter of 1999. Tier 2 payouts rose from around 25% to a peak of 79% of available funds in third quarter of 1999 and have tapered off slightly in the past few months, possibly as a function of seasonal declines in output and/or reduced incentive prices due to market and target price impacts. The seasonal production variations from wind generation can be as much as threefold, with the lowest energy production occurring in the winter months. This explains why payouts tapered off slightly at the end of 1999 even though capacity enrollment continued to increase. Tier 3 payouts rose from 20% at the start of the program to 100% in the second and third quarters of 1999, falling back to about 90% in the last quarter for which data is available (fourth quarter 1999). Tier 1 payouts have been limited by both the payment cap and more recently the target price. Payouts within Tiers 2 and 3 have at times been target limited as well. This has been due primarily to high SRACs in both the PG&E and SCE service territories. Tier 3 payments have never been limited by price caps to date. With the enrollment in the program for all tiers at or close to 100% of the eligible facilities, it is apparent that the planned levels of funding have been sufficient for the program to run as designed. In this regard, the program has been a success.

4.3 Was the Fund Helpful in Negotiating the Transition Period?

The amount of renewable generation from all technologies has been remarkably constant during the two years in which the program has been awarding incentive payments and for which data is available (from the first quarter 1998 to last quarter 1999). While a direct causal connection cannot be established, it is apparent that renewable generation has continued to provide at least its historic contribution to generation diversity in California thus far. Factors working against the continuation of renewable generation have included the

reduction of the high (relative to current markets), fixed energy payments received by many renewable generation projects (the so called “Interim price cliff”), as well as the reduction of some capacity payments under the terms of some Standard Offer No. 4 contracts.

Other factors working against continued renewable generation have included the scarcity of economical fuels for such technologies as biomass and waste tires, and transmission capacity constraints in areas such as Altamont and San Gorgonio Passes for wind generation. For example, both of the waste tire facilities have reported that production has stopped as a result of not being able to secure waste tires at an economic price. In this case, the problem is not easily resolved without further environmental regulation at the state level, as the fuel supply channels for this type of solid waste are not highly developed. Waste tires must be gathered from a very large geographic area. Increasing the solid waste deposit fees for tires will have an impact on this fuel supply issue. Other renewable technologies have more concentrated fuel supplies and generally do not have this kind of problem.

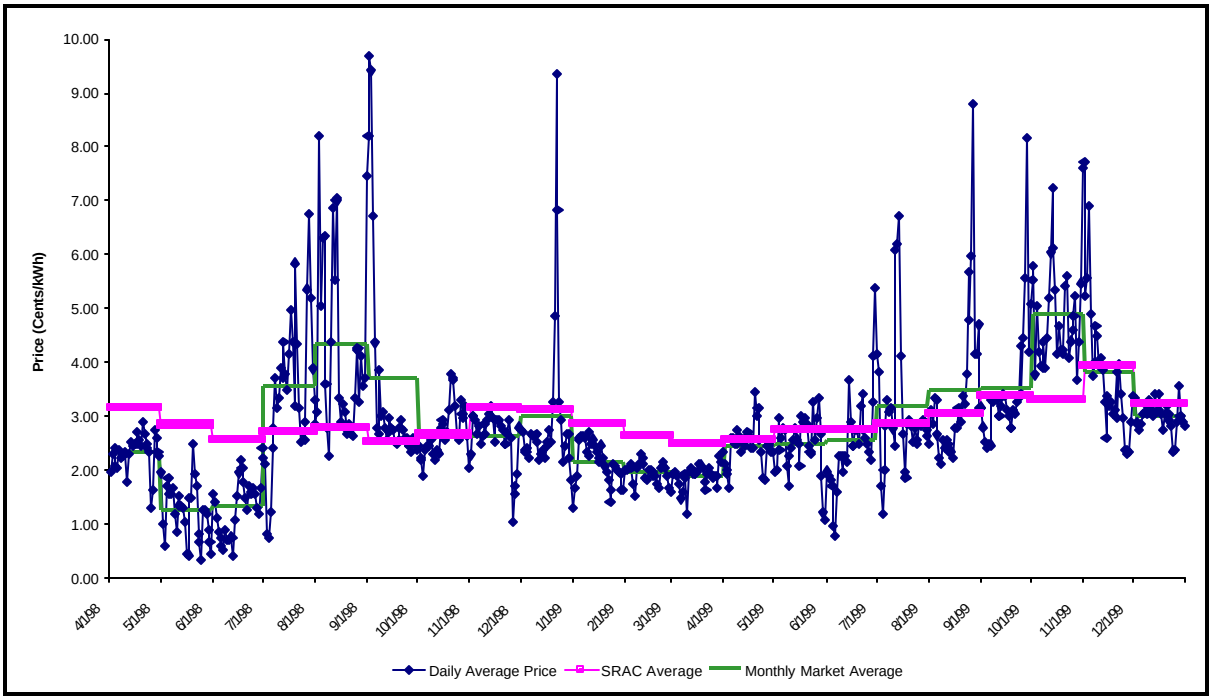
In the future, more volatile PX market prices may also work against continued renewable generation. Volatility creates less certainty in a generator's revenue stream. Observing how PX prices have skyrocketed during the summer of 2000, one might think that it would be good to have energy sales contracts based on the PX price. Unfortunately, hindsight is always perfect. To be able to predict such events is another matter. Most businesses looking at the market from a long-term perspective would opt for more steady and predictable prices over highly volatile and unpredictable prices. In addition, with the introduction of more merchant power plants in the future, the average PX price will most likely trend downward which may create even more uncertainty about future revenues.

During the evaluation period there has been little existing renewable generation coming back on line. This means that there has been little new capacity in the program to offset the possible loss of existing generation. A detailed analysis of the IOUs’ Quarterly Status Report (QSR) Summary data conducted by RER supports this observation. Throughout the term of the Program thus far, operating capacity in municipal solid waste, geothermal, small hydro and solar thermal electric technologies has been essentially flat. Wind capacity increased by about 5%, while biomass MW generation increased 3% and biogas (digester gas and landfill gas combined) increased by 20%.

The fact that renewable generation overall is holding its capacity share at the midpoint in the program’s life provides some evidence that the program has been effective in maintaining the competitiveness of renewable generation. Although the majority of non-utility owned renewable capacity has survived through the ISO4 price cliff does not mean that the program has assured the continuation of renewable generation. One major hurdle yet to be faced by existing renewable generators is their exposure to fully competitive market pricing. Thus far, very few Existing Account Program participants sell their power on the California power

exchange.[2] At present, almost all generators receive an energy payment based on the SRAC (Short-Run Avoided Cost) which is a monthly value calculated by a CPUC approved formula.[3] Discussions are now underway that will eventually redefine the SRAC to parallel the PX price. PX prices currently exhibit a high degree of volatility in comparison to SRAC. As mentioned earlier, this volatility could have deleterious effects on the competitiveness of renewable generation. Furthermore, it is not yet decided whether renewable generators will be exposed to a monthly average PX price or the daily or hourly price variations. A comparison of the SRAC prices versus average monthly and daily prices compiled by Commission staff indicates that the SRAC was above the monthly average PX price for about half the months in 1998 and 1999.[4] However, daily variations were much greater per Figure 4-1.

Figure 4-1: PX and SRAC Prices



What may be more important is that, just as the average PX market prices have been trending upward, so have SRACs, although to a lesser degree during 1999. This is expected in part because SRACs are based upon short-run fuel costs and marginal heat (incremental energy) rates. This trend is illustrated in Figure 4-2. Average PX market prices began to outpace

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2 According to the telephone survey results, 6% of the generators sell their power to the PX or APX.

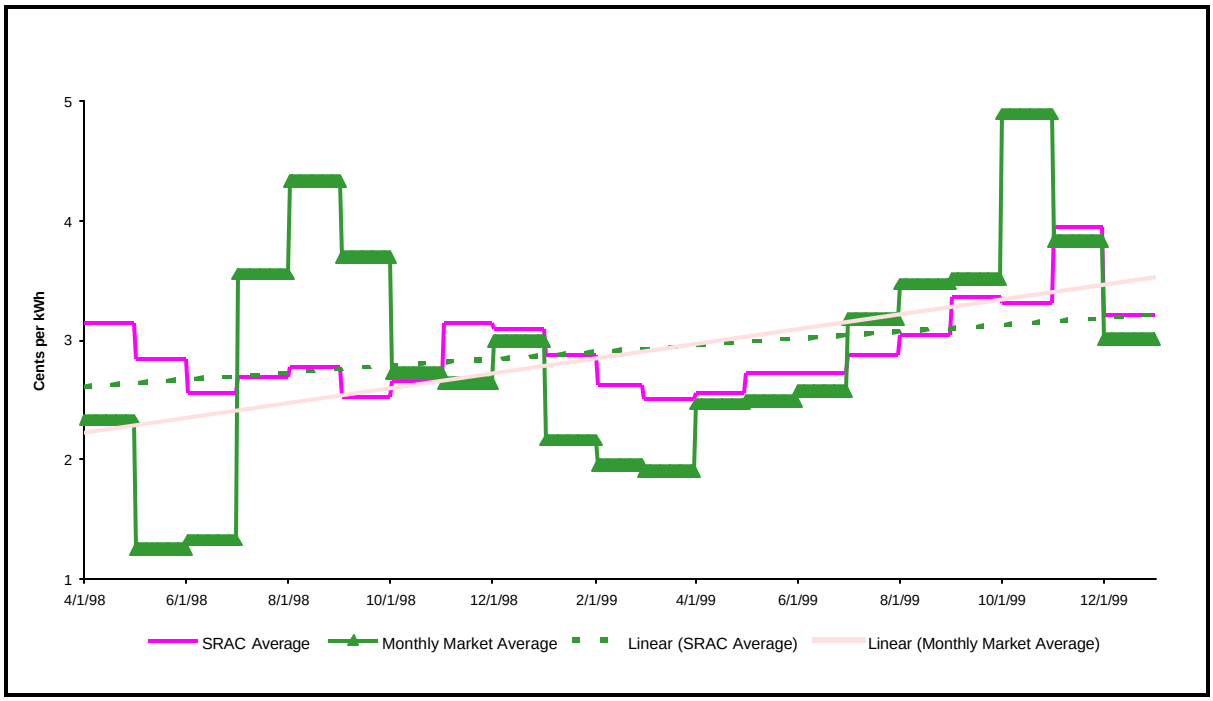
3 SRAC is intended to reflect the weighted average marginal cost of energy within each of the three IOUs' service areas.

4 SRAC was higher in five months in 1998 and eight months in 1999. However in 1999 the difference was only 2 mills or less in seven months of 1999.

SRACs in the middle of 1999, and during the summer of 2000 they were as much as three times greater than SRACs. The upward trend in SRACs is good in that it reflects the movement in market prices and therefore renewable generators are realizing the benefits of increasing market prices. If the target prices are reasonable, then there should be no negative effect of the SRACs exceeding them. The only possible downside to the climbing market prices is that most existing renewable generators can not necessarily benefit from the fact that they are greater, and sometimes much greater, than SRACs.

For those few existing facilities selling their generation into the PX, the incentives have at times been distributed even when the average market price was well above the SRAC price. If the trend of higher average market prices over SRACs continues, then it will become advantageous for renewable energy producers to sell their generation at market prices. It may now be that the power sales contract termination provisions that most existing producers hold, is a limiting factor in their ability to adapt to a competitive environment.

Figure 4-2: SRACs vs Average Monthly Market Prices



Another issue affecting post-program competitiveness is whether certain renewables will even be eligible to bid into the day-ahead or hour-ahead markets. Because wind and solar thermal cannot guarantee their capacity availability, they might be precluded from bidding into these markets, which clearly would diminish their options in the competitive markets. The APX may provide a better opportunity for these renewables. So far, APX prices have

been higher than SRAC prices but they have not experienced the same degree of volatility as the PX prices.

The Existing Account telephone survey provides another means of evaluating the effectiveness of the Program in promoting post-program competitiveness. Over one-half (18 out of 31) survey respondents stated that the program had been effective in enhancing their post-program competitiveness. Furthermore, when asked about their strategy for remaining competitive after the program ends, three of the 31 respondents said they might shut down and another seven said they might reduce output. The remaining two-thirds believed they would find ways to continue full operation.

4.4 Cost-Effectiveness – Success of Triage Approach

The triage approach discussed in the Policy Report is an effort to focus Existing Account funding where it would have the greatest impact. In concept, projects that would have continued to generate without incentive payments should receive little or no support. The same should be true of projects that will not survive the transition to competition. In reality, any government program must follow objective guidelines for eligibility, which cannot perfectly account for all of these individual project characteristics. The grouping of the selected technologies into tiers allows the Commission to differentially tailor incentive payments by technology, and by utility service area. However, by the program design within the three tiers, all of these projects must receive identical treatment.

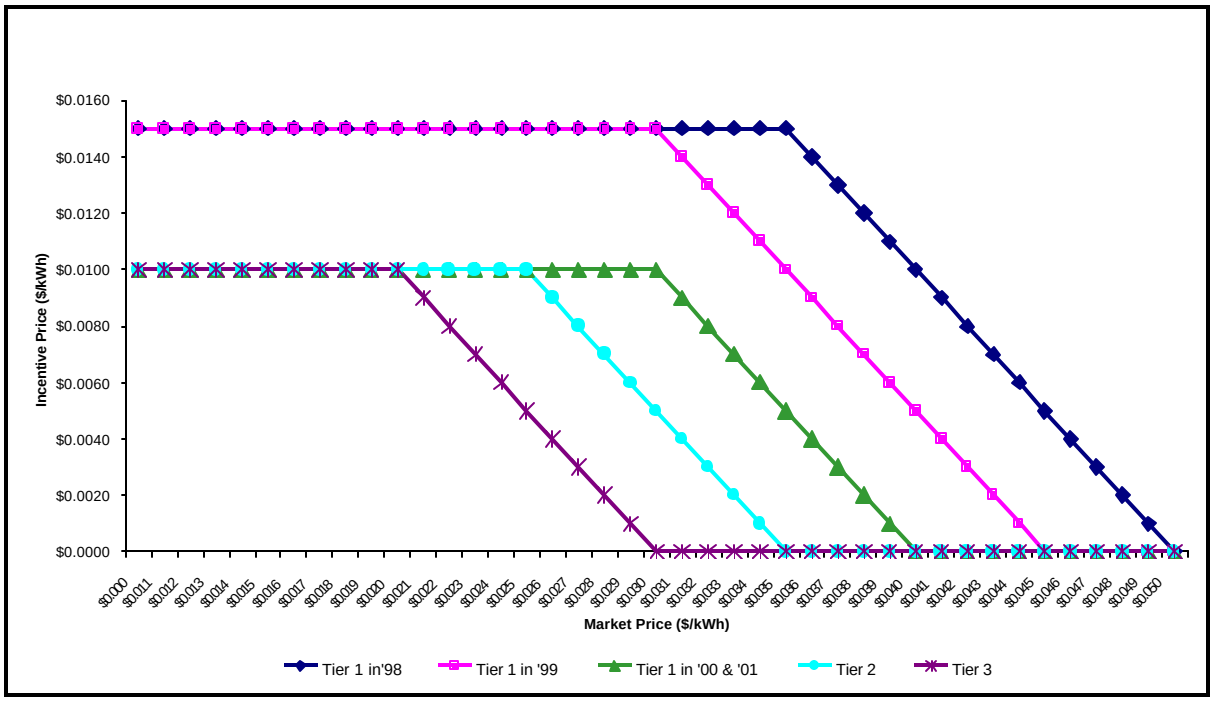
One source of program information cost-effectiveness is the data obtained by the Existing Account telephone survey conducted in connection with the REP Existing Account evaluation. Program incentive recipients were asked directly if their facilities would have operated differently if the Program had never existed. Only one of the eight Tier 1 and none of the five Tier 2 respondents indicated that their operation would have been unchanged without the program. However, a majority (11 of 19) of the Tier 3 survey participants indicated that their operation would not have changed if the Program financial/support had never existed. The same number of Tier 3 survey respondents indicated that restructuring of the electric industry in California has had no effect on their operations.

Given the natural self-interest bias to understate the *no change* response, much of the relatively small percentage of funds paid out to these Tier 3 projects may not have been cost-effective (i.e. due to free-ridership). However, it is also worth noting that the allocation of funding and the Target Prices were by far the lowest for Tier 3. This survey finding thus seems to validate this Program funding allocation decision. The question then remains as to whether the Target Price and price caps for each Tier in the Account are appropriately placed. This key question is discussed in Section 4.5.

4.5 Qualitative Evaluation of Target Prices and Caps

As noted above, the differentiation into tiers allowed the program to focus its available funds on the existing technologies that needed the most assistance. It is also important to assess how the price targets and caps affect incentive payments, with variations in market prices (SRAC). Figure 4-3 illustrates graphically how the incentive price is designed to change with the variations in the monthly average market price. Initially, as the market price increases from zero, the incentive price is unchanged, due to the effect of the price cap. When the market price increases to the point where the price cap no longer takes effect, the incentive price begins to decline linearly until the market price equals the target price. At this point (3.0 cents per kWh for Tier 3 Projects) the incentive is equal to zero and remains at this level as long as the market price remains above the Target Price.

Figure 4-3: Tier Incentive Structure



Tier 1 incentives were limited by the price cap until the last half of 1999 when the difference between the target price and the SRAC fell to less than the $0.015 per kWh price cap. For Tier 1 generators, the governing effect of the price cap and the level of generation during the first six quarters of the program left additional funds in the Tier 1 Account. Cumulative disbursal was 10% below the allocation at the end of 1999. The question remains whether or not this effect has increased the efficiency of the program by cutting unneeded incentives or if it has deprived generators of funds, which would have been helpful in increasing their longer-term competitiveness. The Tier 1 respondents to the telephone survey were fairly convincing in that the program has been beneficial to their operations, however, four of the

seven Tier 1 respondents felt that the price cap was too low. On the other hand, only three of the seven thought the target price was too low. Therefore, it would appear that as of May 2000, the reduction of incentive prices alone has not been overly detrimental to the continued successful operation of Tier 1 projects.

With respect to Tier 2, the price cap as well as the target price have been factors in moderating the cumulative incentive payout to less than 80% of the allocated funds. As with Tier 1, the question is whether these limits have been beneficial in controlling the dispersal of unnecessary incentives or has been detrimental in limiting planned fund expenditures. The majority of wind facility owners and managers interviewed believe that the program has enhanced post-program competitiveness. In addition, the respondents were unanimous that the target price was about right. It would appear that the Tier 2 target price has been set at an effective level and benefits the program participants.

For Tier 3, the price cap was never reached, because the difference between the target price and the SRAC was always less than the 1.0 cent per kWh cap. The target price relative to the SRAC- based market price has been the controlling factor for Tier 3 payments. Based on the telephone survey of participants, it is fairly clear that Tier 3 has not been harmed. Many Tier 3 respondents to the survey of owners and managers don't think the program has had any effect on them and a few think the target price is set too high.

For Tier 3, cumulative payout percentages had risen to 90% or more in all four quarters of 1999. Given that the allocated funds have been paid out almost fully, the target price limitations have effectively spread out the payments to all program participants. If the target price had been higher, more of the funds would have been spent on projects. However, there is no evidence to suggest that this would have eliminated any barriers to success in the open market by the 2001 program end. The opposing question is whether the target price is too high. The only survey respondents to say that the target price is too high came from Tier 3. Only a little more than half the Tier 3 survey respondents believe that the program has enhanced post-program competitiveness. In addition, not many plan to change their operations after the program is over. The evidence would suggest that the target price could have been set lower and not have had an adverse effect on the Tier 3 generators.

There is not enough evidence to suggest that the program target prices and caps have not been beneficial enough, or have been a detrimental factor in any way. Given the available information, the conclusion is that the price caps and target prices have been adequately established with the possible exception of Tier 3. The Tier 3 target price and/or price cap could be set lower and not have an adverse effect of the overall competitiveness of these technologies.

Volume II

5 Program Impacts

This section is intended to provide a quantitative assessment of the performance of the Existing Renewable Resources Account incentive program. Program impacts can be measured in several ways; changes in capacity levels, changes in production levels, and impacts on the overall power market. These impacts will be considered here, within the data limitations of the overall market.

5.1 Quantitative Assessment Methodology

In defining a program impact it is important to establish a clear baseline against which the impact can be measured. After discussions with the Commission, the best indicator was determined to be the level of activity that would have prevailed in the absence of the Program. This baseline should be determined for both capacity and energy production. This baseline can be determined by measuring pre-program trends to forecast what the levels would be had the program not existed. It is important to know when pricing structures change whether due to the program or not, to account for their impacts. This baseline should be compared to self-reports by participants to add further credence to the baseline.

The evaluation should look at the overall levels as they actually are for the period following the start of the program (i.e., January 1998). Since there are other factors that affect energy production levels, these would have to be taken into account. These levels of activity should then be compared to the baseline and a range of probable program impacts developed.

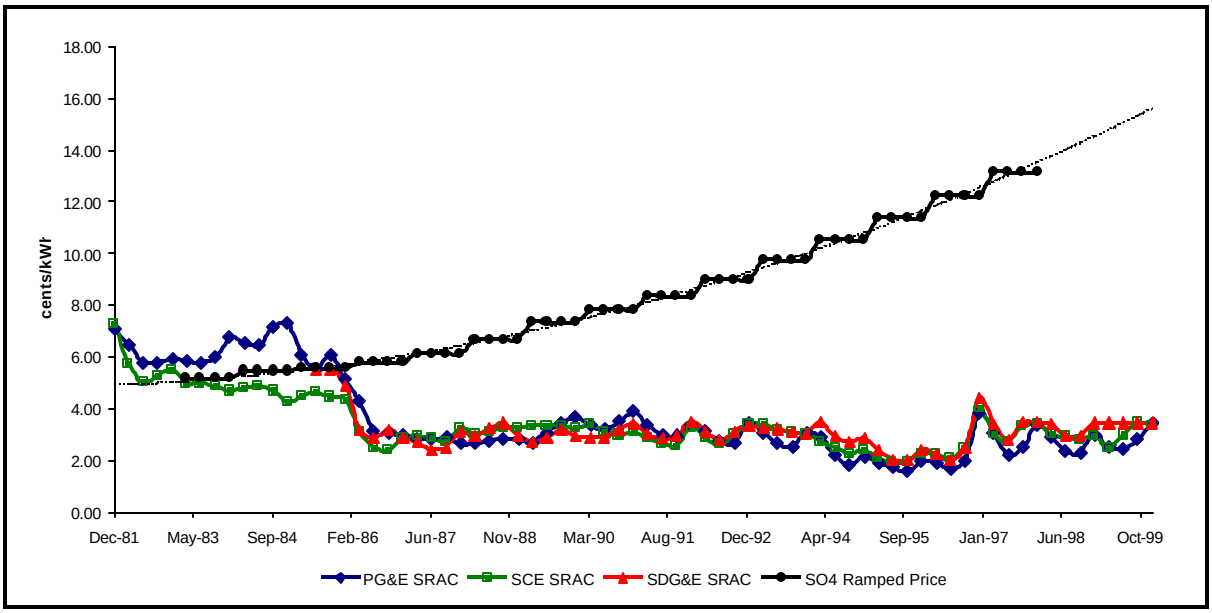
Ideally, this process would be accomplished using econometric modeling. Unfortunately, the available data does not support this kind of analysis. As a result, a less quantitative and more judgmental approach will be necessary.

5.2 Capacity Impacts

Beginning in May of 1983 and continuing through May of 1985, Interim Standard Offer No. 4 (SO4) power sales contracts were offered by the three major investor-owned utilities. These rather special contracts provided renewable facilities with fixed (either leveled or ramped) energy prices and capacity payments for a period of up to ten years, starting from the first day of energy deliveries to the utility. After the first ten years, these fixed energy payments are replaced by variable energy payments based on the local investor owned utilities' (IOUs) short run avoided costs (SRACs).

With an analysis of the Qualifying Facility (QF) database, it would be possible on a quarterly basis to determine what percentage of the capacity no longer receives this above-market fixed energy pricing, and instead receives energy pricing based on SRAC pricing. The effect of this "price cliff" on the market could be observed. In Figure 5-1 the magnitude of the price cliff is illustrated. This graph shows the SRACs for each of the IOUs and shows the SO4 Option 1 ramped price. Many of the contracts did not have the ramped pricing but rather a leveled price based on ten years from the time operation began. For the purposes here, it is easier to show the ramped prices.

Figure 5-1: SRAC Prices vs. SO4 Prices



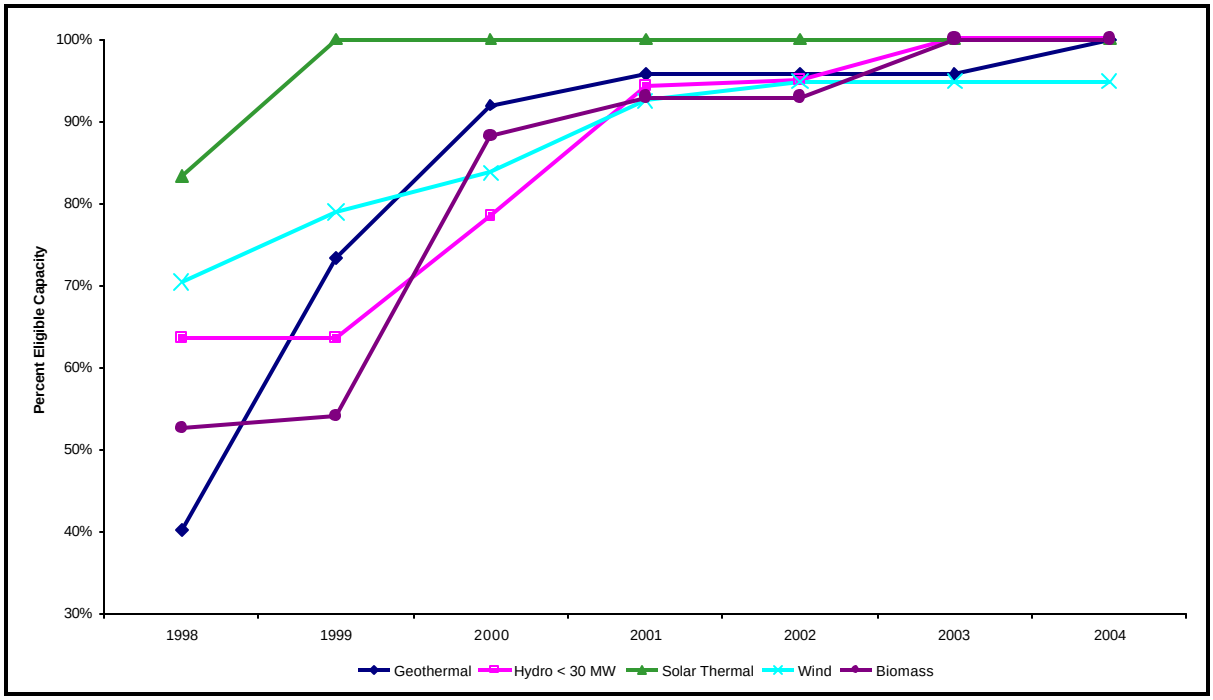
Ideally, an analysis of capacity levels of all facilities that have come off of SO4 fixed price contracts, referred to as the "price cliff", would result in measurable capacity changes resulting from the REP. This analysis should look at trends during the period after the price cliff and before the start of the REP. It should also look at the trends during the first two years of the REP. The impacts would be determined by examining the differences in trends. Unfortunately, this type of analysis was not possible for this evaluation. The Commission's QF database is the only source of detailed information on renewable facilities in California and it requires a significant amount of cleaning, validation, and editing before it can be used for a thorough analysis. Even an assessment of whether or not all eligible facilities are enrolled is hampered by not having a clean database.

As a result, the only capacity level trending that is possible is for small hydro, solar, wind, geothermal, and biomass based on the quarterly summary reports (QSRs) produced by the California IOUs. Even these technology types are not entirely accurate within the QF database and must be viewed cautiously. The other technologies are not included in the

discussion concerning the QSRs because of technology labeling inconsistencies between the QSRs and the REP and other discrepancies found relative to other data sources such as the Commission's database of California power plants.

Near-term effects of the program must take into consideration the level of capacity that is eligible for participation. The Commission has performed its own analysis of the eligible capacity by year for the period over which the program is to run. This analysis was based on the Commission's QF database. Figure 5-2 shows the estimated capacity available for participation as a result of coming off the price cliff. The estimates are expressed as the percent of total reported capacity eligible for participation by year for each of the four technologies reported here from the QSRs.

Figure 5-2: Percent Eligible Capacity



Small hydro capacity reported in the QSRs over the period of 1997 through the second quarter of 2000, is illustrated in Figure 5-3. As of the fourth quarter of 1999, it appears that nearly 87% of the small hydro capacity in California has enrolled in the program. The expected level of participation is higher when compared with the small hydro estimate of approximately 78% in Figure 5-2. This suggests that the program participation is somewhat higher than expected.

Short Term Capacity Changes

One might assume that the program would have an immediate impact on the level of existing renewable generation within the State. The overall trend in capacity appears to be steady just before the program started and during the entire evaluation period reported here. Overall, nearly two thirds of the small hydro capacity in the state is within the PG&E service area with the bulk of the remaining capacity within SCE's service area. SRACs for the PG&E service area tend to be the lowest in the State making energy payments lower but Existing Account incentive payments higher than those in the other two service areas.

Figure 5-3: Small Hydro Capacity Levels

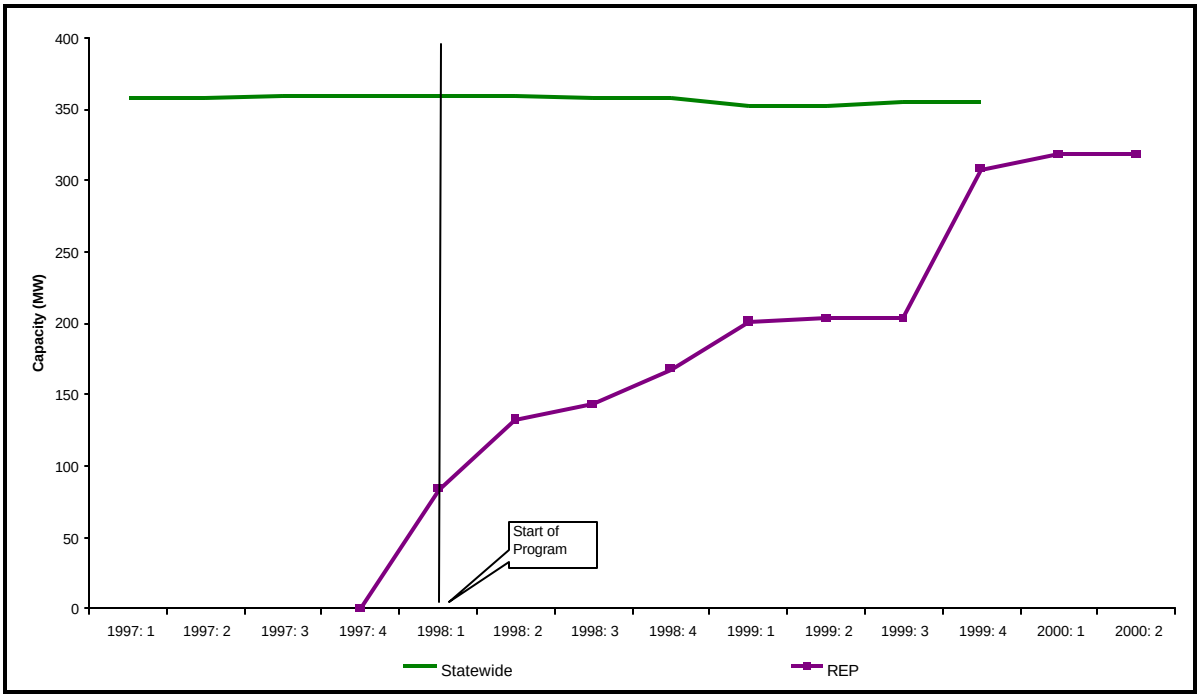
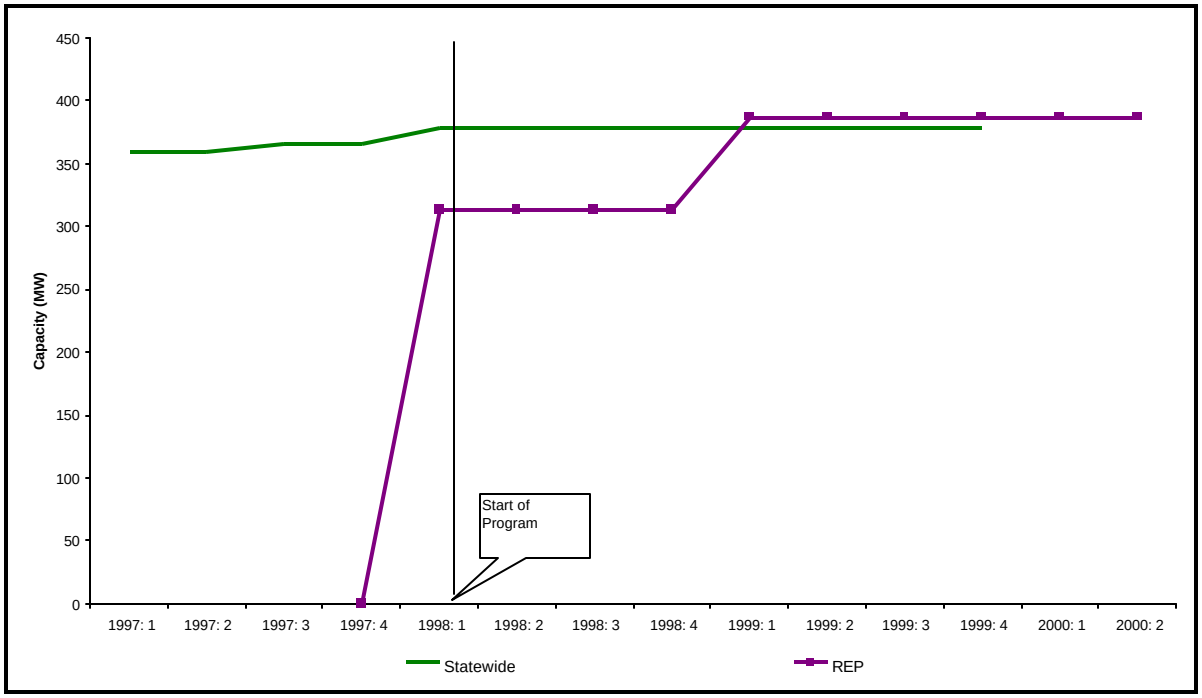


Figure 5-4: Solar Thermal Capacity Levels

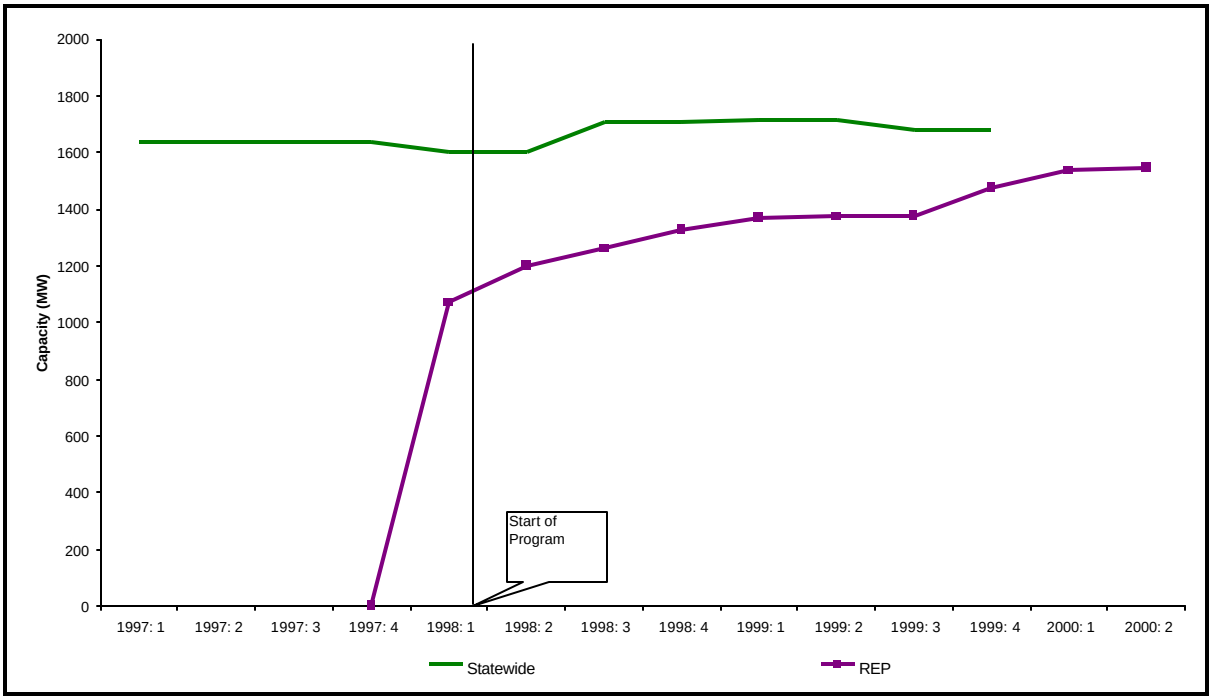


The trend in capacity for solar thermal reported in the QSRs is illustrated in Figure 5-4. This is very consistent with the Commission's findings of eligibility. It appears that all the eligible solar thermal capacity has enrolled in the REP Existing Account. In fact, it appears that more capacity is enrolled than exists. This is most likely due to the inconsistencies of the QF database. Solar thermal could appear under another category due to the occasional use of supplemental fuel to boost efficiency.

Nearly all the solar thermal capacity is within the SCE service territory. SCE's SRACs over the past several years have been the second highest in the State. This makes the incentive levels relative to the other service areas in the middle as well.

Even though there is some uncertainty with the data since the enrolled capacity in the REP is greater than that available in the State, the evidence suggests that all the eligible capacity is enrolled in the program. The trend in overall capacity shows a slight increase just prior to the start of the REP Existing Account energy production incentives. It is not evident from Figure 5-4 whether or not this was a result of the program. This may be the result of new solar thermal facilities which would not be eligible for funds under the Existing Account or it may be a result of previously shut down facilities that have reopened.

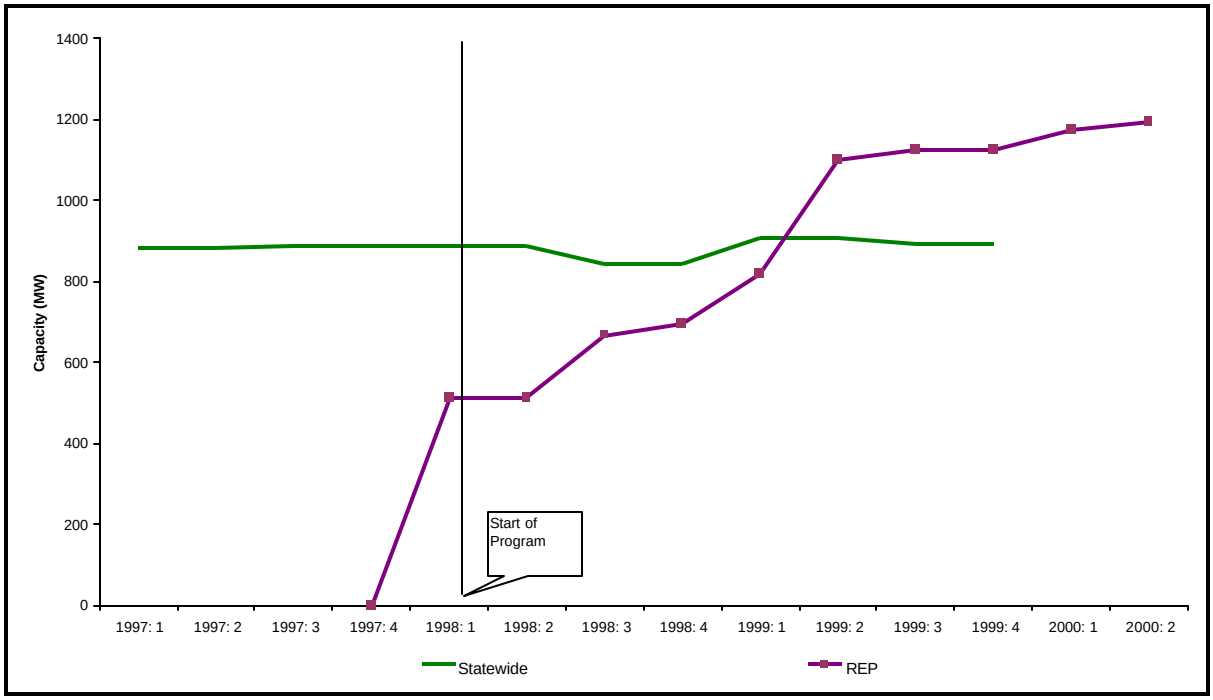
Figure 5-5: Wind Capacity Levels – Existing Account Only



The trends in wind generation capacity are illustrated in Figure 5-5. At the end of 1999, it appears that nearly 88% of the eligible capacity was enrolled in the Existing Account. This is somewhat higher (about 6%) than what the Commission has estimated as eligible.

There appears to have been a slight increase in the overall capacity after the start of the REP It is not known what the cause of this increase stems from, but it does appear to be a result of capacity coming into operation within SCE's service area. Part of this increase may have been due to a 16.5 MW New Renewable Resource Account wind project that came on-line shortly after a bid auction was conducted as part of the New Account program. This facility began operation in early 1999.

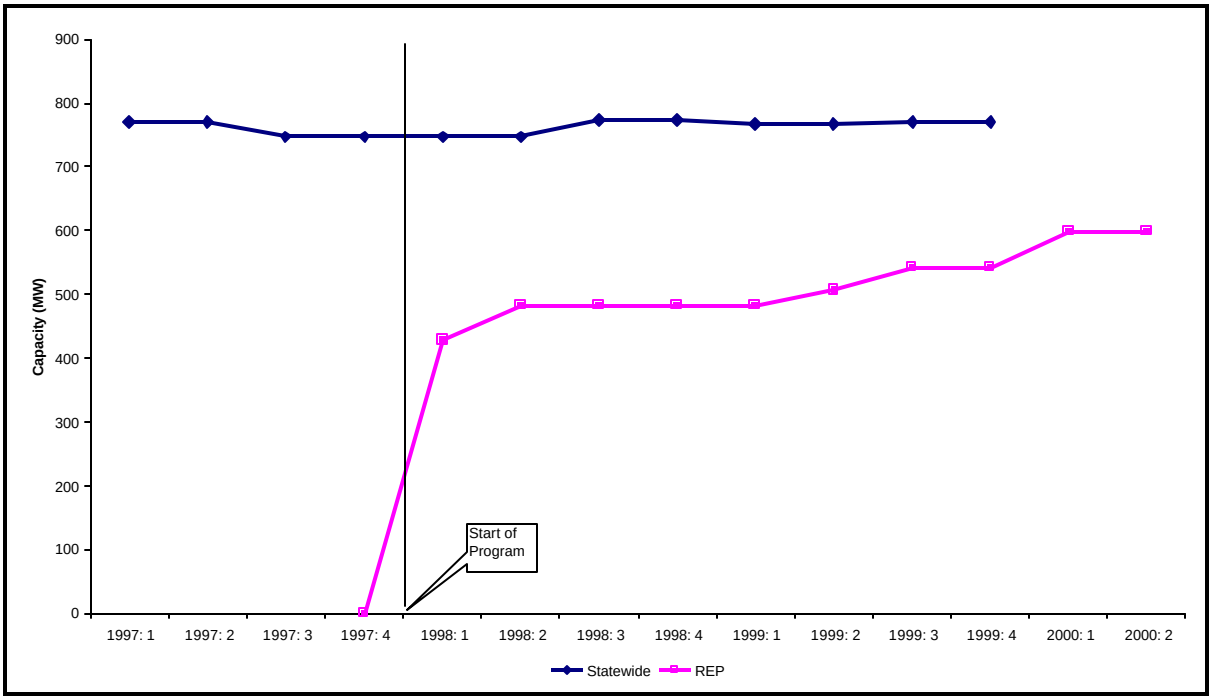
Figure 5-6: Geothermal Capacity Levels



Geothermal operational capacity levels are illustrated in Figure 5-6. At first glance, it appears that there may be a problem with the data since the REP enrolled capacity far exceeds the reported statewide QF geothermal capacity. However, PG&E sold its utility-owned geothermal assets known as the Geysers in early 1999 to non-utility entities. These facilities were never included in the QSRs (statewide total), but many of these facilities (those with QF status) are eligible for funding through the Existing Account. In addition, this would not be captured in the Commission's estimate of eligible capacity either. The added capacity amounts to 256 MW and is consistent with what is observed in Figure 5-6.

Short-term biomass capacity levels are illustrated in Figure 5-7. The capacity level in the second quarter of 2000 is shown to be approximately 78% of the available capacity. This compares to an expected level of 88% as seen in Figure 5-2. It would appear that biomass facilities have not been enrolling to their fullest extent or they have not been coming off the price cliff as rapidly as believed.

Figure 5-7: Biomass Capacity Levels



Long Term Historical Capacity Changes

It is not surprising that there are few changes in capacity during the short period of time the program has been in effect. The effects of the program may be more evident if the trends in capacity and the associated number of generators prior to the start of the REP are examined. Figure 5-9 shows the trends in the number of small hydroelectric facilities and the associated capacity for the period between 1990 and the beginning of the REP in 1998. The data from the QSRs have been plotted and trend lines following a polynomial shape have been drawn through the available data. There is evidence of the price cliff having a negative effect on the number of facilities during the mid-1990s. What is surprising is that the trend in capacity continues to rise during this same period. This suggests that a few larger facilities may have come on-line as numerous smaller facilities shut down. This trend ends around 1995 and the level of capacity starts to decline. Another interesting trend was the decline in the number of facilities that leveled off, which occurred during the same period that AB 1890 was passed. This may suggest that this legislation had an effect on the market before the Existing Account was even started.

Figure 5-8: Small Hydro Facilities and Capacity

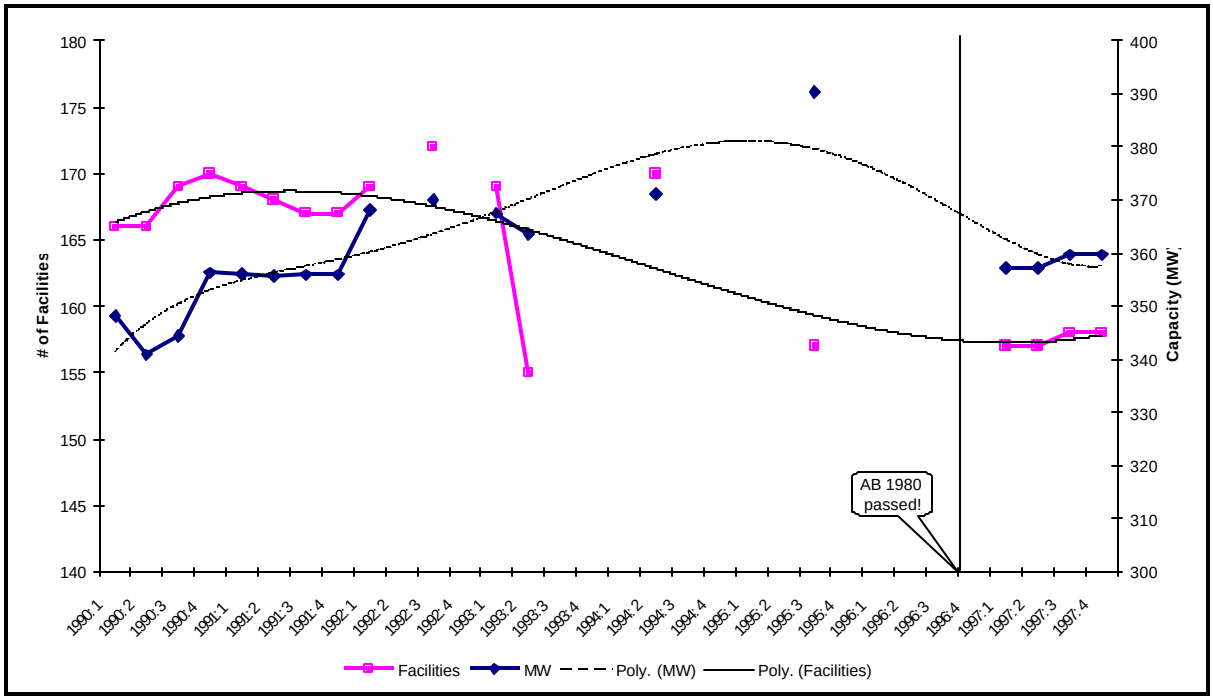
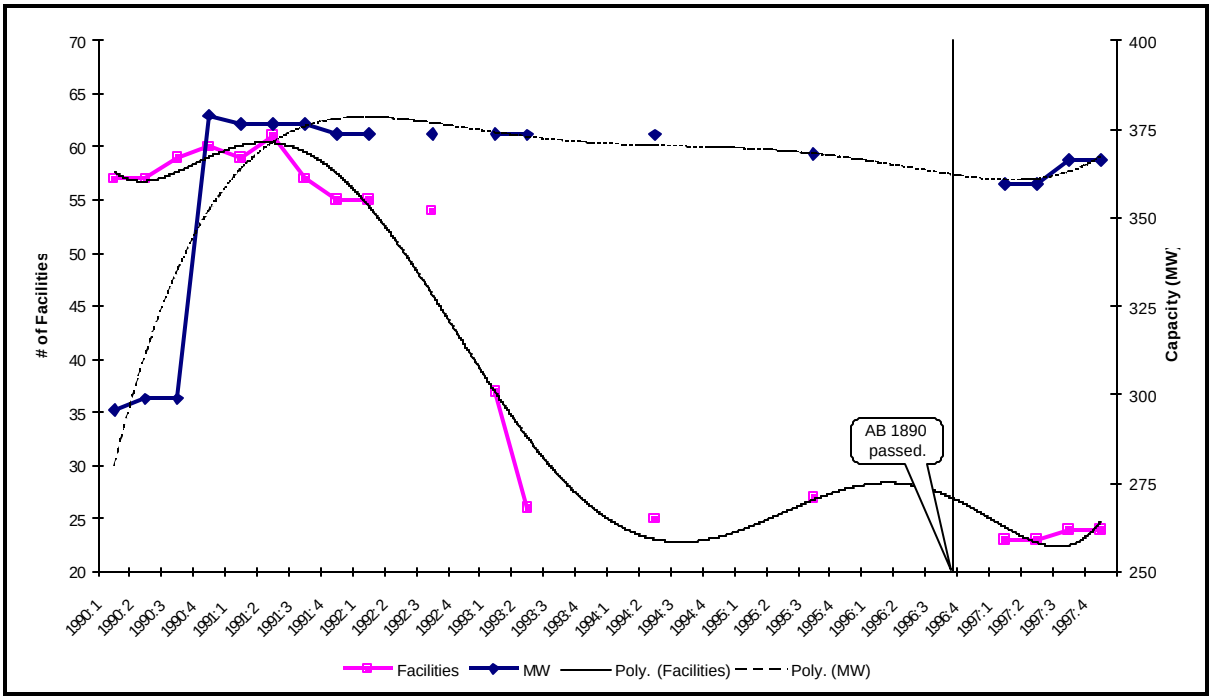


Figure 5-8 shows the trends in the number of facilities and the associated capacity for solar thermal. The number of facilities declines rapidly during the mid-1990s but the decline starts earlier than can be entirely attributed to the price cliff. Another unexpected trend is that, at the same time the number of facilities is dropping off, the capacity is only showing a very slow and steady decline. Numerous small facilities may have shut down during the mid-1990s that did not contribute very much to the overall capacity level. What is not certain is whether the QSR data also reports photovoltaic (PV) facilities. Given that there were only six facilities with 313 MW of capacity enrolled at the start of the REP and 24 facilities with 379 MW of capacity reported in the QSRs, this is very likely. This could account for the drop in facilites without affecting capacity very much.

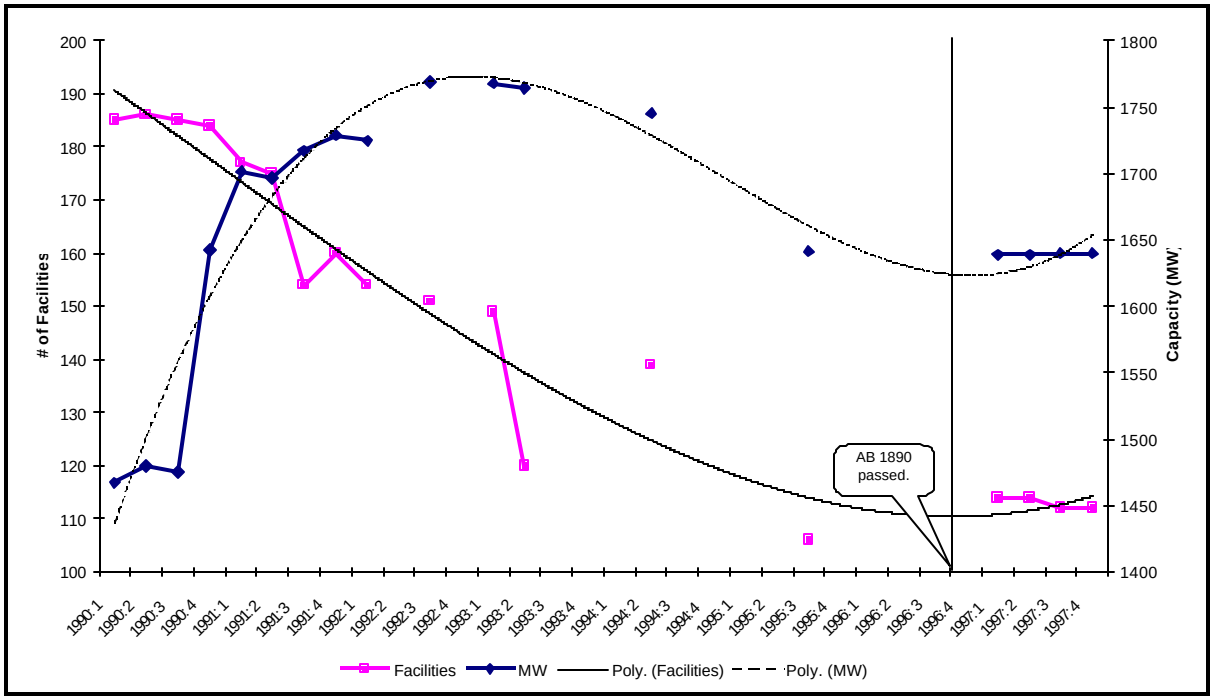
What is also interesting is that just after AB 1890 was passed the decline in both capacity and the number of facilities tapers off. Once again, this suggests that this legislation had an effect on the market before the REP began.

Figure 5-9 Solar Thermal Facilities and Capacity



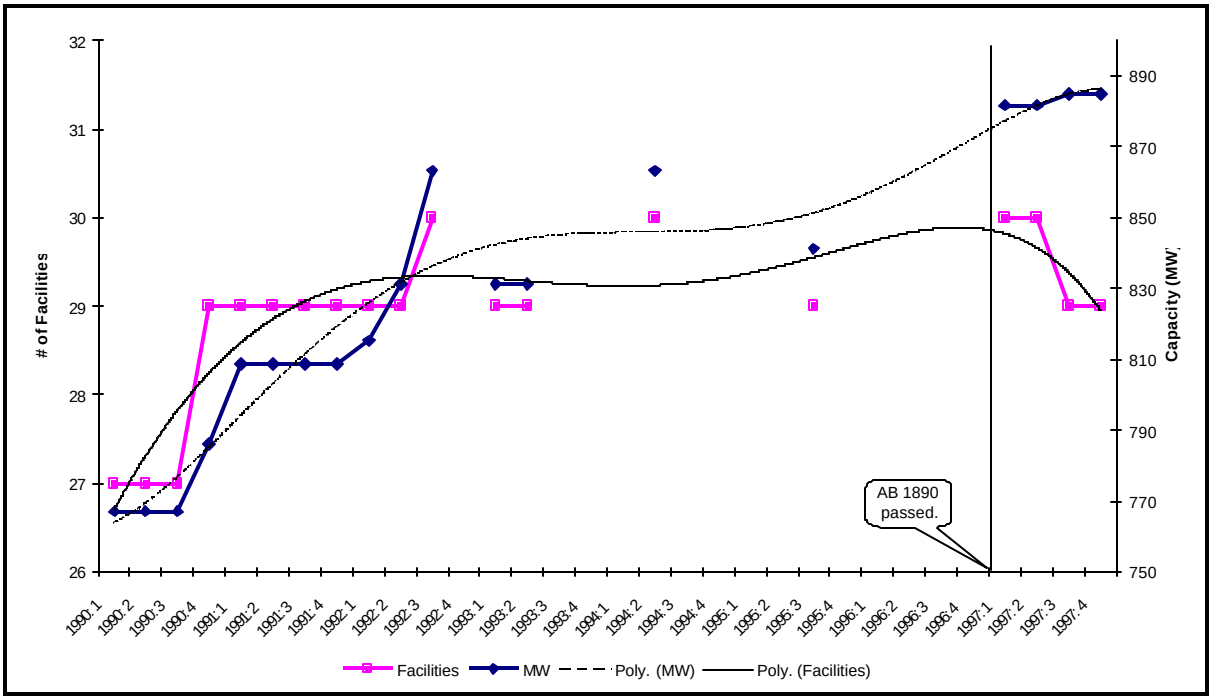
The trends in wind driven generators are illustrated in Figure 5-10. Here the number of facilities begins to decline in 1991 before the price cliff is expected but levels off until the middle of 1993 and then starts to decline again. Wind facilities had a similar trend as that of the small hydro facilities in that the capacity was still increasing in the early 1990s even though the number of facilities was declining. At about the same time as the price cliff is expected, the capacity begins to decline. As was seen in the previous two technologies, shortly after AB 1890 was passed the decline in facilities and capacity levels off. What is not known is the exact cause of the decline in the number of facilities. It is possible that there was some consolidation occurring in the early 1990's which would appear as a drop in the number of facilities but not a drop in capacity.

Figure 5-10: Wind Facilities and Capacity



The geothermal trends are shown in Figure 5-11. For this technology, the number of facilities is fairly constant, with only a net increase of about two facilities between 1990 and 1998. The level of capacity swings substantially as the number of facilities rises and falls. This is due to the relatively large size of these facilities. In looking at geothermal one should remember that utility owned generation is not reflected in the QSR data.

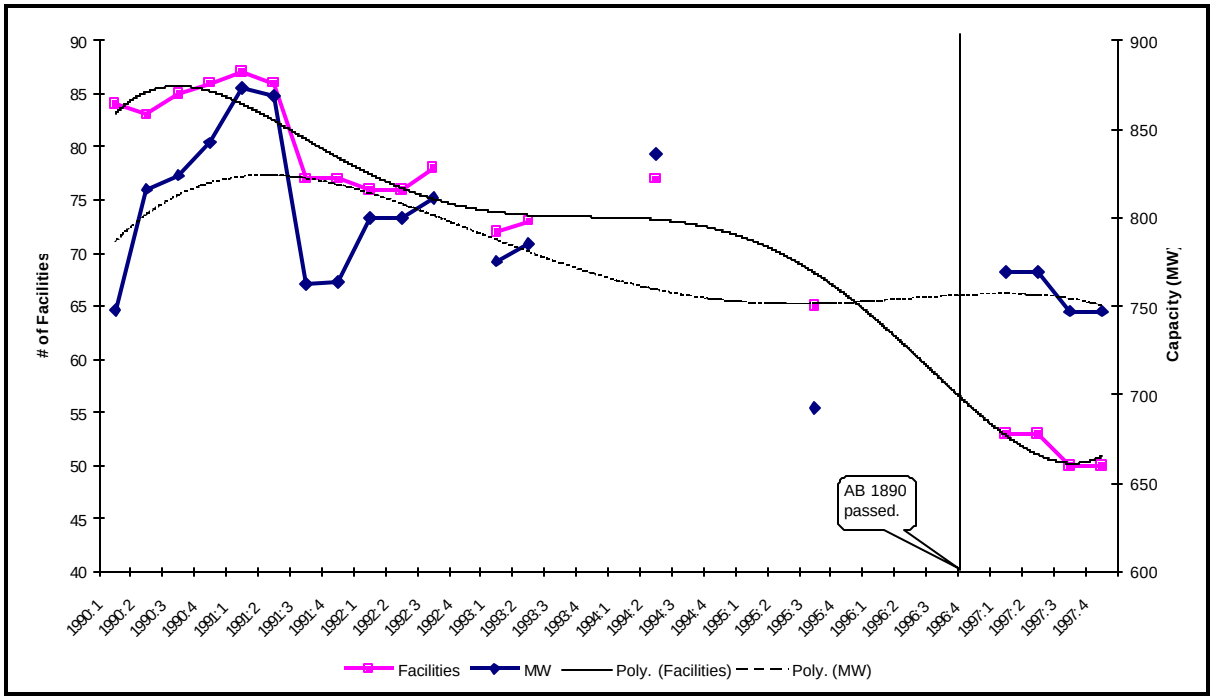
Figure 5-11: Geothermal Facilities and Capacity



The long-term trends in biomass are shown in Figure 5-12. There is a significant drop in the number of biomass facilities and capacity in 1991. The number of facilities falls off again starting in 1994 and appears to be leveling out in 1997. The level of capacity displays some large swings, but by 1997 has started to level off. It would seem that a large number of small facilities came off the cliff and stopped operating.

One interesting finding concerned biomass. The Commission's power plant Siting Division reports that there are 61 facilities, of which 31 were operational in 1998. This implies that 51% are operational. The REP Existing Account has 28 of them already enrolled. The Commission has estimated that approximately 53% of the existing capacity is currently eligible to participate in the program. This estimate is based on historical capacity levels and estimates of when the fixed energy portion of the standard offer contracts would end. These findings strongly suggest that the price cliff has had a significant impact on the number of operational biomass facilities. This is further reinforced by the survey data discussed in Chapter 3 where respondents indicated that the availability of economical fuel is a problem.

Figure 5-12: Biomass Facilities and Capacity



Existing small hydro, wind, biomass, and solar thermal powered renewable energy facilities appear to have been impacted by the passing of AB 1890. It is quite possible that for many facilities coming off the price cliff, the financial support from the REP Existing Account was attractive enough for them to remaining business. These findings are not conclusive, but none the less they are suggested by the data.

As was mentioned earlier, it is difficult to find complete information on landfill gas, digester gas, and MSW. These technologies do not comprise a large amount of the capacity enrolled in the program, though. The predominant trends in existing renewable resources have been captured by the examination of small hydro, solar thermal, wind, geothermal, and biomass.

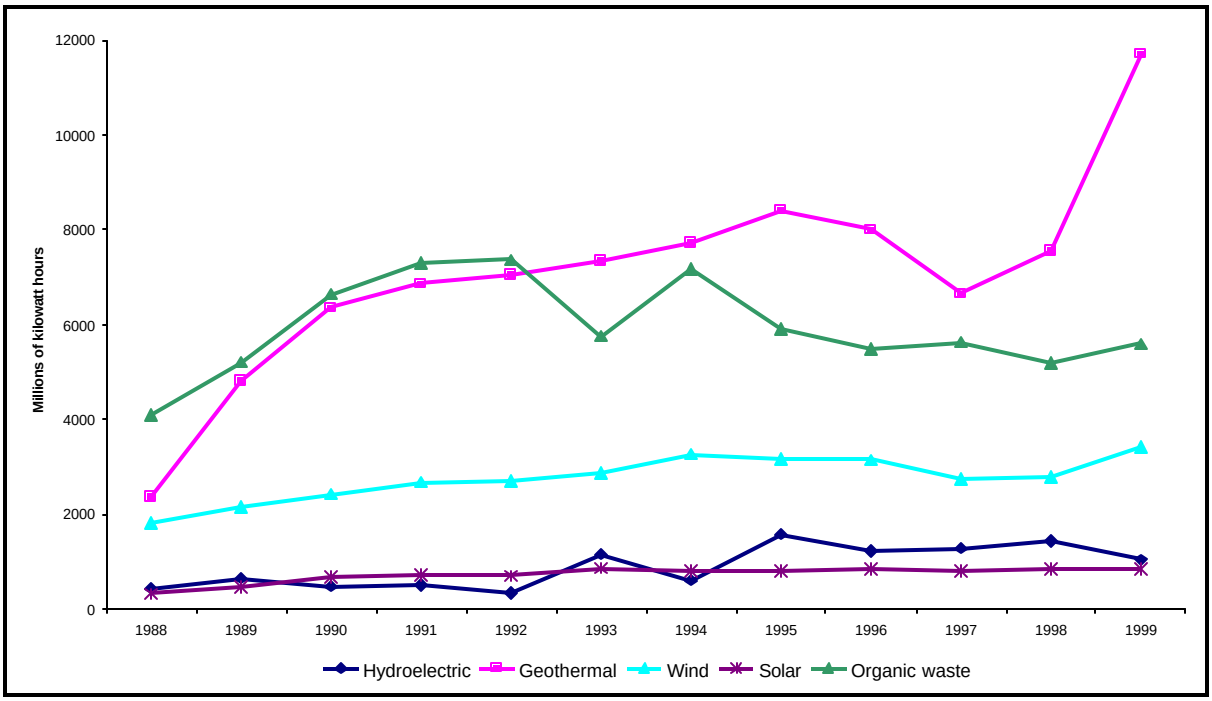
5.3 Energy Production Impacts

The energy produced by renewable resources would give an indication of the effects of conditions other than those that would move facility owners and manager to take their facilities out of operation by terminating production contracts. At present, there are few sources of historical energy production information for renewable facilities in California. The REP data is a good source for those facilities enrolled in the REP but only from 1998 forward. These facilities represent the vast majority of non-utility owned renewable projects in California at present.

The California Energy Commission maintains a database of production from power plants in the State. This database is grouped by utility and non-utility owned generation. The levels

of non-utility generation in the State for the four technologies that have been discussed in this chapter are shown in Figure 5-13. This shows the trends from 1988 through 1999. The levels of generation reported in this database are consistent with the REP program data on generation given the level of participation with the exception of geothermal and organic waste. Geothermal generation in the state suggests that there is a substantial amount of non-QF, non-utility generation that is not participating in the REP.

Figure 5-13: California Non-Utility Electric Energy Generation



The exact composition of the organic waste category reported by the Commission is not known. If it is composed of biogas, landfill gas, digester gas and MSW then the reported levels of generation in the REP only represent around 50% of what is actually being produced in the State by non-utility generators. In light of the enrolled capacity, this suggests that the level of generation of non-participant biomass facilities is greater than that of participant facilities. This may well be the case given that fixed energy payments under SO4 contract are much higher than the market based energy prices after the price cliff. But, because of the lack of information concerning the composition of the "Organic Waste" category, it may be a result of an accounting problem.

Electric generation was beginning to decline for geothermal and wind after 1995 suggesting the price cliff may have been having an effect. For small hydro and solar thermal, generation does not appear to have been impacted by the price cliff. In the case of small hydro this may partially be because by 1999, only 65% of the eligible facilities were estimated to have come

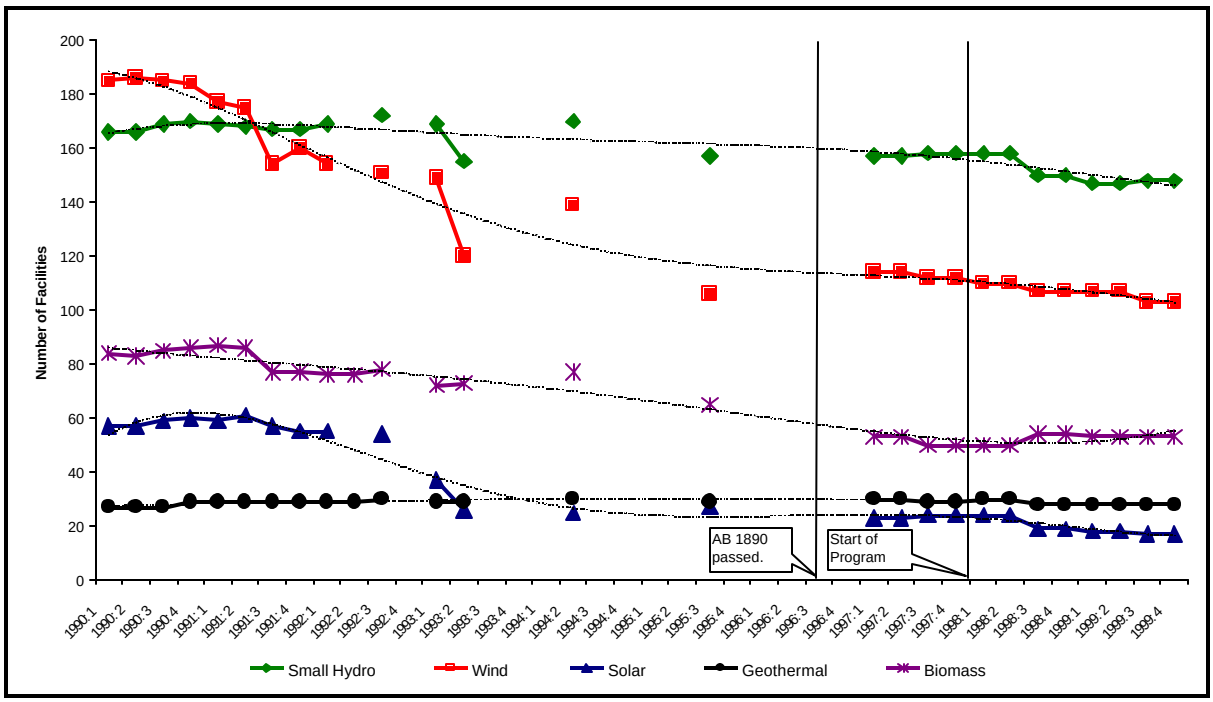
off the cliff. For solar thermal, there was only a small decline in the level of capacity during this period and therefore it is not surprising that the level of generation is relatively constant.

The other technologies not discussed have been difficult to track over time due to inconsistent reporting, their small size, and their small numbers. For instance, biomass has different meanings to different utilities in their QSRs. Other sources use the term "bio waste" and "other" and give no definitions as to what they are comprised. For technologies such as biomass, waste tires, and MSW the most significant impacts on energy production levels are availability of economical fuel stocks. Several biomass facilities have been reported as shut down for just this reason by the California Energy Commission's power plant siting division.

5.4 Impacts on Overall Power Markets

Less obvious from examining the overall levels of capacity and energy production are the trends in the number of operational facilities. This is because the size of renewable facilities varies significantly and so do the economics for these facilities. In Figure 5-14, the effects of the price cliff and possibly other market conditions upon the number of facilities begin to appear for all except geothermal.

Figure 5-14: Number of Renewable Facilities by Technology



Around the first half of 1993, there is evidence of a significant drop-off in the number of operational facilities for four of the five technologies, where relatively clean data exists. This is strongly suggestive that the SO4 energy price cliff did have an effect on the market. What is also suggested by this decline in the number of projects is that it must have been the small renewable facilities that were the immediate casualties of the price cliff, since very little change was observed in capacity and generation. Once the Existing Account Program started, the numbers of facilities leveled off for all four technologies. Since AB 1890 was passed over a year prior to the start of the Program, it was well known that financial support for renewable energy generation facilities was forthcoming. This knowledge of the Existing Account appears to have slowed the decline in the number of renewable resource generators.

The difficulty in making any quantitative determinations is that the market data used to support the evaluation of this REP Account is not in the condition required to perform an accurate analysis. During many QSR reporting periods there are either missing data altogether (or missing data for individual IOU service areas), or there are discrepancies in the historical market data making them unusable. Had the Commission QF database been clean and usable for this preliminary evaluation, a more definitive statement may have been possible concerning the overall effects of the Existing Renewable Resources Account on this market. What can be concluded is that the program does appear to have impacted several of the technologies involved. The decline in the number of facilities (apparently resulting from the price cliff), the level of capacity and the level of electricity produced all appear to have leveled off.

Volume II

6 Program Cost-Effectiveness

6.1 Methodology

While the impact of the REP Existing Account presumably conveys benefits, the viability of this program depends partly on the cost of achieving the impacts in question. As a result, it is useful to define various indicators of cost-effectiveness, or measures of the program cost per unit of impact. This program is designed to increase the competitiveness of existing renewable generators. Consequently, the overall cost-effectiveness could be characterized as the Program cost per unit of net changes in capacity (MW) and/or energy production (kWh).

Unfortunately, the available historical market data necessary to assist in determining the net impacts of the program was not in a suitable form for direct use in this analysis. The detailed project database of historical Qualifying Facility information is in need of further clarification and validation, a task which was not within the scope of this current work authorization.

Had this data been available for analysis purposes, there would have been several specific cost-effectiveness indicators developed. These indicators would take the form of the cost of the program divided by the change in energy production attributable to the program . The cost of the program includes the production incentives paid out and the costs associated with the administration of the program by the Commission Staff. These indicators could then have been developed for each technology-based tier, as well as the program overall. Production changes are difficult to determine because there are no reliable sources of information on renewable energy production before the start of the REP.

Additional cost-effectiveness indicators could have been developed based on the net changes in capacity resulting from the program. These would take the form of the cost of the program divided by the net change in capacity attributable to the program. Capacity changes would most likely appear as renewable generation that had ceased to operate after the price cliff and was resurrected as a result of the REP. Capacity impacts are also difficult to determine due to data issues as well.

The first step in determining the cost-effectiveness is to develop gross program expenditures per kWh generated. This gross Existing Account cost-effectiveness (*GrossEACosteff*) for program year *y* is calculated as the sum of the total incentives paid to each tier *i* and the existing account program administration costs divided by the total production of renewable energy across all tiers. Specifically,

$$GrossEACostEff_y = \frac{\sum_i Incentives_{i,y} + \text{Administra tion}\, Cost_y}{\sum_i RnewablekWh_{i,y}}$$

where:

GrossEACostEff	=	measure of gross cost effectiveness
$Incentives_i$	=	annual incentives paid to tier *i*
AdministrationCost	=	Existing Account annual administration costs
$RnewablekWh_i$	=	annual qualified renewable energy production (kWh) by tier *i*

As defined, *GrossEACostEff* is a measure of gross program cost-effectiveness insofar as it does not attempt to account for the renewable energy that would have been produced in the absence of the Existing Account. This free-rider element needs to be netted out of the annual renewable energy produced by each tier. In particular, net cost-effectiveness measure can be specified as:

$$NetEACostEff_y = \frac{\sum_i Incentives_{i,y.} + \text{Administrat ion}\, Cost_y}{\sum_i RnewablekWh_{i,y}\left(1 - Freerider_{i,y}\right)}$$

where:

NetEACostEff	=	measure of net cost effectiveness
Freerideri	=	percent of free-riders in tier *i*

6.2 Estimation of Cost Effectiveness

Although this preliminary evaluation is not able to quantify the net energy impacts of the Renewable Energy Program's Existing Account, the gross energy production and the actual costs associated with the program reported to date can be examined. At a minimum, the gross cost-effectiveness of the program can be calculated. This is expressed in terms of dollars per kWh and gives an indication of the relative incremental competitive benefit the incentives provide to program participants.

Table 6-1 provides the program's gross production cost effectiveness for each technology within Tiers 1, 2, and 3. The costs per kWh are calculated by dividing the incentive dollars paid out on an annual basis by the total kWh generated. The administrative expenses were distributed in proportion to the number of projects within each technology. The rationale for this is that the administrative costs are more a function of the number of participants and not the energy they produce.

Table 6-1: Existing Account Gross Cost Effectiveness ($/kWh)

Tier	Technology	1998		1999		2000 (to date)	
		Cost w/o Admin	Cost w/ Admin	Cost w/o Admin	Cost w/ Admin	Cost w/o Admin	Cost w/ Admin
1	Biomass	$0.0150	$0.0150	$0.0137	$0.0137	$0.0062	$0.0062
	Solar Thermal	$0.0150	$0.0150	$0.0128	$0.0128	$0.0044	$0.0044
	Waste Tire	$0.0150	$0.0150	$0.0146	$0.0146	$0.0079	$0.0079
	TIER 1 Total	$0.0150	$0.0150	$0.0135	$0.0135	$0.0058	$0.0058
2	Wind	$0.0068	$0.0069	$0.0066	$0.0067	$0.0013	$0.0014
	TIER 2 Total	$0.0068	$0.0069	$0.0066	$0.0067	$0.0013	$0.0014
3	Digester Gas*	$0.0011	$0.0054	$0.0008	$0.0017	$0.0000	$0.0001
	Geothermal	$0.0017	$0.0017	$0.0013	$0.0013	$0.0000	$0.0000
	Landfill Gas	$0.0016	$0.0017	$0.0014	$0.0014	$0.0000	$0.0000
	Small Hydro	$0.0044	$0.0046	$0.0024	$0.0026	$0.0000	$0.0000
	Municipal Solid Waste	$0.0034	$0.0035	$0.0020	$0.0020	$0.0000	$0.0000
	TIER 3 Total	$0.0021	$0.0021	$0.0014	$0.0015	$0.0000	$0.0000
Program Total		**$0.0069**	**$0.0069**	**$0.0050**	**$0.0050**	**$0.0014**	**$0.0014**

*The impact of administrative costs is relatively large compared to other technologies due to the large number of small capacity facilities and their limited production.

Overall, the gross cost-effectiveness of the program improved from 6.9 mills to 5 mills per kWh between 1998 and 1999. This is due to the increase in geothermal production between 1998 and 1999 and the decline in the incentive target price for Tier 1. Within Tier 3, there is a significant variation in cost-effectiveness due to the differing SRACs across utilities. By May 2000, program cost-effectiveness had improved to 1.4 mills primarily because no payments were made to Tier 3 generators at all during the first five months of 2000. In

addition, the market price has been higher than at any other time during the program and the target price and price cap for Tier 1 were further reduced during the 2000 program year.

To begin to get an understanding of the net cost-effectiveness of the program, the self-reported “free-ridership” of the program is introduced here. Table 6-1 illustrates the zero free-rider case. The survey results in Section 3 of this report indicated that roughly 28% of the survey respondents believed that the program had very little effect on them. The greatest free-ridership is present in Tier 3. These results must be viewed with caution though. They are derived from a small sample and do not possess a great deal of precision. In addition, these are self-reported free-rider levels and actual levels may be significantly greater. Not many respondents are likely to say that the incentives have not made any real difference. It is not unreasonable, however, to expect the free-ridership to be greater in Tier 3 than in Tier 2 and greater in Tier 2 than in Tier 1.

To illustrate the impact of free-ridership and the changes in cost-effectiveness over time, the following example is given. Let us assume that the levels of free-ridership are 30% in Tier 1, 50% in Tier 2 and 70% in Tier 3. What this means is that the same amount of incentives have been paid out the same administrative expenses would have been incurred, and approximately 58% of the energy generated under the program would have been generated even in the program's absence. In other words, 42% of the energy generated is attributable to the program.

Although Tier 3 had the largest amount of generation and in this illustration the largest level of free-ridership, it received the lowest level of incentives. Despite higher free-ridership, the cost per kWh of program induced generation remains lower than for Tier 2 or Tier 1. The same is true for Tier 2 relative to Tier 1. If these levels of free-ridership (58% overall) are applied to the 1998 levels of generation the cost-effectiveness overall is calculated to be 15 mills per kWh of program induced renewable generation compared to 6.9 mills per kWh for the zero free-rider case. So that there is no misunderstanding, the levels of free-ridership used in the illustration above are purely hypothetical. They only serve to illustrate the effects of free-ridership on net cost-effectiveness across tiers and overall.

Volume II

7 Conclusions and Recommendations

This section provides the conclusions drawn from the results of the program data and proximate indicator assessment, telephone interviews with program and other market participants, the qualitative assessment, and the program impacts. In addition, we offer program recommendations so that the Existing Renewable Resources Account may increase the prospects of cost-effectively attaining the following goals:

- Helping maintain in-state existing renewable technologies during the first four years of the electric industry restructuring, and
- Assisting existing renewable facility owners in making adjustments to their operations and thereby helping them remain economically viable after the incentives have departed.

7.1 Program Effectiveness

The policy goal set by AB 1890 was to keep renewables online throughout the transition period and enable them to remain competitive after the transition period. The existing renewable generators have been financially assisted by the Existing Account Program with approximately $133 million through May 2000. Based on the survey of renewable facility owners and managers, nearly half of the respondents indicated that they would have reduced their output or shut down completely without the program. Taken at face value, this is a good indication that the program has been effective in achieving its primary goal of keeping existing renewable generators on-line. This is further reinforced by the examination of program impacts earlier in this report. There is some evidence that the program halted an initial decline in the number of active renewable facilities starting with the passing of AB 1890.

What remains to be seen is whether these renewable resources will remain on-line after the transition to a fully competitive market. The largest reported problem with operating renewable generation facilities in California concerns revenue. Survey respondents stated that either the revenue stream was insufficient or there was too much volatility in the market. This translates to the conclusion that for generators in Tiers 1 and 2 the market price these facilities have been receiving for their energy production has not been adequate to remain in business. The survey did indicate that the majority of generators thought that the program has improved their chances of remaining competitive after the program ends. Several survey respondents indicated that the incentives have enabled them to perform equipment upgrades and improve maintenance. Others indicated that the incentives provided some protection

during periods of low market prices. By keeping them operating through the transition and providing revenues which in part have been reportedly used to make facility operations more efficient, the lives of many renewable resource projects have been extended and they are more likely to continue operations in the future.

Participants have expressed high regards for the program, with very few suggestions for improvement or change. The overwhelming majority experienced no problems applying to the program or receiving payment. Many survey respondents complemented the Program's streamlined application process.

7.2 Program Incentive Structure

The incentive structure of the Existing Account was designed to give those technologies with higher operating costs greater support and those with lower operating cost less support. Other technologies have higher costs, but are less likely to become competitive, and therefore do not receive higher incentives. Overall, the design is intended to achieve a balance between supporting certain industries while still encouraging all renewable resource technologies to make the transition to a competitive market. The program has been successful in distributing funds as designed. Tier 1 technologies have been receiving the greatest level of funding and Tier 3 the least. The incentives by design are responsive to participant market prices and they have been tapering off within the last year.

About one-quarter of the owners and managers of renewable facilities surveyed believe the target prices used in calculating incentives are too low. Even though these are the opinions of participants, it is very suggestive that the levels of incentives are not too low. A small percentage of those surveyed indicated that the incentives were too high. These respondents were all Tier 3 participants. This finding also gives some credence to the predominant survey result. When asked about the program price caps, most felt that they have had no effect on the incentives. When participants were asked to recommend changes to the program, only one respondent made a suggestion concerning the structure of the incentive mechanism.

Based on the relative levels of satisfaction of the survey respondents, one might think that Tier 1 prices should have been a little higher and the Tier 3 prices should have been a little lower. If incentive prices were too low and market prices were too low, then one would expect to see attrition in the number of program participants. The only technology/fuel that has showed any decline since the start of the program is the direct combustion of waste tires. This technology appears to have a solid waste regulatory-related fuel delivery infrastructure problem that REP incentives alone are not likely to solve. Given that these two facilities were (at least temporarily) shut down at the time of this evaluation, no action may be necessary. Several Tier 3 facilities have not reported any production in several months. It

has not been confirmed if they have shut down or if they are just not reporting, since they have not been receiving any incentives due to high market prices.

There is some evidence that the Tier 3 incentives could have been lower, at least for some of the technologies. Those survey respondents that said that they thought the incentives were too high all came from Tier 3 Participants. About half of the Tier 3 respondents also indicated that they didn't believe that the incentives had any effect on their operations, but by the same token about half said that they did have an effect. This may be in part due to the variation in incentive prices across IOU service territories. Since SRACs are IOU-specific, the incentive paid in one area can be significantly different from another for the same month. The assumptions used to place technologies into Tier 3 were of two different sorts (triage approach) making it difficult to draw general conclusions that apply to them all.

The overall conclusion is that the incentive structure is acceptable to the participants, but it does not appear to optimally provide incentives based on need. It seems that the incentives for Tier 3 are too great and those for wind projects under Tier 2 have been about right. The incentives for Tier 1 appear to have been effective in the first and second year, but may not be high enough anymore given that a few facilities have shut down in the beginning of year 2000.

We next address the question of whether the allocation of funds across the three tiers is most effective from a public purpose perspective.

7.3 Program Funds Allocation

AB 1890 specified how the funds for this program were to be allocated. To date, the Commission Staff has been successful in meeting the directives for the funds allocation. From the overall perspective of the participants, about one-half are in agreement with the allocation and the other half are not. Only one-third of the Tier 2 participants surveyed agreed with the funding allocation. Despite this, Tier 2 respondents unanimously agreed that the target price was set at about the right level. This would suggest that they are satisfied with the support they are receiving, but that they believe they are not getting their fair share of the account funds.

The allocation of funds for the Tier 3 technologies is a bit more questionable. The majority of survey respondents indicated that the program had little effect on their operation and the majority of respondents said that they were happy with the allocation of funds. In addition, the only respondents to say that the target price was too high represented Tier 3 facilities. Consideration should clearly be given to reallocating the rollover funds from Tier 3 and applying them to another area of the Program. A reallocation of funds across all the tiers

would facilitate the distribution of the incentives to those technologies and energy sources that are in greatest need of support.

7.4 Program Duration

The program was initially designed to give assistance for a certain period of time – the four-year transition to full competition, or *Transition Period*. The support received during this time would allow facility owners to: 1) make improvements to their operations, and 2) learn how to operate under more volatile market pricing thereby improving their chances of being competitive following the Transition Period. The timing of when many of these facilities come off their fixed-price (price cliff) contracts is staggered over several years. As a result, not all of the renewable projects started receiving energy production incentives at the same time. In fact, some renewable energy facilities will not come off the price cliff for a number of years (i.e., until after the current program term).

The perception by the majority of the participants surveyed for this evaluation is that the program needs to be extended. Respondents were naturally positive regarding an extension of the duration of the program when asked. Going beyond the obvious strategic bias of these responses, many cited ways in which their projects could be made more efficient and/or competitive if the program were extended. The unanswered question here is why have these changes not been made (or planned for) during the four years of the current incentive program. Others noted changes in transmission and distribution costs imposed on renewable generators and would like to keep the program in effect to help with these additional transition elements. Some other participants noted that the transition from SRAC to PX pricing is still underway, and felt that the program should be in place until the effects of this change actually take place. The ISO4 contracts vary significantly in duration. Although the fixed energy portion of these contracts was ten years, the total term of these agreements varies from 15 to 30 years. The balance of the term (beyond the fixed energy price period) provides for variable energy pricing at SRAC levels and with other fixed and variable capacity payments. Some facilities already face open market prices, or they will very soon. Others will not see their ISO4 contracts end for approximately 15 more years. If market prices should decline over time, it may be difficult for many existing renewable generators to remain competitive, but there is no way to reliably predict that prices will fall to such levels -- making it uneconomic for them. The uncertainty and volatility of market prices is best demonstrated by the unusual and significant rise of the PX prices during the summer months of this year (Program Year 2000).

It may benefit the success of the program to extend the duration for one or more tiers, if possible, without allocating more funds. Given that SRAC prices have been higher than forecasted and are likely to be higher than originally forecasted during the summer of 2001, more rollover funds will likely be available at the conclusion of the program term than

expected. Extending the program would give the Commission more time for program effects to reveal themselves and allow the necessary time to respond to these effects if necessary. No additional funding would be necessary, as the available funds can be reallocated to extend the overall program length. The combination of falling target prices and rising SRAC prices have created a surplus of available rollover funds that was not originally forecasted. Making these funds available by extending the program would provide for a longer period of assistance and allow some of the as yet unseen uncertainties of the market to make themselves more apparent. On the other hand, there may not be enough of a compelling reason to do this. If more generators exercise the option to switch to PX-based prices over the coming year, and if PX prices climb again during mid-2001, the increased revenue that they may receive would exceed what the Program incentives would provide during all of the non-summer months combined.

7.5 Overall Conclusions

The overall conclusion resulting from this evaluation is that the Existing Renewable Resources Account is having a positive effect on the renewable energy market in California. The program is successful to date in assisting existing California renewable electricity generators to remain in operation. There is evidence that owners and managers are taking actions to better insure their survivability following the full transition to a competitive power market. There is also evidence that the creation of the Program with the approval of AB 1890 halted the declining trend in operational renewable capacity in the State.

On a tier specific basis, the program appears to have been too generous to Tier 3 participants. In fact, the need for incentives for Tier 3 may not be warranted any longer. Tier 1 on the other hand has shown some evidence that the level of incentives is not sufficient and either the target price or the price cap has been lowered too far. If incentives are increased for Tier 1, it will be necessary to increase the level of funding or the incentives paid will be restricted by the level of generation.

7.6 Recommendations

Based upon the analysis and conclusions, the primary recommendations for the Existing Account include:

- Reallocate the funds across <u>all the tiers</u> starting with program year 2001. Some of the rollover funds originally intended for Tier 3 should be made available to Tier 1. Tier 3 is the least in need of incentives and its rollover funds should be wholly redistributed elsewhere;

- Change the basis for incentives to PX pricing for all program participants rather than continuing to base incentives on SRACs. This change should be made for program year 2001 to effectively allow participants to begin to experience the effects of PX prices before the current program ends.
- Extend the duration of the program for at least Tier 1 and Tier 2 participants. Tier 3 participants may also need to receive some minimal continued assistance, depending upon market conditions;

The first recommendation will simply reallocate funds to where they are most beneficial, namely Tier 1. Tier 3 generators are already in a better position to survive in a competitive electricity market. If the recommendation to extend the program for a year within Tier 1 is accepted, the rollover balance from all tiers at the end of program year 2001 should be combined and used to fund the incentives. This would require that a forecast of rollover funds be developed, based on a new SRAC forecast, a new PX price forecast, and an estimate of the number of participants electing to receive PX based pricing in the future. If this analysis reveals that very few rollover funds will be left at the end of the four years, then the extension of Tier 1 for another year will not be effective and therefore unnecessary. As a note, the California Public Utilities Commission is currently examining [R99-11-022] whether to have all QFs switch to PX-based pricing. This determination is expected sometime before the end of 2000.

The second recommendation may provide an incentive for more renewable generators to switch to PX based pricing if they can. If a generator was receiving energy payments based on SRACs and the incentive was based on PX prices, it is theoretically possible for no incentive to be paid out even though the SRAC was less than the target price. This may give generators enough of an incentive to switch so as not to miss incentives based on PX prices. If a generator switches to PX based energy prices then its incentives will be based upon PX prices as well. If nothing else, basing incentives on PX prices will begin to expose the generators to a greater amount of real market conditions.

The third recommendation will serve to continue the assistance that the Existing Account has provided to Tier 1 and Tier 2 during the period covered by this evaluation. The renewable generators are not only staying on-line, but they are reporting that they are using some of the funds to improve their operations. Extending the program will improve the chances of a greater number of Tier 1 and Tier 2 renewable energy facilities (i.e., biomass, solar thermal, waste tire and Wind) being competitive without production incentives in the future.

Renewable Energy Program
Preliminary Evaluation

Volume III
New Renewable Resources Account

Prepared for:

The Governor and the California State Legislature

Prepared by:

Regional Economic Research, Inc.
11236 El Camino Real, Suite A
San Diego, California 92130

TURNING DATA INTO INFORMATION

October 30, 2000

Volume III – New Renewable Resources Account

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Volume III

1 Introduction

The New Renewable Resources Account (New Account) program assessment is designed to address the net impacts of production incentives for incremental supply-side generating facilities on sustaining the renewable resource market. The sustaining of this market is expected to occur by providing a short-term revenue stream to facilitate the development and financing of renewable energy plants. This short-term revenue stream will enable plants to be built by helping overcome short-run development costs and initial operational costs. The program goal is to have the projects produce power at a competitive cost after the incentive payments cease.

The assessment was performed in three parts. The first part involved an analysis of proximate program indicators, followed by a comparison with recent historical markets, and finalized through a survey of renewable developers.

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2 Background and Objectives

Senate Bill 90 (SB 90), enacted on October 12, 1997, established the Renewable Resource Trust Fund and contained directions for distributing this fund through four distinct accounts of which the New Account fund is one. SB 90 initially allocated $162 million to the New Account Program; thirty percent of the total funds established in the Renewable Resource Trust Fund. The California Energy Commission (CEC or Commission) solicited for New Account Program participation via a competitive first-price auction process with bids due on June 5, 1998. This auction process was subject to a maximum production incentive of $0.015 per kilowatt-hour with not more that 25 percent of the total funds being awarded to a single project. The auction process could fully or partially encompass the entire allocation of New Account Program funds. Winning bids were determined based on bid price, with funds being awarded first to the lowest cent per kWh bids.

Funding is available for a five-year period. However, projects that come on-line after December 31, 2001 will not receive a full five years of funding. Before receiving any incentive payments from the Renewable Energy Program (REP) Trust Account, winning projects must come on-line and be certified as an eligible renewable generator. A monthly invoice report and third party documentation must be submitted to the CEC in order to initiate payment for the documented eligible energy production.

Projects cannot receive payments for any electricity produced under this funding agreement if: 1) the power is sold under an existing long-term contract with an existing in-state electrical corporation if the contract includes fixed energy or capacity payments; 2) power is used onsite or is sold to customers in a manner that excludes the Competitive Transition Charge (CTC) payments (or is otherwise excluded from CTC payments); or, 3) the power is produced by a customer-owned electricity generating system. Eligibility to compete for New Account Program funds was not contingent on either the location or the nature of the power purchaser. In addition, repowering projects were eligible for New Account Program incentive funding if project cost was at least 80 percent of the re-powered facility's value.

Volume III

3 Proximate Indicators

Initial success of the New Account Program can be measured by the extent to which the program provisions are being implemented. The final measure of program success is dependent on the long-run impacts of these provisions. However, program provisions must be implemented satisfactorily in order to achieve long-run program success. Measurement of how well these program provisions are being implemented is achieved by measuring certain implementation indicators, referred to as proximate indicators.

For the New Account Program, the proximate indicators are grouped into three categories. These categories measure implementation from the viewpoint of total and technology level planned and actual expenditures, the achievement of milestones and any associated lag time experienced in achieving these milestones, and the number of completed projects and their actual output. The information needed to develop these proximate indicators came from the CEC program tracking database that was last updated for this report in July of 2000.

3.1 General Program Information

Fifty-five (55) projects received approval for funding under the New Account Program. Each project has a different expected on-line date, but the expected production incentives to be paid during the first complete operational year of each project exceeds $31 million. Six different renewable-fueled technologies received approval under the program:

- Biomass,
- Digester Gas,
- Geothermal,
- Landfill Gas,
- Small Hydro, and
- Wind.

Table 3-1 and Figure 3-1 summarize the projects that were awarded New Account Program funding. Landfill gas and wind projects dominate the number of projects initially approved for funding, representing about 40 percent each of the total projects. Wind projects also represent the largest technology category when considered from the viewpoint of plant capacity (57 percent of the funded capacity). However, the capacity from landfill gas projects represents only about 13 percent of the capacity. Though a distant third in terms of number of projects, geothermal projects represent the second largest share of funded capacity, with about 28 percent of the total.

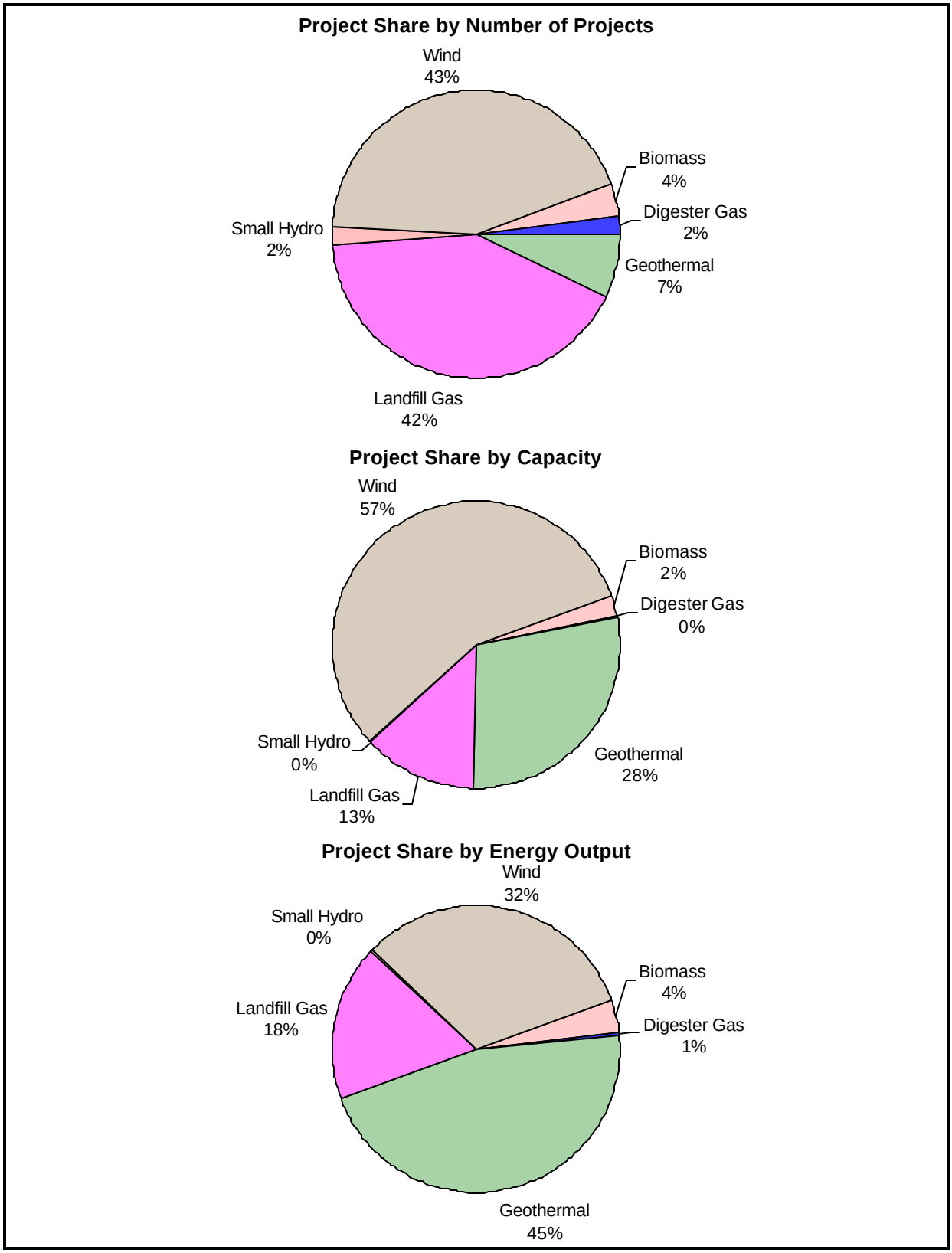
Viewing program participation from the perspective of energy output changes the relative importance of each technology. Geothermal projects, with their much higher capacity factors, are projected to provide the largest share of energy output with 45 percent of the projected total. However, wind projects are still a leading technology with about 32 percent of the expected program energy output.

Production incentives vary considerably both within technology groups and across technology types. Table 3-1 shows that on average wind projects, followed closely by landfill gas projects, have the lowest average incentive rates of $0.01/kWh and $0.0112/kWh, respectively. The single digester gas cogeneration wastewater treatment facility has the largest technology type incentive listed in Table 3-1 at $0.0139/kWh. However, individual projects within both the wind and landfill gas technology types had higher incentive levels than the $0.0139/kWh for the digester gas project. The bid range for wind projects was from $0.007/kWh to $0.0149/kWh and the bid range for landfill gas projects was from $0.0089/kWh to $0.0149/kWh.

Table 3-1: All Bid Projects, Generating Characteristics and Incentives by Technology

Technology	Projects	Capacity (kW)	Output (Year 1 kWh)	Incentive (Year 1)	Average Incentive (Year 1 $/kWh)
Biomass	2	11,600	94,959,000	$1,218,908	$0.0128
Digester Gas	1	2,050	16,521,000	$229,642	$0.0139
Geothermal	4	156,900	1,228,760,000	$15,795,124	$0.0129
Landfill Gas	23	70,125	473,652,400	$5,313,982	$0.0112
Small Hydro	1	1,000	7,342,000	$99,117	$0.0135
Wind	24	310,550	862,603,103	$8,598,694	$0.0100
Total	55	552,225	2,683,837,503	$31,255,466	$0.0116

Figure 3-1: Share of Awarded Projects by Number, Capacity, & Energy Output



3.2 Milestone Achievement and Lag Time

Each project must meet six project milestones within a maximum four-year period in order to be assured of receiving their entire award. The first milestone includes the formal adoption of the Project Award Package (PAP) by the CEC. All 55 projects met this first milestone. The sixth and final milestone is to have the project completed and on-line. Table 3-2 provides a brief description of each of these milestones.

Table 3-2: General Description and Expected Timing of the Six Project Milestones

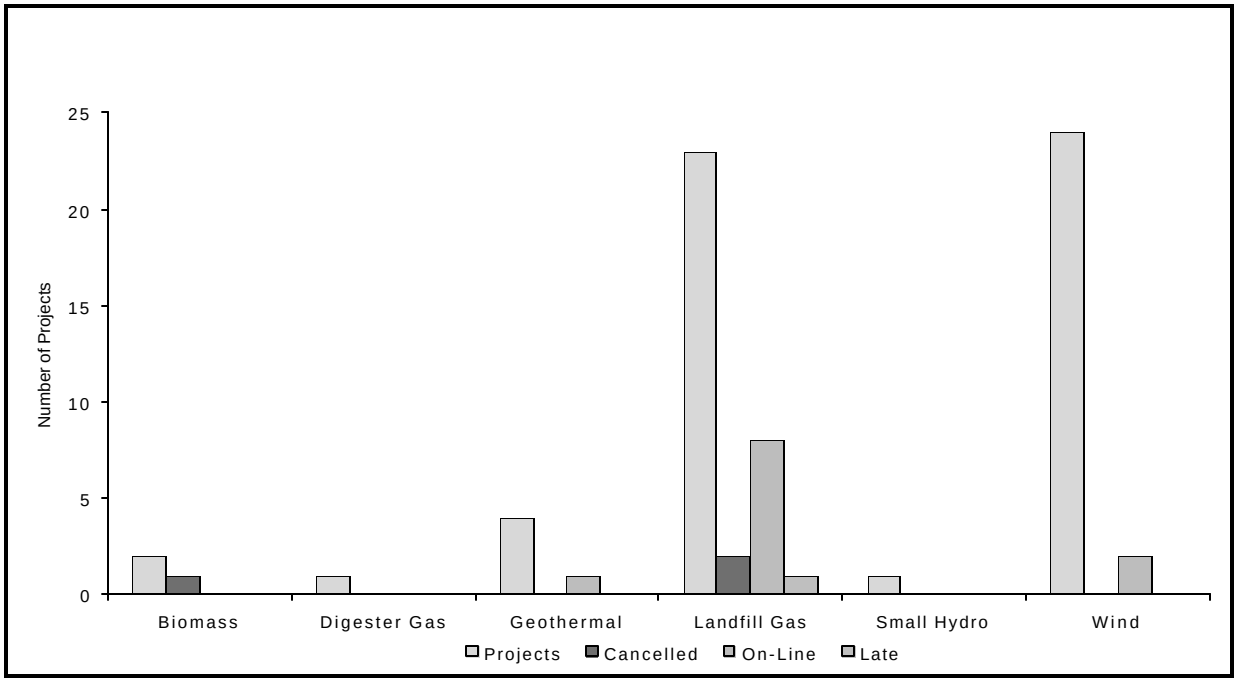
Milestone	Description	Timing
Milestone 1: Project Award Package (PAP)Adopted	Winning projects must have their Project Award Packages approved by the Commission	Within 12 months of the date of the auction
Milestone 2: Applications Filed	Filing of all relevant project construction applications.	Within 6 months after PAP adoption
Milestone 3: Approvals Obtained	Approval of all relevant project construction applications	Within 15 months after PAP adoption
Milestone 4: Construction Started	Beginning of project construction. Foundation or piling work begins, or major equipment delivered to the site.	Within 18 months after PAP adoption
Milestone 5: Construction Progress Check	A progress checkpoint, as defined in the PAP, of the on-going construction.	Within 24 months after PAP adoption
Milestone 6: Project Completed and On-Line	The on-line date is the start of normal operation of the project, after any shakedown period, if necessary.	Within 36 months after PAP adoption

A missed milestone may result in performance bond forfeiture, penalties, incentive payment forfeiture, or secondary milestones being imposed on the project. Although not exercised to date, the CEC reserves the right to terminate a project award and status as winner of the auction if a milestone is missed. However, the CEC intended for these milestones to be flexible and except for Milestone 6, without strict deadlines or defined penalties. Even Milestone 6 has some flexibility, although the amount of time an incentive is received is reduced if the plant is not operational by January 1, 2002. The following discussion on milestone achievements and whether they are early or late should be taken in the context that estimated milestone achievement dates are planning estimates that can reasonably be expected to change as conditions change over time. Further, there is greater incentive to meet certain milestones, such as milestones 1 and 2 that are required to be met before the full bid bond is returned to the bidder.

As of July 2000, project developers have cancelled three of the original 55 projects. One was a biomass project that was cancelled due to difficulty in obtaining long-term fuel supply agreements. The second and third were landfill gas projects, one terminated because of

project development permit difficulties and the other because the project was determined to be too small to be economical. Figure 3-2 provides an overview of program status by technology type. In this figure late projects refer to projects that have missed Milestone 6 (Completed & On-Line). A more detailed analysis of milestone achievement appears below.

Figure 3-2: Project Status by Technology Type



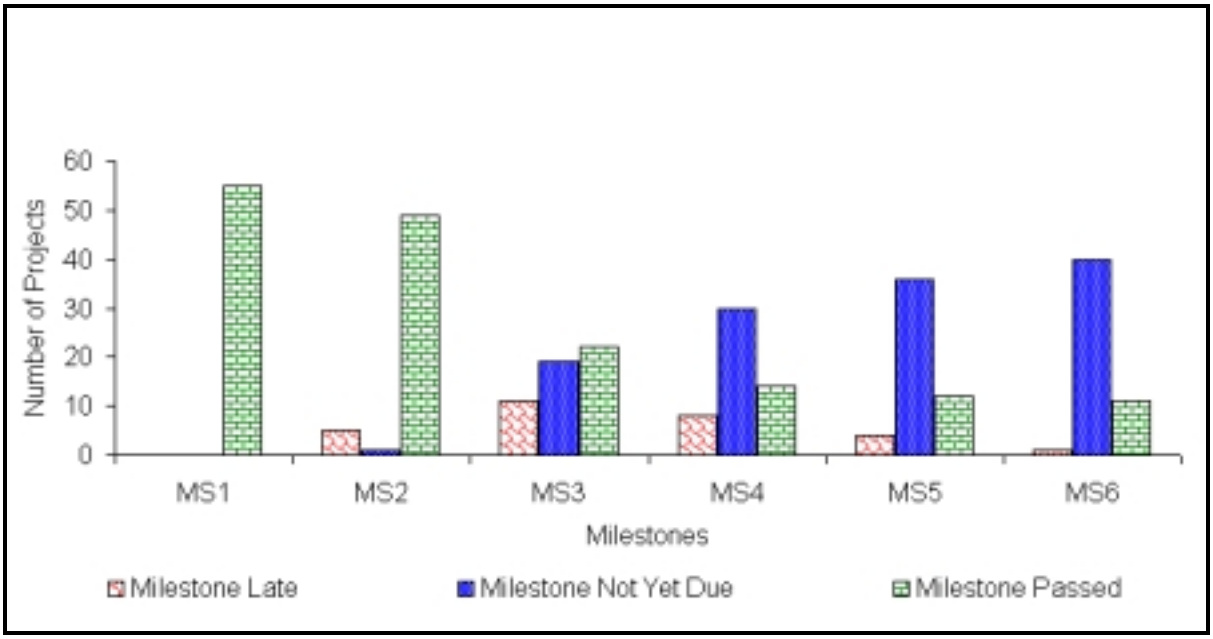
Eleven of the 55 projects are currently on-line. As seen in Table 3-3, the "on-line" milestone (Milestone 6) is not yet due for most projects. Table 3-3 indicates that most milestones are being met in a timely manner. However, Milestone 3 "Approvals Obtained" has a higher incidence of being late. There also appears to be some difficulty in meeting Milestone 4 "Construction Started" in a timely manner. Eight of the 22 projects with due Milestone 4 dates are currently reported as late.

Figure 3-3 depicts the data from Table 3-3.

Table 3-3: Milestone Achievement Through July 2000

Program Milestone	Number of Active Projects	Projects with Milestone not Yet Due	Projects with Milestone Passed	Milestone Late and Not Passed
MS1	55	0	55	0
MS2	55	1	49	5
MS3	52	19	22	11
MS4	52	30	14	8
MS5	52	36	12	4
MS6	52	40	11	1

Figure 3-3: Project Milestone Achievement



An indicator of overall program progress is whether milestone dates are passed early, within a close time frame of the due date, or passed at a date significantly later than the original due date. Table 3-3 and Figure 3-3 provided information on milestone achievement for one point in time, July 2000. Table 3-4 and Figure 3-4 provide information on this issue over the entire time frame of the program. For each of the program milestones (as revised by July of 2000), an assessment is made as to whether the milestone was passed early, within 60 days, from 61 to 180 days, or over 181 days of being due. Milestone 1 is not included since the only expectation was that it be met within the first year and all participants met this one year goal.

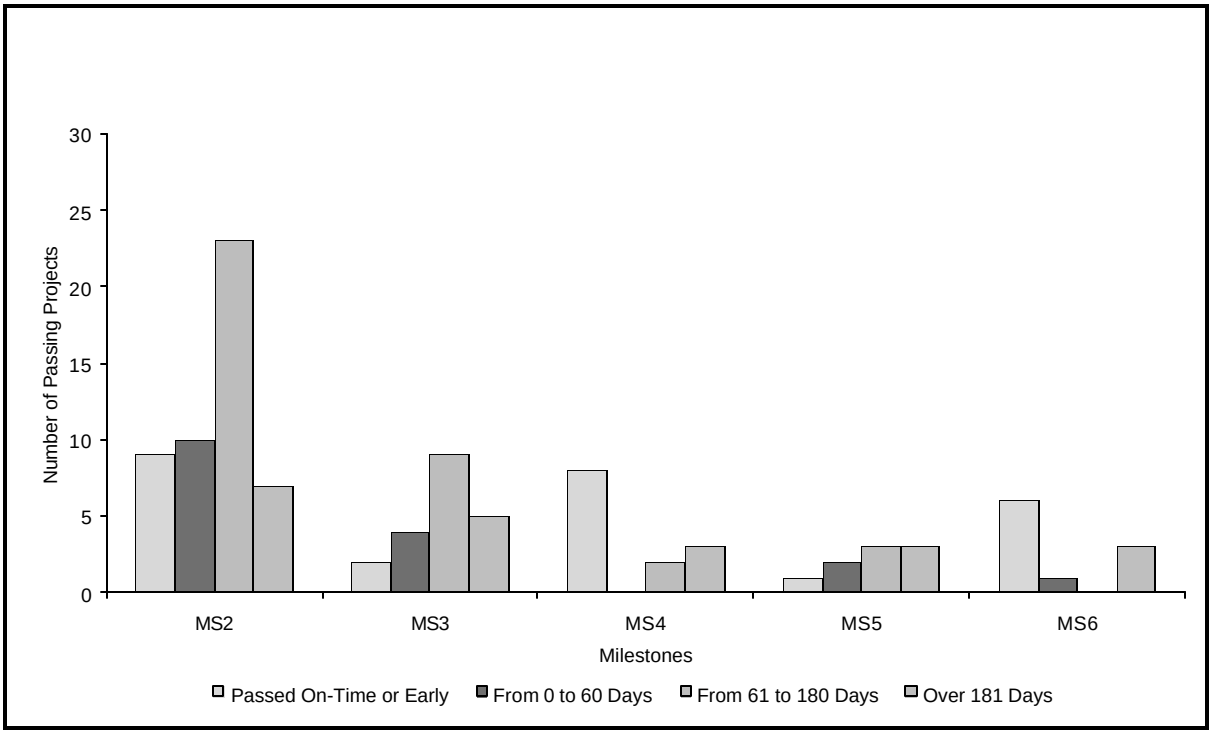
Table 3-4: Milestone Timeline Achievement

Milestone	Milestone Passed	Expected Passing Dates Missing	Milestone Passed On-Time or Early	Milestone Passed From 1 to 60 Days of Due Date	Milestone Passed From 61 to 180 Days of Due Date	Milestone Passed Over 180 Days of Due Date
MS2	49	0	9	10	23	7
MS3	22	2	2	4	9	5
MS4	14	1	8	0	2	3
MS5	12	3	1	2	3	3
MS6	11	1	6	1	0	3

Several projects have milestones that were passed early. For milestones that have been achieved, nearly all pass within 180 days with most passing within the 61 and 180 day time frame. Milestone 3 (receipt of permit approvals) exhibits the greatest incidence of being late. However, Milestone 4 (construction start) has the greatest incidence of being achieved early. Timeliness continues to be favorable especially for Milestone 6. Except for Milestone 4, these data support the conclusions reached through review of Table 3-3 and Figure 3-3. The high incidence of early Milestone 4 passage coupled with the relatively large share of Milestone 4 passage dates due, but not yet passed appears to be a reflection of the small subset of projects that were already into the planning stages when the New Account program began. Those that had been in the planning stages had early Milestone 4 passage dates.

Three technologies (landfill gas, wind, and geothermal) have projects that are now on-line, with most of the current on-line projects being landfill gas projects. Milestone 5 and 6 data in Figure 3-4 are dominated by these three technologies, while data on the earlier milestones include many of the other technologies as well. However, none of these three technologies provide significantly different patterns of milestone achievement timeliness than those presented in Figure 3-4.

Figure 3-4: Milestone Timeline Achievement



3.3 1999 Project Capacity and Generation Characteristics

As stated previously, eleven projects are on-line as of July 2000. Eight of these are landfill gas projects, two are wind energy projects, and one is a geothermal project. Table 3-5 provides program summary information on total projects, capacity, energy output, and capacity factors. The total capacity value of 542,828 kW represents the sum of all 52 projects should they all come on-line. For each of five years, the total energy output in kWh represents the total expected energy output from each of the 52 projects during each project's first, second, etc., year of operation. The Year-One total energy output value of 2,608,890,653 kWh is not meant to correspond to an actual time period, but rather represents a summation of each project's expected first full year energy output regardless of when it comes on-line.

Table 3-5: Program Summary Information

Total # Projects:	52
Total Capacity (kW):	542,828
Total Energy Output (kWh) Yr. 1:	2,608,890,653
Total Energy Output (kWh) Yr. 2:	2,705,631,730
Total Energy Output (kWh) Yr. 3:	2,718,413,263
Total Energy Output (kWh) Yr. 4:	2,719,787,653
Total Energy Output (kWh) Yr. 5:	2,727,511,694
Estimated Capacity Factor Yr. 1:	54.9%
Estimated Capacity Factor Yr. 2:	56.9%
Estimated Capacity Factor Yr. 3:	57.2%
Estimated Capacity Factor Yr. 4:	57.2%
Estimated Capacity Factor Yr. 5:	57.4%

As of July 2000, eight of the 11 on-line projects have received incentive payments from the CEC. To assess how well the program is achieving its goals for on-line generation, the actual capacity and energy production from these eight projects is compared to the expected level of capacity and energy production over the incentive payment time frame. Table 3-6 provides the data and Figure 3-5 illustrates the summation of this data on this issue. The values for scheduled output are calculated by dividing the expected total energy output for year 1 by 12 months, then multiplying that value by the number of months in operation. This method for estimating scheduled output does not take into account the seasonality of energy production, which can vary significantly. However, the 13 and 14 months of operational data available for the eight projects receiving incentive payments is close to an annual 12 month period.

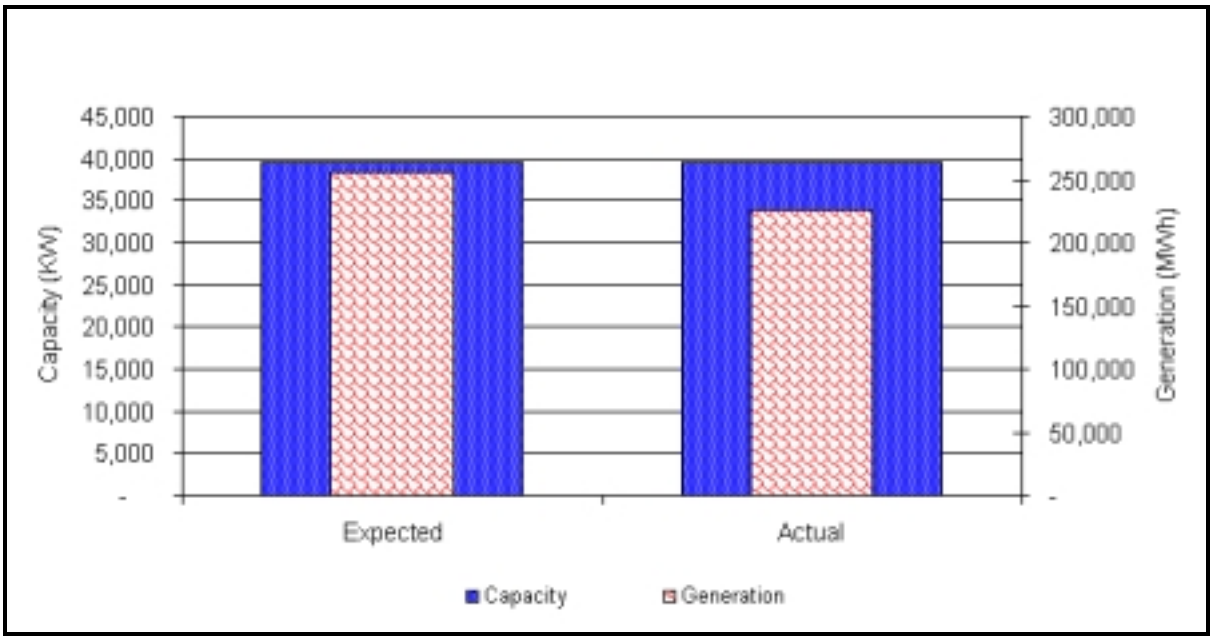
Seven of the eight projects have been receiving incentive payments for 14 months and one for 13 months. The scheduled capacity for the eight projects is the same as the actual capacity. Actual energy production is about 10 percent lower than the expected energy production. Two of the projects are generating significantly more electricity than expected, one about the same and the remaining five less than expected. The single wind project is only producing at about 74 percent of its scheduled output. However, wind conditions are difficult to predict and the wind resource highly seasonal. One of the landfill gas projects is producing only at about 66 percent of its scheduled output. This reflects the difficulty to predict the amount of steady landfill gas production prior to development. For this specific landfill gas project, electricity production is 30 to 40 percent higher in the year 2000 when compared to the electricity production in the same months in 1999. The difficulty of predicting landfill gas production is also evidenced by the fact that another two landfill gas projects are producing at levels about 28% greater than predicted. Overall, energy production is lower than predicted, but appears to be increasing towards the predicted levels.

As shown in Table 3-5, the average expected capacity factors for each year of full production are all between 55 percent and 57 percent. However, the expected capacity factors for each project vary significantly. Landfill gas projects generally have higher expected capacity factors, while wind projects have relatively low expected capacity factors. Figure 3-6 illustrates the expected Year One through Year Five capacity factors for all awarded projects, as well as the expected and actual capacity factors for the eight projects currently receiving CEC incentive payments.

Table 3-6: 1999 Expected and Actual Project Performance

Project # ID/ Technology	Months in Operation	Scheduled Capacity (kW)	Actual Capacity (kW)	Scheduled Output (kWh)	Actual Output (kWh)	Share of Actual to Scheduled Output (%)
41/Landfill Gas	14	5,690	5,690	54,941,562	36,263,726	66%
42/Landfill Gas	14	5,490	5,490	30,443,545	38,802,596	128%
43/Landfill Gas	14	2,000	2,000	18,396,000	23,594,592	128%
45/Landfill Gas	14	1,780	1,780	17,155,803	12,041,178	70%
46/Landfill Gas	14	2,300	2,300	19,418,000	15,382,000	79%
47/Landfill Gas	14	5,690	5,690	55,247,511	52,272,492	95%
11/Wind	13	16,500	16,500	64,121,558	47,628,290	74%
Total		39,450	39,450	259,723,978	225,984,874	87%

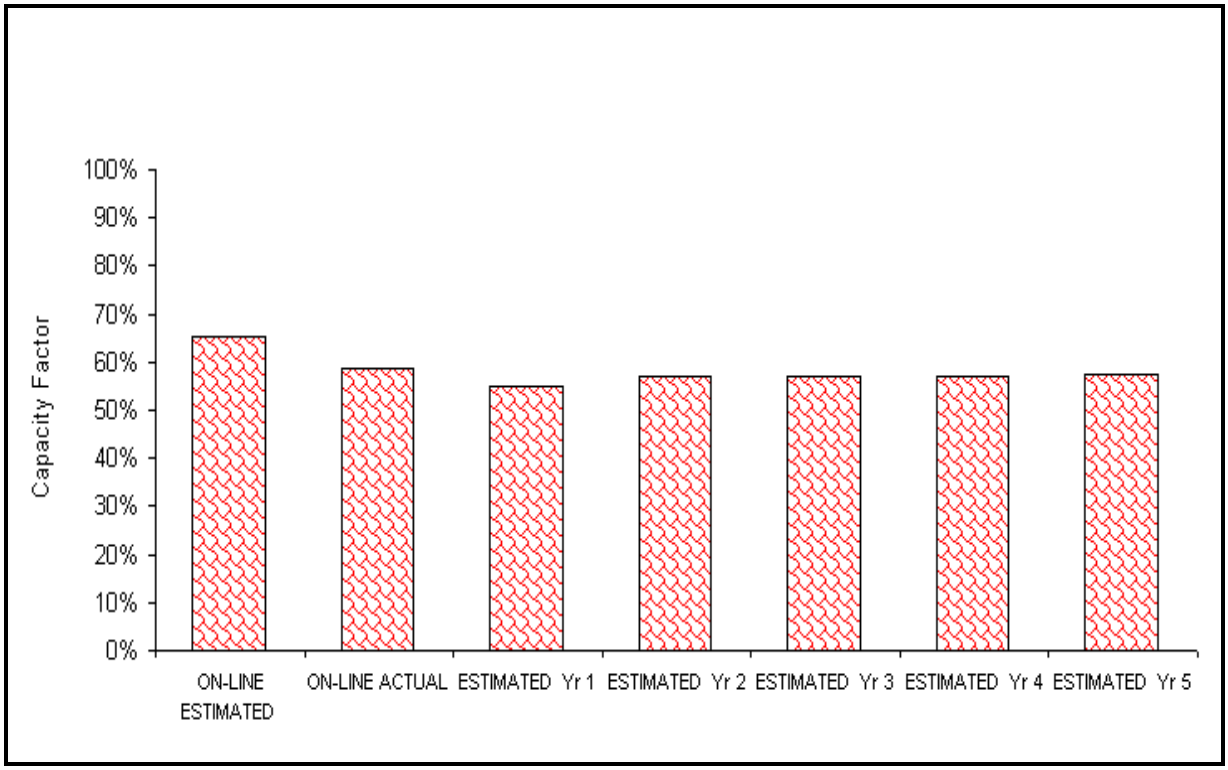
Figure 3-5: 1999 Scheduled and Actual On-Line Capacity and Generation



The predominance of landfill gas projects led to a high expected average capacity factor of about 65 percent for the eight projects receiving incentive payments. However, the actual

average capacity factor for these eight projects was closer to 59 percent. This lower actual average capacity factor does not appear to indicate any problems. Rather, it appears to indicate initially lower landfill gas capacity factors, especially in the one landfill gas project that is producing less electricity than expected. Additionally, the single on-line wind project experienced large swings in monthly capacity factors ranging from a low of 10 percent to a high of 51 percent. The expected average capacity factor for this project is about 41 percent and there is no reason to believe that it will not be achieved over the long run.

Figure 3-6: Estimated Capacity Factors for all Projects and Actual and Estimated Capacity Factors for the 8 Projects Receiving Payment as of July, 2000



Volume III

4 Survey Results

A survey was conducted of companies and governmental agencies participating in the New Account Program as well as companies and governmental agencies involved with the development of renewable energy projects that are currently not participating in the New Account Program. Results from the survey are very insightful in gaining information from clients and potential clients of the New Account Program. However, results from the survey represent self-reported data from the survey respondents with the potential for bias. Therefore, survey results need to be considered from that perspective. The purpose of the survey was to gather information about the following issues:

- Likely capacities and generation output that would have been developed without the New Account Program
- Anticipated changes to capacity and generation output
- Project developers' perceptions of the key barriers to operating existing new facilities to a greater degree
- Barriers to installing additional renewable generation capacity in California
- Participants' experiences to date with the New Account Program
- Regulatory and economic challenges to development of New Account Program technologies
- Program-related decision-making
- REP awareness levels
- Development activity outside of the program, and
- Opportunities for program enhancements

4.1 Participant Survey

The survey was conducted during the period of late May to mid-June 2000. A total of 17 potential respondents with currently active projects were identified. Two additional projects were initially funded under the New Account Program but were cancelled. These two cancelled projects were included in the non-participant survey group These two cancelled projects were included in the non-respondent survey because it was felt that their opinions would more closely reflect the opinions of the non-participant group.

Of the 17 potential respondents, 14 provided complete survey results. Non-respondents to the participant survey included one party that was leaving the country for an extended period

and could not complete the survey before departing, another that stated he did not have time to take for the survey because of pressing deadlines, and a third was never available and never returned calls despite multiple attempts and multiple conversations with the company secretary who assured us that the messages were received. The final group of 14 respondents represented each of the six technologies funded under the New Account Program and represented 48 of the 53 total sites currently participating in the program. Both of the cancelled projects were respondents in the non-participant survey.

The survey consisted of 41 questions that, when given as a cold call over the telephone, took between an hour to hour and one-half to complete. Some of the survey questions also required detailed information that would be difficult to know with certainty without checking with other staff. This was particularly true for those potential respondents with multiple (as many as 15) projects. Because of the lengthiness and required detail of the survey and because all of the potential respondents were senior executives or presidents of their respective companies with little time to spare, each, when contacted by phone, was offered an option of how to participate in the survey. The first option was to continue with the conversation and complete the survey immediately over the telephone. The second option was to schedule a later time to complete the survey over the telephone. The third was to receive a copy of the survey via email or fax for review but to complete the survey at a later time over the telephone. The last option was to receive the survey via email or fax, the respondent would then complete the survey and email or fax back the completed survey. Responses would then be reviewed and follow-up telephone calls made to expand or clarify the responses provided.

Only two respondents opted to complete the survey immediately over the telephone and none opted to schedule a time to complete the survey at a later date over the telephone without prior review of the survey. All of the remaining respondents (and the three non-respondents) wanted a copy of the survey either emailed or faxed for their review before completing. Each of these recipients were re-contacted by phone with four completing the survey over the phone with the instrument in front of them and the remaining eight emailing or faxing back their responses. Most of those that emailed or faxed their responses were re-contacted for minor clarification. Overall, the quality of the responses was very high among each of the types of response with appreciation expressed by the respondents for the fax/email option.

4.1.1 Respondent/Project Characteristics

Nearly all of the respondents first learned of the New Accounts program in early 1998. Each of the six technologies funded under the New Account Program are represented by the survey respondents with most of the respondents having landfill gas (5 respondents) and wind (4 respondents) projects. There were three respondents with geothermal projects (two from one company representing different projects) and one respondent each with biomass, digester gas,

or small hydro projects (same respondent as digester gas). The biomass project uses wood as its fuel. Of the three non-respondents, two had wind projects and one a landfill gas project. A total of 48 projects with total capacity of 536 MW were identified as controlled by the 14 respondents. The project mix by technology was as follows:

- Biomass – 1 project
- Digester Gas – 1 project
- Small Hydro – 1 project
- Geothermal – 4 projects
- Landfill Gas – 19 projects
- Wind – 22 projects

Only four of the respondents indicated that they had projects that are currently on-line with the remaining respondents having projects at various points along the milestone process. Of those with operational plants, none have experienced any notable changes in their facility and none have experienced any problems in receiving their production incentive payments. One respondent indicated that one of their six landfill gas projects (0.6 MW) had recently been voluntarily withdrawn from the program. For the 48 projects identified, the last milestone completed for each, as reported at the time of the survey, is as follows:

- Milestone 1 – 2 projects
- Milestone 2 – 18 projects
- Milestone 3 – 13 projects
- Milestone 4 – 2 projects
- Milestone 5 – 4 projects
- Milestone 6 – 9 projects

One-half (7) of the respondents indicated that their main line of business was generating electricity with renewable fuels and technologies. Three indicated that they were government entities with the remaining respondents being non-renewable electrical generators, diversified energy suppliers or waste management firms.

All respondents expected to operate their facilities year round. None expected that their annual energy production would change by the end of the year 2001 and only one that it would change over the life of the program. This one respondent anticipated adding about 1 MW of capacity to a landfill gas project due to larger than expected gas volumes.

Answers to the question of where the respondents plan to sell their generated electricity covered a wide range of possibilities. The most common answers being the California APX Green Power Market (8 responses), bilateral energy contracts directly with retailers and wholesalers (6 responses) and the California Power Exchange (4 responses).

Only one respondent had a power contract that limited their power output to less than its full rated production. This limitation was caused by their local transmission entitlement through their local utility.

4.1.2 Perceived Program Importance

All of the respondents felt that the program was an extremely important reason for why their projects are operational or being developed. All 14 respondents were of the opinion that the New Account Program was positively affecting the development of a green power market in California. Most (9 responses) indicated that their projects would not exist if the program wasn't in place with the remaining not knowing what the impacts would be (2 responses) or saying that their projects would be delayed (1 response) or be of smaller size (1 response). In a similar open-ended question asking the respondents to describe how the New Account Program affected their facility, 11 respondents described it as the critical if not primary reason for going ahead with the project while only one thought it was unimportant.

Under three scenarios where 1) the New Account Program ceased to exist, 2) the New Account Program would exist but with 50 percent lower incentive levels, and 3) the New Account Program would exist but with 25 percent lower incentive levels, the respondents were asked for the effect on their projects. Under the first scenario where the New Account Program ceased to exist, eight of the respondents indicated that they would cease project development or terminate construction. Two indicated that they would delay construction, two would continue to operate, and one would reduce its size. With the second scenario of 50% lower incentive levels, five of the respondents continued to indicate that they would cease project development or terminate construction. Three indicated that they would delay construction, two would continue to operate, two were uncertain, one would reduce its size, and one indicated that such a scenario would have no significant impact. The third scenario of 25% lower incentive levels found that only two would cease project development or terminate construction. Five indicated that they would delay construction, two no significant impact, two were uncertain, one would continue to operate, and one would reduce its size.

Eight of the respondents indicated that their firm's knowledge of the New Account Program was a factor in the early planning stages of the project. The Program was also important in obtaining financing with 11 respondents indicating that it was important or very important and only one saying it was unimportant. This one respondent answered in this manner because his firm does its own financing.

4.1.3 Opinion of the Process

Several of the survey questions were designed to elicit participant opinion of the New Account Program process. In general, the respondents believed that the program was well

run by the CEC with most of the program requirements justified and reasonably implemented. None of those with operational projects experienced any problems in receiving their production incentive payments. There was some minor complaint that the process was "bureaucratic" with too much paperwork.

The overall opinions of the New Account Program milestones were generally found to be reasonable (10 responses) or very reasonable (1 response). However, two respondents felt the program milestones were unreasonable. One reason given was that their air permits had to be filed ahead of time in order to get the bid bond back, but then had to be re-filed again once the bid for a specific engine for the project was awarded. Another respondent felt that the commercial operation date deadline was unrealistic given the permitting timeline for a renewable energy project. In another question regarding the overall milestone process, 13 of the respondents (1 "don't know" response) felt that the process and time for the CEC granting Program milestone approvals was very reasonable (8 responses) or reasonable (5 responses).

Specific steps in the process were also addressed by the survey. The auction award process was not considered unreasonable by any respondent. Eleven found it reasonable and two found it very reasonable. Nearly identical results were obtained for questions on the reasonableness of the Project Award Package and the overall New Account Program information requirements.

All 14 respondents believed that the requirement to terminate a Standard Offer #2 or Interim/Final SO#4 power sales contract was not a factor in applying for the incentive. Most (11 responses) felt that the exclusion of sales that would avoid an applicable Competitive Transition Charge was not a factor in applying for the program incentive. A reason given for why it was a factor was the difficulty in marketing power to municipal utilities.

The requirement that caused the most controversy was the bid bond requirement. Each respondent was asked to rank how reasonable they thought the bid bond requirement was and to specify what he or she would like to see changed to improve this portion of the process. Half of the respondents rated the bid bond requirement as reasonable (6 responses) or very reasonable (1 response). Six found the requirement average and one found it very unreasonable. The government agencies tended to rate the requirement as average because they generally do not need to obtain bid bonds and they are unfamiliar with the process. One respondent suggested that bid bonds be waived for governmental organizations. Another respondent commented that the bid bond process screened out companies with limited financial resources who could possibly perform the job better than other, larger companies. They would prefer a screening process emphasizing capabilities and track record rather than financial resources.

4.1.4 Future Impacts

The impact of the program on each of the projects in the future was the focus for several of the survey questions. One of the questions asked how the respondents thought the New Account program incentives would affect the market competitiveness of their renewable generation project after the Program ends. In general, the respondents stated that the program impacts were built into their 10 to 15 year planning horizon and as such, the ending of the program would have no effect on the market competitiveness. What the program has enabled the participants to do is lower their initial capital costs. The initial capital costs are seen as a primary barrier with fuel and operational costs being less of a concern.

Thirteen respondents indicated that they have a plan to remain competitive in the market after the end of the New Account incentive support with one "don't know" response. Many cited their 10 to 15 year business plan with additional goals of maintaining lower operational costs, securing long-term contracts, and being prepared to add additional projects if demand warrants. Some respondents indicated that if market conditions proved less favorable than anticipated that they would consider going to a Time of Use production cycle to take advantage of the higher price paid for peak period energy. Only one respondent indicated that they had any present plans to either modify, reduce or cease operation of their project over the next six years. In this one instance, the respondent indicated that they hope to add additional capacity to their site to take advantage of higher than expected landfill gas production if funds become available.

A series of questions was asked regarding expectations of changes in operating and maintenance practices and/or costs if market conditions change. Responses were split in this series of questions with about half saying yes and half saying no to each. In nearly all cases where a change was indicated, operating and maintenance practices and costs would change in response to going to a Time of Use production cycle. Another respondent indicated that they anticipate changes occurring as they continually refine their operating practices as technology improves.

The final future oriented question asked whether the respondents would consider participating in another competitive bid auction with either a new facility, a repowered facility, or a facility enhancement should another auction be held. There was only one no response and one don't know response with the remaining being yes responses. The single no response indicated that his reason was insufficient landfill gas to warrant another project. The range in capacity for future participation ranged widely from a low of 0.5 MW to a high of 300 MW. The total capacity indicated ranged from 328 MW to 915 MW. This could nearly double the capacity currently in the program (current program has 552 MW). The large difference between the high and low range was the result of responses from wind

energy survey participants. These respondents were uncertain about the future economics of the wind turbine industry and the electricity sales market.

4.1.5 Respondent Suggested Program Modifications

Respondents were also asked a series of questions designed to provide an opportunity for them to suggest modifications to the New Account Program. Although the Program is generally highly regarded, most of the survey participants provided suggestions for improvement. The first question of this nature asked if there was anything that the respondent thought might prevent similar new renewable resource facilities from participating in the CEC program. Nine respondents said no. Of those that provided answers other than no, one stated that a significant barrier was a lack of a long-term guarantee for their power. They see no security of revenue over the long term and believe the long-term viability of green power in California is jeopardized because of that. Another found that their limited transmission entitlement through the local electric utility prevented them from taking advantage of power plant economies of scale.

An extensive number of suggestions were provided when respondents were asked if there were other services or program related benefits the State could provide that would help make their projects or business more competitive. Suggestions included the following:

- Extend tax benefits to the county and city governments where the projects are located so that some of these benefits could be passed along to the projects.
- Provide more long-term security in revenues such as requiring a certain percentage of capacity to be green power.
- Have technical assistance and training up-front. Help identify the barriers and evaluate the options.
- Help solve transmission access problems and interaction problems with local utilities.

- Provide additional financial incentives such as tax exemptions for certain technologies, low interest loan programs, establishment of some kind of emissions credit trading mechanism to value the externalities of renewable power sources, a commitment from the State to purchase green power, programs through which permitting costs attendant to satisfying state environmental survey requirements could be funded for appropriate sites. Any one or a combination of these mechanism would allow renewables to compete more effectively with conventional power sources and help to establish a buoyant renewables market in California. Expansion of the program to offset any expiration of the Federal Production Tax Credit (PTC) would secure the benefit of the PTC for California projects if the PTC were not renewed. Adjustments to funding levels to account for inflation could also make the program more viable.
- Awards or forgivable loans that could be used for the drilling of geothermal exploration wells.

An equally extensive list of suggestions were provided for the question that asked the respondents to recommend changes to program specifics that would increase the likelihood of their project being competitive in the market. Some of the responses were similar to the responses provided above. Additional responses beyond those provided above include:

- Determine cancelled projects more quickly and turn the money back into the program at a faster rate.
- Being able to adjust award perhaps 10% to match actual kWh output.
- Allow the award recipients to bid to have their award increased up to the 1.5 cents/kWh cap.
- Allow sales to municipal utilities. (Sales to municipal utilities are allowed by the Program. The respondents misunderstood the program guidelines)

One question asked respondents if they were familiar with the Existing Account production incentives program and if they were, how would they compare the two programs and do they prefer one to the other. Most (11 responses) indicated that they were familiar with the program and half (7 responses) indicated that they had facilities participating in that program. In comparing the two programs, one respondent stated that the Existing Account program was set up to enable existing projects to achieve vital repairs and refurbishment in order to continue to operate. They believed that a similar fixed incentive program for New Accounts would favor those projects that have more energetic wind régimes and therefore the ability to bid for what they really expect to need. They further stated that based on the project dynamics and the interpretation of the market conditions that the Existing Account incentive mechanism is perhaps the most efficient way to encourage renewable development. It should be noted that in the Existing account program, the fixed incentive is equal across all

participants within a Tier. In the New Account Program, the incentive is also fixed, but is variable from participant to participant according to their auction bid.

Most of the remaining respondents felt the Existing and New Account Programs are similar once projects are built or they had no opinion at all. A final respondent had a different opinion of the Existing Account program. He stated that the Existing Account program does not have a high enough credit to overcome the existing energy prices. It does not add any value to an existing plant since the program only pays below a limit of an energy price under $0.03/kWh. They therefore prefer the New Account program as it is designed to aid a project at any energy price and is not limited by market forces. This particular respondent has projects under Tier 3 of the Existing Account Program. Tier 3 projects are provided lower incentive levels compared to Tier 1 and Tier 2 projects since Tier 3 projects are assumed closest to being competitive.

A final question that solicited respondent input asked if they are aware of the "Customer Credit" incentives extended to registered retailers and power marketers by the CEC for purchasing/sale of eligible Green Power, what effect this incentive had on their business, and how had the variable nature of the credit affected their business. Nearly all of the respondents (12 yes responses) indicated that they were aware of this "Customer Credit". Many (6 responses) thought it had an important impact on their business, although an equal number (6 responses) were uncertain of its effect or thought it had no effect. Five respondents indicated that the variable nature of the credit did not affect them or had no effect. One respondent indicated that they would prefer that it remain steady while a second stated that the variable nature of the credit diminished the incentive value in proportion to the perceived future variability.

4.2 Nonparticipant Survey

The survey was conducted via telephone during the period of June 2000. Surveys were completed with eight of fifteen targets. Targeted companies had some interest in, or involvement with the program, but are not participating in it. Selected nonparticipants had either attended a pre-bid conference, submitted a Notice of Intent to bid, voluntarily withdrawn from the program, or contacted the Commission to express interest in a second auction.

Seven of eight respondents were cooperative in providing information. One respondent was engaged in conversation but did not answer most of the questions. Three of the seven nonrespondents were mailed descriptive materials and asked to respond. Telephone numbers were not available for these companies, and searches for company and contact information were unsuccessful. Scheduling conflicts prevented two interviews. The remaining two nonrespondents were located but chose not to participate.

4.2.1 Respondent Characteristics

Three of the respondent companies focus on renewable electricity generation while two each focus primarily on non-renewable electricity generation or powerplant project development services; one respondent was a county government. Distribution by primary technology type was: 3 biomass, 2 wind, 2 landfill gas, 1 geothermal. Two of the eight respondents have wind projects in the Existing Account program.

Six respondents pursue project ownership and operation. The existing total generating capacity of these six operators is about 4,350 MW, of which about 750 MW is renewable. The total renewable capacity associated with the projects that were considered for the New Account first bid auction was about 150 MW. Two respondents offer project development services.

4.2.2 New Account Program Participation Decisions

The six respondents who did not participate in the New Account auction were asked why they did not participate. One respondent did not know. Two respondents cited the magnitude of the bid bond as the reason for not participating. A wind developer with machines in the Existing Account declined to participate in the bid auction due to uncertainty surrounding eligibility consequences of siting new capacity in close proximity to existing capacity. The respondent felt the Commission was not responsive where resolution of his uncertainty was concerned. All responses (and incidence frequencies, when exceeding one) are summarized below.

- Couldn’t raise required bid bond (2)
- Believed participation cost would exceed benefit
- Uncertainty concerning program rules
- Project economics did not justify moving forward
- Development delays unrelated to program

Respondents were also asked if anything might prevent others from participating in the program with similar new facilities. Six out of eight respondents cited at least one factor. The bid bond magnitude and administrative requirements were the factors most often cited. One respondent noted that contractual requirements in some other states are less stringent.

- Bid bond magnitude (3)
- Overly burdensome, complex administrative requirements (3)
- Short time provided for bid development
- Insufficient incentive magnitude
- Threat of environmental-based litigation

Two of the eight respondents participated in the auction and were allocated incentive funds but were forced to withdraw from the program prior to project completion. A biomass project encountered fuel supply problems, while environmental-related litigation delayed a landfill gas project. Both of these projects ultimately were canceled.

Seven of the eight respondents would consider participating in another New Account competitive bid auction. One of the development services companies reported that *several* of its clients would be interested.

4.2.3 New Account Program Design/Scope Issues

Respondents offered a number of suggestions for enhancing the New Account bid auction program. It was noted that New Renewable capacity may be more technologically advanced, and therefore efficient, than renewable capacity in the Existing Account. Suggestions for improving the program that were offered by nonparticipants include:

- Increase and/or extend incentives
- Grant credit for pollution-reducing effects of dairy biogas projects
- Compensate distributed generation projects for VAR support and power quality benefits
- Institute capacity-based incentive
- Increase allocation to inherently more efficient New Account projects
- Designate landfill gas as biomass (In the New Account program, all technologies are treated equally. It is believed the respondent was thinking of the Existing Account Program where biomass is a Tier 1 technology and landfill gas is a Tier 3 technology.)
- Change rules to give small companies a chance

Respondents tended not to have strong feelings about the reasonableness of the "First Price" auction design whereby funds were awarded from lowest incentive to highest incentive until available funds were depleted. Five respondents expressed an opinion about the reasonableness of the auction's design. All respondents judged this aspect of program design as average or better. Responses are summarized below.

Opinion	n
Very Reasonable	1
Reasonable	3
Average	1
Unreasonable	0
Very Unreasonable	0
Don't Know	1

The eight respondents were asked if there were other services the State could provide that would help make future renewable projects more competitive. Most of the suggestions would reduce renewable energy production costs faced by owners, thus stimulating supply. Suggestions also included adoption of public policies that would stimulate demand. The suggestions are listed below.

- Consumer education
- State tax credits
- Imposition of renewable portfolio requirements
- Purchase of renewable energy by state facilities
- Statutory protection for landfill gas project development
- Continuation of economic support for renewables
- Facilitate resolution of transmission capacity constraint problems
- Modify CALPX bid-ahead process so that it fairly treats stochastically dispatchable (e.g., wind, solar) capacity

While six of seven respondents were aware of the REP "Customer Credit" Green Power incentives extended to registered retailers and power marketers, only one thought this green power *market pull* incentive was having an impact on their business. This respondent is participating in the Existing Account Program with both a wind and geothermal project. He reported that the Customer Credit did not affect the wind project because of an existing Standard Offer 4 contract. In regards to the geothermal project, the respondent did not elaborate as to how the Customer Credit incentive assisted with this project. In general, the familiarity of these nonparticipants with the Customer Credit incentive program was modest.

4.2.4 New Account Program Implementation and Effects

Several respondent comments concern program implementation. These comments include:

- Experience with the Commission and the Staff has been very good. Every contact has been most helpful and I believe that the program is being administered in proper fashion.
- The CEC staff was extremely helpful throughout the application and review process.
- The pre-bid meeting was held prematurely, before program details had been sufficiently developed

Respondents who did not participate in the auction were asked if they thought the New Account Program was affecting the development of a green power market in California. The four respondents answering the question all believe that the program is accelerating the development of such a market. Comments related to these opinions include:

- A wind developer claimed to be aware of at least two wind projects that wouldn't have moved forward without the program's assistance,
- Without the program there would be no new renewables development in California (including wind), and
- New Account, in combination with Customer Credit, is probably increasing awareness, which should contribute to market development.

4.2.5 Market Issues

Six of eight non-participant respondents reported having pursued, or considered pursuing, a renewable energy project outside of the New Account's assistance. One respondent didn't answer this question and the other works for a county government whose focus is on providing government services, not developing power projects.

Respondents were asked about the fate of projects considered for participation in the New Account program. Three of six reported that they will continue, or have continued, with project development outside of the program. Two of these three projects are, or will be soon, in the construction phase. The third project is in only the very early stages of development, and project completion is not assured. The fact that two projects developed by nonparticipants have reached the construction phase suggests that there may be some degree of free ridership among New Account Program participants.

Respondents were asked about their company's approach to keeping the renewable energy aspect of their business competitive. Several respondents mentioned they were expanding their field of attention beyond California. Responses are listed below.

- Extend geographic target beyond California (3)
- Pursuit of public/private partnerships (2)
- Take advantage all available credits/incentives (2)
- Repower with improved technology
- Creative project structuring/financing
- Use size to gain favorable purchasing arrangements
- Renewables promoting trade group participation
- Lobby in Washington D.C.

Barriers to Continued Wind Development

One respondent with many years of experience in the wind energy business suggested that addressing fundamental, structural barriers to continued wind development might yield greater benefits than implementation of programs designed to yield marginal effects on the economics of individual projects. Specific issues raised include: 1) transmission capacity constraint, and 2) CALPX bid-ahead penalization of wind energy. The respondent

suggested that the State could play a role in removing these barriers to continued wind development. These ideas are described below.

Transmission Capacity. Transmission capacity is constrained at Tehachapi. In the near future transmission may also be constrained at Palm Springs and Altamont. At Tehachapi current wind capacity is about 650 MW. The ultimate potential may be about 2,200 MW if suitable transmission capacity is available. Available transmission options include stringing small parallel lines, building large, efficient transmission lines, or doing nothing.

The state has altered the way transmission expansion is handled. The state is involved when consumer loads dictate expansion, whereas the generator is responsible when generation capacity dictates expansion. But a single wind developer cannot develop suitable additional transmission capacity. It is generally not economic for even a large single developer, and transmission expansion typically takes 2-5 years whereas wind project development can be accomplished in one to two years including the local permitting process. These circumstances are reportedly reducing the ability of wind developers to bring new capacity on-line. One respondent felt that the State should take a more active role in resolving the transmission capacity problem but did not provide specific recommendations. A resolution of this problem would allow for additional expansion of the wind resource.

CALPX Treatment. The existing CALPX bid-ahead process requires wind power producers to predict next day energy generation and variances are severely penalized. The process could be modified to treat stochastically dispatchable (e.g., wind) capacity in a less discriminatory fashion.

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5 New Account Program Impacts

The impacts from the New Account Program can be assessed from several perspectives. These include:

- Comparing the projected energy and capacity additions expected as a result of the auction awards to what is currently expected or achieved.
- Review past levels of renewable resource capacity and compare these levels with the levels being developed under the New Account Program.
- Assess the issue of free ridership.
- Assess the level of interest in the further development of renewable resources.

5.1 Awarded and Cancelled Projects

As identified in Table 5-1, 55 projects associated with over 550 MW of capacity and 2.6 million kWh/year of expected energy output were awarded funding through the New Account Program auction process. Since that time, three projects have been cancelled or withdrawn. From the standpoint of the program as a whole, these cancelled projects represent less than three percent of the awarded capacity and output. Taken from an individual technology perspective, the single cancelled biomass project represents about two-thirds of the awarded biomass capacity and output. However, the two cancelled landfill gas projects represent less than three percent of the awarded landfill gas capacity and output. From the perspective of awarded compared to cancelled projects, the program has had significant positive impact.

Table 5-1: All Awarded and Cancelled Projects - Generating Characteristics by Technology

Technology	Awarded Projects	Awarded Capacity (kW)	Awarded Output (Year 1 kWh)	Cancelled Projects	Cancelled Capacity (kW)	Cancelled Output (Year 1 kWh)
Biomass	2	11,600	94,959,000	1	7,800	63,039,000
Digester Gas	1	2,050	16,521,000	0	0	0
Geothermal	4	156,900	1,228,760,000	0	0	0
Landfill Gas	23	70,125	473,652,400	2	1,597	11,907,850
Small Hydro	1	1,000	7,342,000	0	0	0
Wind	24	310,550	862,603,103	0	0	0
Total	55	552,225	2,683,837,503	3	9,397	74,946,850

5.2 Past Levels of Renewable Resources

Summary information from investor-owned utility Quarterly Status Reports (QSR) since 1990 were reviewed to determine the size and stability of the green generating resources in California. The QSR database includes data for Qualifying Facilities (QF) but not for utility owned generation facilities. For most technologies this limitation is not significant. However, there is a significant amount of utility owned small hydro and geothermal capacity not included in the QSR database.

To supplement the QSR database, data from the CEC Siting Division's Power Plant database were reviewed. In that database, no utility owned biomass, digester gas, landfill gas, or wind resources were identified. Utility owned geothermal and small hydro resources were included in the Power Plant database. Within the geothermal category, 954 MW of capacity in 11 plants were identified as utility owned. Four of these eleven plants were listed as either being closed or decommissioned. One plant did not have a closure date identified (54 MW) and the closure/decommissioning years for the remaining three were 1987 (45 MW), 1992 (24 MW), and 1994 (59 MW). There were also an ownership transfer of an additional 452 MW between a utility and a private corporation over the past five years although the specific date of the transfer was not identified.

Over the 1990's, it appears that about 10 percent of the geothermal capacity was closed or decommissioned. The utility owned small hydro resource has been much more stable than the geothermal resource. Within the small hydro category, 78 were identified as utility owned with a total of 513 MW of capacity. One 21 MW plant was identified as cancelled (no date listed) and another one MW plant was identified as proposed and placed on line in 1998. Based on the information in the Power Plant database, it is uncertain whether the cancelled plant was ever on-line or cancelled within the last ten years. Total utility owned renewable resource capacity was about 1,275 MW by the end of 1999.

The QSR data were grouped into four technology categories to correspond as closely as possible to the six technology categories funded under the New Account Program. The biomass, municipal solid waste, waste tire, digester gas, and landfill gas technologies could not be separated in the QSRs over the time period reviewed and these five technologies are grouped together into one biomass category. Table 5-2 provides an estimate of capacity by technology and year as reported in each year's fourth quarter report. It is uncertain whether increases in capacity from one year to another reflect new capacity or an adjustment to existing green generating resources as a result of maintenance, market conditions, or in 1998 and 1999 the impacts of the Existing Renewable Resource Accounts program.

A detailed review of each QSR or a search of the CEC QF database identifying new QF ID #s would be necessary to specifically identify any new project capacity. A review of the

New Account Program tracking database indicates that about 40 MW of the total 1999 capacity listed in Table 5-2 are from the New Account Program. What is evident from the perspective of the QSR data is that there are only small differences in the resource capacities in the pre-program high capacity years from 1990 to 1997 and the post-program years of 1998 and 1999. When including the effects of utility owned small hydro and geothermal resources a small decline in total renewable resource capacity was observed in the pre and post program years.

Table 5-2: Renewable Generating Resources in California As Identified by Investor-Owned Utility (IOU) Quarterly Status Reports (does not include IOU owned renewable capacity)

Year: 4th Quarter	Biomass (MW)	Wind (MW)	Small Hydro (MW)	Geothermal (MW)	Total (MW)
1990	853	1,643	356	786	3,638
1991	877	1,729	356	809	3,771
1992	924	1,769	370	831	3,894
1993	933	1,755	370	831	3,889
1994	920	1,704	410	863	3,897
1995	837	1,641	390	846	3,714
1996	827	1,641	357	882	3,707
1997	949	1,639	360	885	3,833
1998	976	1,708	357	845	3,886
1999	985	1,679	355	890	3,909

In terms of QSR total capacity, 1994 had the largest pre-program capacity with 3,897 MW while the post-program year of 1999 was less than one percent higher at 3,909 MW. Of the four technologies, two are slightly larger and two slightly smaller in the pre and post program periods.

Combining the 1999 totals of 3,909 MW of QSR identified capacity, reducing it by the 40 MW of New Account Program capacity included within it, and adding the 1,275 MW of utility owned geothermal and small hydro capacity yields a total of 5,144 MW of renewable resource capacity. The currently expected addition of over 540 MW through the New Account Program is a significant addition of over 10 percent to this current level of renewable capacity. Within the context of expanding the total available green resource in California, especially in the wind, geothermal, and landfill gas technologies, the New Account Program is having significant positive impact.

5.3 Program Free Ridership

Free ridership, which is the program participation of a project that would have been built even without the program, is difficult to determine for the New Account Program. However,

indicators of free ridership can be identified by reviewing the program participant database, the stability of the renewable generating resource over the past ten years, and the results from the participant and non-participant surveys.

Data from the CEC program tracking database indicates that several projects were in the planning stages and moving forward at the time of the program's creation. The date for the New Account auction was June of 1998. An *eligible project* under the New Account Program Guidelines was defined as first in operation after September 26, 1996. One project generating facility was built and operational by late1996. In addition, the Authority to Construct air quality permit was received in 1996 or 1997 for three projects. Two additional projects passed Milestone #2 within five months of the auction bid date which could indicate that significant planning had already taken place. It appears that the majority of projects were developed in response to the program. It also appears that several could be considered as free riders. If the six projects identified above are considered free riders, then the free ridership rate would be about 12 percent. However, other sources of information need to be reviewed before a free rider estimate can be established.

The data reported in Table 5-2 from the utility QSR reports cannot be directly used to assess free ridership. However, the relatively stable levels of resource capacities before and after the beginning of the program indicate low levels of free ridership.

Additional sources of information for assessment of the free ridership issue are the participant and non-participant surveys. The information is self-reported but does provide some insight into the issue. In the participant survey, several questions asked how important the New Account Program was to their project and in nearly all cases the program was cited as the primary reason that the project existed. One particular question asked how the New Account Program affected their facility/company. Eleven of the fourteen respondents stated that the program was a critical component to their operation and only one said that it was not important.

In the non-participant survey, there appeared to be some indications that free-ridership may be occurring. When non-participants were asked if they thought the New Account Program was affecting the development of a green power market in California, the general response was that many projects would not exist without the program. However, when asked if they were pursuing or considering pursuing projects outside of the New Account's assistance, several non-participants said yes. Although the number of projects was not great, the mere existence of projects being developed outside of the New Account's assistance indicates that at least for some projects, the economics are sufficient to warrant development without assistance.

Based on these three indicators of free ridership, it appears that some free ridership is occurring. Data limitations prevent developing a firm estimate of free ridership, but it appears to be in the range of 12 to 20 percent. The importance of the program is evident by the large number of projects that are participating in the New Account Program that were not in the development stage before the program was created. The self-reported response from both participants and non-participants who thought the program was essential for the development of the green power market along with the consistent responses throughout the participant survey on how important the program was in decisions to proceed with projects leads to the conclusion that most projects would not be developed without the program. However, the fact that some of the funded projects were already under development before the program was created along with the responses in the non-participant survey on how other projects are being developed outside of the program leads to the conclusion that a limited amount of free ridership is occurring. However, the amount of free ridership does not appear to be large and the overall impact of the program is highly positive.

5.4 Interest in Future Development of Resources

A final indicator of program impact is how successful the program is in encouraging consideration of additional renewable resource projects in the future. Based on both the participant and non-participant surveys, interest in developing additional renewable resources is high, especially if another New Account auction occurs in the near future. Current participants have already identified additional projects about equal to double the size of the current level of award that they would like to possibly develop. Others, in both the participant and non-participant surveys indicated an interest in participating in future resource development without specifying any specific future project or concept. As with the other three indicators of program impact, the high interest in future resource development indicates that the program has had significant positive impact.

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6 Program Cost Effectiveness

It is still too early in the New Account Program life to assess cost effectiveness from the perspective of actual delivered energy and incentive payments since only a handful of projects are yet on-line. The cost effectiveness of the New Account Program can currently be assessed in the following manner:

- Determine if the auction process was successful in obligating all or nearly all of the $162,000,000 budget set aside for award to projects.
- Compare the average awarded incentive cost/kWh to the allowable maximum award of $0.015/kWh.
- Assess what level of funds could be re-allocated to a new bid auction process. This would be based on the number of cancelled projects and the possible delayed implementation of the remaining projects.
- Review the share of CEC administrative costs to the amount of funds awarded to projects.

The June 1998 New Account Program auction resulted in the awarding of 55 projects. The award process was very efficient in allocating all of the available $162 million. The average weighted incentive award was about $0.0116/kWh which compares very favorably to the allowable maximum award of $0.015/kWh. If an auction process had not been used and the program was instead designed to give a flat $0.015/kWh incentive, about 600,000 MWh/year less would have been funded through the program. If the maximum estimate of 20 percent free ridership were applied to the $0.0116/kWh average incentive award, the cost would be raised to $0.0145/kWh, which is still below the $0.015/kWh incentive maximum.

Since the awarding of bids in July 1998, three projects have dropped out of the program. In addition, in reviewing the program tracking database, it appears that at least two projects will have difficulty meeting the December 31, 2001 deadline for coming on-line. Current indications are that their start-ups will be substantially delayed. The current guidelines indicate that winning facilities that come on-line after December 31, 2001 will receive less than the full five years of incentive payment (prorated on a day for day basis).

Exclusion of the three cancelled projects reduces expected incentive awards by about $4.7 million. This $4.7 million represents less than three percent of the available $162 million and most has already been re-allocated to another project. The two projects that may be delayed in coming on-line to after December 31, 2001 represent additional funds that could be re-allocated. The CEC has done a good job of re-allocating funds to-date and is expected to continue to insure that the funds are cost-effectively distributed.

Since most of the New Account program funds are pass-through to support the development of specific projects, one would expect the CEC administrative costs to be low when expressed as a percentage of the New Account Program award fund. An administrative cost of less than 0.5 percent indicates that nearly all the funds are distributed to actual projects and is cost effective. According to CEC program planning documents, the New Account program has project management resource needs of 4.0 Person Years (PY) of CEC staff, 0.5 PY of student intern labor and contract costs of $100,000. For planning purposes, the CEC budget office uses an average loaded personnel cost of $75,000/year (a mix of higher and lower salaried people) and a cost for full time students of $25,000/year. Although $100,000 was set aside for administrative assistance contract services, only $20,000 was actually spent. The total CEC management cost is $332,500, which is only 0.2 percent of the $162 million award fund and therefore is considered cost effective.

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7 Conclusions and Recommendations

7.1 Conclusions

The conclusions reached at this point are preliminary, as few of the projects are currently on-line. However, based on the review of the proximate indicators, assessment of the participant and non-participant surveys, and appraisal of the program impacts and cost effectiveness, it appears that the New Account Program is highly effective, well received, and well managed. The only caveat to these conclusions is some projects will likely not be on-line by December 31, 2001 and therefore will not receive a full five years of funding.

Budgetarily, all of the $162 million set aside for New Account incentives were awarded. Although six different renewable technologies are represented in the group of projects given awards, wind, geothermal, and landfill gas projects make up the bulk of the projects receiving New Account Program awards with over 97 percent of the awarded capacity. Only three small projects have been cancelled to date and only moderate milestone slippage has occurred. Most of the funds from the three cancelled projects have already been re-allocated to another project.

Program participants are, in general, very satisfied with the program and most look forward to participating in future New Account Program bid auctions. Program participants perceive the program as being vital for the current development of green resources and believe such development would be very difficult, if not impossible, without the program. This view is supported by a review of historical levels of renewable resources over the past ten years prior to the New Account Program that found little change in the overall size of the renewable resource over this time period.

7.2 Recommendations

Interest in the New Account Program is high, it has been well received by the renewable energy developers in California, and to date it is cost-effective and has demonstrated positive program impacts. Based on these findings, the primary recommendations are to keep the program operational and if possible with the available funds, initiate another round of New Account auction bids.

Several of the recommendations provided in the participant and non-participant surveys merit consideration and should be reviewed. Three specific survey recommendations are particularly noteworthy dealing with other governmental organizations, the bid bond requirement, and providing more long-term security for renewable generation.

Each of the auction bid award recipients who were government entities mentioned the bid bond requirement as being especially difficult to accommodate. Primarily this is because government agencies are unfamiliar with the bid bond process and also have difficulty obtaining funds on relatively short notice through their budgetary process. To help overcome the unfamiliarity, RER recommends that the CEC provide up-front technical assistance and training. This training should not only be for government entities, but all potential bid submitters that helps identify the barriers to securing a bid bond and evaluate the options available.

Related to this and still dealing with the bid bond requirement is the extra burden placed on small companies and government entities to meet this requirement. As one survey respondent noted, the bid bond process functions to screen out companies with limited financial resources who could possibly perform the job better than other, larger companies. RER recommends that there should be a tempering (although not an elimination) of the bid bond screening process through a focus more on capabilities and track record rather than only financial resources. Each bidder should be required to meet a minimum capability and track record requirement (as established by the Energy Commission) along with a reduced bid bond requirement to a level about one-half of its current level.

The last specific recommendation was echoed by a large number of survey respondents. This is the desire to have a mechanism in place in California that provides more long-term security for the sale of renewable electric generation. Among the several different suggestions for attaining this long term security was the idea to require that a certain percentage of generating capacity in California be green power. Other ideas included establishment of an emissions credit trading mechanism to value the externalities of renewable power source, and tax exemptions for certain technologies. However, implementation of many of these ideas to establish long term security would likely need legislative action. In addition, the current incentive levels are being fully utilized and evidence doesn't overwhelmingly support changing these current levels. RER recommends that if changes are made to the incentive mechanism that these changes be made in a fashion that promotes equal treatment of competing technologies. Alternate incentives, such as tax credits for certain technologies, should be reviewed to insure that green power alternatives are not disadvantaged. Further, benefits accruing from positive externalities, such as reduced emissions and waste, should be considered when developing incentive levels and length of time for incentive payments for green power alternatives.

Renewable Energy Program
Preliminary Evaluation

Volume IV
Emerging Renewable Resources Account

Prepared for:

The Governor and the California State Legislature

Prepared by:

Regional Economic Research, Inc.
11236 El Camino Real, Suite A
San Diego, California 92130

TURNING DATA INTO INFORMATION

October 30, 2000

Volume IV – Emerging Renewable Resources Account

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Volume IV

1 Introduction

This report addresses the Preliminary Evaluation of the Emerging Renewable Resources Account (Emerging Account) element of the State of California's Renewable Energy Program (REP) established under Assembly Bill 1890 (AB1890), the State's electric utility restructuring legislation. Senate Bill 90 (SB 90), enacted on October 12, 1997, placed the $540 million in ratepayer collected funds into the Renewable Resource Trust Fund. SB90 directs that ten percent of the renewable trust funds provided under AB 1890 are used for the support of emerging renewable technologies. This funding identified under SB90 totals $54 million to be collected over four years and is currently being used to fund a multi-year, consumer-based program to encourage the development of emerging renewable generation technologies in stationary on-site distributed generation applications.

SB 90 also provides a number of specific requirements for the Emerging Account, including the following:

- Funding for emerging technologies shall be provided through a competitive, market-based process that shall be in place for a period of not less than four years.
- The program shall provide monetary rebates, buydowns, or equivalent incentives, to purchasers, lessees, lessors, or sellers of eligible electricity generation systems.
- Incentives shall be issued on the basis of the rated electrical capacity of the system measured in watts.
- The amount of the incentive shall decline over the term of the program.
- There shall be a limit to the maximum percentage of an eligible system's cost that can be provided by the incentive.
- Specified proportions of the emerging incentive funds shall be available to smaller systems of specified sizes.

SB 90 also determined that the emerging renewable technologies eligible to participate in this REP element include: 1) photovoltaic (PV), 2) solar thermal-electric, 3) fuel cell technologies that utilize renewable fuels, and 4) small wind turbines of not more than ten kilowatts of rated electrical capacity per customer site. The legislation further states that these four technologies are only eligible to participate in the program if they meet the emerging technology eligibility criteria contained in the Commission's March 1997 Policy Report on AB 1890 Renewables Funding.

1.1 Emerging Buydown Program Overview

The Emerging Buydown (Buydown) Program is a multi-year program providing rebates (or a system "buydown") on the installed cost to buyers, sellers, lessors or lessees of eligible emerging renewable electric generating systems. The payments from the Emerging Account are intended to substantially reduce the current costs of generating equipment using emerging renewable technologies. The major premise of the Buydown Program is to reduce the net cost to the end user of such generating systems and, thereby, stimulate substantial sales of such systems during a period of at least four years beginning in early 1998. The increased sales of on-site renewable generating equipment resulting from the Buydown Program are expected to encourage manufacturers, sellers and installers to expand their operations/ target markets and in due course reduce their installed costs to consumers.

To ensure that the costs of these systems decrease over time, the level of the Buydown payment is expected to decline in five steps, from $3 per watt down to $1 per watt during the course of the program. Each level of "buydown" is tied to a "Funding Block" or specific portion of the Program's $54 million in funding. These five funding blocks vary in size from $10.5 to $12 million. Once the available funds in the first block of $3.00 per watt have been completely committed, the next block of funds (at $2.50 per watt) with a lower level of Buydown payment become available, and so on until the final funding block of $1.00 per watt Buydown incentive is fully committed.

In order to be eligible to receive a Buydown incentive, however, specific systems in each of the four technology categories must meet the requirements contained in the Emerging Account Guidebook. These equipment participation requirements include *system level* specifications[1], and must be met before the Commission can approve a Buydown Application[2]. The State's Buydown Program is also intended to foster the siting of small, reliable generating systems throughout California at locations where the electricity produced is both needed and consumed, thereby unloading the local utility's distribution system. This particular approach is known as *"distributed generation"*. In order to be eligible for the Buydown Program, the generating system must: 1) be on the premises of the customers of California's electrical corporations, and 2) be of a such a size that the electricity produced is expected to primarily offset part or all of the customer's annual electrical needs at their premises. To maintain minimum standards of quality and safety, the Buydown Program also requires:

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[1] For example, meeting of either standards or one-year Performance, full warranties, permits and contractor installation.

[2] The Commission recognized that there may be individual systems within each of the four technology categories that may not be able to meet these requirements because of the system's stage in its research, development and demonstration cycle. These systems will not qualify for the Buydown incentive despite being within an eligible technology category.

- A minimum of a full five year warranty on the entire generating system if installed by a contractor, or a limited five year warranty if installed by the owner;
- Installation by an appropriately licensed contractor and in compliance with appropriate electrical codes: and
- Certain key system components, or the entire generating system, be certified to meet certain established standards, where available.

The amount of buydown payment an eligible system will receive is dependent on:

1. The specific funding block available to provide a Buydown at the time the system buydown is reserved and/or installed;
2. The size or rated electrical output of the system; and
3. The total eligible costs of the system

The remaining sections of this report include the following components of this preliminary evaluation of the Emerging Account. In Section 2, the Program description, status and Proximate Indicators are discussed. In Section 3, the qualitative analysis is presented that incorporates the market research and the proximate indicator results. Section 4 addresses the energy and peak demand impacts by technology of the completed and approved/in-process Emerging Buydown projects to date. Section 5 discusses the Buydown Program cost-effectiveness analysis, and Section 6 provides conclusions and recommendations resulting from this preliminary evaluation effort.

Volume IV

2 Program Description and Status

2.1 Overview

This Section describes the Emerging Renewables Buydown Program (Buydown Program) and summarizes the program status and achievements to date. This portion of the Buydown Program evaluation required the development of proximate indicators of program success. In general, the proximate indicators enable one to examine the extent to which Buydown Program goals and objectives have been fulfilled. These Buydown Program indicators fall into three primary categories and include the following:

- **Number and capacity of projects receiving incentive funds**
- **Program Expenditures**
  - Total expenditures of Emerging Account Buydown incentive funds
  - Participant contributions
- **Market Development**
  - System installation/contracting suppliers
  - System supply market

The program data provided for this evaluation covers November 1998 through March 2000. Although a time series database does not exist, a time series was created from six program database outputs of the following dates:

- November 18, 1998
- December 29, 1998
- June 2, 1998
- November 17, 1999
- March 22, 2000
- August 14, 2000

2.2 Background

The Buydown Program provides consumer-based buydown incentives for certain emerging renewable electric generation technologies. The incentive structure of the Buydown Program is designed to facilitate the development of a more vibrant market for renewable-fueled on-site generation systems by reducing the net costs incurred by consumers. The increased sales of these emerging systems will then encourage upstream market participants (equipment manufacturers, retailers, and installers) to expand their business activity and thus reduce their costs over time. Reductions in incentive fund levels over time will foster the development of a self-sustaining market for the targeted emerging renewable generation technologies. The total program funds, qualifying technologies, and the incentive structure of the program is summarized below.

2.2.1 Program Funds

SB 90 allocated 10% of the total $540 million in the Renewable Resource Trust Fund to the Emerging Renewable Resources Account. As directed, the $54 million allocated to this account funds the multi-year Buydown Program to foster the development and adoption of emerging, renewable-fueled electricity generation systems.

2.2.2 Qualified Technologies

The Buydown Program covers photovoltaics, solar thermal-electric, fuel cells, and small wind turbine technologies. In the context of the Buydown Program Guidelines and this current evaluation, the following definitions apply:

- *Small* projects are those considered having a rated output less than or equal to 10 kW,
- *Medium* projects have greater than 10 kW but less than or equal to 100 kW rated output, and
- *Large* projects have greater than 100 kW rated output.

Among other requirements, generating systems must exhibit the following to be eligible for program funds:

- Systems must be connected with the utility electrical grid,
- Systems must be accompanied by a minimum full five year warranty if installed by a contractor, and a limited five year warranty if owner installed, and
- Systems must be installed by a licensed contractor, unless installed by the purchaser, and must be installed in accordance to the manufacturer's specifications and must comply with all applicable electrical codes and standards.

2.2.3 Incentive Structure

As previously stated, the funds allocated to this account are paid out in the form of incentives to consumers.[1] Table 2-1 summarizes the Buydown Program's current declining block incentive structure. As shown, the $54 million of total available funds is divided into five funding blocks; the total funds for each block must be reserved before the funds in the next block become available.

Table 2-1: Emerging Renewables Buydown Program Incentive Structure Summary

Program Criteria	Funding Block					Total
	1	2	3	4	5	
Total Program Funds (million $)	$10.5	$10.5	$10.5	$10.5	$12	$54.0
Min. 60% reserved for *small systems £ 10 kW*	$6.3	$6.3	$6.3	$6.3	$7.2	$32.4
Max 25% reserved for *systems > 100 kW*	$2.6	$2.6	$2.6	$2.6	$3	$13.5
Max 40% reserved for *systems > 10 kW*	$4.2	$4.2	$4.2	$4.2	$4.8	$21.6
Max. incentive per watt of system output	$3.00	$2.50	$2.00	$1.50	$1.00	
Max. buydown as a percent of total eligible system cost	50%	40%	30%	25%	20%	
Min. kW covered by the Buydown Program	3,500	4,200	5,250	7,000	12,000	32,000

The amount of payment an eligible system can receive is a function of the funding block available at the time of application review/reservation, project output, and total eligible system costs. Important elements of the incentive structure that serve as the basis for a significant portion of this evaluation are summarized below.

- Incentives awarded to individual projects are a function of the system capacity and total system costs. In particular, the program will pay the lesser of a maximum percentage of total system costs or a maximum amount per watt of output. At the onset of the program (Block 1), the program paid up to 50% of a project's total eligible system costs, or $3.00 per watt. In the final phase of the Buydown

[1] Note that incentives may be paid directly to the retailer; however, the Buydown incentive must directly and exclusively reduce the cost of the eligible system, or the electricity produced by the system.

Program, the program will pay up to 20% of total system costs, or $1.00 per watt of output.

- A minimum of 60% of the $54 million must be awarded to small systems having less than 10 kW rated output.
- A maximum of 25% of the funds can be reserved for large systems of greater than 100 kW rated output.
- A maximum of 40% of the funds can be reserved for medium and large systems of greater than 10 kW rated output.
- Incentives can be paid to the system supplier (retailer), to the system purchaser, or to the lessee or lessor of a leasing arrangement.
- Projects in service after September 1, 1998 will be awarded a maximum payment of $500,000 from any funding block and a maximum payment of $1 million for any single project.

Incentive funds were first available in March 1998; and the program is currently scheduled to continue through March 2002.

2.3 Number and Capacity of Program Reservations

A rather practical indicator of the Buydown Program accomplishments is the status of reservations submitted to receive buydown funds. Both the number and the capacity of projects submitted, approved, and ultimately completed indicate successful program marketing. In addition, examining the project status over time at least partly reflects improvement (or deterioration) in program marketing and application processing.

First, it is useful to outline the various stages through which a project passes before it is completed and incentives are paid.

- **Received:** A project application has been submitted to the Commission and is currently being reviewed.
- **Approved/Disapproved:** The Commission program staff have reviewed the submitted application and determined that the project has or has not met the program requirements. A “disapproved” designation can also be used for applications that have been returned to the applicant due to inaction on the part of the retailer or customer in providing all necessary information needed to process the application within 60 days of receipt.
- **Warning Letter/ Extended:** Once approved, projects must be installed and verified as operational within nine months for small projects and 18 months for large projects. A warning letter is sent to an applicant with an approved reservation that is due to expire within 30 days. An extension denotes a reservation that has expired, has been reapplied for, and subsequently received approval.

- **Cancelled:** Following approval by Commission program staff, the system installation was cancelled.
- **Project Completed:** Upon verification of a complete installation, incentives are paid according to the applicable funding block and project output. For a sub-sample of projects, an onsite verification that the system is operational is conducted on a periodic basis by an independent evaluator.

Table 2-2 summarizes the status of all projects submitted to receive Buydown Program incentive funds. As shown, 761 applications have been submitted to receive buydown funds through August 14, 2000. Seventy-three percent (560) of these reservations, representing a total capacity of approximately 4,368 kW have been approved through this date.[2] Sixty-one percent (344) of these applications have been completed with systems installed while 4% of them have been cancelled.

The following summarizes project status according to technology:

- Ninety-percent of all applications submitted to date include PV systems, 79% of which were small systems of 10 kW or less. Seventy-three percent of all PV system applications received have been approved (502 of 688). As shown below in Figure 2-1, nearly 63% of the PV projects that have been approved are now complete, 6.4% have been extended, cancelled, or issued a warning letter.
- Just over 7% of all Buydown Program applications include small wind systems; 52 (88%) of them were approved for the program. Twenty-six of the 52 approved reservations (50%) have been completed as of August and three (5.7%) have been cancelled.
- Only six of the 761 applications submitted to date have been for fuel cell generating systems. Although all six projects were deemed eligible to receive Buydown funds, only two have been completed. The output of these projects is greater than 100 kW. The other four fuel cell projects were cancelled by the applicant.
- Only eight of the 761 applications submitted to date include solar thermal electric generating systems. None of these projects are approved for the Buydown Program.

[2] This refers to any reservation that was approved at some point in the application process. In particular, these include all approved, extended, warned, completed, and cancelled reservations.

Figure 2-1: Approved PV Project Status

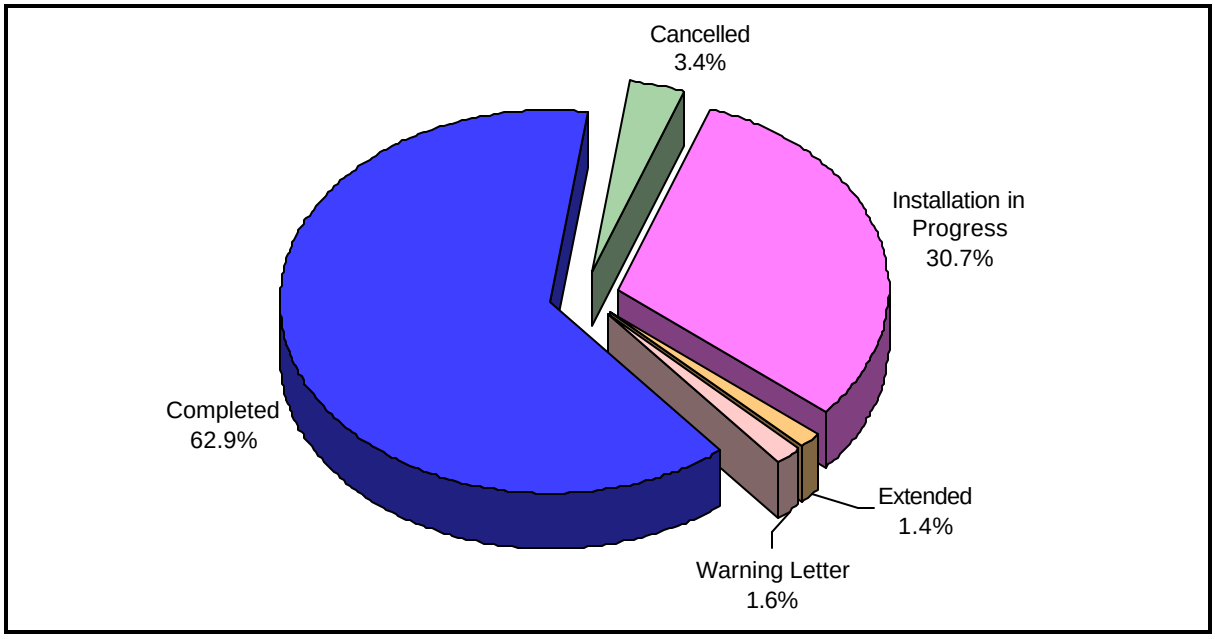


Table 2-2: Buydown Program Reservation Status

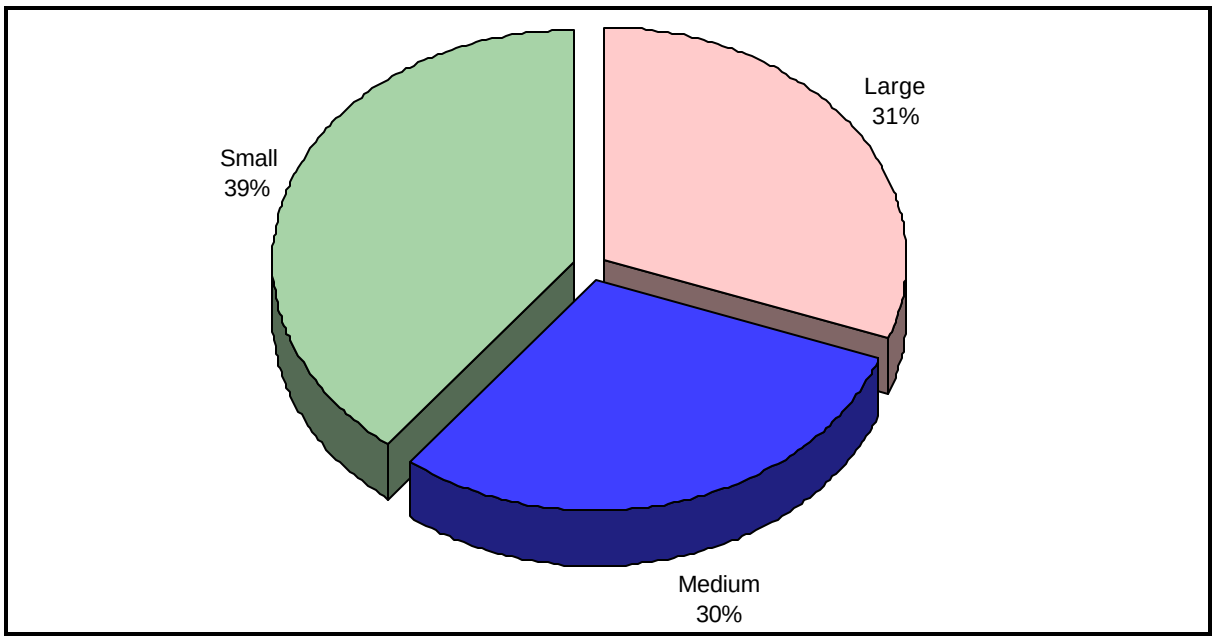
Technology	Size Category*	Status as of August 14, 2000							Total Projects
		Received	Approved	Disapproved**	Extended	Warning Letter	Project Completed	Cancelled	
Fuel Cells	Small	0	0	0	0	0	0	0	0
	Medium	0	0	0	0	0	0	0	0
	Large	0	0	0	0	0	2	4	6
	Unknown	0	0	0	0	0	0	0	0
	Total	**0**	**0**	**0**	**0**	**0**	**2**	**4**	**6**
Photovoltaic	Small	41	143	36	5	8	300	11	544
	Medium	0	10	104	0	0	15	4	133
	Large	2	1	2	2	0	1	2	10
	Unknown	0	0	1	0	0	0	0	1
	Total	**43**	**154**	**141**	**7**	**8**	**316**	**17**	**688**
Small Wind Turbine	Small	2	21	5	2	0	26	3	59
	Medium	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Large	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Unknown	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Total	**2**	**21**	**5**	**2**	**0**	**26**	**3**	**59**
Solar Thermal Electric	Small	0	0	0	0	0	0	0	0
	Medium	0	0	1	0	0	0	0	1
	Large	0	0	0	0	0	0	0	0
	Unknown	0	0	7	0	0	0	0	7
	Total	**0**	**0**	**8**	**0**	**0**	**0**	**0**	**8**
All	Small	43	164	41	7	8	326	14	603
	Medium	0	10	105	0	0	15	4	134
	Large	2	1	2	2	0	3	6	16
	Unknown	0	0	8	0	0	0	0	8
	Total	**45**	**175**	**156**	**9**	**8**	**344**	**24**	**761**

Projects in the "unknown" size category are those for which applications have been received but net yet approved for the Buydown Program, or projects that were disapproved.

** Very few reservations have been explicitly "disapproved", except for in solar thermal. Most of the disapproved reservations did not move forward because the reserving parties did not provide the required information to accept their reservation.

Figure 2-2 below reveals that small projects with less than 10 kW rated output account for 39% of the total generating capacity of all projects that have been completed or approved to date. This represents 519 small projects (164 approved, 326 completed, 8 warned, and 7 extended projects). Large projects having greater than 100 kW output account for about one-third of the total "approved" and "completed" capacity.

Figure 2-2: Total kW Capacity by System Size



* Includes all approved, completed, warned, and extended projects.

While a current "snapshot" of submitted projects in terms of status and capacity is useful, it is more insightful to track program activity in terms of applications and corresponding capacity through the early life of the Buydown Program. Figure 2-3 depicts the approved and completed projects, by number of reservations and generation capacity, from November 1998 through August 2000.[3] The total number of completed reservations has significantly increased over time (by over 900%). The majority of decreases in *Approved kW* are directly offset by increases in *Completed kW* as projects are installed and become operational.

Table 2-3 presents the number of newly completed projects reflected in each program database used for this analysis. As shown, the project completion rate has increased by nearly five-fold over time, from about four projects to about 19 projects per month between November 1998 and November 1999. The completion rate has since decreased to about 12 projects per month.

[3] Program data was not available for all months in this period. As previously explained, the five program databases provided for this evaluation were used for time series analysis.

Figure 2-3: Number of Projects and Total kW Capacity

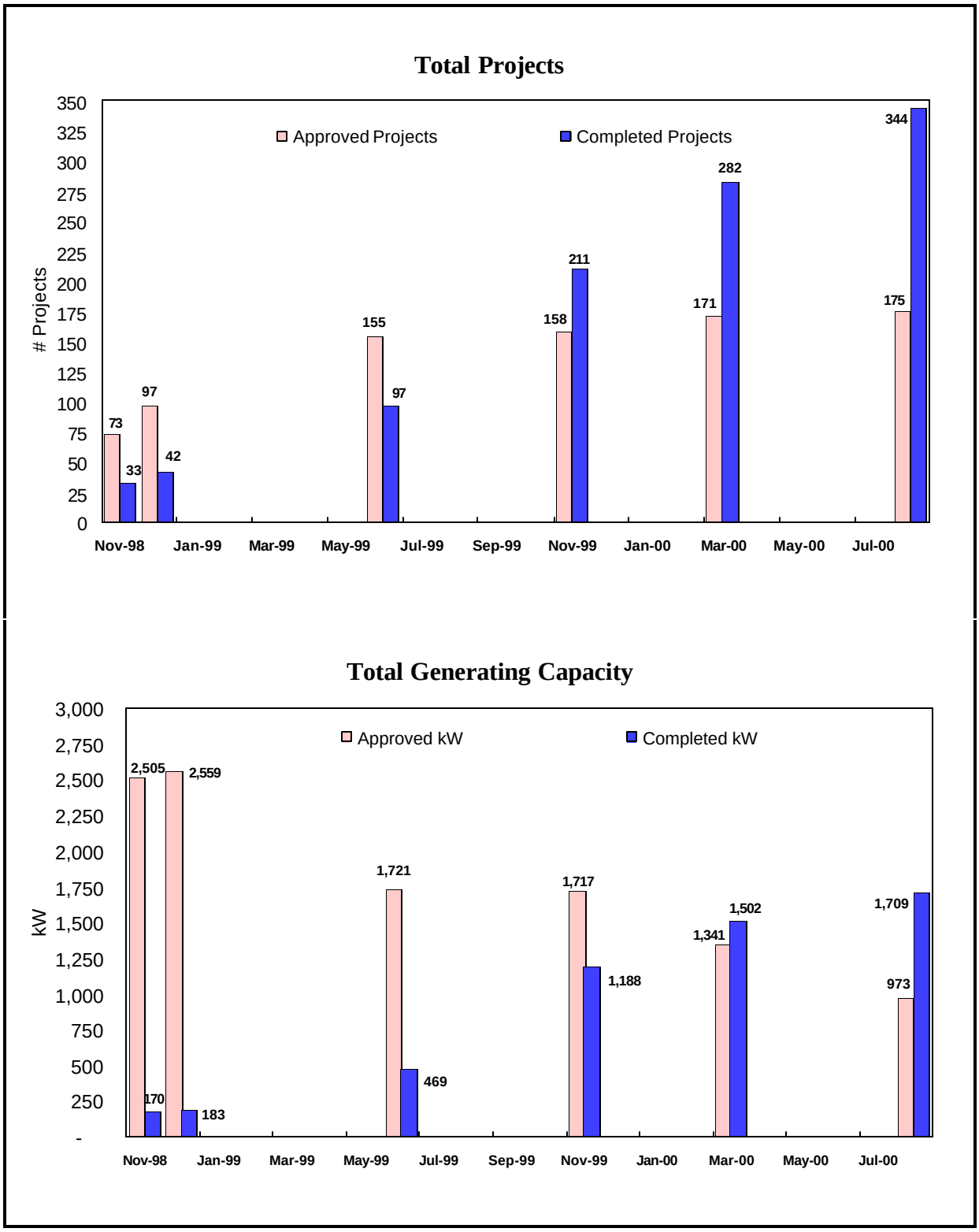


Table 2-3: Project Completion Rate

Date of Buydown Program Database	# of Newly Completed Projects	Average Projects Completed per Month
November 17, 1998	33	4
December 29, 1998	9	9
June 2, 1999	55	9
November 18, 1999	114	19
March 22, 2000	71	18
August 14, 2000	62	12

2.4 Program Expenditures

Expenditures of Buydown Program incentive funds are a direct indicator of the extent to which program goals are achieved. It is most useful here to compare actual program expenditures based upon the funding and incentive structure previously outlined in Section 2 (see Table 2-1). Total reservations and reservations by funding block, eligible system costs, and participant contributions are summarized below.

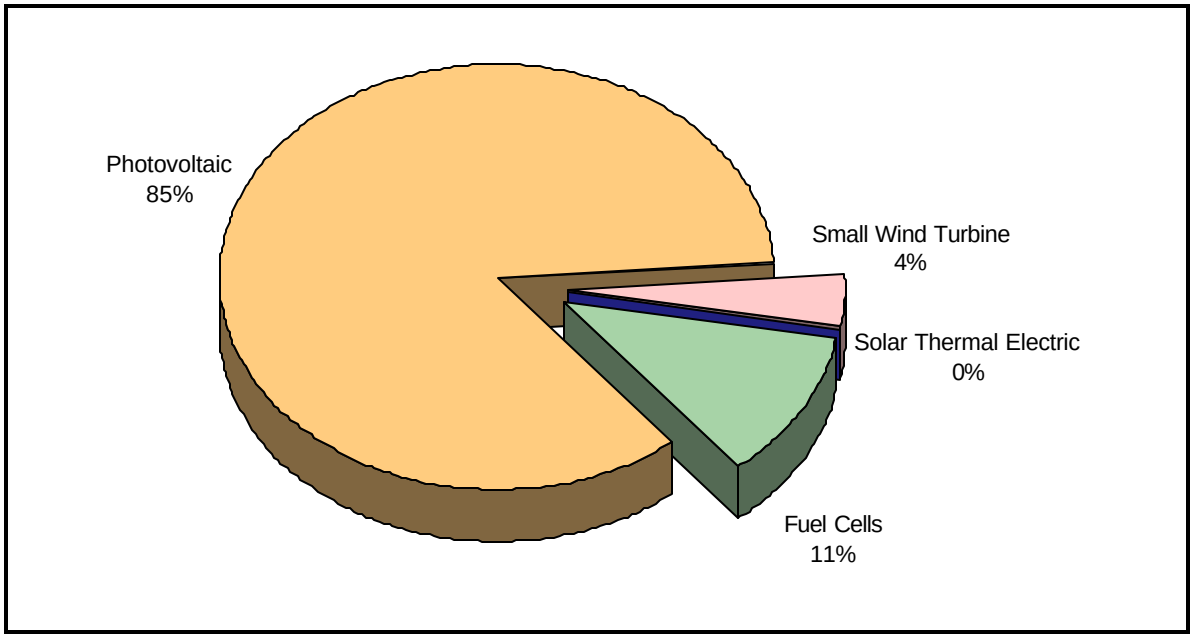
2.4.1 Total Reservations of Buydown Incentive Funds

Table 2-4 and Figure 2-4 present the total Buydown Program expenditures as of August 14, 2000. As shown, a total of over $8.4 million has been reserved and/or paid, or 15.7% of the total account of $54 million. The majority of funds (85%) have been reserved for PV systems.

Table 2-4: Total Buydown Funds Reserved by Funding Block

Emerging Technology	Funding Block		Total
	Block 1	Block 2	
Fuel Cells	$500,000	$458,240	$958,240
Photovoltaic (PV)	$5,335,056	$1,872,533	$7,207,667
Small Wind Turbine	$319,056	$0.00	$319,056
Solar Thermal-Electric	$0	$0	$0
Total	$6,154,189	$2,333,073	$8,487,262
Total Buydown Funds Available	$10,500,000	$10,500,000	$54,000,000
% of Available Funds Reserved	58.6%	22.2%	15.7%

Figure 2-4: Total Buydown Program Funds Reserved by Technology



As explained in previously, at least 60% of the Buydown Program funds must be awarded to systems with rated output of 10 kW or less, and an additional 15% of the program funds in each block are reserved for systems rated at 100 kW or less. Thus, the maximum amount of funding for systems rated at more that 100 kW is 25% of the total funding available for each block and 40% for those systems rated at more than 10 kW. Table 2-5 presents Buydown Program expenditures for each funding block by size (kW capacity output) category. The fourth column of this table includes the total funds reserved for eligible generating projects in each size category for each funding block. The sixth column includes funds available in the funding block corresponding to each Buydown Program size category, and the final column presents the percentage of the available funds reserved (as of August 14, 2000).

Ignoring the figures in parentheses for the moment, these figures show that a maximum of $4.2 million of the $10.5 million is available in Block 1 (40%) for medium and large projects. Just over $2.6 million of Block 1 funds was reserved for medium and large projects, or 62% of the $4.2 million available. As evident, the Buydown Program is now allocating Block 2 funds.

The fifth column of Table 2-5 presents Block 1 funds reserved for projects that were cancelled. As shown, projects accounting for over $1.6 million are cancelled; the majority of these projects were large and medium fuel cell projects. According to Buydown Program managers, these projects were cancelled following the switch over to the lower Block 2 funds for projects having greater than 10 kW rated output. To ensure the cancelled funds would be

fairly allocated to other new projects (given the previous transition to Block 2 funding) , they were effectively transferred for use in the lower incentive level funding Block 2.

The figures in parentheses in Table 2-5 account for the Block 1 cancelled funds. As shown, the total monies available in Block 1 effectively decrease by just over $1.6 million, the funds available for medium and large projects decreases by $1.5 million, and the funds available for projects less than 10 kW rated output decrease by $90,974. As shown, 100% of Block 1 funds for projects greater than 10 kW rated output have been reserved. While it would appear that funds allocated for Block 1 were not exhausted before Block 2 monies began to be reserved, accounting for the Block 1 cancelled reservations for medium and large projects shows that Block 1 funds were, in fact, exhausted before Block 2 funds were accessed.

Table 2-5: Program Reservation Expenditures by Funding Block

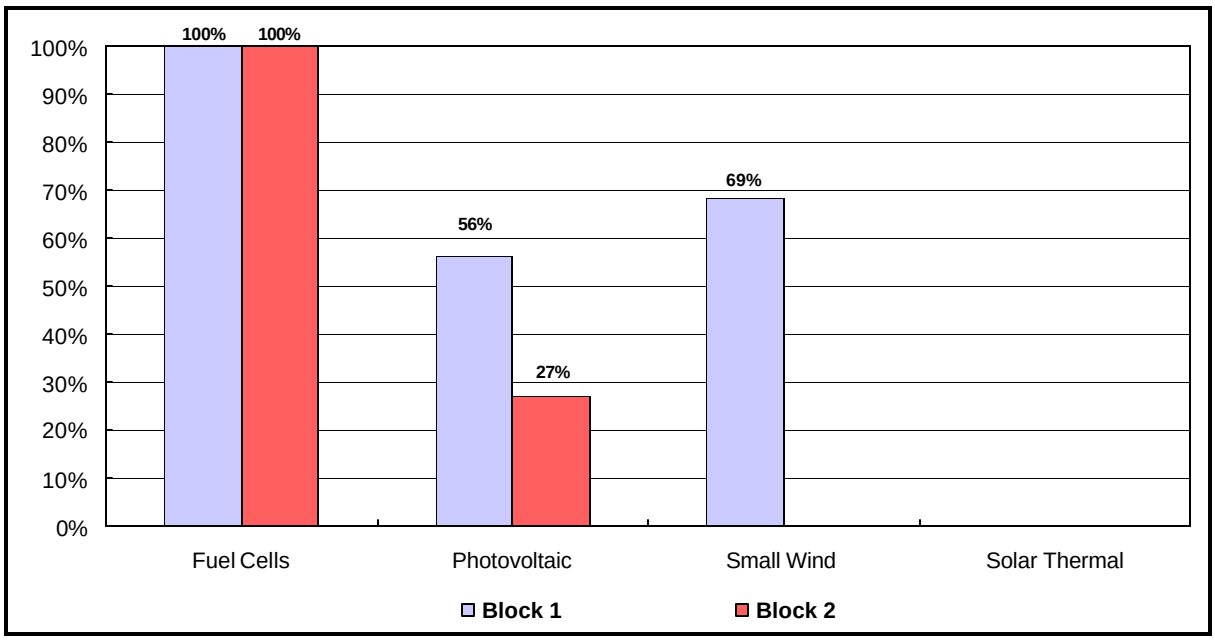
Funding Block	Funds Available in Block	System Size	Total Funds Reserved	Reserved Funds Cancelled*	Funds Available In Block by Size	% of Total Available $ Reserved
Block 1	$10,500,000 ($8,870,232)	Large	$1,799,910	($1,538,794)	$4,200,000 ($2,661,206)	62% (100%)
		Medium	$808,575			
		Small	$ 3,562,672	($90,974)	$6,300,000 ($6,209,026)	56% (57%)
		All	$ 6,171,157	($1,629,768)	$10,500,000 ($8,870,232)	59% (69%)
Block 2	$10,500,000 ($12,129,768)	Large	$710,920		$4,200,000 ($5,738,794)	55% (40%)
		Medium	$1,602,885			
		Small			$6,300,000 ($6,390,974)	0.0% (0.0%)
		All	$2,313,805		$10,500,000 ($12,129,768)	22% (19%)

* Figures in ( ) account for the funds originally reserved in Block 1 that were cancelled after the Buydown Program began to reserve Block 2 funds. To ensure fairness to all participants, the cancelled Block 1 funds were transferred for distribution in funding Block 2.

Currently, reserved funds for small systems total just over $3.5 million, consuming about 57% of the total funds available for small projects within funding Block 1. This amount is only 34% of the total funds allocated for Block 1, which is just more than half of the required 60% minimum. As depicted in Figure 2-5, all of the reserved funds for fuel cell generation systems have been paid to the applicants (in both Block 1 and Block 2), because the funds reserved for the four cancelled systems were returned to the overall Emerging Account. The remaining two approved fuel cell systems have been completed and paid. Fifty-six percent

and 69% of the reserved Block 1 funds for PV and small wind turbine systems, respectively, have been completed and paid out as of August 2000. Twenty-seven percent of the funds reserved for medium and large PV systems in funding Block 2 have been paid to date. Reserved funds that are not yet paid represents approved reservations for projects that are not yet complete.

Figure 2-5: Completion Status - Reserved Funds Paid by Technology and Funding Block



2.4.2 Emerging System Costs and Participant Contribution

As explained previously, the Buydown incentive for a renewable fueled generating system is a function of two parameters: 1) the total eligible system costs and 2) the maximum $ per watt designated for each funding block. The Buydown Program will pay the lesser of: 1) the incentive based upon approved system rated output, or 2) a fixed percentage of the total eligible system cost. The maximum incentive per rated watt of system output for Block 1 is $3.00; the incentive element declines by $0.50/watt in each subsequent funding block until it reaches $1.00 per watt for Block 5. The maximum Buydown as a percentage of total eligible system costs begins at 50% in Block 1 and this incentive parameter also declines for each subsequent funding block (i.e., 40% for Block 2).

Across all emerging technologies, the average Block 1 funds reserved as a percentage of total eligible system cost is 32%; and the average Block 2 funds reserved as a percentage of total system costs is 35%. This corresponds to an incentive of $2.92 per watt for projects receiving Block 1 incentives and $2.41 per watt for those in Block 2, implying that overall costs have come down slightly.

Figure 2-6 through Figure 2-8 disaggregate the program and participant contributions for each technology and funding block to date. Figure 2-6 includes the weighted average of reserved funds per watt of rated output and Figure 2-7 the weighted average amount reserved as a percentage of total eligible system costs. Figure 2-8 summarizes the participant contribution relative to the portion of total system costs per watt.

In both Block 1 and Block 2, participants that have installed PV systems have been paid the maximum dollar value per watt of rated capacity of their system allowed in their respective funding block. In funding Block 1, the average incentive paid $3.00 per watt in Block 1 and $2.49 per watt in Block 2. This corresponds to an average PV system Buydown of nearly 31% of total eligible system cost for both Block 1 and 34% in Block 2. The average incentives paid per watt for fuel cells is 50% and 40% respectively for Blocks 1 and 2. The average Buydown for small wind turbine systems is 47%.

PV systems have been by far the most popular emerging technology since the inception of this program, despite the fact that, on average, participants installing PV systems pay more per watt of capacity as compared to the other systems. In particular, the average price per watt that each Block 1 participant pays is $6.73 for PV systems, compared to $2.68 per watt for fuel cell systems and $2.59 per watt for small wind turbine systems. Due to decreasing costs of the larger systems (medium and large) reserved under Block 2, the average participant contribution per watt capacity of PV systems actually falls to $4.93.

Figure 2-6: Average Funding Reserved per Watt of Capacity

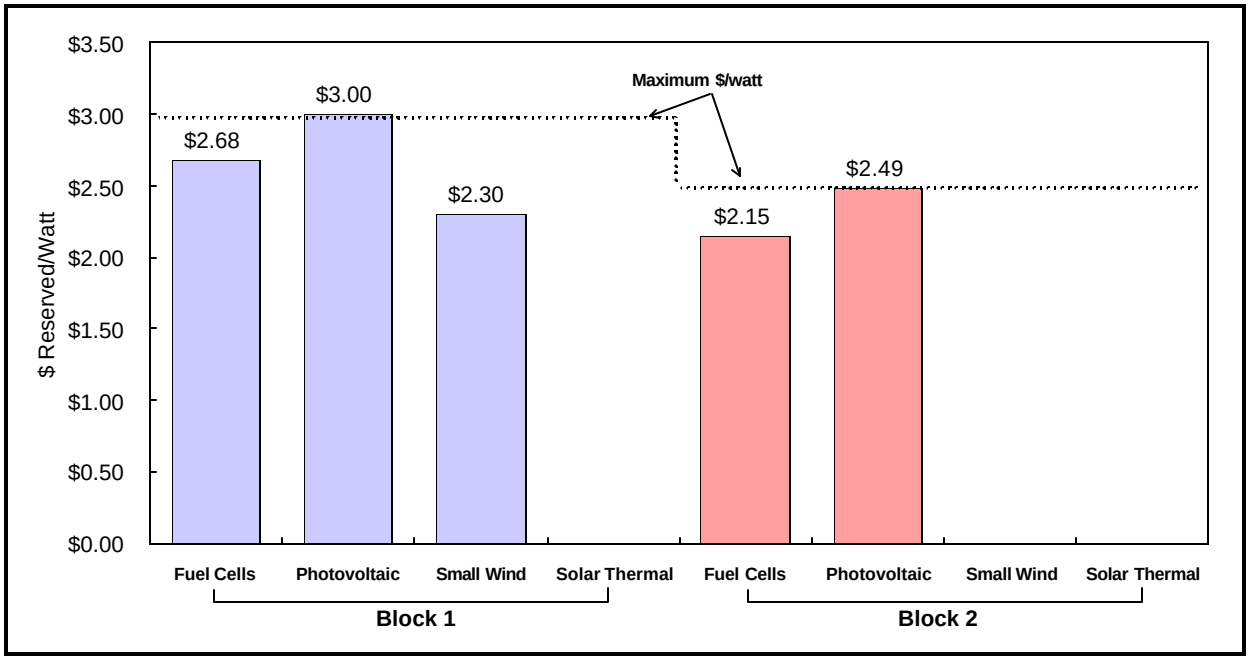


Figure 2-7: Average Funding Reserved as a Percent of Total System Cost

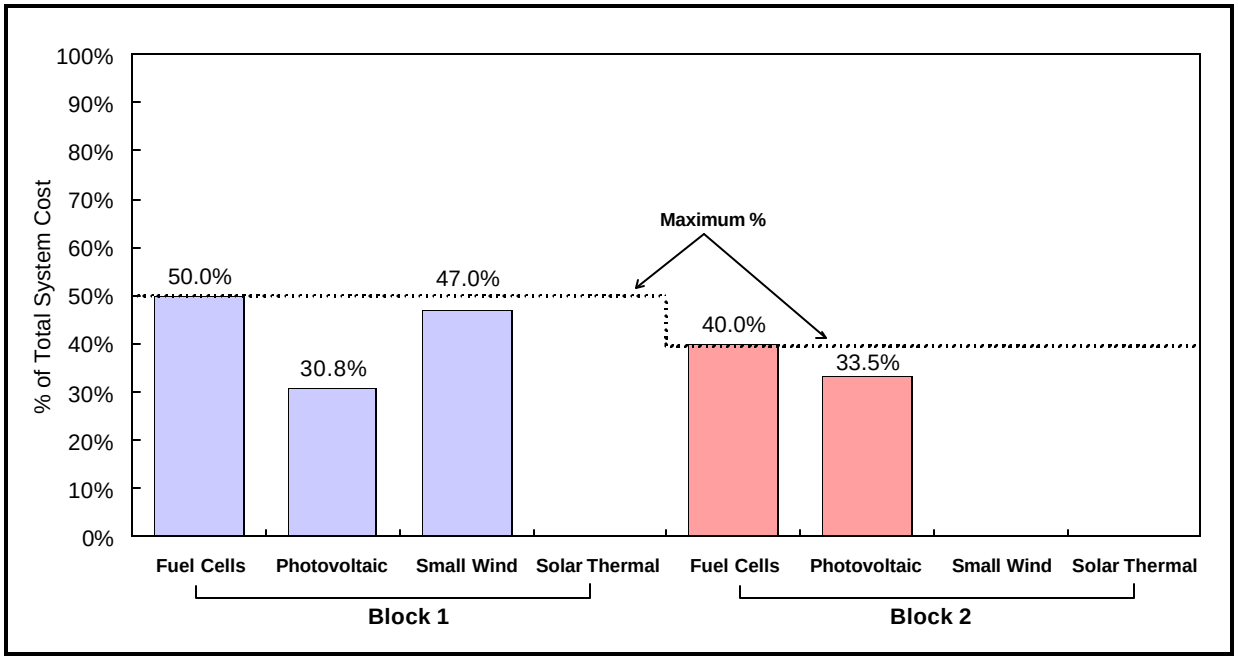
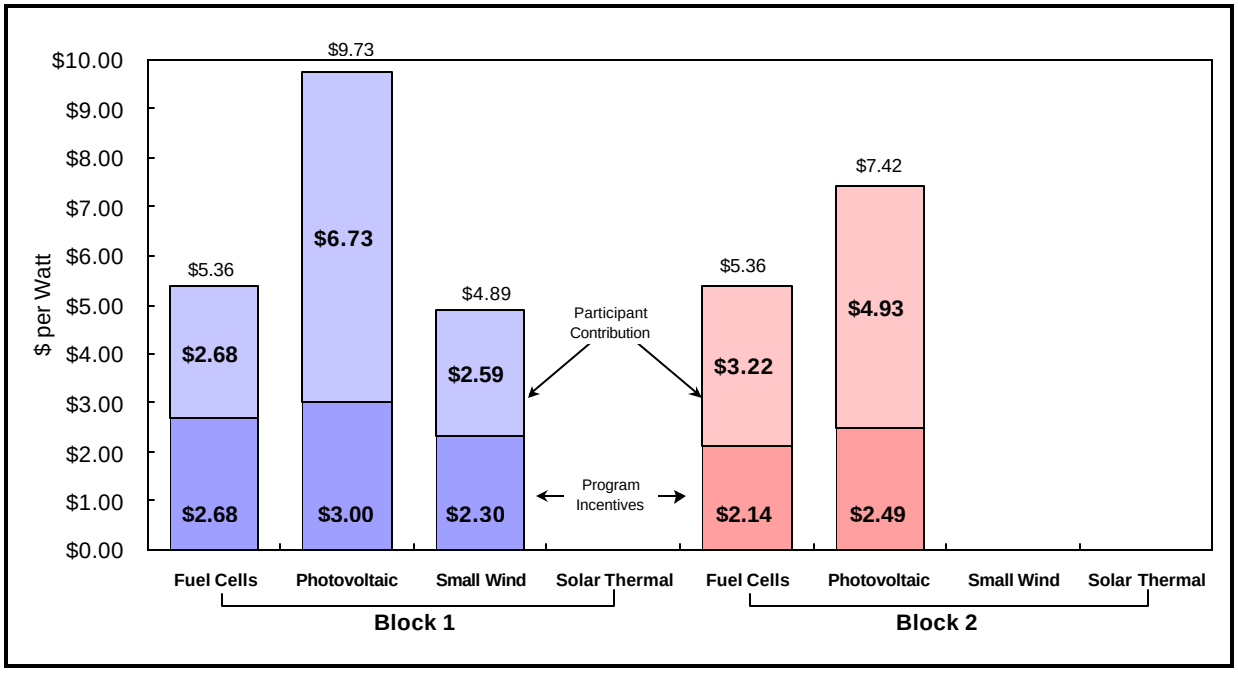


Figure 2-8: Participant Contribution vs. Program Incentives



* Totals above columns indicate average total eligible system costs per watt.

2.5 Market Development

The Buydown Program's characteristics and incentive structure are designed to reduce costs of renewable-fueled generation systems faced by consumers. The resulting increased demand for such systems should have a ripple effect through the marketplace, fostering the development of a self-sustaining market for the targeted technologies. Indicators of this phenomenon are the existence of businesses and services dedicated to these generating technologies. Here, we examine the availability of installation contractors and equipment suppliers as another indicator of market development.

2.5.1 System Installation/contracting Suppliers

The existence and increasing number of installation contractors for on-site renewable generation systems in part indicates that a market is developing based upon at least some of the emerging technologies. Furthermore, the existence of contractors whose *primary business* is based upon renewable-fueled on-site electric generation systems indicates that the market is becoming self-sustaining.

Figure 2-9 and Table 2-6 respectively summarizes the percentage and number of projects installed by contractors and system owners. Over half of the projects either have or will be installed by electrical contractors. As shown in Table 2-6, 78% of the total emerging systems approved, extended, warned, or completed were (or will be) installed by contractors.[4] Additional observations include the following:

- As expected, the majority of *Owner Installations* include small systems (99%). None of the large systems and only one of the 29 medium size (10 kW < and < 100 kW) projects were/will be installed by their owners, and nearly 23% of the small systems were/will be owner-installed.
- The bulk (80%) of all PV systems will be/were installed by contractors. Both of the fuel cell systems were installed by contractors and nearly 61% of the small wind systems were/will be installed by contractors.

[4] Projects approved refer to those that are currently approved, warned, completed, or extended.

Figure 2-9: System Installers

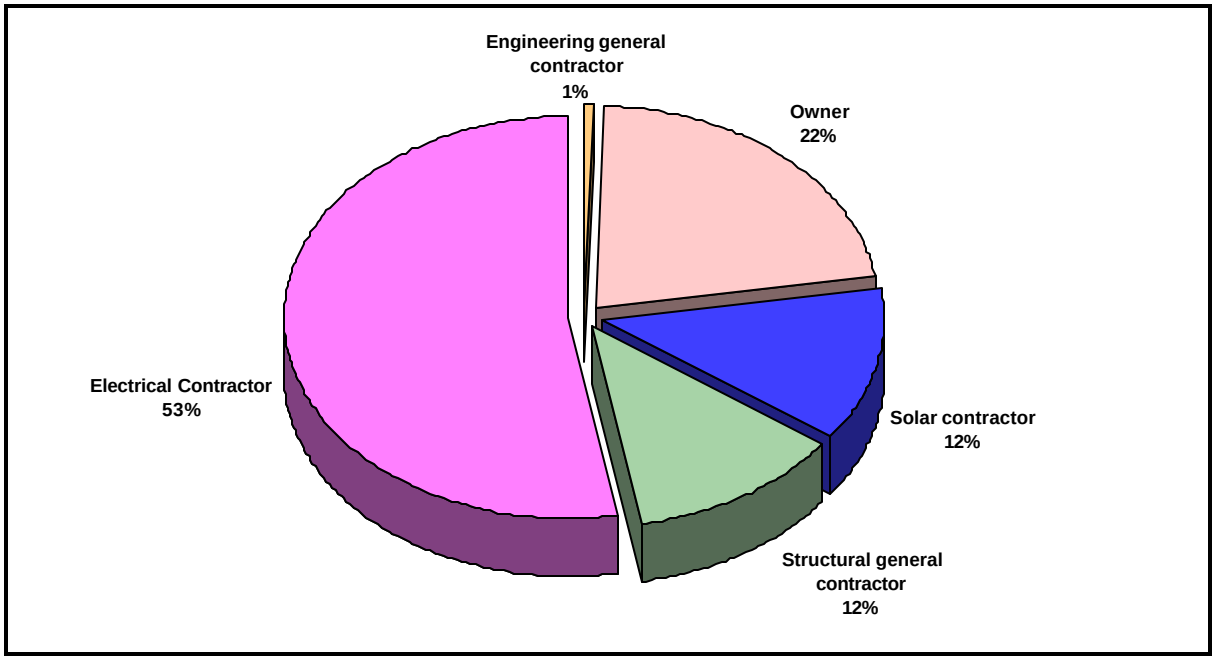


Table 2-6: Emerging System Installers, by Technology

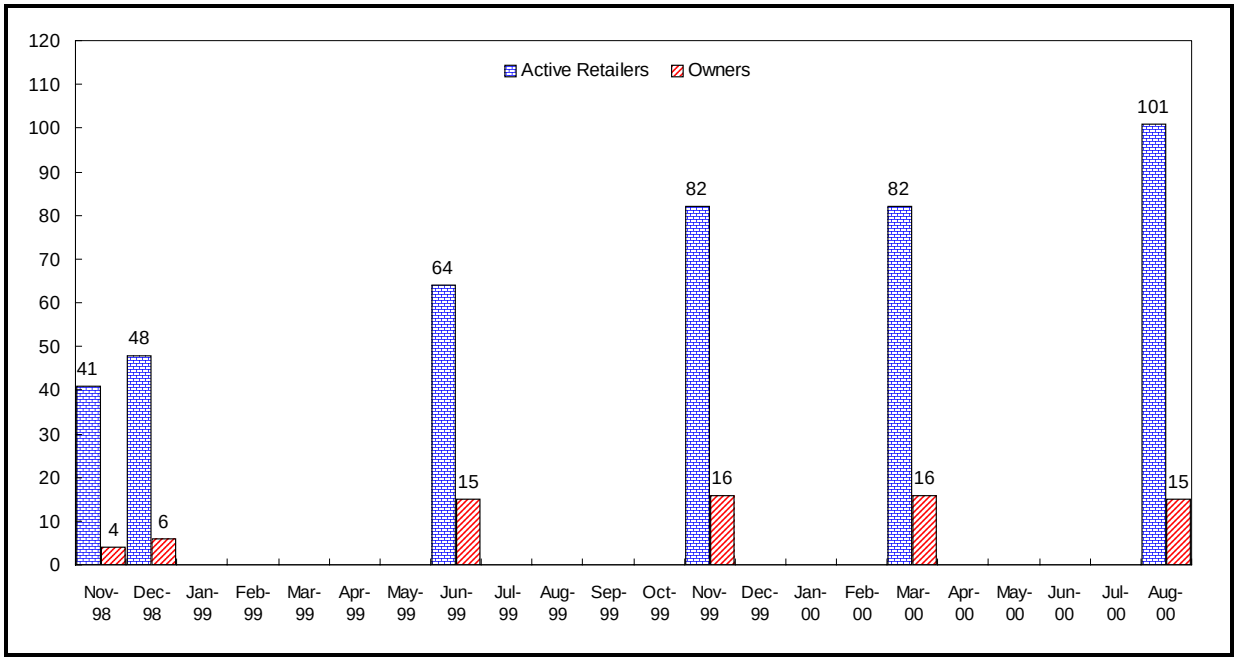
Installer	Fuel Cells	Photovoltaic	Small Wind Turbine	Solar Thermal Elec.	Total
Electrical Contractor	2	265	19	0	286
Engineering General Contractor	0	0	3	0	3
Owner	0	97	19	0	116
Solar Contractor	0	62	6	0	68
Structural General Contractor	0	61	2	0	63
Total	2	485	49	0	536

* Figures include all approved, completed, extended, and warned projects only.

2.5.2 System Supply Market

Figure 2-10 and Figure 2-11 illustrate the number of active system retailers and owner-installers and the number of retailers active in the Buydown Program by geographic region, respectively. As shown, the number of retailers active in the program more than doubled from November 1998 to August 2000 from 41 to 101.[5] Figure 2-11 reveals that, while the number of active retailers has steadily increased in each of the four regions, there are significantly less suppliers operating in the South Coastal region than in other areas of the state.

Figure 2-10: Number of System Retailers and Owner-Installers



[5] In comparison, the number of suppliers registered on the program's web site increased from 72 in July 1999 to only 79 in January 2000. Six months later, 111 suppliers were registered on the Buydown Program website. As of September 2000 there were 113 retailers listed.

Figure 2-11: Number of Active Retailers, by Region

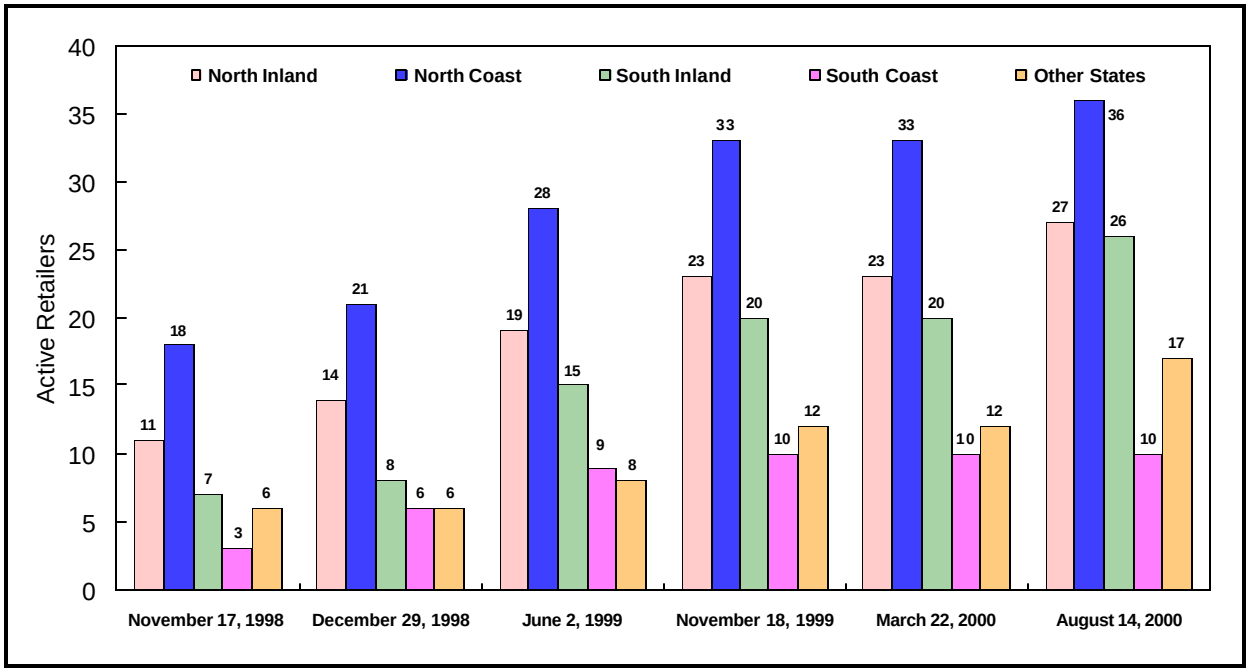


Table 2-7 summarizes the Buydown payment distribution practice to date. The design of the Buydown Program allows the incentive payment to be made either to the retailer selling the system (with a direct pass-through to the customer) or directly to the system purchaser. As shown, incentive funds are to be (or have already been) distributed to the purchaser for 42% of the approved, extended, warned, and completed projects. Note that for small wind projects the owner receives the Buydown incentive about one-half of the time, while for PV only about 2 of every 5 participants receive the Buydown payment directly from the State.

Table 2-7: Payment Summary

	Pay the Purchaser	Pay the Retailer	Total
Fuel Cells	2	-	2
Photovoltaics (PV)	197	288	485
Small Wind Turbines	25	24	49
Solar Thermal Electric	-	-	-
Total	224	312	536

* Figures include all approved, completed, extended, and warned projects only.

Volume IV

3 Qualitative Analysis

The primary objective of the Emerging Renewable Resources Account is to stimulate growth in the emerging renewable technologies market by achieving substantial reductions in the installed cost of eligible technologies directly to end-users. Because of the increased market activity derived from the Program incentives, one would expect that the market infrastructure (i.e., manufacturers, distributors, retailers, installers and service firms) will expand over time. As certain operational costs at each point in the supply channel are of a fixed nature with respect to sales volume, one would expect that the effect would be to reduce the total installed system costs charged to their customers. The belief is that over time the reduction in installed costs for some of the emerging systems, coupled with increased awareness from REP Consumer Education efforts, will have the effect of increasing the number of consumers desiring to purchase these systems. Eventually, the sales will increase to a point where a significant market can develop on its own -- without the need for a market incentive. Clearly, it is unlikely that this scenario will play out for all four of the current Buydown Program technologies – although time and the near-term success in the marketplace will eventually determine the outcome for each.

In this section of the preliminary evaluation report, we address the Emerging Account's level of success to date in achieving this very significant goal. The relevant information available to RER in performing this qualitative review includes:

- Emerging Account Program database output at selected periods in time (per the Program Status review discussed previously),
- Consumer mail survey of residential and business customers implemented in May 1999, and
- Supply channel in-depth telephone interviews

3.1 Reductions in Installed System Costs

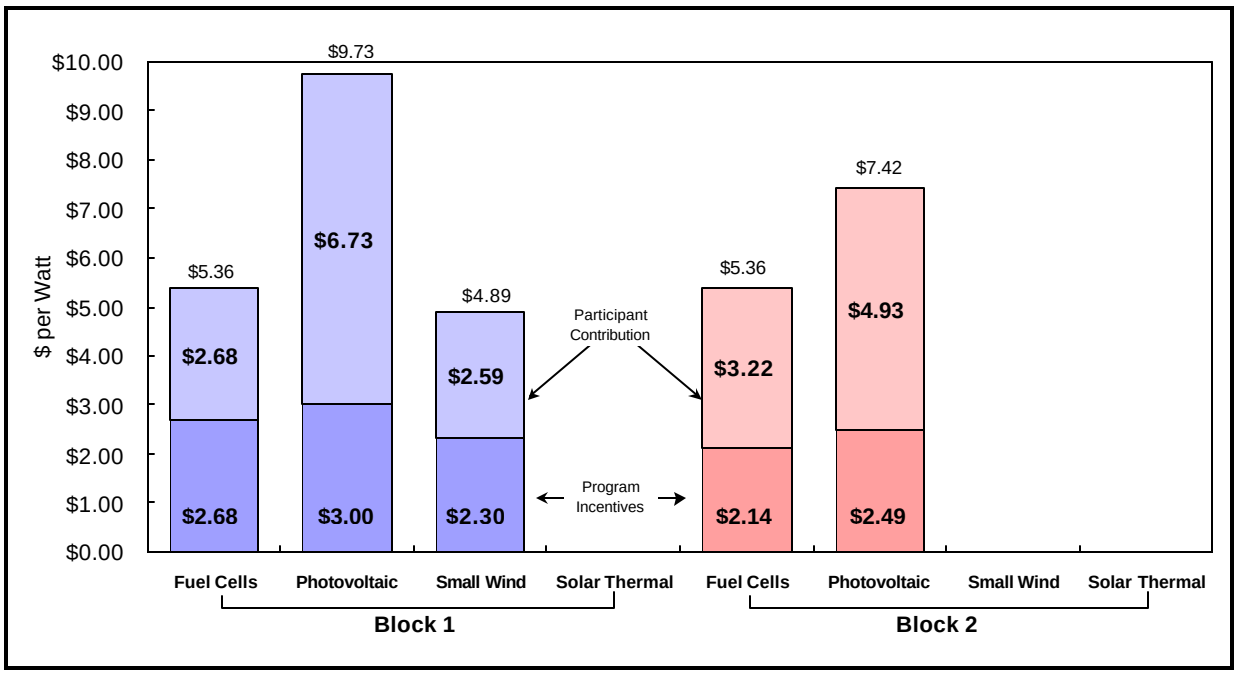
In order to address the question of whether the program has reduced installed system costs to consumers, we must first consider the full context of this key Emerging Account objective. The capital costs of the four Emerging renewable technologies overall are quite high, especially for the most popular of these, photovoltaics. Reported installed retail costs for PV systems range from $4.35/watt for large systems (>100 kW) to over $18 per watt for very small grid-connected systems of only a few hundred watts with battery storage capabilities. At the two extremes, this would imply minimum installed costs for large systems of $435,000 for a 100 kW commercial system, and maximum installed costs of $18,000 for a

one-kilowatt system, at the small end of the size spectrum. Average Block 1 installed costs for PV systems as reported in the Buydown Program database is nearly $9 per watt, or $13,500 for a typical 1.5 kW residential system. This represents a rather significant cost to the vast majority of residential and business consumers in California. In order for a robust market to develop, in pure economic terms, the consumer's perceived value over some portion of the system's life must therefore be greater than the initial installed cost.

3.1.1 Buydown Program's Near-Term Cost Impacts

By design, the Emerging Buydown program has substantially reduced the retail installed cost of emerging technologies by approximately one-third for PV systems to one-half (for most small wind and fuel cells) of the total eligible system cost. As illustrated in Figure 3-1, the Buydown Program funding contribution has been the highest for PV systems, at the maximum allowed level of $3.00 per watt for Block 1 participants and nearly $2.50 per watt for the more recent applicants with medium and large PV systems (> 10 kW) in Funding Block 2. The Buydown incentive has been more significant relative to the total installed cost for fuel cells and small wind at nearly 50% for both in Block 1 reservations, as compared to only 31% for PV. However, the magnitude of the fuel cell and small wind incentive funding on a dollar per kilowatt basis is less than that provided for PV systems at $2.68 and $2.30 per watt, respectively. It should be noted that battery storage components are not eligible for Buydown incentive funds and therefore those systems incorporating back-up energy storage will experience a somewhat lower percentage contribution to the overall (eligible and ineligible components) system cost.

Figure 3-1: Relative Contributions of Buydown Program and System Owner/Participant



* Totals above columns indicate average total eligible system costs per watt.

Note that there has been no approved solar thermal-electric applications received to date in the Buydown program and therefore no direct near-term Program related cost affects to consider.

3.1.2 Inferred Longer-term Cost Impacts to date from the Program

Although the Buydown Program has been in operation for just over two years (since late March 1998), it may be possible at this early point to at least infer whether the Program and other related market/infrastructure changes have begun to impact longer-term costs of the emerging technologies. As presented in Section 2.3, most (85%) of the Buydown funds reserved to date support PV projects. Only two fuel cell projects have been approved, both early in the program. Small wind projects represent only 4% of the reserved funds to date (21 approved and 26 completed projects). PV projects have remained by far the most active, with 43 projects currently in the approval process, 154 approved and awaiting installation and another 316 projects installed and operational.

As there were only two (nearly simultaneous) applications for renewable-fueled fuel cells during the first two years of the Program, there is little useful data to assess in terms of assessing the long-term price impacts for this technology. Given the high variability in site specific and turbine/control system costs and the relatively small number of wind systems approved and installed under the program these past two years, this review of longer-term

impacts to date will focus solely upon the PV market, where the Buydown Program has clearly had the most market influence.

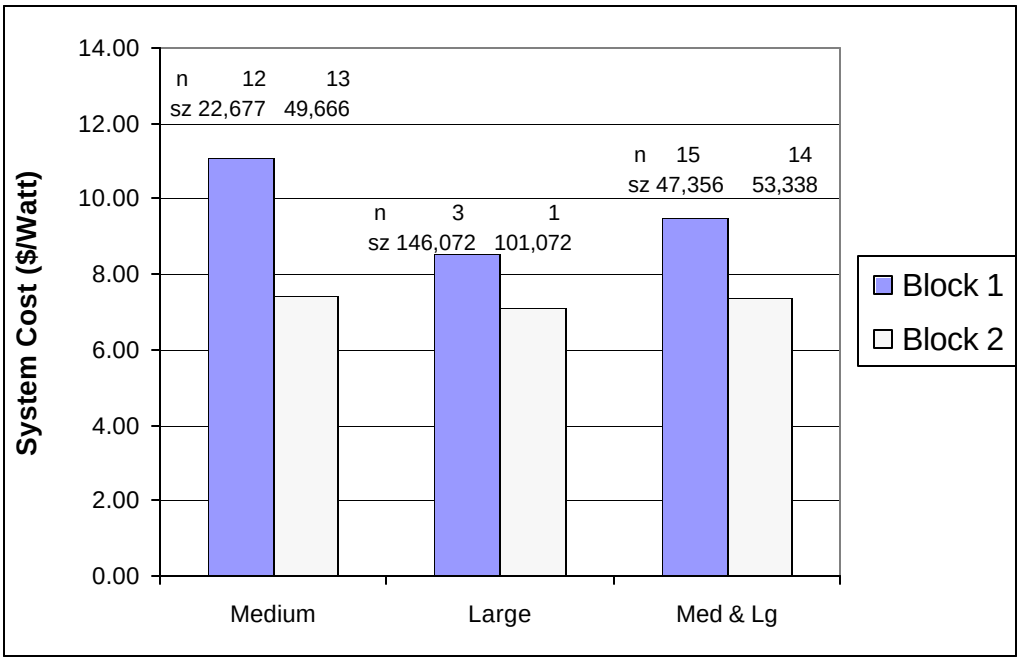
As illustrated in Figure 3-1 above, a simple comparison of total eligible PV system costs between the generally early systems in Funding Block 1 (at $9.73/ watt) and those more recent applications funded at $2.50 per watt under Block 2 (at $7.42/ watt) indicate that the installed costs have been reduced by nearly $2.30 per watt. However, Block 2 PV contains only medium and large systems which skews the cost downwards relative to Block 1 PV, which includes a significant number of higher cost per watt *small* PV systems.

Therefore, this assessment of the longer-term cost reduction impacts for PV to date includes the following approach:

- Eligible Program costs are first segmented by system size category (due to the known variability in small versus medium/large installed PV system costs from previous Buydown Program market research);
- Next, the PV applications are segmented by funding blocks 1 and 2 (to account for both the change in Buydown incentive and in elapsed time (at least for medium and large PV systems). Note that for small systems, there are yet no Block 2 applications as the Block 1 funds have not been fully consumed (nearly 30% of the Block 1 funds remain exclusively for small systems).
- Since small PV systems comprise the majority of the applications at just over 500 (and nearly 40% of the funds reserved) to date, a comparison of the first group of 300 applications with the latter group of 100 applications will be performed to develop a general trend of small PV system costs.

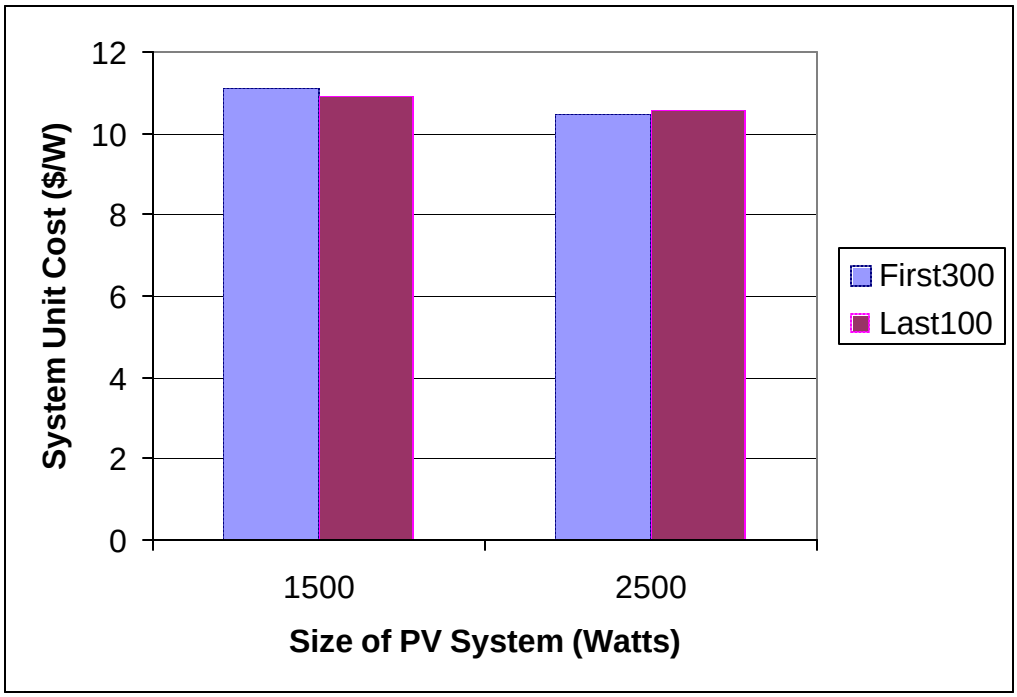
The results of this assessment indicate that the costs for medium and large PV systems have been reduced during the transition of the early applications under Block 1 and those latter applications funded under Block 2. As shown in Figure 3-2, the average total eligible costs for Block 1 medium and large systems is $ 9.49 per watt. Funding Block 2 PV project costs, which first became approved under the Program in August, 1998 (excluding cancelled projects), currently average $7.39 per watt, as of August 2000. This simple comparison of non-small PV project eligible installed costs over approximately the first half of the Buydown program's initial term, indicates that eligible installed costs have decreased (notably) since the beginning of the Program, by an estimated $2.10 per watt.

Figure 3-2: Comparison of Funding Blocks 1 Vs. 2 -- PV Installed Costs (Medium and Large Systems)



The other set of useful market data to assess eligible installed cost trends includes the $3.5 million in reservations approved for small PV systems. Figure 3-3 provides a graphical comparison of these early versus latter approved installed system costs. In comparing the early (first 300) application costs of the small PV systems directly with the more recent (last 100) applications that were approved beginning in early December 1999, we find that small PV system costs have essentially not changed overall since the Program first began.

Figure 3-3: Distribution of Small PV Installed System Costs – Early Vs. Recent Applications



In summary, it appears that the Buydown Program and external market/infrastructure influences in the first two and a half years of the Program have induced some effects on reducing the installed costs of at least the medium and large PV systems in the non-residential market segment. There appear to be little if any changes to date in the cost of small PV systems, primarily installed in the residential sector.

3.2 Emerging Renewables Market and Infrastructure Impacts

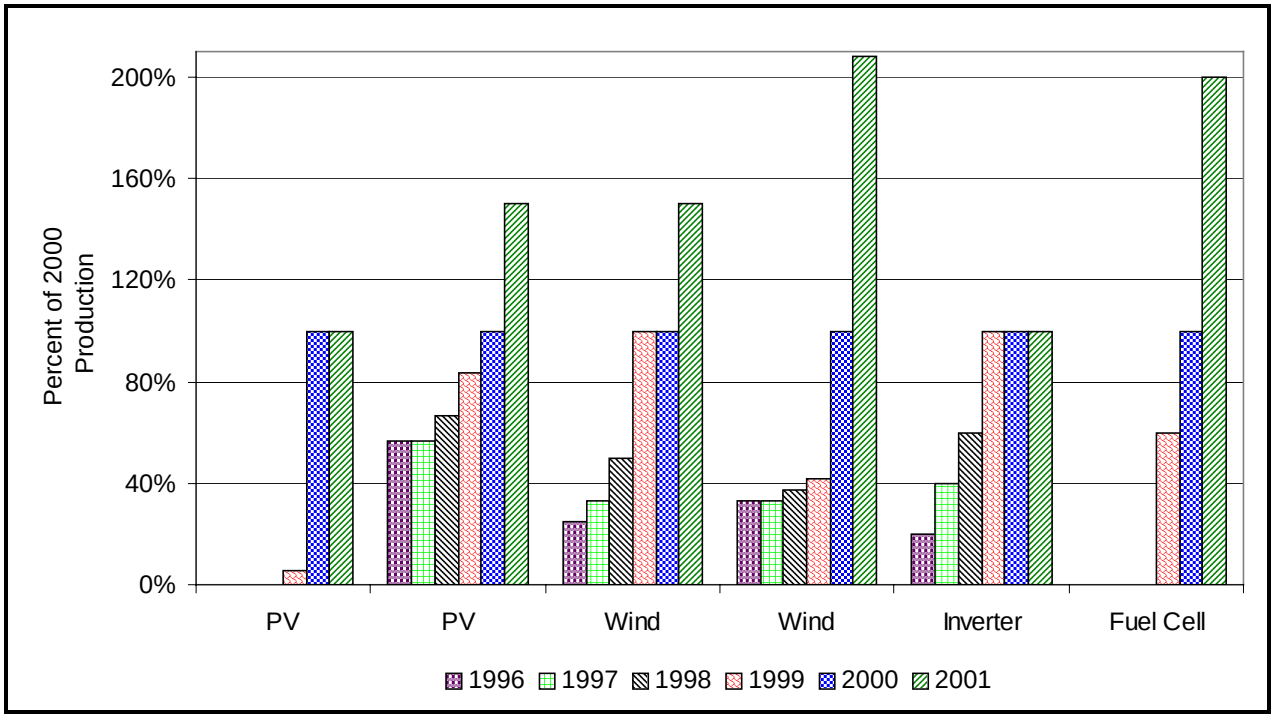
A second set of indicators of Emerging Renewable Resources Account program success is the impacts upon the emerging technology markets and infrastructure. In this section, we address some of these indicators -- as the current Program data and market research information allow. This includes a review of production capacity trends, the availability of suppliers and installers, market expansion, education of consumers and verification/monitoring efforts.

3.2.1 Manufacturer Production Capacity Trends

Eight manufacturers of Emerging technology equipment were interviewed in May of 2000 as part of a previous market research effort in support of the Emerging Account implementation activities. Six of these firms provided their input on recent and planned future production of their equipment to serve their overall market. The emerging technology manufacturers contacted for this research effort had either recently expanded their facilities production, or

they planned to do so in the near future. Figure 3-4 illustrates the previous, current and planned production of equipment from 1996 to 2001, in terms relative to year 2000 production.

Figure 3-4: Production Expansion Plans for Surveyed Renewable Equipment Manufacturers



Because manufacturers sell most of their systems through their dealer network rather than directly to the end user, their knowledge of the deployment and use in California is somewhat limited. Typically, information on end users is obtained from larger system sales, which they might provide directly to the end user or from feedback through their dealer network. Although, this data limitation does not allow for a direct attribution to the State of California Buydown Program, clearly the overall market for the PV and wind emerging renewable technologies appears to be expanding at a rapid rate. The one inverter manufacturer that provided production information to RER indicated that there had been a leveling off of equipment production output by 2000 that was expected to continue through 2001. This is not unexpected, given that emerging renewable technologies currently represent a very small portion of the total power inverter market.

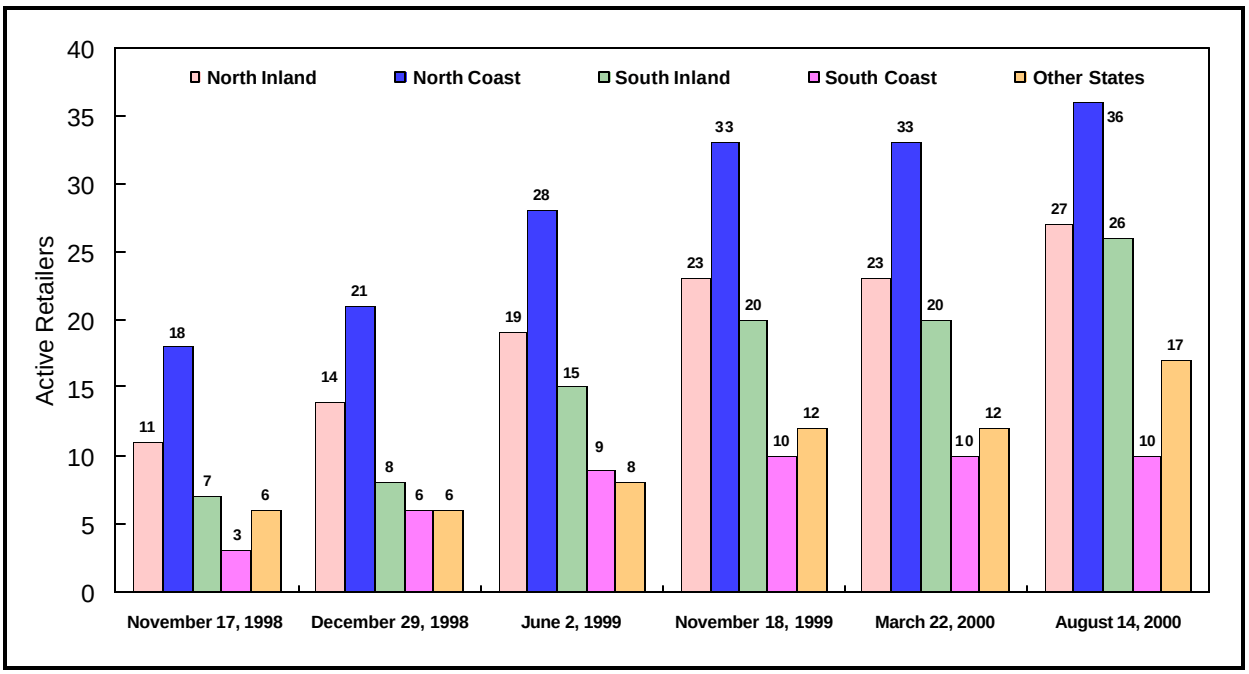
3.2.2 Expansion of Equipment Suppliers: Retailers and Installers

As summarized in Section 2.5 of this report, the number of active retailers marketing emerging renewable technologies has steadily climbed over the evaluation period. In November 1998, there were 41 active retailers and 4 owner-installers included in the

Buydown Program. By November 1999, the number of active retailers generating Buydown reservations had nearly doubled, increasing to 82. As of August 2000, the number of actively participating retailers has increased to just over 100. This constant rise in the activity of new installers coming to the market indicates that the California market is continuing to become more vibrant.

In reviewing the count of retail suppliers by geographic region, the North Coast and North Inland areas of California continue to lead the Southern areas of the state as illustrated in Figure 3-5. However, the number of active retailers in the Southern Inland region have nearly quadrupled since late 1998 and are now close to the retail infrastructure levels in the North Inland areas of the state. Note that there also appears to be some indications of increasing market spillover into other neighboring states, as retailers active in California from these areas have more than doubled since November 1998.

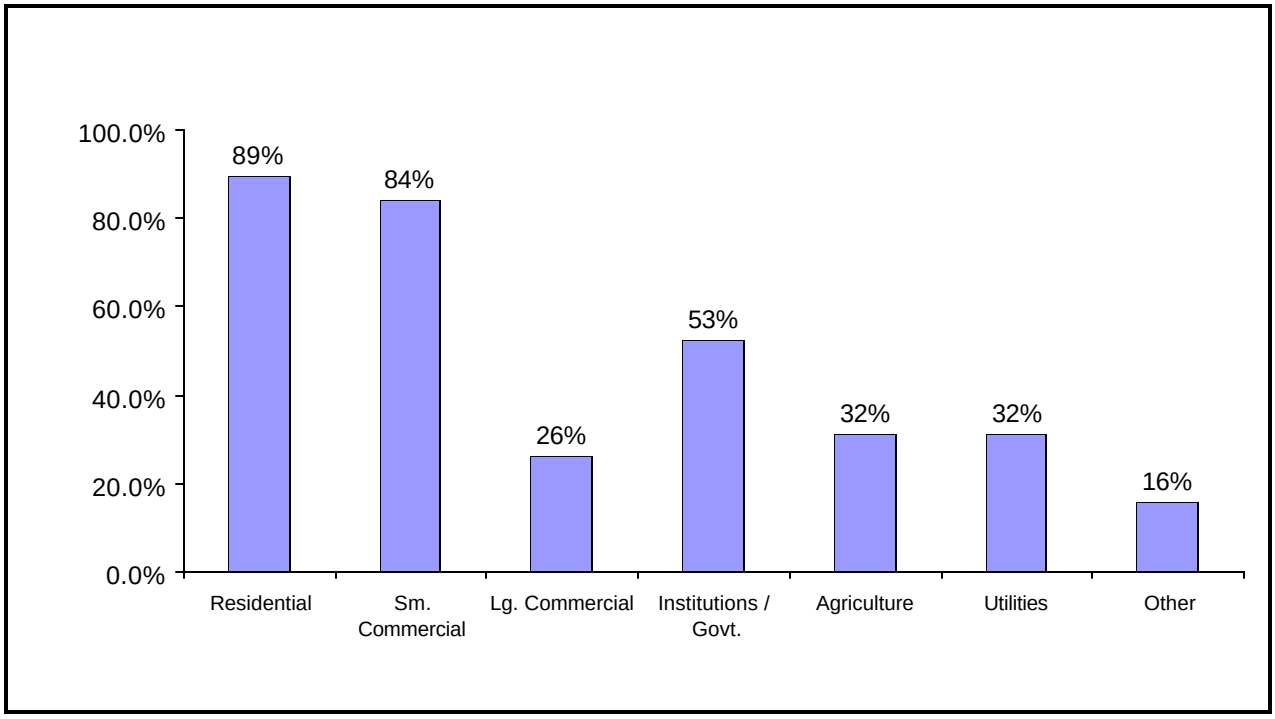
Figure 3-5: Count of Active Buydown Program Retailers by Region



3.2.3 Expansion of Retail Markets

Based upon input from the in-depth supplier interviews, wholesalers and retailers are expanding their markets into several additional segments. Retailer and installer respondents for the most part initially targeted primarily residential and small commercial customers. Figure 3-6 illustrates the surveyed retailers' current distribution targeting each customer market segment.

Figure 3-6: Customer Classes Marketed by Buydown Program Retailers



As shown above, over half of the retailers now also market to government and a third now target utilities (TCU) and agriculture, while a quarter have indicated that they address the large commercial segment. Therefore, it appears that the Buydown Program has helped retailers and wholesalers to expand their product marketing activity beyond the residential and small commercial market segments.

3.2.4 Education and Market Research Support to Consumers Retailers, Installers, Permit Agencies/Building Inspectors

The Emerging Account has been responsible for implementing a number of Stakeholder research and related education activities in the first two years of its existence. This infrastructure support has included:

- certification of eligible system components;
- targeted market research of general consumers, current end-users and supply channel stakeholders;
- on-site review, verification, and troubleshooting of PV and small wind systems; and more recently,
- longer-term monitoring of PV, wind and PV/wind hybrid systems.

Each approved PV Module and inverter component has been independently reviewed and certified for component specific energy output under specified test conditions (PTC) for all listed manufacturers and models numbers in the Buydown Program. Given the results of the monitoring efforts to date, it should be noted that this certification process cannot effectively include the effects of other whole system losses, only at the component (i.e., module level). This performance de-rating process for standard test conditions has had the effect of improving consumer understanding of the expected component performance.
A second area of infrastructure support the Buydown Program has provided to consumers and retailers/installers is the independent on-site verification and spot performance testing of a sample of systems installed under the Buydown Program. These efforts have provided some useful insights into the emerging infrastructure/market. First, is the apparent lack of any real understanding of instantaneous or cumulative emerging system performance (energy output) by most all system purchasers. System owners either don't have access to any kW output information (due to lack of a readout device), or they don't understand how to access (or decipher) this information if they do have such readout devices included somewhere within their system (usually if a device exists, it will be included within the inverter).

When a system is identified in the field that requires further attention, due to a performance or safety concern, the Buydown Program has provided on-site system troubleshooting services to the participant and their retailer/installer. Early in the Program installation problems were noted by a number of users, even among those having their system professionally installed by electrical/solar contractors. The Buydown Program is now beginning to support such infrastructure education assistance to Permitting Agencies/Building Inspectors, retailers/installers and owner-installers through the Renewable Energy Program technical support contract. These emerging technology infrastructure education efforts should continue as long as they remain needed, to ensure that all market barriers are eliminated as soon as possible in support of a sustainable market in the future.

Volume IV

4 Impact Analysis

4.1 Overview

One measure of program success will be the extent to which program activities increase the number of installed systems and the quantity of electricity produced by those onsite renewable technologies in California. While there are several ways to estimate this impact, the most straightforward approach involves estimating the electric production of equipment for which Buydown incentives are issued. This section of the evaluation documents an impact analysis of this type. In the future, these results may be compared to results of impact analyses based on a more general examination of renewable technology markets in California.

This interim analysis of Emerging Buydown Program impacts covers only those projects that have either been completed or were in progress as of August 14, 2000. Electric system energy and demand impact analysis results are expressed in terms of total and per-unit kWh/year and kW, respectively. Reported demand impacts are based on power production levels that can reasonably be expected to occur at the time at which system loads reach their annual maximum, or peak MWs. Savings resulting from transmission and distribution system loss reductions are not included in this analysis, however.

4.2 Data Sources

Principal data sources used in this impact analysis include the program tracking database, verification data collected during post-installation onsite visits, interval-metered data being collected from a sample of photovoltaic systems, and monthly solar radiation data from the California Irrigation Management Information System (CIMIS).

The program tracking database contains key project details for every project covered by the Emerging Account. Technology type, system size, installation location, project status, rebate magnitude, and total project cost are tracked for every project for which a buydown reservation or request form is received.

Onsite verification visits were conducted at a sample of sites. Most of these sites included only photovoltaics, although several included PV/Wind hybrid systems. While on site the verifier confirmed equipment was installed and operating properly, made spot-measurements of system performance, and documented system configuration details. Verification work is documented in detail in *Draft Final Report, On-Site Verification, Phases One and Two*.

Interval-metered energy production data collected from photovoltaic systems operating in California were used in the analysis of program impacts. Results of analysis of these data were applied to tracking system data to estimate program impacts. Metered data were available from two sources. The first source is data from the Utility PhotoVoltaic Group (UPVG) in conjunction with its Building Technology Experience to Accelerate Markets in Utility Photovoltaics (TEAM-UP) program. Many TEAM-UP projects in California's investor-owned utility territories also received support through the Buydown program. The second source is interval-metered data from fourteen additional systems in the Buydown program, collected by RER under contract to the Commission and DOE.

Solar radiation data downloaded from the California Irrigation Management Information System (CIMIS) website were used in combination with Typical Meteorological Year (TMY) radiation data to insolation normalize metered energy production data from photovoltaic systems.

4.3 Analysis Methods

Impact estimates are based on a combination of engineering algorithms, simulation models, and findings of analysis of interval-metered data. Data availability and program activity considerations governed approaches selected for each renewable technology covered by the Emerging Buydown Account. Specific methods utilized for each of these technologies are summarized below. Detailed algorithms are included as Appendix A.

4.3.1 Photovoltaics

Several sources of data are available and were used in the analysis of photovoltaic system impacts. The characteristics of these sources, which are summarized in Table 4-1, play a determining role in the specification of impact analysis methods.

Table 4-1: Characteristics of Available Data Sources

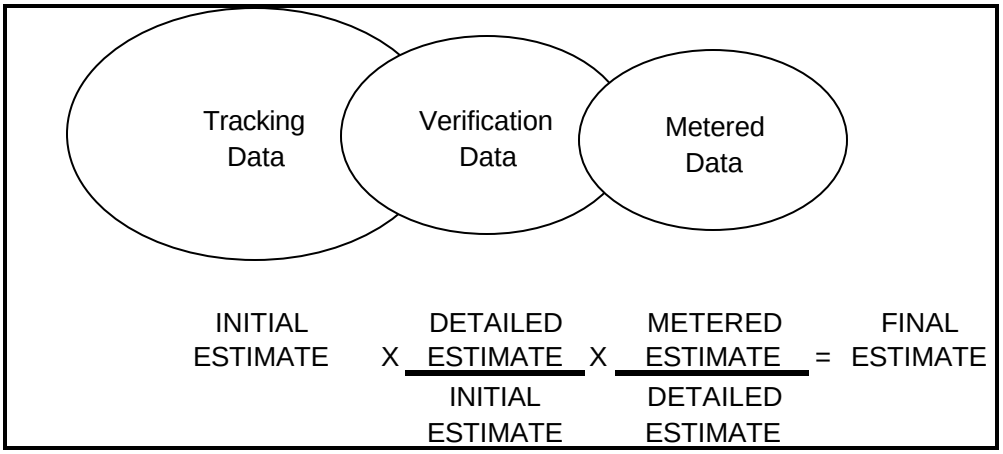
	Data Source		
Characteristic	**Program Database**	**Verification Data**	**Metered Data**
No. Sites	All	Medium	Few
Detail	Low	Medium	High
Cost	Low	Medium	High

While accuracy would be maximized by metering all projects, the cost to do this would be prohibitive. The challenge then is to apply findings of analysis of available detailed data to the wider population of program participants. In this analysis the link between metered data and program tracking database data was established with calculated results based on verification data. This approach incorporated, to the greatest extent practicable, site-specific configuration and actual in-field performance information into the analysis.

The general approach used for both energy and demand calculations is summarized in Figure 4-1. Analysis of verification and metered data results in ratios that, when multiplied by initial impact estimates based on tracking system data, yield final estimates. Separate ratio adjustment factors were calculated for small (less than 10 kW) systems with battery storage, small systems without battery storage, and larger systems without batteries.

A simulation tool was used to calculate initial and detailed energy estimates based on tracking database and verification data, respectively. Engineering algorithms were used to calculate initial and detailed demand estimates. Metered estimates were based on measured electricity production, and were adjusted to account for differences between typical solar radiation and radiation received during the period of data collection.

Figure 4-1: Illustration of Ratio Analysis



4.3.2 Energy Impacts

Initial energy impact estimates were based on site-specific application of PVWATTS, NREL's grid-tied photovoltaics analysis tool. This simulation tool calculates annual energy production estimates based on system capacity, configuration, and geographic location. PVWATTS is capable of estimating impacts for 10 locations in California. Purchaser zip code from the program tracking database was used to identify the PVWATTS weather station closest to the installation location. System capacity values used to calculate initial energy impact estimates were based on system size (kW) data from the program tracking database. System configuration default values used to estimate initial energy impacts are identified in Table 4-2.

Table 4-2: Configuration Default Values – Initial Estimates

Parameter	Default Value
Azimuth	South Facing
Tilt	Fixed at Site Latitude

For verified sites additional system configuration and type details were available and were used to calculate detailed energy impact estimates. The additional data elements are identified in Table 4-3.

Table 4-3 Verified Data Elements

Verified Parameter
Azimuth & Tilt
Fixed Tilt versus Tracking
Battery versus No Battery

Initial and detailed PVWATTS results for the verified sites were used to calculate a factor (VERIF) that adjusts initial results based on system configuration and type characteristics exhibited by a representative sample of Buydown program participants.

For metered sites, PVWATTS was again used to calculate detailed energy impact estimates. Metered data were used to determine actual energy production under observed conditions. Lifecycle cost-effectiveness calculations require impact estimates based on typical weather conditions, however. For each month for which metered data were available, a ratio of typical to observed solar insolation was calculated and applied to raw metered data to yield a result suitable for life-cycle performance analyses. Detailed PVWATTS results and insolation-normalized metered results were used to calculate a factor (METER) that adjusts detailed PVWATTS results based on actual, in-field energy production demonstrated by a sample of operating photovoltaic systems.

Demand Impacts

The approach used to calculate demand impact estimates was identical in kind to that used for energy impact estimates. However, engineering algorithms were used instead of PVWATTS to calculate initial and detailed impact estimates. Definition of the basis of demand impact estimates must also address the issue of coincidence of photovoltaic system production and electric transmission and distribution system loads that govern system operation and expansion decisions.

The electric system peak is likely to occur anywhere between May and October, while renewable system output is by nature variable and seasonal. Interval-metered data collected

from 23 PV systems were used in combination with California Independent System Operator (ISO) data for the Summer of 2000 to estimate the impact of PV systems on transmission and distribution system peak loads. First, CIMIS weather data were used to identify particularly hot days during the Summer of 2000. Next, actual ISO system hourly loads for these days were examined and the hour of system peak was identified. The average load during these seven late afternoon hours was 42.3 GW, which compares to a total ISO system capacity in the neighborhood of 45 GW. Finally, interval-metered data were analyzed to determine the contribution of PV systems to meeting these peak ISO loads.

4.3.3 Wind Systems

An engineering algorithm was used to estimate wind system impacts. While several participating wind systems were verified, and interval-metered data are being collected from two sites, these data are insufficient to support estimation of impacts for all participants. Wind resource magnitude is a very strong function of local conditions so measured data from a larger sample would be necessary to develop information suitable for application to all other wind projects.

Average annual wind speed is the most important wind system algorithm input because wind system power varies with the cube of wind speed. Uncertainty in average wind speed estimates is therefore amplified considerably in energy production estimates. In this analysis published wind resource data were used in combination with installation location to estimate average annual wind speeds.

This approach attempts to capture gross effects of regional wind speed variability (e.g., wind machines in Tehachapi are assigned higher annual average wind speeds than those in the Central valleys). However, for any given wind system local influences on the wind resource (e.g., topography, trees, buildings) may be just as important as regional effects. For this reason it is particularly difficult to estimate wind system impacts accurately without relatively detailed information concerning local conditions. The modest participation levels being experienced at this time do not justify the expense of additional data analysis and collection if the primary interest is in improving the accuracy of program-level impacts.

Energy Impacts

An engineering algorithm was used to estimate annual energy production of wind systems. The general approach is to expand a single, annual average wind speed value into a wind speed probability distribution that yields estimates of the number of hours per year that particular wind speeds will occur. Typical wind system performance characteristics are used to estimate the annual energy production for each of these wind speeds, and total production is calculated as the sum across the distribution of speeds.

Wind resource magnitudes were based on data developed by the SERI for the U.S. DOE. These data are presented as wind class contour maps, where wind classes represent a range of average annual wind speed at a height of ten meters. The distribution of wind class assignments for Buydown program participants is summarized in Table 4-4. While only 38 percent of systems are installed in the windier regions (Wind Power density classes 3 to 5), these systems account for nearly half of the capacity. There has been some tendency to install larger small wind systems in the higher wind power density regions.

Table 4-4: Wind Power Class Distribution for Buydown Participants

Wind Power Class	Average Speed (mph)	Count of Projects		Installed Capacity	
		No. Proj.	% of Proj.	kW	% of kW
1	5	23	46%	49.9	35%
2	11	8	16%	24.1	17%
3	12	7	14%	10.0	7%
4	13	9	18%	56.1	39%
5	14	3	6%	4.3	3%
Total		50	100%	144.4	100%

A typical wind shear exponent was used to estimate wind speed at the height of wind system hubs (assumed equal to 40 and 90 feet for smaller and larger systems, respectively). A Weibull curve was used to expand hub-level average wind speeds into wind speed probability distributions. Wind machine power output was calculated for each resulting wind speed bin. These calculations were done for the upper and lower speed bounds of the wind class, and separate results were calculated for typical wind systems in two capacity ranges. For each capacity range, annual energy production per unit of nameplate capacity was calculated as the average of results obtained for the speed bounds of the wind class. In the case of the lower wind class areas this approach may be conservative because there may be a tendency to install wind machines primarily in the windier portions of these modest wind resource areas.

Program Tracking Database data were the source of wind system capacities and locations. Annual energy production was calculated as the product of capacity and per-unit results described above. Finally, results were adjusted to account for altitude effects (due to the change in air density).

To check the reasonableness of this approach, average annual capacity factors were calculated using results for each wind class. In this context, capacity factor is defined as annual average production rate as a percentage of wind machine nameplate capacity. Results

are presented in Table 4-5. Tower height is the parameter most responsible for the variance between results for large and small units.

To put these results in perspective, the Commission's 1992 Energy Technology Status Report reported a range of capacity factors of 21 to 31 percent for utility-scale wind systems, while the American Wind Energy Association reports that a Wind Power Class of at least 4 is generally desired for utility-scale wind systems.

Table 4-5: Wind Power Class versus Capacity Factor

Wind Power Class	Assumed Capacity Factor	
	Large Units	Small Units
1	9%	5%
2	20%	12%
3	26%	16%
4	30%	19%
5	34%	22%
6	37%	25%
7	42%	32%

Demand Impacts

Due to the seasonal and highly variable nature of wind system power output no peak demand impacts are assumed for this analysis. In reality, some wind facilities are probably on-line and generating during peak hours, and thereby providing demand impacts.

4.3.4 Fuel Cells (Renewable Fueled)

Two fuel cells were installed at a waste water treatment facility where anaerobic digestion produces methane gas. Rather than flaring this methane, as was done in the past, the fuel cells convert it into electricity and usable heat. The plant will no longer emit substantial quantities of smog-producing combustion products, and electricity produced by the fuel cells will be more than sufficient to power the plant's systems. Surplus electricity will be delivered to the grid in a net metering arrangement.

Energy Impacts

A plant engineer familiar with the actual operation of the fuel cells provided information required to calculate estimates of fuel cell power production. Data used in this analysis included: actual production rate and heat content of digestion products, and assumed electrical conversion efficiency. Resulting average capacity factor falls within the range (60-75%) of fuel cell capacity factors published in the Commission's 1992 Energy Technology Status Report.

Demand Impacts

Fuel cells are assumed to operate continuously as baseload units. Demand impacts were calculated as the average hourly power output based on continuous steady-state operation.

4.3.5 Solar Thermal-Electric

No solar thermal-electric projects were included in the program data covered by this interim impact analysis.

4.3.6 Projects In Progress

Impacts were calculated for all projects that have already been completed or may be completed in the future. For the latter group, impacts calculated with the methods described above were adjusted to account for the fact that some projects may be canceled or disapproved, or may expire before reaching completion. The range of specific project status points is presented in Table 4-6.

Table 4-6: Specific and General Project Status Points

Specific Status	General Status
Received, Approved, Extended, Modified, Warning Letter Sent	"In Progress"
Project Completed, Canceled, Expired, Disapproved	"Completed"

For each technology and size combination the attrition characteristics of "Completed" projects was analyzed. Findings of this analysis were applied to "In Progress" projects to estimate the impacts that will ultimately be yielded by these projects. For "Completed" projects, the total number of purchasers associated with specific status equal to "Project Completed" was compared to the number of purchasers associated with projects with other specific status values (i.e., Canceled, Expired, Disapproved). Resulting completion rates are summarized in Table 4-7. These rates were used to adjust energy and demand impact estimates calculated for projects that are currently in progress.

Table 4-7: In Progress Projects: Projected Completion Rates

Technology	System Size Category	Estimated Completion %
Photovoltaics	Small	94%
	Medium	82%
	Large	30%
Wind	Small	88%

4.4 Program Attribution

Participant data from the program tracking database were used to estimate energy and demand impacts produced by equipment for which Emerging Renewable Buydown incentives were issued. This straightforward approach establishes a reference point around which other evaluation issues may be explored. Of particular interest is the issue of attribution. Two terms used to refer to program attribution issues are "free ridership" and "spillover", which are related to the questions indicated below.

- **Free Ridership:** Would program participants have taken the same actions in the program's absence?
- **Spillover:** Would program nonparticipants have taken the same actions in the program's absence?

4.4.1 Free Ridership

Anecdotal evidence resulting from retailer and purchaser surveys suggests that free ridership effects may be small, and that the program is in fact responsible for changing purchase decisions of participants. In the case of photovoltaics, decision-related comments were offered by several early participants involved in the verification process. Representative comments related to decision making and program attribution are presented below.

- "Great program. We couldn't have done it without the rebate."
- "The rebate really got me in gear to do this."
- "Buydown program made it affordable so I could actually do it."

Free ridership is an evaluation element that may change throughout the course of program implementation. Factors related to decision making that may change through time include: participant characteristics, incentive magnitudes, and system costs. While available data suggest early program activity is not subject to high degrees of free ridership, this is a factor that should be tracked through time.

4.4.2 Spillover

At least one retailer interviewed suggested that the program was responsible for sales of some systems not rebated through the program. The reasoning behind this suggestion was that the existence of the program affected general levels of consumer awareness, thereby affecting purchase decisions of some nonparticipants.

Given relatively low levels of general program awareness indicated by current market research described elsewhere in this report, the spillover effects described above may be small at this time. However, given the Commission's plans to increase promotional activities in the future, this may be an area deserving additional attention in future evaluation work.

4.4.3 Conclusion

Qualitative assessment of data available at this time suggest that attribution issues (i.e., free ridership and spillover) are not of primary importance, where performance to date of the Emerging Buydown Account is concerned. While future evaluation work should further explore these issues, it is not necessary to adjust interim impact and cost-effectiveness analysis results to account for these attribution effects.

4.5 Results

Results of the impact analysis are presented in Table 4-8 and Table 4-9. Results for completed projects are presented in Table 4-8.

Table 4-8: Energy and Demand Impacts – Completed Projects

			Total		Per-Unit	
Technology	**Size**	**# of Projects**	**Energy (kWh/yr)**	**Demand (kW)**	**Energy (kWh/yr)**	**Demand (kW)**
Wind	Small	26	154,609	0*	5,947	0.0*
Fuel Cell	Large	2	2,628,000	300	1,314,000	150.0
Photovoltaic	Small	300	875,002	402	2,917	1.3
	Medium	15	693,664	203	46,244	13.6
	Large	1	169,901	50	169,901	49.7
	All Projects	*316*	*1,738,567*	*655*	*5,502*	*2.1*
All Tech.	Small	326	1,029,611	402	3,158	1.2
	Medium	15	693,664	203	46,244	13.6
	Large	3	2,797,901	350	932,634	116.6
	All Projects	*344*	*4,521,176*	*955*	*13,143*	*2.8*

* For this analysis, wind projects are assumed to have zero demand impacts.

Impact analysis results for projects whose development remains in progress are presented in Table 4-9. This table also presents total results for all projects. Per-unit impacts are not included in this table because these impacts reflect application of the completion rate factor, which confounds the basis of per-unit impacts. Per-unit impacts for all program activity will be included in impact estimate tables presented in the final evaluation report.

Table 4-9: Energy and Demand Impacts – In-Progress and All Projects

		In Progress Projects			All Projects		
Technology	**Size**	**# of Projects**	**Energy (kWh/yr)**	**Demand (kW)**	**# of Projects**	**Energy (kWh/yr)**	**Demand (kW)**
Wind	Small	25	59,431	0	51	214,040	0
Fuel Cell	Large	0	0	0	2	2,628,000	300
Photovoltaic	Small	197	534,993	243	497	1,409,994	646
	Medium	10	732,428	207	25	1,426,092	410
	Large	5	420,049	122	6	589,950	171
	All Projects	*212*	*1,687,470*	*572*	*528*	*3,426,036*	*1,227*
All Tech.	Small	222	594,423	243	548	1,624,034	646
	Medium	10	732,428	207	25	1,426,092	410
	Large	5	420,049	122	8	3,217,950	471
	All Projects	*237*	*1,746,900*	*572*	*581*	*6,268,076*	*1,527*

4.5.1 Discussion of Results

Estimated total impacts for all projects completed and in-progress to date are 6.3 million kWh/year and 1.5 MW. While fuel cell project activity was limited to two units at one facility, it was responsible for 42 percent of the total energy impacts and approximately one-fifth of demand impacts. These units began operating in the fall of 1999. No additional renewable-based fuel cell projects are currently in progress within the Buydown Program.

Wind systems account for a small fraction of total program activity, in terms of both number of projects and total energy and demand impacts. Small photovoltaic systems outnumber small wind systems by nearly 10 to 1. Modest participation levels and impacts attributable to small wind systems are likely due in large part to special considerations surrounding wind resources as compared to solar resources.

While photovoltaic system energy production is sensitive to local shading effects, wind system production may be affected by local surface obstructions anywhere within hundreds of feet of the wind machine. Whereas annual incident solar radiation is somewhat constant across California outside of the immediate coastal zone, wind resources vary radically as a function of regional geography and local topography. Among purchasers participating with small wind systems, the wind resource was estimated to vary by approximately 400 percent.

The variance in solar insolation across all photovoltaic systems was only one-tenth of this value (42 percent).

Basis of Demand Impacts

Reported demand impacts are based on program-level impacts on system-level loads. This basis was selected because it provides an indication of the extent to which these renewable technologies may be able to affect the future need for generation, transmission, and distribution capacity expansion. Estimation of the impact of renewable technologies on the billed demand of particular customers would require information concerning the time at which their loads reached the billed demand level. This type of analysis is beyond the scope of this project.

Rebated versus Actual PV System Electric Output Capacity

A measure of system performance that may be of interest to program participants is actual system capacity under PVUSA Test Conditions (PTC) of 1000 W/m^2 plane-of-array irradiance, 20 C ambient dry bulb temperature, and 1 m/s wind speed. Average size of small rebated systems (kW) is compared to estimates of average actual system capacity under PTC in Table 4-10.

Table 4-10: Rebated vs. Estimated Actual Capacity (Completed Projects)

PV System Size & Battery Status	Rebated (kW)	Est. Actual (kW)	D%
Small – Battery	2.35	1.62	-31%
Small – No Battery	2.35	1.74	-26%

Estimated actual system capacities are approximately one-quarter to one-third less than rebated capacities. This may be a cause for concern if participants do not fully understand that the basis of rebated capacity values does not include effects of several factors that may diminish system output. Examples of the types of factors expected to diminish system capacity are summarized in Table 4-11.

Table 4-11: Losses Excluded from Rebated kW Calculation

Loss Source	Description
Mismatch, Wiring, & Shading	Average mismatch, wiring, and shading losses are estimated to be on the order of 8%.
Inverter Efficiency	Rebated capacity calculations are based on nominal rated inverter efficiency. Actual efficiencies under fully loaded design conditions are estimated to be on the order of 7% less than the rated efficiency.
Batteries	Presence of battery storage may constrain maximum power production.
Orientation	System orientation may not be optimized for peak power production

Battery Storage

A substantial portion of small photovoltaic systems includes battery storage. Battery storage introduces inefficiency into the system in at least three ways. First, batteries are not perfectly efficient storage devices. The total cycle efficiency of a typical lead-acid battery is 75 to 80 percent. Second, all batteries are subject to self-discharge, which may be measured in terms of percent loss per month, or voltage drop per day. Finally, batteries may prevent photovoltaic arrays from operating at their maximum power point.

Findings of this analysis suggest small systems with batteries produce 28 percent less energy per year than systems without batteries. For small, completed photovoltaic systems, a battery storage incidence rate of 65 percent is reflected in impact estimates presented in Table 4-8. Impacts that would have been yielded had none of these systems included battery storage are presented in Table 4-12. At the program level, absence of batteries would have resulted in annual energy production for small systems being 22 percent higher.

Table 4-12: Effect of Batteries on Energy Impacts – Small, Completed Photovoltaics Projects

Batteries?	# of Projects	Total Energy (kWh/yr)	Per-Unit Energy (kWh/yr)
Yes	300	875,002	2,917
No	300	1,070,898	3,570
Difference	0	195,896	653
Difference (%)	0%	22%	22%

The effect of battery storage on energy production of any particular system is a function of a variety of factors, including: condition of batteries, charge/discharge cycling frequency and depth, charge controller and inverter control programming, and charge controller and inverter instrumentation accuracy. A value equal to 0.94 has been suggested by Brooks (Brooks,

1999) to quantify the difference between energy production of grid-connected photovoltaic systems with and without battery storage. In this paper the author notes that "…few data were found to help quantify this system loss".

Finally, battery storage systems may be used to shift load from on-peak to off-peak periods. Several residential program participants on Time Of Use (TOU) tariffs report operating their photovoltaic system systems in this manner. Depending on the structure of their electric tariff, operation in this manner may yield participants substantial benefits. However, benefits of load shifting do not come without cost. A Sandia National Laboratories paper (Palomino, 1997) presented findings of an analysis of data from a system operated in this manner. In this case data from fourteen months of operation suggest battery losses on the order of 25 percent. This value does not include maximum power point tracking effects that may also be important when comparing battery storage systems to systems without battery storage.

4.6 References

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Volume IV

5 Cost-Effectiveness Analysis

5.1 Overview

Buydown program impacts and costs are combined in this section to yield measures of program cost-effectiveness from several perspectives. Program cost-effectiveness is expressed in terms of dollars ($) per unit of impact (kWh). Perspectives covered include Participant, Energy Commission, and Society. This interim analysis of Emerging Buydown Program cost-effectiveness covers projects that either had been completed or were in progress as of August 14, 2000.

5.2 Data Sources

Principal data sources include findings of the impact analysis presented in Section 4, and cost-related data contained in the Buydown program tracking database. The program tracking database contains total project costs and buydown incentive magnitudes for each project. Cost data from the tracking system are summarized in Table 5-1 and Table 5-2. In the case of the latter, project costs and buydown payment magnitudes are projections; they may change during the course of project development.

Table 5-1: Tracking System Data (Completed Projects)

			Total			Per-Unit		
Technology	**Size**	**No. of Projects**	**Rebate Size (kW)**	**Rebate Paid ($1000)**	**System Cost ($1000)**	**Rebate Size (kW)**	**Rebate Paid ($)**	**System Cost ($)**
Wind	Small	26	93	219	471	3.6	8,424	18,112
Fuel Cell	Large	2	400	958	2,146	200.0	479,120	1,072,800
Photovoltaic	Small	300	706	2,109	7,052	2.4	7,029	23,505
	Medium	15	409	1,115	4,051	27.3	74,336	270,063
	Large	1	100	300	733	100.0	299,910	733,306
	All Projects	*316*	*1,215*	*3,524*	*11,836*	*3.8*	*11,151*	*37,455*
All Tech.	Small	326	799	2,328	7,522	2.5	7,140	23,075
	Medium	15	409	1,115	4,051	27.3	74,336	270,063
	Large	3	500	1,258	2,879	166.7	419,383	959,635
	All Projects	*344*	*1,708*	*4,701*	*14,452*	*5.0*	*13,666*	*42,013*

Table 5-2: Tracking System Data (In-Progress Projects)

Technology	Size	No. of Projects	Total Rebate Size (kW)	Total Rebate Reserved ($1000)	Total System Cost ($1000)	Per-Unit Rebate Size (kW)	Per-Unit Rebate Reserved ($)	Per-Unit System Cost ($)
Wind	Small	25	51	113	235	2.1	4,516	9,416
Fuel Cell	Large	0	0	0	0	0.0	0	0
Photovoltaic	Small	197	452	1,352	4,390	2.3	6,864	22,283
	Medium	10	509	1,296	3,759	50.9	129,642	375,867
	Large	5	806	2,300	6,824	161.3	459,915	1,364,846
	All Projects	*212*	*1,767*	*4,948*	*14,973*	*8.3*	*23,340*	*70,626*
All Tech.	Small	222	504	1,465	4,625	2.3	6,599	20,834
	Medium	10	509	1,296	3,759	50.9	129,642	375,867
	Large	5	806	2,300	6,824	161.3	459,915	1,364,846
	All Projects	*237*	*1,819*	*5,061*	*15,208*	*7.7*	*21,355*	*64,169*

A program tracking database provided by the Utility PhotoVoltaic Group (UPVG) was used to identify Buydown projects that also received support through the UPVG's TEAM-UP program. Equipment lives used in cost-effectiveness calculations were estimated using information from the Commission's 1992 Energy Technology Status Report. Finally, there are administrative costs associated with implementation of the program. Estimates of these costs were provided by the Commission.

5.3 Analysis Methods

Energy impact analysis findings presented in Section 4 were used in the cost-effectiveness analysis. Annual energy production was assumed constant for each year of system life. Energy impact estimates were combined with a variety of cost elements, each of which is discussed below. This discussion of each cost element is followed by a description of the methods used to combine the cost elements to yield levelized cost-effectiveness results.

5.3.1 Treatment of Cost Elements

The cost elements covered below include program administration, Buydown program rebates, system total installed costs, sales tax, income tax, Federal tax credits, UPVG buydown support, incentives from the Federal Climate Change program, and ongoing operations and maintenance.

Program Administration

In addition to direct costs of buydown payments, the program carries administrative implementation costs. A total of $387,500 is allocated for implementation of the Emerging Resources Buydown Account. These costs are assumed to be incurred in equal increments

over the four program years, and are allocated across technologies and size ranges in proportion to number of projects. Program administration costs were used in the Commission and Societal cost-effectiveness calculations.

Sales Tax

System cost data from the program tracking database include sales tax. These data represent costs from the perspective of Participants. From the perspective of society the sales tax portion of total system cost represents a transfer payment rather than a true societal cost. System costs used in calculations of cost-effectiveness from society's perspective must have sales tax removed from them. Removal of sales tax from total system cost is complicated by the fact that it is assessed to the equipment portion of system cost only. For this analysis, all systems were assumed subject to 7.75 percent sales tax on the equipment portion of total system cost. Equipment was assumed to account for 85 percent of total pre-tax installed cost; installation was assumed to account for the remaining 15 percent.

Income Tax

Rebate payments issued by the Commission are treated as taxable income by the State and Federal governments for both individuals and businesses participating in the Buydown program. The purchaser has the option of receiving the rebate check or having it be issued to the retailer. In either case, the incentive recipient is responsible for treating the buydown payment as taxable income. The net effect is to reduce the level of net buydown realized by participants. A detailed analysis would require knowledge of marginal tax rates for each participant. In the absence of detailed financial information for each retailer and purchaser, a simplified approach was used to account for tax implications. A total average marginal income tax rate of 30 percent was assumed for all participants installing photovoltaic and small wind systems. The nonprofit municipal water district was assumed exempt from State and Federal income tax.

Federal Tax Credit

Some Buydown program participants are also eligible for the Federal government's Business Energy Investment tax credit program. This program offers a 10 percent tax credit for photovoltaic systems purchased and installed by businesses. For this analysis, the identity of each Medium and Large photovoltaic system was reviewed to determine apparent eligibility for the business energy tax credit. In cases where the purchaser was a business, participation in the federal tax credit program was assumed. Effects of the tax credit's depreciation clauses were not incorporated into the analysis.

Operation and Maintenance

Project costs in Table 5-1 and Table 5-2 represent initial costs of equipment purchase and installation. Additional operations and maintenance (O&M) costs may be incurred on an ongoing basis. Whereas actual equipment installed costs were available from the program tracking system, operations and maintenance (O&M) costs were estimated. Photovoltaic and small wind system O&M costs were assumed negligible. Fuel cell O&M costs of 1.5 cents per kWh were based on manufacturer data. These costs include routine maintenance, stack replacement, and fuel processing system overhaul.

Other Programs

The Utility PhotoVoltaic Group's (UPVG) TEAM-UP (building Technology Experience to Accelerate Markets in Utility Photovoltaics) program provides grants to encourage wider use of photovoltaic systems. Each medium and large PV project in the Buydown program was cross-checked with the TEAM-UP program tracking database. Eight of the ten largest completed projects in the Emerging Buydown program also received support through the TEAM-UP program. Additional findings of this review are summarized in Table 5-3. For this analysis, projects in both programs were assumed to have had 20 percent of their system cost paid by the TEAM-UP program.

Table 5-3: TEAM-UP Program Activity Among Medium & Large Projects

Status	Total Rebates (kW)	TEAM-UP (kW)	TEAM-UP (%)
Complete	509	392	77%
In-Progress	1,315	28	2%

The fuel cell projects were supported by both the State's Buydown program and the Federal Government's Climate Change Fuel Cell Program. The Federal program provides grants to encourage demonstration projects utilizing stationary, US-manufactured fuel cells. The Climate Change Program provided $1 per Watt of nameplate fuel cell capacity.

Projects In Progress

This analysis includes projects that have already been completed or may be completed in the future. For the latter group, project costs yielded by the methods described above were adjusted to account for the fact that some projects may be cancelled or disapproved, or may expire before reaching completion. A detailed description of the basis of the completion rates is included in Section 4, Impact Analysis. The same rates were used to adjust project costs and expected rebate payments for in-progress projects.

For in-progress projects whose status as of August 14, 2000 was "Received", the tracking database does not yet contain system cost or reservation incentive magnitudes. For purposes of completing the cost-effectiveness analysis, values for these two parameters were estimated based on project size (kW) and findings of analysis of data for other in-progress projects. These estimated values are included in summary data presented in Table 5-1 and Table 5-2. This explains the difference between values in these tables and those presented in Table 4, Cumulative Total Funds Reserved, presented in the "Program Description and Status" section of this report.

5.3.2 Calculations

Calculation of cost-effectiveness results entails three steps. First, the present value of each cost element introduced above is calculated and totals are calculated for each of the three perspectives. Next, total present value costs are distributed across all years of equipment life. Finally, cost-effectiveness ratios are calculated as levelized costs divided by annual energy production.

Present Value Costs

For this analysis, all costs except operation and maintenance (O&M) are assumed to occur at time zero. Base year O&M costs are calculated as described above in the preceding section. An assumed inflation rate of 3 percent is used to calculate O&M cost estimates for future years. A present worth discount factor was used to calculate the present value for each of the future O&M costs. Nominal discount rate and equipment life assumptions used in the O&M and present value analyses are presented in Table 5-4.

Table 5-4: Discount Rate/Equipment Life

Perspective	Discount Rate	Technology	Life (Years)
Participant	10%	Small Wind	20
Commission	6%	Fuel Cell	30
Society	6%	Photovoltaic	20

Finally, present value cost totals are calculated for each perspective using the equations in Table 5-5.

Table 5-5: Cost Bases for Three Perspectives

Perspective	Cost Basis
Participant	(System + Sales Tax) – (Rebate – Income Tax) – Tax Credit – Other Grants + O&M
Commission	Rebate + Administration
Society	System + O&M + Administration

Levelized Costs

Present value cost totals for each perspective were allocated across each year of equipment life. A levelization procedure was used to accomplish this allocation. Levelized costs were calculated as the product of present value total cost and a capital recovery factor. Resulting levelized costs account for the time value of money, whereas a simple allocation factor equal to 1/(Equipment Life) would not. The following example illustrates the magnitude of levelization effects.

For a $20,000 renewable energy system with a life of 20 years, a simple allocation (i.e., 1/20) would allocate $1000 to each year. If instead a discount rate of 10 percent is assumed, the capital recovery factor is equal to 0.1175, which results in allocation of $2350 to each year. Annual cost allocations for this example and several discount rates are presented in Table 5-6. These results illustrate the fact that a discount rate equal to 0 percent yields a result identical to that yielded by the simple allocation procedure.

Table 5-6: Example Annual Cost Allocation versus Discount Rate

Discount Rate (%)	Annual Cost Allocation ($/Year)
0	$1000
10	$2350
20	$4108

Cost-Effectiveness

Cost-effectiveness results were calculated as the ratio of levelized cost ($/Year) to annual energy production (kWh/Year).

5.4 Results

Results of the cost-effectiveness analysis for Completed and Approved projects are presented in Table 5-7 and Table 5-8, respectively. Cost-effectiveness expressed in terms of $/kW is addressed in Section 2, Proximate Indicators.

Table 5-7: C-E Results For Completed Projects

		Cost-Effectiveness ($/kWh)		
Technology	**Size**	**Participant**	**CEC**	**Society**
Wind	Small	0.24	0.13	0.26
Fuel Cell	Large	0.05	0.03	0.07
Photovoltaic	Small	0.75	0.22	0.67
	Medium	0.43	0.14	0.48
	Large	0.21	0.15	0.35
	All Projects	*0.57*	*0.18*	*0.56*
All Tech.	*All Projects*	*0.26*	*0.09*	*0.28*

Table 5-8: C-E Results For In-Progress Projects

		Cost-Effectiveness ($/kWh)		
Technology	**Size**	**Participant**	**CEC**	**Society**
Wind	Small	0.27	0.16	0.30
Fuel Cell	Large	----	----	----
Photovoltaic	Small	0.71	0.22	0.65
	Medium	0.33	0.13	0.34
	Large	0.39	0.15	0.40
	All Projects	0.47	0.16	0.45
All Tech.	*All Projects*	0.46	0.16	0.45

5.4.1 Discussion of Results

On a $/kWh basis, the large fuel cell projects are substantially more cost-effective than the other technologies. From the Commission's perspective, this is due in part to the fact that fuel cells typically operate with high capacity factors to satisfy base load requirements. Solar and wind resources exhibit seasonal and daily variability, which results in lower capacity factors. This influences cost-effectiveness results because the Commission per-Watt incentive payments were identical for all eligible technologies and were based on equipment capacity rather than expected average energy production rates.

Battery Storage Effects

Energy production estimates used in the cost-effectiveness analysis include effects of battery storage. Presence of battery storage was found to reduce energy impacts of small photovoltaic systems, which tends to decrease their renewable energy production cost-effectiveness. Battery storage systems also entail additional capital cost. However, including these costs while simultaneously excluding the benefits they yield would produce cost-effectiveness results that could easily be misinterpreted. For this reason, the cost of battery storage equipment was excluded from this analysis of cost-effectiveness. This treatment is consistent with program design, which did not include the cost of battery storage among eligible system costs. In the future, a more exhaustive benefit-cost analysis could explore the non-energy benefits of increased reliability, as well as the potential to use batteries to take best advantage of time-of-use rates.

TEAM-UP Program

The status of the TEAM-UP program may change during the course of the EBDP's life. The (UPVG) is a national consortium of public and private stakeholders interested in accelerating the development of photovoltaic markets. The UPVG implements TEAM-UP, which awards DOE money to select photovoltaic projects. Competitive solicitations have been used to award program funds, which are distributed as lump sum first cost buydown grants.

The UPVG has been managing the TEAM-UP program since 1994. As of Summer 2000 about 6.0 of 7.5 MW (80%) of Phase I-III projects had been completed. Remaining projects, a substantial portion of which will be installed in California, are scheduled to be completed by October 1, 2000. To-date, installations in California have accounted for about 40 percent of total TEAM-UP program activity.

TEAM-UP is currently in the seventh year of a five year program. While the President's proposed budget for FY2001 appears sufficient to provide continued support, the Congress has yet to pass this spending bill and funding details remain uncertain. It is anticipated that money will be available to implement some type of program that facilitates installation of photovoltaic systems, but continued existence of the program is not assured. If it does continue, it may not look exactly like the previous three phases of the TEAM-UP program.

In the first three rounds of TEAM-UP funding, the incentive covered 20 percent of total project costs. Grid-connected TEAM-UP ventures received US$13.8 million ($1.84/Watt) in funding from TEAM-UP, towards total costs of US$70.3 million ($9.37/Watt). Concern exists that loss of TEAM-UP support will lead to decreased EBDP participation rates. TEAM-UP staff report that in at least a couple of instances TEAM-UP support was critical to project completion. However, it is also true that projects have been completed in regions where the TEAM-UP incentive was the only incentive available.

Discount Rate Influence

Discount rate magnitude is an influential determinant of cost-effectiveness. Two implications of this influential nature are discussed below. First, the relationships between participant and societal results when discount rates are different. Second, the sensitivity of participant results to discount rate.

The results of Table 5-9 provide an illustration of the influence of discount rates on the relationship between participant and societal cost-effectiveness when different discount rates are used for each of the perspectives. For small, completed photovoltaic projects societal costs exceed participant costs by nearly 50 percent. All else equal, cost-effectiveness results would vary by a similar margin. However, use of different discount rates results in cost-effectiveness results varying by about 8 percent.

Discount rates associated with energy efficiency investment have been studied in the past. Amongst the general public these rates have been found to be quite high. Emerging renewable energy technologies may face similar circumstances. Whereas early participants may make purchase decisions based on a discount rate of 10 percent or lower, as the program begins to target later adopters it may encounter groups that make investment decisions based on higher discount rates. This could have implications on program design and the ability of the program to achieve its goals.

To illustrate the sensitivity of cost-effectiveness results to discount rate, participant cost-effectiveness calculations were done for small, completed photovoltaic projects using three additional discount rates: 0, 5, and 15 percent. Results of this calculation are presented in Table 5-9.

Table 5-9: Small PV C-E Sensitivity Analysis

Discount (%)	Participant C-E ($/kWh)
0%	0.32
5%	0.51
10%	0.75
15%	1.02

The average cost of small photovoltaic systems exceeds $20,000. The discount rate ascribed to renewable energy system investments by potential purchasers will have a significant impact on its attractiveness as an investment option. This is the case whether the discount rate is implicit or explicit, conscious or unconscious. It should also be noted that many purchasers may not be purchasing kWh only. They may also be ascribing value to, and

demonstrating a willingness to pay for, reliability and environmental consequences of renewable energy investments.

5.5 References

1992 Energy Technology Status Report (ETSR). California Energy Commission Staff Report, P500-92-007A V2, December 1992.

Volume IV

6 Conclusions and Recommendations

6.1 Overview

This Emerging Renewable Resources Account program evaluation effort considered and assessed input from the following key sources: 1) legislative guidance under AB1890 and SB90, 2) Commission program policy (AB1890 Renewables Policy Report), 3) market research of consumers and supply-side stakeholders, 4) Emerging Buydown program database, and 5) on-site system verification and performance monitoring results. The Emerging Renewable Technologies market research efforts involved separate mail and Internet surveys of several thousand California residential and business consumers, in-depth interviews with manufacturers, retailers, and installers. These data were evaluated to assess the effectiveness of the Emerging Renewable Resources Account.

This final section of the Emerging Account evaluation report presents our conclusions based on the results of this assessment, followed by recommendations for improving the current Buydown Program.

6.2 Conclusions on Program Effectiveness

The primary objective of the Buydown program is to facilitate sales of qualifying emerging technologies by substantially reducing the installed costs to purchasers/lessees of these on-site distributed generation systems. SB90 also required that the Buydown Program provide such funding through a competitive, market-based process that shall be in existence for at least four years. In addition, the Program incentives shall be based upon the rated electrical generation capacity of the system (measured in watts); and the incentive levels shall decline over the term of the Program, in order to stimulate reductions in installed cost. The eligible emerging renewable technologies included within the initial program include: photovoltaic (PV), solar thermal-electric, fuel cells that are powered by a renewable fuel, and small wind turbines less than 10 kW.

Based upon the market research and program results to date, providing a financial incentive to offset the capital cost of Emerging renewable on-site generation systems has to a limited degree begun to stimulate a market in California.

Most PV and small wind system manufacturers and retailers/installers interviewed for this assessment reported that the program had been effective in stimulating sales to customers in

California. Conclusions concerning this matter are necessarily restricted, due to the limited sample size of supply channel interviews.

As less than 0.01 percent of California consumers have installed qualifying grid-connected emerging technologies through the Buydown Program at this time, this market is clearly still in its most infant stages of development. Given this premise, the following key findings from this assessment are vital for the future planning and implementation of the Emerging Account.

- ***Reduction in Installed Costs of Medium and Large PV Systems.*** Based upon the limited data from the combined medium and large PV system reservations in Funding Blocks 1 and 2 to date, there is evidence that the installed costs have decreased by about $2 per watt since the beginning of the program.
- ***Low Consumer Awareness of Emerging Technologies.*** Approximately 60% of residential and 75% of nonresidential customers surveyed are not well aware of PV as an on-site electric generation option. Residential and business consumers are even less informed about the other three emerging technologies. As consumer demand is an important element in the development of a long-term sustainable market, these market research results indicate that much work needs to take place with consumer education surrounding the emerging technologies.
- ***Installed PV System Performance.*** Monitored electric output of a select number of systems installed under the program to date have indicated that system performance in terms of inverter AC output is lower than expected, especially for smaller systems with battery storage.[1] It appears that the Buydown incentive, as currently determined via certified module efficiency at PTC and peak inverter efficiency is not directly representative of most system's peak performance, as verified/monitored in field tests to date. Either a further overall PV system de-rating procedure is needed, or at a minimum, customers need to be further informed of the expected peak and annual performance of the system before making their purchase decision. This performance issue also has implications upon the level of the Buydown incentive.
- ***Low Buydown Program Awareness.*** One year after the program was launched, 9.5 percent of residential and business consumers were aware of the Buydown Program's substantial purchase cost incentives. Nearly one year later, the residential awareness had risen about five percentage points to 14 percent, while business consumers' awareness levels remained nearly constant at 9 percent. Awareness of Commission Buydown Program promotional materials is much lower, at about 4 percent for residential and 1 percent for commercial respondents.
- ***Lack of Solar Thermal-Electric and Fuel Cell Market Activity.*** PV (and to a lesser degree small wind) reservations have dominated the Buydown Program

[1] Small system with battery storage performance was reduced by an average of 25% to 35% below expected output levels.

to date, with only two large fuel cell projects (but with a combined generating capacity of over 400 kW) and no approved Solar Thermal-Electric applications. There may be a need to target market the wastewater treatment industry with program informational materials, if appropriate based upon the experience with these two operating units to date, using the existing Buydown Program customer as a "case study" for others to learn from and follow.

- ***Reported Willingness to Pay a Premium for Financed Emerging Systems.*** The greater majority of customers reported they would not be willing to pay any premium (over and above their electric/energy bill savings) for a financed on-site renewable generation system.[2] Thirty percent of the residential respondents were willing to pay $1 to $25 per month (or more) for an emerging system. Only 10 percent were willing to pay an additional $25 or more per month, and 1.5 percent stated that they were willing to pay $75 per month. This Willingness to Pay profile for general consumers is notably different from the current end users surveyed for this assessment, and therefore has a significant impact on the future of the Buydown Program. Either incentives will need to increase (coupled with reductions in installed prices to consumers) or retail electric prices will need to rise substantially in order to transform the market for these high cost generation systems into a sustainable mode. Under nearly every scenario, significant levels of financial incentives are needed in the near-term to continue to assist in the development of this market.
- ***High Variability in Participant Cost-effectiveness.*** Based upon completed project costs and performance to date, there is a great level of variance in the cost-effectiveness of the Emerging Technologies. Fuel Cells are clearly the lowest cost, at $0.05 /kWh, but have demonstrated very limited fuel applicability coupled with low consumer awareness. Small wind ranks second overall at about $0.24/kWh and PV the highest at $0.43/kWh for medium-size projects. There is no direct Buydown Program data for solar thermal electric. Given the highest level of participation is with PV, consumers are clearly valuing other benefits beyond simple cost-effectiveness (i.e., environmental ethic, back-up/reliability, leading edge technology ownership, etc.).
- ***Dual-Inverter & Owner-Installation System Performance.*** Performance of systems with dual-power inverters has been in question in a number of on-site verification and monitoring cases to date. Overall, owner-installed system performance has also been somewhat lower than the average contractor-installed systems. Technical support to address system installation and subsequent trouble-shooting issues should continue to be provided by the Commission to support further development of the emerging technology infrastructure.

[2] Over 50% of the residential respondents indicated that they would expect to see a net savings of $1 to $25 or more per month from a leased system.

6.3 Recommendations for Buydown Program Improvements

Based upon the above conclusions from this assessment and input from market research, on-site verification, short- and long-term monitoring and infrastructure training activities implemented under the Buydown Program over the last two years, the following Program recommendations are provided for the Commission to consider. Our Emerging Account recommendations are segmented into two categories: Legislative and Regulatory.

6.3.1 Legislative Recommendation

Implementation of this first recommendation may require a change in existing legislation, which requires that the Buydown Program rebate level not exceed it currently established dollar per watt limit.

- **Revise the current Program incentive structure to enable capture of a more significant portion of the current California consumer market.** Based upon the recent monitored performance, installed costs, retail rates, net metering benefits, and willingness to pay information, it is clear that at current incentive levels only a very small fraction (<1%) may be willing to actually purchase an emerging renewable generation system. Based upon our analysis of the current market and PV performance data, if the Commission wanted to potentially be capable of eventually capturing a maximum of two percent of the residential consumer market, then the Buydown incentive should be increased to about $3.50 per watt. In order to potentially capture 10 percent of the current PV market over a period of time (with no change in installed cost), the Buydown may need to increase to about $6.30 per watt, or essentially *double* the current Block 1 incentive level.
- Since there would likely be installed cost reductions over this period for the smaller PV systems similar to what has been seen to date for the medium and large PV systems, it is estimated that $4.50 per watt (still with a maximum of 50 percent of eligible installed cost) may be sufficient to develop the required self-sustaining momentum in this market. In order for the market to gain any self-sustaining momentum that will reduce overall installed costs of the smaller systems in the long term, it appears evident that the Buydown incentive will need to be substantially increased in the short- term.

6.3.2 Regulatory/Guideline Recommendations

The following recommendations are of a regulatory or operations nature, some of which may require changes to the Emerging Buydown Program Guidelines.

1. ***While increasing the volume of Program participation, per AB 1890/SB90 incorporate a greater level of market-driven competitiveness elements to increase the incentive for price reductions at the manufacturer/wholesaler and retailer levels.*** This market-based competition element could take a number of forms, including a simple monthly (or quarterly) auction of Buydown Incentives for a given amount of available funding each period -- with a pre-established yet higher "bid price cap" that is consistent with Recommendation #1. Although this approach could be harmful for any one individual or retailer in terms of delaying a project, it could potentially benefit the industry and consumers on the whole by driving costs downward more quickly over time as market volume increases due to the higher initial incentive levels.

   A second, though probably less effective alternative to consider, involves increasing the level of retailer/installer and wholesaler market competition through a feedback- incentive approach that would provide financial rewards for a "top tier" of retailers and/or wholesalers that sold their systems at the lowest (or pre-determined target) installed price. A potential concern with this approach is that of gaming the incentive mechanism to the point of harming the financial being of the retailers or reducing the quality of ancillary system components and installations.

2. ***Implement further actions to target and improve consumer's informed awareness of emerging technologies installed costs and benefits (environmental, energy savings, utility system back-up/reliability).*** Consumer Education efforts and related funding need to be expanded in the near term, supported by both the industry participants and the Renewable Energy Program. General awareness of the emerging technologies is low to moderate. However informed awareness of the technology applicability, costs and benefits is still considered low overall.

3. ***Require installation of (and financially support to either some degree; i.e., such as 50% of incremental cost) or fully support to a maximum dollar limit a very basic level of system performance measurement (simple A/C watt-hour cumulative output meter) for the consumer to be able to verify whether their system is operating adequately under optimal environmental conditions.*** In most instances during on-site verification of the first 69 Buydown participants, it was evident that the vast majority of system owners were not aware of how much energy their emerging system was producing – either on an instantaneous (kW) basis or a cumulative KWh basis. This information is the key to understanding how well the system is functioning over time, not only Both at the time of installation (to verify that the system is generating the kW that was actually purchased under standard

environmental conditions) and over the course of ownership. Without this basic system performance monitoring capability, owners may have their emerging systems operating at very low levels of efficiency on a single component (such as an inverter or battery charge controller) for an extended period of time without any knowledge of a performance problem.

4. ***Increase installation training support activity for retailers/installers, owner-installers, and code compliance support for building inspectors/local permitting agencies and electric local distribution companies.*** Some of the performance issues identified through the verification, monitoring, and troubleshooting efforts to date have been traced to proper installation issues, for certain key components and ancillary items, such as wiring and fuses, etc. Improving the emerging technology infrastructure support in these key areas will impact the future performance of the systems installed under the Program and provide a better opportunity for a self-sustaining market to occur. Improved familiarity of the emerging systems with local building department inspectors and electric utility metering/parallel inspection personnel will help reduce existing barriers reported by some of the current participants.

In summary, there are a number of areas where the Emerging Account can be improved upon to provide additional benefits to all of the stakeholders in this growing California renewable generation market. Some of these efforts are already underway, or in the process of being considered for implementation.

Renewable Energy Program

Preliminary Evaluation

Volume V

Customer Credit Subaccount

Prepared for:

The Governor and the California State Legislature

Prepared by:

Regional Economic Research, Inc.
11236 El Camino Real, Suite A
San Diego, California 92130

October 30, 2000

Volume V – Customer Credit Subaccount

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Volume V

1 Introduction

1.1 Overview

The Customer Credit program element of the California Energy Commission's (Commission) Renewable Energy Program (REP) started operation in April 1998 and was designed to run through December 2001. The program was designed to provide a vehicle to rebate funds efficiently to end-use customers from the Renewable Resource Trust Fund (Fund). Energy Service Providers (ESPs) register to participate in the program and provide renewable electricity to California customers in the San Diego Gas & Electric, Southern California Edison, Pacific Gas & Electric, and Bear Valley Electric territories.

This preliminary program impact assessment covers program activity from April 1998 through April 2000. The remainder of this section describes the program, presents the approach used in the analysis, and outlines the remainder of the report.

1.2 Program Description

The Customer Credit Program was designed to meet the following objectives:[1]

- To reduce the cost premium for renewable energy that customers pay, thus encouraging them to buy renewable power,
- To help build a green market infrastructure by helping renewables become competitive with nonrenewable generation technologies, and
- To facilitate consumer choice of renewable power.

The program pays an incentive to registered ESPs who purchase eligible renewable electricity[2] and sell it to San Diego Gas & Electric, Southern California Edison, Pacific Gas & Electric, or Bear Valley Electric customers. Currently, the incentive is $10.00 per MWh and will remain at this level through December 2000. Every six months, the Commission is scheduled to re-evaluate program activity and remaining funds and, if deemed necessary, change the incentive amount for the subsequent six-month period. Table 1-1 presents the variation of the incentive level since the beginning of the program.

---

1 *Policy Report on AB1890 Renewables Funding*, California Energy Commission, March 1997.

2 Providers and wholesalers of green power must register their products with the Commission in order to be considered eligible for Customer Credit incentives. Eligible green power products must be generated by an in-state renewable electricity generation technology as defined by Public Utilities Code section 383.5(a).

Table 1-1: Customer Credit Incentive Levels[3]

Time Period	Incentive (per MWh)
April 1998 through November 1999	$15.00
December 1999 through June 2000	$12.50
July 2000 through December 2000	$10.00

As shown, the credit was initially set at $15.00 per MWh and remained at that level through November 1999 in order to provide a stable market signal during the introduction of the program. Demand for the program was low at first, and funds were sufficient to pay credits at this level for the initial 20-month period. Rapid growth in demand during 1999 resulted in a decision to reduce the credit level for December 1999 and the first six months of 2000.[4] After this period the incentive level may be changed at six-month intervals; however, it cannot exceed $15.00 per MWh.

The program is funded through the Fund. Due to anticipated market growth over time, the Fund is scheduled to provide an increasing allocation over the life of the program. Table 1-2 presents the planned allocation for the Customer Credit program as stated in the AB 1890 Renewables Policy Report.

Table 1-2: Allocations to the Customer Credit Subaccount[5]

Funding Element	1998	1999	2000	2001	Overall
Renewable Resource Trust Fund (in millions)	$135	$135	$135	$135	$540
Percent Allocated to Customer Credit	8%	12%	16%	20%	14%
Annual Allocation to Customer Credit (in millions)	$10.8	$16.2	$21.6	$27.0	$75.6

As shown, the Customer Credit program has been allocated $75.6 million, representing 14% of the entire Fund. Furthermore, the allocation ranges from $10.8 million in the first year (representing 8% of that year's overall allocation from the Fund) to $27.0 million in the final year (representing 20% of that year's allocation).

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3 See the Commission website, http://www.energy.ca.gov/renewables/current_past_credit_levels.html

4 Lowering the credit level in December 1999, rather than in January 2000, allowed the $1,000 cap on credits to large customers to remain in place. Without the cap in place, the credit level would have had to be lowered more significantly in 2000 to avoid running out of funds.

5 *Volume 4 Customer Credit Subaccount*, Fourth Edition, California Energy Commission, June 2000.

ESPs participating in the program file monthly performance reports with the Commission. Each report presents: 1) data on a particular month's sales of eligible green power to customers, 2) data on when the power was generated and purchased, and 3) data on the technology (fuel type) of the purchased energy. Sales and purchases need not occur in the same month, as the program allows ESPs to bank excess purchases or excess load served and true it up annually.[6] Incentives are paid, however, only when power purchased is matched to power delivered. Program guidelines call for incentive payments to be made to providers within five weeks of the date the performance report is submitted.

The Program places an annual ceiling or " cap" on incentives paid for service to customers who are not designated as residential or small commercial by their utility rate schedule. These large commercial and industrial, agricultural, and public lighting customers represent a third customer class. Program incentives paid for service to each meter in this customer class are capped at $1,000 per year. Furthermore, there is a maximum of $15 million that this class of customers may receive from the Fund over the life of the Program. Due to these restrictions, providers are required to report sales by the three general customer classes on their monthly performance reports.

The Program initially required an annual report, audited by an independent third party, to be submitted by each participant ESP. A review of the audit process options for the Customer Credit Program was carried out by PriceWaterhouseCoopers in late 1999. This effort included a literature review of certificates, interviews with Commission and Green-e staff to discuss problems and concerns with the auditing process, and a study of analogous processes in other industries. A set of agreed upon procedures for verifying annual reports during spot reviews was developed and presented at a public workshop. The procedures were then finalized, and Commission staff received training on them. The results of this process will be considered in the next stage of evaluation for the Program.

[6] Through November 1999, the amount banked was valued at the quantity of kWh multiplied by the current incentive rate. In December 1999, the program changed banking procedures so that the quantity of kWh was banked. With the new procedure, the value of the banked kWh amount is determined at the time the credit is passed on to consumers. At the end of every year, a true up is calculated.

1.3 Evaluation Approach

Data for this study were collected from three areas:

- A program database developed from monthly performance data submitted by ESPs and from payments made by the Commission,
- A mail survey of residential and business customers in the San Diego Gas & Electric, Southern California Edison, Pacific Gas & Electric, and Bear Valley Electric territories, and
- A series of in-depth interviews of ESPs.

The approach used in this study included an analysis of the following areas.

Program Performance. Using the program data supplied by the Commission, the performance of the program was evaluated based on program goals and a set of proximate indicators developed during the initial stage of the analysis. The indicators used are the following:

- Program participation,
- Program incentive payments, and
- Renewable power provided under the program.

Consumer Attitudes. Consumer survey responses were analyzed to determine attitudes and perceptions toward green power as well as understanding of the market and of the Customer Credit program.

ESP Market Perceptions and Experience. Interviews with participant and nonparticipant ESPs revealed how they are responding to the program and to the ongoing development of a retail green power market in California.

1.4 Organization of Report

The remainder of this report is organized as follows:

- Section 2 presents program performance results,
- Section 3 presents the results of the in-depth interviews with ESPs,
- Section 4 presents the results of the consumer surveys,
- Section 5 presents an assessment of the program,
- Section 6 presents the program costs, and
- Section 7 presents a conclusion and recommendations for the program.

Volume V

2 Program Results

2.1 Overview

This section presents some preliminary achievements of the Customer Credit program. Program data was supplied by the Commission for this evaluation and ranged from April 1998 through April 2000. A set of descriptive indicators of program achievements were identified and evaluated over this time period. The indicators identified fall into the following categories:

- Program participation,
- Program incentive payments, and
- Renewable power provided under the program.

The remainder of this section describes each of the above categories of program data in more detail.

2.2 Program Participation

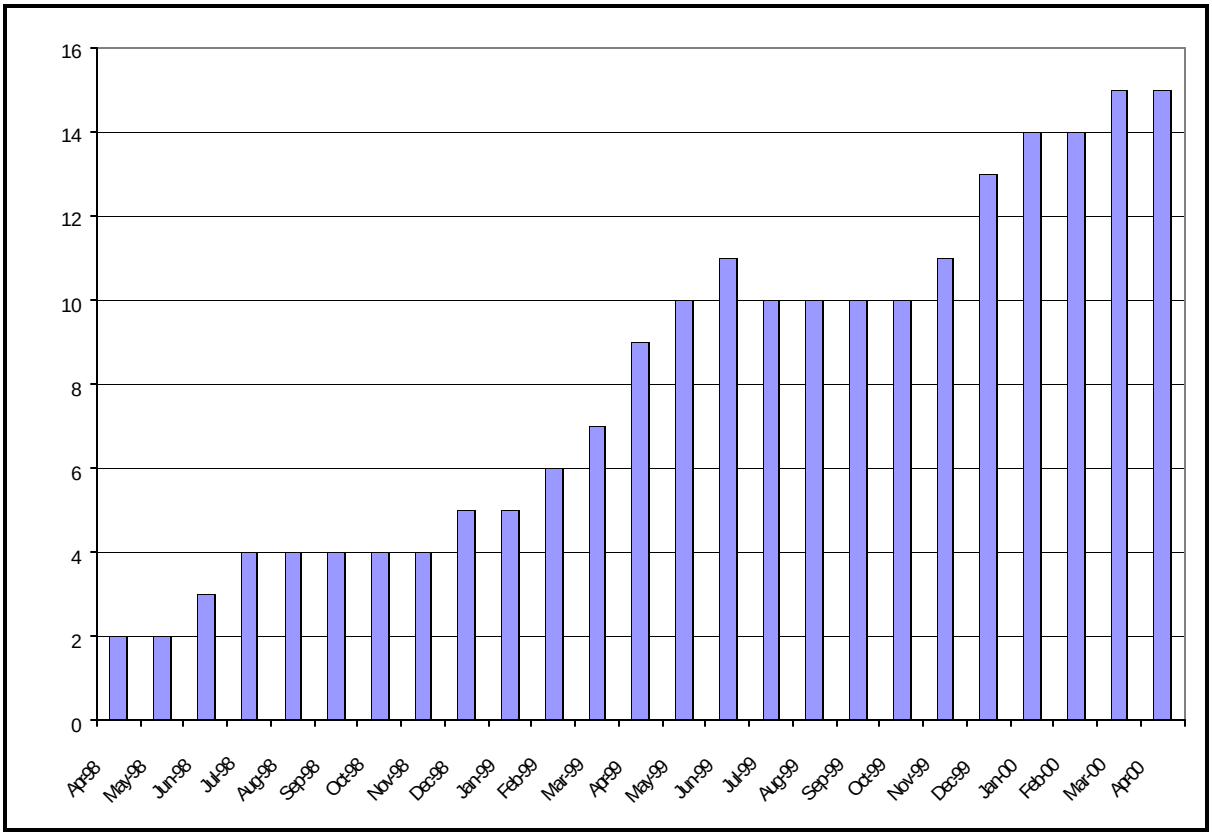
In this subsection, the participation of ESPs and customers through April 2000 is considered. Furthermore, customers are segmented into Residential, Small Commercial and *Other*[1].

ESP Participation

During the two years of program activity analyzed for this study, 19 ESPs registered in the program and 17 of these reported customer activity. As shown in Figure 2-1, the number of participants with customers gradually rose from two in April 1998 to a maximum of 15 in March and April 2000.

[1] The customer segment entitled "Other" is made up of large commercial-industrial, agricultural, and public lighting customers.

Figure 2-1: Number of ESP Participants with Customers



A series of new ESPs started reporting in early 1999: one in February, one in March, two in April, one in May, and one in June. The result is an upward trend through the first half of 1999. Two ESPs stopped reporting customers after joining the program: one in July 1999 after seven months of reporting, and one in November 1999 after eight months of reporting.

Customers Served

Customers served under the Customer Credit Program ranged from roughly 11,059 to 211,498 over the period evaluated. Table 2-1 shows the minimum and maximum number of customers served by segment.

Table 2-1: Ranges of Participation for Customer Segments

Segment	Minimum	When Minimum Occurred	Maximum	When Maximum Occurred
Residential	9,482	4/98	165,673	4/00
Small Commercial	1,036	4/98	31,264	4/00
Other	541	4/98	14,698	3/00

Figure 2-2 illustrates the increase of customers served over the period April 1998 through April 2000. As shown, the number of customers served under the program steadily increased through this period for the residential segment. Large changes in February 1999 for the Residential and Small Commercial segments reflect the beginning of reporting for one ESP in the program.

Figure 2-2: Number of Customers Served Under Program

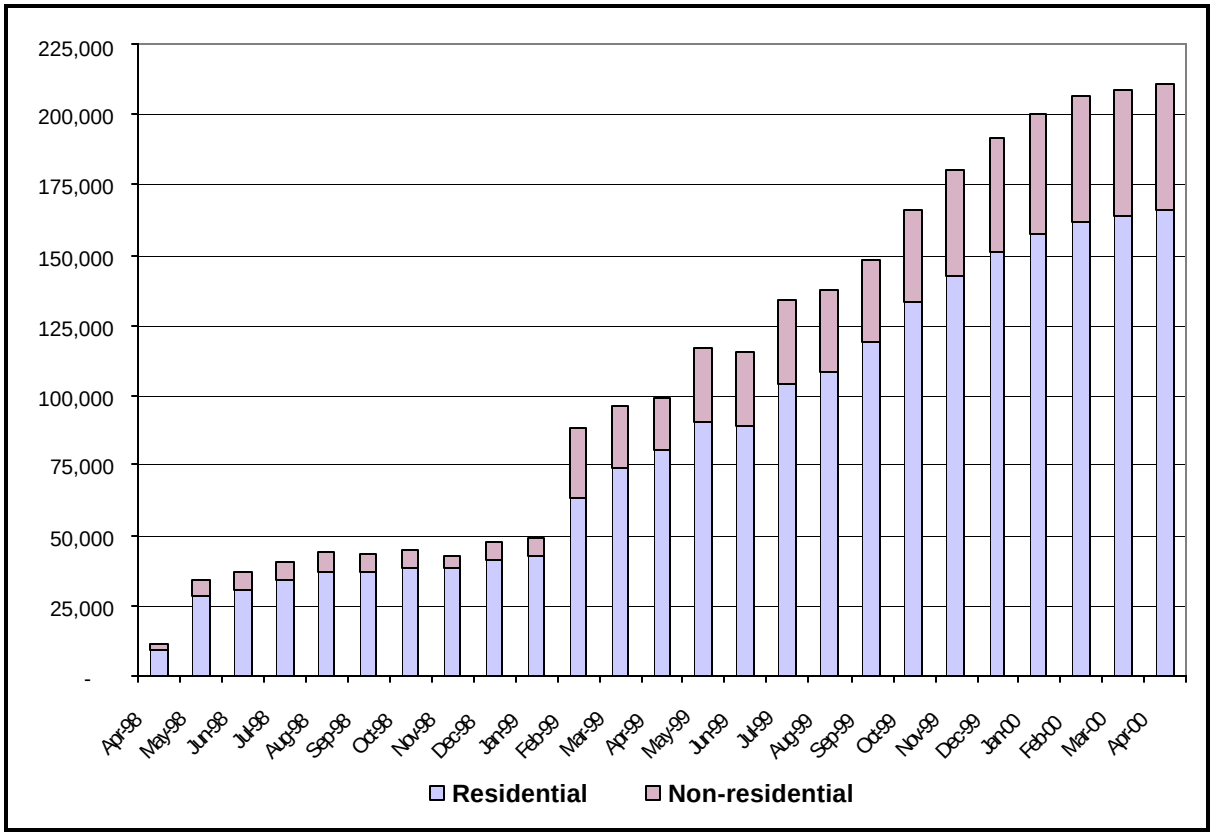
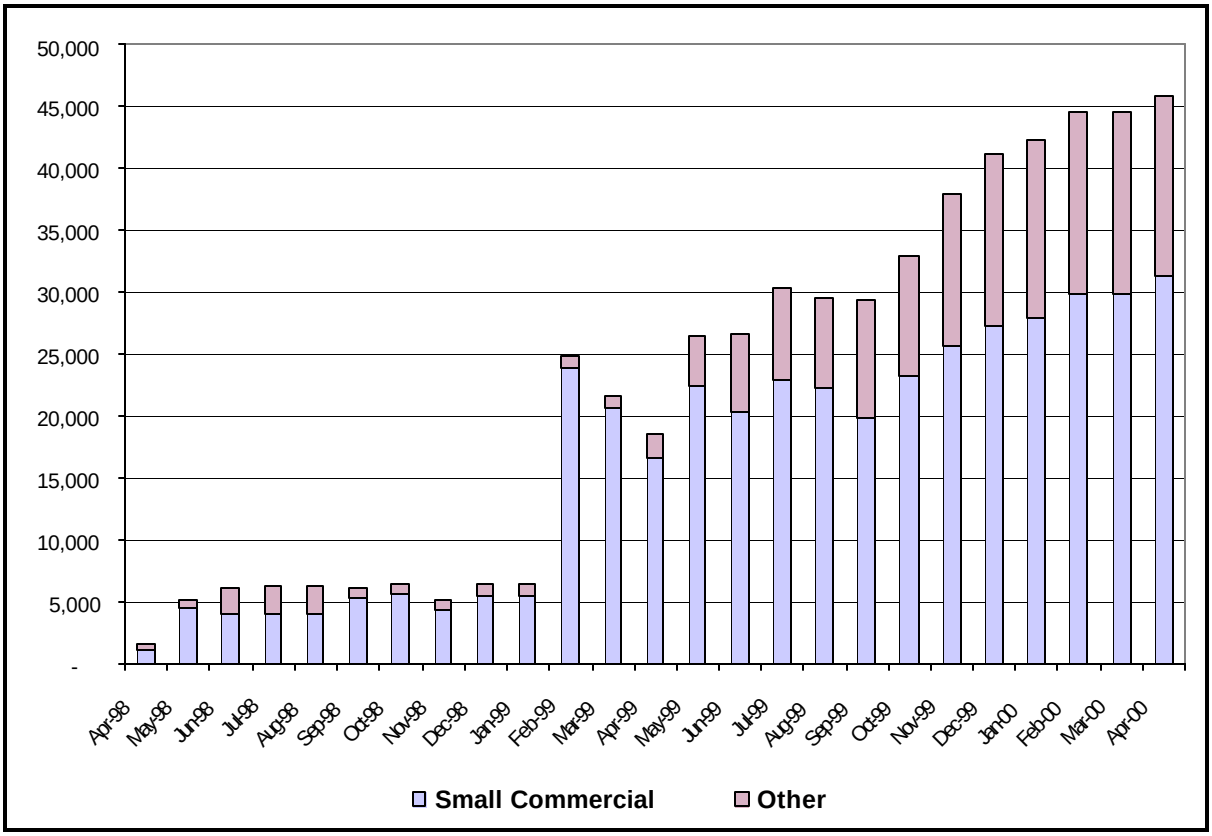


Figure 2-3 illustrates the change in nonresidential customers during this period. As shown, the Small Commercial sector increased nearly five-fold in February 1999. This result is due to the addition to the program of an ESP that started to report customers in February 1999. Similarly, the additional customers in the *Other* segment in May and June 1999 are from ESPs that previously did not report sales in this sector.

Figure 2-3: Number of Nonresidential Customers Served Under Program



For the Small Commercial segment, the number of customers served nearly reached a peak in February 1999, then decreased some in the spring, and started an upward trend again in October 1999. The *Other* segment (large commercial, agricultural and public lighting customers) experienced a drop-off in participation in September 1998 that lasted through February 1999. Customer participation for *Other* then started an upward trend and peaked in March 2000.

2.3 Program Incentive Payments

Increased incentive payments generally indicate a more active green power market. However, since the program credit can change every six months, there may be "adjustments" in this relationship at times when the credit incentive changes.

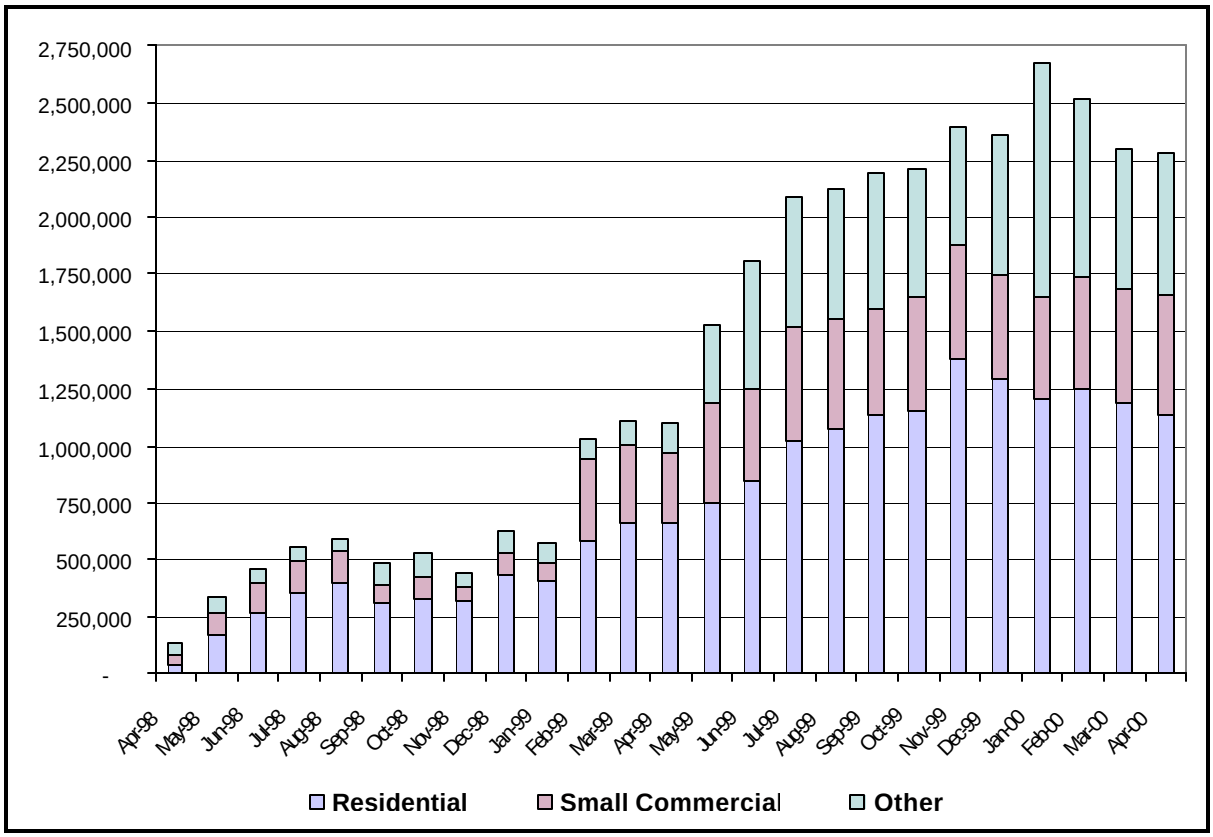
Incentive payments through April 2000 totaled more than $34 million. Table 2-2 shows the minimum and maximum monthly payments during this period. Furthermore, payments for residential customers represented approximately 53% of total payments. Proportions for the Small Commercial and *Other* customer segments were 22% and 25% respectively.

Table 2-2: Ranges of Monthly Incentive Payments by Customer Segment

Segment	Minimum Monthly Payment	When Minimum Occurred	Maximum Monthly Payment	When Maximum Occurred	Total for Period
Residential	$36,328	Apr-98	$1,376,854	Nov-99	$18,331,678
Small Commercial	$42,120	Apr-98	$519,591	Apr-99	$7,654,149
Other	$54,739	Jul-98	$1,028,169	Jan-00	$8,443,116
Total					***$34,428,943***

Incentive payments by customer segment over the evaluation period are illustrated in Figure 2-4. As shown, incentive payments peaked in January 2000 at just over $2.6 million.

Figure 2-4: Incentive Payments to ESPs



The per customer incentive on a monthly basis ranged from a low of $4 for the Residential segment to a high of $109 for the *Other* segment. The overall average incentive payment per customer was $9 for the Residential segment, $21 for the Small Commercial segment, and $72 for the *Other* segment.

Table 2-3 compares funds allocated with funds disbursed for the program through April 2000. As shown, the Program paid approximately $34.4 million in incentives through April 2000, leaving slightly more than $41 million in program funds available for the remainder of the Program. In addition, credits disbursed through that date exceeded allocations by $228,943.

Table 2-3: Customer Credit Funds

Period	Allocated	Disbursed	Allocation Balance	Customer Credit Fund Balance
4/98 – 12/98	$10,800,000	$4,149,170	$6,650,830	$71,450,830
1/99 – 12/99	$16,200,000	$20,507,635	$2,343,195	$50,943,195
1/00 - 4/00	$7,200,000	$9,772,138	$(228,943)	$41,171,057
Total	***$34,200,000***	***$34,428,943***		

2.4 Renewable Power Provided Under the Program

Increases in the quantity of renewable power sold by participating ESPs would indicate a more robust market in California.

Table 2-4 presents the ranges of monthly MWh provided by the participating ESPs through April 2000. As shown, total reported eligible sales for this period were 2,456,970 MWh.

Table 2-4: Ranges of Monthly MWh Provided by Participating ESPs

Segment	Minimum Monthly MWh	When Minimum Occurred	Maximum Monthly MWh	When Maximum Occurred	MWh Sales Total To Date
Residential	2,422	4/98	103,525	12/99	1,302,691
Small Commercial	2,808	4/98	41,567	4/00	542,624
Other	3,649	7/98	82,254	1/00	611,655
Total					***2,456,970***

This activity resulted in the following average monthly green energy (kWh) sold per customer for each customer segment:

- Residential segment: 592 kWh per customer, per month
- Small Commercial segment: 1,445 kWh per customer, per month, and
- *Other* segment: 4,912 kWh per customer, per month.

Figure 2-5 illustrates the monthly sales of MWh reported by participants. Note that the reported MWh of eligible green power provided under the Program peaked in January 2000 at 214,083 MWh. Overall, the majority of green power was provided to residential customers (53%), with 22% and 25% sold to the Small Commercial and *Other* sectors, respectively.

Figure 2-5: Monthly MWh Sold by Participating ESPs

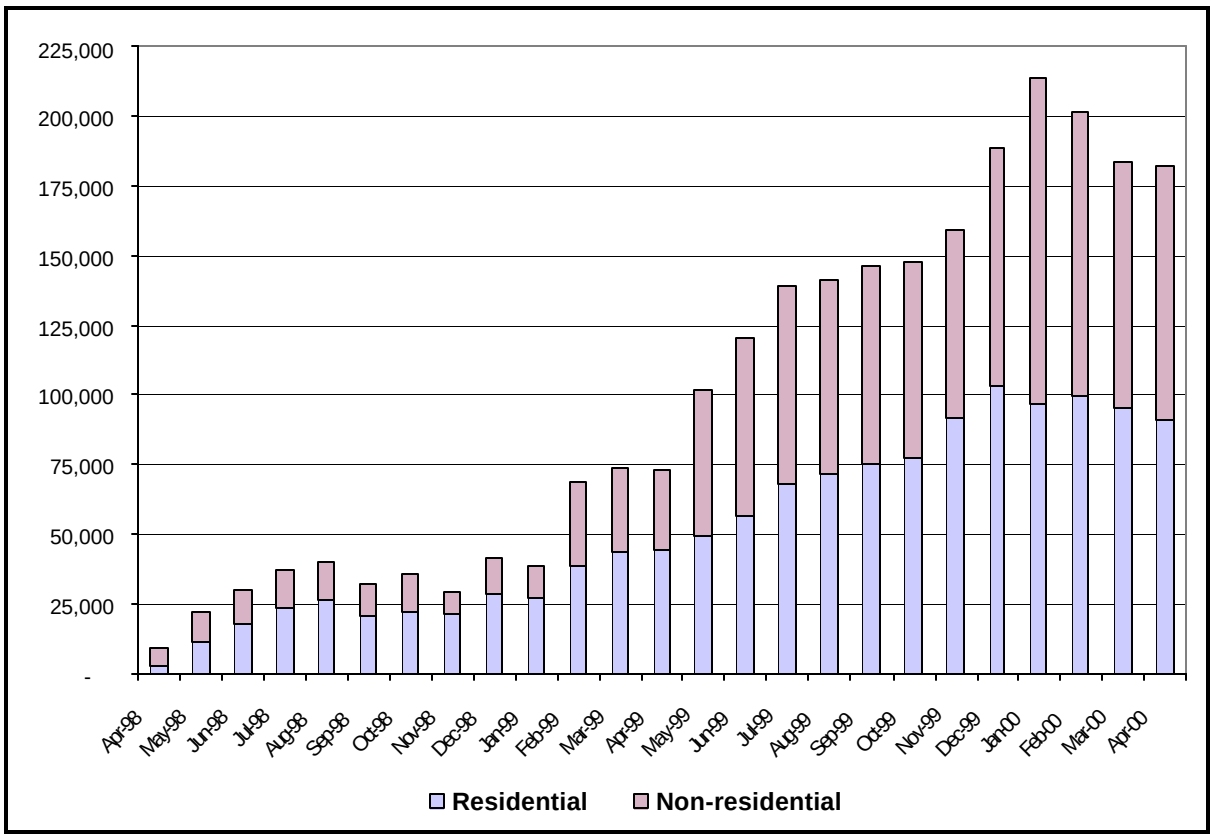
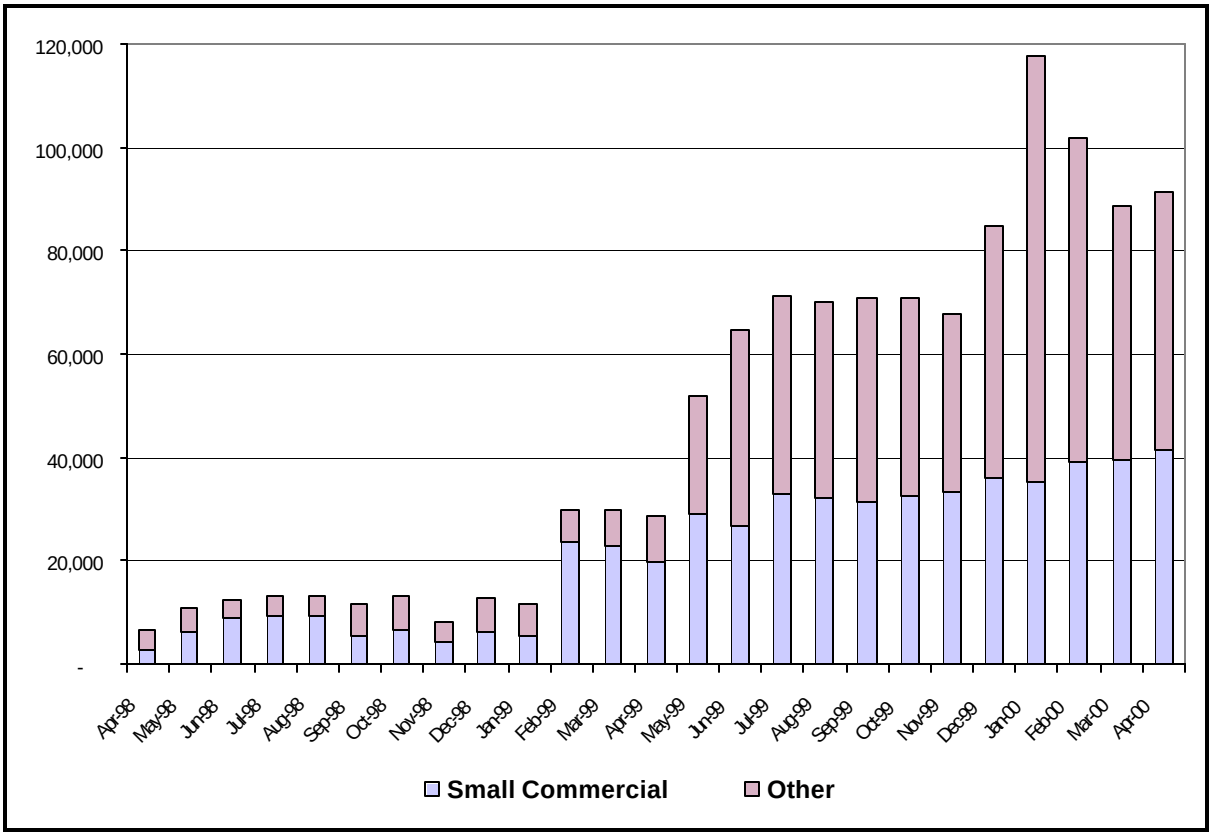


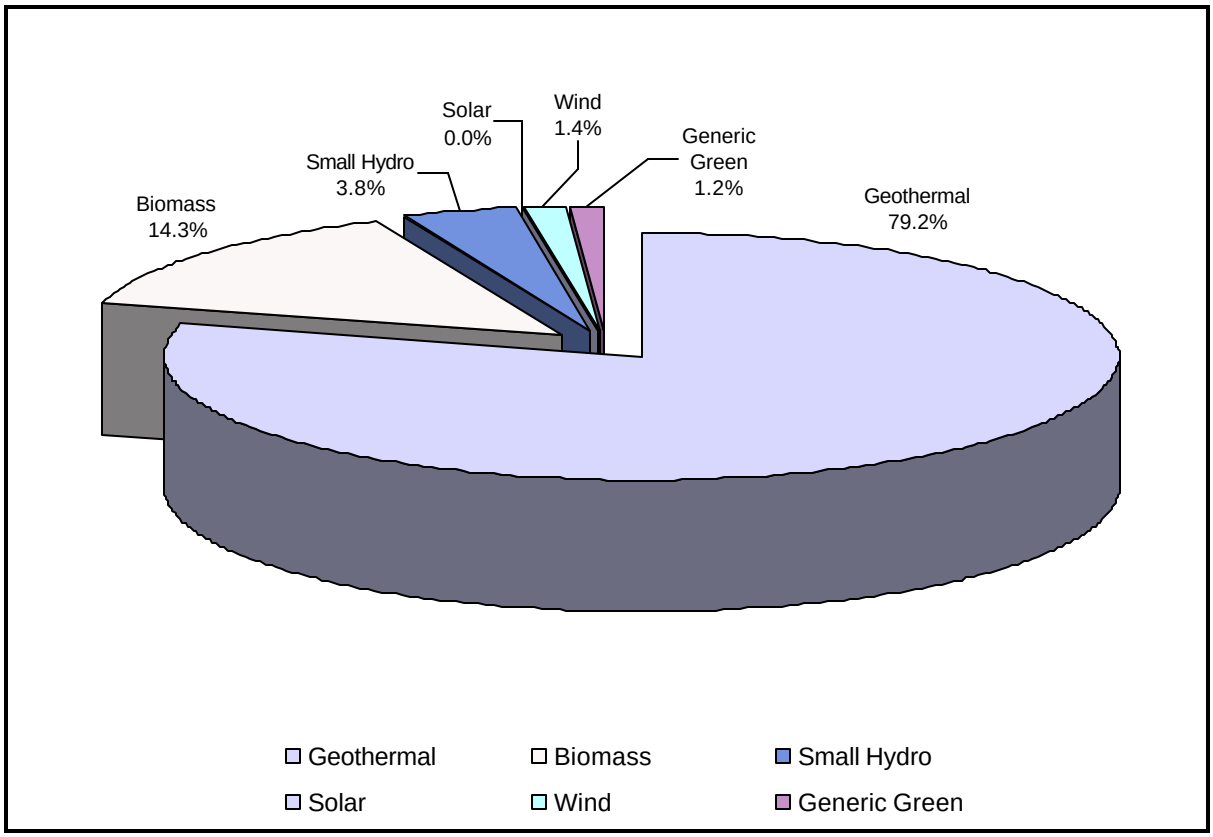
Figure 2-6 presents the monthly MWh sales reported by participants for the nonresidential sectors. As shown, green power provided to the *Other* sector more than doubled in May 1999 as two ESPs started reporting sales in that month. Furthermore, large increases in load reported by two ESPs in January 2000 caused the MWh sales to increase sharply for this sector. A new ESP to the program started reporting in that month as well.

Figure 2-6: Nonresidential Monthly MWh Sold by Participating ESPs



In comparison, Figure 2-7 illustrates the quantity of power purchased by ESPs in the program. As shown, this is reported by type of renewable energy: geothermal, biomass, small hydro, wind, and generic green. At 79% of the total, geothermal is by far the most common source of renewable energy purchased for the program. Other technologies contributed as follows: biomass (14%), small hydro (4%), and wind (1%). The small contribution by wind power reflects the fact that it was not purchased until September 1999.

Figure 2-7: MWh Green Power Purchased by Participating ESPs



Volume V

3 ESP Survey Results

3.1 Overview

A series of in-depth interviews was conducted with Energy Service Providers (ESPs) in order to glean their attitudes and behaviors relative to the retail green power market in California and to the Customer Credit Program. This section first discusses the sampling procedure for surveying ESPs, then presents the results of the in-depth interviews, and concludes with a summary of the findings.

3.2 Sampling Procedure

From program materials supplied by the Commission, 13 ESPs were identified that had reported customer activity in the Customer Credit Program through December 1999. The sampling procedure called for contacting as many participants as possible. In addition, as many nonparticipants were to be contacted as possible up to a target of 30 completed interviews. Nonparticipant ESPs were to include firms outside of California as well as firms that offer green power products and firms that did not offer green power products.

Table 3-1 presents the targeted and completed sample sizes for this effort. As shown, 18 participant and 4 nonparticipant interviews were completed for this program assessment. Several of the participants had just joined the program when interviewed and had not started reporting activity as of that time. Two of the participants interviewed had registered products with the Commission but did not have any sales as of the time of the interview.

Table 3-1: Targeted and Completed Sample Sizes

ESP	Targeted	Completed	Offers Green Power
Participant	13	18	18
Nonparticipant	17	4	0

3.3 Survey Results

Copies of the in-depth interview guides for participant and nonparticipant ESPs are provided in Appendix A. Results from the in-depth interviews with ESPs are described below. The results are organized in the following areas:

- Market Areas
- Customer Segments
- Consumer Education
- Marketing Approaches
- Market Barriers
- Customer Concerns
- Opinions of the Program.

Each of these is discussed in more detail below.

3.3.1 Market Areas

All of the ESPs interviewed sold power in the California market. Three of them sold only in particular geographic areas in California, while the others sold throughout the three major IOU territories. Ten of the interviewed ESPs sold in other states besides California. Eight ESPs sold only green power products and four ESPs sold only conventional products; the remainder sold both types. Of those selling green power, four ESPs sold in Pennsylvania as well as California. Table 3-2 summarizes these findings.

Table 3-2: ESP Sample by Power Products

Product/Market	Participants	Nonparticipants
Offers green power in California	18	0
Offers green power outside California	4	0
Offers conventional power product	10	4

Not all ESPs registered under the program are actively marketing green power or even have green power customers. As one respondent explained, “if someone comes in through our web site or 800 number we will sign them up but we do not actively solicit them.”

3.3.2 Customer Segments

The following discussion addresses some important differences among the Residential, Small Commercial, and *Other* sectors as reported by the ESPs.

Residential and Small Commercial

Of the ESPs interviewed, 16 of them (73%) served residential and/or small commercial customers. Most served both segments; there were two exceptions: one respondent was marketing only to small commercial customers and had plans to begin marketing to residential customers in the future; a second respondent reported marketing only to residential customers.

While many respondents indicated that marketing practices for these two sectors are similar, one respondent noted a difference: he explained that small commercial customers want some personal attention such as an agent discussing their account with them. Many residential customers, on the other hand, sign up at events or on the Internet. Another respondent explained that small commercial customers are more attractive than residential customers because of their aggregate load shapes. They tend to use electricity more evenly throughout a given week or month as opposed to a residential customer whose energy consumption is more dependent on the weather.

Most respondents with small commercial customers explained that their customers are buying green power only because it is discounted due to the Customer Credit Program. As one respondent stated, "we've had a lot of growth in this area but that's due to the credit which allows us to offer a discount; they won't pay more for green power."

One respondent explained that they target only small commercial but get some residential customers through that effort because people with small businesses may want the service for their home also. They described using traditional marketing channels such as telephone sales, direct mail, sales events at stores, and the Internet. Another described targeting specific types of commercial customers, such as post offices and water agencies.

Large Commercial and Industrial

Four respondents reported serving only customers in the *Other* segment. Ten others reported serving the *Other* segment as well as another customer segment. The most common comment heard about the *Other* customer segment from interviewed ESPs is that they will not pay more for green power. One respondent explained that, due to the large amounts of power large customers require, even an additional 1% of their bill is too much for them to pay because they are trying to keep their overheads low and remain competitive. In addition, the cap on the customer credit incentive for large non-residential customers causes the

benefit from the incentive to be minimal given their level of energy consumption. Therefore, large customers have little interest in green power. Two other reasons given for why ESPs may not market green power to large businesses include: 1) large customers may have multiple decision makers making the sales process more difficult, and 2) the ESPs do not want to get involved with metering which may be required.

On the other hand, some ESPs reported receiving inquiries from large businesses for green power pricing because they wanted to brand themselves as environmentally conscious or because their employees were asking for it.

One respondent described the way they market to select large commercial and industrial customers as totally different from smaller customers. "They want direct face to face sales as opposed to phone or mail, they expect to have account representatives rather than a call center customer rep., they require interval meters to be installed in their facilities, and the metering and billing is more complex."

3.3.3 Consumer Education

Respondents were asked how useful they thought the power content label was for educating consumers about their energy products. In addition, they were asked if they were aware of the consumer education efforts being implemented by the Renewable Energy Marketing Board and how effective they thought the efforts were. The responses to these questions are summarized below.

Power Content Label

Respondents reported mixed views regarding the power content label. Ten of the ESPs interviewed for this study reported that customers either were unaware of the label or were not interested in it. A few ESPs used it actively but explained that only very interested or educated consumers paid attention to it. They further explained that, for those customers who are interested, the power content label is useful to compare different products and to identify the technology (fuel source) for their green power.

Renewable Energy Marketing Board Efforts

Six of the ESPs interviewed had heard of the consumer education efforts implemented by the Renewable Energy Marketing Board, but none knew enough to have an opinion about their effect. One respondent commented that the only time she saw anything about them was when it came through their office; she had not seen anything as a consumer or heard of anyone seeing anything outside of her office. Another respondent explained that what she had seen was not very visible so it was probably not having much of an effect. On the other hand, one respondent commented that these efforts were "contributing in a good way to developing the market."

3.3.4 Marketing Approaches

ESPs were asked if their marketing messages for green power focused more on environmental or pricing issues. Five responded that they stressed environmental issues in their marketing messages, and eight reported emphasizing both environmental and pricing issues. Just two respondents reported emphasizing only price in their product marketing. Several respondents reported that they are not actively marketing at this time. They described how they have a registered green product and wait for customers to contact them about it.

One respondent described the difference he noticed in his marketing once they offered the Customer Credit discount. Before the credit, they had to make a stronger sales effort to overcome the price premium. Now, he explained, "it's an easier conversation to have with the customer when there's no price component." Another respondent who sells to governmental agencies explained that a few of his customers choose green power for environmental reasons. "The rest probably don't even know they get green power, but they like it because it's a lower cost due to the state subsidy." One respondent who supplies a conventional power product explained that he uses green power as a management tool so when the price of peak power becomes too high, he uses green power and his customers do not know what they are receiving.

Most ESPs interviewed charge a premium above the cost of conventional power for green power, for example $0.01 to $0.02 per kWh. Two described charging a fixed fee per month in addition to the California Power Exchange (PX) price per kWh. Two respondents reported discounted pricing for green power; they charge their customers the PX price, less a percentage discount. For ESPs who sell to both residential and commercial customers, the pricing structures are often different for the two market sectors. For example, one respondent described how their commercial customers pay $0.01 cents per kWh above PX, while his residential customers pay the PX price plus $2.99 per month.

Most respondents declined to discuss their profit margins. One explained that even though they had a bigger margin on their green product than they did on their conventional product, they were actually losing money on the green power products. He further explained that due to the differences in cost and reporting requirements for green and conventional products, comparing margins would be like "comparing apples to oranges." Two respondents reported that their margins on green power were "much higher due to the subsidy." Another respondent reported that his margin on green power was less because he dealt with large commercial customers subject to the $1,000 per year cap. Yet another respondent explained that it depended on which area he used for comparison because they sold in other states and their margins vary according to the region. He further explained, however, that it is easier to

make a profit with green power than with conventional power because people have shown that they will pay a premium for green power, but they will not for conventional power.

Respondents were also asked how a price increase of 5% would affect their overall sales. Several responded that it would cause a "significant impact" especially for larger nonresidential customers. Two respondents asserted that there would not be a large change in demand since their customers bought green power for the cause and not the price. As one stated, "two-thirds of the people out there are inclined to do things for the environment and about one-third are willing to pay more for an environmentally friendly product, so we try to sell to that one-third." Another respondent said they would lose some customers because large commercial or industrial customers just would not pay a higher price. Yet another stated that a 5% price increase would "break the back of the market."

3.3.5 Market Barriers

Respondents were asked to describe what barriers they were aware of that would impede the development of a competitive green power market. Barriers mentioned in the in-depth interviews include the premium price for green power, problems with the wholesale market for electricity in California, and the lack of consumer awareness.

ESPs explained that there are a few consumers who are so environmentally concerned that the price for green power is not an issue for them; however, the majority of consumers do not want to pay a premium for green power.

ESPs mentioned several characteristics of the California wholesale electricity market that represent barriers to their business. They further explained that having a sound generic market for electricity is the best way to have a good green market. Competing with utilities who are able to buy electricity in different ways was one noted area of contention. For example, one ESP mentioned the need to unbundle utility costs so that everyone can compete on a level playing field with the IOUs. Other comments heard along these lines include:

- "The California market was not set up to be very friendly to retail competition;"
- "The utilities are selling at a fixed wholesale rate that no one can beat;"
- "The utilities are able to buy in the forward market and they are able to hedge in a certain way that we cannot, and we are not able to compete on that basis."

Another key element of the current California wholesale market mentioned by the ESPs as impeding their business is the need for more new generation facilities. Respondents explained that California's stringent power plant siting requirements, along with the lack of economic incentives for new generation facilities, was restricting the addition of new power supplies. For example, one respondent explained "you need the right signals for generators

to come into California from the wholesale end so they can feel comfortable, have longevity, and know their prices will be sustained. Once the wholesale market comes into play, the green will follow."

The lack of consumer awareness was also mentioned by ESPs as a barrier to their market expansion. Respondents explained many consumers are still unaware of their option to switch providers, as well as the alternative of green power.

3.3.6 Customer Concerns

ESPs mentioned some concerns they have heard from their customers regarding switching to green power. Foremost among these was price, mentioned by nearly half of the interviewed ESPs. Furthermore, for large businesses, the concern is even greater since they are "bottom-line driven."

Another concern of customers, mentioned by ESPs in the in-depth interviews, is their lack of understanding of how the electricity grid works. Customers ask questions such as "do I need to get new power lines?" and "how do I know the electricity that comes to my house is really green power?" As one ESP explained, "the challenge is to give the customer enough information without confusing them."

Customers may also be unaware of the characteristics of renewable power and how it differs from the generic California mix. For example, some customers have stated that they thought the content of California's power mix was regulated to include renewable power. One ESP reported that he answers this concern for his customers by explaining that their product is 100% renewable, which is more than what is required by regulation.

One ESP interviewed mentioned the difficulty of handling billing and customer service issues with customers from the IOUs. He stated, "this is our biggest problem – bigger than anything associated with green power."

3.3.7 Opinion of the Program

All ESPs interviewed were aware of the Customer Credit Program. One ESP had just started selling green power to customers in May and had not yet submitted a monthly report (but planned to very soon). Six providers explained that they had registered a green product, but had no sales yet. One had no plans to sell green power. One explained that it was not worth it for the firm to be involved with the program, since all their customers were large energy users, and the $1,000 annual cap made the benefit insignificant.

Most respondents expressed positive views about the Customer Credit Program. Some of the comments made about the Program include the following: it is well-administered, it has

helped to get the green power market started in California, and it has helped ESPs to sell green power and stay competitive. Only a couple of negative comments were received: one ESP stated the Program was creating false price signals so that the true demand for green power was unknown; another ESP protested that the program made it more difficult for ESPs because of the increased cost of doing business.

Many ESPs interviewed stated that they thought the market would diminish if the program does not continue. One estimated the market might be cut in half after the Program ends. Another speculated that the market might go back to where it was before the Program. A third stated that since California policies were not conducive to developing a competitive green power market, the only thing keeping the market going at this time is the Program.

Respondents were questioned about their opinions on the Program's reporting requirements, the banking feature, and the variability of the incentive. Again, the overwhelming majority of responses were positive and supportive of the Program. Each of these areas is described further below.

Reporting Requirements

ESPs were not concerned about the monthly reporting requirements of the program. When asked about the monthly reporting requirements, most mentioned that they had received adequate help from Commission staff and did not find the reports burdensome or expensive to produce. Some commented that matching sales and purchases in the right months was sometimes frustrating. Many commented that they understood the requirements were necessary and were glad to comply. One stated "for a governmental agency, they did a good job keeping that fairly simple and straightforward."

The annual reporting requirement, however, was a different story. This requirement consists of an annual report audited by an independent auditor. The report is required to detail sales and incentive information by customer class. In the case of customers in the *Other* segment, sales per customer must be identified in order to monitor the Program's $1,000 per year funding cap.

Many ESPs interviewed had been participating in the Program less than one year and therefore had not yet gone through this process. Those who did comment on the annual reporting requirement said it was complex, not understood, burdensome, and time-consuming. However, when asked if the requirement caused a significant expense for their business, no one reported that this was the case.

Banking

Respondents were unanimous in praising the capability of banking excess renewable power purchases and load served through the program. Several said it was a "very important" feature of the program because it is difficult for them to know exactly how much electricity their customers will demand. In addition, the banking feature allows them to buy additional green power when the price is low and use it for future demand. One respondent added that it can get confusing, because the APX essentially "banks" the green power tickets for them while the program banks their overage or shortage of power sales. Another respondent explained that the banking feature helped with billing issues. "It's hard to figure the consumption correctly beforehand because ESPs rely on utilities to give meter read information and if the utility gives an estimated reading we have to go back (later) and get the actual reads."

Incentive Variability

Comments regarding the variability of the Customer Credit incentive were mixed. Most respondents conceded that lowering the credit incentive periodically would extend the program's life and they saw the need for that. They differed, however, on the impacts they thought the variability had on their prices. Most reported that varying the incentive level over time had a significant impact on their pricing. A few reported that they included the varying incentive in their long-term pricing structure and therefore had not made any changes so far to their pricing as a result of the credit changing.

One respondent thought that the forecasts presented by the Commission (when the reduction to $12.50 per MWh was announced) were overstated, and therefore the change to $12.50 was unnecessary. Another stated that they thought the incentive money was lasting longer than they had anticipated. Other comments stated that the variable incentive process was reasonable and well-managed.

Respondents were further asked if they would stay in the market if the credit were further reduced or discontinued. One ESP stated that if the incentive dropped below $10 per MWh, it would not be profitable for them to stay in the market. Several indicated they would have to raise their prices and see how many customers remain. A few stated they would think about pulling out of the California market. One stated that they would remain in the market because their pricing was not based on the credit. One stated they would remain in California but may not sell green power. Another stated that they would continue to sell in California, but would lower the percentage of renewable power in their product.

Other Comments

Most respondents indicated they thought the program had helped start a market for green power. Many stated that demand would drop off without the Program and that most green ESPs would leave the market. One respondent explained that they had offered green power for a year before joining the program. They reported that after they offered the discount, they had a "huge increase in customer sign-ups."

One respondent lamented that the program was not more stringent on utilizing new renewable resources. This ESP explained that some energy providers are just reshuffling their existing resources in order to get the incentive.

Respondents were asked how influential they thought the program had been on the development of a retail green power market in California. Responses were based on a one to five scale, where one means "not at all influential" and five means "very influential." Responses ranged from one to five with a mean of 4.0 (corresponding to a response of "influential") and a standard deviation of 1.17.

All respondents indicated they would like the program to continue. Suggestions for funding the program during a longer period included using 1) more public benefit funding, 2) California's tax windfall, or 3) a tax on conventional power. One ESP stated, "if deregulation of the utility industry follows what the telecommunications industry did, you'd expect after about four years that about 25% of the people would be willing to switch providers. To get to that, it would be good to have these credits available."

3.4 Summary

This section presents the results of in-depth interviews with 22 ESPs concerning their attitudes and opinions on the green power market and the Customer Credit Program. The following summarizes the key findings of these interviews.

- Slightly more than one-third of the ESPs interviewed offer green power products exclusively; 18% sold just conventional energy products; the remainder sold both green and conventional products.
- Most ESPs who serve residential customers also serve small commercial customers. Approximately 40% of the ESPs interviewed served all three major customer classes.
- A common trait reported about the *Other* segment is that they are unwilling to pay a premium for green power.
- Nearly half of the respondents reported that the power content label was not useful because most customers were not interested in it.

- Over 70% of the ESPs reported they had not heard of the marketing efforts of the REMB; those who had heard of these efforts did not know enough to comment on them.
- Only two ESPs reported emphasizing only pricing in their marketing messages.
- Two ESPs reported selling green power at a discount, making it less than the PX price; most sold it for a premium.
- ESPs mentioned the following market barriers to developing a competitive green power market in California: premium price for green power, problems with the wholesale market for electricity in California, and the lack of consumer awareness.
- ESPs mentioned the premium price of green power, lack of understanding of the renewable power and power grid, and problems with billing and customer service as major concerns of customers in California thinking of switching to green power.
- Nearly all ESPs spoke well of the Program and all wanted it to continue.
- Participants reported no concerns with the Program's monthly reporting requirement; however, the annual audit requirement was reported to be difficult to understand.
- ESPs differed on their opinions of the variability of the credit incentive. Many reported that they needed the credit to stay where it currently is ($10 per MWh) in order for them to remain competitive with conventional energy products and stay in business in California.
- On the average, ESPs rated the program as "influential" in developing a retail green power market in California.

Volume V

4 Customer Survey Results

4.1 Overview

A key element of this program evaluation, a mail survey, was sent to electric consumers in the California IOU territories. The survey included both residential and non-residential customers and asked respondents questions regarding their opinions on green power and, if aware of it, on the Customer Credit Program.

4.2 Sampling Procedure

4.2.1 Residential Mail Survey Sample Design

Overview

This section discusses the sample design used for the residential electric energy preference mail survey. There were two distinct samples drawn from the population of residential customers in the Pacific Gas & Electric (PG&E), Southern California Edison (SCE) and San Diego Gas & Electric Company (SDG&E) service territories. The first sample was designed to reflect the population of residential customers in the three utilities (all-residential customer sample). Data for this sample design were gathered from California Energy Commission (Commission) records, and commercial mailing lists. The second sample was drawn from the population of residential customers located in the three utility service territories participating in the Customer Credit Program (ESP-residential customer sample). Data for the latter group were developed from Commission Customer Credit Program records supplied by participating ESPs.

Just under 2,000 surveys were mailed out to the ESP-residential customer sample. From this mailing, just under 700 were completed and returned, reflecting a response rate of 35.0%. A total of approximately 2,750 surveys were sent to the all-residential customer sample. Of those sent, 470 were completed and returned, indicating a response rate of just over 17%.[1]

Detailed discussions of the sample design and response rate for the two residential mail survey efforts are provided below. These discussions include information on the sample frame, sample stratification scheme, sample allocation, mailing protocol and the response rate for each survey.

[1] The total sent out includes the 256 that were returned with incorrect mailing addresses or name of occupant. If we subtract these from the number sent the response rate is 18.8%.

All-Residential Customer Sample

A stratified sampling scheme was developed for the survey of residential electric consumers in the three IOU utility service areas. In particular, the sample frame was stratified by utility and residence type (single family and multi family[2]). The frame for the all-residential customers sample was developed from data on total number of customers by utility and residence type based upon data provided by the Commission.[3]

The sample size for the survey was predetermined as 2,750 mailed out surveys. Based on an assumed response rate of 25%, this would result in 687 completed surveys. The sample of 2,750 was first proportionally allocated across the survey territory by number of customers. Insofar as the SDG&E service territory is substantially smaller than either the SCE or PG&E services territory, and much of the SDG&E service area was included in REMB's initial Consumer Education Pilot, a relatively small sample size was calculated for the SDG&E service territory. Therefore, it was decided to oversample the SDG&E service territory.

Once the final allocation was determined, the required mail out sample was randomly selected within each stratum from a commercially available list of residences.[4] Information from the commercial list included occupants' names, addresses, and residence types. This information allowed the list to be stratified by utility area and residence type and provided the necessary contact information to send the survey[5]. The mail survey protocol included a single mail out of the survey with a post-card follow up two weeks later.

Table 4-1 presents a summary of the sample design by residence type for all residential customers. As depicted in the table, 470 surveys were completed and returned, representing an overall response rate of 17%. The response rate for single-family homes was slightly higher than for residential customers in multi-family homes.

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2 A single-family home is a single detached home, including mobile homes. A multi-family contains two or more attached units.

3 California Energy Commission, Staff Report, California Energy Demand: 1995-2015, Volumes III, V, and VII, July 1995.

4 American Consumer Lists were provided with explicit instructions on the number of needed sample points and to select these sample points using a random sampling technique. The American Consumers Lists company has been in the data business for over 28 years and is experienced with the use of most data sampling techniques.

5 The list of California residences was purchased from American Consumers Lists. American Consumers Lists developed the list based on the strata definitions and sample allocations defined by RER.

Table 4-1: Summary of Residential Mail Survey – All Residential Customers

Residence Type	Frame[6]	Sample Targets	Mailed	Completed	Response Rate
Single Family	6,933,634	487	1,950	368	18.9%
Multi-Family	2,770,805	200	800	102	12.8%
ALL	9,704,439	687	2,750	470	17.1%

ESP-Residential Customer Sample

A stratified sampling scheme was also developed for the ESP-residential customer sample design. In particular, the sample frame of all residential customers receiving the customer credit was stratified by participating ESP. Information to develop the sample frame was collected from the Customer Credit Program records. This included data on the number of customers receiving the customer credit for each of the participating ESPs.

Although the Customer Credit Program records could provide a distribution of customers by ESP, there was no individual customer data available in the files. Therefore the major ESPs that participate in the Customer Credit Program were contacted to seek their cooperation in mailing out the survey to a sample of their customers. Four ESPs serving residential customers agreed to assist us in the survey effort. These four ESPs were either supplied with survey materials and mailed out the survey themselves, or they supplied the contact information to RER and RER mailed out the survey.

The sample size was based on a mail out sample of 2,000. Based on an assumed response rate of 25%, around 500 completed surveys were expected. The sample was allocated proportionally across the ESPs that agreed to participate in the survey, based on the number of residential customers served by the participating ESPs.

Table 4-2 presents an overview of the sample design for the ESP-residential customer survey. Included in Table 4-2 is the break out by ESP of the sample frame, the sample targets, the number mailed, the number completed and the response rate. As shown, the response rate was substantially higher than the all-residential customer survey, with an average response rate of 35% across all ESPs. The ESP4 customers exhibited the highest response rate with just over 50% of customers responding to the survey.

6 Sample frame data from California Energy Commission, Staff Report, California Energy Demand: 1995-2015, Volumes III, V, and VII, July 1995.

Table 4-2: Summary of ESP-Residential Customer Mail Survey

ESP	Residential Frame	Sample Targets	No. Mailed	No. Completed	Response Rate
ESP1	-	-	-	-	-
ESP2	13,233	55	221	30	13.6%
ESP3	60,733	254	1,014	271	26.8%
ESP4	42,926	179	717	383	53.4%
ESP5	1,633	7	27	8	29.6%
ESP6	708	-	-	-	-
ESP7	17,308	-	-	-	-
ESP8	2,032	-	-	-	-
ESP9	2,952	-	-	-	-
ESP10	789	-	-	-	-
All ESPs	142,311	-	-	-	-
ESPs participating in Survey	118,525	495	1,979	692	35.0%

4.2.2 Commercial, Industrial and Agriculture Mail Survey Sample Design

Overview

This section discusses the sample design developed for the commercial, industrial and agricultural (C-I-A) electric energy preference mail survey. Similar to the residential design, there were two distinct samples drawn from the population of commercial and residential customers in the PG&E, SCE, and SDG&E service territories. The first sample was designed to reflect the population of C-I-A customers in the three utilities (All C-I-A sample). Data for this sample design were gathered from California Energy Commission (Commission) records and commercial mailing lists. The second sample was drawn from the population of C-I-A customers who are participating in the Customer Credit Program (ESP C-I-A sample) (and therefore are located in the three utility service territories). Data for the latter group were developed from Commission Customer Credit Program records and from randomly drawn customer ESP mailing lists supplied by participating ESPs.

Just over 900 surveys were mailed out to the ESP C-I-A sample. From this mailing, just under 200 were completed and returned, reflecting a response rate of 21.8%. A total of

approximately 2,750 surveys were sent to the All C-I-A sample. Of those sent, 306 were completed and returned, indicating a response rate of just over 11%[7].

Detailed discussions of the sample design and response rate for the two C-I-A mail survey efforts are provided below. These discussions include information on the sample frame, sample stratification scheme, sample allocation, mailing protocol and the response rate for each survey.

All-C-I-A Sample Design

A stratified sampling scheme was developed for the survey of C-I-A customers in the three IOU utility areas. In particular, the sample frame was stratified by sector (Commercial, Industrial and Agriculture). The commercial sector was then stratified by building type, and the industrial sector was broken out by construction, mining and manufacturing. The frame for the All-C-I-A customers sample was developed from data on annual kWh usage for each sector by utility and from data on square footage by building sector and by utility from the Commission[8].

The sample size for the survey was predetermined as 2,750 mailed out surveys. Based on an assumed response rate of 25%, this would result in 687 completed surveys. The sample of 2,750 was first proportionally allocated across the sectors (commercial, industrial and agricultural) and survey territory by annual usage. The commercial sector sample was then proportionally allocated across building types by total square footage. The industrial sector was then proportionally allocated across subsectors (construction, mining, and manufacturing) by annual usage. Once this preliminary allocation was complete, the allocations across sectors were adjusted to oversample commercial buildings and undersample agricultural. Further, insofar as the SDG&E service territory is substantially smaller than either the SCE or PG&E services territory, a relatively small sample size resulted for the SDG&E service territory. In addition, much of the SDG&E service area was included in REMB's initial Consumer Education Green Power Pilot activities. Therefore, it was decided to oversample the SDG&E service territory.

Once the final allocation was determined, the required mail out sample was randomly selected within each stratum from a commercial list of C-I-A facilities. Information from the commercial list included contact name, business name, address, and SIC designator. This information allowed the list to be stratified and provided the necessary contact information to

[7] The total sent out includes the 273 surveys that were returned with incorrect mailing addresses or the name of occupant. If we subtract these from the number sent out, the response rate climbs to 12.3%.

[8] California Energy Commission, Staff Report, California Energy Demand: 1995-2015, Volumes III, V, and VII, July 1995.

send the survey. The mail survey protocol included a single mail out of the survey with a post-card follow up to all non-respondents two weeks later.

Table 4-3 presents a summary of the All C-I-A customer survey sample design. Included in Table 4-3 is the break out by sector of the sample frame, the sample targets, the number mailed, the number completed and the response rate. As depicted in the table, 306 surveys were completed and returned, representing an overall response rate of 11.2%.

Table 4-3: Summary of Non-Residential Mail Survey – All C-I-A Customers

Sector	Frame[9] (%)	Sample Targets	No. Mailed	No. Completed	Response Rate
Commercial:					
Office	12.2	120	479	52	10.9%
Restaurant	1.5	14	55	9	16.4%
Retail	8.6	83	331	35	10.6%
Food Stores	2.3	21	85	14	16.5%
Lodging	2.8	29	116	14	12.1%
Colleges	2.3	23	92	11	12.0%
Hospitals	2.7	27	107	19	17.8%
Schools	4.3	39	154	12	7.8%
Warehouse	7.4	71	283	29	10.2%
Misc	9.7	90	359	31	8.6%
Industrial:					
Construction	9.6	80	319	29	9.1%
Mining	4.8	2	7	2	28.6%
Manufacturing	22.9	69	275	38	13.8%
Agriculture:	8.9	20	78	11	14.1%
All C-I-A	***100.0***	***685***	***2,740***	***306***	***11.2%***

9 Distribution of Frame based on sales by sector. Commercial sector segmented based on estimated total square footage. See California Energy Commission, Staff Report, California Energy Demand: 1995-2015, Volumes III, V, and VII, July 1995.

ESP C-I-A Customer Sample

A stratified sampling scheme was also developed for the ESP-C-I-A customer sample design. In particular, the sample frame of all C-I-A customers receiving the customer credit was stratified by participating ESP. Information to develop the sample frame was collected from the Customer Credit Program records. This included data on the number of small commercial and other large C-I-A customers receiving the customer credit for each of the participating ESPs.

Although the Customer Credit Program records could provide a distribution of customers by ESP, there was no individual customer data available in the files. Therefore, similar to the residential survey effort, the major ESPs that participate in the Customer Credit Program were contacted to seek their cooperation in mailing out the survey to a sample of their customers. Five of the eight ESPs serving C-I-A customers at the time of the survey agreed to assist RER in the survey effort. These five ESPs were either supplied with survey materials and mailed out the survey themselves, or they supplied the appropriate contact information to RER and RER mailed out the surveys.

The sample size was based on a mail out sample of 919. Based on an assumed response rate of 25% we were expecting around 229 completed surveys. The sample was allocated proportionally across the ESPs that agreed to participate in the survey, based on the number of customers served by these ESPs.

Table 4-4 presents an overview of the sample design for the ESP C-I-A customer survey. Included in Table 4-4 is the detail by ESP of the sample frame, the sample targets, the number mailed, the number completed and the response rate. As shown, the response rate was substantially higher than the All C-I-A customer survey, with an average response rate of 22% across all ESPs. The ESP5 commercial customers exhibited the highest response rate with just under 36% of the sampled commercial customers responding to the survey.

Table 4-4: Summary of Non-Residential Mail Survey – ESP C-I-A Customers

ESP	Frame	Sample Targets	No. Mailed	No. Completed	Response Rate
ESP1	5,235	13	53	11	20.8%
ESP2	2,520	23	92	14	15.2%
ESP3	16,951	116	464	71	15.3%
ESP4	725	28	114	34	29.8%
ESP5	5,743	49	196	70	35.7%
ESP6	141	-	-	-	-
ESP7	6,566	-	-	-	-
ESP8	25	-	-	-	-
ESP9	-	-	-	-	-
ESP10	-	-	-	-	-
All ESPs	37,906	-	-	-	-
ESPs participating in Survey	31,174	229	919	200	21.8%

4.3 Approach

In presenting the survey responses, respondents were characterized as either "green" or "nongreen," meaning they purchased green power or they did not purchase green power. These two categories were determined as follows. First, all respondents known from the sampling procedure to be customers of ESPs participating in the Program were labeled as "green." Second, of the remaining respondents, those who named an ESP participating in the Program as their electricity provider were labeled as "green."[10] All remaining respondents were labeled as "nongreen."

A small set of survey questions were addressed to respondents who claimed to be aware of the Customer Credit Program and receiving the credit. In these cases, respondents were further characterized as "known participants" or "others." Respondents known from the sampling procedure to be customers of ESPs participating in the Program were labeled as "known participants." All remaining respondents were labeled as "others."

[10] The assumption was made that California customers of participant ESPs were receiving green power. Further, it was learned during the in-depth interviews with ESPs that those ESPs who also sell nongreen products either sell them in other states or sell them to customers in the Other segment after the capping limits are reached.

Expansion weights were constructed for both the residential and non-residential mail surveys. These weights were developed to account for the stratified sample design and the oversampling of customers receiving power from ESPs. In particular, two sets of weights were developed. The first set of weights was constructed for comparing green and nongreen respondents. The second set of weights was constructed for comparing customers known to be receiving power from ESPs and customers not known to be receiving power from ESPs.

4.4 Survey Results

In the remainder of this section, the results of the residential and non-residential surveys are presented. These results are further discussed in Section 5. Copies of the survey instruments for residential and non-residential customers are provided in Appendix B.

4.4.1 Residential

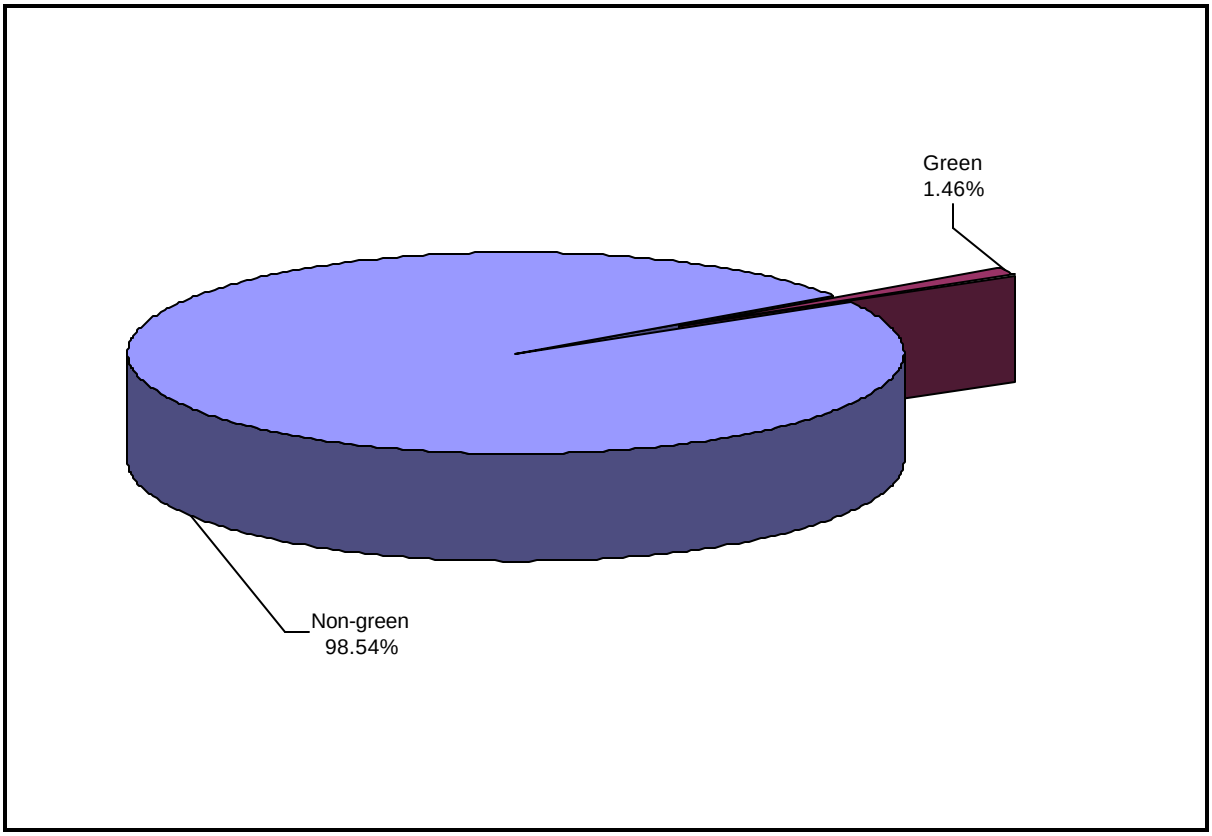
A total of 1,162 completed surveys were received. Of these, 74 surveys were omitted from the analysis because the respondents did not live in an area eligible for the Customer Credit Program. This left 1,088 completed surveys available for analysis. Table 4-5 provides some of the mean characteristics for this sample.

Table 4-5: Residential Sample Characteristics

Attribute	Mean
Age	52
Years of schooling	16
Home ownership	79%
Number in household	3
Typical winter monthly electric bill	$89
Typical summer monthly electric bill	$85
Buys green power	65%
Receives Customer Credit	64%

When weighted up to the population, the proportion of individuals purchasing green power is 1.46%. Figure 4-1 illustrates this relationship.

Figure 4-1: Proportion of Population Purchasing Green Power (April 2000)



The remainder of this subsection presents weighted survey responses for the residential sample. The results are presented as follows:

- Characteristics of Green Power Customers,
- Awareness of Choice,
- Awareness of and Opinions about Green Power,
- Reported Willingness to Pay for Green Power, and
- Awareness of the Customer Credit Program.

Characteristics of Green Power Buyers

With the possible exception of upper-level education and lower-end electric bills, the demographics of the respondents who buy green power are similar to those for the nongreen respondents. As shown in Figure 4-2, both groups have the highest proportion of their income in the $50,000 to $74,999 range.

Figure 4-2: Income Groups

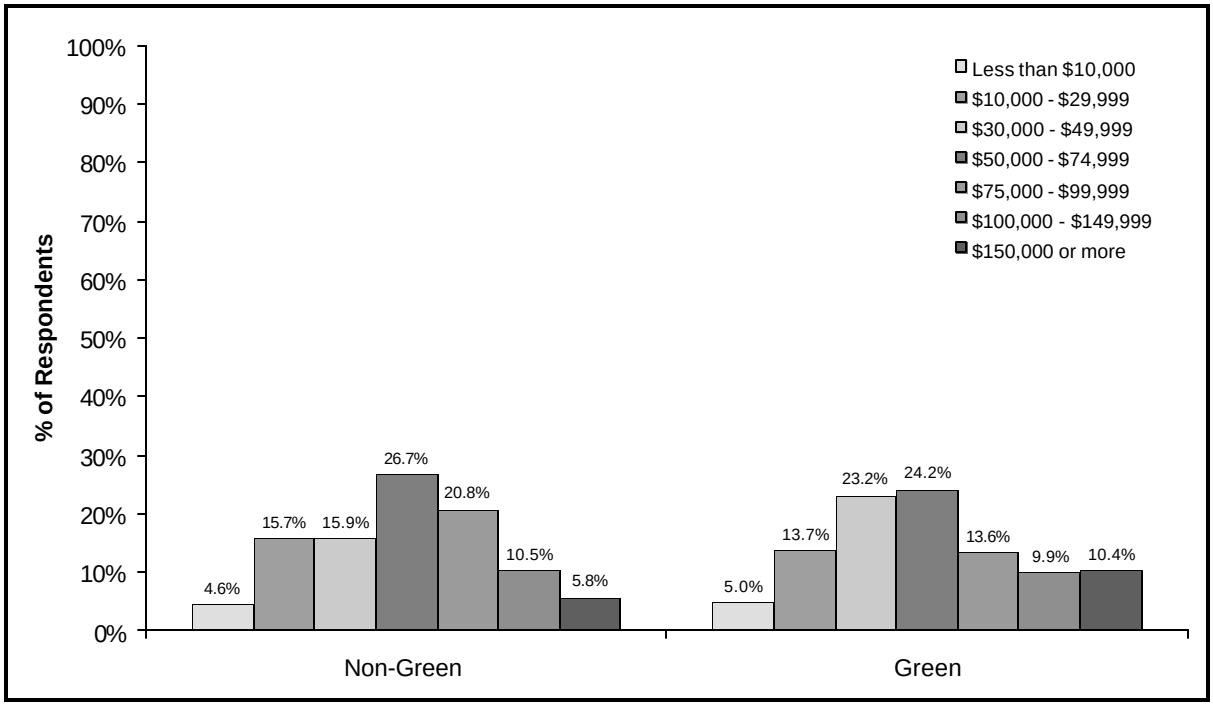


Figure 4-3 presents the age distributions for the green and nongreen respondents. As shown, both groups are distributed similarly.

Figure 4-3: Age Groups

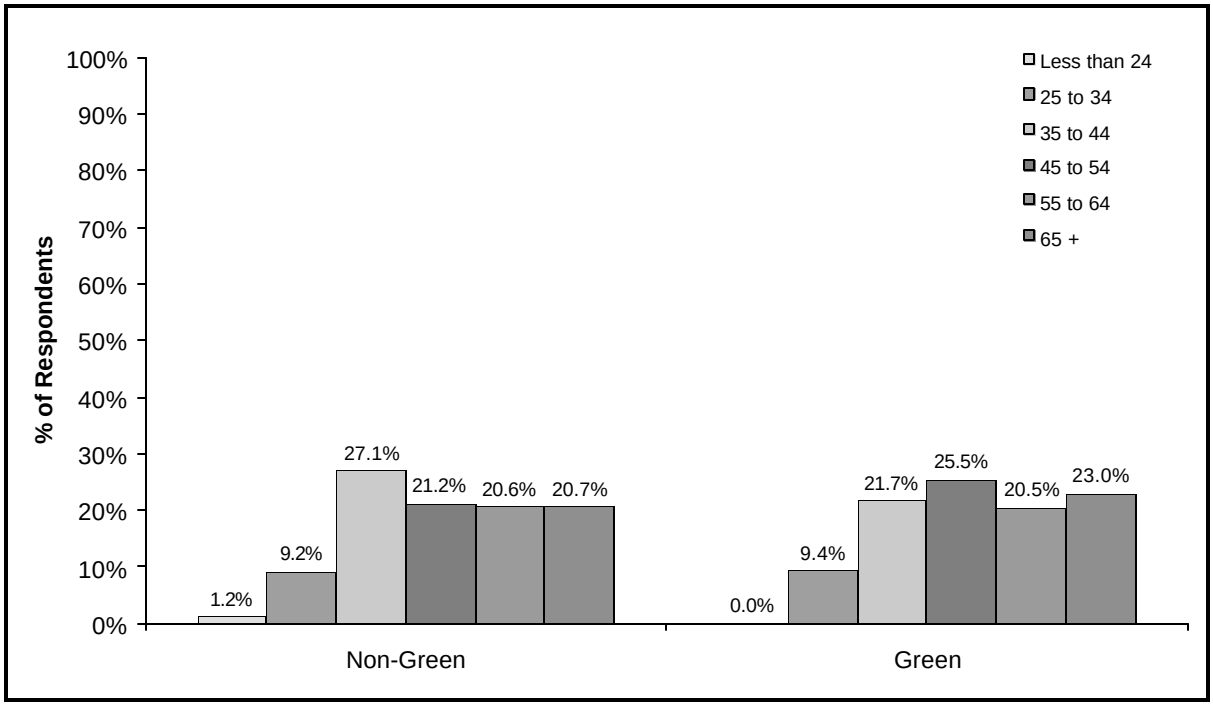


Figure 4-4 presents the distributions of education levels for green and nongreen customers. It is interesting to note that the green group shows a higher proportion of respondents who attended graduate school than does the nongreen group.

Figure 4-4: Education Groups

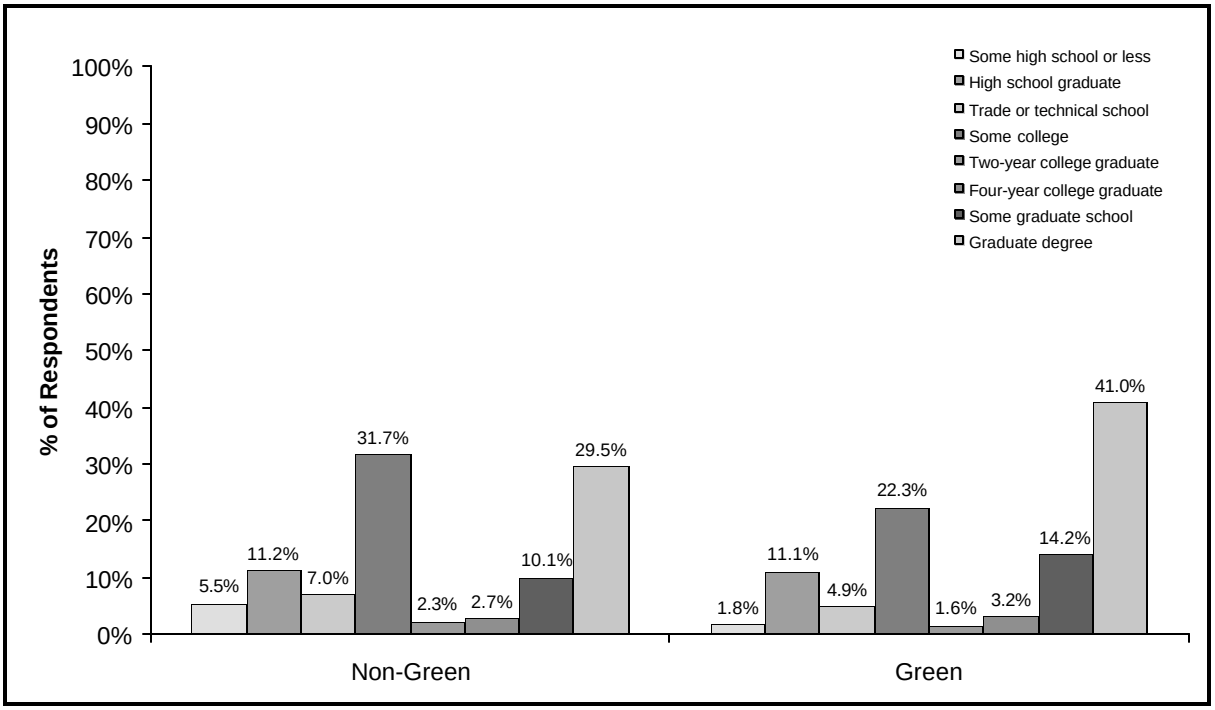


Figure 4-5 presents the distribution of housing types for green and nongreen respondents. Interestingly, there appears to be a slight increase in single-family homeowners in the nongreen group.

Figure 4-5: Types of Housing

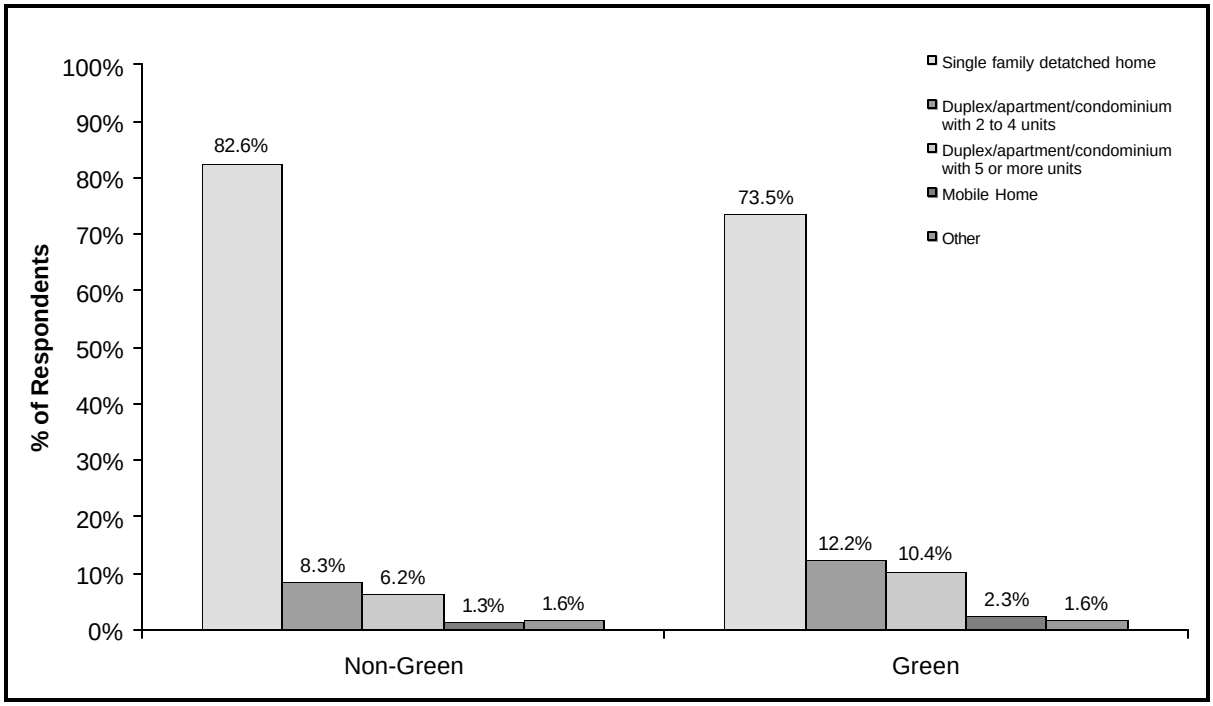
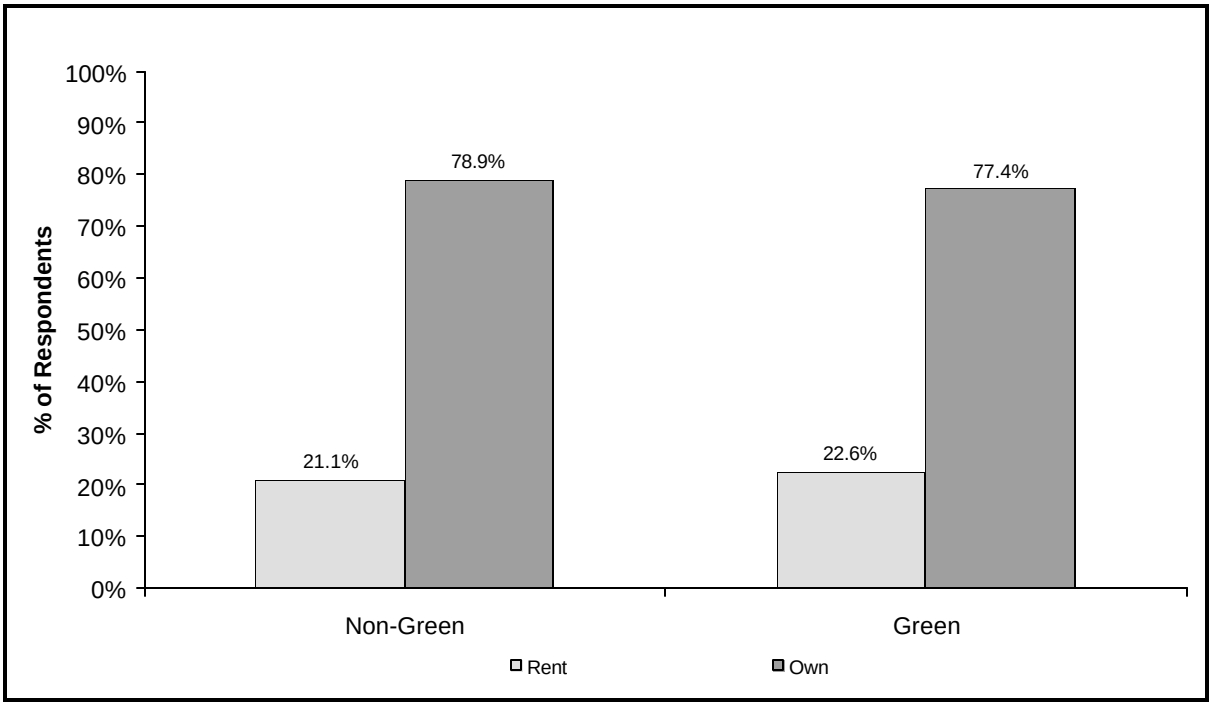


Figure 4-6 presents the proportion of respondents in both groups that owns or rent their home. As shown, the homeownership characteristics for the two groups are distributed very similarly.

Figure 4-6: Home Ownership



Respondents were asked to report their typical electricity bills for the winter and summer months. A note was included in the survey to remind them that if they also used gas, the electricity might be only a portion of their monthly bill. As shown in Figure 4-7, the majority of respondents reported monthly winter bills under $100, with a slightly higher proportion of green customers in this range.

Figure 4-7: Typical Monthly Winter Electric Bill

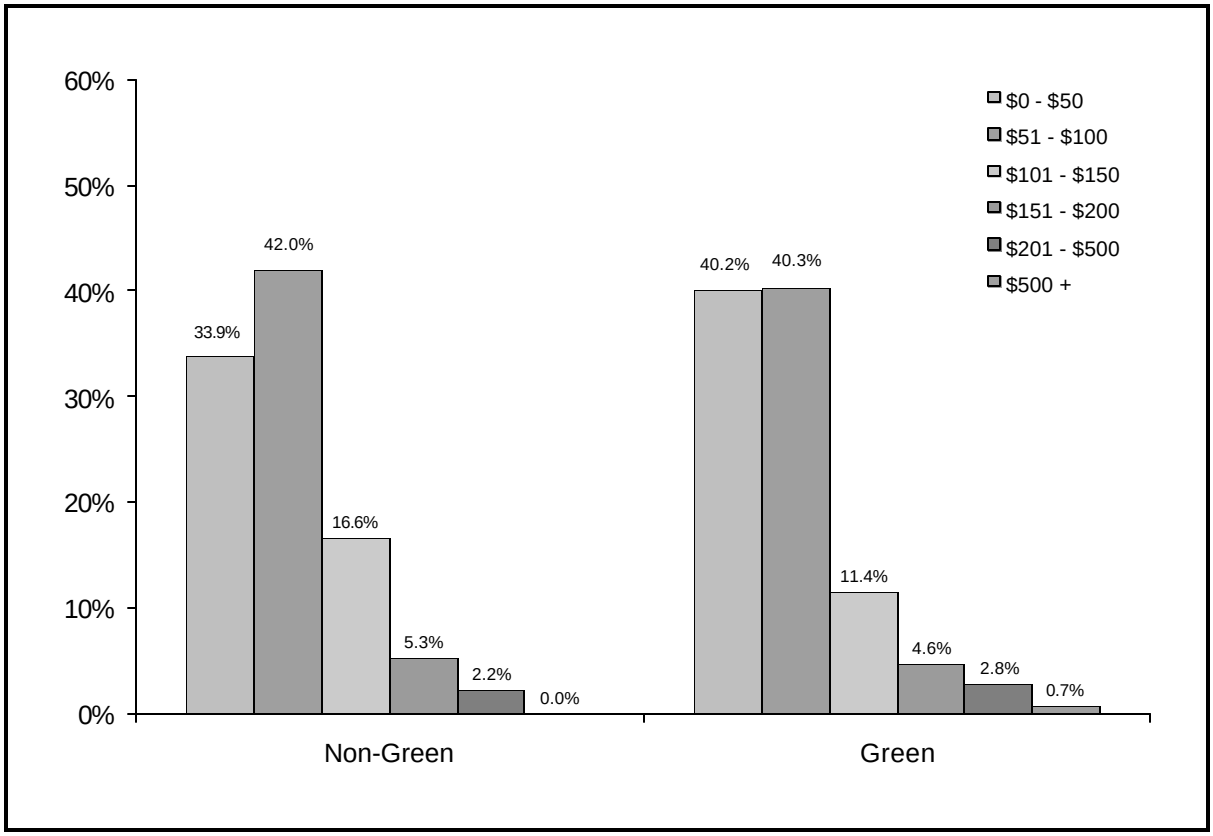
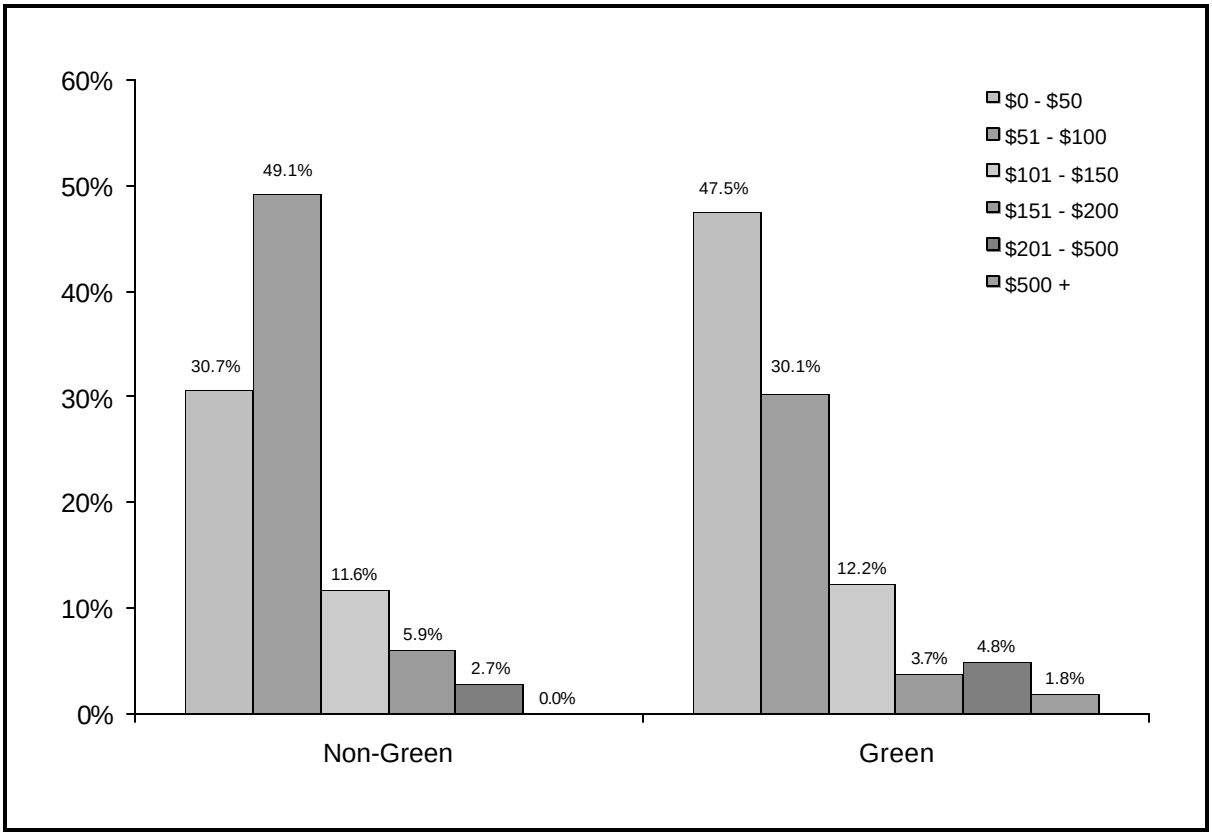


Figure 4-8 presents the responses for reports of summer electric bills. Nearly half of green respondents reported a typical summer monthly bill of less than $50 and a third reported a monthly bill of $51 to $100. For nongreen respondents, nearly half reported their bills in the $51 to $100 range with a third reporting bills of less than $50.

Figure 4-8: Typical Monthly Summer Electric Bill



Awareness of Choice

Electric consumers were asked several questions regarding their awareness of electric industry deregulation and their ability to switch energy providers. As shown in Table 4-6, 70% of the *green* respondents acknowledged they buy electricity differently now than they did a year or two ago, while only 16% of the *nongreen* respondents acknowledged this. Furthermore, 75% of the green respondents reported receiving offers from ESPs, as compared to less than one-half of the *nongreen* respondents.

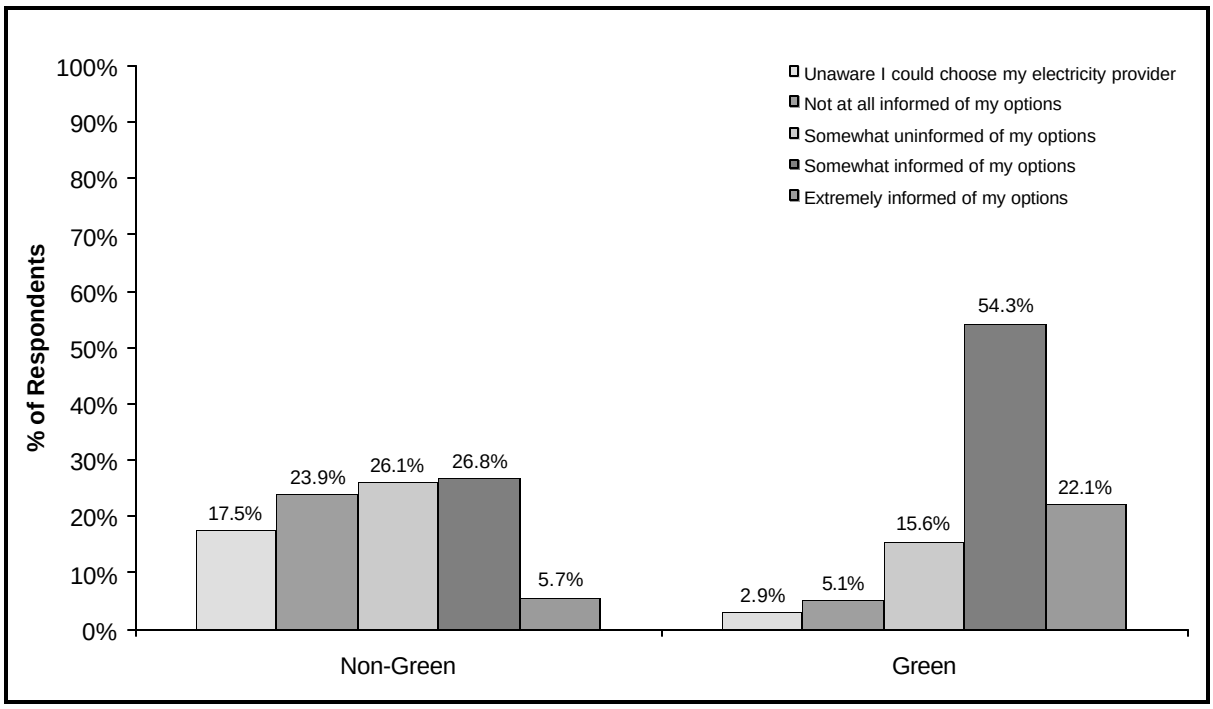
Table 4-6: Customer Awareness

Response	Nongreen	Green
The way I buy electricity currently is different from a year or two ago.	16.8% (0.0207) n = 328	70.0% (0.0178) n = 665
In the past two years, I have received information in the mail or by telephone from companies asking me to switch my energy provider.	49.7% (0.0259) n = 374	75.1% (0.0164) n = 695

Standard errors shown in parentheses

Figure 4-9 presents the results of a question that asked respondents to what extent they felt that they were informed about their options for choosing an electricity energy provider. As shown, the majority of green respondents (76%) reported they were somewhat or extremely informed of their options, while only 31% of nongreen respondents felt this informed of their options.

Figure 4-9: Extent Informed of Options



Respondents were asked what factors would be important to them if they were to consider changing electricity energy providers. Responses were given on a scale of one to five, where one means "not at all important," and five means "very important." Table 4-7 presents the mean weighted responses.

Table 4-7: Factors Important to Choice of Energy Provider

Factor	Nongreen	Green
Hassle of changing companies	3.85 (0.0677)	3.27 (0.0552)
Research involved in making the switch	3.93 (0.0599)	3.66 (0.0446)
Quality of customer service	4.62 (0.0379)	4.29 (0.0349)
Reliability of customer service	4.84 (0.0296)	4.61 (0.0309)
Safety	4.58 (0.0454)	4.36 (0.0401)
Location of provider (in-state vs. out-of-state)	3.43 (0.0770)	2.63 (0.0555)
Contract commitments	4.31 (0.0533)	3.90 (0.0448)
Cost of electricity	4.80 (0.0307)	4.42 (0.0358)
Source of electric generation (gas/oil/nuclear/green)	3.71 (0.0709)	4.19 (0.0441)
Sign-up incentives (bonus airline miles or free electricity)	2.92 (0.0760)	3.05 (0.0534)
sample sizes	n = 378	n = 710

Standard errors shown in parentheses

On average, all respondents rated reliability of customer service, cost of electricity, safety, and quality of customer service as the most important factors in the consideration to switch energy providers. Both green and nongreen respondents, on average, gave *reliability of customer service* the highest rating and *cost of electricity* the second highest rating. For green respondents, there is a significant statistical difference between the first and second ratings: that is, on the average, green respondents value reliable customer service slightly more than cost of electricity. For nongreen respondents, there is no significant difference between their first and second ratings. Green and nongreen respondents differed somewhat in their opinions of the *hassle of changing suppliers, location of their energy provider* and on the *sources of their electric generation*. Green respondents were less concerned about either the hassle factor or the location of their energy provider, while nongreen respondents were slightly less concerned about the source of their electric power.

Awareness of and Opinions About Green Power

Customers were also asked questions regarding their awareness of and opinions about green power. Not surprisingly, green respondents reported greater awareness than did nongreen respondents. Table 4-8 presents the results.

Table 4-8: Awareness of Green Power

Response	Nongreen	Green
I am aware I can choose to buy power generated from renewable sources, often called "green power."	44.8% (0.0257) n = 375	75.8% (0.0162) n = 701
I have received information in the mail or by telephone from companies selling green power.	27.0% (0.0232) n = 369	0.7% (0.0184) n = 704
I am familiar with the power content label. *(Note: a picture was displayed in the survey.)*	8.9% (0.0148) n = 370	37.1% (0.0184) n = 687
The energy I am purchasing is significantly different from the average California power system mix contained on the power content label.	3.7% (0.0098) n = 371	29.3% (0.0174) n = 683
I have seen the Green-e logo. *(Note: a picture was displayed in the survey.)*	2.5% (0.0082) n = 362	11.0% (0.0120) n = 682
I have heard of the term "Green-e certified."	3.5% (0.0095) n = 369	11.7% (0.0122) n = 692

Standard errors shown in parentheses

As shown, 76% of green respondents reported they are aware that they can choose green power. While this is a large proportion, one may wonder how the remaining 24% of them are buying green power without being aware of doing so. This may imply that these customers were marketed on the basis of some other feature (presumably reduced cost), or that the green attribute of the power sold was not important to them. In addition, 61% of green respondents reported receiving offers from ESPs selling green power compared to only 27% of nongreen respondents. A minority of green respondents and only a small proportion of nongreen respondents reported awareness of the Power Content Label and the Green-e certification and logo. Furthermore, a difference of means test revealed that the differences shown between green and nongreen participants are significant.

Respondents were also asked to rate various features of green power according to their importance in the decision to purchase green power. Responses were given on a scale of one to five, where one means "not at all important," and five means "very important." Table 4-9

gives the results. As shown, all factors were given high ratings. For both green and nongreen respondents, cleaner air and reduced water pollution received the highest average ratings.

Table 4-9: Important Factors in Choosing Green Power

Factor	Nongreen	Green
Reduction of carbon dioxide emissions (known to affect global climate change)	4.28 (0.0522)	4.41 (0.0397)
Reducing ground and water pollution and environmental damage (such as acid rain impacts)	4.51 (0.0441)	4.58 (0.0325)
Support the use of renewable energy resources (conserve fossil fuels)	4.20 (0.0524)	4.46 (0.0343)
Increased electric price stability during oil production shortages	4.27 (0.0500)	3.99 (0.0447)
Cleaner air for future generations (less fossil fuel)	4.43 (0.0476)	4.65 (0.0294)
Fewer nuclear power plants	3.61 (0.0764)	4.11 (0.0496)
sample sizes	n = 378	n = 710

Standard errors shown in parentheses

Reported Willingness to Pay for Green Power

Customers were asked a series of questions to help determine how much of a premium they would be willing to pay for green power. First, customers were asked if they would purchase green power if it cost the same as conventional power. As shown in Table 4-10, nearly all green respondents (92%) and most nongreen respondents (84%) indicated they would purchase green power at the same price as the generic mix. Furthermore, there is no significant difference between these two mean responses.

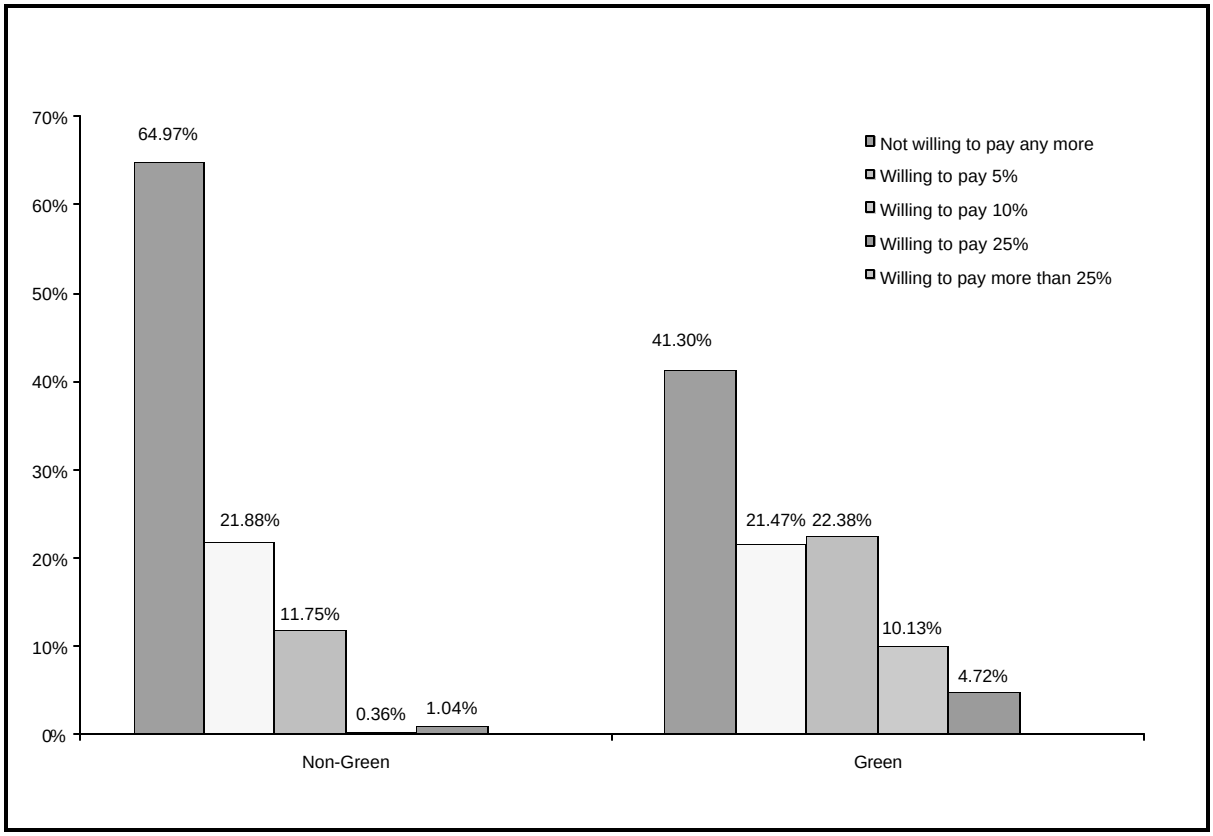
Table 4-10: Willingness to Purchase Green Power

Response	Nongreen	Green
I would purchase green power over conventional power if the cost were the same.	83.7% (0.0196) n = 356	92.1% (0.0104) n = 676

Standard errors shown in parentheses

Next, customers were asked if they would purchase green power at a premium and how much of a premium (percentage increase of their monthly electric bill) they would be willing to pay. Figure 4-10 presents these results.

Figure 4-10: Willingness to Pay a Premium for Green Power



As shown, 65% of nongreen respondents reported they were unwilling to pay a premium for green power while only 41% of green respondents did so. Interestingly, 35% of nongreen respondents reported that they would pay a premium ranging from 5% (22% of nongreen respondents) up to more than 25% (about 1%). The proportion of green respondents willing to pay a premium was higher (59% of green respondents), with nearly 5% willing to pay more than a 25% premium for green power.

Awareness of Customer Credit Program

The survey briefly described the Commission's Customer Credit Program and then asked customers if they had heard of it. As shown in Table 4-11, 24% of green and 9% of nongreen respondents reported that they had.

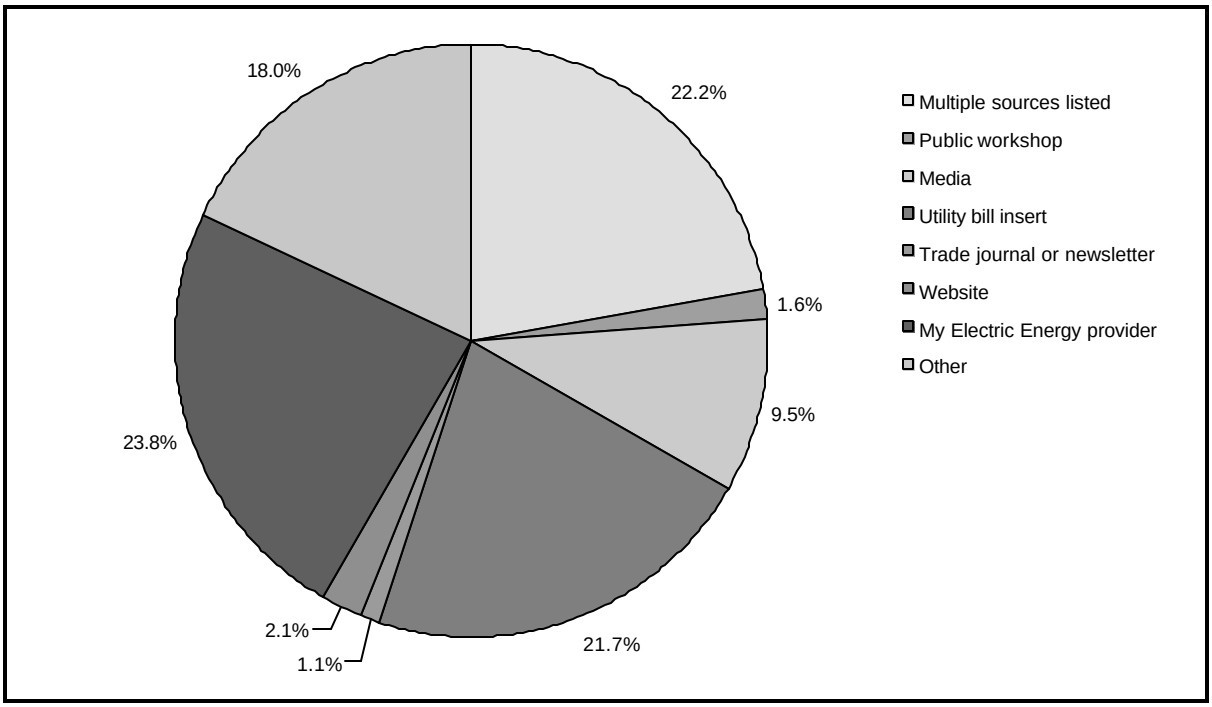
Table 4-11: Awareness of Customer Credit Program

Response	Nongreen	Green
I have heard of the Customer Credit Program.	8.5% (0.0145) n = 371	24.1% (0.0163) n = 691

Standard errors shown in parentheses

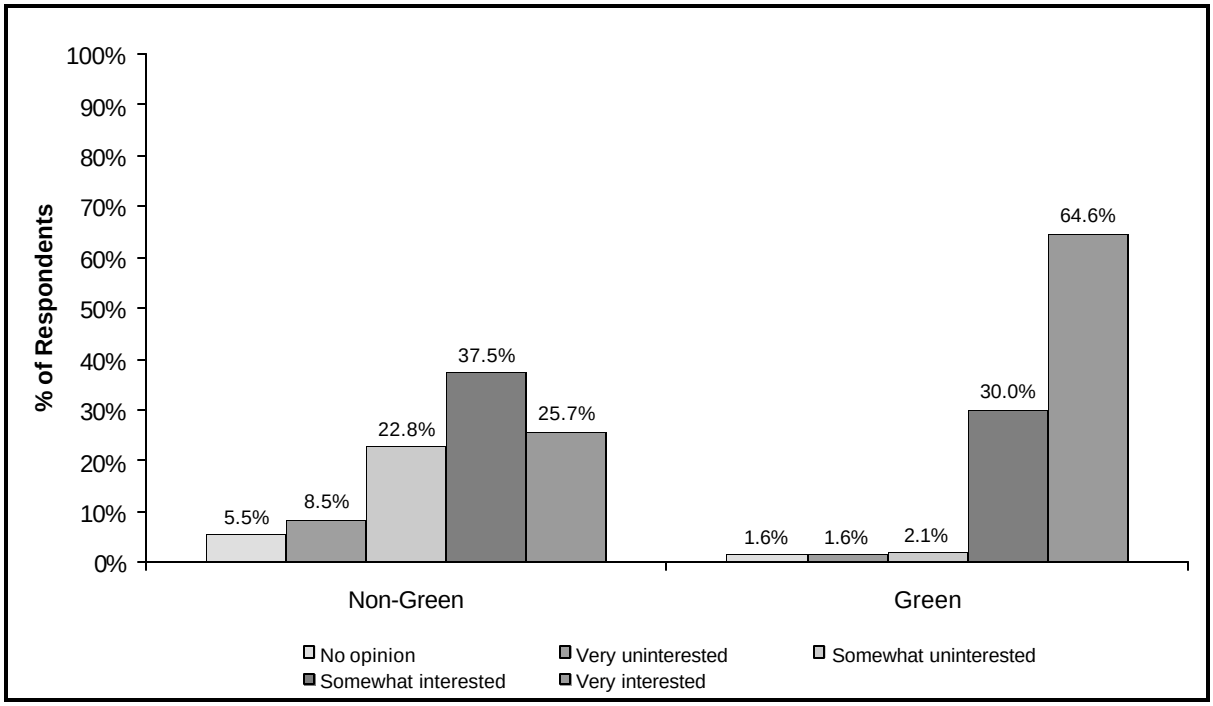
Respondents who reported they had heard of the Customer Credit Program were also asked how they found out about it. As shown in Figure 4-11, nearly half of respondents aware of the Program heard of it from a utility bill insert or from their ESP.

Figure 4-11: Sources of Hearing about the Customer Credit Program



Respondents who indicated awareness of the Program were further asked how interested they were in buying green power from an ESP participating in the Program. Overall, the interest in buying green power was high from those who were familiar with the Customer Credit Program. As shown in Figure 4-12, 95% of green respondents indicated they were somewhat or very interested, with 65% reporting they were *very interested*. The proportion of nongreen respondents interested in buying green power under the Program was 63%, with 22% reporting they were *very interested*.

Figure 4-12: Interest in Buying Green Power From ESP in Program



Respondents who indicated awareness of the Program were further asked if they were currently receiving the credit. These results in Table 4-12, along with those in Table 4-13 and Table 4-14, are weighted using the set of weights constructed for known participants of the Customer Credit Program. As shown, 86% of green respondents who reported awareness of the Program also reported receiving the credit.

Table 4-12: Receiving the Credit

Response	Other	Participant
I am currently receiving the Customer Credit from my electric energy service provider.	11.8% (0.0673) n = 24	85.9% (0.0298) n = 138

Standard errors shown in parentheses

Customers who reported receiving the credit were asked additional questions about the Program. First, customers were asked to rate how influential the Program was on their decision to buy green power. Responses were reported on a scale of one to five where one means “not at all influential” and five means “very influential.” The mean weighted responses are reported in Table 4-13. These results seem to indicate a high influence of the Program on both known participants and the other customers receiving the credit. While the influence appears to be slightly greater for the “other” group, the means for these two groups are not significantly different.

Table 4-13: Influence of Program

Response	Other	Participant
Influence of Customer Credit on my decision to purchase renewable energy.	3.93 (0.4988) n = 5	3.57 (0.1279) n = 118

Standard errors shown in parentheses

Table 4-14 presents the results of two additional questions asked of only those respondents who indicated they are receiving the credit. As shown, 30% of the known participant group claimed awareness that the credit is able to vary every six months. Although they may not be fully aware of the price implications on their customer bills, 75% of the respondents who reported receiving the credit and are known participants also stated they would continue to purchase green power without it.

Table 4-14: Participant Awareness of Customer Credit Program

Response	Other	Participant
I am aware that the credit may be as high as 1.5 cents per kWh and may change every six months due to variability in the market for renewable energy.	46.6% (0.2494) n = 5	29.9% (0.0423) n = 118
I would continue to purchase renewable energy if the Customer Credit were discontinued.	50.0% (0.2887) n = 4	75.2% (0.0425) n = 104

Standard errors shown in parentheses

4.4.2 Non-Residential Survey Results

A total of 506 surveys were received. Of these, 44 surveys were omitted from the analysis because the respondents were not located in an area eligible for the Customer Credit Program. This left 462 completed surveys available for analysis. The following are some mean characteristics for this sample.

Table 4-15: Non-Residential Sample Characteristics

Attribute	Mean
Own building	48%
Number employees	68
Number locations in California	10
Typical winter monthly electric bill	$4,322
Typical summer monthly electric bill	$5,532
Buys green power	45%
Receives Customer Credit	43%

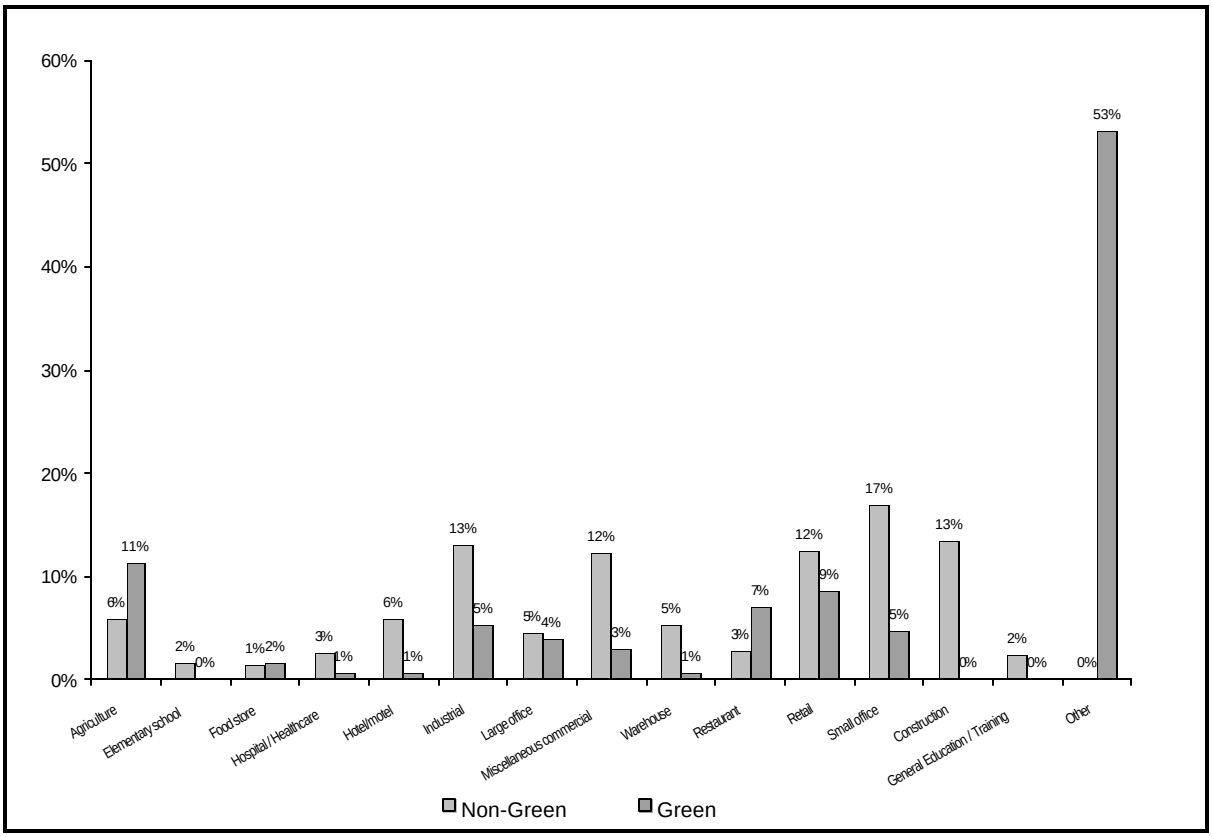
The remainder of this subsection presents weighted survey responses for the non-residential sample. The results are presented as follows:

- Characteristics of Green Power Customers,
- Awareness of Choice,
- Awareness of and Opinions about Green Power,
- Reported Willingness to Pay for Green Power, and
- Awareness of the Customer Credit Program.

Characteristics of Green Power Buyers

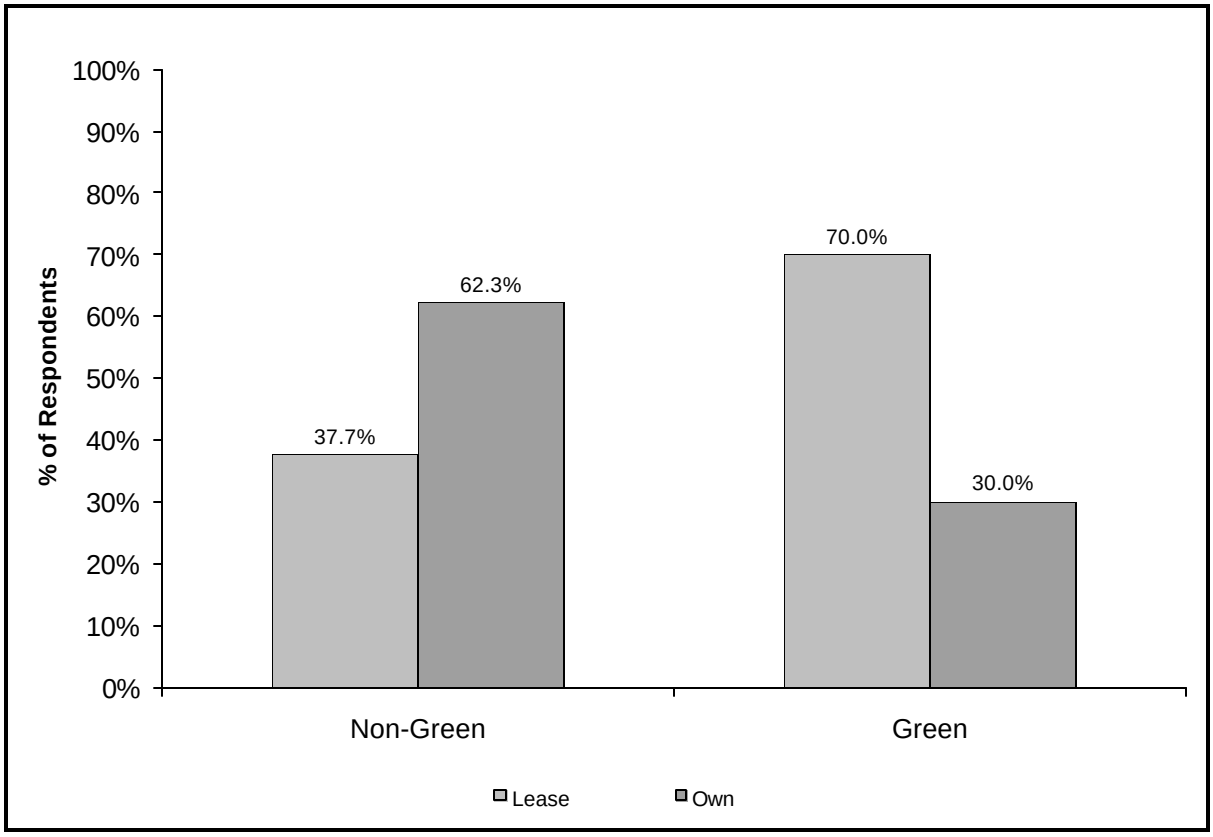
As shown in Figure 4-13, a wide range of business types are represented in the sample. Note that nongreen respondents who reported "other" as their business type were recategorized according to their SIC code which was available from the sample design data. For green respondents, however, this information was unavailable. Examples of types of businesses in this "other" category include auto repair, churches, gas stations, and government agencies.

Figure 4-13: Type of Business



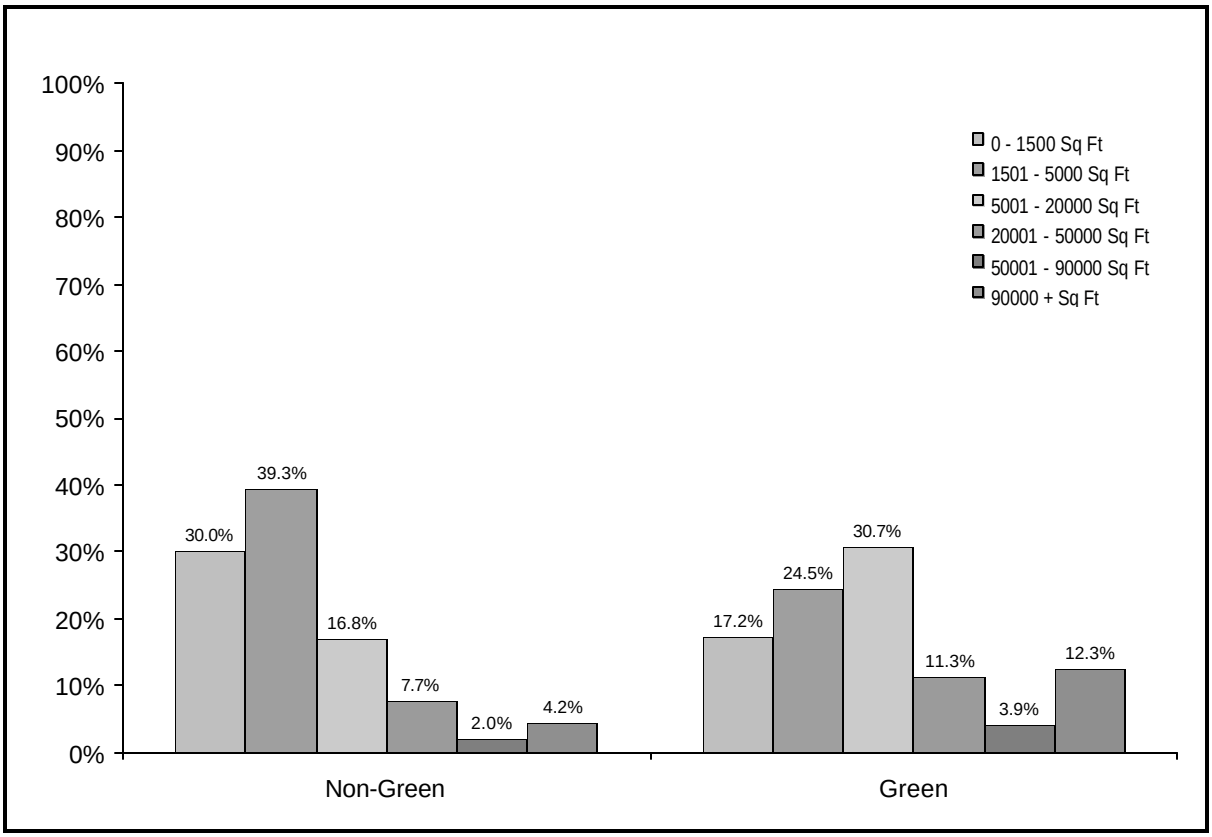
While less than a third of green respondents reported owning their facility as opposed to leasing it, 62% of nongreen respondents reported owning their facility. These results are illustrated in Figure 4-14, and indicate a higher proportion of green respondents lease their buildings than do nongreen respondents.

Figure 4-14: Own versus Lease



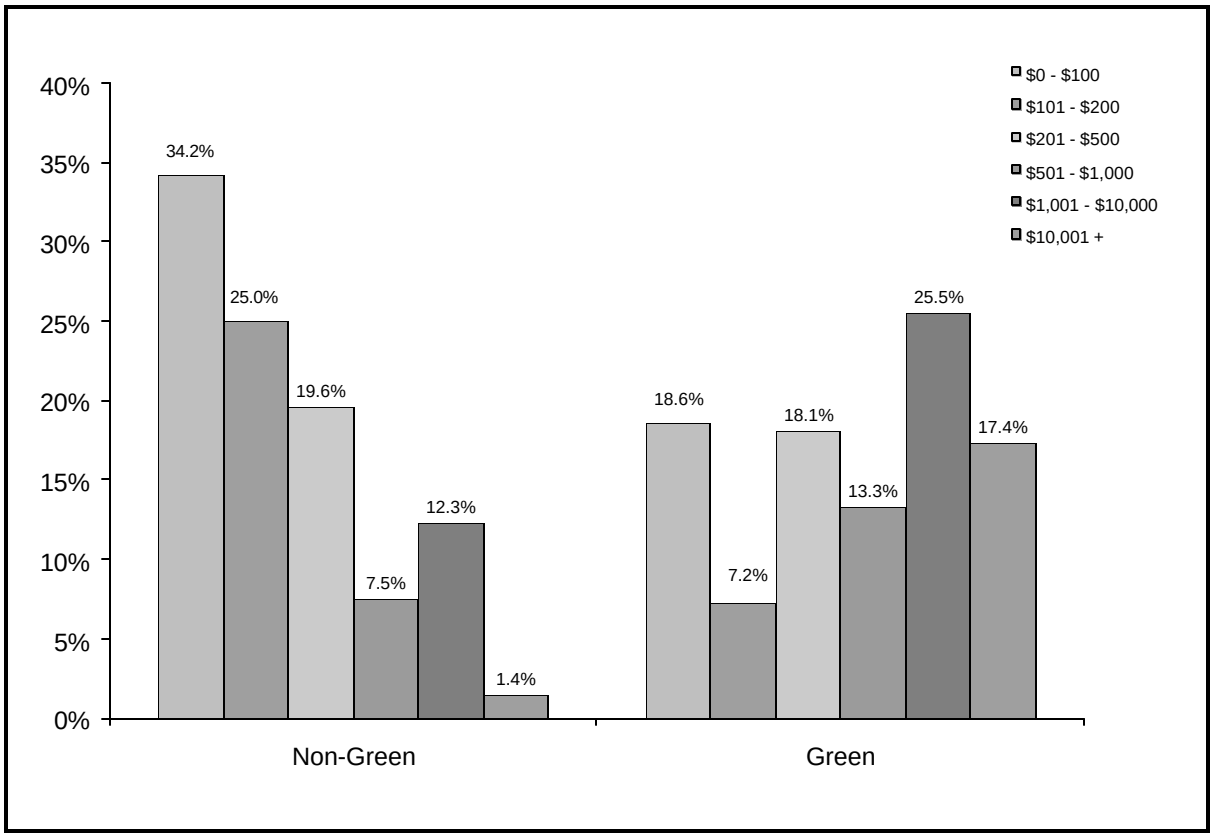
Green respondents in the sample appear to be larger businesses than nongreen respondents. Specifically, on the average they reported more square footage and higher electricity consumption than did nongreen respondents. As shown in Figure 4-15, roughly 70% of nongreen respondents reported floor space of 5,000 or less square feet, while the majority of green respondents reported more than 5,000 square feet. In fact, more than 12% of the green respondents reported floor space of over 90,000 square feet, while less than 5% of the nongreen respondents fell into this category.

Figure 4-15: Floor Space



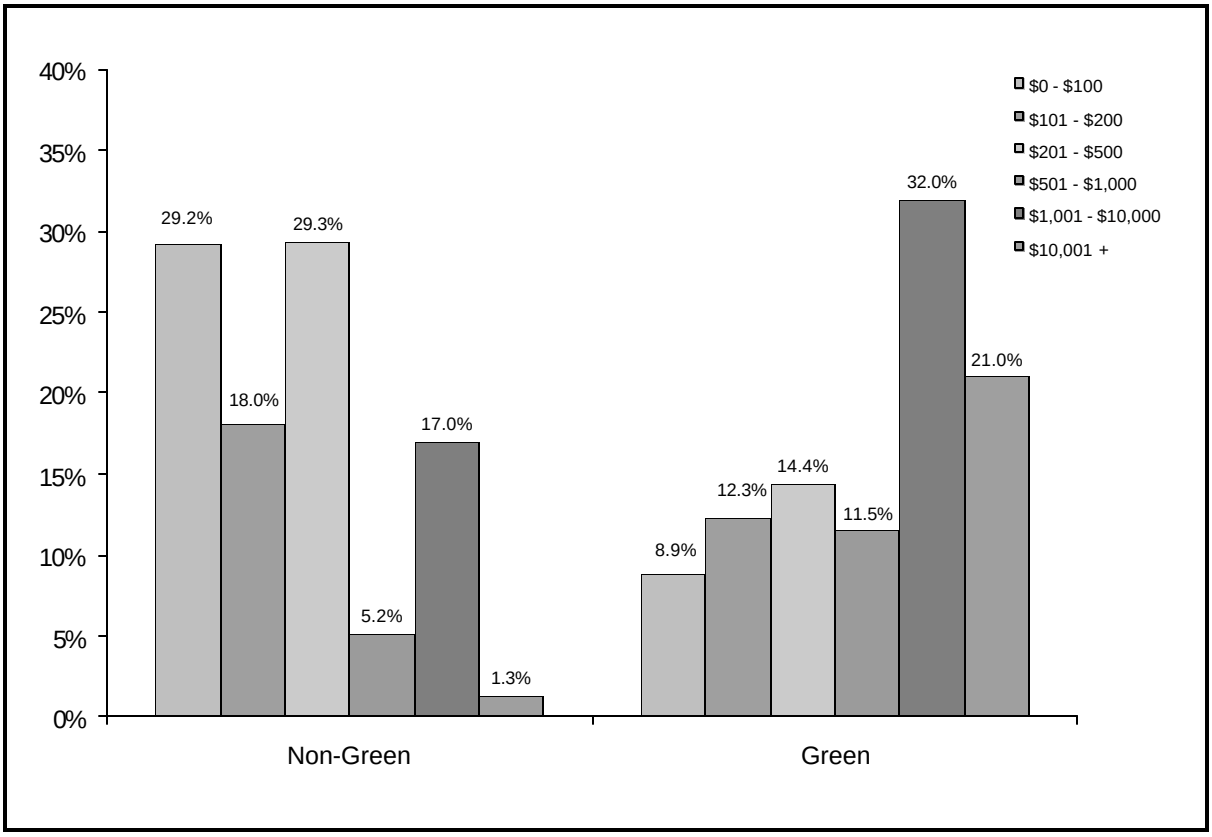
Respondents were asked to report their "typical" electricity bills for the winter and summer months. A note was included in the survey to remind them that if they also used gas, the electricity might be only a portion of their monthly bill. As shown in Figure 4-16, a majority of nongreen respondents reported bills of $200 or less whereas only a quarter of the green respondents did so. Furthermore, a quarter of green respondents reported monthly bills in the $1,000 to $10,000 range and 17% reported monthly bills over $10,000.

Figure 4-16: Typical Monthly Winter Electric Bill



A similar result was found for summer bills. Figure 4-17 shows that nearly 65% of green respondents reported summer electric bills of over $500 whereas the majority of nongreen respondents reported bills of under $500.

Figure 4-17: Typical Monthly Summer Electric Bill



Awareness of Choice

Customers were asked several questions regarding their awareness of deregulation and their ability to switch energy providers. As shown in Table 4-16, 50% of green respondents reported buying electricity differently than they did a year or two ago and nearly 70% of them reported receiving offers from ESPs. In comparison, only 7% of nongreen respondents buy electricity differently and 45% reported receiving offers from ESPs. The reason that the remaining 31% of green respondents did not recall receiving an offer may be related to their specific job responsibilities (e.g., their job might not include dealing with ESP green power offers/solicitations).

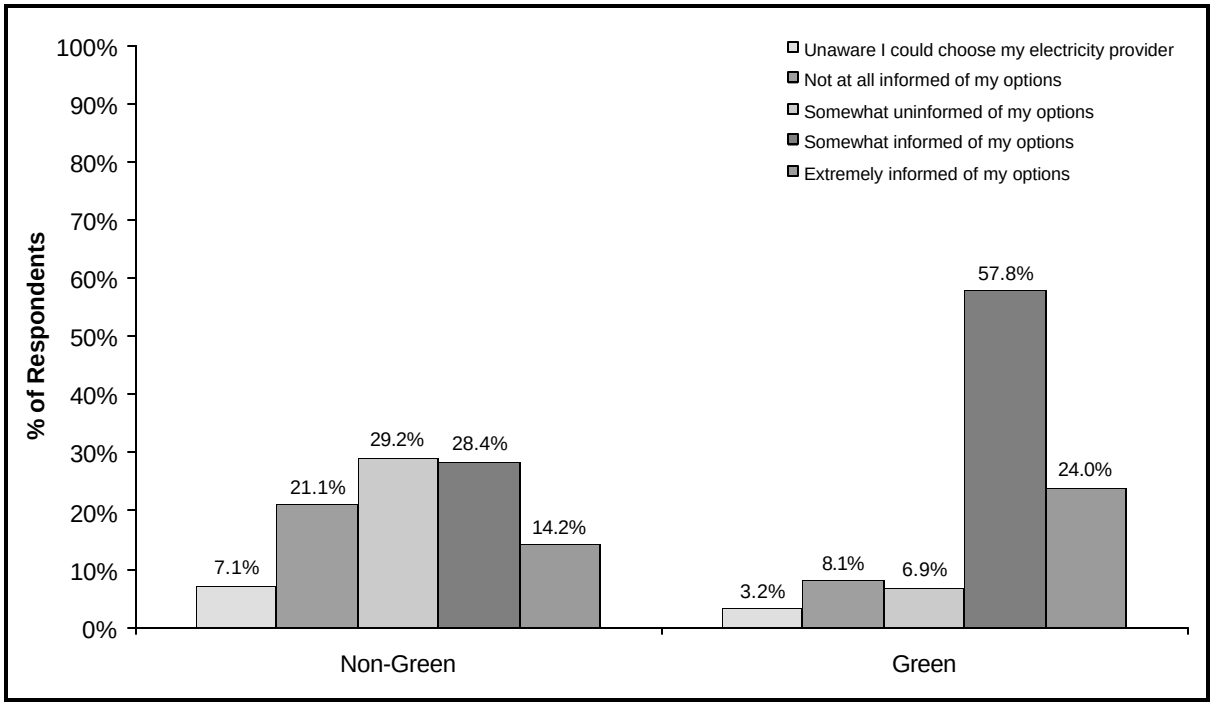
Table 4-16: Customer Awareness

Response	Nongreen	Green
The way I buy electricity currently is different from a year or two ago.	7.1% (0.0168) n = 237	50.0% (0.0360) n = 194
In the past two years, I have received information in the mail or by telephone from companies asking me to switch my energy provider.	44.9% (0.0314) n = 252	69.3% (0.0324) n = 203

Standard errors shown in parentheses

Figure 4-18 presents the results of a question that asked respondents to what extent they were informed about their options for choosing an electric energy provider. As shown, the majority of green respondents (82%) reported they were somewhat or extremely informed of their options, while only 42% of nongreen respondents did so.

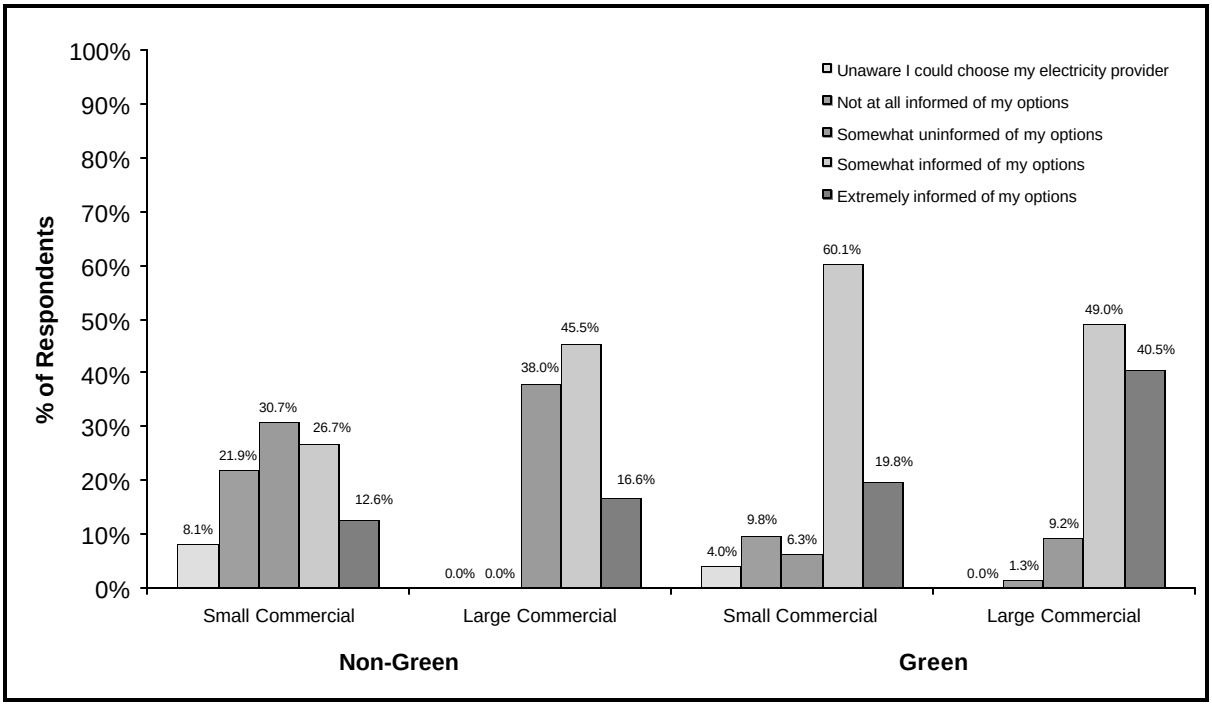
Figure 4-18: Extent Informed of Options



Non-residential customers were further classified into large and small businesses based on the following criteria: if their facility was larger than 100,000 square feet or if their electricity consumption was greater than $200,000 per year they were classified as large.

Figure 4-19 presents the weighted responses to the question "to what extent are you informed about your options for choosing an electricity energy provider?" by large and small businesses. As shown, a higher proportion of large businesses reported they were somewhat or extremely informed than did small businesses for both green and nongreen customers.

Figure 4-19: Extent Informed, Large and Small



Respondents were asked what factors would be important to them if they were to consider changing electricity energy providers. Responses were given on a scale of one to five, where one means "not at all important," and five means "very important." Table 4-17 gives the results.

Table 4-17: Factors Important to Switching Energy Providers

Factor	Nongreen	Green
Hassle of changing companies	3.92 (0.0736)	3.46 (0.0993)
Research involved in making the switch	3.69 (0.0663)	3.43 (0.0870)
Quality of customer service	4.35 (0.0652)	4.18 (0.0711)
Reliability of customer service	4.65 (0.0551)	4.37 (0.0894)
Safety	4.16 (0.0705)	3.72 (0.0956)
Location of provider (in-state vs. out-of-state)	3.25 (0.0883)	2.61 (0.0989)
Contract commitments	3.84 (0.0759)	3.94 (0.0888)
Cost of electricity	4.70 (0.0487)	4.70 (0.0527)
Source of electric generation (gas/oil/nuclear/green)	3.09 (0.0910)	2.82 (0.0883)
Sign-up incentives (bonus airline miles or free electricity)	3.13 (0.0768)	2.77 (0.1000)
Sample Sizes	n = 255	n = 207

Standard errors shown in parentheses

As shown, *cost of electricity* was rated most important by both groups and *reliability of customer service* was rated second most important. Furthermore, a difference of means test showed that there is a significant difference between these two ratings; in other words, on the average, both groups significantly value *cost of electricity* as a more important factor than *reliability of customer service*. In addition, differences in means between nongreen and green responses for each factor are significant with the exception of *contract commitments* and *cost of electricity.*

It is interesting to note that nongreen consumers rated *the source of electric generation* of higher importance when switching providers than did green consumers. One reason for this may be that commercial customers who do switch providers base their decisions mostly on cost; thus, environmental concerns are of less importance to them.

Awareness of and Opinions About Green Power

Customers were asked questions regarding their awareness of and opinions about green power. As expected, green respondents reported greater awareness than did nongreen respondents. Table 4-18 presents the results.

Table 4-18: Awareness of Green Power

Response	Nongreen	Green
I am aware I can choose to buy power generated from renewable sources, often called "green power."	57.6% (0.0320) n = 239	69.8% (0.0325) n = 201
I have received information in the mail or by telephone from companies selling green power.	25.7% (0.0277) n = 250	43.5% (0.0347) n = 205
I am familiar with the power content label. *(Note: a picture was displayed in the survey.)*	4.7% (0.0136) n = 246	8.8% (0.0201) n = 200
The energy I am purchasing is significantly different from the average California power system mix contained on the power content label.	1.2% (0.0069) n = 238	7.1% (0.0183) n = 198
I have seen the Green-e logo. *(Note: a picture was displayed in the survey.)*	5.9% (0.0150) n = 250	7.9% (0.0190) n = 202
I have heard of the term"Green-e certified."	6.5% (0.0156 n = 253	11.6% (0.0225 n = 204

Standard errors shown in parentheses

As shown, 70% of green respondents reported that they are aware they can choose green power and 50% of nongreen respondents did so. Furthermore, 44% of green respondents and 26% of nongreen respondents reported receiving offers from green ESPs. Low proportions in both groups reported awareness of both the power content label and the Green-e certification and label. Furthermore, a difference of means test revealed that the differences shown between green and nongreen respondents are significant.

Respondents were asked to rate how important various features of green power were in their decision to buy it. Responses were given on a scale of one to five where one represents "not at all important," and five represents "very important." Table 4-19 presents the weighted mean responses for green and nongreen businesses.

Table 4-19: Important Factors in Choosing Green Power

Factor	Nongreen	Green
Reduction of carbon dioxide emissions (known to affect global climate change)	3.90 (0.0738)	3.81 (0.0810)
Reducing ground and water pollution and environmental damage (such as acid rain impacts)	4.17 (0.0652)	4.03 (0.0766)
Support the use of renewable energy resources (conserve fossil fuels)	3.97 (0.0725)	3.93 (0.0779)
Increased electric price stability during oil production shortages	4.15 (0.0603)	4.13 (0.0684)
Cleaner air for future generations (less fossil fuel)	4.20 (0.0677)	4.14 (0.0719)
Fewer nuclear power plants	3.40 (0.0980)	3.55 (0.1054)
Support the development of a "green energy" industry in California	3.64 (0.0825)	3.63 (0.0917)
Sample Sizes	n = 255	n = 207

Standard errors shown in parentheses

As shown, both green and nongreen respondents rated cleaner air, reduced water pollution and increased price stability with high ratings. Moreover, there is no significant difference in the ratings of these three; that is, all were rated important factors to be considered in the purchase of green power.

Willingness to Pay for Green Power

Customers were asked a series of questions to determine how much of a premium they would be willing to pay for green power. First, customers were asked if they would purchase green power if it cost the same as conventional power. As shown in Table 4-20, nearly all respondents said they would purchase green power if the cost were the same as conventional power. While it may seem that a slightly higher proportion of green respondents answered in this manner, in fact there is no significant difference between the mean responses of these two groups.

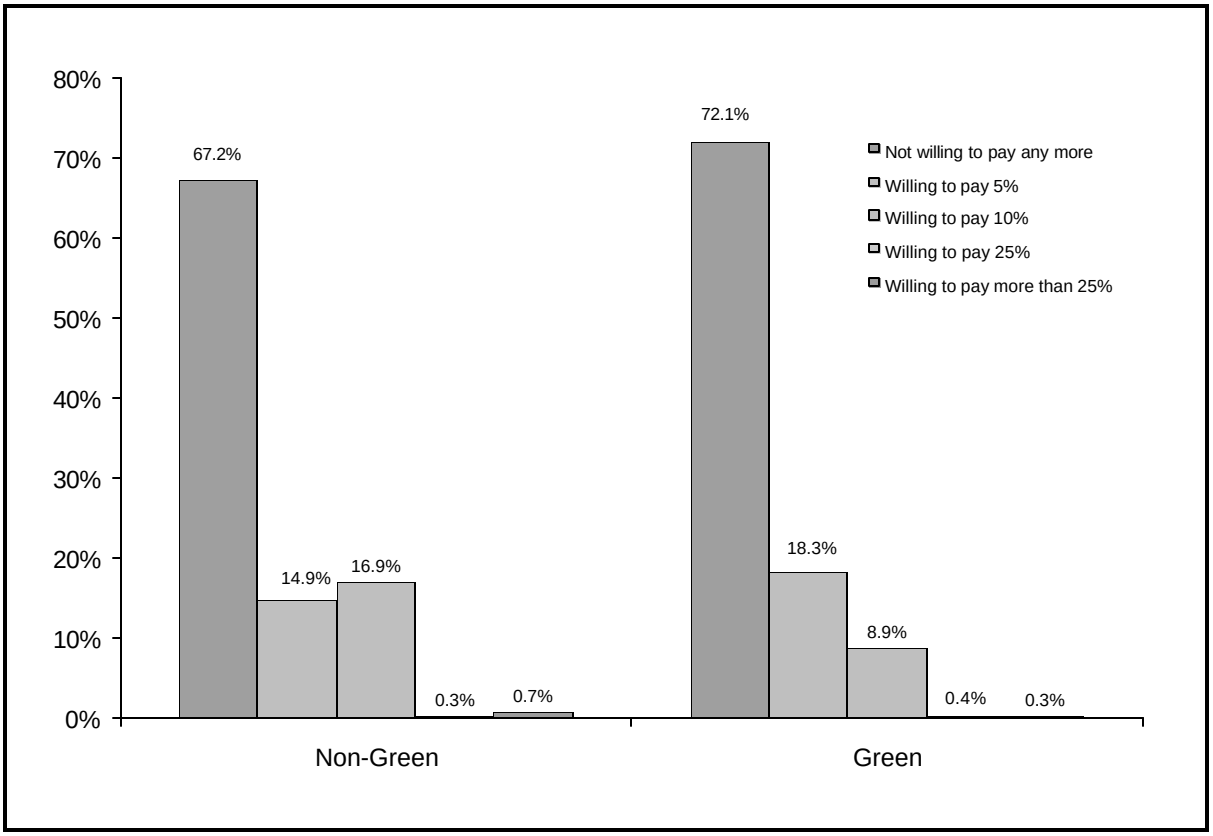
Table 4-20: Willingness to Purchase Green Power

Response	Nongreen	Green
I would purchase green power over conventional power if the cost were the same.	83.43% (0.0243) n = 235	89.85% (0.0218) n = 193

Standard errors shown in parentheses

Next, customers were asked if they would purchase green power at a premium and how much of a premium they would be willing to pay. Figure 4-20 presents the results.

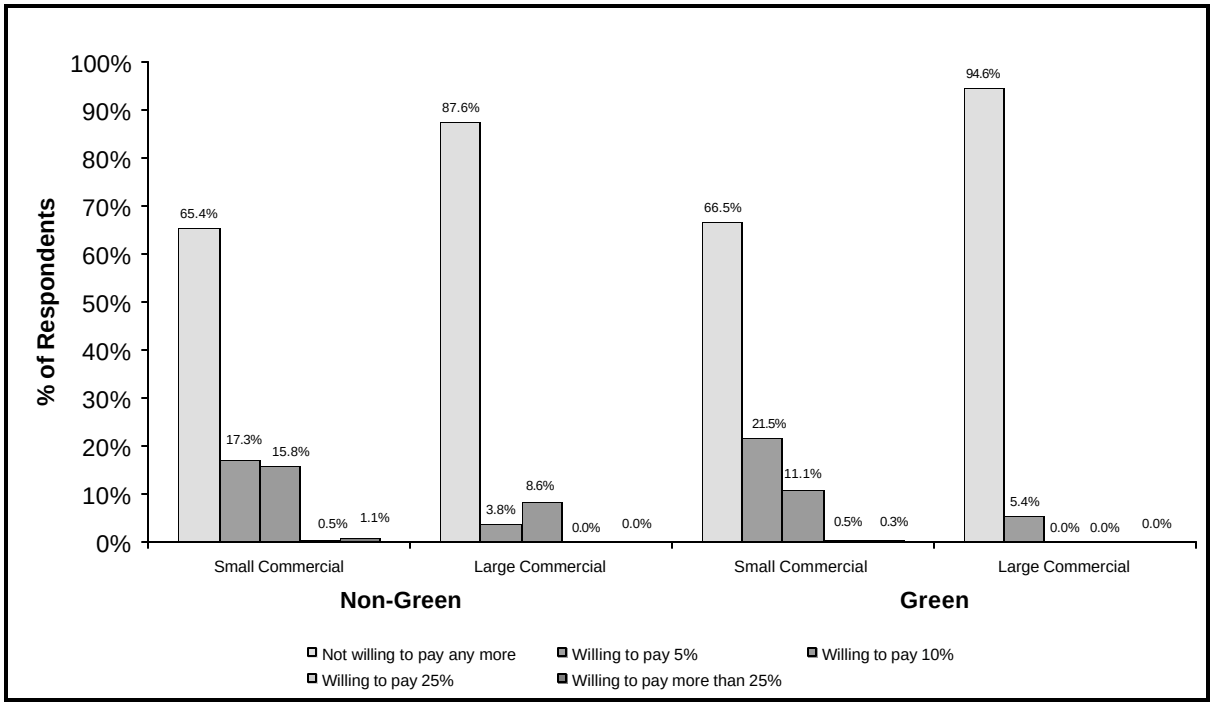
Figure 4-20: Willingness to Pay a Premium for Non-Residential



As shown, the majority of both green and nongreen respondents reported they would not pay any more for green power than for conventional power. While 32% of nongreen and 27% of green respondents reported they were willing to pay a premium of up to 10%, virtually none in either group would pay more than 10%.

Figure 4-21 presents the responses by large and small businesses. As shown, small businesses on the average are more willing to pay a given percentage premium for green power than are large businesses, due to the fact that they experience smaller electric bills and therefore the "green premium" is not perceived to be as large to this customer subgroup. Moreover, this result was true for both green and nongreen customers.

Figure 4-21: Willingness to Pay a Premium, Large vs. Small Businesses



Awareness of Customer Credit Program

The survey briefly described the Commission's Customer Credit Program and then asked customers if they had heard of the Program. As shown in Table 4-21, 28% of green and 8% of nongreen respondents reported that they were aware of the Program.

Table 4-21: Awareness of the Customer Credit Program

Response	Nongreen	Green
I have heard of the Customer Credit Program.	7.8% (0.0169) n = 253	27.7% (0.0313) n = 205

Standard errors shown in parentheses

Table 4-22 compares the responses for this question by large and small businesses. While it appears that large businesses on average are more aware of the Customer Credit Program than are small businesses for both green and nongreen customers, there is no significant difference between the large and small mean responses for nongreen customers. For green customers, however, significantly more large businesses than small businesses are aware of the Program.

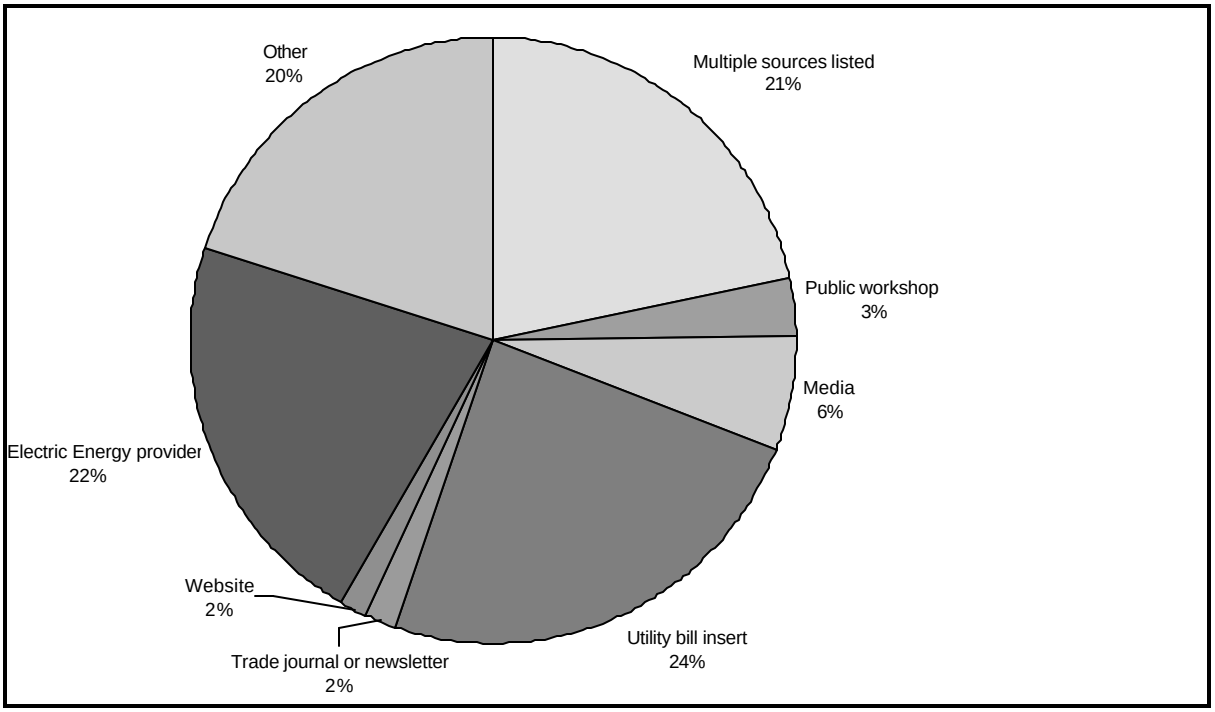
Table 4-22: Awareness of Program, Large and Small

Response	Large Nongreen	Small Nongreen	Large Green	Small Green
I have heard of the Customer Credit Program.	12.7%	8.6%	42.1%	24.1%
	(0.1003)	(0.0181)	(0.0847)	(0.0329)
	n = 12	n = 241	n = 35	n = 170

Standard errors shown in parentheses

Respondents who reported they had heard of the Customer Credit Program were also asked how they found out about it. Similar to the residential segment, as shown in Figure 4-22, most identified utility bill inserts and their ESP as the source.

Figure 4-22: Sources of Hearing about the Customer Credit Program



Respondents who indicated awareness of the Program were further asked how interested they were in buying green power from an ESP participating in the Program. As shown in Figure 4-23, 93% of green respondents indicated they were, with the majority stating they were very interested. Furthermore, nearly two-thirds (61%) of nongreen respondents indicated they were interested in buying green power under the Program.

Figure 4-23: Interest in Buying from ESP in Program

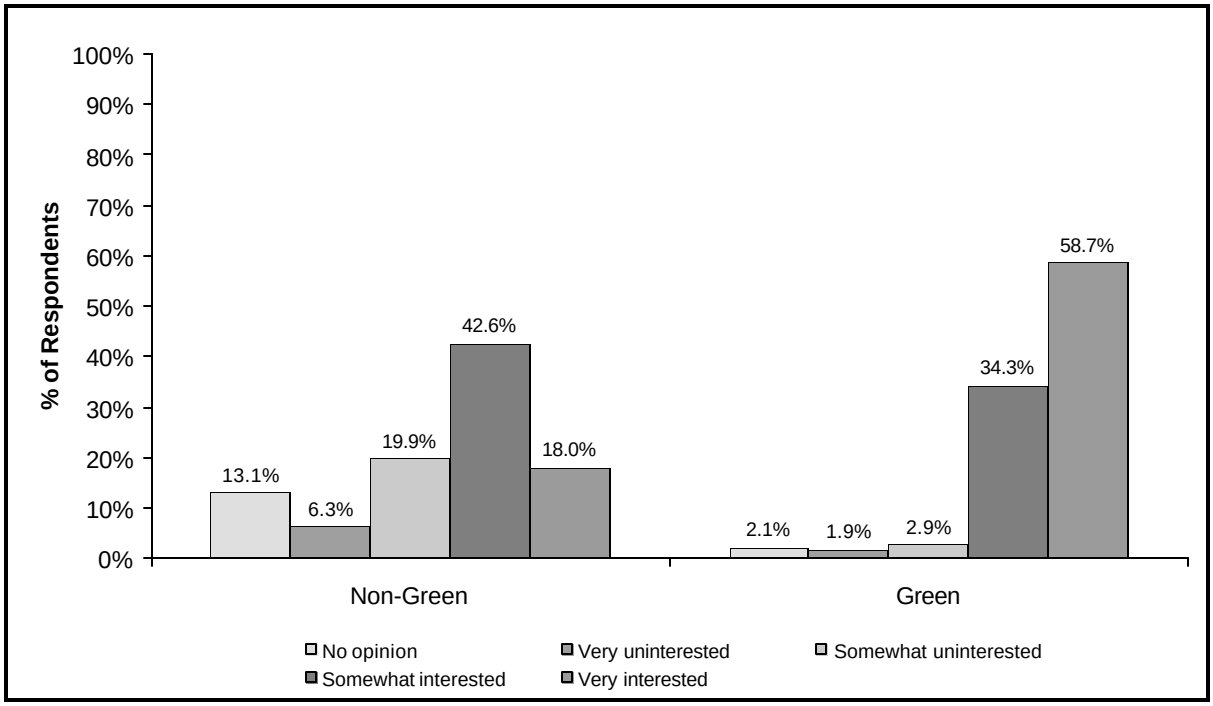
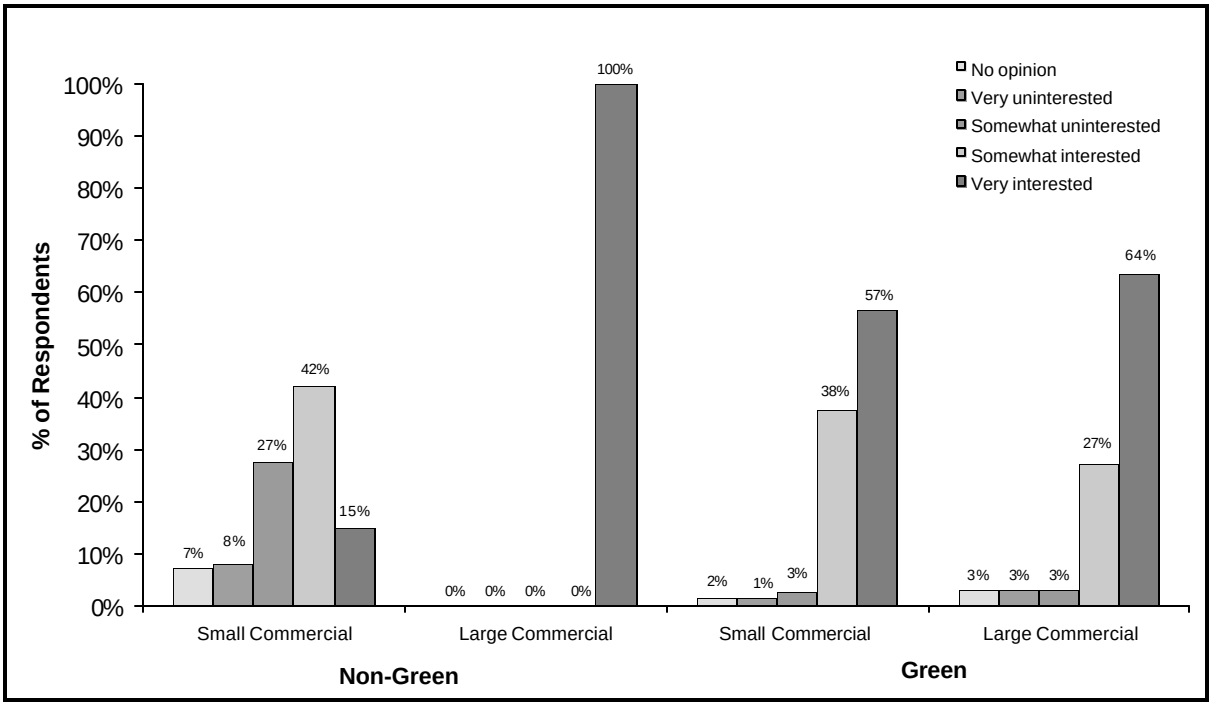


Figure 4-24 presents the results by large and small business. As shown, large businesses reported more interest in the Program than small businesses for both nongreen and green customers. This response may be reflected in the greater price sensitivity of the larger business customers as opposed to their smaller counterparts.

Figure 4-24: Interest in Program, Large vs. Small Businesses



Respondents who indicated awareness of the Program were further asked if they were currently receiving the credit. The results are shown in Table 4-23. These, along with the results shown in Table 4-24 and Table 4-25 are weighted using a set of weights constructed for known participants of the Customer Credit Program. As shown, 76% of green respondents who reported awareness of the credit also reported knowledge that they are receiving the credit.

Table 4-23: Receiving the Credit

Response	Other	Participant
I am currently receiving the Customer Credit from my electric energy service provider.	30.2% (0.1114) n = 18	76.2% (0.0741) n = 34

Standard errors shown in parentheses

Respondents who reported receiving the credit were asked additional questions about the Program. First, customers were asked to rate how influential the Program was on their decision to buy green power. Responses were reported on a scale of one to five where one means “not at all influential,” and five means “very influential.” The mean weighted responses are reported in Table 4-24. These responses seem to indicate that, on the average, known participants were more influenced by the Program than others; however, a difference of means test revealed that there is no significant difference between these two categories.

Table 4-24: Influence of Program

Response	Other	Participant
Influence of Customer Credit on my decision to purchase renewable energy	2.26 (0.7403) n = 5	3.56 (0.3133) n = 23

Standard errors shown in parentheses

Table 4-25 presents the results of two additional questions asked of respondents who indicated they are receiving the credit. As shown, 57% of known participants reported they are aware that the credit may vary as compared to 35% of respondents in the other category. Interestingly, 62% of known participants and 16% of others indicated they would continue to buy green power even without the credit. These respondents may be unaware of the price impacts to their electric bills as their ESPs may be reporting on their bill a relatively small pass through as a percentage of the total Program credit.

Table 4-25: Participant Awareness of Customer Credit Program

Response	Other	Participant
I am aware that the credit may be as high as 1.5 cents per kWh and may change every six months due to variability in the market for renewable energy.	26.4% (0.2204) n = 5	57.2% (0.1055) n = 23
I would continue to purchase renewable energy if the Customer Credit were discontinued.	15.6% (0.1814) n = 5	61.8% (0.1114) n = 20

Standard errors shown in parentheses

4.5 Summary

This section presents the results of residential and non-residential customer electric energy preference surveys that asked questions about green power and the Customer Credit Program. The overall findings are summarized below.

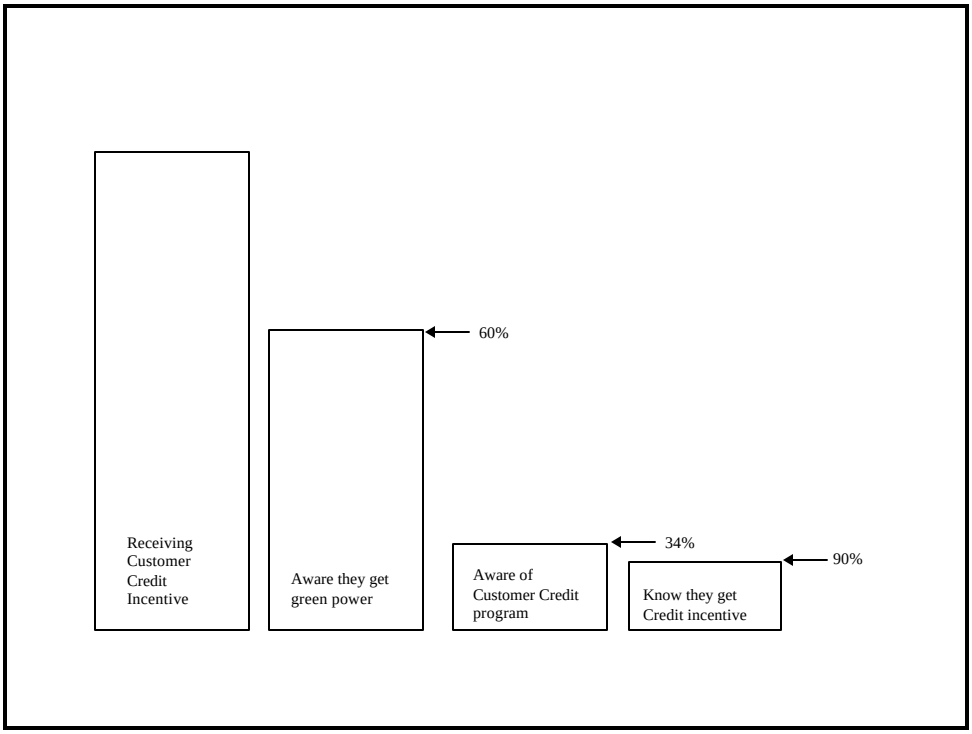
Residential Customers

The survey results indicate that residential customers who buy green power tend to be more educated, have lower electric bills, and consider themselves more informed and aware of their choices for buying electricity than do customers who do not buy green power. Moreover, green customers are more willing to pay a premium for green power and are willing to pay a higher premium than nongreen customers.

Figure 4-25 illustrates the level of awareness of the Program among the residential customers receiving the credit. The first block represents all residential customers receiving the credit. Of these, 60% are aware that they buy green power and are represented by the second block

in the figure. From this group of customers, the proportion who have heard of the Program is 34% and is represented by the third block. Finally, the fourth block represents the proportion of customers from the third block who reported receiving the credit – approximately 90%.

Figure 4-25: Awareness Levels of Residential Customers Receiving Credits



Results weighted to population of Customer Credit Program

This attrition illustration shows that the majority of customers receiving the Customer Credit incentive through their ESP are not aware of it. The last block, those who know they receive the incentive, represents 15% of residential customers who receive the incentive. In other words, only 15% of those who get the credit report that they are aware of it. Furthermore, Table 4-26 presents some mean characteristics of each of these groups.

Table 4-26: Characteristics of Residential Customer Participants

Mean Characteristics	Receiving Customer Credit Incentive	Aware They Get Green Power	Aware of Customer Credit Program	Know They Get Customer Credit Incentive
Proportion of previous group	100%	59.5%	33.7%	89.9%
Age	52	51	53	54
Years of schooling	16	16	16	16
Home ownership	77%	82%	85%	89%
Number in household	3	3	3	3
Monthly winter electric bill	$99	$87	$78	$83
Monthly summer electric bill	$109	$92	$128	$146
Premium willing to pay for green power	8.9%	13.1%	11.9%	9%

Results weighted to population of Customer Credit Program

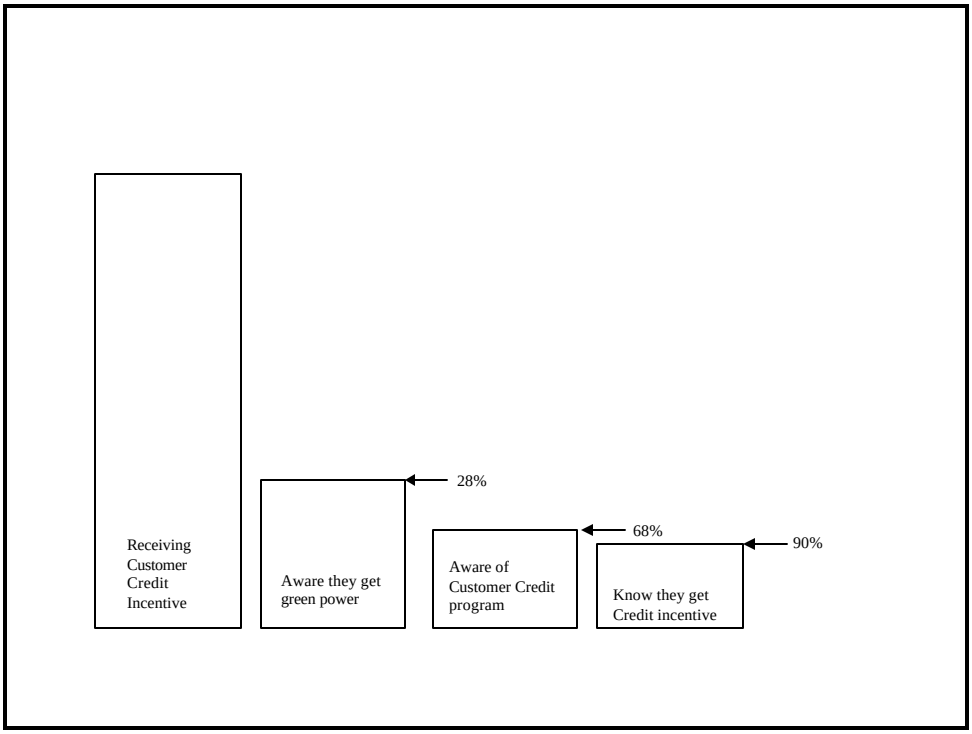
Non-Residential Customers

Non-residential customers who buy green power are more likely to lease than own their building. Moreover, they are more likely to have larger buildings and higher electricity consumption. In addition, they are more informed and aware of their options for buying electricity than are nongreen customers. Interestingly, they report they are less willing to pay a premium for green power than nongreen customers.

When comparing responses of large and small businesses separately, the results show that large businesses consider themselves more informed of their options for purchasing electricity than do small businesses. Furthermore, large businesses report more interest in the Program. Interestingly, *small businesses reported they were more willing to pay a premium for green power* than were large businesses.

Figure 4-26 illustrates the level of awareness of the Program among the non-residential customers receiving the credit. The first block represents all non-residential customers receiving the credit. Of these, 28% are aware that they buy green power and are represented by the second block in the figure. From this group of customers, the proportion who have heard of the Program is 68% and is represented by the third block. Finally, the fourth block represents the proportion of customers from the third block who reported receiving the credit – approximately 90%.

Figure 4-26: Awareness Levels of Non-Residential Customer Participants



This attrition illustration shows that the majority of business customers receiving the Customer Credit incentive through their ESP are not aware of it. The last block, those who know they get the incentive, represents 16% of residential customers who receive the incentive. Therefore, only 16% of those who are impacted by the credit report that they are aware of it. Furthermore, Table 4-27 presents some mean characteristics of each of these groups.

Table 4-27: Characteristics of Non-residential Customer Participants

Mean Characteristics	Receiving Customer Credit Incentive	Aware They Get Green Power	Aware of Customer Credit Program	Know They Get Customer Credit Incentive
Proportion of previous group	100%	28%	68%	90%
Owns Facility	59%	57%	67%	68%
Number of Employees	234	544	751	867
Number of Locations	8	8	11	11
Monthly winter electric bill	$12,341	$29,078	$42,163	$45,815
Monthly summer electric bill	$12,377	$22,656	$31,588	$34,317
Premium willing to pay for green power	2.0%	3.6%	3.1%	1.8%

Results weighted to population of Customer Credit Program

Volume V

5 Program Assessment

5.1 Overview

This section provides an assessment of the performance of the Customer Credit Program. In addition, several issues related to the program and the green power market are addressed. Finally, net program impacts are estimated based upon the available information.

5.2 Program Assessment

The Customer Credit Program is designed to meet the following objectives:[1]

- To reduce the cost premium for renewable energy that customers pay, thus encouraging them to buy renewable power,
- To help build a green market infrastructure by helping renewables become competitive with nonrenewable generation technologies, and
- To facilitate consumer choice of renewable power.

Each of these is discussed below along with key results of the ESP interviews and customer surveys.

5.2.1 Program Objectives

The first objective of the Program is to reduce the premium paid for renewable energy. This is realized when participant ESPs pass the credit through to their customers, in effect lowering their prices for green power to the enduser. During the indepth interviews, half of the participant ESPs interviewed reported that their prices were a function of the credit and that, if the credit was reduced, their prices would increase. This result does not imply, however, that the remaining ESPs do not pass the credit through to their customers; only that this information was not reported in the interviews. In fact, only one participant ESP reported that their prices were not a function of the credit. These results suggest that at least some ESPs are reducing their green power prices to customers as a result of the program.

The second objective, to help build a green power infrastructure, may be assessed by evaluating selected indicators of market growth. Evidence that the market has grown since its inception in early 1998 can be seen in the following indicators:

[1] *Policy Report on AB1890 Renewables Funding*, California Energy Commission, March 1997.

- ***Customers Switching to Green Power.*** Program records show an upward trend in the number of customers switching to green power during the period the Program has been in effect. For example, omitting the first six months of Program activity because of various start-up changes, average monthly growth rates from October 1998 through April 2000 are as follows. Small commercial customers experienced the highest average monthly growth rate to date at 20%; residential customers increased on the average by 9% per month, and customers in the Other segment by 19%. Moreover, when those customers who were aware of the program and knew they were in it were asked if it had influenced their decision to buy green power, approximately half indicated that it had.[2] It should be noted, however, that this group represents a small proportion of total program customers, as most were not aware they were in the program.
- ***ESPs Offering Green Power Products.*** The number of ESPs participating in the program grew from two to fifteen during the period of April 1998 through April 2000. From the indepth interviews with ESPs, it was learned that the program has strongly influenced their activities in the market. When asked what the impact would be to them when the credit abates, six of the participant ESPs explained that they would raise their prices and see how customers react. Two stated that they might leave the market, and one stated that they would leave the market. Three ESPs reported that they would stay in the market selling green power regardless of when the program ended, although one clarified that they might reduce the percentage of green power in their mix after the program ended.
- ***MWh Sales of Eligible Green Power Reported Through the program.*** MWh of green power delivered through the program have been increasing since the program began and peaked in January 2000 at 214,083 MWh. This represents a percentage increase of over 2,200%. Moreover, more than half of this has been delivered to residential customers.
- ***Program Funds.*** The program disbursed approximately $34 million since its inception through April 2000, leaving a balance in program funds of roughly $41 million for the remainder of the program.

The third objective, facilitating consumer choice of green power, is difficult to assess. In particular, the results of the consumer surveys show that most endusers who benefit from the Program are unaware of it, and some are even unaware that they are buying green power. Additional research is being done in another portion of this study to determine the effect of consumer education efforts funded by the Program.

5.2.2 Key Results of ESP Interviews

The following are some key findings from the ESP interviews:

[2] Weighted means: 48% for residential, 50% for nonresidential.

- Slightly more than one-third of the ESPs interviewed offer green power products exclusively; 18% sold just conventional products; the remainder sold both green and conventional products.
- Most ESPs who serve residential customers also serve small commercial customers. Approximately 40% of the ESPs interviewed served all three customer classes.
- Only two ESPs reported emphasizing pricing in their marketing messages.
- Two ESPs reported selling green power at a discount, making it less than the PX price; most sold it for a premium.
- ESPs mentioned the following market barriers to development of a competitive green power market in California: premium price for green power, problems with the wholesale market for electricity in California, and lack of consumer awareness.
- ESPs mentioned the premium price of green power, lack of understanding of renewable power and the power grid, and problems with billing and customer service as major concerns of customers in California considering switching to green power.
- Participants reported no concerns with the program's monthly reporting requirement; however, the annual audit requirement was reported to be complex.
- ESPs differed on their opinions of the variability of the credit incentive. Many reported they needed the credit to stay where it was in order for them to remain competitive and stay in business.

5.2.3 Key Results of Customer Surveys

The following are some key findings from the customer surveys:

- Residential customers who buy green power tend to be more educated and have lower electric bills.
- Only 15% of the residential customers who receive the Customer Credit are aware of it. The percentage is slightly higher for nonresidential customers at around 16%.
- Nonresidential customers who buy green power tend to lease rather than own their facilities. Furthermore, they typically have larger buildings and higher electricity consumption than do businesses who do not buy green power.
- Small businesses reported they were more willing to pay a premium for green power than were large businesses.
- Large businesses report more interest in the Customer Credit Program than do small businesses.

5.3 Other Program/Market Issues

This subsection discusses additional issues related to the program. Brief discussions of the wholesale green power market, program funding, and a discussion of free ridership in the market are presented as they relate to the Customer Credit Program.

5.3.1 Green Power Wholesale Market

ESPs who provide green power in California purchase the power either through bilateral contracts with renewable wholesalers or from the Automated Power Exchange (APX). Customer Credit participants purchased approximately 78% of the power they provided to customers from April 1998 through December 1999 through bilateral contracts and about 22% from the APX.

Since May 1999, ESPs who buy from the APX purchase a separate green ticket in addition to the energy product.[3] The tickets represent the green attribute[4] for which a premium is paid to the generator. The premium charged for green tickets is not based on the hourly demand for power, but rather on an aggregate demand for the tickets. The Commission requires ESPs to match their purchases of green tickets to the metered demand of their green power customers in order to receive the credit incentive. APX purchases by program participants have ranged from 0 to 51% of total power delivered by those participants, with an overall average since the program began of approximately 22%. Geothermal represents the most common type of renewable power traded, representing 71% of APX purchases by program participants.

Participant ESPs who buy through bilateral contracts purchase approximately 82% geothermal energy and 12% biomass. Percentages for wind and hydro are 0.3% and 4% respectively.

During the indepth interviews with ESPs, respondents were asked to describe any problems they had obtaining renewable supply to meet their demand. All who responded to this question explained they were experiencing no problems obtaining supply. Some concerns regarding the structure of the power market in California were expressed, however. Specifically, the following were mentioned:

- Make a level playing field for all power trading. As long as utilities are selling at a wholesale price with their costs covered, there is no competitive market.
- There are not enough economic incentives for new generation facilities to be built in California due to stringent siting requirements.

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[3] Prior to May 1999, the APX Green Power Market operated as a week-ahead hourly market.

[4] Pepper, Janice. "Opportunities for Biomass in the APX Green Power Market," http:\\www.apx.com/biomass_paper.htm.

In addition, a few respondents commented on differences in the California and Pennsylvania markets. For example, Pennsylvania was credited with having a "good generic market," albeit no green incentives, thus resulting in a higher proportion of customers who have switched providers but a lower proportion of customers who have chosen green power. One respondent stated that there is better consumer education in Pennsylvania. Two respondents explained that the way prices are structured in Pennsylvania, it is easier for customers to understand. Specifically, they explained that the price for buying from a utility is set and known and does not fluctuate as it does in California. So, when customers hear a price from an alternate provider, they are able to readily compare it with what their utility would charge them.

5.3.2 Program Funding

Program incentives totaled approximately $34.4 million paid through April 2000, leaving slightly more than $41 million in program funds available for the remainder of the current Program. In addition, credits disbursed through that date exceeded allocations by $228,943. In considering what time period the remaining funds might cover, growth rates were developed for the three customer segments in the program.

To do this, monthly growth rates for each customer segment were evaluated. Two scenarios were considered: 1) an overall growth rate based on the period of October 1998 through April 2000 and 2) a more recent growth rate based on December 1999 through April 2000. In constructing the overall growth rate, the first six months of program data were dropped due to erratic changes during the program start-up period. In addition, only the last five months of data were considered for the more recent growth rate, due to numerous fluctuations in the data in the months directly preceding the last five. In contrast, usage per customer remained relatively stable throughout the program lifetime. Table 5-1 presents the results of this analysis.

Table 5-1: Average Monthly Growth Rates of Customers

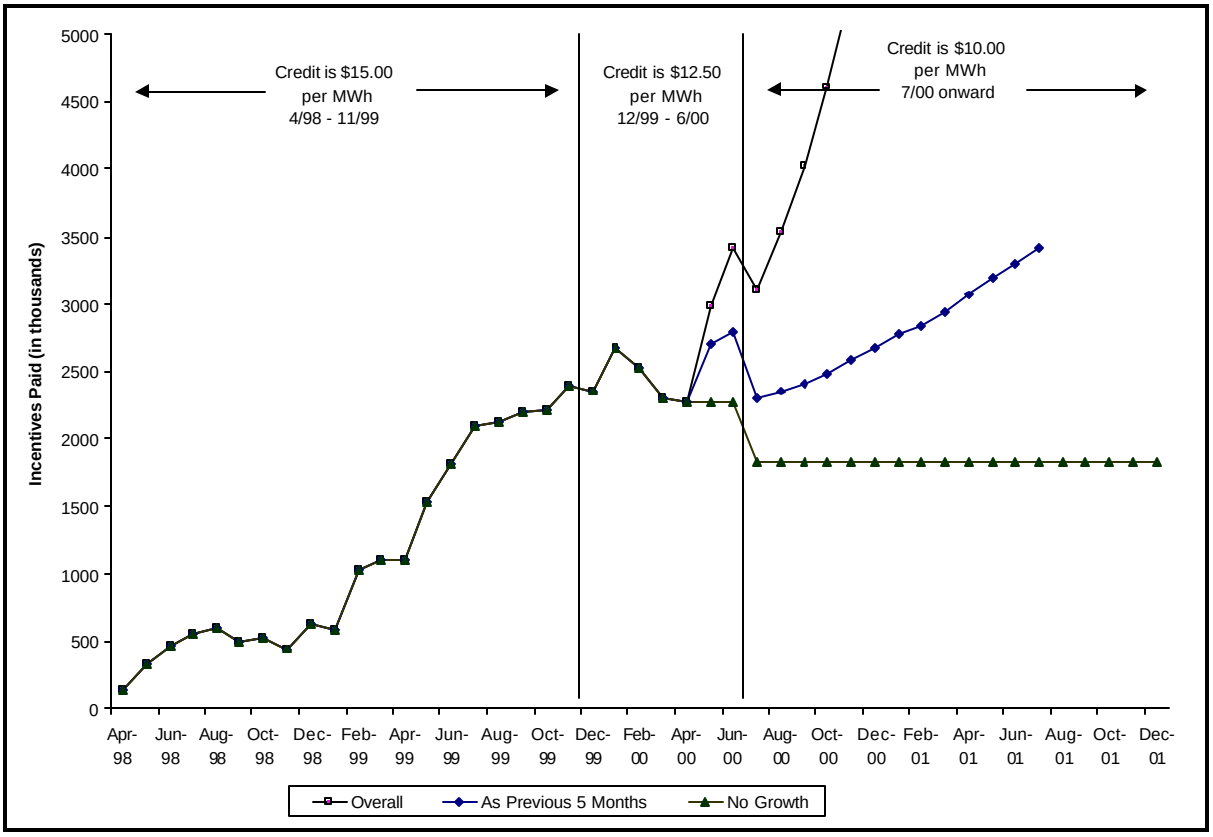
Customer Segment	Overall (10/98 – 4/00)	Last 5 Months (12/99 – 4/00)
Residential	9%	3%
Small Commercial	20%	4%
Other	19%	4%

As shown, the overall growth trend is quite high relative to more recent trends and, given the reduced program incentive levels, is unlikely to continue through the remainder of the program. Therefore, this growth scenario will be used mainly for comparison and not as a realistic representation of expected market behavior.

The approach used in this analysis differed in two ways from that taken by the Commission Staff in establishing their own forecast of Program expenditures. First, the analysis for this study looked at customer segments individually, rather than applying a single growth rate to all customer classes. Second, predicted customers per segment were multiplied by average kWh per customer to arrive at predicted load. Note that, for the Other segment, the $1,000 incentive cap was taken into account, as the base used for determining kWh per customer was comprised only of incented MWh.

Figure 5-1 shows the results of these alternative incentive revenue forecasts. Note the vertical axis represents monthly incentives paid in thousands of dollars and incorporates the Program incentive changes that took place on December 2, 1999 and on July 1, 2000.

Figure 5-1: Program Expenditure Growth Forecast



The overall growth trend results in Program funds being depleted in February 2000, whereas the trend based on the previous five months of data results in funds depleting in July 2000. Should no growth occur and Program incentives continue to be paid at the same rate as in April 2000, current available Program funds would last through March 2002. These results suggest that, given the established growth trend in the last five months of data, and in the

absence of other market changes, additional funding will be needed to support the program through December 2001.

5.3.3 Estimate of Customer Credit (Green Market) Free Ridership

An estimate of free-ridership by sector was derived from information on customers' willingness-to-pay for green power collected on the Electricity Preference mail survey and estimates of the retail price of green power without the Customer Credit Program.

Willingness-to-pay for Green Power. Participants in the mail survey were asked about their willingness to pay a premium for electricity generated from renewable resources relative to electricity generated from conventional sources. The green power premium was presented in the mail survey questionnaire in terms of percent above the cost of delivered electricity generated from conventional sources. Table 5-2 presents a summary of the responses to this question by sector. For example, as shown in Table 5-2, 15.1% of residential customers stated they would be willing to pay a premium of more than 10% to purchase green power.

Table 5-2: Summary of Willingness to Pay a Premium for Renewable Energy

Willing to Pay	Residential	Small Commercial	Other
No More	41.2%	67.6%	94.2%
Up to 5% More	21.6%	21.0%	5.8%
Up to 10% More	22.1%	10.5%	0.0%
Up to 25% More	10.3%	0.5%	0.0%
More than 25% More	4.8%	0.3%	0.0%

Retail Cost of Green Power without the Customer Credit Program. Estimates of the retail cost of green power by sector were developed from currently published rates from ESPs[5] and assumptions on the average monthly usage of customers in each sector[6]. These costs were then adjusted upwards by the amount of the incentive (1.25 cents per kWh) to reflect retail prices in the absence of the customer credit program[7]. An estimate of the cost of conventional power by sector was developed from retail price information provided to the Public Utilities Commission and assumptions on the average monthly usage of customers in each sector. The estimated monthly bill for customers using conventional power was then compared to the estimated monthly bill for customers using green power. This analysis

[5] The ESP rates were gathered from individual ESP sites and from web sites providing comparisons of energy prices (e.g. http//nic.cpuc.gov and ENERGYguide.com).

[6] Residential customers were assumed to use 500 kWh per month, Small Commercial customers were assumed to use 1,500 kWh per month and Other customers were assumed to use 5,000 kWh.

[7] This adjustment makes the simplifying assumption that the total amount of the incentive is passed through to the customer in the form of lower per kWh energy costs.

suggests that, in the absence of the Customer Credit Program, the retail rates for green power would be roughly 9% to 27%, 9% to 35%, and 17% to 23% higher than conventional energy for the Residential, Small Commercial and Other sectors, respectively.

Combining these two pieces of information suggests the percent of participating customers who would purchase green power in the absence of the Program. Table 5-3 presents a summary of the range of estimates for freeridership by sector[8]. As shown, free riders are most prevalent in the Residential sector and non-existent in the Other sector.

Table 5-3: Estimated Range of the Percent of Free Riders

Sector	% Self Reported Free Riders High	Low
Residential	21.7%	4.4%
Small Commercial	2.8%	0.2%
Other	0.0%	0.0%

5.4 Estimated Net Program Impacts

Net Customer Credit Program impacts on the sales of qualified MWh of green power can be estimated using the program records of gross sales of qualified power and estimates of free ridership. Specifically, net MWh sales in sector *i* and year *y* can be expressed as:

$$NETMWh_{iy} = GROSSMWh_{iy} \times \left(1 - FREERIDER_{iy}\right)$$

where

$NETMWh_{iy}$ = net qualified MWh for sector *i* and year *y*
$GROSSMWh_{iy}$ = total qualified MWh for sector *i* and year *y*
$FREERIDER_{iy}$ = fraction of free riders for sector *i* and year *y*

Table 5-4 presents a summary of net program impacts by sector and year. As shown, the net MWh served increased from approximately 253,075 (midpoint of the range shown) during 1998 to 1,296,281 MWh during 1999. Furthermore, in the first four months of 2000, the net MWh served has totaled 729,568 MWh.

[8] The estimates of free riders were developed by assuming that customers are distributed evenly within each category of the willingness to pay response categories.

Table 5-4: Summary of Customer Credit Net Program Impacts

Year / Sector	Gross MWh Served	% Self Reported Free Riders		Estimated Range of Net MWh Served	
		High	Low	Low	High
1998[9]					
Residential	173,563	21.7%	4.4%	135,829	166,004
Sm Commercial	59,852	2.8%	0.2%	58,196	59,728
Other	43,196	0.0%	0.0%	43,196	43,196
Total	**276,611**	**14.4%**	**2.8%**	**237,221**	**268,928**
1999					
Residential	746,766	21.7%	4.4%	584,412	714,243
Sm Commercial	327,286	2.8%	0.2%	318,231	326,605
Other	324,535	0.0%	0.0%	324,535	324,535
Total	**1,398,588**	**11.9%**	**2.3%**	**1,227,178**	**1,365,383**
2000[10]					
Residential	382,362	21.7%	4.4%	299,233	365,709
Sm Commercial	155,485	2.8%	0.2%	151,183	155,162
Other	243,924	0.0%	0.0%	243,924	243,924
Total	**781,771**	**11.5%**	**2.2%**	**694,340**	**764,795**

9 Data represents April through December 1998.

10 Data represents January through April 2000.

Volume V

6 Program Cost-Effectiveness

6.1 Introduction

This section discusses the development of a cost-effectiveness measure for the Customer Credit Program. Gross and net cost-effectiveness measures are developed by RER based on: 1) available program information to date (April 2000), and 2) findings of the free-ridership analysis of mail survey data.

The following sections present an overview of the method used to develop the cost-effectiveness measures and the results of the analysis.

6.2 Methodology

The first step in the Customer Credit Program cost-effectiveness analysis was to develop estimates of gross program expenditures per delivered kWh (sold to residential, small commercial and *Other* sectors). This gross cost-effectiveness measure (*GrossCCCosteff*) for program year *y* is calculated as the sum of the total incentives paid to each sector *i* and the Customer Credit Program administration costs divided by the total sales of qualified renewable energy across all sectors. Specifically,

$$GrossCCCostEff_y = \frac{\sum_i Incentives_{iy} + AdminCost_y}{\sum_i RnewablekWh_{iy}}$$

where:

$GrossCCCostEff_y$	=	measure of gross cost-effectiveness for year *y*
$Incentives_{iy}$	=	incentives paid to sector *i* in year *y*
$AdminCost_y$	=	Customer Credit Program administration cost for year *y*
$RnewablekWh_{iy}$	=	qualified renewable energy sales (kWh) to sector *i* in year *y*

As defined, *GrossCCCostEff* is a measure of gross program cost-effectiveness insofar as it does not attempt to account for the renewable energy that would have been delivered in the absence of the Customer Credit Program. This free-rider element should be netted out of the annual renewable energy sold to each sector. In particular, net cost-effectiveness can be specified as:

$$NetCCCostEff_y = \frac{\sum_i Incentives_{iy.} + AdminCost_y}{\sum_i RnewablekWh_{iy} \times \left(1 - Freerider_{iy}\right)}$$

where:

$NetCCCostEff_y$	=	measure of net cost-effectiveness for year y
$Freerider_{iy}$	=	fraction of free riders in sector i for year y

6.3 Estimation of Cost-Effectiveness Measure

Data from the Customer Energy Preference mail survey and the Customer Credit Program records were used to estimate gross and net cost-effectiveness measures for the Customer Credit Program.

6.3.1 Gross Cost-Effectiveness Measure

Table 6-1 presents a summary of the gross cost-effectiveness measure by year and sector. Table 6-1 includes the total MWh served, total incentives paid, administration costs, and gross cost-effectiveness measure.

The MWh served and incentive payments were assembled from the Customer Credit Program records. The administration costs were developed from Program work plan information provided by the Commission. These costs include labor and overhead costs for the Customer Credit Program staff and contract costs expended to develop program reporting protocols. Insofar as the program administration costs are not reported by sector, the administration costs were allocated proportionally across sectors on the basis of total MWh served.

As shown, the gross cost-effectiveness results for all sectors range from $0.0154/kWh in 1998 to $0.0126/kWh in 2000. The steady improvement in cost-effectiveness through time has been driven by the reduction in the credit level.

Table 6-1: Summary of Gross Cost-Effectiveness

Year / Sector	MWh Served (MWh)	Incentives Paid	Administrative Costs	Gross Cost-Effectiveness Measure ($/kWh)
1998[1]				
Residential	173,563	$2,603,442	$65,242	$0.0154
Sm Commercial	59,852	$897,783	$22,498	$0.0154
Other	43,196	$647,945	$16,237	$0.0154
Total	**276,611**	**$4,149,170**	**$103,978**	**$0.0154**
1999				
Residential	746,766	$10,948,712	$74,025	$0.0148
Sm Commercial	327,286	$4,812,798	$32,443	$0.0148
Other	324,535	$4,746,126	$32,170	$0.0147
Total	**1,398,588**	**$20,507,635**	**$138,638**	**$0.0148**
2000[2]				
Residential	382,362	$4,779,525	$22,602	$0.0126
Sm Commercial	155,485	$1,943,568	$9,191	$0.0126
Other	243,924	$3,049,045	$14,419	$0.0126
Total	**781,771**	**$9,772,138**	**$46,213**	**$0.0126**

6.3.2 Net Cost-Effectiveness Measure

Table 6-2 presents a summary of the net cost-effectiveness measure of the Customer Credit Program. Table 6-2 includes the gross cost-effectiveness measure, low and high estimates of the percentage of free riders,[3] and the corresponding range of net cost-effectiveness estimates.

This approach to developing the cost-effectiveness measure assumes that free-ridership is measured at the customer level. It is recognized, however, that there could be an impact from the customer credit incentive at the retailer or ESP level. That is, in the absence of the Customer Credit Program, there are ESPs that would no longer provide green power. However, analysis of the ESP in-depth surveys indicates that some ESPs would still be in the green power market with or without the incentive.

As shown in Table 6-2, the net program-level cost-effectiveness estimates range from $0.0179/kWh for the high free ridership scenario in 1998 to $0.0128/kWh for the low free ridership scenario in 2000. Cost-effectiveness improvement through time is driven by the

[1] Data represents April 1998 through December 1998.

[2] Data represents January 2000 thru April 2000.

[3] For a further discussion on the free rider estimate, please see Section 5.

reduction in the credit level. For any given year and sector, the lower free ridership scenario yields the better cost-effectiveness results.

Table 6-2: Summary of Net Cost-Effectiveness

Year / Sector	Gross Cost-Effectiveness Measure ($/kWh)	% Self Reported Free-riders (FR)		Net Cost-Effectiveness Measure ($/kWh)	
		High FR	Low FR	High FR	Low FR
1998[4]					
Residential	$0.0154	21.7%	4.4%	$0.0196	$0.0161
Sm Commercial	$0.0154	2.8%	0.2%	$0.0158	$0.0154
Other	$0.0154	0.0%	0.0%	$0.0154	$0.0154
Total	**$0.0154**	**14.4%**	**2.8%**	**$0.0179**	**$0.0158**
1999					
Residential	$0.0148	21.7%	4.4%	$0.0189	$0.0154
Sm Commercial	$0.0148	2.8%	0.2%	$0.0152	$0.0148
Other	$0.0147	0.0%	0.0%	$0.0147	$0.0147
Total	**$0.0148**	**11.9%**	**2.3%**	**$0.0168**	**$0.0151**
2000[5]					
Residential	$0.0126	21.7%	4.4%	$0.0160	$0.0131
Sm Commercial	$0.0126	2.8%	0.2%	$0.0129	$0.0126
Other	$0.0126	0.0%	0.0%	$0.0126	$0.0126
Total	**$0.0126**	**11.5%**	**2.2%**	**$0.0141**	**$0.0128**

[4] Data represents April 1998 through December 1998.

[5] Data represents January 2000 through April 2000.

Volume V

7 Conclusions and Program Recommendations

7.1 Overview

This research collected data on the Customer Credit Program from three key sources: Commission Program records, in-depth interviews with Energy Service Providers, and mail surveys with residential and business customers. These data were subsequently evaluated to assess Program effectiveness

This section presents conclusions resulting from this program review, and recommendations for improving the program.

7.2 Program Effectiveness

By providing a financial incentive for the purchase and delivery of green power, the program has reduced the cost of green power for participant ESPs. In addition, it has reduced the retail price of green power for at least some consumers.

ESPs interviewed for this research on average reported that the program had influenced the development of a retail green power market in California. Evidence of this market's development can be seen in: 1) new market entrants, and 2) increasing growth rates of the number of customers switching to green power and associated quantities of delivered green energy. The program has contributed to this market growth by providing incentives to ESPs, thus encouraging new firms to enter the market and existing firms to offer green power products. At this relatively early stage of program implementation program data availability constraints preclude development of precise estimates of the magnitude of these effects. As the program matures it will be possible to increase the resolution of program impact estimates.

As only approximately 1.5 percent of California consumers have switched to green power at this time, the market remains in its early stages of development. With this in mind, the following key findings from this research are important for future planning of programs and, as appropriate, incentives that will continue to assist the development of the market.

- ***Lack of Consumer Awareness.*** Approximately 40% of residential and 72% of nonresidential customers in the program are unaware that they are buying green power. Furthermore, the majority of customers (approximately 85%) who buy green power under the program are unaware that they are receiving an incentive. As consumer demand is an important element in the development of a long-term

sustainable market, these preliminary Program assessment results indicate that much work remains to be done with consumer education.

- ***Reported Willingness to Pay a Premium for Green Power.*** Most customers (83% to 92%) reported they would buy green power if it were the same cost as conventional power. Furthermore, 35% of residential customers currently not buying green power reported they would pay a premium of 5% or more to buy green power. In addition, 32% of nonresidential customers currently not buying green power reported they would pay a premium of 5% to 10% to buy green power. On average, small businesses are more willing to pay a premium than large businesses. This finding is particularly important, considering that some customers in the program are buying green power at a discount rather than a premium. If the credit incentive continues to diminish and retail prices rise, this reported willingness to pay will be tested.
- ***Ineffectiveness of Power Content Label.*** Most green power consumers (63% of residential and 91% of nonresidential) are unaware of the power content label. In addition, many ESPs reported that their customers are not interested in it. These results seem to indicate the need to reassess the effectiveness of this consumer education tool.

7.3 Recommendations for Improvement

Unless the Program continues at or near April 2000[1] participation levels, further credit level reductions or program funding increases will be required before its December 2001 sunset date. A forecast of growth based on the most recent months of data, as described in Section 5, suggests that additional funding will be needed by midyear 2001. However, one should note that this scenario was developed using data only through April 2000. As additional data becomes available, particularly data after July 2000 that includes the effect of the incentive change to $10 per MWh, this issue will need to be revisited again.

Concerning the design of the program, ESPs interviewed for this research reported that they were happy with the program, considered it well-administered, and certainly wanted it to continue. The program appears to be working as intended and no recommendations for changes in its design are recommended at this time. However, should credit level drop further (e.g., below $10/MWh), it is currently unclear whether the success of the Program experienced to date will continue.

The market for green power is growing; however, as only 1.5 percent of California consumers are purchasing green power at this time, and many of them are unaware they are doing so, the market is at a critical stage. Should the Program end in the near future, increased retail prices would probably follow, resulting in consumers switching away from green power and ESPs leaving the market. Therefore, continuation of the program is

[1] April 2000 was the last month for which complete Program data was available for this analysis.

recommended. However, additional data is needed to determine whether supplementary program funds will be needed to sucessfully operate the Program through its intended completion.

Renewable Energy Program

Preliminary Evaluation

Volume VI

Consumer Education Subaccount

Prepared for:

The Governor and the California State Legislature

Prepared by:

Regional Economic Research, Inc.
11236 El Camino Real, Suite A
San Diego, California 92130

October 30, 2000

Volume VI – Consumer Education Subaccount

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Volume VI

1 Introduction

1.1 Overview

The Consumer Education Subaccount is a component of the California Energy Commission's (Commission) Renewable Energy Program. The Consumer Education Program was conceptualized in 1997 and 1998 through a public process. The Program's Marketing Plan[1] was adopted on March 17, 1999.

This study evaluates Phase I program activities conducted through September 30, 2000. The remainder of this chapter provides a description of the consumer education effort, presents the approach used in the evaluation, and outlines the remainder of the report.

1.2 Description

As a result of Senate Bill 90, one percent of the $540 million Renewable Resource Trust Fund is allocated to the Consumer Education Subaccount. The purpose of the consumer education subaccount, as noted in the guidelines,[2] is to support a consumer education and marketing campaign:

- To promote renewable energy;
- To disseminate information on renewable energy technologies; and
- To help develop a consumer market for renewable energy and small-scale emerging renewable energy technologies.

Beginning in October 1997 Commission staff employed a public process to develop a strategy for consumer education. During 1997 and 1998 through workshops and public comment, Commission staff developed a marketing plan outlining a strategy to accomplish the goals of the Consumer Education Subaccount.

The Renewable Energy Consumer Education (RECE) Marketing Plan was adopted March 17, 1999 and an initial allocation of $1.2 million funding to execute a portion of the marketing plan was made to the Renewable Energy Marketing Board (REMB) on the same date. The RECE Marketing Plan (Plan) set out the goals of raising awareness of renewable energy and increasing purchases of both renewable energy from the grid and "emerging renewables" that are installed on customer premises.

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1 California Energy Commission (1999) Renewable Energy Consumer Education Marketing Plan. P500-99-018. February 1999.

2 California Energy Commission (2000) Renewable Energy Program Volume 5 Consumer Education Subaccount Guidebook, 2nd Edition. P500-97-011V5. July 2000.

The plan further set forth a goal of leveraging the value of the education campaign by 4:1 so that the campaign would have sufficient momentum to continue after the four year funding was gone.

A key component of the RECE Marketing Plan was the decision to rely on grassroots organizations to implement portions of the consumer education plan. This approach had been strongly supported in the public workshops and offered a means for leveraging limited funds available for consumer education. Another key component of the Plan was the recognition that the Renewable Energy Market and the Emerging Renewable Technologies Market were different and would likely require different strategies. Table 1-1 displays the distribution of the $5.4 million in funds as of September 30, 2000.

Table 1-1: Funding Allocation for Consumer Education Projects[3]

Type of Allocation	Renewable Energy Market ($1,000)	Emerging Technologies Market ($1,000)	Total ($1,000)
Initial Allocation	$4,320	$1,080	$5,400
Contracts	$1,200	$0	$1,200
Grants	$0	$375	$375
Technical Support	$0	$300	$300
Remaining	$3,120	$405	$3,525

The REMB proposed to act as program administrator and fiscal agent for a variety of grassroots organizations that would implement the RECE Marketing Plan for the Renewable Energy Market. The team members included:

- REMB, representing the renewable energy marketing community (e.g., green power marketers),
- Global Green USA, a grassroots organization based in the Los Angeles area,
- The Center for Energy Efficiency and Renewable Technologies (CEERT), a public interest law group working on renewable issues based in Northern California,
- Center for Resource Solutions (CRS), a non-profit organization promoting renewable energy and sustainable energy technologies. CRS manages the green electricity labeling effort, Green-e,
- Twin-Pines Cooperative, an umbrella organization for California food cooperatives, and
- Two media and public relations consultants.

3 Transcript. Staff Workshop Before The California Energy Resources Conservation and Development Commission, Docket No. 98-REN-EDU. Thursday, August 17, 2000.

The Commission accepted the proposal and initiated a 15-month initial phase of work with the REMB team. Throughout the contract period, work authorizations were released to REMB giving permission to team members to engage in specific tasks with agreed upon milestones and deliverables.

The REMB team focused on the renewable energy market. Consistent with the market approach outlined in the RECE Marketing Plan, the REMB team used the contacts from grassroots organizations to gain media and public relations attention for green power switches and to educate consumers about green power so that they would make the switch to green power.

Initially, Commission staff accepted a proposal and initiated negotiations with CEERT to implement activities for the Emerging Renewable Technologies Market. However, the negotiations did not result in a contract, as CEERT did not feel they could commit to the leveraging requirements. Consequently, the Commission staff began developing and implementing activities for the emerging technologies market. These activities began in late spring 1999.

1.3 Evaluation Approach

Data for this study were collected from:

- In-depth interviews with members of the REMB team and Commission staff between October 4 to 20, 2000
- Review of REMB team monthly reports and the REMB contract
- Data collected for the Emerging Technologies Market Research as baseline data for the Consumer Education evaluation.
- Data collected for the Customer Credit Program as post campaign impact evaluation.
- Benchmarking data from the Northwest Energy Efficiency Alliance's betterbrick.com consumer education campaign.
- Switches to green power.

The evaluation of Phase 1 is primarily formative in nature. The purpose is to provide information for mid-course correction of the Consumer Education effort to ensure that Phase 2 is as effective as possible.

Initially, the Commission hoped to have a pre- and post survey to help determine whether consumer and business awareness of green power had changed as a result of the 15-month Phase 1 effort. However, this did not occur. The contracting process for the evaluation effort included delays, such that the pre-survey could not be conducted prior to the initiation of Phase 1 and the post-survey could not be conducted immediately following Phase 1.

1.4 Report Organization

The remainder of this report is organized as follows:

- Program Activities
- Program Impacts
- Conclusions and Recommendations

Volume VI

2 Program Activities

2.1 Overview

The RECE Marketing Plan outlined an approach to consumer education for renewable energy. The plan noted that there were two markets: the renewable energy market and the emerging renewable technologies market. The renewable energy market is generally known as the "green power" market, while the emerging renewable technologies market consists of on-site distributed generation using renewable technologies such as small wind, photovoltaics and others.

This chapter presents an overview of the RECE programs for each market. It discusses the activities that resulted from these programs and the lessons learned. Each of the two markets is treated separately in this revew of program activities.

2.2 Renewable Energy Marketing

The following describes the renewable market approach, discusses the perception of goals held by REMB team members and Commission staff for the Phase 1 period, reviews the specific activities implemented during Phase 1 under the REMB contract, and the lessons learned.

2.2.1 Description

The renewable energy market project administrator was the Renewable Energy Marketing Board (REMB). The REMB proposed to assemble a team of experienced grassroots renewable energy organizations and to facilitate that team's efforts to reach consumers throughout California.

The REMB began as a project of the Independent Energy Producers Association. The purpose of the REMB was to provide a mechanism for marketing green power to consumers. Composed of renewable energy generators, renewable energy marketers, and nonprofit environmental groups the REMB was able to commit to leveraging funds from marketers and generators to enable the project team to meet the Commission leveraging requirement, something none of the nonprofit grassroots environmental groups felt comfortable making a commitment to.

The REMB contract included seven work authorizations (WAs) as presented in Table 2-1.

Table 2-1: REMB Contract Work Authorization Details

WA #	Project Activity	WA Term	Budget ($)	Leverage $
1	Pilot Cable Television/Direct Mail in Santa Monica	3/17/99-9/1/99	143,401	171,400
2	General Tasks for Renewable Energy Market Action Plan	3/17/99-9/30/00	761,396	879,331
3	Cable Television/Direct Mail in Oakland	10/1/99-6/30/00	40,550	6,000
4	Local Governmental Outreach	10/1/99-6/30/00	10,000	10,000
5	Grassroots Education Targeting California Food Co-ops	10/1/99-6/30/00	54,675	238,000
6	RECE Business Outreach	11/99-6/00	27,000	50,000
7	Earth Day 2000 - Media Outreach and Polling	10/1/99-6/30/00	284,600	60,000
	TOTAL:		$1,321,622	$1,414,731

The end of contract report from REMB[1] indicates that final leveraged funds and in-kind contributions were $2,565,630. Of these, well over 90% were in-kind contributions of staff time from the various REMB team members, office support and in-kind donations from supporters of the REMB team member organizations.

2.2.2 Perception of Goals

The REMB Team and Commission staff shared similar, but not identical goals for the REMB effort. In fact, across the REMB Team goals perceptions varied as well. All parties agreed that the overall goal was to increase green power switching, however, the foundation of the goal varied. Some of the members saw the goal as developing capability among renewable energy generators, marketers and advocates to be able to pursue marketing activities without state funds after the initial four years.

[1] Kelly, Steven. (2000) Phase I Report, Contract Number 500-98-057. Renewable Energy Marketing Board. September 2000.

Others saw the goal primarily as awareness building toward long term increased purchases of green energy. Still others saw the goal as primarily supporting their own activities promoting renewable energy.

These different views of the goal lead to some conflicts among team members as to how the project should be implemented. Some of those we spoke with felt that all parties should cooperatively work together to develop strategy and implement strategy on a statewide basis. Other parties thought they should be permitted to operate autonomously to do their best and to report back when done. Still others wanted something in-between autonomy for the groups in the field with cooperation across all groups so that efforts were viewed as coordinated.

A further area of inconsistent perceptions was in regards to the nature of Phase 1. Some of the team members thought Phase 1 was to be a pilot period to test different ideas and see what worked best. Others thought it was just the first phase of what would be an ongoing contract, with additional funding for the activities that worked well in the first phase. These perceptions generally led some parties to expect the contract to continue after June 2000, leading to some unhappiness when the contract was not refunded in June 2000.

Inconsistent goal perceptions are often at the root of implementation problems when multiple groups seek to implement a common program. The fact that the REMB was the only organization willing and able to contract with the Commission given the leveraging requirements, meant that the foundation of the REMB Team was not a commitment to specific goals, but only to the overall goal of the RECE Marketing Plan. The differences in goals for the groups could only have been addressed by a specific component of the project for participation in strategy and planning sessions. In such a setting, differences in goal perception would likely have emerged and been dealt with by the team as a whole.

2.2.3 Activities

The strategy of the REMB team members was to increase consumer awareness of the opportunity to switch, increase their awareness of the option of green power, and then encourage consumers who would switch to chose green power. To implement this strategy the REMB Team focused their activities on potential early adopters: environmental group members and citizens of communities that switched to green power.

The team initially thought the highest potential for early adopters were members of environmental groups. This proved to be incorrect. After initial discussions with environmental groups, the team realized that environmental groups were quite skeptical of green power out of concern for green washing, the notion that a product is marketed as green when it really is not.

Following early problems with environmental groups, the REMB team focused their efforts on the people living in communities that were willing to switch to green power (city switches) and those

attending Earth Day 2000 celebrations. These were viewed as providing optimum opportunity for leveraging the limited Phase 1 budget and obtaining earned media, as opposed to paid-for commercial media.

Various promotional tools were used to maximize the impact of the city switch and Earth Day activities. To facilitate this overall approach, the REMB Team produced a 30-second TV commercial for green power (using in-kind contributions from a film company) and purchased commercial advertising time on Cable stations in the five geographic areas targeted for city switch or Earth Day activities. In addition to purchased Cable time, speakers appeared on radio talk shows, direct mail was used to send brochures to citizens of the cities that switched, articles were placed in a variety of publications, and an online tool for switching was added to REMB Team member websites. To facilitate switching, the REMB team also contacted green power marketers and asked that they coordinate their marketing efforts with the REMB team promotional efforts.

The city switches required concerted efforts with technical staff at each city to develop a request for proposals from energy marketers, as well as meetings with various key city officials who had to offer their support to the concept of switching to green power.

Three other approaches were also included in the REMB strategy.

- The REMB team also developed a strategy for another group of potential early adopters, food co-op members. In association with Twin Pines Cooperative, food co-ops throughout California installed an information kiosk on green power and ran stories and ads encouraging members to switch to green power.
- The REMB team attempted to expand the city switch opportunities by conducting four workshops with local government officials in Northern and Southern California to explain the opportunity and process required to implement a switch, three of these were implemented.
- The REMB team also developed an outreach campaign for businesses. Table 2-2 displays the outputs from these activities as reported by the REMB team in the REMB final report and from final reports submitted by REMB Team members.[2]

[2] Highlights from the Center for Resource Solution - REPC Task and Deliverables Contract 500-98-057; Local Government Commission Report REMB CEC #500-98-057; Final Report Green Energy Education Program for Consumer Food Cooperatives in California, Twin Pines Cooperation Foundation, July 30, 2000; CEERT Clean Power Education Campaign, Received CEC August 22, 2000; REMB City of Santa Monica Pilot Media Project Report, August 10, 1999.

Table 2-2: Activities Accomplished by the REMB Team

Activity	Purchased (P) or Earned (E)	Number of Placements[a]	Comments
Press Releases	E	19 35[b]	Poorly documented
Stories	E	15 27[b]	Poorly documented
Radio Talk shows	E	6 12[b]	Poorly documented
Television stories	E	2	Poorly documented
Articles Placed	E	35	Poorly documented
Direct Mail Brochure	P	72,000 mailings	Two communities, 3 Mailings
Cable Advertisements	P	267,000 subscribers	Four communities, 3 weeks in each
Food Co-op kiosks	P	8	60,000 members
Co-op news coverage	E	3	Viewership unspecified
Presentations	E	100+	Mostly undocumented
Local Government Wrkshps	P	3	1 cancelled
Earth Day 2000			
Contra Costa	P/E	30,000 visitors	
Santa Barbara	P/E	15,000 visitors	
San Diego	P/E	60,000 visitors	
Clean Power Day 1999	P/E	5,000-8,000 visitors	
Santa Monica Pilot Media Campaign[c]			
Direct Mail	P	3 mailing to 16,000 households[c]	
Response Cards	P	90 returned	
Cable Ads	P	7.4 times by 24,720 viewers	
Website	P	1,200-1,500 unique hits	
Call Centers	P	144 calls received	

a. Total counts as provided in REMB final report, except as noted otherwise
b. Total counts from information provided in in REMB monthly status reports
c. Total counts as documented in REMB report on pilot media effort in Santa Monica

2.2.4 Lessons Learned

The lessons learned fall into five major categories. These are lessons learned about the teams initial assumptions on target audience and strategy, lessons learned regarding the ability to gain and use earned media, lessons learned about coordination and the contract requirements, lessons learned about working with green power marketers, and lessons about using workshops and presentations. The following discusses each of these categories.

Assumptions about Target Audience and Strategy

The REMB Team began with two assumptions, one proved not valid while the other proved valid. The first assumption was the environmental groups and their supporters would be the most likely candidates to switch to green power. The second assumption was that if large municipalities switched to green power that a great deal of positive press could be obtained and city residents would be more likely to make a switch themselves.

The first assumption proved false for one major reason, the fear of green washing. The REMB Team members approached several environmental groups and learned that there was a massive education effort required to explain why green power was not a green washing problem. These concerns had risen as the result of a report released in October 1998 by Public Citizen, the group founded by Ralph Nadar, criticizing the green power marketers in California for not sufficiently contributing to the development of new renewable generation resources.[3] To compound the problem, the REMB team also found that for some environmental groups with local chapters, such as the Sierra Club, each local chapter needed to be treated independently, further increasing the required effort to address concerns about greenwashing.

As a result of the failure of this assumption, many of the REMB team members feel that market research is required to identify target market opportunities for green power.

The second assumption, however, appears to have been proven true. The REMB team decided to organize around city switches. They piloted this approach with citizen in Santa Monica. They developed a 30-sec TV spot on green power and purchased time on Cable stations in the Santa Monica area. They also developed a brochure on the choice to switch and green power and direct mailed that to citizens of Santa Monica. The REMB Team felt that this approach was effective but did not have any empirical data to measure effectiveness. Based on data from the cable companies they only knew that about 24,000 people had seen the ads an average of 7.4 times. Subsequently, the same approach was used around Earth Day in Santa Barbara along with pre and post survey of awareness. The post-test indicated a 12% increased in awareness of green power and a 9% increase in willingness to switch to a green provider, confirming for team members that this approach is effective.[4]

As a result of the success of this assumption, most REMB team members feel that continued pursuit of city switches is warranted for the near future.

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[3] Radar, Nancy. (1998) Green Buyers Beware. Public Citizen, Washington. D. C. October 1998. http://www.citizen.org/press/greenreport.htm

[4] The survey was conducted with over 400 respondents in the pre and the post conditions resulting in a better than 95/5 confidence level on these estimates.

Earned Media

Another component of the strategy was to seek earned media. Earned media is that which occurs as the result of media interest in a story. Such exposure is not purchased as advertising. It can have a significant impact on the target audience because it is perceived as newsworthy and therefore more valuable, also with the budget allocation for the REMB contract, purchased media was not a serious option. The city switches and Earth Day events provided venues for news. The food coop efforts in smaller communities also provided news events for the local television stations.

In addition to events, the REMB team contracted with a professional writer who developed stories and placed them in a variety of publications. These stories, press releases and op-ed pieces were built on activities conducted by the REMB team as well as on those of other organizations working on renewable energy in California. Examples of these other organizations include Episcopal Light and Power and various businesses that signed up for green power such as Toyota, Kinkos, and Sony records. The REMB Team was sufficiently aware of these activities to ensure that their publicist prepared news stories or press releases on these activities.

Despite the success of the earned media effort, REMB team members cautioned that media interest is driven by two factors; news worthiness and continuity. The effectiveness of the city switch strategy in garnering earned media will not persist forever, at some point it will be no longer be newsworthy and what stories are published will be smaller than those published during the Phase 1 period. Both to understand when a story is lagging in news worthiness and to keep the story in front of media contacts, continuity of the effort is important. The REMB Team included a primary lead in each of the two halves of the state. The worked with the team professional writer and a professional media consultant to keep the media informed in their areas of the state.

While the approach was successful REMB team members expressed two concerns,

- That continuity be maintained, essentially that the ball not be dropped on all of the success they had with earned media during Phase 1 but that continued efforts be funded as soon as possible.
- That efforts begin now to explore how to implement a media campaign that will not rely as heavily on earned media, once the news worthiness of the story begins to dissipate.

Coordination and Contract Requirements

Perhaps the major negative lesson learned in this project was the difficulty of coordination and need to fulfill contract requirements. Almost everyone we spoke with expressed dissatisfaction with the contract requirements. REMB Team members expressed difficulty meeting the requirements feeling that the documentation efforts detracted from their ability to do the work, and the Commission staff members expressed dissatisfaction over the team's timeliness in submitting documentation and in the quality of their documentation.

Furthermore, these problems created communication and coordination problems among team members and between the team and the Commission. By the end of the Phase 1 period:

- REMB the program administrator was no longer willing to continue as fiscal agent and program administrator. This was primarily because the level of documentation and information required from team members to satisfy the Commission contract requirements took much more time and effort than had been expected.
- REMB Team Members tended to feel that they had been required by the program administrator to provide too much detail and to do too much documentation. They also felt that they should have been allowed to do their jobs and as a group felt a grant approach would have been more satisfactory.
- All REMB Team members felt that the requirement for leveraging had been both difficult or impossible to meet and had distracted from their work efforts, leading to problems in meeting reporting requirements.[5]
- All members of the REMB Team felt that the contract approach had tied their hands when it came to purchased media, since payment from the Commission was on a task completion basis yet payment was required up-front by the television stations.
- Commission staff felt they had been left in the dark about too many details of the strategy and its implementation and had the view that communication among REMB team members was limited, while REMB Team members thought that

[5] The Commission Work Authorizations required leveraging for each WA independently, but none of the team members was willing (and in some cases able) to provide this information to REMB until the end of the project period.

communication was satisfactory and that the expectation of more communication was unwarranted.

- Most REMB Team members felt that these problems could have been reduced if a grant approach rather than a contract approach had been used, while Commission staff and some REMB team members felt that more communication directly between Commission staff and the subcontractors upfront would have solved the problem

Coordination with Green Power Marketers

The REMB team believed that the REMB itself would provide an effective vehicle for communication and coordination with green power marketers. This proved to be only partially true. Not all green power marketers were interested in being members of REMB and those that were, did not equally participate in the REMB strategy discussions. Not surprisingly, the largest green power marketers were willing to be members and did participate in discussions with the REMB team about strategy and coordination.

The Commission staff however, heard complaints from some marketers. Those not actively involved in the REMB who were smaller companies and one with products that were not Green-e certified[6] expressed some dissatisfaction with the REMB team efforts to the Commission staff. This created some concern on the part of the Commission staff that REMB was not actually doing the coordination that had been expected. Another concern expressed by green power marketers was heard in the Customer Credit Evaluation.[7] Some of the green power marketers stated that the California consumer education effort was not as effective as that in Pennsylvania.

Despite involvement in REMB planning effort, the REMB Team learned as they proceeded through Phase 1 that the green power marketers were not forthcoming with information. They found the green power marketers:

- Would not disclose whether they would actually market their products at the same time as the REMB Team promotional efforts,
- Would not disclose the number of switches they received in specific locales targeted by the REMB Team in comparison to other areas, and
- Would not work with the REMB team when potential sales were eminent with businesses and cities. It was a surprise to the REMB team that when they obtained

6 Green-e certification is provided by an independent certification body sponsored by the Center for Resource Solutions (CRS). Green-e certification has no bearing on whether a green power product qualifies for the customer credit through the Commission Renewable energy program nor whether it can be sold in California.

7 Regional Economic Research, (October, 2000) California Energy Commission Renewable Energy Program: Preliminary Evaluation of Customer Credit Subaccount.

> the interest of some cities and businesses, that at first, no green power marketer had a product to offer.

These experiences convinced the REMB team that the business interests of the green power marketers could not be easily aligned with the consumer education campaign. Yet the lack of coordination limited the effectiveness of the effort.

Workshops and Presentations

The REMB team found that there were lots of opportunities to do presentations on renewable energy. Workshops however, were another story. The team obtained a WA to conduct four workshops with local governments on the process of switching to green power. They had poor attendance at two and had to cancel a third. The one that was effective, in Oakland has provided additional opportunities. As a result of their experience with these local government workshops, the REMB team members noted that presentations made in association with meetings that were already occurring had been more effective than attempting to attract participants to a workshop on a specialized topic.

2.3 Emerging Renewables Technologies

This section describes the emerging renewable technologies market effort up to September 30, 2000, including activities conducted by the Commission and lessons learned during this period.

2.3.1 Program Description

The Emerging Renewable Technologies component of the RECE effort was allocated about 20% of the funding. Initial contract negotiations were conducted with CEERT to be program administrator. As noted previously, CEERT declined the contract due to concern that the leveraging requirements would be too difficult to meet. After looking for another organization to serve as program adminstrator, the Commission staff decided that they would assume the program administrator role.

The RECE Marketing Plan working group and the Commission staff thought that funding decisions for emerging technologies should wait the results of a number of market research efforts conducted under the technical support contract (Contract No. 500-97-022, WA#5, WA#s7 & 21,and WA#19). These market research efforts were completed in late 1999 through mid-2000 and published in September 2000.[8]

The market research helped to define opportunities for targeting activities. The process of waiting for completion of the research effort also provided the Commission staff with the opportunity to learn from the REMB contract experience and to identify potential contractors to conduct activities in the emerging technologies area.

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[8] Regional Economic Research. (June, 2000). California Energy Commission Emerging Technologies Market Research, On-site Verifications & End-User Surveys.

During this period the Commission staff conducted projects for the emerging technologies area. These included:

- Development of a program identity, logo and booth that could be used for both renewable consumer education efforts;
- Development and broadcasting of videos for the Sacramento public television station,
- Development of a brochure and fact sheets on emerging technologies,
- Development of a consumer guide for Photovoltaic Systems and the Clean Power estimator located at the Commission website;
- Participation in trade fairs and sponsorship of Solfest 2000 which drew 10,000 visitors. Hosted a workshop at the event on the Emerging Buydown Program.
- Support for the Northern California Solar Energy Associations Solar Home Tour.

The Commission staff developed a Program Opportunity Notice (PON) in May 2000. Table 2-3 displays the seven grants that were awarded as a result of the PON. Grant agreements for these contracts were being signed at the time of this report, with results anticipated in 2001.

Table 2-3: Grant Solicitation Awards for Emerging Renewable Technologies

Company Name	Project Title (description)	Project Duration	Funding Requested	Match Fund
Chico Community Publishing Inc.	Educational media outreach program	9/13/00-9/30/01	$69,178.00	$34,271.44 (50%)
Evergreen Energy LLC	Small Wind Consumer's Guide	11/1/00 – 5/1/01	$24,650.00	$6,500.00 (26%)
Northern California Solar Energy Association	Solar Home Tour in Northern California	10/1/00 – 10/1/01	$11,300.00	$9,800.00 (87%)
Pathfinder Communications	Development of articles, website content and hand-outs	10/1/00 – 10/1/01	$75,000.00	$57,400.00 (77%)
San Diego State University Foundation	San Diego Region Photovoltaic Education and Outreach Project-virtual PV clearinghouse & targeted outreach campaign	10/1/00 – 10/1/01	$74,980.00	$33,214.00 (44%)
The Rahus Institute	Rahus Renewable Roots Campaign-posters, flyers, demo kit, interactive display, PV display, media articles, web site development	8/31/00 – 10/1/01	$71,965.00	$92,500.00 (129%)
Twin Pines Cooperative Foundation	PV and/or Wind for Co-ops Education and Demonstration program	10/1/00 – 8/31/01	$47,923.00	$37,330.00 (78%)
TOTAL			$375,000.00	$269,630.44 (72%)

2.3.2 Emerging Technology Activities

The Commission staff accomplished some key activities between April 1999 and September 2000. Recognizing that the emerging technology area needed both consumer education and marketing assistance, the Commission staff developed a program identity and logo for the Renewable Energy Program and a booth for use at trade shows and community events. They also developed a brochure and a series of fact sheets on emerging technologies. With these materials in hand, they participated in four trade fairs: the Pacific Coast Building Conference and Trade Show in San Francisco, the Solfest in Hopland, CA, and a Tehechapi Wind Fair. In addition, the booth was used in the Contra Costa Earth Day celebration with REMB team members.

The Commission also worked with the County of Sacramento and the Sacramento Municipal Utility District (SMUD) to develop a series of videos for the KVIE Green Energy Video Project. Each sponsor contributed $15,000 to the project resulting in a series of three vignettes for each sponsor, that aired from December 1999 through March 2000. Each sponsor received a total of 37 airings of their messages.

To provide consumer education on emerging technologies the Commission staff took a consumer guide for PV systems developed by the National Renewable Energy Laboratory (NREL) and Department of Energy and modified it for California. That guide plus a Clean Power estimator tool were then made available on line at the Commission website and to consumers who call in or write for the materials. The PV Guide has been the most frequent download from the Commission renewables website since it was posted.

Finally, the Commission staff developed an Program Opportunity Notice (PON) for projects to support the emerging renewable technology market . The RFP allocated $375,000 for possible projects. The resulting responses offered over $1.2million in projects. The seven projects identified in Table 2-3above were approved for awards.

2.3.3 Lessons Learned

The major lessons learned concern the value of waiting for the market research to be completed and the need for a review of funding allocation and the consumer education mission in the emerging technologies market.

The Commission staff believes that the decision to wait for the results of the market research was one of the best decisions they made on emerging technologies. While less was accomplished during the 15 months than for the renewable energy market, some of the key assumptions about the target market and market potential for emerging technologies were challenged by the results of the marketing research. Consequently, Commission staff believes that they will be able to select projects with greater confidence and design projects on which contractors can bid to implement that will have a greater likelihood of success.

Another key lesson learned is that the current allocation of 20% of the $5.4 million for RECE efforts is insufficient for the emerging technologies area, a 30% allocation would be more appropriate. Similarly, from both the REMB contract and their own efforts in the emerging technologies market two other issues became apparent:

- The total allocation of $5.4 million will not provide much in the way of consumer education over a four-year period, even with the most ardent efforts to secure in-kind contributions. Fundamentally, while there is some awareness of renewable energy and emerging technologies it cannot be increased substantially without greater investment.
- The need for marketing in addition to consumer education is critical for both renewable energy and for emerging technologies. The directive to focus on consumer education could be interpreted to preclude involvement in marketing, and yet marketing is going to be very important if awareness is to increase and move to a willingness to make a choice or invest in the emerging technology.

Volume VI

3 Program Impacts

Renewable Energy Consumer Education (RECE) through the Renewable Energy Marketing Board (REMB) has taken many forms. The primary forms have included:

- News releases and story placements in newspapers, magazines, periodicals, and web-based publishing.
- Consumer outreach through technology demonstrations, brochures, and other materials distributed through food cooperatives and local forums such as Earth Day and Clean Power Day.
- Mass media through cable television promotional spots, radio talk shows, and TV news interviews.
- Direct mail to targeted audiences in conjunction with other news events (such as a City switching to green power) or promotional activity.
- Web-site based information and links on green power and how to purchase it.
- Workshops and public presentations.
- Direct assistance to local government staff to help them in their efforts to purchase green power.

Implementation of these consumer education strategies has been designed to achieve three primary goals. These include:

- Increasing the awareness of renewable energy and emerging renewable resources as electricity purchase options.
- Increasing the amount of renewable and emerging renewable generated electricity purchases.
- Mobilizing a network of committed organizations that in the future will assume the financial and management responsibility for long-term green energy promotion.

The linkage between the RECE campaign and how well goals have been achieved can be inferred from the data available. These data include consumer and Energy Service Provider (ESP) surveys, data available on the number of switches to green power over time, utilization of the California Customer Credit Fund, and an assessment of the amount of co-funding and in-kind support achieved through the RECE campaign. The RECE campaign itself was limited both geographically and financially. Influences from other information sources such as the federal government and the marketing efforts of the ESPs make direct linkage between the RECE campaign and observed results difficult to measure. Finally, because of the

difficulty to assess the value of the work conducted under the REMB contract, a benchmarking comparison against a similar type of effort in the Pacific Northwest will be conducted.

3.1 Goal #1: Increasing Awareness

The effectiveness of the RECE campaign to increase consumer awareness is assessed by reviewing consumer surveys and energy service provider surveys. This section of the Report will review the results of these surveys as they relate to consumer education and provide an overall assessment as to how well this goal was met. The means used to help achieve this goal include news story placement, cable TV advertising, working with local governments to help them switch to green power, participating in community activities such as clean power day and earth day, public presentations, and working with a food cooperative association to use them to distribute information. In reviewing the program documents, The RECE campaign was able to place a large number of news stories, implemented several cable TV advertising buys, worked successfully with several cities to assist them to switch to green power, were highly visible in many public events, completed a number of public presentations before interested groups and on talk shows, and successfully distributed information through food cooperatives.

3.1.1 Consumer Surveys

Two consumer survey efforts for the Renewable Energy Program Evaluation included specific consideration of consumers within the RECE campaign target areas. These surveys were not specifically designed to measure the impacts of the RECE campaign, but rather included questions that would be useful for evaluating the RECE efforts. The surveys were specifically performed to evaluate emerging technologies program and the customer credit program. A specific customer survey effort directed toward the RECE campaign was initially planned, but cancelled due to time constraints caused by contract delays.

Baseline consumer information is provided by the emerging technologies survey performed in mid-1999 on residential and small commercial awareness of renewable energy and the option to purchase renewable energy under de-regulation. RECE campaign impact information is provided by the customer credit survey performed in mid-2000 for residential and non-residential customers.

The following were the RECE campaign target areas:

- San Diego County
- Marin County
- Santa Barbara
- San Jose
- Santa Monica, and
- The East Bay area (Oakland, Berkeley, and Richmond).

Baseline Survey Information

In support of the Emerging Technologies market research, a general consumer mail survey was implemented in mid-1999 to assess the awareness and attitudes of California households towards emerging renewable technologies and electric industry customer choice. The residential sample was designed to represent the population of owner-occupied housing units in California.[1] The commercial sample was designed to represent the number of business establishments in California.[2]

For the residential sector, a stratified sampling method was implemented, segmenting the homeowner population by geographic region. In addition, over-sampling for the residential sector was performed for the RECE target areas resulting in a final sample target of 1,065.[3] Actual completed surveys statewide equaled 1,810 respondents of which 494 were from the RECE target areas. The response rate was 35% for the RECE target area and 34% statewide.

For the commercial sector, a stratified sampling approach was used to develop this sample. In particular, the sector was divided into 18 Standard Industrial Classification (SIC) codes.[4] The target of 500 completed surveys was proportionally allocated across the 18 groupings based on the number of business establishments, with a minimum target of five for each SIC grouping. This approach resulted in a completed sample target of 511 respondents. In addition, there was some over-sampling for four SIC codes – Agriculture, Colleges, Hospitals, and TCU (transportation, communications, and utilities) – resulting in a final sample of 912.[5] There were 632 respondents representing an overall response rate of 14%. Despite a lower than expected response rate, all SIC codes were well covered by the respondents. In addition, the overall response distribution was similar to the sample design.

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1 July 1997 Population Estimates by county, U.S. Census Bureau.

2 1996 California County Business Patterns, number of establishments by SIC.

3 The designed completed sample size of 1,065 was sufficient to support a relative precision of ± 5% with 90% confidence for proportions of .5 at the overall state level.

4 The groupings were developed from 3-digit SIC codes.

5 The design completed sample size of 912 was sufficient to support a relative precision of ± 6% with 90% confidence for proportions of 0.5 at the overall state level.

Survey Results

Only the portion of the survey results relevant to the goals of the Consumer Education effort are included in this report. Complete survey result information is available in the Emerging Technologies Market Research Report.[6] Results are presented for both the residential and commercial sectors with the results presented for the two sectors side-by-side. Presenting the results side-by-side allows for easy comparison between the two market segments.

Awareness of Restructuring and Customer Choice

As shown in Figure 3-1, residential respondents in the RECE target areas were aware of general changes in electric industry restructuring offering a choice of energy providers. Over 38% were very aware and over 58% were somewhat aware of restructuring. This is slightly higher than awareness levels at the residential statewide level. Business respondents in the RECE target areas, as shown in Figure 3-2, also reported that they were aware of recent changes in California's electricity industry. Nearly 31% indicated that they were *very aware* and almost 64% felt they were *somewhat aware*. About 6% of business respondents were not aware of these recent changes in the electric utility industry. These commercial sector awareness levels are very similar to the statewide results of nearly 34% *very aware*, over 57% *somewhat aware*, and about 7% *not aware*. Responses for both segments are presented in Table 3-1.

[6] *Emerging Technologies Market Research Report*, Regional Economic Research, September 2000.

Figure 3-1: Awareness of Recent Industry Changes – Residential Sector Customer Choice

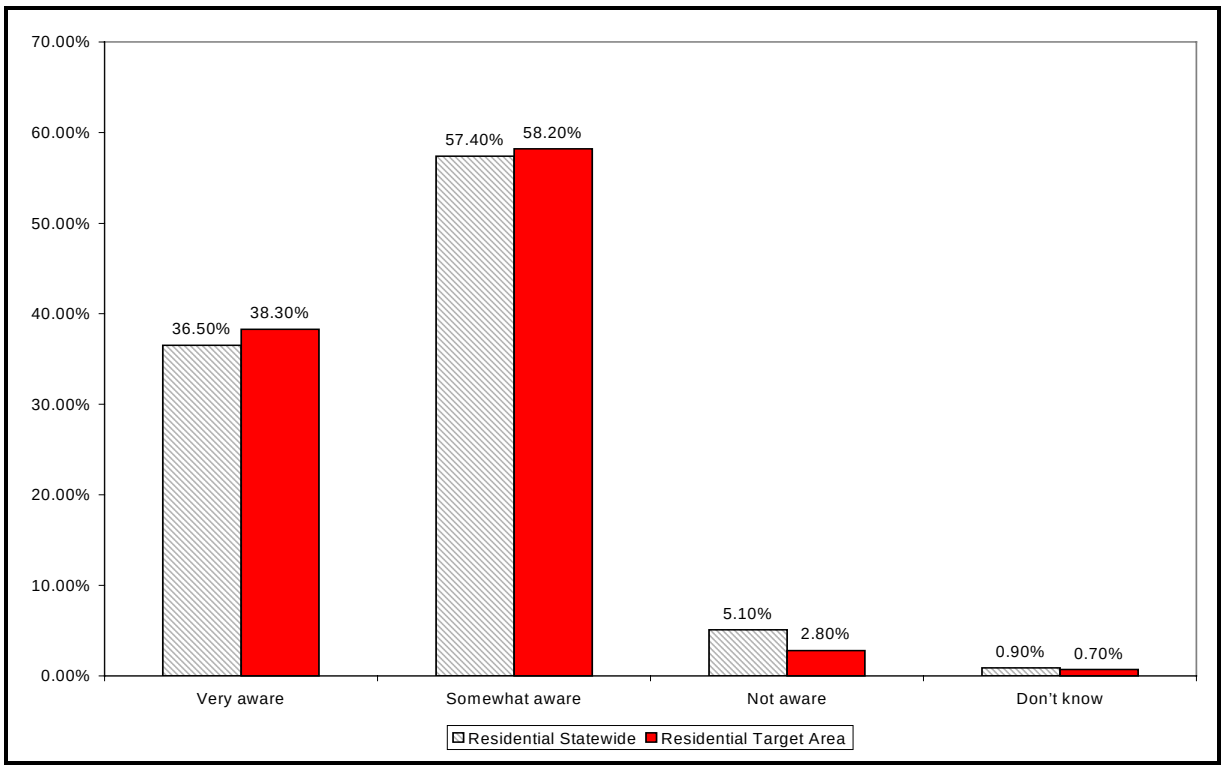

Figure 3-2: Awareness of Recent Industry Changes – Commercial Sector Customer Choice

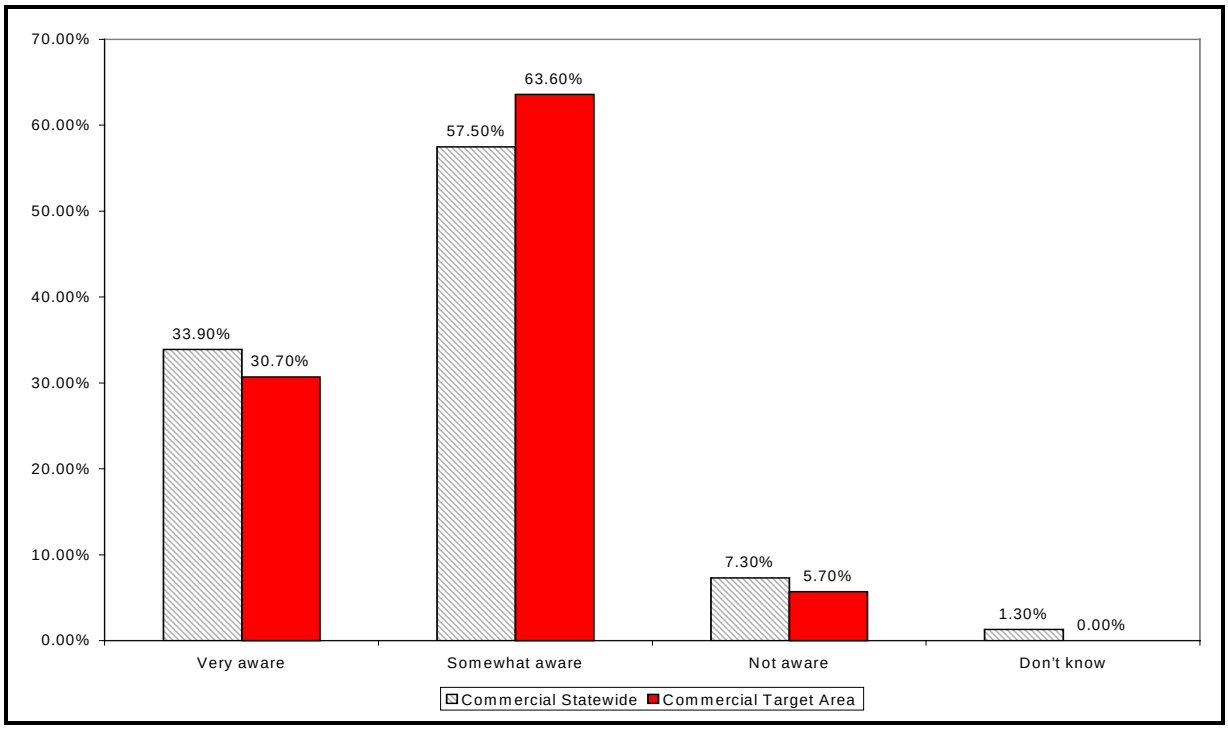

Table 3-1: Awareness of Recent Industry Changes - Customer Choice

The California electric utility industry has been changing over the last few years. How aware are you of recent changes in California's electricity industry allowing customers to buy electricity from a variety of suppliers?				
Response categories	***Residential Statewide***	***Residential Target Area***	***Commercial Statewide***	***Commercial Target Area***
Very aware	36.5%	38.3%	33.9%	30.7%
Somewhat aware	57.4%	58.2%	57.5%	63.6%
Not aware	5.1%	2.8%	7.3%	5.7%
Don't know	0.9%	0.7%	1.3%	0.0%
Base n	1806	572	631	88

Awareness of Choice - Green Energy Supply

Baseline awareness of renewable energy sources was high in both the residential and commercial sectors. As illustrated in Figure 3-3 and shown in Table 3-2, nearly 80% of residential respondents and 75% of commercial business respondents knew they could choose renewable energy sources supplied by their energy provider (to supply some or all of their energy needs). These reported awareness levels are about 8% higher than the statewide responses with the residential respondents and 14% greater in the commercial segment.

Figure 3-3: Awareness of Choice - Green Energy Supply

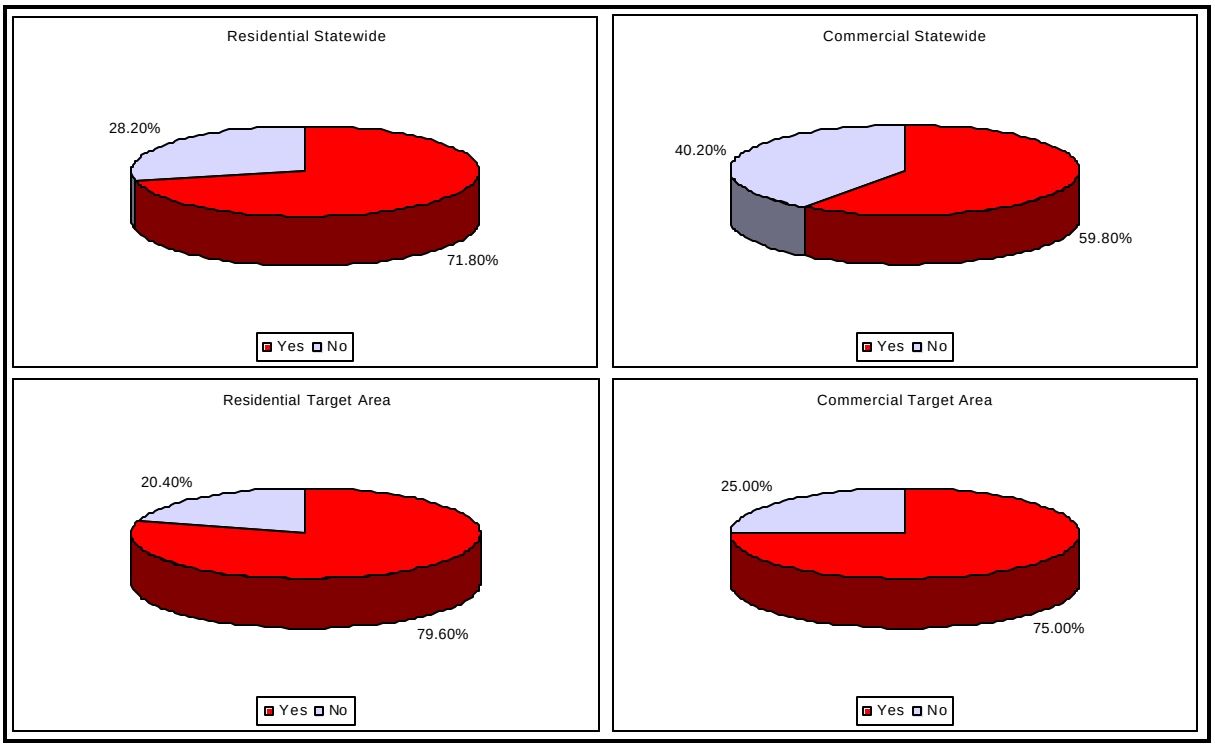

Table 3-2: Awareness of Choice - Green Energy Supply

*Are you aware that you can now choose **renewable** energy sources, such as more environmentally friendly "green power" (energy produced from biomass, solar, wind, geothermal or hydropower), supplied by your Energy Provider to supply some or all of your electricity needs?*				
Response categories	***Residential Statewide***	***Residential Target Area***	***Commercial Statewide***	***Commercial Target Area***
Yes	71.8%	79.6%	59.8%	75.0%
No	28.2%	20.4%	40.2%	25.0%
Base n	1805	570	629	88

Awareness of Commission's Emerging Buydown Program

Respondents were queried on the general awareness of the Commission's Emerging Renewable Buydown Program. About 9% of RECE target area respondents in both market segments were reportedly aware of the *Emerging Renewables Buydown Program*, as shown in Figure 3-4 and Table 3-3 These results are very consistent with both the commercial and residential statewide sample populations (9.4% and 9.5%, respectively). Over 90% of the target markets were unaware of the Buydown Program before the implementation of the RECE campaign.

Figure 3-4: Awareness of Commission's Emerging Buydown Program

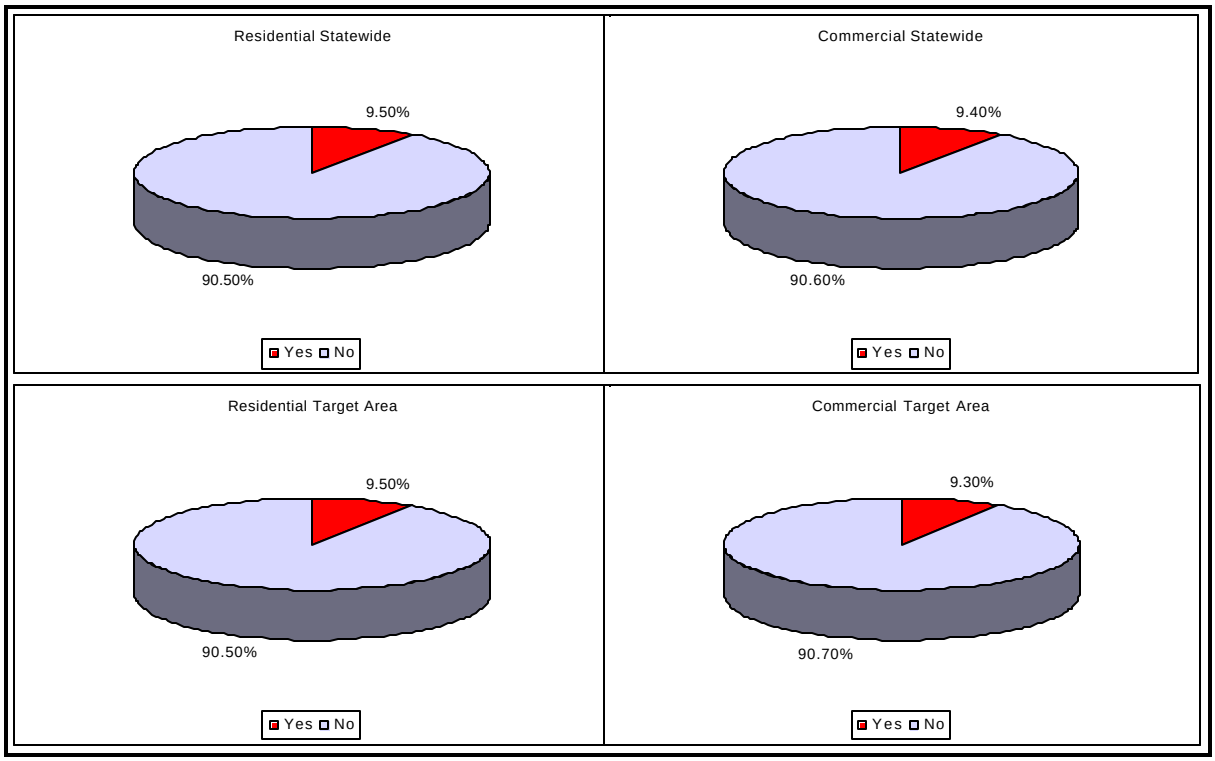

Table 3-3: Awareness of Commission's Emerging Buydown Program

Are you aware of the State of California's financial incentive program, called the Emerging Renewables Buy-down Program, for electric generation technologies, including solar cells (photovoltaics), wind electric energy conversion systems, fuel cells, and solar-thermal electric generation systems?				
Response categories	***Residential Statewide***	***Residential Target Area***	***Commercial Statewide***	***Commercial Target Area***
Yes	9.5%	9.5%	9.4%	9.3%
No	90.5%	90.5%	90.6%	90.7%
Base n	1,795	567	620	86

Summary of Consumer Baseline Survey

In general, the baseline consumer awareness levels in electricity restructuring and the awareness of now being able to purchase green power through their electric service provider was high. This awareness was higher in the RECE campaign target areas than in the state as a whole. Awareness of the Commission's Emerging Buydown Program was low, at about 9% for both the residential and commercial sectors. However, awareness of this Commission program is not critical in that most consumers would be purchasing green power through an ESP who would be utilizing the Buydown Program to reduce the cost of green power.

RECE Target Area Customer Credit Survey

A specific post-campaign impact survey was not performed for the RECE campaign due to time constraints. However, in support of the Customer Credit Program, a mail survey was sent to electric consumers in the California Investor Owned Utility (IOU) territories. These territories include the RECE target areas. The survey included both residential and non-residential customers and asked respondents questions regarding their opinions on green power and, if aware of it, on the Customer Credit Program. Although not specifically designed to evaluate the Consumer Education Program, it contains questions useful in evaluating the results of RECE campaign. The survey includes a subset of participants residing or doing business in the RECE target areas, and it was fielded in May of 2000 which was very near the end of the RECE 15 month Phase I timeframe.

For the residential sector, the sample was designed to reflect the population of residential customers in the three IOU utilities (all-residential customer sample). Data for this sample design were gathered from California Energy Commission (Commission) records, and commercial mailing lists. Approximately 2,750 surveys were sent to the residential customer sample. Of those sent, 470 were completed and returned indicating a response rate of just over 17%. Of these 470 statewide responses, 38 were within the RECE target area.

For the commercial sector, a stratified sampling scheme was developed of commercial, industrial, and agricultural customers in the three IOU utility areas. The commercial sector was then stratified by building type, and the industrial sector was broken out by construction, mining and manufacturing. The sample frame was developed from data on annual kWh usage for each sector by utility and square footage by building sector and by utility from the Commission.[7] About 2,750 surveys were sent to this sample. Of those sent, 306 were completed and returned indicating a response rate of just over 11%. Of these 306 statewide responses, 65 were within the RECE target area.

Only the portion of the survey results that are relevant to the goals of the Consumer Education effort are included in this report. Complete survey information is available in the Customer Credit Preliminary Evaluation Report.[8]

Residential Sector Survey Results

Results are presented for both statewide and the RECE campaign target area with the results presented side-by-side. Presenting the results side-by-side allows for easy comparison between the statewide and target area results.

Awareness of Restructuring and Customer Choice

Two questions were directed toward measuring respondent awareness of restructuring and customer choice. Table 3-4 lists the two questions and the responses for both statewide and the RECE campaign area. Figure 3-5 and Figure 3-6 illustrate these responses for each question; respectively.

The responses to the two questions indicate a greater understanding of electricity purchase options and a greater awareness that the consumer can choose to purchase green power through their electricity provider from those who reside within the RECE campaign target areas than the state as a whole. As illustrated in Figure 3-5, those who state that they are either 1) unaware they could choose an electricity provider or 2) not at all informed of the electricity purchase options is nearly 6% higher in the statewide results compared to the target area results. Awareness that a consumer can purchase green power is about 50% - 50% in both the state and target areas, as illustrated in Figure 3-6. However, awareness of this option is about 7% higher in the RECE campaign target areas over the statewide results.

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7 California Energy Commission, Staff Report, California Energy Demand: 1995-2015, Volumes III, V, and VII, July 1995.

8 *Renewable Technology Program Preliminary Evaluation: Customer Credit*, Regional Economic Research, October 2000.

Table 3-4: Awareness of Restructuring and Customer Choice (Residential)

To what extent are you informed about your options for choosing an electricity energy provider?		
Response categories	***Target area***	***Statewide***
Extremely informed of my options	2.7%	5.0%
Somewhat informed of my options	35.1%	32.6%
Somewhat uninformed of my options	29.7%	24.3%
Not at all informed of my options	18.9%	21.2%
Unaware I could choose my electricity provider	13.5%	16.8%
Base n	37	457
*Are you aware that you can choose to buy power that has been generated from **renewable** sources, often called "green power" (energy produced from renewable energy sources such as wood/landfill/sewage waste [biomass], solar PV cells, wind, geothermal, or small hydropower), from your electricity service provider for some or all of your electricity needs?*		
Response categories	***Target area***	***Statewide***
Yes	52.6%	45.6%
No	47.4%	54.4%
Base n	38	467

Figure 3-5: Extent Individual Feels Informed of Option (Residential)

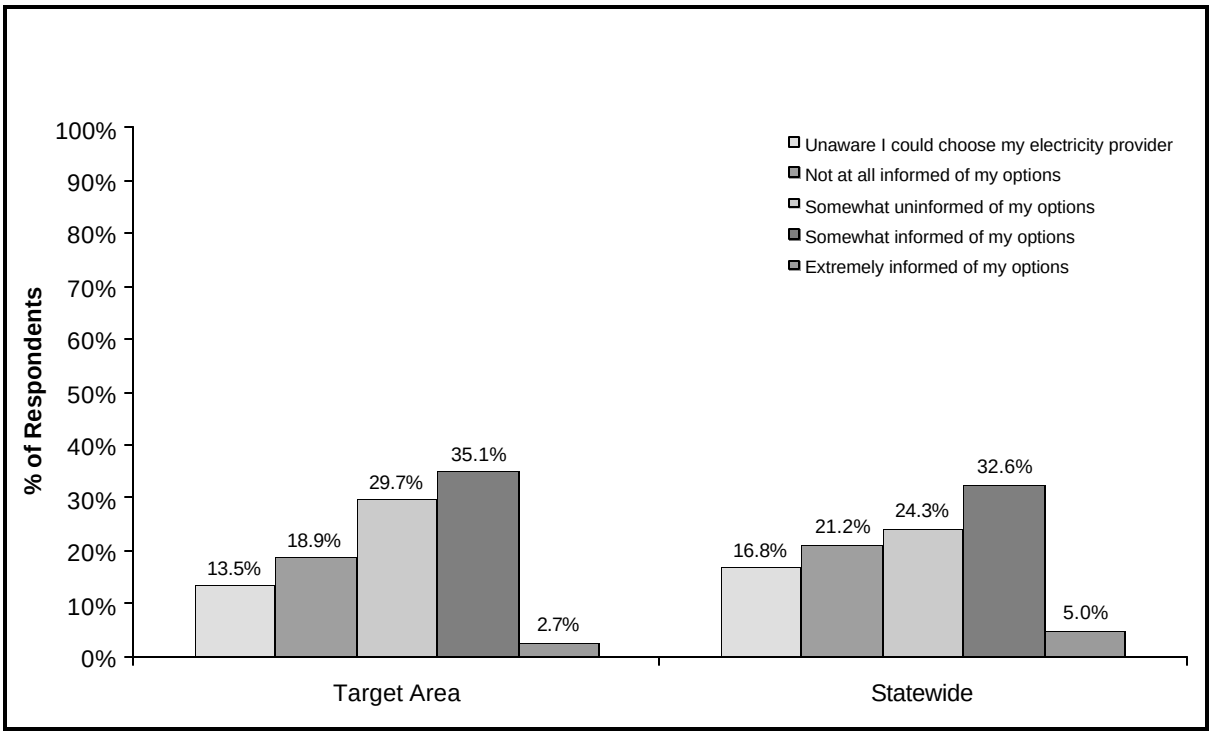
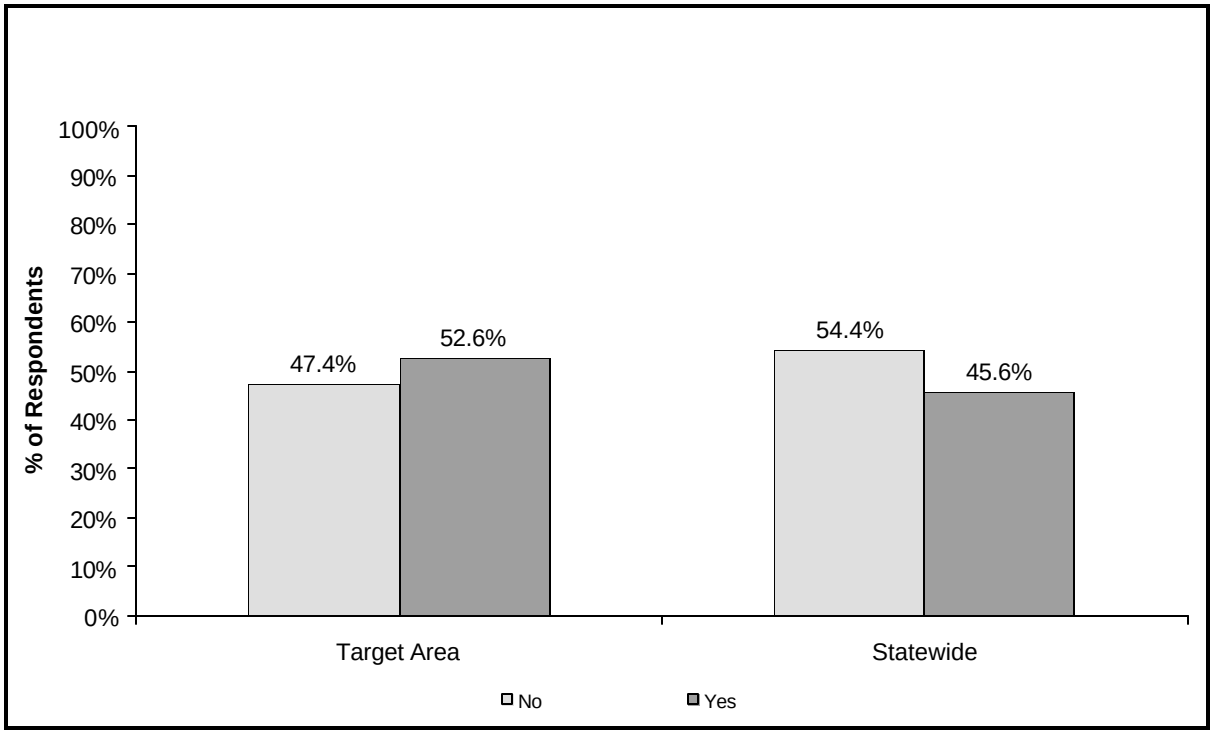


Figure 3-6: Are you aware that you can purchase green power (Residential)?



Electricity Purchase Choices

Two questions were directed toward identifying how the respondents are currently purchasing their electricity. The responses to these questions are provided in Table 3-5. The first question asked if they were currently purchasing electricity from their local utility or from another electric energy provider. Figure 3-7 presents the results of this question. For this question, a greater percentage of target area respondents indicated that they still purchase their electricity from their local utility. However, as illustrated in Figure 3-8, just over 10% more of the target area respondents are purchasing green power for some or all of their electricity purchases than the statewide respondents.

Familiarity With Customer Credit Program

The Commission's Customer Credit Program provides funds to electric energy providers to help reduce the cost of green power to consumers. As shown in Table 3-5, over 92% of both the target area and statewide respondents have never heard of this program. However, awareness of this Commission program is not critical in that most consumers would be purchasing green power through an ESP who would be utilizing the Customer Credit to reduce the cost of green power.

Table 3-5: Electricity Purchase Choices (Residential)

Are you currently purchasing electricity from your local utility or from another electric energy provider?		
Response categories	***Target area***	***Statewide***
Local Utility	90.9%	82.3%
Electric Energy Provider	9.1%	17.5%
Don't Know	0.0%	0.2%
Base n	33	429
Are you currently purchasing renewable energy or gren power as either part or all of your purchased electricity?		
Response categories	***Target area***	***Statewide***
Yes, all	4.3%	4.7%
Yes, part	17.4%	6.5%
No	78.3%	88.8%
Base n	23	276

Figure 3-7: From who are you currently purchasing electricity (Residential)?

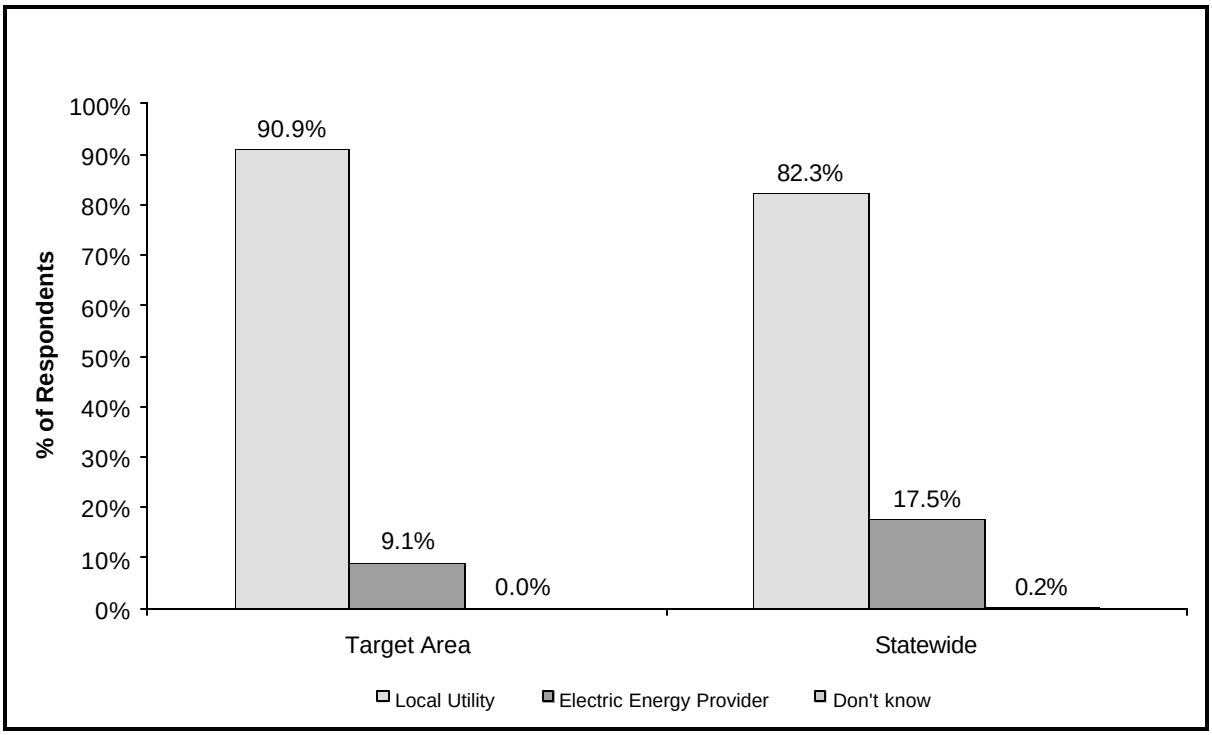


Figure 3-8: Are you currently purchasing green power? (Residential)

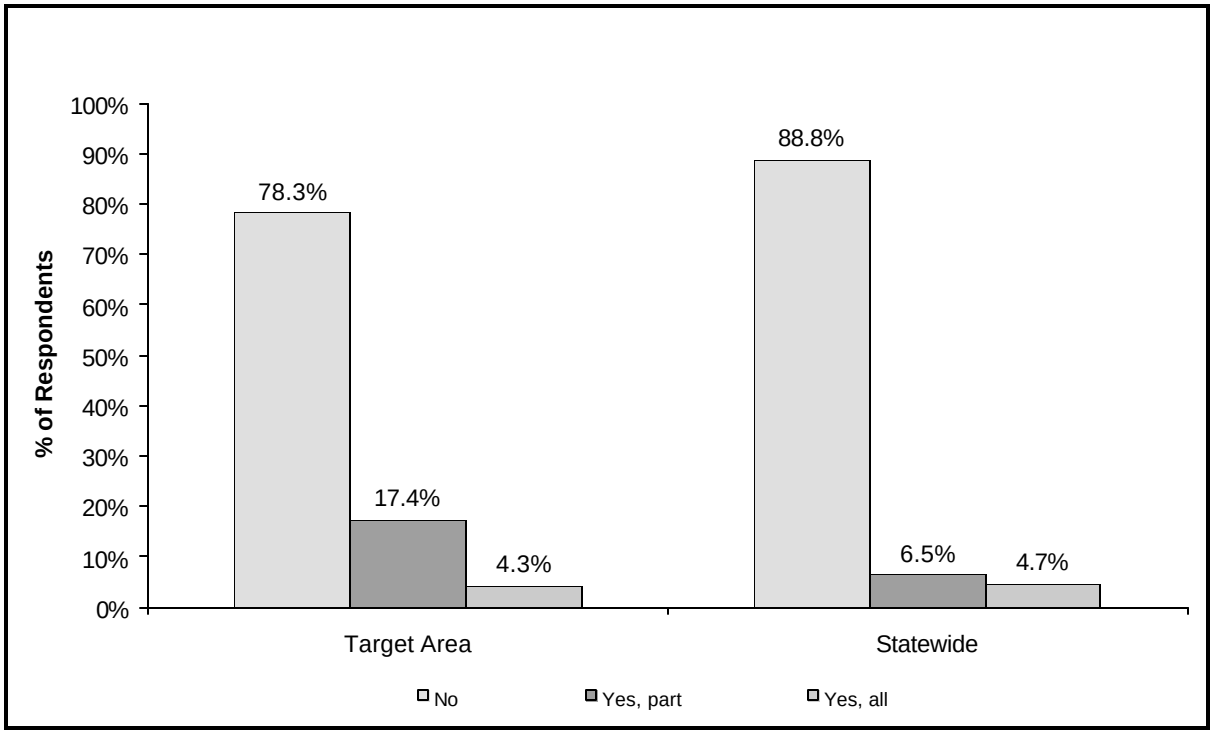


Table 3-6: Familiarity with Customer Credit Program (Residential)

The California Energy Commission has a program called the ***Customer Credit Program*** *that provides funds to electric providers who sell electricity from qualified renewable sources. Consumers who purchase from these providers automatically receive "credit" on their electric bill to offset the cost of acquiring renewable energy. Have you heard of this program?*

Response categories	***Target area***	***Statewide***
Yes	7.9%	7.4%
No	92.1%	92.6%
Base n	38	460

Green Marketing

Three questions related to green marketing were asked in the Customer Credit survey. Table 3-7 lists the three questions and the responses for both statewide and the RECE campaign area. Figure 3-9 illustrates the response to the question "Have you received any information from companies selling green power?" Illustrations for the remaining two questions were not developed since there was little difference between statewide and RECE campaign target area responses.

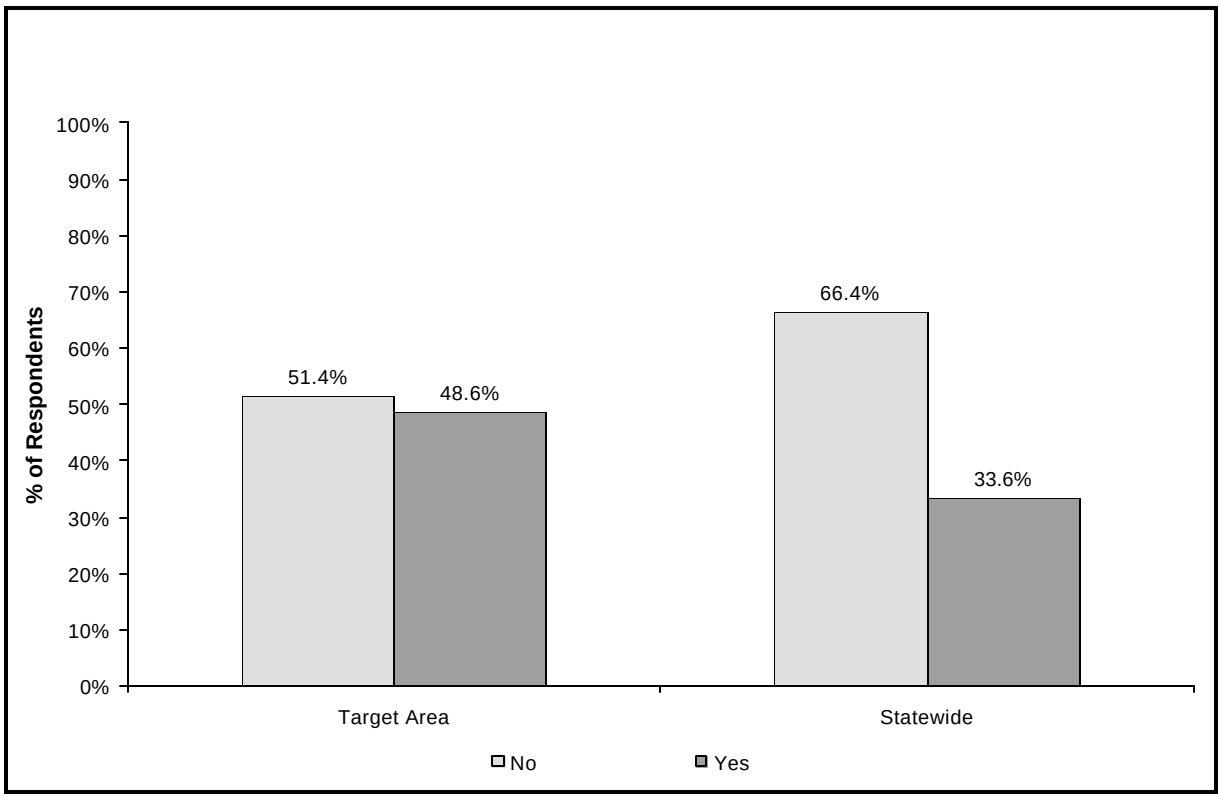
As illustrated in Figure 3-9, nearly one-half of the target area respondents indicated that they have received information from companies selling green power. The number of people contacted is 15% greater than that experienced by the statewide respondents. The other two

questions related to familiarity with the "Green-e" logo and whether the respondents had ever heard of the term "Green-e" certified. Both statewide and target area responses were nearly identical with about 95% of all respondents not being familiar with the logo or term.

Table 3-7: Awareness of Restructuring and Customer Choice (Residential)

In the past two years, have you received any information in the mail or by telephone from companies selling green power?		
Response categories	***Target area***	***Statewide***
Yes	48.6%	33.6%
No	51.4%	66.4%
Base n	37	461
Have you seen this logo before (referring to the "Green-e" logo)?		
Response categories	***Target area***	***Statewide***
Yes	2.9%	3.6%
No	97.1%	96.4%
Base n	35	449
Have you heard of the term "Green-e" certified?		
Response categories	***Target area***	***Statewide***
Yes	5.4%	4.3%
No	94.6%	95.7%
Base n	37	460

Figure 3-9: Have you received any information from companies selling green power? (Residential)



Commercial Sector Survey Results

As with the residential sector, results are presented for both statewide and the RECE campaign target area with the results presented side-by-side. Presenting the results side-by-side allows for easy comparison between the statewide and target area results.

Awareness of Restructuring and Customer Choice Two questions were directed toward measuring respondent awareness of restructuring and customer choice. Table 3-8 lists the two questions and the responses for both statewide and the RECE campaign area. Figure 3-10 and Figure 3-11 illustrate these responses for each question; respectively.

The responses to the two questions indicate in the commercial sector a greater understanding of electricity purchase options and a greater awareness that the consumer can choose to purchase green power through their electricity provider compared to the residential sector. As with the residential sector, those who do business within the RECE campaign target areas show a greater understanding of electricity purchase options and a greater awareness that the consumer can choose to purchase green power. As illustrated in Figure 3-10, those who state that they are either extremely informed or somewhat informed about their power purchase options is about 11% higher in the RECE target areas. Awareness that a consumer can

purchase green power, as illustrated in Figure 3-11, is about 4% higher in the RECE campaign target areas over the statewide results.

Table 3-8: Awareness of Restructuring and Customer Choice (Commercial)

To what extent are you informed about your options for choosing an electricity energy provider?		
Response categories	***Target area***	***Statewide***
Extremely informed of my options	4.1%	7.0%
Somewhat informed of my options	42.9%	29.0%
Somewhat uninformed of my options	28.6%	30.7%
Not at all informed of my options	20.4%	25.3%
Unaware I could choose my electricity provider	4.1%	8.0%
Base n	48	294
*Are you aware that you can choose to buy power that has been generated from **renewable** sources, often called "green power" (energy produced from renewable energy sources such as wood/landfill/sewage waste [biomass], solar PV cells, wind, geothermal, or small hydropower), from your electricity service provider for some or all of your electricity needs?*		
Response categories	***Target area***	***Statewide***
Yes	55.6%	51.9%
No	44.0%	48.1%
Base n	45	187

Figure 3-10: Extent Individual Feels Informed of Option ? (Commercial)

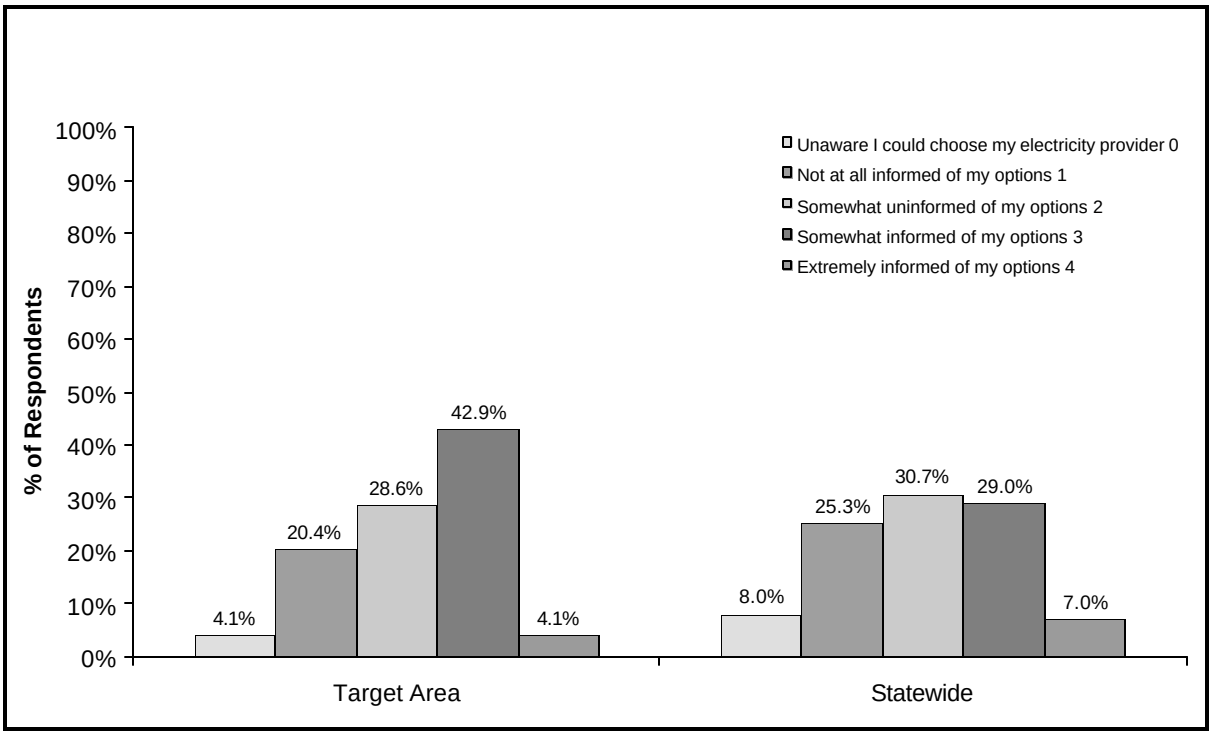
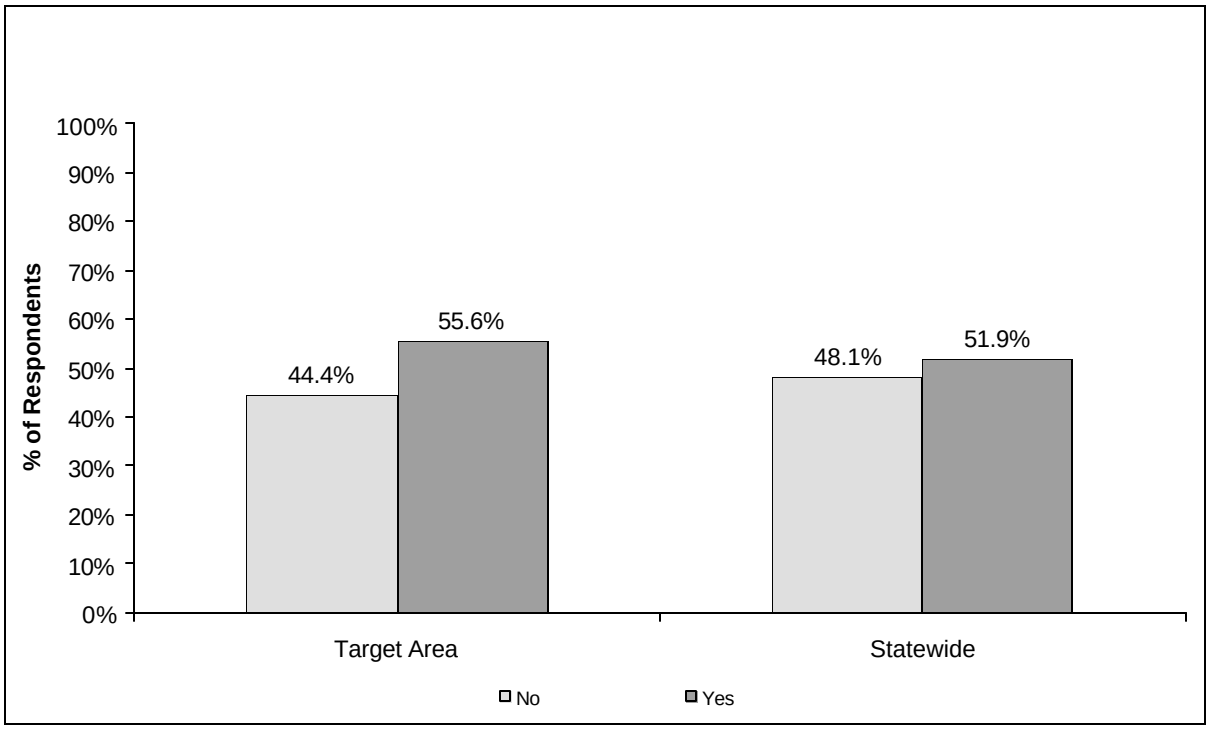


Figure 3-11: Are you aware that you can purchase green power? (Commercial)



Electricity Purchase Choices. Two questions were directed toward identifying how the respondents are currently purchasing their electricity. The responses to these questions are provided in Table 3-9. The first asked if they were currently purchasing electricity from their local utility or from another electric energy provider. Figure 3-12 presents the results of this question. For this question, a greater percentage of target area respondents indicated that they still purchase their electricity from their local utility. This result is the same as for the residential sector. However, the number of respondents purchasing their electricity from their local utility is much higher in both the target area and statewide results when compared to the residential sector.

As illustrated in Figure 3-13, 4% more of the statewide respondents are purchasing green power for some or all of their electricity purchases than the target area respondents. This result is opposite of what was observed in the residential sector where 10% more of the target area respondents purchase green power over statewide respondents.

Familiarity With Customer Credit Program. The Commission's Customer Credit Program provides funds to electric energy providers to help reduce the cost of green power to consumers. As shown in Table 3-10, familiarity with this program is low in both the target areas and in the statewide results with program unfamiliarity being over 92% for each. Familiarity in the commercial sector is at about the same level as in the residential sector. However, as with the residential sector, awareness of this Commission program is not critical in that most consumers would be purchasing green power through an ESP who would be utilizing the Customer Credit to reduce the cost of green power.

Table 3-9: Electricity Purchase Choices (Commercial)

Is your company currently purchasing electricity from your local utility or from another electric energy provider?		
Response categories	***Target area***	***Statewide***
Local Utility	100.0%	89.8%
Electric Energy Provider	0.0%	9.1%
Don't Know	0.0%	1.1%
Base n	49	222
Is your company currently purchasing renewable energy or green power as either part or all of your purchased electricity?		
Response categories	***Target area***	***Statewide***
Yes	6.3%	10.3%
No	93.8%	89.7%
Base n	32	165

Figure 3-12: Who are you currently purchasing electricity from? (Commercial)

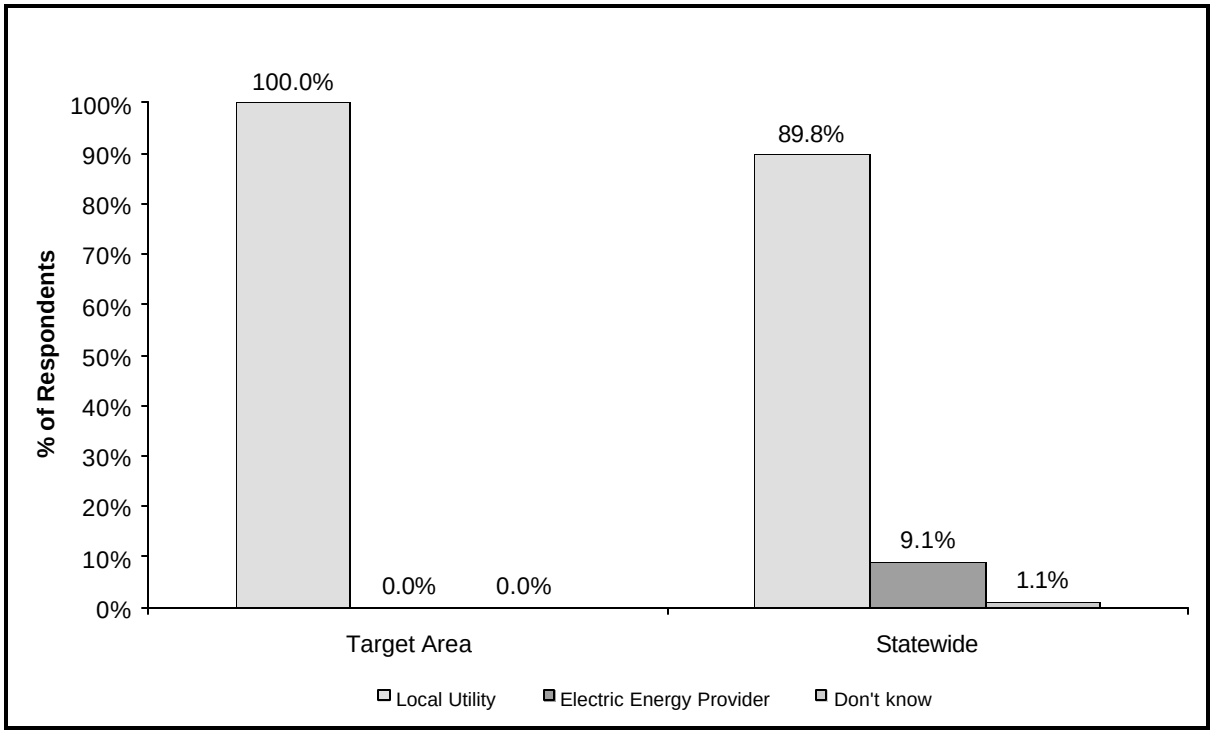


Figure 3-13: Are you currently purchasing green power? (Commercial)

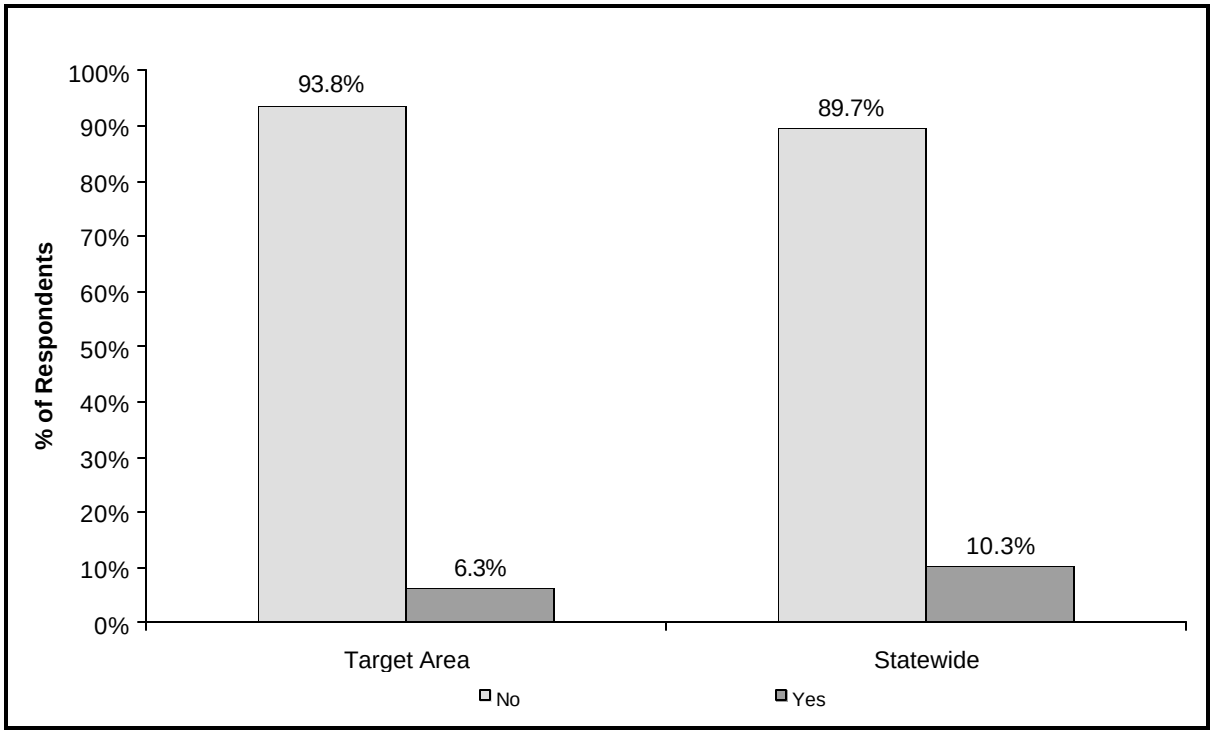


Table 3-10: Familiarity with Customer Credit Program (Commercial)

*The California Energy Commission has a program called the **Customer Credit Program** that provides funds to electric providers who sell electricity from qualified renewable sources. Consumers who purchase from these providers automatically receive "credit" on their electric bill to offset the cost of acquiring renewable energy. Have you heard of this program?*

Response categories	***Target area***	***Statewide***
Yes	6.0%	7.9%
No	94.0%	92.1%
Base n	50	302

Green Marketing Three questions related to green marketing were asked in the Customer Credit survey. Table 3-11 lists the three questions and the responses for both statewide and the RECE campaign area. Figure 3-14 illustrates the response to the question "Have you received any information from companies selling green power?" Illustrations for the remaining two questions were not developed since there was little difference between statewide and RECE campaign target area responses.

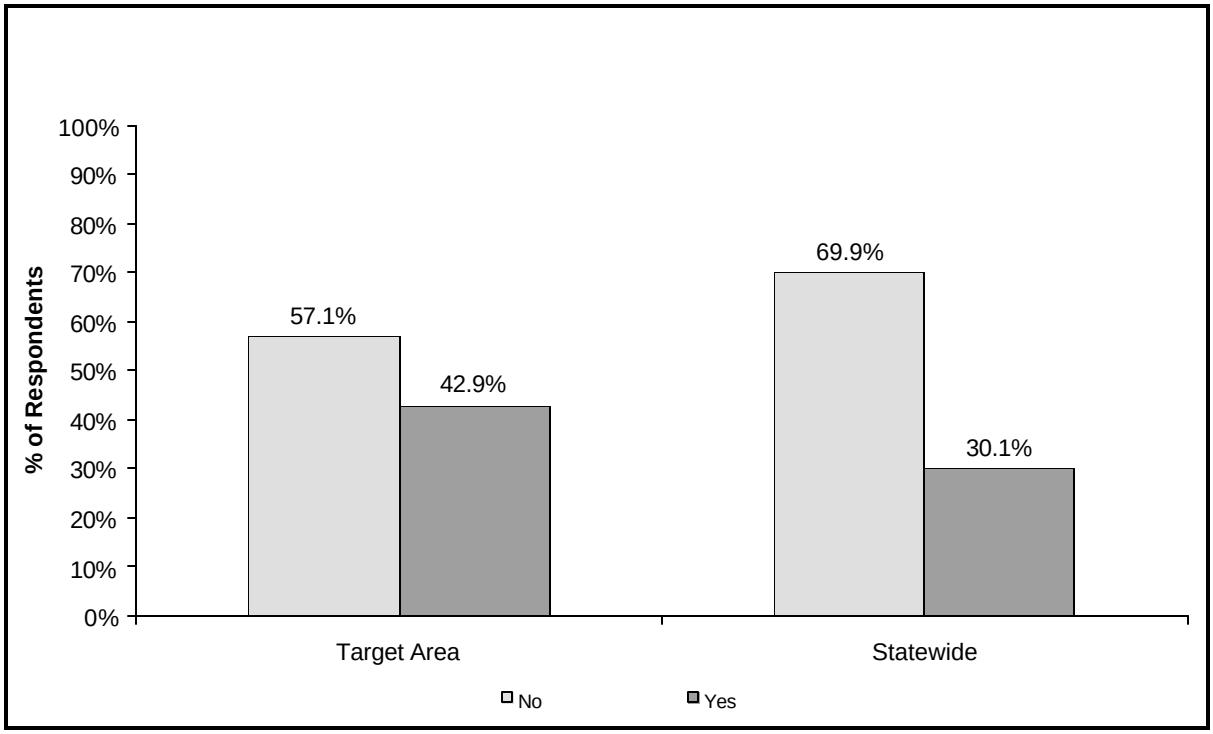
As illustrated in Figure 3-14, about 43% of the target area respondents indicated that they have received information from companies selling green power. Statewide, only 30% of the commercial sector respondents indicated that they had received information. Both of these commercial sector results are slightly lower than found in the residential sector.

The remaining two questions related to familiarity with the "Green-e" logo and whether the respondents had ever heard of the term "Green-e" certified. Both statewide and target area responses were nearly identical with about 92 to 95% of all respondents not being familiar with the logo or the term. These results indicate slightly more awareness of "Green-e" in the commercial sector.

Table 3-11: Awareness of Restructuring and Customer Choice (Commercial)

In the past two years, have you received any information in the mail or by telephone from companies selling green power?		
Response categories	***Target area***	***Statewide***
Yes	42.9%	30.1%
No	57.1%	69.9%
Base n	49	299
Have you seen this logo before (referring to the "Green-e" logo)?		
Response categories	***Target area***	***Statewide***
Yes	8.0%	4.4%
No	92.0%	95.6%
Base n	50	296
Have you heard of the term "Green-e" certified?		
Response categories	***Target area***	***Statewide***
Yes	8.0%	6.0%
No	92.0%	94.0%
Base n	50	301

Figure 3-14: Have you received any information from companies selling green power? (Commercial)



Summary of the Customer Credit Survey in Relation to Consumer Education. A review of the results from the consumer credit survey in relation to consumer education reveal three clear indications. First, the level of awareness of the ability to purchase power from alternate electricity providers and awareness of green power in general is much higher in the commercial sector over the residential sector. Second, awareness of these two issues is much higher in the RECE campaign target areas than in the state as a whole. Third, despite higher awareness levels in both the residential and commercial sectors in the RECE campaign target areas, overall awareness is still relatively low.

3.1.2 Energy Service Provider Survey

A series of in-depth interviews were conducted with Energy Service Providers (ESPs) in order to glean their attitudes and behaviors relative to the retail green power market in California and to the Customer Credit Program. This survey was primarily performed to support the evaluation of the Customer Credit Program but also included questions relating to consumer education.

From program materials supplied by the Commission, 13 ESPs were identified that had reported customers in the Customer Credit Program through December 1999. The sampling procedure called for contacting as many participants as possible. In addition, as many nonparticipants were to be contacted as possible up to a target of 30 completed interviews. Nonparticipant ESPs were to include firms outside of California as well as firms that offer green power products and firms that did not offer green power products. Eighteen participant and four non-participant interviews were completed for this program assessment. Several of the participants had just joined the program when interviewed and had not started reporting activity as of that time. Two of the participants interviewed had registered products with the Commission but did not have any sales as of the time of the interview.

All of the ESPs interviewed sold power in the California market. Three of them sold only in particular geographic areas in California, while the others sold throughout the three major IOU territories. Nine of the interviewed ESPs sold in other states besides California. Eight ESPs sold only green power products and four ESPs sold only conventional products; the remainder sold both types.

When specifically asked if they were aware of the consumer education efforts being implemented by the REMB and how effective they thought the efforts were, six of the ESPs interviewed (one-third of the participants) had heard of the REMB, but none knew enough to have an opinion about their effect. One respondent commented that the only time she saw anything about them was when it came through their office; she had not seen anything as a consumer or heard of anyone seeing anything outside of her office. Another respondent explained that what she had seen was not very visible so it was probably not having much of

an effect. On the other hand, one respondent commented that these efforts were "contributing in a good way to developing the market."

This response from the ESPs parallels some of the responses from the interviews of RECE campaign project team members. They stated in their interviews that in general, the RECE and ESP efforts were not well coordinated across the spectrum of ESPs. What coordination did occur was limited to only a few of the ESPs.

3.1.3 Goal #1 Assessment

Results from the customer credit survey strongly suggests that awareness of renewable energy and emerging renewable resources as electricity purchase options is higher in the RECE campaign areas than for the state as a whole. This is true for both the residential and commercial sectors. The customer credit survey also indicates that the incidence of purchase of green power is greater for both sectors in the RECE campaign areas. However, it does not appear conclusive that the RECE campaign is the reason for these higher levels of awareness and green energy sales.

Reviewing the baseline survey results from the Renewable Energy Program market research indicates that there was already a higher level of awareness in these target areas before the RECE campaign was initiated. A question that goes to the heart of the awareness issue appeared in similar language in both the Emerging Renewable Technology and the Customer Credit consumer surveys. As asked in the Customer Credit survey, it stated "Are you aware that you can choose to buy power that has been generated from **renewable** sources, often called "green power" (energy produced from renewable energy sources such as wood/landfill/sewage waste [biomass], solar PV cells, wind, geothermal, or small hydropower), from your electricity service provider for some or all of your electricity needs?" The difference between the statewide and RECE campaign area results for this question in the baseline Emerging Renewable Technology was an 8% higher residential and 15% higher commercial answer of "Yes" in the RECE target areas. For the post-program Customer Credit survey, the incidence of the "Yes" response was a similar 7% higher for the residential sector but only 4% higher for the commercial sector. In fact, the difference was smaller in the post program survey, especially for the commercial sector, than it was for the pre-program survey.

The ESP survey did not support the position that the RECE campaign made a difference in the target areas. Only one third of the ESPs had heard of the REMB, and none knew enough to have an opinion about their effect.

A conclusive answer on whether this goal was achieved cannot be provided since specific survey research was not conducted for this program element. The related research that

included information on awareness levels in both the state and the RECE campaign target areas indicate that to date little impact occurred as a direct result of the program.

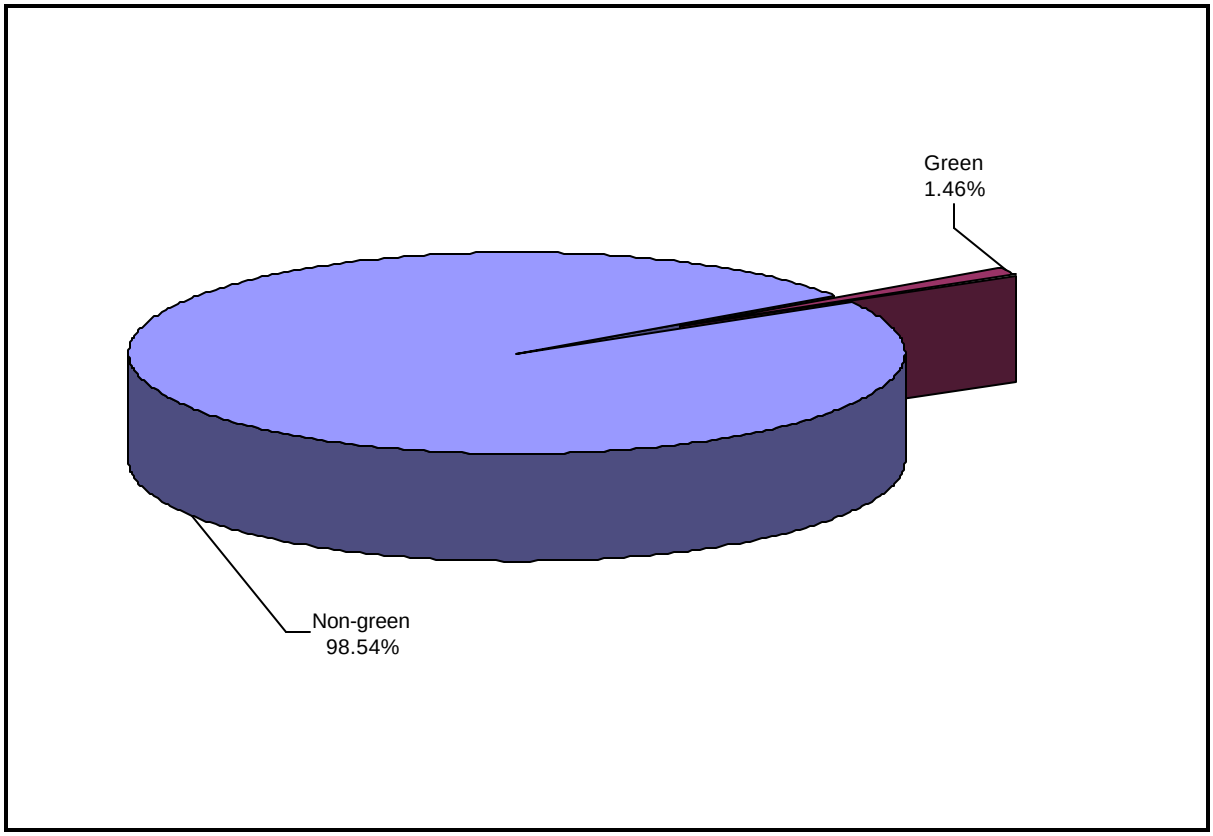
The higher levels of awareness in the RECE target areas both before and after the RECE campaign may be a function of the demographics of these geographic areas that pre-dispose them to higher levels of energy awareness. However, it often takes time before public campaigns can be translated into measurable results. The RECE campaign was able to develop a significant amount of public information and interaction within a very limited timeframe and budget and the full impacts may still be felt in the future.

3.2 Goal #2: Increasing Green Energy Sales

As with the first goal, little data is available to measure the direct effectiveness of the RECE campaign to the amount of green energy purchased by consumers. According to REMB staff, ESPs would not provide geographically disaggregated information on sales or switches to green power, as they deemed this proprietary information. Without this information, one can only speculate on the effectiveness of the program to meet its second goal.

To date, about 2% of California residential and commercial customers have switched away from their local utilities to a new electric energy provider. Of these switches, most have been to green power. Based on the Customer credit survey when weighting survey results up to the population, the proportion of individuals purchasing green power is about 1.46%. Figure 3-15 illustrates this relationship.

Figure 3-15: Proportion of Population Purchasing Green Power (April 2000)



Although the number of switches represents less than 2% of potential customers, the growth rate of "green switches" from December 1998 through April 2000 has been significant. In January 1999, when the REMB was formed, there had been about 50,000 switches. By April of 2000, the number of switches had increased to about 225,000.[9] Pressure on the Customer Credit Program has also grown over this time. Beginning in April 1998, the credit was initially set at $15.00 per MWh and remained at that level through November 1999 in order to provide a stable market signal during the introduction of the program. Demand for the program was low at first, and funds were sufficient to pay credits at this level for the initial 20-month period. Rapid growth in demand during 1999 resulted in a decision to reduce the credit level to $12.50 per MWh for December 1999 and the first six months of 2000.[10] In July of 2000, the credit was lowered again to $10.00 per MWh.

Growth in green power sales has been encouraging, but again, without specific data for the RECE campaign target areas, it is not possible to specifically measure the effectiveness of

[9] Data from the California Public Utilities Commission.

[10] Lowering the credit level in December 1999, rather than in January 2000, allowed the $1,000 cap on credits to large customers to remain in place. Without the cap in place, the credit level would have had to be lowered more significantly in 2000 to avoid running out of funds.

the program to meet its second goal. An indirect indicator would be the response to the post-program Customer Credit survey, which asked if the respondents were currently purchasing green power. Adding together the "Yes, all" and the "Yes, partially" responses for the residential sector found just over a 10% higher incidence in the RECE target areas over the statewide results. This difference is slightly larger than most of the other residential "awareness" differences found between statewide and target area results. However, in the commercial sector, the incidence of green power purchase was just under 4% higher in the RECE target areas, which is less than most of the other commercial "awareness" differences found between statewide and target area results. Again, these results are also inconclusive regarding the level of achievement for Goal 2.

3.3 Goal #3: Mobilizing a Network of Committed Organizations

Part of the contract between the REMB and the Commission was a requirement to acquire matching funds, either in the form of cash or in-kind services. One of the purposes of this matching fund requirement was to help achieve this third goal of mobilizing a network of committed organizations that in the future would assume the financial and management responsibility for long-term green energy promotion. For Phase I, the requirement was a two for one match. Assessment of how well this match was achieved serves as a good measure at how successful Phase I was toward meeting this goal. Other measures include how successful the RECE campaign was in creating partnerships with organizations outside of the REMB project team.

As reported in the REMB final report and confirmed with the interviews of the REMB team members, the RECE campaign appears to have been successful in meeting its initial Phase I goal of leveraging other resources on at least a 2:1 basis. The reported leveraging amount was 2.25:1. These matching funds could be in the form of cash or in-kind services. The interviews with the REMB project team indicated that most of the match was in the form of in-kind services. When project team members were questioned about the legitimacy of the in-kind service claims, they agreed that accounting and estimating the value was difficult. However, they believe that the leverage estimate of $2.7 million was likely much less than actually occurred due to the difficulty of estimating value and accounting for the in-kind claims.

Working with other organizations outside of the REMB project team proved to be difficult. Some organizations appeared to have a mistrust of the green power concept and were reluctant to offer their assistance or place RECE campaign news stories in their publications. Over the past two years, green power had received some negative publicity from certain environmental groups that the RECE campaign found difficult to overcome.

Overall, progress toward meeting the third goal appears to be have moved forward somewhat. It is clearly not at the point of self-sufficiency with some people being laid off and some efforts discontinued since the REMB funding ended. However, not all activity ceased and it does appear on the track of meeting that goal in the future. Working with other environmental organizations will be critical toward finally achieving that goal as well as establishing cooperative arrangements with ESPs, which met with limited success during Phase I of the RECE program.

3.4 Benchmarking

It is very difficult to assess the value of the work conducted under the REMB contract. Documentation of some of the key activities were not available: website tracking data, call center use, direct mail response, green switches by zip code, post-Phase 1 survey data on consumer awareness of green power and emerging technologies as a choice.

As another measure we have attempted to benchmark this campaign. It is difficult to benchmark these activities because there is little that is comparable to renewable energy consumer education efforts. Nonetheless, we explored the possibility of comparing a similarly focused consumer education effort for energy efficiency. Table 3-12 provides a comparison of some of the key indicators that were provided by the REMB Team as indicators of their success to similar indicators used to assess the effectiveness of a consumer education effort focused on new commercial construction practices in the Pacific Northwest.

The Pacific Northwest public information campaign is entitled *betterbricks.com* and is a $3.5 million, eight-month campaign. The campaign includes commercial television ads, public relations efforts and print ads. These efforts were designed to push commercial business decision makers to use a website (betterbricks.com) to learn how to improve the productivity of their workers by using better quality lighting and heating, ventilating and cooling technologies. The campaign is sponsored by the Northwest Energy Efficiency Alliance (Alliance) and was launched May 1, 2000.

The public relations results for betterbricks.com in Table 3-12 are for a five-month period from May 1 to September 30, 2000. The public relations results for the REMB Team are for the 14-month period, from April 1, 1999 to June 20, 2000. The website and call center results for the REMB team are for the 3-week Santa Monica campaign and the three-week Earth Day campaign. For the Alliance's *betterbricks.com* campaign the website and call center results are for September 2000, during which ads were run during the three-week summer Olympics.

Table 3-12: Benchmarking Data

Activity	*REMB Team*	*Betterbricks.com*
Time Frame	14-month - 5 News events	5-months - 2 news events
Press Releases	36	2 press releases plus 50 e-mails
Stories and articles	62	6
Radio/TV Talk shows	12	5
TV ADS Period Placed	Santa Monica Cable June/July 1999	September 2000 3-week Olympics
Website total hits	23,641	9,700
Website unique hits	1,200-1,500	2,215
TV ADS Period Placed	Earth Day 2000 - Santa Barbara, San Diego, Contra Costa Cable April 2000	
Total hits	8,363	
Website unique hits	441	

In both campaigns, the coordinators conducted extensive telephone contacts to media contacts to discuss the efforts and answer questions and attempt to get the issues on their agenda. In addition, the *betterbrick.com* campaign included e-mail messages to media contacts to keep them informed of the project efforts.

Comparing the two campaigns suggests that the grassroots effort, in terms of publicity was at least as effective as the purchased media campaign, if not more so. Though the newsworthiness of the renewable energy issue may have been higher than the betterbricks.com launch.

On the other hand, the purchased media campaign seemed to attract more website hits than the cable media campaigns. This is likely a reflection of the audience population differences, the smaller size cable TV audience in the California communities compared to the purchased media audience in the Pacific Northwest.

Volume VI

4 Conclusions and Recommendations

4.1 Overview

This section discusses our conclusions regarding the consumer education effort from March 1999-September 30, 2000. We also offer some recommendations for the next phase of this effort.

4.2 Conclusions

The RECE effort between March 1999 and September 2000 can be characterized as both a period in which some successful outreach occurred for the renewable energy market and a learning period for both markets.

Outreach in the Renewable Energy Market was Successful

With very few resources a group of grassroots renewable energy organizations were able to amplify their efforts to educate consumers about the opportunity for choice and green power. Are there other ways they could have spent the resources? Clearly yes. Could more have been accomplished using other approaches? Probably yes. But could more have been accomplished given the same resources? Probably not.

However, these are difficult questions to answer with certainty. All members of the REMB Team tout the effectiveness of the City Switch and Earth Day campaigns. The evaluation effort around the Santa Barbara Earth Day campaign confirms this view, the trend in green switches during the 15-month REMB project also confirms this view as does the finding that for residential consumers those in the target areas were more aware of the green power option than were residential consumers statewide. The areas targeted by the REMB Team were small relative to the entire state of California. Comparable changes in willingness to switch are unlikely to be observed across the state based on the 15-month Phase 1 effort. Much more work will be required. In addition, all members of the team believe that market research is needed to further understand and clarify the appropriate target market for future efforts and few believe that the City Switch strategy will work beyond the next year.

Nonetheless, their efforts demonstrated that if one can generate a newsworthy event then earned media can be effectively used to gain increased exposure for the message. They also demonstrated that having contacts in different parts of the state facilitated the earned media approach, with local contacts available for radio and television when needed. But if newsworthy events cannot be generated, commercial advertising will become necessary.

Many Lessons Were Learned

The other major conclusion to be drawn from this period is that it was a time of learning. The contracting mechanism proved difficult for the REMB Team and Commission. Because Team members were being asked to leverage the dollars and were being given additional resources to do work they were already doing, all parties concluded that a grant mechanism would have worked better than a contract mechanism.

In the emerging technologies market, the 15-month period was marked by a Commission contract for market research. The contract purpose was to help the Commission identify current awareness and attitudes of residential and business consumers and end-users towards emerging technologies and to identify the target market for emerging technologies. During this period, the Commission implemented some projects to develop tools that could be used in the future: brochures and fact sheets, a guidebook for PV, a logo and booth.

The result of this learning period was the completion of the emerging technology consumer education focussed market research and a successful solicitation for $375,000 in consumer education projects for emerging technologies using a grant mechanism. Could more have been accomplished? Probably yes. Will more effective projects in the next phase be the likely result of this learning period? Probably yes.

4.3 Recommendations

From the findings about the project and the conclusions noted above, we make the following recommendations to facilitate increased effectiveness in the RECE efforts for the next implementation period.

4.3.1 Program Design and Implementation

Planning and Strategy Coordination Are Invaluable

There was an overall vision and strategy for the implementation of the REMB Team project. All members of the Team had specific activities they were working on toward the larger vision of facilitating City Switches and community member switches and Earth Day awareness. Business switches tended to be ancillary to the larger vision. In the future, if the Commission chooses to be program administrator there will have to be either a requirement for coordination and planning among grantees or the Commission might consider creating a task force or committee to conduct strategic planning for the overall RECE effort. Members of the task force could be from the grantee organizations or could be a mix of grantee and nongrantee interested parties. Mostly likely, task force members will need to be compensated for their time and effort and associated direct costs.

Market Research is Needed for Renewable Energy Market

One of the first lessons learned in the REMB Team effort was that the assumptions about the target market were incorrect. The emerging technologies market had already benefited from conducting market research at the outset and the renewable energy market now requires the input of market research data to facilitate better project focus in the future. Such a research effort should take care to differentiate the commercial and residential markets. In the analysis, linkages between the customer credit program qualifications and market segment characteristics should be explored.

Continue to Follow Through on Current City Switch Effort

The City Switch campaign is only partially completed. Some cities are in the midst of deciding and still require the combination of technical and policy level support that the REMB Team offered. Facilitating the completion of these efforts will ensure that lost opportunities are not created by the change in funding approach. However, it is important to recognize that new barriers have emerged. With the recent passage of legislation, cities can no longer claim the customer credit benefit for a switch to green power. Only by working with the key cities now, who have been actively thinking about switching, can the Commission clarify the effect of this recent change and determine what solutions are required.

Continue to Build on Earned Media Efforts

Although poorly documented, the REMB Team members appear to have accomplished a significant amount of *earned media* from the City Switches and Earth Day events. Cnosideration should be given to continue these efforts to maintain the momentum and understand what tactics are required to keep the green power story familiar to media contacts and one they are willing to provide press coverage. A strategic planning task force for RECE should necessarily include media experts.

Fit the Contracting Mechanism to the Project

All parties we spoke with thought that the contract mechanism had created problems for the REMB Team. They could not pay for media buys directly up-front (they could have used a line of credit and the project would have covered the cost of the line of credit), they had to provide extensive documentation of their activities on a monthly basis and they often found themselves having to rewrite/document invoices and progress reports to meet the Commission requirements. They also had to use other REMB Team members to conduct tasks, when their own staff or contractors were not pre-approved for the contract. While many concluded that grants would have been the preferred strategy, that may not always be the case because many of the reporting requirements are the same, and some team members recognized this. Grants and contracts have specific purposes and should be used when appropriate in future RECE efforts. The major difference is that work done on behalf of the state is a contract and the state 'owns' the products. Contracts are used as an extension of state government staff. Grants should be used to support a portion of an organizations activities when the goals are parallel. The product is 'owned' by the grantee. Based on our understanding of the project

requirements we recommend the Commission use grants where appropriate to support organizations with ongoing activities that support RECE campaign activities and are in parallel with RECE goals.

Program Administrators Must Know the Market

Program administrators must be familiar with the market. REMB was a good choice for program administrator of the renewable energy market because they know and work with all the players in the renewable energy market. However, they felt they could not use contract dollars to oversee and manage the project, but had to use their leveraging dollars to do that function. As a consequence, they did not allocate sufficient resources to run the effort as a program administrator, and in the end opted to no longer fulfill that role.

As the Commission is now choosing to be the program administrator for all RECE efforts, it will be necessary for the Commission to conduct all functions that a program administrator fulfills. This includes the planning and strategy function as well as knowing the market and the various grass roots players in the market. We recommend that the Commission staff actively meet with green power marketers and emerging technology implementers as well as grass roots organizations by attending their conferences and trade meetings on a regular basis. We also recommend that members of these markets be included on the task force for planning and strategy decisions as well.

Continue to Walk the Line Between Consumer Education and Marketing

Consumer education and marketing are different sides of a coin. One seeks to educate one to persuade. In the case of the renewable energy market, the marketing aspect is clearly a private sector function for the green power marketers. In the emerging technologies market, the specific sale of a PV or small wind system is best left in the hands of the implementers. However, the need to promote and educate consumers about the basic technology benefits and the program itself requires the Commission to go beyond consumer education and to actually market the program. In so doing, consumers will become both aware that emerging technologies are an option (the education function) and also aware that the Commission offers a program to support investment in emerging technologies (the program marketing function).

4.3.2 Funding Allocations

The 1% allocation to consumer education will not be satisfactory to get the two messages of renewable energy and emerging renewable technologies out to the residential consumer and to commercial businesses. A multi-faceted approach in the neighborhood of at least $3 to $7 million per year is recommended during the years when mass media is used. In years with no mass media effort a campaign of $2 to $3 million will be required. Before developing a new campaign, additional market research needs to be performed to identify the most effective message(s) and to identify the proper target audience(s). Eventually, commercial media purchases will be required to reach consumers throughout California about renewable energy. In order to be effectively reached, the

emerging technologies market requires both education and program marketing materials. The 20% allocation made previously to emerging technologies also will not be sufficient. These are niche markets located throughout the state. They can be leveraged in some geographic areas with City Switches and with special events such as Earth Day and Solfest, but it will take a deeper campaign to reach the majority of the market.

4.3.3 Evaluation Recommendations

Several indicators did not prove meaningful in evaluating the RECE campaign. Table 4-1 suggests possible changes in indicators and additional data collection activities that could be conducted to more effectively measure the effectiveness of the RECE campaign.

Table 4-1: Recommended Indicator Changes

Goal	Indicator	Recommended Revised Indicators
Increased awareness of renewable energy/emerging renewables as a purchase option	Pre and post surveys	Set a goal for awareness of choice or renewable purchases to increase
	Increased traffic on hotlines and websites	Need documentation of website and call center usage, should expect to see an increase tied to media efforts.
	Increased Public Relations coverage	Develop contact with clipping service and begin this *prior to, through and after* any focused campaigns.
	Message dissemination	Track media contact awareness of message over time.
Increased purchased of renewables energy and emerging renewables	Full subscription of all Customer Credit and Emerging Buydown funds by end of program	Expectations for subscriptions set on an annual basis; as well as Annual Targets for generation from renewable resources sold in California.
Mobilize network of committed organizations that will assume financial and management responsibility for ongoing promotion	Commission observation of activity level of key players, quantifying co-funding and in-kind support	Interviews with green ESPs, funded and nonfunded renewable organizations.
	Match SB 90 funds by 4:1 by end of program	Drop
	Ongoing financial reports from consumer education program administrators	Drop