

**Residential Contractor Program Evaluation
Phase II Final Report
Volume Two: Supplemental Studies**

***Appendix A: Interim Process Evaluation Report
Appendix B: Contractor Market Segmentation Analysis
Appendix C: GIS Mapping and Analysis***

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Appendix A: Interim Process Evaluation Report

Interim Process Evaluation: *PY99 Residential Contractor Program -- SF Element*

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Executive Summary

Overview

This report summarizes interim findings resulting from process evaluation research conducted in support of the PY99 Residential Contractor Program (RCP). The objective of this process evaluation is to provide program managers and policy analysts with timely information that may be used to inform the planning and administration of the RCP program in California.

There are two elements within the RCP -- single family (SF) and multi family (MF). This report deals predominantly with the single family (SF) element of the RCP. Importantly, the SF RCP was newly designed and implemented in 1999 as an innovative approach to transform residential markets for energy efficiency.

The objectives¹ of the SF RCP program include:

- Improve customers' awareness and understanding of the benefits associated with energy efficiency;
- Promote whole system and whole house approaches to energy efficiency in the residential sector; and
- Provide standard incentives for contractors to help build self-sustaining businesses that provide diagnostic/tune-up procedures and installations of various energy efficiency measures to customers.

Summary of Findings

Important findings resulting from this research include the following:

- *The RCP is gaining momentum in the market* -- The RCP program has gone to great lengths to provide training and introduce both contractors and consumers to packages of measures that have not historically been provided to, or demanded by, the residential contracting marketplace. New energy efficiency services are being provided within the private sector, by newly-trained contractors using newly-acquired equipment.

¹ Policy and Procedures Manual: Single Family Element of the 1999 Residential Contractor Program. Version 1: May 1, 1999. PG&E, SDG&E, SCE, and SoCal Gas.

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- *Timeliness of Payments is a Critical Issue* -- Interviews with participating contractors indicate that issues related to paperwork requirements and timeliness of voucher payments are an over-riding concern. Many of the contractors within the target market are small in size and simply do not have the financial resources to cover the cost of expenses for periods of 45+ days.
- *Paperwork is Viewed by some Contractors as Being Burdensome* -- In a market transformation program such as RCP, the administrative requirements should be as transparent as possible in order to allow private sector firms to concentrate on developing their businesses and promoting the services / practices of the program. When contractors are not paid in a timely manner and feel that they are spending an inordinate amount of time completing paperwork, the participation experience becomes dominated by administrative concerns rather than the business of transforming markets.
- *RCP Will Not Address all Lost Opportunities in the Residential Sector* -- It should be noted that, while this program is intended to provide a foundation for transforming a portion of the residential contracting market, such transformation is not realistically going to occur overnight. Importantly, the program cannot address all available opportunities for energy efficiency in the residential sector.
- *Training Approaches* -- Each of the utilities has provided technical training to contractors, with each using a markedly different approach. The approach used in the SDG&E service area seems to have been the most successful in terms of feedback offered by contractors through our research. There are pros and cons to each approach used, and it is recommended that the utilities conduct a workshop to review the approaches used and to assess what training methods have worked best and coordinate future training efforts as much as possible.
- *Participation to Date* -- Participation in the program thus far represents a small fraction of the target market. Due to the fact that the program started at mid-year and requires time to train and qualify contractors, it is too early to assess this level of activity.
- *Reasons Why Some Contractors are Not Participating* -- Contractors that have not participated in the program to date cite an array of perceived issues that appear to be based largely upon prior experiences with utility programs, including (1) paperwork requirements, (2) time to receive payments, and (3) incentive levels. It is recommended that program

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overview workshops be offered on an on-going basis in order to provide up-to-date and accurate information to the contractor community -- including participants and non-participants.

- *Program Tracking* -- Efforts to collect and analyze tracking data from each of the utilities highlights the need for a coordinated tracking effort. At present, each utility is using a different format and collecting different types of information. Merging the data is unnecessarily time-consuming (akin to running railroads on different gauge tracks between countries). More importantly, it is evident that Program Managers do not have access to the data for program management purposes. They are unable to see aging studies on contractors who are trained but not approved or obtain data on vouchers submitted but not paid. There is a concern as well that there is inadequate coordination between the contractor training/approval data management process and the voucher tracking process. The potential exists for a contractor removed from the program to still receive a vouchers.

Highest Priority Recommendations

Importantly, we have identified a set of recommendations that we feel should be given highest priority by the program administrators. These priority recommendations are fundamental in nature and will have the greatest impact upon the future success of the program. A second set of additional recommendations is also included within the report, but these issues are not as vital to the near-term viability of the RCP. High priority recommendations that should be considered immediately include:

- *Shorten the Voucher Payment Cycle* -- a target of 10-15 days will be most effective for encouraging market transformation.
- *Streamline all Installation Paperwork* -- while it is not within the scope of this evaluation to scrutinize all of the installation forms, it appears simply combining forms and eliminating redundancies will go a long way. Freer distribution of voucher forms to contractors, as is being done in the Edison/SoCalGas service area, would also eliminate many of the delays that are now occurring for other participants.
- *Re-evaluate Processing Q/C Requirements* -- ensure that QC efforts are matched to the level of incentive in question.

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- *Provide Paperwork Training to Contractors* -- At this point, it may be worth preparing a "sample form" and a list of Frequently Asked Questions (FAQ) in paper copy and available on the Internet.
- *Standardize and Consolidate Program Tracking* – At the very least, the utilities should ensure that they are tracking consistent data in terms of customer information, measures installed, and rebates paid. Each utility should track voucher submittal dates and payment times, and develop aging reports on these payments. For SCE/SoCalGas and PG&E, there is no single source for approved contractors accessible to both program managers and voucher processors. There needs to be one official approved list controlled by the program manager, which the voucher processors will use to track contractors. The passing of lists back-and-forth between screening agencies, trainers, program managers, and voucher processors has the potential to lead to payments to contractors not in or no longer in the program.

Section 1. Introduction

This report summarizes interim findings resulting from process evaluation research conducted in support of the PY99 Residential Contractor Program (RCP). The objective of this process evaluation is to provide program managers and policy analysts with timely information that may be used to inform the development of energy efficiency programs in California funded through Public Goods Charge (PGC) funds.

1.1 RCP Program Overview

There are two elements within the RCP -- single family (SF) and multi family (MF). This report deals predominantly with the single family (SF) element of the RCP. Importantly, the SF RCP was newly designed and implemented in 1999 as an innovative approach to transform residential markets for energy efficiency.

The objectives² of the SF RCP program include:

- Improve customers' awareness and understanding of the benefits associated with energy efficiency;
- Promote whole system and whole house approaches to energy efficiency in the residential sector; and
- Provide standard incentives for contractors to help build self-sustaining businesses that provide diagnostic/tune-up procedures and installations of various energy efficiency measures to customers.

The program focuses on market interactions that occur between a variety of residential contractors and single family homeowners. Customers may obtain and utilize vouchers for payment to "eligible" contractors who provide energy efficiency services in accordance with program guidelines. It is intended that a significant number of these eligible contractors will exist in the marketplace such that consumers may select their preferred provider in the marketplace. To develop this market, the utility administrators

have provided training services to interested contractors, developed screening criteria for eligible contractors, and made lists of eligible contractors available to customers.

1.2 Report Organization

This report provides information on the following:

- Overview of the SF RCP program design;
- Summary of program activity to date;
- Feedback from participant contractors;
- Feedback from non-participant contractors;
- Feedback from program administrator staff and related personnel; and
- Summary and interim recommendations.

² Policy and Procedures Manual: Single Family Element of the 1999 Residential Contractor Program. Version 1: May 1, 1999. PG&E, SDG&E, SCE, and SoCal Gas.

Section 2. RCP Program Design Overview

This section provides an overview of the SF RCP program design, including:

- Statewide RCP Comparison
- Contractor Screening
- Contractor Training
- Eligible Measures
- Incentives

For the SF program, SCE and SoCalGas operate a joint program, and differences exist in the detailed program operation between SCE/SoCalGas's program and those run by SDG&E and PG&E. Contractors who wish to participate in the SF RCP program must first complete a utility-provided training in their service-type area and pass an examination, or if previously trained just pass the examination. To be eligible to participate, contractors must also be screened on their business, insurance and financial records by either the League of California Homeowners or the Electric & Gas Industries Association. Eligible contractors may then install any of the approved, incentive-provided measures for which they have passed the examination in homes of willing homeowners. To receive the voucher for the incentive, the homeowner or in one utility program the homeowner or the contractor, must obtain a voucher form and notify the utility to reserve the available funds. Upon completion of the work, the homeowner pays the contractor for the full price of the job minus the value of the incentive. The contractor must submit the voucher form and complete invoice to the utility. The contractor receives the incentive payment from the utility company. Each utility program processes their own voucher submittals and performs periodic inspections of contractors' work.

2.1 Statewide RCP Comparison

The SF RCP element is intended to be a statewide program administered by each of the major investor owned utilities (IOUs), including Pacific Gas & Electric Company (PG&E), Southern California Edison (SCE), Southern California Gas Company (SoCalGas), and San Diego Gas & Electric Company (SDG&E). While the program is

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indeed very similar in structure across the state, there are some important differences. Table 2-1 provides a comparison of the program as implemented across the state. Because SoCalGas and SCE are jointly administering the RCP single family program in their service area, the table (and subsequent discussion in this report) speaks of a single program for these companies.

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Table 2-1: Statewide RCP Comparison Overview

	Element	PG&E	SCE/SoCalGas	SDG&E
Program Administration	Contractor screening	Electric & gas Industries Association (EGIA)	League of California Homeowners (League)	League of California Homeowners (League)
	Voucher processing completed by	PG&E	SCE	SDG&E
	Vouchers paid by	PG&E	SCE	SDG&E
	Updates to eligible contractor list	Provided periodically by EGIA to PG&E	Provided weekly by League to Mowris Associates	Provided periodically by League to SDG&E
	Quality control			SDG&E
	Program tracking	PG&E	SCE	SDG&E
Screening & Eligibility	General Requirements	Different from others (see Table 2-2)	Similar to SDG&E (see Table 2-2)	Similar to SCE/SoCalGas (see Table 2-2)
	Signed agreement with utility?	Yes	No	No
	Credit check required?	No	Yes	Yes
	Reference check required?	No	Yes	Yes
	Equipment ownership required?	No	No	Yes
Training and Equipment	Technical training?	Provided by PG&E technical staff, primarily at Stockton Training Center	Provided by Mowris Associates at SoCalGas facility in Downey	Provided by Proctor Engineering using field-based approach under TPI effort.
	Business and/or sales training?	Not provided	Initiated in November workshops	Not Provided
	Diagnostics equipment discounts?	No; under consideration	Not in RCP; related program offers some discounts	Yes. Contractors required to own relevant equipment.
Marketing	Customer marketing in PY99	PG&E website	Limited. League website Utility websites	Limited. League website
	Lists of eligible contractors	Available via mail from EGIA	Available via mail or internet from League	Available via mail or internet from League
Vouchers	Obtaining voucher forms	Customer must request. Available upon request from EGIA or PG&E	Available through participating contractors or upon request from League	Customer must request. Available upon request from SDG&E
	Reservation of funds required	No, reserved when voucher is requested.	Yes, via telephone	Yes, via telephone
	Incentives	Consistent	Consistent	Consistent
	Eligible measures	No restrictions	No restrictions	Some AC measures limited by CEC Climate Zone.

2.2 Contractor Screening

Each of the utilities is using a third party to handle the screening of contractors for RCP. Reliance on a third party is considered desirable as a means of providing for impartiality in the screening process. The League of California Homeowners (League) handles screening responsibilities for three utilities: SDG&E, SCE, and SoCalGas. The Electric & Gas Industries Association (EGIA) handles screening responsibilities for PG&E.

The screening requirements vary from the PG&E area to the remainder of the service areas, as outlined in Table 2-2.

Table 2-2: Comparison of Screening Requirements

		EGIA	League
License requirements	CA contractor's license	√	√ (<i>with appropriate license for specialty</i>)
	CA business license	√	√
	State & local licenses	√	√
Insurance requirements	Worker's Comp.	√	√
	General liability	√	√
	Commercial auto	√	√
	Employer's liability	√	
Agreements	Signed agreement with Implementation Administrator	√	
Legal check	Tax liens		√
	Supplier's liens		√
	Bankruptcy proceedings		√
	Outstanding judgements		√
Credit check	TRW score of 70+		√
	Good payment history for past 15 months		√
References	Customer references		√
	Supplier references		√

Eligibility for RCP is also contingent upon satisfying the respective training/testing requirements of each utility.

2.3 Contractor Training

A major component of this program is its provision of contractor training on energy efficiency products and practices. In most cases, RCP training is handled by third parties under contract to the utilities for this service. Training is provided by Proctor Engineering and Robert Mowris & Associates, respectively, for SDG&E and SCE/SoCalGas. Training for PG&E is handled internally by their Technical Applications Group.

The topics covered by training sessions vary from one utility to another as shown in Table 2-3 below.

Table 2-3: Topic Coverage of Training Provided to Contractors

Element	PG&E	SCE/SoCal Gas	SDG&E
Combustion appliance safety (CAS)	√		√
Duct testing & sealing	√	√	√
HVAC		√	√
EE windows	√	√	√
Ceiling insulation	√		√
Wall insulation	√	√	
Plumbing		√	√

For the most part, the training sessions are technical in content. PG&E has a separate non-technical session, called an orientation session, for business owners that covers basic program information. Frequently, the business owners attending the orientation sessions enroll employees for the specialty classes at that time.

Table 2.4 provides an overview of the features of each utility’s training program for RCP.

Table 2.4: Comparison of Training Approaches

	PG&E	SCE/SoCalGas	SDG&E
Setting	Stockton laboratory setting for duct and CAS sessions; multiple locations for window and insulation sessions and orientation.	Single site in Downey; classroom setting.	At contractors' premises and in residential locations served by firm.
Frequency of sessions	Flexible; to date once or twice per month.	Every two weeks.	Frequent; sometimes daily.
Skills assessment	Practical exams for duct and CAS classes.; pen and paper tests for window and insulation sessions.	Pen and paper tests.	Practical exams in class and in field.
Follow-up	Telephone surveys to determine use of course material in business operations.	Attendee ratings of course content and instructors.	Data collected from field on refrigerant charging calls; attendee ratings of course.

Key areas of interest with respect to RCP contractor training include the following:

- Training or demonstration of skill mastery is required -- In order for contractors to be eligible for SF RCP, they must complete utility-sponsored training classes and pass the associated tests. Options also exist for contractors to test out of some of the training sessions without attending the related workshops.
- Who must be trained? -- Requirements as to who must attend the training sessions differ to a degree across the utilities. PG&E requires that any field crew performing work for RCP be under the supervision of a crew leader who has passed RCP training. Contractors are not permitted to have their trained supervisors train other supervisors within their firm and then participate in PG&E's area. The San Diego program, like the PG&E program, requires trained personnel working on the RCP jobs. In contrast, the SCE/SoCalGas approach allows for, and assumes that, individuals receiving RCP training will train their co-workers. The SCE/SocalGas program places the responsibility for correct installation on the company in a similar manner to the licensing process. The licensed contractor does not

need to be on-site continuously, but he/she assumes ultimate responsibility for the work.

- Inclusion of hands-on training -- The training provided for the SDG&E program emphasizes field work, with trainers accompanying contractors to provide on-the job training after they have completed classroom training. The training offered by PG&E varies in the degree to which hands-on work is incorporated. Classes in windows and insulation consist of classroom sessions only. HVAC and duct testing and sealing include laboratory simulations and lab practicals as part of the exams. As of late October, some in-the-field training was being offered to selected firms deemed to need additional training prior to being approved for RCP. The training for the SCE/SoCalGas program consists entirely of classroom learning and testing.
- Monitoring Training Effectiveness-- Each training program apparently has some assessment mechanism in place to track the effectiveness of the training. PG&E is using telephone follow-up surveys 3-6 months later while the other training organizations collect feedback by means of pen and paper questionnaires at the conclusion of each training session. The focus of the Robert Mowris surveys is to provide quick feedback on the quality of the training. Proctor Engineering also conducts similar research with its attendees. They further track field performance of the workshop attendees using specialized software which collects data relating to refrigerant charging. In contrast, the PG&E surveys will be used to determine whether or not attendees are using the training information in their business operations.

2.4 Eligible Measures

RCP addresses efficiency measures for residential space heating and cooling, water heating, and lighting, specifically:

- basic HVAC diagnostic tune-up
- duct testing and sealing
- high efficiency gas furnaces, air conditioners and central heat pumps
- programmable thermostats
- attic and wall insulation
- high performance windows
- high efficiency gas water heaters
- pipe insulation
- water-saving showerheads
- hard-wired fluorescent fixtures
- screw-in compact fluorescent lamps

On the whole, this set of eligible measures has not changed much since the start of the program, but some minor modifications have been made. For example, the efficiency

requirements for heat pumps were modified to conform to those used for the Energy Star program. Homes in some of the areas with milder climatic conditions were not eligible for air sealing and high efficiency air conditioning. The program was later changed to include high efficiency air conditioning in most areas of the State.

The list of eligible measures may be expanded for PY2000. One measure under consideration, for example, is the attic ventilation fan.

2.5 Financial Incentives

For the most part, incentives for these measures were uniform across the four utility service areas, reflecting the statewide nature of this program. The initial exception to this was for air conditioning equipment. In this case, certain areas were not eligible for air conditioning incentives, this being determined on the basis of climate zones. Three of the four utilities have since decided to eliminate the climate zone restrictions on air conditioning incentives. SDG&E may follow the other three, but currently prefers not to change the air conditioning incentives further. The utility already opened up one-third of its territory for AC incentives

Furthermore, RCP incentives were structured so as to encourage more comprehensive retrofits than might otherwise be performed. For example, some measures are eligible for incentives only when installed as part of a larger package of measures. This is the case for programmable thermostats, hard-wired fluorescent fixtures, screw-in compact fluorescent lamps, and water saving showerheads. In other cases, bonus incentives are available for installing measure packages. Installation of both attic and wall insulation would qualify for such a bonus.

Section 3. Summary and Analysis of Program Activity

Data has been acquired from each of the utilities on training, voucher released and vouchers submitted. We have used these data to complete Tables 3.1 to 3.4, shown below. The data have also been assembled into a geographic information system. The maps produced show the distribution of contractors across the state.

3.1 Contractor Training Activity

As Table 3.1 illustrates, many of the contractors who have attended training have not yet been approved for the program. A small number of firms are in the pipeline to be approved. However, in the vast majority of cases, the contractor has chosen not to submit the required application to the Screening Agency.

Table 3.1: Contractor Training Activity

	PG&E	SCE/Socal	SDG&E
Number of Firms Trained	551	223	?
Number of Firms Approved	53	132	25
Approved for HVAC	27	79	19
Approved for Duct	28	79	?
Approved for Insulation	11	25	2
Approved for Windows	22	47	4
Approved for AC/Heat Pump	25	79	19
Approved for Gas Furnace	27	?	?
Approved for Water Heater	15	8	4

PG&E through 11/15/99, SCE/SoCalGas through 11/4/99, SDG&E through 11/30/99

3.2 Submitted Voucher Activity

Table 3.2 shows the number and the amounts of vouchers that have been completed and returned to the utility for payment. We use this number, rather than the vouchers released, as a measure of program activity, because many of the vouchers released will never be returned. As table 3.2 illustrates, most of the activity is in the tune-up and duct sealing areas. In addition, PG&E has supported a good deal of insulation installation.

Table 3.2: Submitted Voucher Activity

	PG&E	SCE/SoCalGas	SDG&E
Number of firms with submitted vouchers	12	26	11
Number of vouchers submitted	412	1255	270
Total amount submitted vouchers	\$59,627.73	\$181,642.50	\$32,734.56
Basic tune up	\$19,575.00	\$8,475.00	\$17,775.00
Advanced tune up	\$300.00	\$8,100.00	\$8,100.00
Duct test	\$0.00	\$31,050.00	\$600.00
Duct test seal	\$4,000.00	\$88,200.00	\$1,200.00
High efficiency gas furnace	\$2,000.00	\$250.00	\$250.00
High efficiency central heat pump	\$225.00	\$225.00	\$450.00
High efficiency central air	\$4,050.00	\$4,950.00	\$1,350.00
Program thermostat	\$500.00	\$700.00	\$925.00
Attic insulation	\$19,284.75	\$10,443.15	\$1,461.00
Wall insulation	\$7,940.16	\$3,568.04	\$343.56
Insulation package bonus	\$569.82	\$195.36	\$24.00
High efficiency windows	\$1,183.00	\$25,485.95	\$256.00
High efficiency gas water heater	\$0.00	\$0.00	\$0.00
Pipe insulation	\$0.00	\$0.00	\$0.00
Water saving showerheads	\$0.00	\$0.00	\$0.00
Hard wire compact fluorescents	\$0.00	\$0.00	\$0.00
Screw-in compact fluorescents	\$0.00	\$0.00	\$0.00

PG&E through 11/15/99, SCE/SoCalGas through 11/22/99, SDG&E through 11/30/99

3.3 Activity Level of the Most Active Contractors

As seen in Table 3.3, one or two firms are accomplishing most of the activity in the program in each utility. Over 60 percent of the activity in SCE/SoCalGas is being

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performed by one firm, providing duct-sealing services to mobile home parks. In the other two utilities, two firms dominate the activity, with one firm having more vouchers and the other having a larger dollar value for the vouchers submitted.

Table 3.3: Activity Level of the Most Active Contractors

		PG&E	SCE/SoCalGas	SDG&E
Most Active -- Greatest Number of Vouchers Submitted	Total # Vouchers Submitted:	412	1255	270
	Total # Vouchers Submitted by the Single Most Active Firm:	119	827	122
	Percentage of Total Vouchers Submitted by the Single Most Active Firm:	28.9 %	65.9 %	45.2 %
	Dollar Value	\$8025	\$115,025	\$9600
	Type of Measures	Basic Tune-ups	Duct Testing and Sealing	Duct Testing and Sealing
	Location of Firm	Rocklin	Hayward	El Cajon
Most Active -- Greatest Dollar Value of Vouchers Submitted	Total Dollar Value of Vouchers Submitted	\$59,627	\$181,642 (same firm as above)	\$32,734
	Dollar Value of Vouchers Most Active Firm:	\$19,408	\$115,025	\$10,200
	% of Total Paid to Most Active Firm:	32.5 %	63.3 %	31.2 %
	# Vouchers Submitted by Firm:	86	827	97
	Types of Measures Installed by Firm:	Insulation	Duct Testing and Sealing	Duct Testing and Sealing
	Location of Firm:	Concord	Hayward	San Diego

Section 4. Summary of RCP Staff Interviews

In-depth interviews were conducted with utility and non-utility personnel involved in administering the PY99 RCP program. Program managers were interviewed at each of the four utilities -- PG&E, SCE, SoCalGas, and SDG&E. Additional information was also obtained from the staffs of these program managers and computer support persons. These interviews were then supplemented with interviews of staff from the organizations that provide training and screening functions for RCP. These included Electric & Gas Industries Association (EGIA), the League of California Homeowners (League), Robert Mowriss and Associates, Proctor Engineering, and the PG&E Technical Applications group.

Information obtained from these in-depth interviews reviewed the following:

- Program administration and operations;
- Contractor screening procedures; and
- Contractor training.

4.1 Program Administration and Operations

Information on program administration and operations included the following:

- Program management -- The utilities report that they have been receptive to input from the market in designing the RCP program. Refinements in both the single family and the multifamily elements have been made in mid-course, refining the program design to better fit the preferences and needs of the target market. Moreover, the program managers indicated a continued willingness to hear and consider input on the program design as the program moves forward as well.
- Contractor approval time -- While no data were available on lag time for contractor approval, several of the people interviewed alluded to some cases involving months elapsed from the date of training without approval for program participation. One program manager indicated that it was impossible for them to determine the root cause of the delays when the information from the screener and the contractor were at odds with one another. Better tracking data for the program managers may be needed to monitor aging applications of trained contractors.

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- Paperwork and Forms -- On the whole, the program managers indicated that they had not had a lot of complaints regarding the vouchers for RCP's single family component. Only minor changes to the forms were being considered. In contrast, the paperwork associated with the multifamily component was recognized as being an area of complaints for some contractors and was being re-examined to determine if any changes would be made for the coming program year.
- Payment processing time -- Data on the time required to process voucher payments were not were available from the utilities. One program manager indicated that they were aware of some contractors trying to find out the status of their payments and having difficulty getting an answer. No program manager reported any complaints about payment processing time generally, although one utility reported that virtually every participating contractor had had at least one voucher returned for corrections or lack of complete information. This factor, along with the fact that contractors are calling in with inquiries, suggests a possible lag time issue with voucher payments. Each utility should track voucher submittal dates and payment times, and develop aging reports on these payments.
- Voucher distribution -- Two alternative approaches have been used for giving customers vouchers. In PG&E and SDG&E, customers are required to call to request a voucher form. In SCE/SoCalGas areas, contractors are allowed to carry voucher forms and make these available to customers during the course of their normal operations. The program manager at Edison reported that contractors had expressed a strong preference for this streamlined approach to voucher distribution.

4.2 Contractor Screening Procedures

Information provided on the screening process included the following:

- Variations in screening requirements -- The requirements for participation in PG&E's program differ from those for participation in the programs of the other utilities. For PG&E's area, the requirements were developed by PG&E itself. For the remainder, the requirements are a combination of utility-imposed requirements and requirements imposed by the League. The League's role introduces additional background checks into the RCP screening process, including credit information and legal records. This reflects the standards of the League itself, which provides a watchdog function to consumers in southern California. The result of the current arrangement is that contractors interested in participating in the PG&E area and another area will have to pass two separate screening processes. To date, the limited program activity has not required much coordination between EGIA and the League. This is likely to change as program activity

increases. It would be helpful to ensure that the screening process for the coming years be made as streamlined as possible for those contractors wishing to be eligible for RCP statewide.

- Contested screening requirements -- Some contractors have objected to the insurance requirements of RCP which are, reportedly, more stringent than those of other programs. While in general we tend to recommend that the utilities look to reduce participation barriers wherever possible, in this case we recommend that the utilities balance their own concerns regarding adequate insurance coverage against the contractors' desires to cut overhead expenses. Other aspects of the program should probably take precedence in the ongoing refinements that are made.

- Access to screening data records -- Because enrollment activity has been fairly limited to date in the PG&E area, EGIA relays data updates on an as amended basis. Data on newly qualified or disqualified contractors is faxed from the League to Robert Mowris weekly for contractors in the Edison/SoCalGas area. This information is communicated directly to the program manager at SDG&E where, again, enrollment activity has been less. We believe there is a need to develop more formalized and complete reporting for the utilities for PY2000 showing not only those firms whose approval status has changed, but also the status of firms pending approval. Aging reports and reasons for lack of approved status should be identified.

4.3 Contractor Training

Information provided on contractor training included the following:

- Training content -- Training efforts are reported to have focused on technical issues. It was mentioned that additional training in business planning and marketing may be helpful for those specialties which are newer and more unfamiliar to the market. Absent this type of information, contractors tend to focus on up front costs and uncertainties and fail to see potential opportunities for revenue enhancement for their firms. A pilot training session introducing calculations estimating the cost-effectiveness of investing in duct testing and sealing was reported to have created substantial interest among workshop attendees, generating requests for product pricing information.

- Training approach -- There is some difference of opinion about the value of classroom teaching on subjects relating to efficiency practices. While satisfaction ratings are very high for the classroom-only workshops, there is skepticism that this type of training is adequate to truly convey the knowledge necessary to effectively transform contractor practices. The utilities have diverged in their training approaches for PY99 and PY2000.

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The relative effectiveness of the differing approaches needs to be explored more fully in the coming year and the best practices embraced for RCP statewide.

- Monitoring training effectiveness -- More than one source indicated that for some contractors the sessions can present an almost overwhelming amount of new information. This is truer for the newer services such as refrigerant charge or airflow diagnostics, and duct services than for other areas such as insulation or windows. It may be worthwhile to consider a re-certification process or a selective field monitoring process for addressing quality control in these fields. The CheckMe software offered by Proctor Engineering is an innovative method for monitoring technician performance in a manner that is not labor-intensive. Experience with this tool may also provide useful information about the degree to which training in the first year provides a lasting knowledge base and whether additional re-training is of value for the program.
- Training variations -- Similar to the contractor screening process, the training provided with the program varies from one service area to another. Again, looking to the future of RCP, it would be worthwhile to identify ways to streamline the training requirements for contractors wishing to participate in multiple service areas.
- Increasing training availability -- Current arrangements relying on single sites for training sessions may be adversely affecting enrollment of contractors in some geographic areas. PG&E plans to increase the number of locations available for RCP training. RCP training for certain types of sessions can now be arranged at eight locations throughout the service area. The Company is looking into ways to make the Duct Sealing and Combustion Testing sessions available in other areas.
- Outcomes of training monitoring -- At the time of our interview, PG&E had not yet had the opportunity to review and act upon findings from this monitoring effort, but both trainers for SCE/SoCalGas and SDG&E were utilizing monitoring data. In the case of Robert Mowris & Associates, the training sessions have been modified in response to attendee feedback and the effectiveness of these changes reflected in continually increasing attendee satisfaction levels.
- Changes in Training Planned for PY2000 -- PG&E has plans to pilot classes in air flow and refrigerant charge in December 1999. These components will be assessed and a determination made on whether or not to make these optional components for 2000. Robert Mowris and Associates, trainer for SCE/SoCalGas may begin to offer more business planning content in its

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training sessions. A principal focus in this training component is to address barriers to duct sealing by demonstrating potential returns on investment to contractors concerned about the first costs and market uncertainties. This option was piloted in November with success. The attendees requested information on where to purchase duct sealing and testing equipment - without price discounts or other incentives being offered.

Section 5. Feedback From Participant Contractors

In-depth interviews were conducted with a sample of 25 contractors participating in the PY99 RCP program. These included the following as shown in table 5.1:

Table 5.1: Distribution of Participant Contractor Interviews

	HVAC	Windows	Insulation	Total
PG&E	4	1	1	6
SCE/SoCalGas	3	2	1	6
SDG&E	7		1	8
Total	12	3	3	20

Information obtained from these in-depth interviews with participant contractors identified a number of over-arching issues and concerns that need to be addressed in very short order to improve the chances of success for this innovative market transformation effort. Issues that were raised and appear to be relevant across all contractor types are discussed first, followed by a discussion of issues that are applicable to specific types of contractors (*i.e.*, HVAC, Window, Insulation).

5.1 Positive Feedback Received From Contractors

Importantly, a majority of the contractors interviewed are of the opinion that the program has the potential to have a positive impact upon their businesses and the market for energy efficiency measures. Positive elements that were noted most frequently include:

- Value of the Training – Most contractors felt the training was a valuable service offered. One participant who had taken the training in both SDGE and SCE/SoCalGas was very clear that the SDGE was far superior. He particularly felt that the field training for the duct testing, where he had no previous experience, was essential. Several contractors in the SDG&E program also explained that the in-field training helped to overcome skepticism they had regarding the value of the duct testing and sealing approaches promoted by the program.

- In-field Training Helps Overcome Contractor Skepticism --
- RCP has been Helpful in Developing New Business -- Insulation contractors, in particular, noted that the program was helping them develop new business. HVAC contractors frequently requested that the utilities promote the program more aggressively with customers.

5.2 Administrative Issues and Concerns -- All Contractors

Although contractors see potential in the RCP program, there was a fair amount of concern involving administrative requirements / activities of the program. These concerns appeared to be most significant in the PG&E and SCE / SoCalGas service areas. Although it is too early to tell if there are programmatic design issues that affect this, it is worth noting that the SDG&E program is somewhat smaller and, at the same time, has also taken a different approach to training contractors that may have an impact upon this topic. A brief discussion of each of the issues is provided below:

- Payment Processing Time -- Processing of payments is reportedly taking a long time, often in excess of 60 days. While at present this seems to be more of a concern in PG&E and SCE/SoCalGas service areas, the issue is one that may have implications statewide. Several contractors complained about this and, importantly, a few cited this as a reason for withdrawing from the program. Even in cases where contractors viewed the program favorably, these positive perceptions were often overshadowed by negative perceptions resulting from not receiving payment within a time period that they considered to be acceptable. To give the program a chance, program administrators need to be sure that contractors are paid in a timely manner.
- Paperwork and Forms -- The voucher form constitutes only a small portion of the paperwork that contractors are required to complete for this program. It appears that a minimum of four pieces of paper is required for each reimbursement requested. Even more are required when CAS testing is required. Contractors are very dissatisfied with the amount of paperwork required and recommend streamlining the process to eliminate redundancies across forms and to combine information wherever possible.
- Training in Paperwork -- Training efforts are reported to have focused on technical issues and not program administrative requirements. It was mentioned that additional training in simply completing forms would be helpful.

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- Obtaining Answers to Administrative Questions -- Several contractors referenced difficulties experienced in obtaining answers to their questions. Junior staff were noted as often not being able to answer questions, thereby necessitating talking with the program managers who are (understandably) quite busy.
- Consistency of Information to Customers/Contractors -- Contractors report several instances in which customers or contractors were apparently given inaccurate or incomplete information by the utility or by the training contractor. These situations appear to involve, most frequently, questions concerning the link between EE furnace/AC rebates and duct testing/sealing requirements.
- Customer Requests for Vouchers -- Two alternative approaches have been used for giving customers vouchers. In SCE/SoCalGas areas, contractors are allowed to carry copies of the vouchers and make these available to customers. In PG&E and SDG&E, customers are required to call a request copies of the voucher. This presents a problem in cases where time is of the essence, especially in cases of emergency replacement, because of the delays inherent in this arrangement. Customers have reportedly had to wait up to two weeks before receiving a copy of vouchers. This breaks up the sales cycle, and is again especially problematic in cases of emergency replacement. In some cases where the planned job differs from the work ultimately performed, this creates additional delays necessitated by the customer being required to obtain a new voucher.
- Lists of Eligible Contractors Automatically Sent to Customers -- Contractors in PG&E areas have complained about customers automatically being sent complete contractor lists when they request vouchers on the recommendation of a particular contractor, along with recommendation to get multiple bids. As reported by contractors, arrangements were supposed to be in place to prevent this from happening. This issue needs to be clarified with participating contractors. Clearly, lists need to be made available if customers request this; whether or not such lists should automatically be sent with voucher information is a gray area that should be clarified by the program managers.
- Uncertainty about Program Duration -- There is an expressed uncertainty / confusion in the contractor community regarding the future of the program and, specifically, how long the program is slated to last. Several contractors were under the impression that the program would end in December, 1999, making it difficult to approach RCP from a long-term perspective as required for market transformation.

- Linking Voucher Payments Together -- A contractor installing a new unit is required to complete the basic tune-up and duct testing in order to receive a high efficiency rebate. They are not necessarily required to seal the ducts. However, in cases where they have attempted to seal the ducts, but not succeeded, and have still applied for the duct sealing rebate, the entire rebate amount has been held up. The effect this has upon contractors is slowing down the payment process. It was recommended by contractors that the administrators have a way of paying individual vouchers rather than locking up the entire payment.
- Lack of consumer marketing -- Participating contractors would like to see the program supported with consumer advertising.

5.3 Issues Specific to HVAC Contractors

- Basic Tune-ups Are Often Offered at No Cost -- The basic tune-up is being offered by some firms at no cost to the consumer. This time spent by the company that is not reimbursed by the rebate is viewed as a marketing expense. However, when the contractors have to float the amount to be reimbursed as well (see discussion of "payment processing"), this becomes a drain on cash flow, ties up their ability to access lines of credit, and increases the overall costs of participating in the program.
- Linking Duct Testing and Equipment Replacement -- The program requires that, in order to qualify for a high efficiency heat pump or AC rebate, the customer's ducts must meet certain standards. Contractors are required to seal the ducts if they fail the duct test. Contractors report that, in some cases, customers opt to go with a lower cost bid that does not involve any uncertainty about duct testing or sealing costs. Several noted that they have informed homeowners that they will not qualify for the AC rebate because the contractors knows that their existing duct cannot be sealed to the required level, only to have another less scrupulous participant contractor promise the homeowner that the ducts can qualify.
- Difficulties in Meeting Duct Sealing Standards -- There is a perception that the duct sealing standards are both difficult and costly to achieve. One person characterized the situation as one of diminishing marginal returns, wherein obtaining the last increment of required sealing is very costly and the energy savings and incentive do not warrant the additional cost. Contractors also perceive a marketing risk in suggesting sealing services on very leaky ducts, because these are hardest to bring to program standards and create the greatest chance of lost incentives and damaged customer relations. This factor was also cited by non-participant contractors as a reason for not participating.

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- Need to Streamline Paperwork on Duct Servicing -- Sometimes the work performed at the site differs from that originally planned because the results of the duct testing do not support implementation of the duct sealing services. (Or the contractors feel that they will be unable to sufficiently seal the ducts to qualify for RCP incentives.) In at least one service area, these jobs are required to get completely new vouchers reflecting the more limited services rendered. This created an added difficulty for contractors trying to promote duct sealing services while complying with the program's requirements.
- Competition from Non-Participant Contractors -- Some non-participant contractors are reported to offer the rebate directly to customers, without participating in the program, as a means of matching offers of participating contractors. These contractors have seen the marketing value of offering the basic tune-up at no cost, but do not perceive it as being worth their while to participate in the required training and spend time completing the paperwork for the program. Moreover, since customers dealing with these contractors do not have to wait to receive their voucher forms (up to 2 weeks), they can close the sale more easily and quickly than participating contractors. Add in the CAS testing requirements, and the contractors that are participating may actually be at a disadvantage in the marketplace.
- HVAC and Duct Incentives Do Not Address Issues of Sizing and Balancing -- According to one contractor, duct sizing and balancing is more often a problem than duct sealing. He regards the duct sealing approach as "overkill" in terms of leak testing requirements, and feels that a focus on balancing would be more productive in terms of both energy use and comfort.
- Diagnostic Tune-up Requirements -- Program specifications require that outside air temperature be 55 degrees, but one contractor maintains that it needs to be 75 degrees for the prescribed process to work. Such testing can only be done during peak cooling season, but is required for replacement incentives regardless of the time of year in which a unit is replaced.
- Requirements for Charging Systems -- Program requirements include checking the charge on new packaged systems. There is some confusion among contractors as to why this is required since units are charged at the factory. It was reported that only in rare cases are units without charge, and this is when they have a major leak and do not function at all.

- Inclusion of Variable Speed Furnaces < 90% AFUE -- One contractor suggested that variable speed furnaces should be included since they have lower electricity (fan) use, even when the furnace is less than 90% efficient. This particular contractor does not feel that the cost to customers of installing 90% or greater makes sense given the small heating loads and low cost of gas where they are located.

5.4 Issues Specific to Window Contractors

- Positive Impact upon Windows and Insulation Businesses -- Window and insulation installers report that the program has helped their businesses. Especially in the case of insulation retrofits, the program promotion and incentives are viewed as being especially helpful in stimulating customer demand.
- Window Manufacturer Promotions -- Windows contractor mentioned that they have, on occasion, provided free low-e for one month in order to stimulate consumer interest. These programs have been supported with manufacturer assistance, and were reported to be very successful.
- Window Incentives -- The window incentives were felt to be helpful, but increasing the incentive to \$2/SF, even for a limited time to gain market attention, was recommended as being more helpful.

5.5 Issues Specific to Insulation Contractors

- Positive Impact upon Windows and Insulation Businesses -- Insulation installers report that the program has helped their businesses. Specifically, the program promotion and incentives are viewed as being especially helpful in stimulating customer demand.
- Duct Insulation Recommended for Inclusion -- One insulation contractor perceives that there are savings to be had through duct insulating and that this should be rebated through the program.
- Combine Insulation Addendum with Voucher Form -- This was recommended to minimize incomplete paperwork and simplify the voucher payment process.

Section 6. Feedback From Non-participant Contractors

In-depth interviews were conducted with 26 non-participant contractors. The sample included contractors from all utility areas who had not participated in the program. In order to target those contractors who were likely to have some interest in the program, an effort was made to include: (1) contractors that were already approved to work in the RCP but had not yet submitted any vouchers, and (2) contractors who were members of EGIA or the League (and therefore likely candidates for participation) but were not yet approved for the program. Table 6.1 presents the completed sample by utility service area and type of contractor.

Table 6.1: Single-family Non-participant Contractor Sample

Utility	HVAC (incl. Diagnostic)	Electric	Insulation	Windows	Total
PG&E	4	1	0	0	5
SCE/SoCal Gas	5	3	3	5	16
SDG&E	2	1	2	0	5
Total	11	5	5	5	26

6.1 General Issues and Concerns

The two most common reasons heard from contractors for why they will not participate in the program are paperwork requirements and low incentives. These were mentioned from all different types of contractors as well as various sizes of companies. These reasons, plus others, are described in more detail below.

- Paperwork Requirements – A number of contractors reported the time required to read the manual and submit required information and forms made the program unattractive. As one contractor put it, “we’d rather just give the customer a discount.”
- Low Incentives – The amount of the voucher was mentioned by contractors as a deterrent to participation. The cost they charge for many of the measures compared to the amount available on the vouchers requires that the customer still pay for most of the service. An incentive amount closer to 50

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percent of the cost was suggested by some. Another suggestion was to rebate a percentage of the amount charged by the contractor, rather than a flat fee.

- Range of Measures – The range of measures offered in various areas was mentioned as a problem for some contractors. Contractors perceived either that the measures were “all wrong for the area” or that there were not enough of them to make it worth their participation. One HVAC contractor lost interest in the program when she heard the ENERGY STAR[®] equipment measures were not available in her area, and a window contractor decided he didn’t want to work with a program that didn’t include window tinting. Suggestions for additional measures to offer in the program included an 80% dual speed furnace, radiant heat barriers, solar heaters for swimming pools, window tinting, and exterior gas lights.
- Customers are Not Asking For It – Some contractors geared up for the program but just haven’t had anyone call them with a request. This was heard even from contractors in the SoCalGas area, where contractors are encouraged to market the program on their own. One contractor stated that he thought the program would result in more business, but he hasn’t seen a lot of results yet.
- Use of Vouchers – The use of vouchers is unappealing to many contractors. Specifically, contractors reported that they see this process as a hassle to deal with and there is uncertainty as to when they will receive payment. One contractor mentioned that his experience with voucher programs in the past led him to think it would take three to six months to get paid.

In addition to these issues, a few others surfaced during the interviews that were mentioned by only one contractor. However, due to the small sample used in this research, these comments should be considered.

- Paying to Get on the List -- One contractor in the SoCalGas area mentioned he did not like the idea of paying to get on a list. This was a relatively small contractor, who typically worked on 30 houses a year with four employees.
- Don’t Need the Business -- Another small contractor, who works by himself on approximately 50 houses a year, stated that he did not need the business and therefore was not planning on participating. This same contractor had the perception that the program required him to provide “on call” follow-up services to any customers from whom he accepted vouchers.

- Low Income Option -- One contractor mentioned that he'd like to see a measure covered for low-income customers, and he suggested a lower-end piece of equipment. He further explained that these customers can't afford the high-efficiency models, and their existing equipment is so old that it presents a fire hazard. This contractor worked on approximately 200 houses a year and had five employees.

6.2 Contractor-Specific Issues

HVAC and window contractors mentioned some specific issues applicable to their line of work. In particular, issues for HVAC contractors related to the time needed to obtain training and certification and to the measures of duct sealing and duct testing were reported. Issues for window contractors related to shading coefficient specifications.

- HVAC Certification Time – This issue has to do with the time required for HVAC contractors to obtain approval, training, and certification to be able to work under the program. Contractors who planned to work under the program, but were still in the preparation stage, mentioned this reason for why they had not yet participated. In addition, one contractor reported that he thought the program was ending in 1999, and therefore he did not want to put a lot of effort into it.
- Duct Sealing Measure -- Some HVAC contractors explained that performing duct sealing on existing houses is difficult due to hard-to-access areas. In addition, some felt they could not meet the leakage levels required by the program. Furthermore, they did not think customers would be willing to pay what it would cost the contractor to perform this service, including the required diagnostic testing.
- Duct Testing Equipment – One respondent had gone through the training but had decided not to offer this service due to the cost of purchasing the equipment. In his perspective, demand for this service was too low to justify investing in equipment that he would have no use for when the program ended.
- Window Shading Coefficient -- One window contractor who worked on approximately 100 homes a year stated that the specifications for the windows measure were “off” and that a “.4 shading coefficient does not make sense for certain elevations.”

6.2 Utility-Specific Issues

The following issues are specific to a particular utility area.

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- Financing Program -- Contractors in the SoCalGas area expressed disapproval with the Volt Viewtech financing that is apparently being offered in conjunction with RCP. From their perspective, the interest rates offered were too high and the qualification requirements stringent. Interestingly, they viewed this as a negative aspect of the RCP.
- Liability Concerns -- A contractor in the PG&E area stated that he had been told not to use the utility's name in promotion of the program, and that this had kept him from marketing the program. This particular contractor is a large one and works on over 6,000 homes per year with 20 employees.

Section 7. Summary and Interim Recommendations

In this section, we provide a summary of key findings and recommendations arising from our research to date. Importantly, we have identified a set of recommendations that we feel should be given highest priority by the program administrators. These priority recommendations are fundamental in nature and will have the greatest impact upon the future success of the program. The second set of additional recommendations are also important, but not as vital to the near-term viability of the RCP.

7.1 Summary of Findings

Important findings resulting from this research include the following:

- *The RCP is gaining momentum in the market* -- The RCP program has gone to great lengths to provide training and introduce both contractors and consumers to packages of measures that have not historically been provided to, or demanded by, the residential contracting marketplace. New energy efficiency services are being provided within the private sector, by newly-trained contractors using newly-acquired equipment.
- *Timeliness of Payments is a Critical Issue* -- Interviews with participating contractors indicate that issues related to paperwork requirements and timeliness of voucher payments are an over-riding concern. Many of the contractors within the target market are small in size and simply do not have the financial resources to cover the cost of expenses for periods of 45+ days.
- *Paperwork is Viewed by some Contractors as Being Burdensome* -- In a market transformation program such as RCP, the administrative requirements should be as transparent as possible in order to allow private sector firms to concentrate on developing their businesses and promoting the services / practices of the program. When contractors are not paid in a timely manner and feel that they are spending an inordinate amount of time completing paperwork, the participation experience becomes dominated by administrative concerns rather than the business of transforming markets.
- *RCP Will Not Address all Lost Opportunities in the Residential Sector* -- It should be noted that, while this program is intended to provide a foundation for transforming a portion of the residential contracting market, such transformation is not realistically going to occur overnight. Importantly, the

program cannot address all available opportunities for energy efficiency in the residential sector.

- *Training Approaches* -- Each of the utilities has provided technical training to contractors, with each using a markedly different approach. The approach used in the SDG&E service area seems to have been the most successful in terms of feedback offered by contractors through our research. There are pros and cons to each approach used, and it is recommended that the utilities conduct a workshop to review the approaches used and to assess what training methods have worked best and coordinate future training efforts as much as possible.
- *Participation to Date* -- Participation in the program thus far represents a small fraction of the target market. Due to the fact that the program started at mid-year and requires time to train and qualify contractors, it is too early to assess this level of activity.
- *Reasons Why Some Contractors are Not Participating* -- Contractors that have not participated in the program to date cite an array of perceived issues that appear to be based largely upon prior experiences with utility programs, including (1) paperwork requirements, (2) time to receive payments, and (3) incentive levels. It is recommended that program overview workshops be offered on an on-going basis in order to provide up-to-date and accurate information to the contractor community -- including participants and non-participants.
- *Program Tracking* -- Efforts to collect and analyze tracking data from each of the utilities highlights the need for a coordinated tracking effort. At present, each utility is using a different format and collecting different types of information. Merging the data is unnecessarily time-consuming (akin to running railroads on different gauge tracks between countries). More importantly, it is evident that Program Managers do not have access to the data for program management purposes. They are unable to see aging studies on contractors who are trained but not approved or obtain data on vouchers submitted but not paid. There is a concern as well that there is inadequate coordination between the contractor training/approval data management process and the voucher tracking process. The potential exists for a contractor removed from the program to still receive a vouchers.

7.2 Highest Priority Recommendations

Recommendations that should be considered immediately include:

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- Shorten the Voucher Payment Cycle -- a target of 10-15 days will be most effective for encouraging market transformation.
- Streamline all Installation Paperwork -- while it is not within the scope of this evaluation to scrutinize all of the installation forms, it appears simply combining forms and eliminating redundancies will go a long way. Freer distribution of voucher forms to contractors, as is being done in the Edison/SoCalGas service area, would also eliminate many of the delays that are now occurring for other participants.
- Re-evaluate Processing O/C Requirements -- ensure that QC efforts are matched to the level of incentive in question.
- Provide Paperwork Training to Contractors -- At this point, it may be worth preparing a "sample form" and a list of Frequently Asked Questions (FAQ) in paper copy and available on the Internet.
- Standardize and Consolidate Program Tracking -- At the very least, the utilities should ensure that they are tracking consistent data in terms of customer information, measures installed, and rebates paid. Each utility should track voucher submittal dates and payment times, and develop aging reports on these payments. For SCE/SoCalGas and PG&E, there is no single source for approved contractors accessible to both program managers and voucher processors. There needs to be one official approved list controlled by the program manager, which the voucher processors will use to track contractors. The passing of lists back-and-forth between screening agencies, trainers, program managers, and voucher processors has the potential to lead to payments to contractors not in or no longer in the program.

7.3 Additional Recommendations

Additional recommendations for the RCP program that should be considered once the high priority issues are first addressed include:

- Expanded Availability of Eligible Contractor Lists -- With careful attention to ensuring that one central party maintains the current list of eligible contractors, it would then be beneficial to have these lists made available to any and all organizations that would like to make these lists available to consumers. For example there are numerous home improvement related Internet services that may wish to promote RCP contractors. Retail outlets may wish to advertise the program and provide lists of eligible contractors. In making this recommendation, we assume that the list of "eligible"

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contractors (i.e. those who have been screened by the League or EGIA and have received all required training) is public information and is not proprietary to any single organization.

- Contractor Recruitment -- There are areas of coverage that will need to be addressed as the program moves forward. Targeted marketing to contractors in certain geographic areas, as indicated through GIS analysis, is recommended. Moreover, it is recommended that training classes be offered in these areas in order to minimize the inconvenience and costs of taking part in this training.
- Additional Measures -- It has been suggested by numerous parties that additional measures should be added to the RCP program. It is recommended that the program managers first develop a public list of potential additional measures, followed by the development of a ranking criteria for identifying measures that should first be added. While there are certainly measures that can be added, it is also important to keep the program manageable and that training / outreach efforts be in place to transform the markets into new areas. Simply including additional measures because there is some number of specialist contractors, without undertaking efforts to increase the size of that pool of eligible contractors, will not likely lead to market transformation.
- Relaxing the performance requirements for duct sealing -- Difficulties in meeting the performance requirements for duct sealing are a deterrent to contractors for those jobs involving the leakiest of existing systems. This is a tough issue to resolve, but modification of the current standard may be appropriate for houses in which ducts are sealed to a level that is significantly better than when they started, even though the standard is not met. Another option would be to have a separate duct replacement incentive for catastrophic ducts.
- Promote and Disseminate Program Results -- Feedback to the contractor community, promoting program activity and successful business models, will stimulate word-of-mouth interest in the program and technologies promoted by the RCP program.
- Continue and Expand Training Offerings -- Options to consider, for example, include (1) providing a series of on-going state-wide introductory workshops to provide a program overview for new contractors, (2) including energy efficiency sales training as a core course for all contractors, and (3) making low-cost equipment available for all training participants.

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- *Begin Promotion to Customers* – The utilities have been rightly reluctant to promote this program before there were contractors able to provide the services. However, for the program to expand and truly develop as a market transformation program, it must promote itself to customers. Many contractors are not following through on the approval process because they do not believe that there is adequate demand for these services. The utilities should begin with very targeted promotional activities. The GIS system will help identify and monitor the results of these activities.

Appendix B: Contractor Market Segmentation Analysis

This report presents the results of a segmentation analysis of California residential contractors. An exploratory procedure was used to cluster contractors into relatively homogeneous groups and to examine characteristics belonging to each group. The report is organized as follows: the first Section provides some background on the data used, Section 2 describes the clustering method used in the analysis, Section 3 presents the results, and Section 4 concludes the report.

B.1 Background

The data used in the analysis were collected as part of the California Baseline Contractor Survey.³ The Baseline Survey was conducted to establish a quantifiable assessment of baseline practices and attitudes related to energy efficiency for residential contractors.

The data used consists of 444 completed surveys. Included in each survey are a series of ten questions designed to collect information to be used to segment the respondents into groups. These questions consist of two groups of statements, one group describing the contractor's perceptions of his customers' demand characteristics, and the second group describing the contractor's business practices. In the first group of statements, respondents were asked to rate their agreement with the statement on a scale of one to four where one meant "strongly disagree" and four meant "strongly agree." The first group of statements is as follows:

- Customers are usually looking for the best price up-front, not necessarily the least cost over the life of the product.

³ Wirtshafter Associates, Inc. et. al. Report of the Residential Contractor Program Evaluation: Volume 2: California Residential Retrofit and Repair Baseline Contractor Survey Summary Report, Pacific Gas & Electric, April 2000.

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- Customers generally know what they want and need without our input so we don't usually try to give them a lot of new information.
- Customers are looking for premium quality and are willing to pay more to get it.

In the second group of statements, respondents were asked to rate their agreement with the statement on a scale of one to four where one meant "does not describe our business at all" and four meant "completely consistent with our business." The second group of statements is as follows:

- Our firm doesn't need to do much advertising because we usually have enough business.
- We try to attract new customers by offering something different from our competitors.
- We've run our business more or less the same way for a number of years and we are not planning any major changes or additions to our services.
- Equipment and installation approaches change frequently in our industry.
- We think it is a good investment for our company to send employees to outside training programs.
- We do not generally use the new innovative products, we prefer to sell products that have been on the market for a while and that have a proven track record.
- The market is always changing and we have to change in order to continue be successful.

Of the 444 surveyed contractors, 393 completed all the segmentation questions. Therefore, the segmentation analysis is performed with a database of 393 observations. Table B.1 shows the types of contractors making up the completed sample.

Table B.1: Contractors in Completed Sample

Contractor Type	Number	Percentage of Sample
HVAC contractors	120	31%
Window contractors	95	24%
Electric/lighting contractors	92	23%
Insulation contractors	20	5%
General contractors	66	17%
<i>Total</i>	<i>393</i>	<i>100%</i>

The purpose of the segmentation analysis is to use the responses to these questions to develop a meaningful segmentation scheme for residential contractors that could be used to characterize these market actors for the purposes of marketing and other program activities.

B.2 Approach

Cluster analysis is an exploratory method for detecting groupings in data and combining them into homogeneous sets. Its application here is designed to develop relatively homogeneous contractor segments. In contrast with factor analysis, which assumes an underlying theoretical model, cluster analysis is typically used when neither the number of the groups nor the membership of the groups is known a priori.

The cluster method employed in this analysis is the k-means method. In this method, the first k records in the data are used as temporary estimates of the k cluster means (where k is the number of clusters). A cluster “center” is defined as the mean of the group of records making up the cluster. Each record is assigned to a cluster based on the closest center, and the cluster mean is recomputed. An iterative process is used to refine the cluster centers. The end result is a set of final cluster centers, or means, reported by cluster, for each of the variables used in the analysis. This approach is generally used when the number of records in the analysis is large.

The k-means method requires a specification of the number of clusters as an input to the computation. To arrive at the appropriate number of clusters, a number of scenarios were run for cluster sizes ranging from three to seven. The results of each scenario were evaluated for clusters that were significantly different from each other yet had little internal variation. It was found that three clusters produced the most meaningful results.

B.3 Results

As stated above, a k-means cluster analysis was conducted using three clusters on the 393 responses to the Baseline Survey. The resulting cluster centers are presented in Table B.2. The closer the number associated with each question is to four,⁴ the more likely individuals in that cluster are to agree that the segmentation question describes their business. The last column in the table presents an F-statistic. It is important to note that due to the nature of the analysis this statistic should not be used as a measure of significance. Rather, it is used to indicate the importance of the question in the cluster formation. Questions with a high F-statistic are ones with greater differentiation in the sample and were thus used heavily in forming the clusters.

⁴ A four corresponds to a survey response of "strongly agree" with the segmentation question/statement.

Table B.2: Cluster Results

Segmentation Question	Cluster 1	Cluster 2	Cluster 3	F-Statistic
1. Our customers are usually looking for the best price up-front, not necessarily the least cost over the life of the product.	3.00	3.00	3.27	3.24
2. Customers generally know what they want and need without our input so we don't usually try to give them a lot of new information.	1.63	1.94	2.27	14.98
3. Our customers are looking for premium quality and are willing to pay more to get it.	2.85	2.52	2.91	6.58
4. Our firm doesn't need to do much advertising because we usually have enough business.	2.48	3.36	3.28	28.38
5. We try to attract new customers by offering something different from our competitors.	3.26	1.75	3.13	91.71
6. We've run our business more or less the same way for a number of years and we are not planning any major changes or additions to our services.	1.70	3.46	3.67	280.65
7. Equipment and installation approaches change frequently in our industry.	2.82	2.21	3.16	31.44
8. We think it is a good investment for our company to send employees to outside training programs.	3.27	1.62	3.45	189.24
9. We do not generally use the new innovative products, we prefer to sell products that have been on the market for a while and that have a proven track record.	2.50	2.86	3.33	24.49
10. The market is always changing and we have to change in order to continue be successful.	3.58	2.65	3.53	53.16
No. of Contractors	125	139	129	
Percentage of Sample	32%	35%	33%	

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As shown, responses to question six exhibited the most variation. On the average, cluster one respondents disagreed with the statement that they had run their business the same way for a number of years, while clusters two and three respondents in general reported agreement. Responses to questions eight (sending employees to training programs is a good investment) and five (attracting new customers by offering something different) were the next most influential for the analysis. In both cases, respondents in clusters one and three in general agreed with the statement while respondents in cluster two did not. Based on these results, the following describes the three groups or clusters of contractors.

- Cluster 1 contractors are changing the way they run their businesses. They try to differ from their competitors and they send their employees to training. They also report that the market is changing and they are trying to change with it. One way to characterize this group might be to call them innovators.
- Cluster 2 contractors are more traditional. They are not changing their business practices and they don't typically train employees or differentiate themselves from their competition as much as the other groups. They also see less change in the market. These contractors might be called traditionalists.
- Cluster 3 contractors are similar to those in cluster one with the difference that they are not changing their business practices. One explanation for this apparent inconsistency may be that these contractors' practices have been at the forefront of the industry for a number of years; therefore, they do not see themselves in a change mode. These contractors might be called leaders.

Table B.3 shows the distribution across clusters for each type of contractor. As shown, they are well distributed across groups.

Table B.3: Percentage of Cluster Type for each Type of Contractor

Contractor	Cluster 1 Innovators	Cluster 2 Traditionalists	Cluster 3 Leaders
HVAC	39%	25%	36%
Glazing	27%	42%	31%
Insulation	32%	47%	21%
Electrical	24%	42%	34%
General	35%	33%	32%

To describe these clusters more thoroughly, some key business characteristics were examined by cluster. In particular the following characteristics were considered:

- Percentage of contractors that work on existing homes,
- Percentage of contractors that work on existing multi-family buildings,
- Number of employees,
- Years in business,
- Number of miles from their office that contractor will travel to accept work,
- Percentage of their work in 1998 where they worked as a subcontractor, and
- Familiarity with the Residential Contractor Program (RCP).

Table B.4 presents the means for each of these characteristics by cluster.

Table B.4: Mean Business Characteristics by Cluster

Contractor	Cluster 1 Innovators	Cluster 2 Traditionalists	Cluster 3 Leaders
Works in existing homes	74% (2.8) n = 125	67% (2.9) n = 138	69% (2.8) n = 128
Works in existing multi-family buildings	73% (2.6) n = 123	75% (2.5) n = 134	71% (2.5) n = 126
Number of employees	11 (1.4) n = 124	5 (0.5) n = 139	7 (0.6) n = 127
Years in business	20 (1.4) n = 125	20 (1.2) n = 139	21 (1.3) n = 126
Miles away from office that contractor will accept work	94 (11.2) n = 118	74 (5.8) n = 132	82 (9.8) n = 120
Percentage of business in 1998 worked as subcontractor	24% (3.0) n = 121	31% (3.3) n = 132	31% (3.4) n = 124
Familiarity with RCP (1 to 4 scale)	1.7 (0.08) n = 123	1.7 (0.08) n = 138	2.0 (0.09) n = 128

Standard errors are shown in parentheses.

As shown, most of these characteristics show little differentiation among clusters. One exception is that the Innovators tend to have more employees than either of the other groups. Moreover, the standard errors for these results show that these differences are significant.⁵ This result suggests that contractors in cluster one, the Innovators, tend to have larger companies. Looking at the number of miles contractors travel to accept work, there appears to be some differentiation among groups; however, the difference in means between cluster two and three is insignificant, and the difference in means between cluster

⁵ Significance throughout this analysis is reported at the 95% level of confidence.

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one and two is only marginally significant. A similar result applies for the percentage of business worked as a subcontractor.

It is interesting to note that cluster three contractors, the Leaders, show significantly more familiarity with the RCP than do the other clusters. These contractors may be ones that typically participate in programs and are the real drivers in the market. The cluster one contractors or Innovators, on the other hand, may be new learners who have recently started making changes, and cluster two contractors, the Traditionalists, may typically be non-participants.

Contractors' self-reported experience with high efficiency equipment was also considered by cluster. Specifically, the following characteristics were evaluated:

- For HVAC contractors, the percentage of gas furnaces installed in existing homes in 1998 that had AFUE ratings above 80%,
- For HVAC contractors, the percentage of air conditioners installed in existing homes in 1998 that had SEER ratings above 10,
- The number of HVAC contractors who own diagnostic equipment,
- For window contractors, the percentage of windows sold in 1998 that were ENERGY STAR,
- For insulation contractors, the average R-rating of attic insulation installed in existing homes in 1998, and
- For insulation contractors, the percentage of homes worked on in 1998 that included installing wall insulation.

Table B.5 shows how the self-reported energy efficiency services match up with these cluster groups.

Table B.5: Experience with Energy Efficient Equipment

Indicator	Cluster 1 Innovators	Cluster 2 Traditionalists	Cluster 3 Leaders
Percentage of gas furnaces installed by HVAC contractors that are more than 80% AFUE	20.8% (4.30) n = 42	14.1% (5.51) n = 11	21.3% (8.69) n = 13
Percentage of air conditioners installed by HVAC contractors that are more than 10 SEER	40.9% (4.83) n = 39	17.7% (4.76) n = 22	30.9% (5.30) n = 31
HVAC contractors who own diagnostic equipment	48.5% (0.09) n = 33	14.3% (0.10) n = 14	43.5% (0.11) n = 23
Percentage of windows sold by window contractors that are ENERGY STAR [®]	58.8% (24.01) n = 4	82.5% (17.5) n = 4	60.6% (11.24) n = 8
Average R-value of attic insulation installed	23 (4.0) n = 2	22 (2.0) n = 7	19 (0.0) n = 2
Percentage of homes worked in by insulation contractors that included installing wall insulation	36% (22.5) n = 4	8% (4.67) n = 7	25% (5.0) n = 2

Standard errors are shown in parentheses.

For HVAC contractors, the Traditionalists in cluster two appear to install less high efficiency measures than contractors in the other two clusters. However, the differences in means for high efficiency gas furnaces installed is not significant for the three groups. There is a significant difference, however, between cluster one and cluster two for high efficiency air conditioners installed. This suggests that contractors in cluster one, the Innovators, are installing more high efficiency cooling equipment than the Traditionalists. In addition, the difference between cluster two and cluster three for this indicator is marginally significant. Interestingly, the difference in means among clusters for HVAC contractors who own diagnostic equipment is strongly significant, suggesting that cluster one and three contractors do more diagnostic work than do cluster two contractors.

At first glance, it appears the window contractors in cluster two, the Traditionalists, are installing more high performance windows than the other groups. However, the differences in means between these groups are not significant. For insulation contractors, the apparent differences in R-ratings of attic insulation installed are not significant. There is, however, a marginal difference in means between cluster one Innovators and cluster two Traditionalists in the proportion of jobs that included wall insulation. The difference between cluster two Traditionalists and cluster three Leaders is even more significant. Specifically, cluster one Innovators and three Leaders tend to include wall insulation more in their jobs than did cluster two Traditionalist contractors.

B.4 Conclusion

This analysis used data collected on California residential contractors to form a segmentation scheme that could be used to characterize residential contractors. Data collected from 393 contractors on a series of ten questions asking about contractors' perceptions of customer demand characteristics and their own business practices was used with the k-means clustering method.

Three contractor segments were identified: a group of innovative contractors who are changing to keep up with the market, a more traditional group of contractors who avoid new approaches in the industry, and a third group of contractors who operate like the innovative ones but have been doing it for some time.

The groups were found to be distributed rather evenly among the various types of contractors. In addition, they share a number of characteristics. Some notable differences are the following:

- The Innovators tend to be larger businesses.
- The Leaders are on average more familiar with the RCP program than are the other groups.
- The HVAC Innovators tend to install more high efficiency cooling equipment than do the HVAC Traditionalists.
- The HVAC Innovators and Leaders own more diagnostic equipment than do the Traditionalists.
- The insulation Innovators and Leaders tend to install more wall insulation than do the Traditionalists.

Appendix C: GIS Mapping and Analysis

A geographic information system (GIS) is a computer-based tool for mapping and analyzing things that exist and events that happen on earth. GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies. (ESRI 4/99 AVDemo CD).

The prominent software tools used to generate and manage GIS databases are ArcInfo and ArcView. ArcInfo is the parent GIS software that provides the processing foundation for managing, manipulating, analyzing and displaying geographic data in map form. ArcView is the lighter desktop application that allows the user to integrate, analyze, query and view geographic information. Information can be displayed as either a raster image (eg. satellite image or aerial photograph) or vector data (eg. point, lines and polygons of geographic features), or a combination of both for a fully integrated GIS solution. The real strength of a GIS system is its ability to combine or overlay numerous maps with different boundary definitions and to maintain the underlying data attached to each location.

For example, in the RCP case, we are able to take one map showing number of occupied housing units by census tract and overlay that with a map of the utility service territories. In many places, utility service territories intersect the census tracts. The composite map of the overlay now contains a series of whole and partial census tracts that are within each utility service territory. The computer processing recalculates the areas of the subdivided tracts and apportions the occupied housing units proportionally based on the partial tracts' relative areas. Instantly, the GIS provides an accurate measure of the number of occupied housing units within each service territory. Also provided are housing densities, and all of the other underlying data associated with each census tract.

What also makes the GIS really powerful is its geocoding/address identification ability to locate from street addresses the coordinate location of any data point. By

geocoding the location of program participants, we can associate the appropriate census tract data to that location. Similar overlays of climatic data make it possible to attach localized climatic data to each participant's location.

C.1 The GIS Process

The following discussion outlines the sources and types of data used in the RCP GIS. It also provides a brief overview of the methodology used to set up the GIS. Later in this report, we will use two examples to illustrate how the GIS is then used to address specific applications.

Types of Data, Sources and Preparation. Using GIS has become feasible for many new applications because spatial data are now readily available, and the software is more user-friendly. Detail political boundary data, street files, and census information are available on the Internet.

Boundaries: The utility boundaries were obtained for the respective utility companies. There was some overlap between utility boundaries because one utility may provide gas and the other electricity. For purposes of this GIS, the border was drawn using the electricity boundary as the border line.

Street Segmentation: The street data were downloaded from the ESRI ArcData Online web site. It is 1996 US Census Tiger digital line graph data. The datasets were downloaded by county, and merged and clipped on the basis of the utility boundaries. The streets were geocoded to prepare the line segments for address matching. This process identifies the address ranges occurring between intersections along a street segment. With this information established, the GIS can pinpoint most street addresses to a specific block and side of the street. The entire GIS contains 2,343,185 separate line segments

Census Data: The census data were downloaded from the ESRI ArcData Online web site. It is the 1990 US Census Tiger Data, broken down by census block. Census blocks are the smallest unit of aggregation of the census data. Select demographic and housing-related fields were downloaded including, number of households, average income,

census block ethnicity, and age of housing stock. There are 5,869 census tracts in the utility territories studied in California.

Participant Contractor Data: A list of contractors, who had qualified for the program was obtained from the participating utilities in the form of database files recording the contractor name, street address, type of work performed (eg. HVAC, windows, walls, plumbing, ducts). Some of the utility databases also contained the locations of all branch offices, some the number of crews, and one the counties in which the contractor provides services. The database listings were added to the GIS as tables that were address matched to the geocoded street locations, based on the main office of the contractor.⁶ There were 210 contractors included in the database.

Participant Households. A list of participants, measured as those households that have completed the vouchers form and returned it to the utility, was obtained from each utility. The exact location of each household is geocoded using the same process as was used to locate contractor locations. Also included in this database are the measures included and the amount of incentives earned.

C.2 Contractor Coverage Analysis

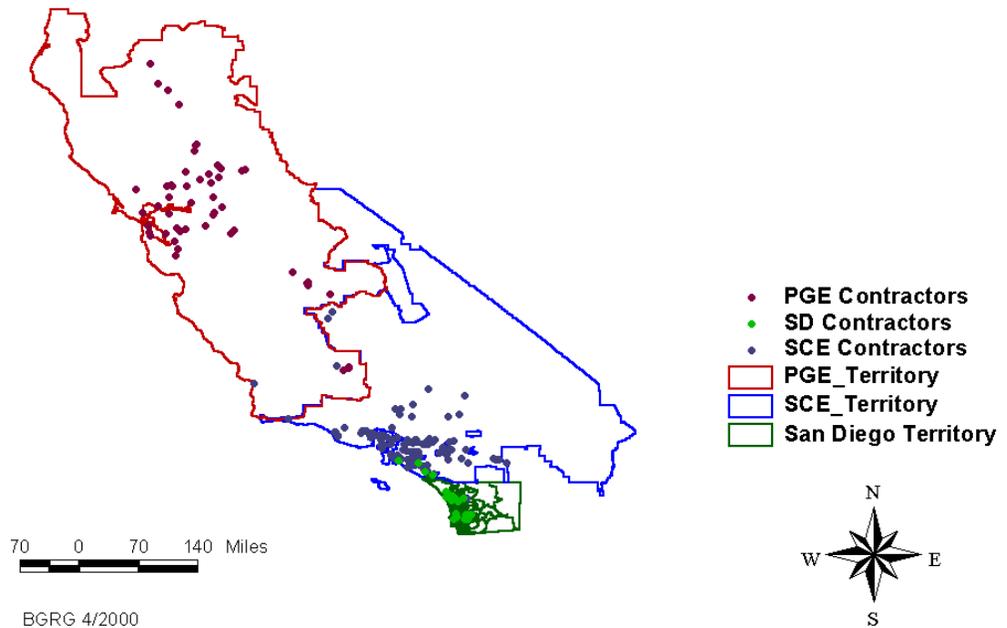
One pressing issue confronting planners is the need to know what degree of coverage there is for participant contractors over the service territories. Program managers had a rough idea of the coverage by examining the counties that contractors indicated they worked in. This gave the program managers the knowledge that some areas of their service territories were without qualified contractors. This crude assessment did not provide information on how many contractors served a particular area, nor did it provide the number of contractors as a percentage of the number of available households. To illustrate how we developed our more sophisticated assessment we provide the following case study.

As a first step, we prepared a map in which the location of each contractor's home office is plotted. Figure C.1 illustrates the results of this exercise, which provides a visual

⁶ . In some cases the ARCVIEW software cannot locate the exact address. In these cases, unmatchable addresses were manually located at the centroid of their zip code area.

product similar to the program managers' rough assessment. The map clearly outlines areas of the state where no contractors have their headquarters, but it does not really answer the question as to what areas lack contractor coverage.

Figure C.1: Location of RCP Qualified Contractors

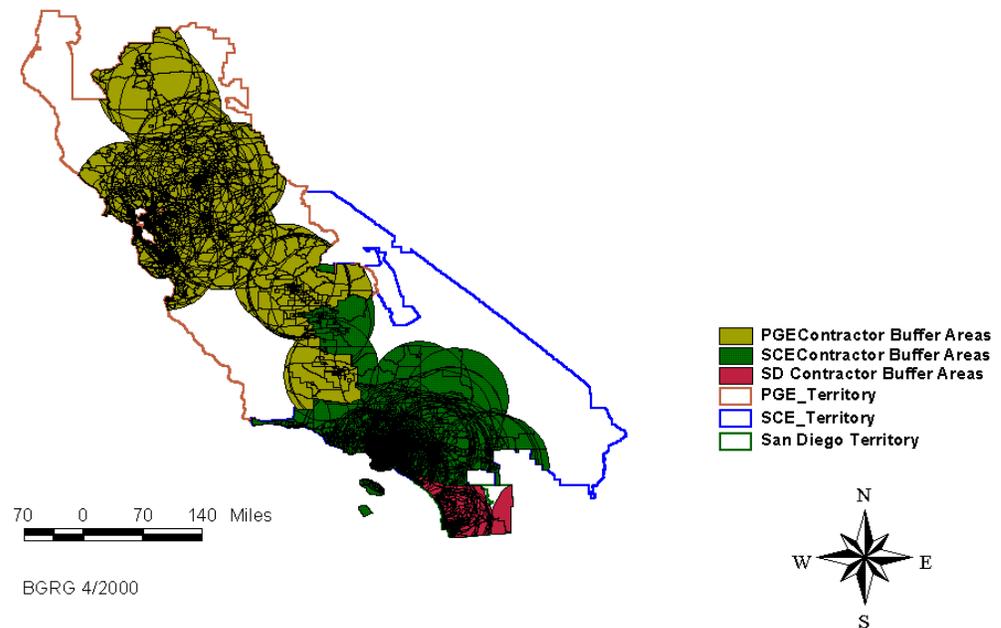


We then wanted to create a map that showed the range of area that each contractor actually covered. Each contractor has a self-determined service area. This area is somewhat fluid in that it shrinks and expands based on current workload and size of prospective job. Contractors could if asked outline the range of their service area, and we see this as a valuable exercise in the future, but at the time of the RCP study no such information was available. We knew from a baseline survey of contractors that on average they define their business range as 60 miles. This figure was clearly too high for urban areas, but our baseline data did not have enough data points to disaggregate results to a finer level. We finally settled on using a sixty mile buffer for rural/suburban areas and

thirty miles for San Francisco, Oakland, Los Angeles, San Diego, and Orange Counties. One feature of the ARCVIEW software is the ability to create a buffer area around a point. Figure C.2 shows the Contractor Range created by using the 60-mile buffer except in the urban areas where a 30-mile buffer is used.

As Figure C.2 indicates, there are still large areas of the state without any contractor coverage. While Figure C.2 can effectively illustrate areas with no coverage, it cannot effectively quantify how much coverage is available, and more importantly how does the coverage that is there compare to the number of households that potentially could be participants. We create the Contractor Coverage Potential to answer this last query.

Figure C.2: Areas of State Covered by Using 30 Mile Urban and 60 Mile Rural Travel Limits for Contractors



As we define the real issue, the objective of the analysis is to determine what the probability is that a household could be serviced by a contractor. The probability of a specific contractor servicing a household is shown in Equation 1.

$$\text{Contractor Service Probability by specific contractor} = \frac{\text{no. crews}}{\text{no. of households in contractor range}}.$$

The probability that a household will be serviced by all of the available contractors is the summation of the individual contractor probabilities for those contractors whose service territory overlaps a particular location, as shown in Equation 2.

$$\text{Overall Contractor Coverage Probability} = \sum \text{Contractor Service Probability (Equation 1)}$$

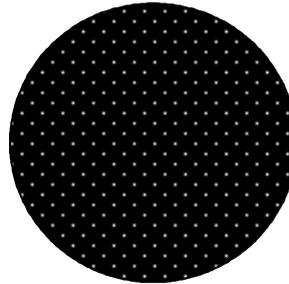
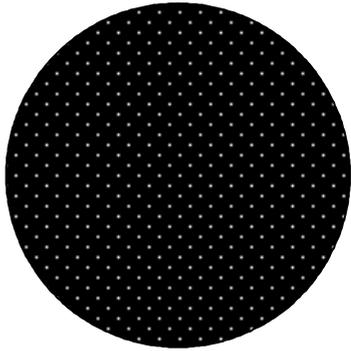
To calculate this process involved generating a dataset with topological structure so that each area within a utility region correctly accounted for probability of households being serviced by contractors within each common intersection of contractor service areas. Effectively, it requires that the database identify all of the unique combinations created when each circle in Figure C.2 is overlaid unto all of the other circles. To better illustrate this process, we have created Figure C.3. In Step 1, we calculate the Contractor Service Probability for each contractor. In Step 2, we begin overlaying the contractor circles. As can be seen, the area labeled Area A still maintains a probability of 1/100,000, and the Area B still maintains a probability of 1/25,000. The intersection of the two circles, Area AB, now has a combined probability of 1/100,000 and 1/25,000 or 1/20,000. For Figure C.3, these steps are repeated as each new circle added creates new intersections and new smaller polygons.

Figure C.3: Illustration of Contractor Coverage Probability Analysis

Step 1: Calculate Service Probability

Contractor A:

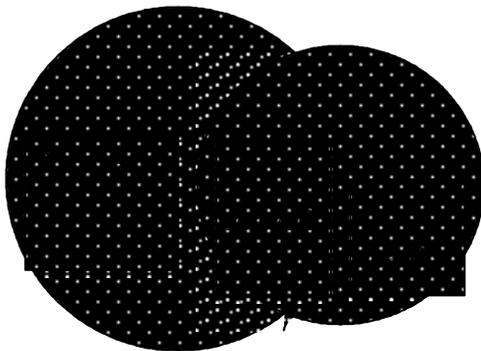
Contractor B



1 crew /100,000 households
Contractor Probability = 1/100,000

2 crews/50,000 households
Contractor Probability = 1/25,000

Step 2: Calculate Contractor Coverage Probability



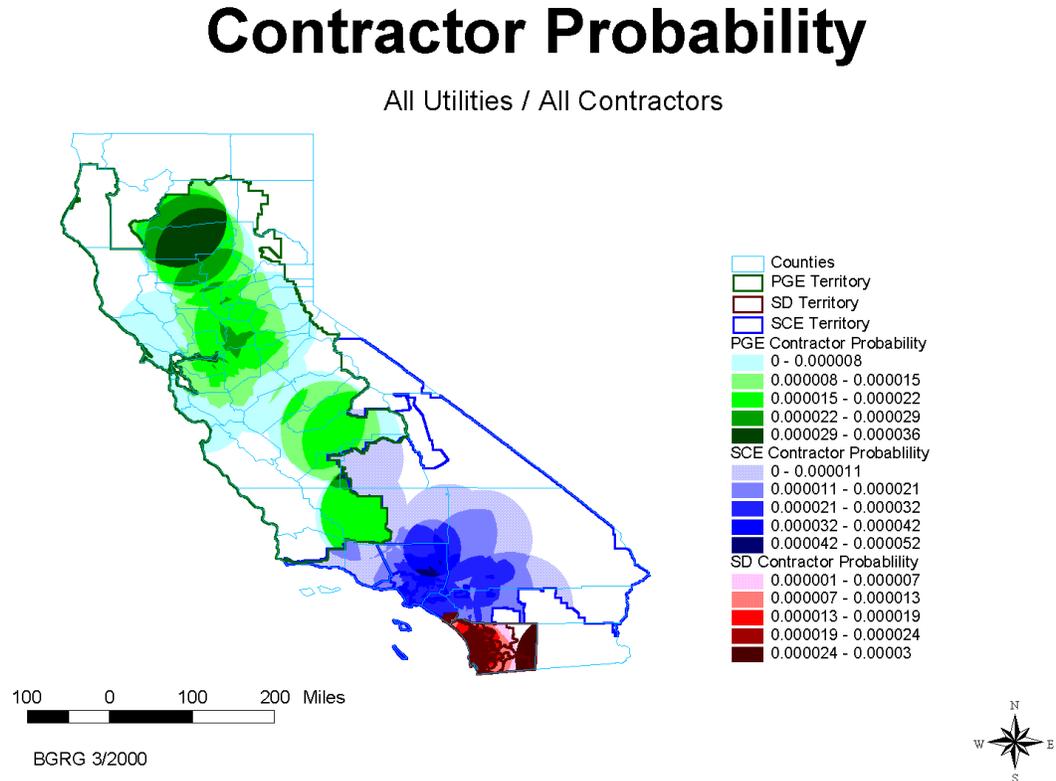
Contractor Coverage Probability

Area A = 1/100,000

Area B = 1/25,000

Area AB = 1/20,000 (1/100,000 + 1/25,000)

Figure C.4: Contractor Coverage Potential



This is an intensive computational task and it was necessary to transfer the data to a mainframe system using ArcInfo software. Even with this transfer, the overlays had to be done one at a time. Each contractor range was added and the resulting composite map was created. Then the next contractor range was overlaid to the composite map. Each time the composite was added to, the program recalculated the areas of the intersecting polygons and recalculated the probabilities. A master program was written to optimize the execution of these programs.

The resulting geo-spatial data is a new geometry displayed as a complex set of new polygons. These new polygons are formed from contractor service area buffer overlaps, each overlap consisting of a unique combination of intersections. The probability of a household in the unique buffer overlaps being serviced by a contractor is a function of the

number of households each contractor has available to service within their buffer area and the number of contractor service areas overlapping.

Figure C.4 provides the Contractor Coverage Potential for all contractor trades for all of California. Other more detailed maps are included at the end of this report. Because the number of crews and the existence of branch offices were not available for most of the contractors, the actual coverage probabilities are lower than depicted in Figure C.4. Still as Figure C.4 illustrates, using 1999 program participation data, most of the state has in fact very low probabilities of contractor coverage. Keep in mind that a contractor coverage probability of less than 1/25,000 means that it will take 25 years to service all of the homes assuming contractors can do 5 homes a day, 200 days per year.

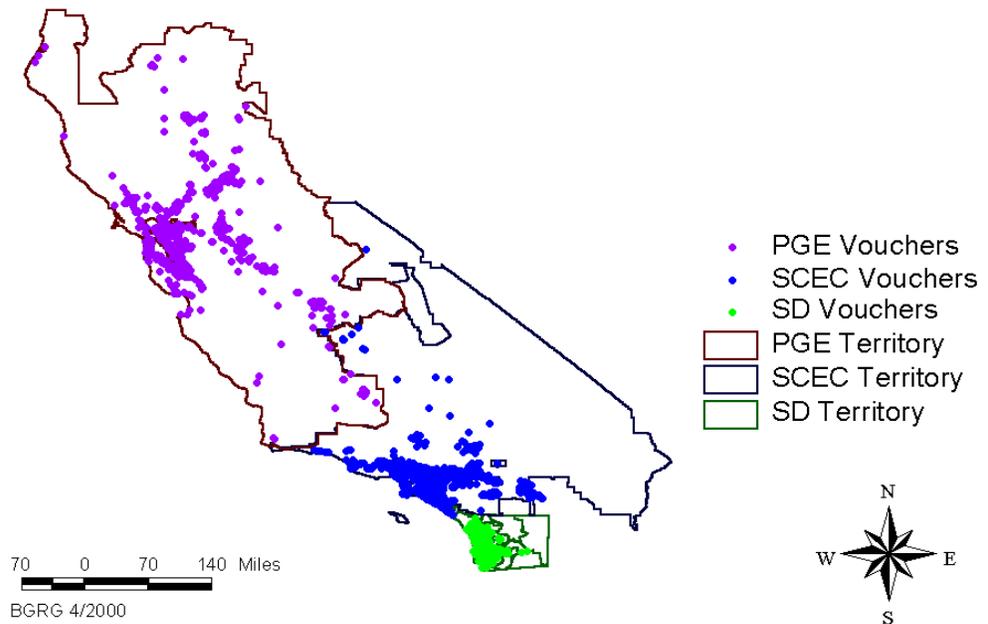
The results show that there are not enough participant contractors, in most areas of the State the coverage is so light that there is effectively no available contractors.

C.3 Case Study Two: Voucher Distribution

A second issue of concern to the program managers is the question of which residential customers are participating in the program. Many DSM programs have been criticized because they tend to attract mostly better-educated and wealthy households. Program managers are thus sensitive to this issue and need intelligence regarding who is participating. Unfortunately, the data necessary to make such an assessment is not typically available to program managers until after evaluations are completed. Utilities do not generally know the income or ethnicity of their customers unless they have entered into a payment arrangement, so the program managers generally must wait for survey results to determine program participant characteristics.

Because the GIS can pinpoint the exact location of participants, the opportunity exists to superimpose the participant data onto the underlying census data. We do this by summing incentive dollars by census tract and then using standard database queries to relate incentive dollars to average income, and ethnicity.

Figure C.5: 1999 Voucher Locations



The voucher data can be overlaid with census data to determine the types of households that are participating. This gives evaluators an approach for determining ethnicity or income level that is more reliable than post-facto survey responses. In this analysis we have aggregated the census blocks into four quartiles, based on the median income of the census block. Table C.1 gives the results of the data aggregation.

Table C.1: The Distribution of Program Benefits by Census Track Median Income Quartile

	Census Track Income Quartile	Median Income of Entire Quartile	Number of Vouchers	Total Incentive Dollars	Vouchers/ Household
PG&E	Lowest	\$25,463	365	\$63,015	0.00356%
	2 nd	\$34,212	251	\$51,218	0.00211%
	3rd	\$42,023	315	\$61,261	0.00262%
	Highest	\$53,914	246	\$42,127	0.00223%
SCE/SoCalGas	Lowest	\$26,050	1073	\$161,560	0.00907%
	2 nd	\$35,652	530	\$85,022	0.00382%
	3rd	\$43,383	505	\$95,920	0.00393%
	Highest	\$54,218	572	\$119,516	0.00460%
SDG&E	Lowest	\$26,646	36	\$5038	0.0145%
	2 nd	\$35,888	98	\$14,855	0.0371%
	3rd	\$43,484	173	\$30,034	0.0704%
	Highest	\$54,613	173	\$25,648	0.0707%

The results of Table C.1 show that for SCE/SoCalGas there is marked skewness towards support of the lowest income quartile. This is largely the impact of the single largest contractor, who has done over half of SCE/SoCalGas’s jobs, and targets the mobile home community. This emphasis on the mobile home market puts the RCP program at least for SCE/SoCalGas in a unique position of having their voucher distribution favoring the lower income areas. SDG&E which has focused mostly on air-conditioning services has a perceptible bias towards areas with higher median incomes.

The GIS gives an opportunity for further examining issues of ethnicity. In Table C.2, the distribution of census tracts by race is examined. The census tracts within each income quartile have been divided based on whether or not a voucher was redeemed by any households in that census tract. Using 1990 census data for percentage of population that is white, the race distribution of participant homes can be generally compared to the race distribution of non-participant areas. The results demonstrate that census tracts with higher percentages of white persons are more likely to have had participants in RCP.. This is particularly true of the lower income census-tract quartiles. This indicates that RCP's positive record in reaching lower-income households is not as positive in reaching non-white households.

Table C.2: Race Distribution Differentiated by Census Tracts with and without Program Participation

Income Quartiles	Percent of Entire Quartile Population that Is White	Percent of Population that is White for those Census Blocks in Quartile that Had a Participant	Percent of Population that is White for those Census Blocks in Quartile that Did Not Have a Participant
PG&E			
Lowest	61%	65%	60%
2 nd	74%	77%	73%
3 rd	76%	80%	75%
Highest	79%	82%	79%
SCE/SoCalGas			
Lowest	45%	69%	41%
2 nd	63%	70%	60%
3 rd	73%	78%	71%
Highest	81%	82%	80%
SDG&E			
Lowest	61%	66%	59%
2 nd	77%	81%	73%
3 rd	81%	84%	75%
Highest	88%	87%	89%

Table C3 shows the distribution of vouchers by percentage of population that is black. The quartile representing those census tracts with the highest percentage of black inhabitants have had the least program activity.

Table C3. Distribution of Incentives by Percentage of Black Population

Black Population Quartiles (Sorted by Percentage of Population that is Black)	Percentage of Blacks in Census Tract	Number of Vouchers Received	Amount of Incentives Received
PG&E			
Lowest	0.0-0.0080%	503	\$87,148
2 nd	0.0080-0.0224%	319	\$63,458
3 rd	0.0224-0.0675%	341	\$67,022
Highest	>0.0675%	193	\$34,100
SCE/SoCalGas			
Lowest	0.0-.0178%	1385	\$230,365
2 nd	0.0178-0.0227%	98	\$18,005
3 rd	0.0227-0.0623%	681	\$122,577
Highest	>0.0623%	516	\$91,069
SDG&E			
Lowest	0.0-0.0072%	107	\$14,640
2 nd	0.0072-0.0249%	200	\$32,382
3 rd	0.0249-0.0572%	132	\$22,191
Highest	>0.0572%	41	\$6362

Table C4 shows a similar assessment for the distribution of vouchers to Hispanic households. In SDG&E and SCE/SoCal Gas programs, the census tracts with the highest percentage of Hispanic inhabitants are receiving the least program support.

Table C4. Distribution of Incentives by Percentage of Hispanic Population

Hispanic Population Quartiles (Sorted by Percentage of Population that is Hispanic)	Percentage of Hispanics in Census Tract	Number of Vouchers Received	Amount of Incentives Received
PG&E			
Lowest	0.0-0.0616%	535	\$96,464
2 nd	0.0616-0.1061%	250	\$46,947
3 rd	0.1061-0.2028%	226	\$44,765
Highest	>0.2028%	345	\$63,552
SCE/SoCalGas			
Lowest	0.0-0.1031%	682	\$122,604
2 nd	0.1031-0.2180%	1244	\$210,461
3 rd	0.2180-0.4448%	635	\$109,514
Highest	>0.4448%	119	\$19,437
SDG&E			
Lowest	0.0-0.077%	155	\$22,233
2 nd	0.077-0.0113%	161	\$27,118
3 rd	0.0113-0.0222%	104	\$17,283
Highest	>0.0222%	60	\$8,941

C.4 Discussion of Other Applications

The two case studies only begin to describe the full potential of GIS as a planning and evaluation tool. Now that the GIS is in place, the program managers can use the system to explore numerous other activities. We discuss five more below.

The addition of climatic data allows the program managers to create their own climatic zones or to analyze the existing participation using the 16 California climatic zones. One particularly pressing issue that is needed is to analyze the cost-effectiveness of the various technologies that are part of the program. As it stands now, neither the program managers nor the contractors know what the paybacks are for the measures that

are in the program. The GIS system could establish a payback map for each measure based on the underlying climatic conditions and simple engineering assumptions.

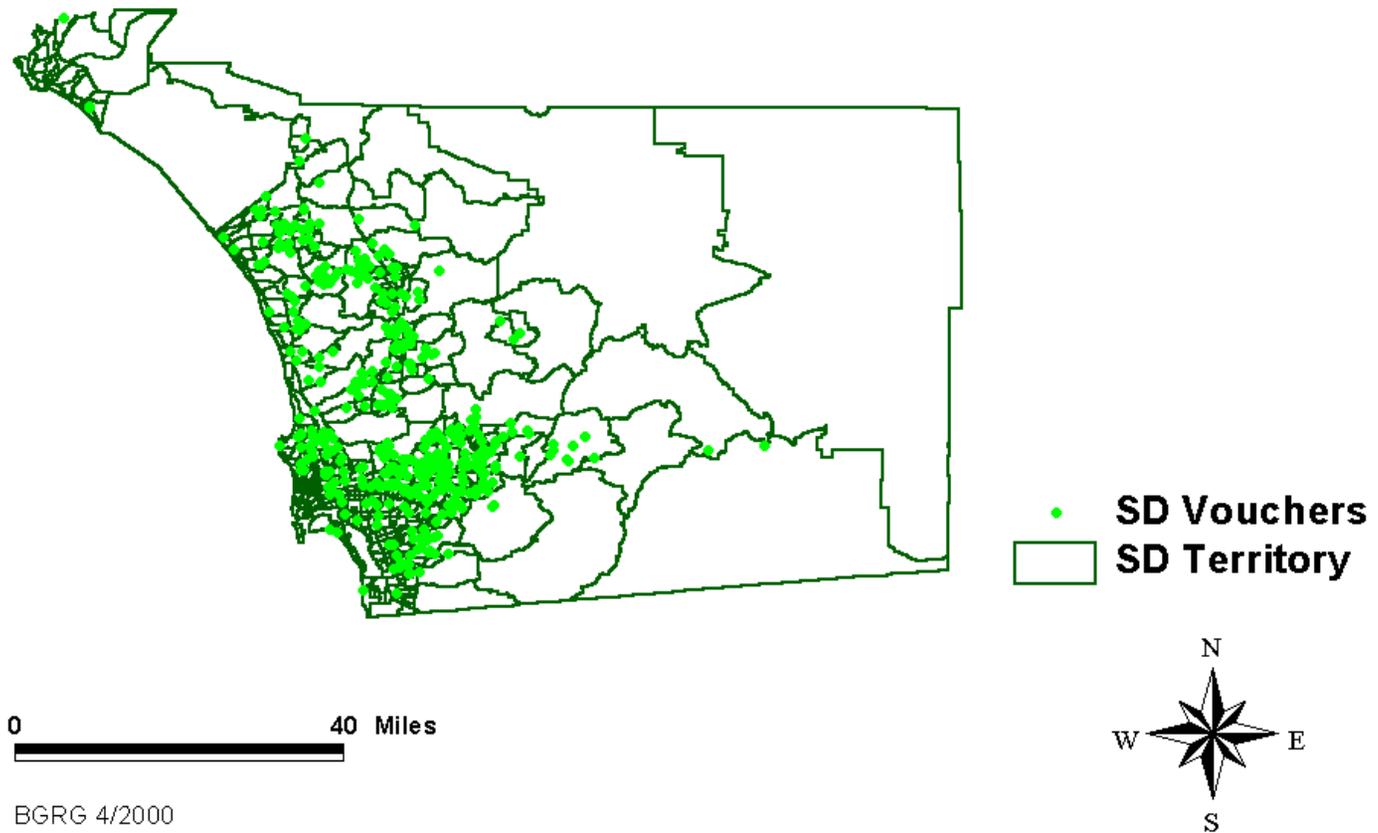
An enhancement to the payback map would be to have a map of overall measure potential. This assessment would require the development of a housing status survey that indicates what measures have already been adopted and what measures still could be potentially installed. The GIS could use these data to create a map showing the local potential for each measure across the state.

A part of the RCP program includes a contractor referral service. Potential participants call the hotline or check an Internet site to find qualified contractors. Names of local contractors are given to the caller. Right now, the definition of local is at the zipcode level or county level. If each participating contractor drew an outline of their service territory, the caller could be given a more accurate list of contractors who would actually be willing to serve that caller.

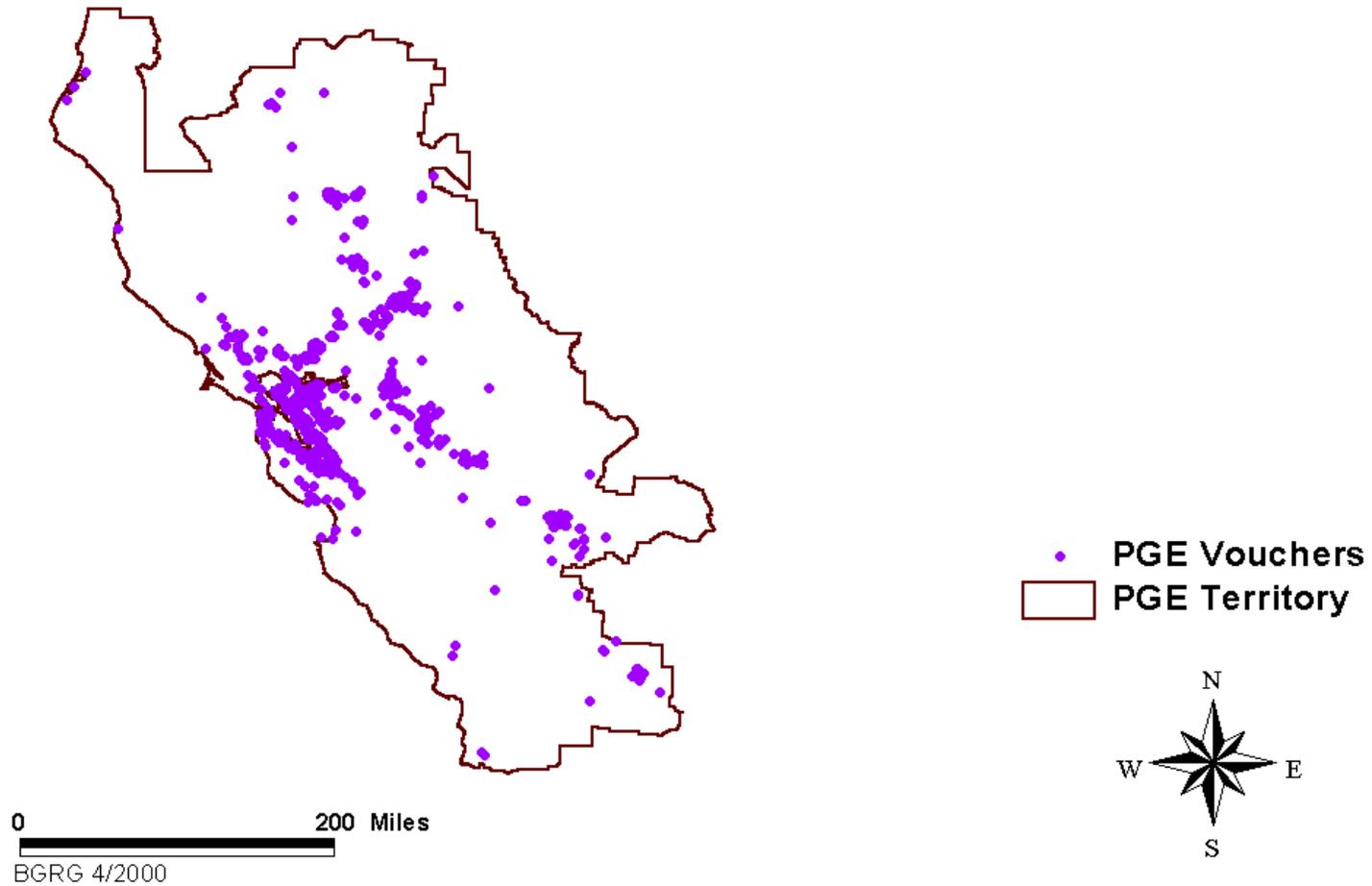
The GIS can also be used to implement targeted marketing. Program managers can send information to customers in specific areas where participation is low or where program potential is high. Using the GIS to affect this target marketing will better pinpoint the target audiences.

Perhaps the most important future opportunity for GIS lies in its ability to tract market effects. The GIS if used over time can tract the development of the market for the program measures. The introduction of new contractors into areas not previously served, and the initiation of participants in new market areas constitute the types of market effects that RCP as a market transformation program are designed to encourage. The GIS can be used to identify these effects both on a strictly spatial basis, and also using the underlying demographic data, or to measure potential data described as the second enhancement above. This tool would be a vast improvement over today's approach that essentially treats all potential households as homogeneous.

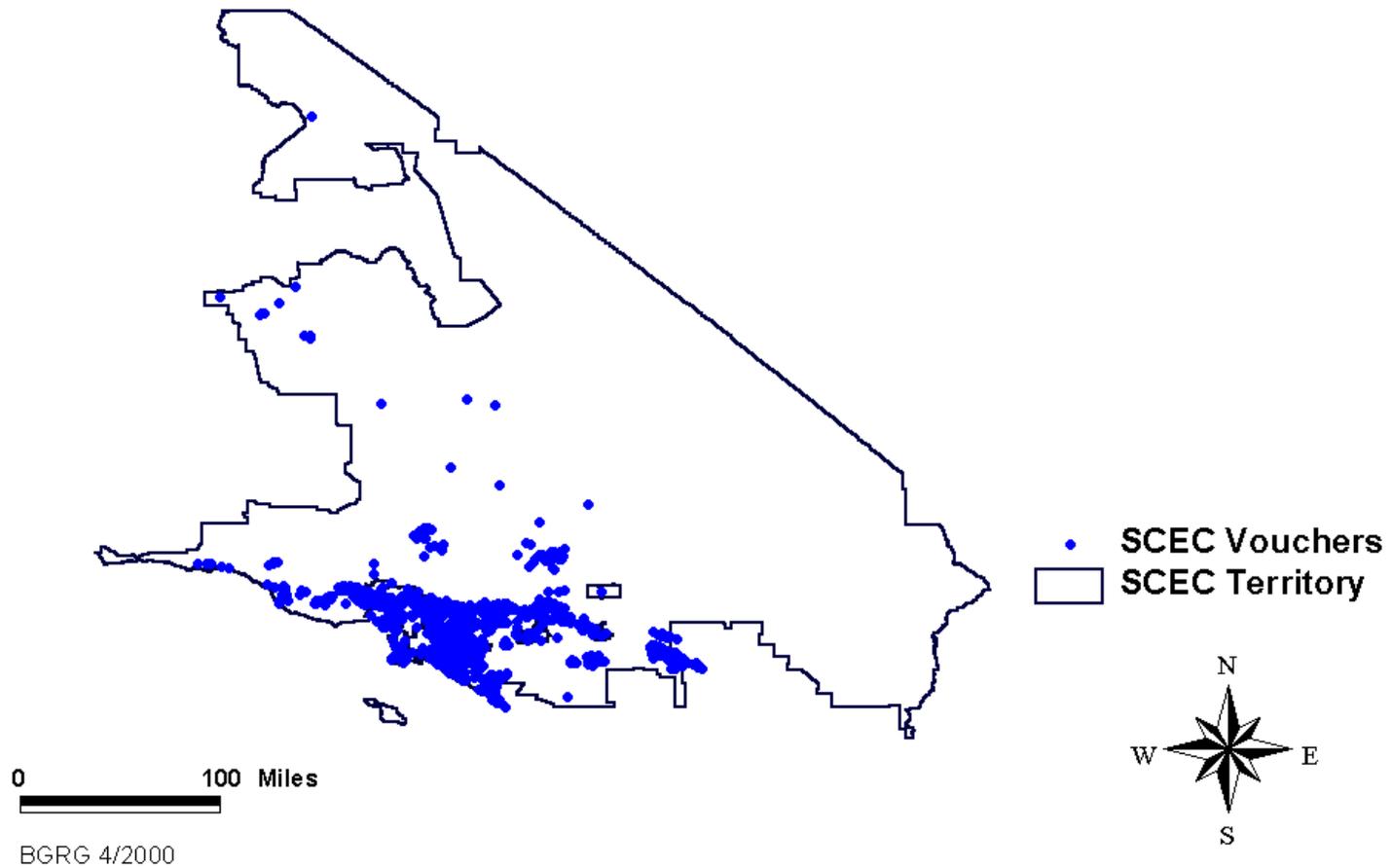
Vouchers Received in SDGE Area



Vouchers Received in PGE Area

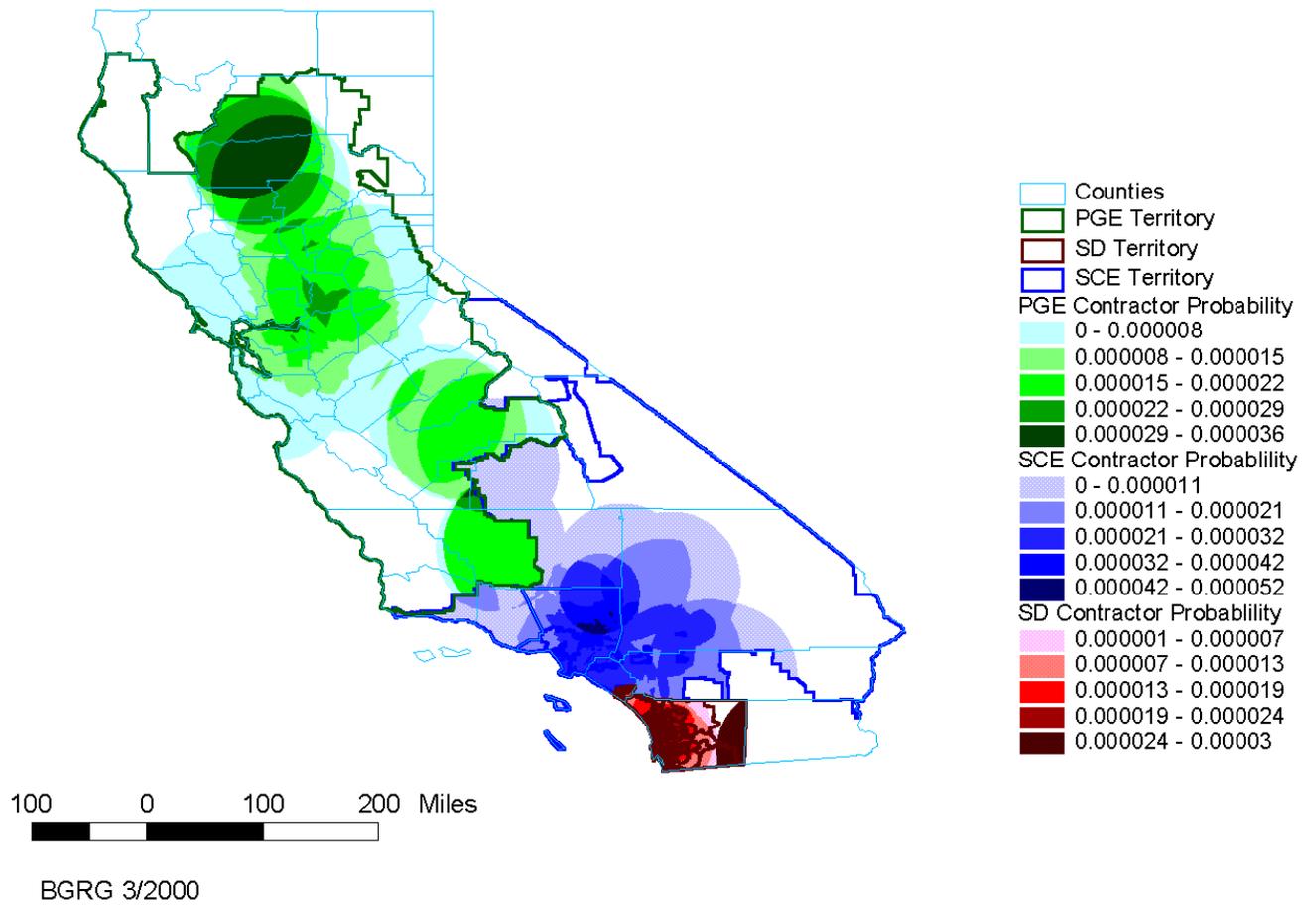


Vouchers Received by Location in SCE/Socal Region



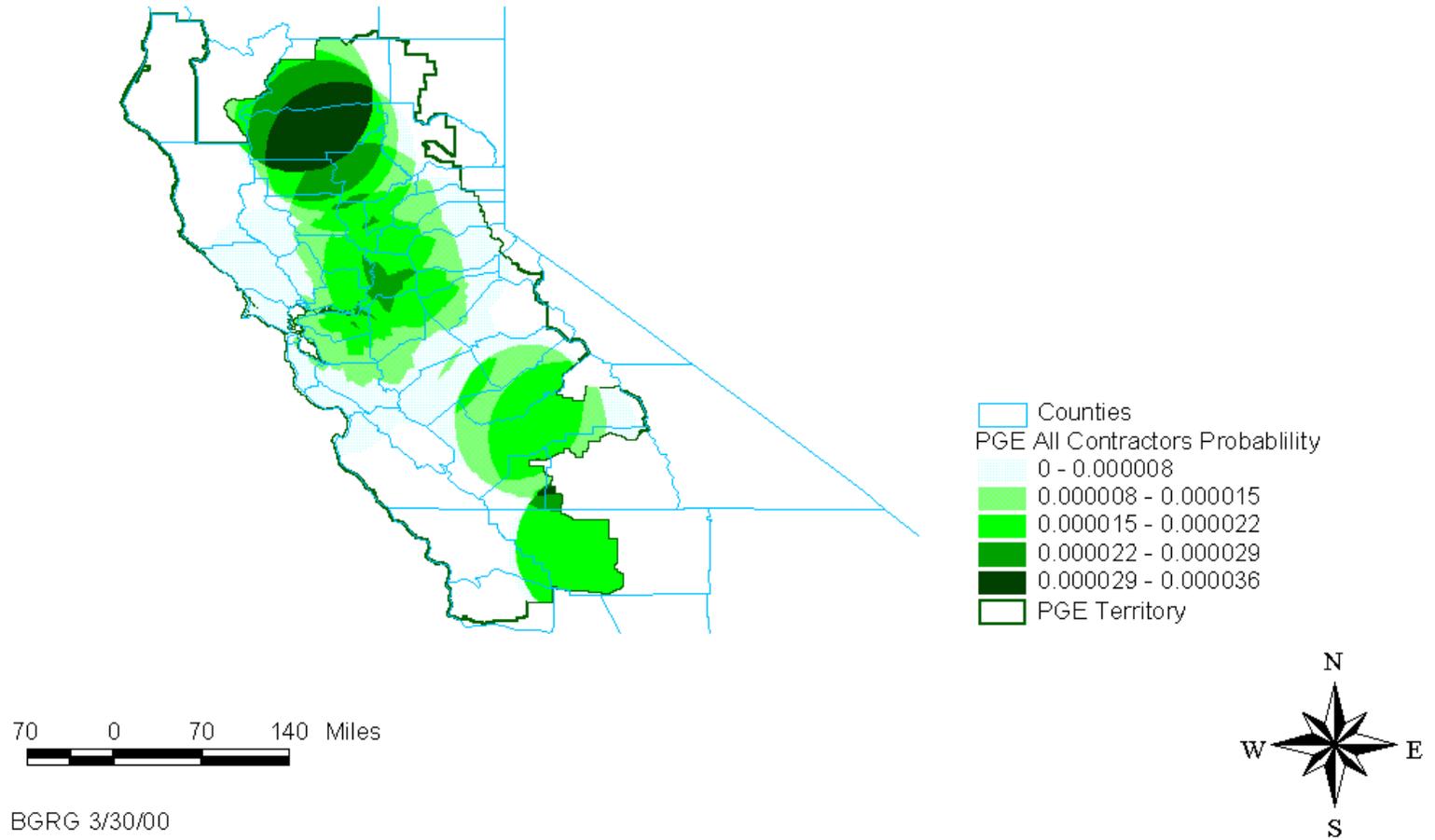
Contractor Probability

All Utilities / All Contractors



PGE Contractor Probability

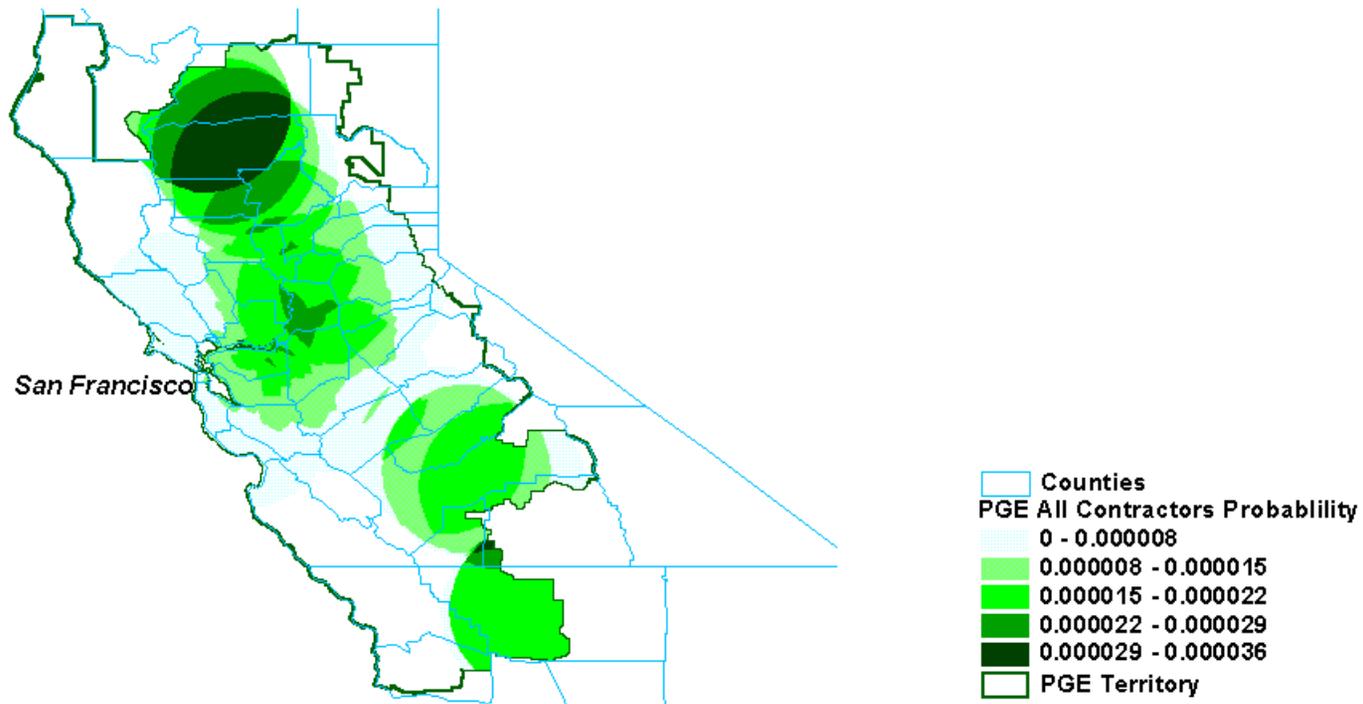
(All PGE Contractors)



BGRG 3/30/00

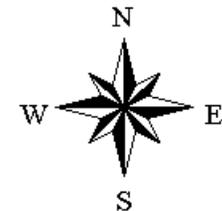
PGE Contractor Probability

(All PGE Contractors - Northern California)



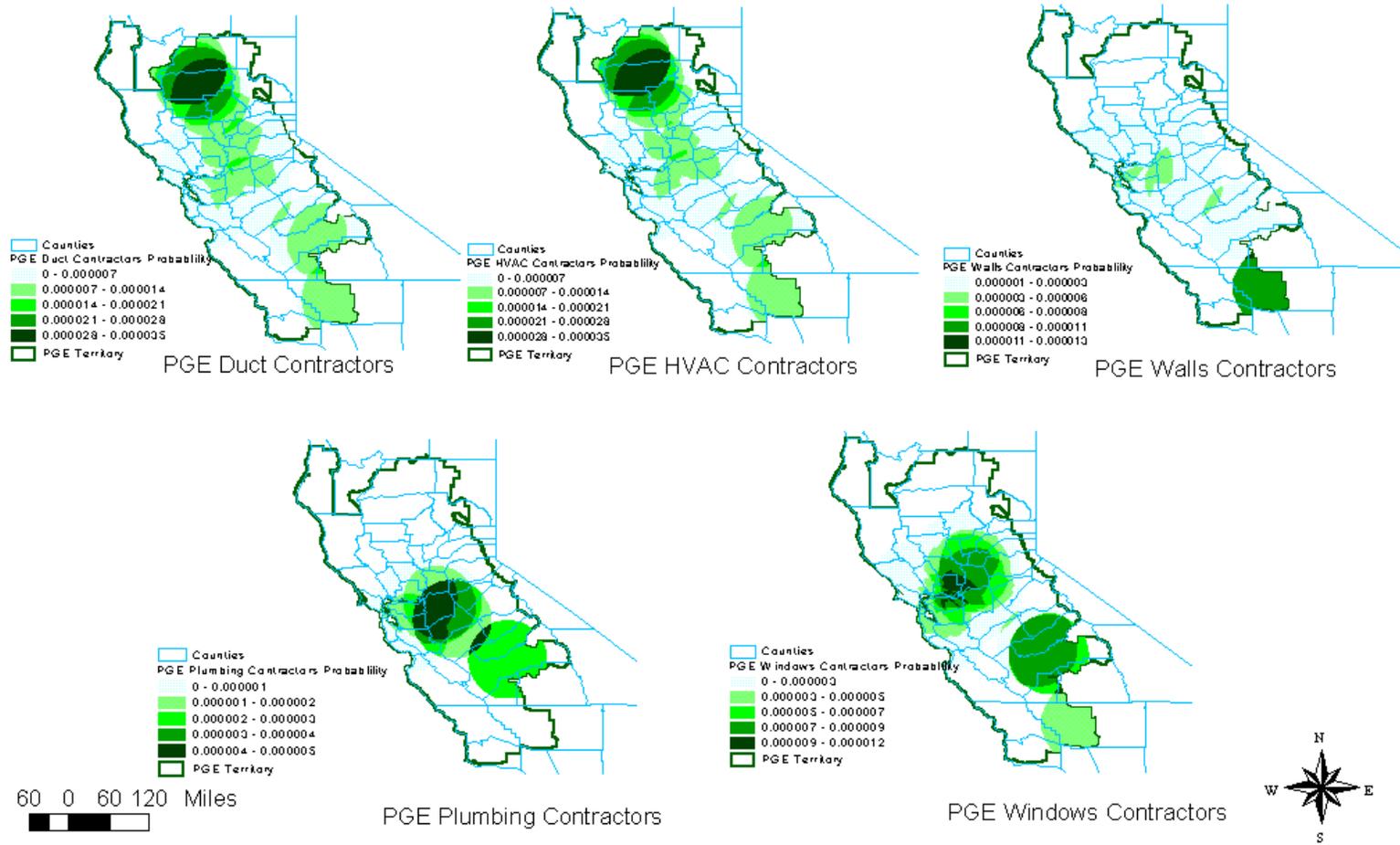
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BGRG 3/30/00



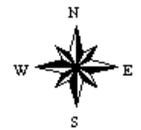
PGE Contractor Probability

(All Contractor Types)



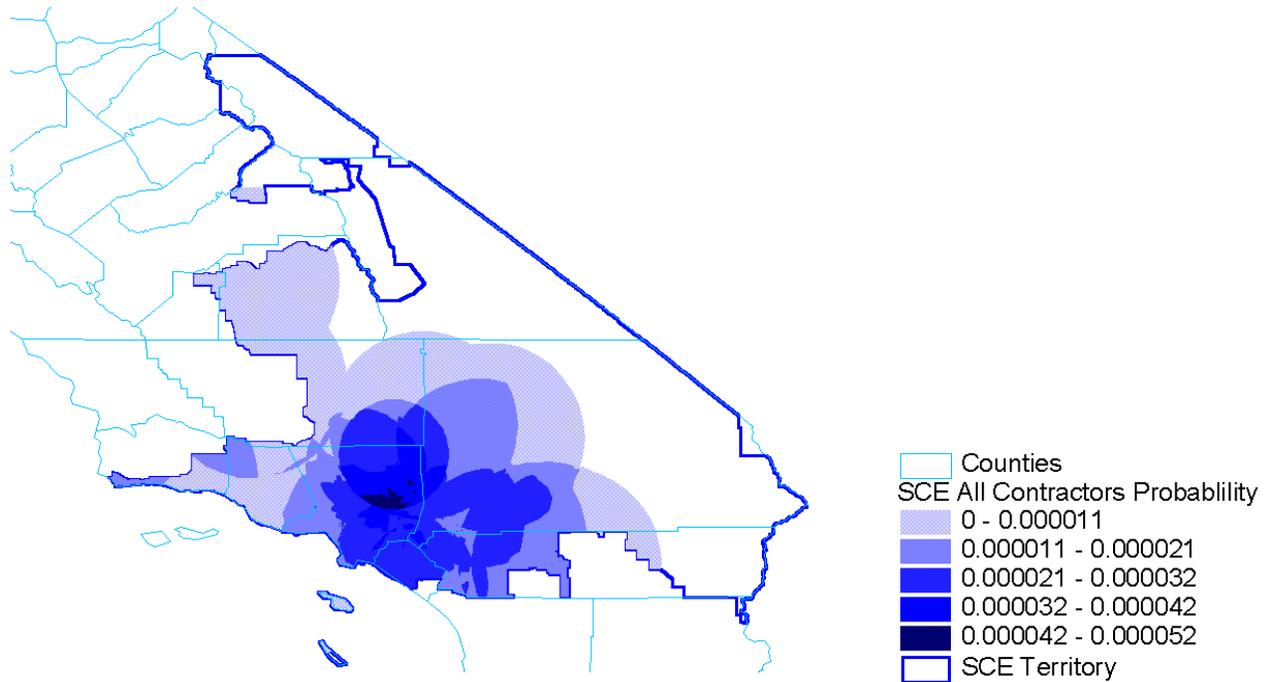
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BGRG 3/30/00



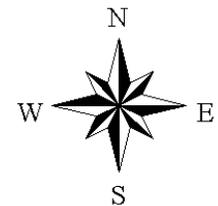
SCE Contractor Probability

(All SCE Contractors)



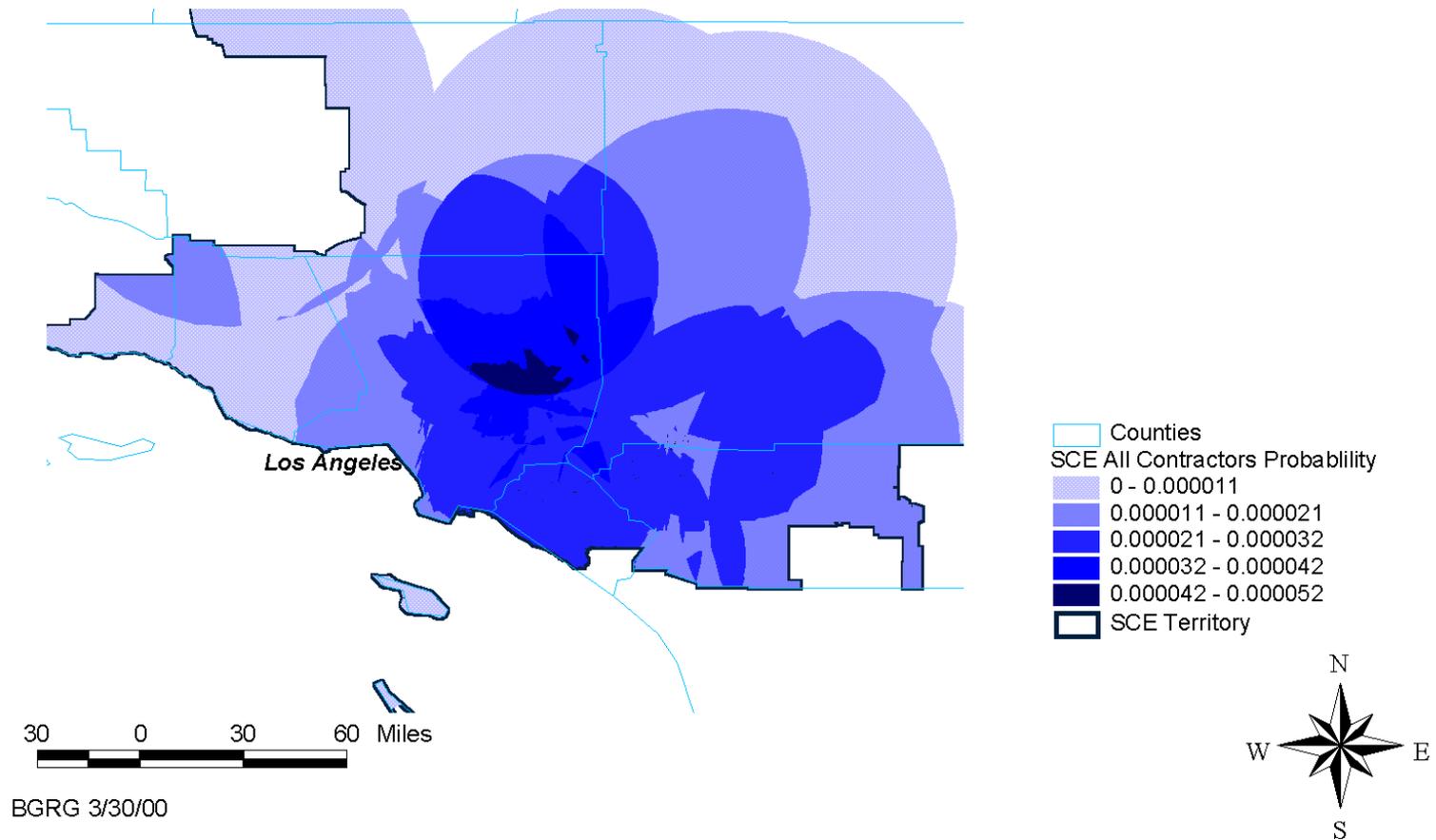
60 0 60 120 Miles

BGRG 3/30/00



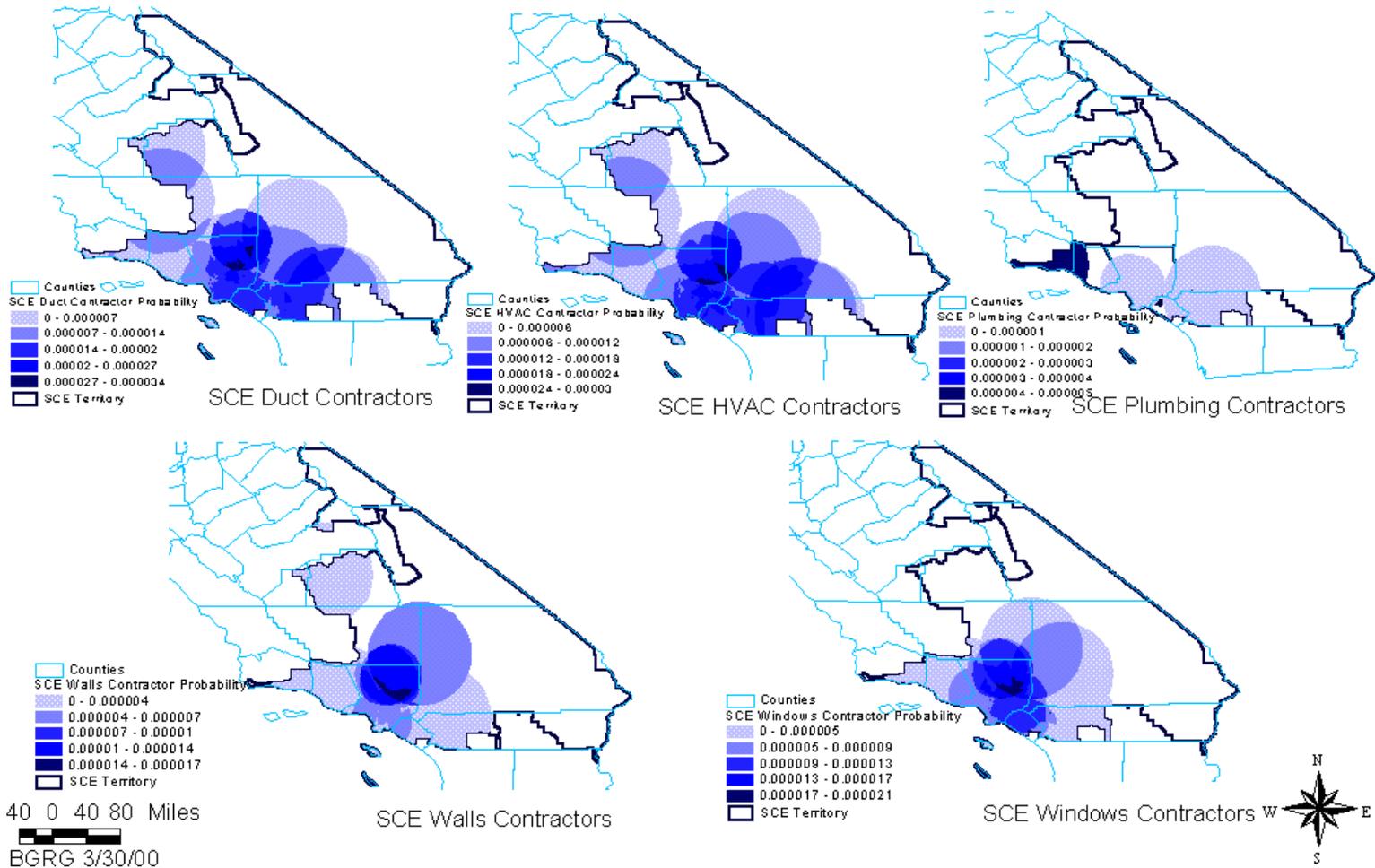
SCE Contractor Probability

(All Contractors - Los Angeles Metropolitan Area)



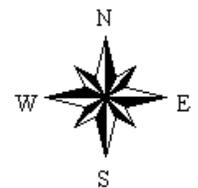
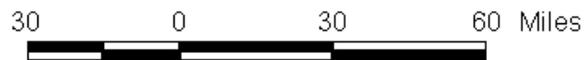
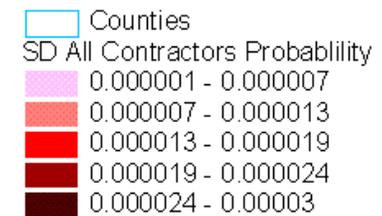
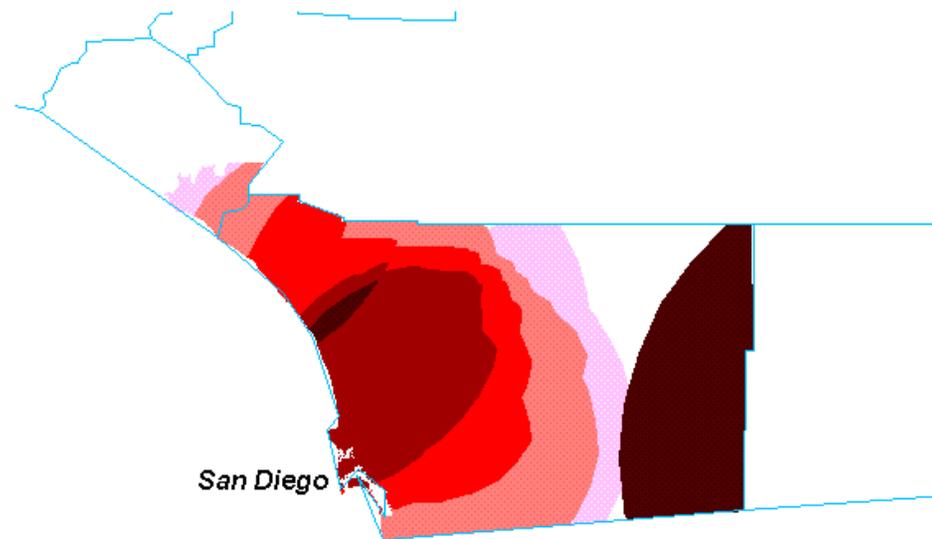
SCE Contractor Probability

(All Contractor Types)



San Diego Contractor Probability

(All Contractors)



San Diego Contractor Probability

(All Contractor Types)

