Phase II
Low Income Needs Assessment

Volume 1
Final Report

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1. Executive Summary

1.1 Background

This report presents the findings of Phase II of the California Public Utilities Commission (the Commission) Low Income Needs Assessment Study. The needs assessment was conducted in two phases. Phase I was essentially a scoping study designed to direct the focus of the needs assessment, to identify data sources that can be used in the assessment of needs, and to design a means of collecting data that are not already available. Phase II has involved the execution of the needs assessment, including the analysis of existing data and the collection and analysis of additional primary data.

1.2 Phase II Objectives and Tasks

The principal objectives of Phase II were to:

- Characterize and assess the energy-related needs of California's low income population, including:
    - Identifying needs that are being met by existing programs,
    - Identifying service gaps not being addressed by existing programs, and
    - Identifying barriers that cause service gaps.
- Make recommendations on appropriate and effective methods for meeting energy-related needs in light of these potential barriers.
- Develop baseline estimates of the potential for CARE and LIEE, as well as methods for tracking changes over time.

To address these objectives, the following data collection and analysis tasks were implemented as part of Phase II:

- Census data collection and analysis
- Onsite survey data collection and analysis
- Analysis of program eligibility, penetration and potential
- Segmentation analysis

Each of these tasks is described in detail in Section 3. Subsequent sections of this report include the detailed results of the characterization analysis (Section 4), a comprehensive summary of the results of the

needs assessment (Section 5), the results of the analysis of energy savings potential for the LIEE Program (Section 6), and a set of recommendations for program targeting, outreach, design, and delivery (Section 7). These recommendations have been developed based on the results of a segmentation analysis, as well as the findings from the characterization, needs assessment, and energy savings potential analyses presented in Sections 4 through 6. Finally, we conclude with Section 8, which provides a summary of the methods developed as part of this study to update eligible population estimates and track energy savings potential over time.

1.3 Summary of Key Findings and Recommendations

The needs assessment was designed to answer the following questions:

- How many households are eligible for CARE and the LIEE Programs?
- How many households are enrolled in CARE and have recently participated in LIEE?
- What is the remaining potential for CARE?
- What LIEE measures are needed among eligible households?
- What is the available energy savings potential from LIEE?
- Are the programs reaching the appropriate targets? Are there significant under- or over-served segments?
- Are the programs achieving maximum potential? What strategies should be used toward this end?
- Is there adequate coordination among the IOUs, SMJUs, municipal utilities and other (non-regulated) energy service providers?

The results of the needs assessment suggest that, over time, the programs have effectively targeted and provided services to low-income households that have the greatest need. As of year-end 2006, however, there remains significant untapped potential in terms of the number of eligible households not enrolled in CARE and the number of households for which LIEE measures would be technically feasible, applicable and needed.

1.3.1 How many households are eligible for the CARE and LIEE Programs?

As shown in Table 1-1, one in three of California's households (33%) qualified for the CARE and LIEE Programs in 2006. That is, nearly 4 million households out of a total 2006 statewide population estimate of just over 12 million households.

Table 1-1
Estimates of CARE and LIEE Program Eligibility (2006)
(Statewide and by IOU/Commodity)

	Total Households Technically Eligible for CARE [1]	CARE Eligible Households (200%)	Percent CARE Eligible (200%)	Total Households Technically Eligible for LIEE[1]	LIEE Eligible Households (200%)	Percent LIEE Eligible (200%)
Statewide	**12,192,996**	**4,012,010**	**33%**	**12,192,996**	**4,012,010**	**33%**
IOU (Commodity)						
PG&E (electric and gas)	3,160,349	870,432	28%	3,160,349	870,432	28%
PG&E (electric only)	1,341,454	463,571	35%	1,443,690	504,540	35%
PG&E (gas only)	847,735	267,235	32%	1,533,468	493,622	32%
SCE	4,240,631	1,351,845	32%	4,271,645	1,365,633	32%
SCG	5,267,327	1,762,569	33%	5,826,634	2,005,118	34%
SDG&E (Electric)	1,203,806	335,015	28%	1,343,769	394,242	29%
SDG&E (Gas)	831,970	233,302	28%	1,045,003	322,179	31%

[1] Technical eligibility distinguishes individually metered from sub-metered/subunit households. CARE and LIEE programs have different requirements with regard to sub-metered households (i.e., sub-metered households are eligible for CARE, whereas LIEE requires that 80% of the units in a sub-metered property must be income eligible in order to qualify for the program).

1.3.2 How many households are enrolled in CARE and have recently participated in LIEE?

Table 1-2 displays estimates of CARE and LIEE Program penetration. For CARE, year-end 2006 penetration ranged from 66% for SDG&E to 78% for SCE. Annual penetration for LIEE ranged from 2-4%, which is consistent with prior years.

Table 1-2
Estimates of Annual CARE and LIEE Program Penetration (2006)
(2006, by IOU)

	CARE Eligible Households (200%)	CARE Participants	**Annual CARE Penetration**	LIEE Eligible Households (200%)	LIEE Participants	**Annual LIEE Penetration**
PG&E	1,601,238	1,133,663	**71%**	1,868,594	58,250	**3%**
SCE	1,351,845	1,055,710	**78%**	1,365,633	53,004	**4%**
SCG	1,762,569	1,264,264	**72%**	2,005,118	36,852	**2%**
SDG&E [1]	335,015	220,010	**66%**	394,242	13,965	**4%**

[1] SDG&E CARE penetration estimate is based on the electric tariff counts of CARE participants and the electric service counts of CARE eligible households.

1.3.3 What is the remaining potential for CARE?

Table 1-3 shows the number of eligible households not enrolled in CARE at year-end 2006. As shown, nearly 500,000 eligible households in SCG's service area and another 500,000 eligible households in PG&E's service territory were eligible but not enrolled in CARE in 2006. Nearly 300,000 SCE customers and just under 115,000 SDG&E customers were eligible but not enrolled in CARE in 2006.

Table 1-3
Eligible Households Not Enrolled in CARE (2006)

IOU	**Number of Eligible Households Not Enrolled in CARE (2006)**
PG&E	464,359
SCE	297,406
SCG	493,519
SDG&E	113,905

1.3.4 What LIEE measures are needed among eligible households?

Table 1-4 shows the number of households where there is a need for LIEE measures that would be technically feasible and applicable to install. As shown, CFLs, faucet aerators, water heater pipe wrap and blankets, and weatherstripping were among the most commonly applicable and needed measures. Measures that were applicable and/or needed least often include central AC replacements, water heater replacements, duct testing & sealing measures, and furnace replacements.

Table 1-4
Number of Eligible Households Where LIEE Measures are Applicable and Needed (2006)

Measure	Number of Eligible Households Where LIEE Measures Applicable and Needed (2006)
CFLs	3,661,557
Faucet Aerators	2,293,503
Water Heater Pipe Wrap	2,253,266
Weatherstripping	2,213,029
Water Heater Blankets	2,052,081
Refrigerator Replacement	1,368,054
Low Flow Showerhead	1,327,817
Hardwired Porch Light Fixture	1,247,343
Ceiling Insulation	1,166,870
Caulking	1,086,396
Room AC Replacement	519,056
Furnace Repair	511,008
Evaporative Cooler Replacement	321,895
AC or Evaporative Cooler Cover	241,421
Furnace Replacement	160,948
Duct Testing & Sealing	120,711
Water Heater Replacement	40,237
Central AC Replacement	8,047

1.3.5 What is the available energy savings potential from LIEE?

The needs assessment determined that 584 GWh and 84 Mth in energy savings potential is available from eligible households who would be willing to participate in the LIEE Program. For electricity, the measures with the largest available energy savings potential are CFLs, replacement refrigerators, and ceiling insulation. Measures with the largest available natural gas savings potential include ceiling insulation and water heater tank wraps. Figures 1-1 and 1-2 present the share of total available electricity and natural gas savings potential by end-use.

Figure 1-1
Percentage of Available Electricity Savings Potential, by End-Use

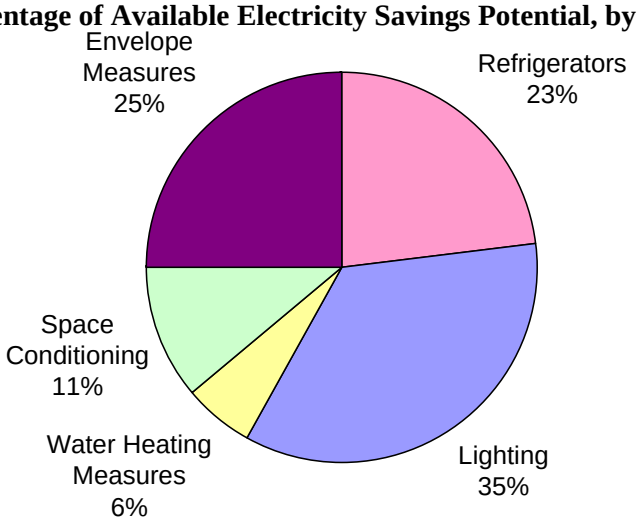
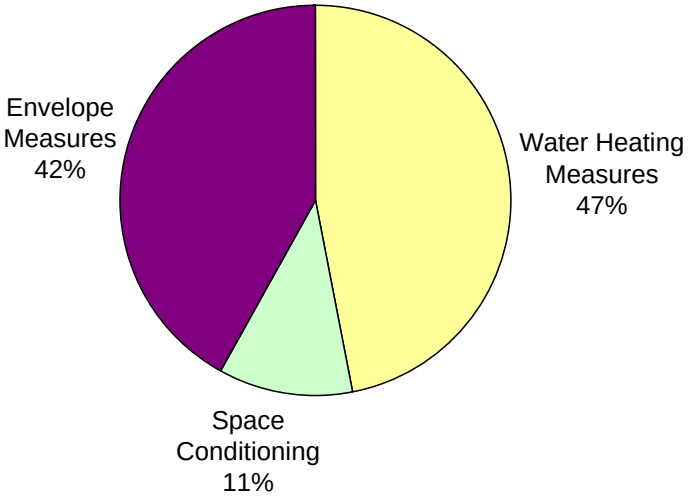


Figure 1-2
Percentage of Available Natural Gas Savings Potential, by End-Use



1.3.6 Are the programs reaching the appropriate targets? Are there significant under- or over-served segments?

Generally, the results of the needs assessment suggest that the programs have effectively targeted and provided services to low-income households that have the greatest need. The outreach and delivery channels have been effective in addressing the wide range of characteristics exhibited in the population. There are few, if any, geographic or demographic groups that have been missed or overlooked. And, participation does not appear to be overextended to one particular group.

Recommendations:

- *Continue to actively recruit and enroll households in areas were the programs have already had success.* The needs assessment indicated that eligible households not currently enrolled in the programs exhibit the same (or similar) characteristics as those households who have already or are currently participating (e.g., Hispanic households, larger families, and households with limited educational backgrounds). The programs, should continue – and aggressively expand – efforts to target these types of low-income households as they represent those with the greatest need and interest in participating.

- *In addition, efforts to increase penetration within these demographic groups should require little modification to the existing outreach and delivery channels.* The programs have been successful in reaching low-income households through channels they frequently access and, potentially, even more effective at engaging local resources to more cost-effectively reach and deliver program services. The utilities should continue to use bill inserts and other direct mail efforts to raise awareness and continue to promote the programs via non-English media sources (e.g., TV, radio and/or newspapers written in non-English languages). The utilities should continue their work with local, community-based organizations and government agencies to cost-effectively generate qualified and quality leads for the programs.

1.3.7 Are the programs achieving maximum potential? What strategies should be used toward this end?

While penetration rates for CARE were fairly high under the prior eligibility standards, the new standards leave substantial room for expansion. In addition, there is significant untapped potential for LIEE. The needs assessment has developed a number of recommendations that should be considered to ensure that, going forward, the program continues to successfully address the needs of low-income households for whom the programs would provide the greatest benefit.

Recommendations:

- *More aggressive strategies are needed to achieve higher penetration in areas where there do not appear to any unique challenges to expanding participation.* Eligible households from areas such as San Diego County and the Central Valley region (climate zone 12 in particular) exhibit many of the same characteristics as participating households, they have the same level of need, are willing to participate, and are easily accessible through existing outreach and delivery channels. Yet, penetration levels in these areas are not as high as they appear they could be. The needs assessment did not reveal any obvious reasons or explanations for why participation appears to be lagging in these areas. This is not meant to be a criticism of the efforts undertaken to encourage participation in these areas (or others with similar characteristics). Rather, we are suggesting that more aggressive efforts and strategies are likely to be successful in achieving higher penetration.

- *Expand efforts to target households with special needs and African-American households.* The needs assessment indicated that eligible households with disabilities and African-American households demonstrate significant need for the programs' services and would be willing and relatively straightforward to recruit. However, participation from these segments appears to be lagging behind need and, as such, more aggressive efforts to target these important groups should be pursued.

- *Recognize and encourage increased participation from large-sized families.* These households have limited household resources (which are stretched across many household members) and other important burdens and responsibilities (e.g., caring for elderly family members, raising children). As such, the programs should be credited for the efforts to assist these families and continue to find new and innovative ways to serve these important members of the low-income population.

- *Develop creative efforts to increase participation in remote areas and "needle in the haystack" areas.* "Needle in the haystack" areas are moderate to heavily populated areas where the incidence of low income households is relatively low. Other than where they live and how difficult (expensive) it would be to find them, we do not see any unique characteristics in these households that would indicate they are not interested in participating or would not benefit from the programs' services. However, the existing outreach and delivery efforts do not appear to have been as effective in generating participation from within these isolated areas. We recommend the Commission work the utilities, local governments, and the relevant community-based organizations to develop creative and cost-effective channels through which locate eligible households from these areas.

- *Target high consumption households.* Use annual energy consumption metrics, as well as seasonal and above-baseline benchmarks, to develop targeted marketing lists for CARE and LIEE recruitment efforts. There are many low-income households that are not currently enrolled in CARE that use considerably higher amounts of energy (both electricity and natural gas). These nonparticipating households also exhibit high seasonal (winter and summer) and above-baseline consumption patterns. The utilities should use the results of the needs assessment to develop the appropriate criteria for these metrics (e.g., above 1,500 kWh during the winter months), and then develop recruitment lists to proactively target nonparticipating households who meet these criteria. The Commission should require the utilities to report how many households are participating that meet or exceed these criteria.

- *Target high-benefit LIEE measures.* Continue to target housing characteristics for which the LIEE Program can provide the greatest benefit. The needs assessment analysis has identified many features of low-income housing that should (continue to) be targeted as they represent the most substantial opportunity for energy savings through the LIEE Program.

- *Continue to look for ways to simplify/streamline the application process.* Many households who are eligible for CARE and LIEE are already aware that the programs exist, but they are unwilling to participate because of what they find to be real (not just perceived) barriers to participation. These households feel the applications are confusing, that it is difficult to apply, and that it takes too long to get the services from these types of programs. The Commission should review the success the utilities have been having with some of the application processing changes initiated through the 2005-2006 Winter Initiative (e.g., qualification based on neighborhood, automatic enrollment in LIEE if eligible for CARE, etc.). Areas with the greatest success should be expanded.

- *Some barriers simply cannot be overcome and resources may be better spent elsewhere.* The programs should make every effort to make sure all households eligible for these programs are aware of them, that they clearly understand what is and is not required of them to qualify, and they understand how and why they are being asked to participate. If a household is still unwilling or unable to comply with the requirements and/or are otherwise not interested in participating, then program outreach specialists should move on as it is likely that there are others who would be better served.

1.3.8 Is there adequate coordination among the IOUs, SMJUs, municipal utilities and other (non-regulated) energy service providers?

The needs assessment indicates that there is room for improved coordination in areas served by more than one utility, as well as areas where a considerable number of eligible households use non-regulated fuels for space heating and water heating. The following recommendations are provided to ensure that, going forward, the program continues to successfully address the full spectrum of energy-related needs of low-income households.

Recommendations:

- *Encourage coordination among IOUs, SMJUs, municipal utilities, and other energy service providers.* The needs assessment indicates that there is considerable room for improved coordination in areas served by more than one utility. Key areas include Los Angeles and Sacramento Counties, where eligible households receive overlapping services provided by the IOUs and large municipal utilities (LADWP and SMUD, respectively). In addition, improved coordination should be encouraged in less populated areas with overlapping services provided by IOUs and SMJUs. In addition, coordination among IOUs with overlapping service territory – e.g., Orange, King and Kern. We recommend that the Commission require each IOU and SMJU to document its efforts to encourage coordination among all relevant energy utilities in the areas they serve.

- *Investigate opportunities in non-regulated energy service providers (e.g., propane distributors/equipment sales).* Because eligible households can use non-regulated fuels for space heating and water heating, there are likely to be challenges to delivering comprehensive services through the IOU and SMJU LIEE Programs. There may not be much that the Commission can require the utilities to do here. However, if we use the example of water utilities coordinating with the IOUs to deliver complementary program services, we see that there could be opportunities worth exploring. The Commission should investigate the extent to which local distributors and contractors would be willing to participate in the LIEE Program and provide support for the delivery of weatherization and other types of relevant measures.

2. Introduction

2.1 Study Background

Under the jurisdiction of the Commission, the publicly owned energy utilities in the state of California offer low-income assistance programs to qualified low-income customers. The first of these programs is the California Alternate Rate for Energy (CARE) Program. CARE provides a rate discount to qualified low-income customers who request to participate. Funding for the CARE Program is uncapped; that is, all qualified customers who request to participate in the program may receive the discount. The second program is the Low-Income Energy Efficiency (LIEE) Program. The LIEE Program provides that weatherization and energy efficiency measures be installed in qualified customer homes at no charge. In addition, the LIEE Program instructs participants on how they may reduce their energy bills by employing energy efficiency practices. Budgets for the LIEE Program are currently capped.

In its Decision 97-02-014, the Commission indicated that the amounts authorized for the LIEE Program in 1996 were adequate until the Commission could determine if additional funding is warranted. The Commission requested that a needs assessment be conducted to enable it to determine appropriate specific goals for the future regarding the low-income programs.

In its Resolution E-3646, dated March 16, 2000, the Commission authorized its Energy Division to oversee a comprehensive needs assessment study. The Commission ordered that the study be conducted in two phases, with the first phase being a design phase and the second phase an implementation stage. Phase I was conducted by Regional Economic Research, Inc. (RER), under contract to the Commission. As part of Phase I, RER conducted various public workshops, focus groups and market actor interviews to obtain input on the design of the needs assessment. RER also investigated existing data sources on the needs of the low-income community and identified a methodology for conducting a comprehensive assessment of those needs as the second phase of this study.

This report presents the results of this second phase of research. In addition, the study was recently expanded to address changes in program eligibility standards resulting from the Winter Initiative (2005-2006).

2.2 Phase II Objectives

The Phase II Low Income Needs Assessment Study was designed to accomplish the following:

- **Estimate the size of the eligible population.** A primary objective of Phase II was to develop baseline quantitative estimates of the number of program-eligible, low-income households in the state of California. This study also determined the number of program-eligible dwelling units in each of the major California investor-owned utilities' (IOUs) service territories, as well as the

service territories of the small multi-jurisdictional utilities (SMJUs). These estimates of the eligible population were used as baseline data for evaluating penetration rates for the CARE and LIEE Programs. U.S. Census data, Claritas population estimates, and utility records were used to generate these estimates. The Phase II study produced estimates for 2003, and we have also included the utilities' reported estimates for 2005.

- **Collect data to characterize the eligible low-income population.** In-depth interviews and detailed energy audits were also completed for a representative sample of over 1,500 of California's eligible low-income customers. U.S. Census data, utility billing records, and on-site survey data were used to develop a profile of the demographic, socio-economic, dwelling-type and geographic characteristics of the eligible low-income population in California. In addition to characterizing the population of low-income households across the state, the needs assessment study was designed to provide characterizations within individual utility service territories, including the major investor-owned utilities and the small multi-jurisdictional utilities (SMJUs). Data collection and analysis for this component of the Phase II study was completed in late 2003/early 2004.

- **Assess energy-related needs of eligible low-income population.** Using information collected from energy audits and detailed customer interviews, issues such as energy burden, energy insecurity, need for energy efficiency measures, and household comfort, health and safety were explored during the comprehensive needs assessment. In addition, Phase II included a thorough assessment of the barriers to participate in the programs, including such factors as program awareness, participation process, reluctance to accept aid, fear or distrust, and structural barriers to LIEE measure installation. Finally, an assessment of the energy savings potential for the LIEE Program was included in Phase II. Again, data collection and analysis for this component of the study was completed in late 2003/early 2004.

- **Integrate characterization and needs assessment results and develop recommendations to improve targeting efforts and program design.** Based on the results of the characterization and needs assessment analyses, recommendations have been developed for program targeting, outreach, design and delivery. By characterizing who has participated and who has not, we have developed insight into the effectiveness of program outreach and delivery efforts thus far. By looking at the characteristics of non-participants, we have identified segments that represent more promising targets for future efforts, as well as segments that represent less promising targets. We have used observable information on the underlying characteristics of these segments to information future outreach and delivery strategies.

- **Develop recommendations for improving methods to determine estimates of the eligible population and track penetration of programs over time.** Finally, we have developed a set of

recommended methods for updating population and penetration estimates over time, as well as identified the sources and schedule for these updates. We have provided methods for tracking penetration by key demographic segments in order to assess reasons for low penetration in important areas. We have also developed methods for updating energy savings potential overtime.

2.3 Study Approach

This study involved several research and analysis tasks. These are described briefly below and in more detail in the Methods Section.

- **Analyze Census data and utility records to assess population size (including CARE eligible participants and LIEE eligible dwelling units) and program participation rates.** Population estimates were developed at three different levels:

    - Statewide Estimates – provides an estimate of the total number of households in California that would be eligible for CARE and LIEE

    - Major IOU Estimates – provides an estimate of the total number of households in each of the major IOU service territories that would be eligible for CARE and LIEE

    - SMJU Estimates – provides an estimate of the total number of households in each of the eight SMJUs that would be eligible for CARE and LIEE

  Penetration rates for CARE and LIEE were also developed for each of the four major IOUs and the eight SMJUs. Population and penetration estimates were developed for 2003. Utility reported results have been integrated into this study to provide an update for 2005.

- **Conduct onsite data collection with 1,500 households to characterize the low-income population and assess needs.** The data collection effort was carried out in late 2003/early using two-person teams, consisting of an experienced interviewer (or outreach specialist) and a trained energy auditor. The in-depth interview was conducted with the head of the household and/or a member of the household who was responsible for the management of household finances such as energy bills. The interview captured primarily household characterization and needs assessment data. The energy audit involved the collection of more detailed information about the home and the components of energy use, as well as the condition of the housing stock and the need/feasibility for energy efficiency measure installations.

- **Conduct characterization analysis.** This task involved describing the low-income population in terms of its economic, demographic, housing, and geographic characteristics. Data from Census as well as the onsite surveys completed in late 2003/early 2004 were used to feed the

characterization analysis. The characterization information was analyzed for the state as a whole, by IOU and SMJU service territory, and for CARE participants vs. non-participants. The results of the characterization analysis have been integrated with the results of the needs assessment analysis to develop recommendations for improving future program targeting and design.

- **Conduct needs assessment analysis.** The needs assessment task provides insight on low-income household needs, wants and concerns in order to inform program design. The needs assessment involved a number of interrelated analyses along the following dimensions:

    - Assessment of Energy-Related Burdens and Concerns – Addresses the relative energy burden experienced by different customer segments, as well as energy insecurity.

    - Determination of Energy-Related Needs – Documents the need for energy efficiency measures as identified through the on-site energy audit, as well as the energy savings potential determined for these measures. Also addresses related household needs concerning health, safety and comfort.

    - Program Perceptions – Assesses channels of information dissemination and satisfaction with the CARE and LIEE programs to help in targeting outreach and identify any obvious gaps in program implementation.

    - Barriers to Participation – Identifies barriers to participation in the CARE and LIEE programs, including program awareness, participation process, reluctance to accept aid, and fear or distrust. Also addresses differences in perceived barriers across customer segments.

    - Willingness to Participate – Establishes baseline levels of willingness to participate in the CARE and LIEE programs. Also assesses participation in other public assistance programs as evidence of willingness to participate in CARE and LIEE (and as an indicator for determining the effectiveness of auto-enrollment activities).

- **Conduct energy savings potential analysis.** Energy savings potential estimates for the LIEE program were derived from the analysis of detailed energy audits, and combined with measure-specific impact estimates from recent program impact studies. Energy savings potential estimates were developed for 2003 and beyond (10 year forecast).

- **Integrate Results and Develop Recommendations.** This section presents the results of segmentation analysis completed to draw attention to important subgroups within the low income population based on their underlying geographic, demographic, housing, and energy use characteristics. By looking at the characteristics of these low income households, we gain a better

understanding of how to reach them and provide them with program services that are needed and will provide the most benefit. Recommendations have been developed for program targeting, outreach, design and delivery.

2.4 Organization of the Report

The remaining sections of this Draft Report are organized as follows:

- Section 3: Methods
- Section 4: Characterization
- Section 5: Needs Assessment
- Section 6: Energy Savings Potential
- Section 7: Results Integration and Recommendations
- Section 8: Tracking Potential and Penetration Over Time
- Appendices
    - A: Population Estimation Method
    - B: Onsite Survey Materials
    - C: Detailed Cross-Tabulations of Characterization Results
    - D: Detailed Cross-Tabulations of Needs Assessment Results
    - E: Onsite Survey Dataset Contents and Documentation
    - F: Illustration of Ongoing Tracking of LIEE Savings Potential

3. Methods

This section presents an overview of the methodology employed for each of the study's key tasks, namely:

- Refining the work scope
- Providing opportunity for public input
- Updating eligible population and program penetration estimates
- Conducting on-site data collection
- Characterizing the low-income population
- Assessing the energy-related needs of the low-income population
- Determining the energy savings potential among the low-income population
- Developing methods for updating eligible population and energy savings potential estimates over time.

Each of these tasks is discussed in greater detail in the following sections.

3.1 Refine the Project Work Scope

A project initiation meeting was held with the Commission's project manager and other key staff on August 5, 2003. The purpose of this meeting was to refine the Phase II work scope, and to discuss and finalize the study goals and objectives, specific tasks, and the schedule and budget. On September 9, 2003, the draft research plan was submitted to the Commission, and on September 26, 2003, a formal meeting was held with the Commission project manager and other key staff to address issues that needed to be addressed prior to finalizing the research plan. The final research plan was delivered to the Commission in October 2003.

3.2 Provide Opportunity for Public Input

Throughout the project, public workshops have been conducted at key intervals to obtain review and comment from interested parties on the project work. These workshops were often coordinated with existing Low Income Oversight Board (LIOB) meetings and have been conducted in various areas of the state.

The first public workshop was held in San Francisco on November 21, 2003, which coincided with a regular meeting of the Low Income Oversight Board (LIOB). The purpose of this workshop was to introduce members of the Phase II study team, review the policy background and research objectives of

the study, provide a detailed overview of the study scope and methods, and to solicit public input on the study, including recommendations for the best ways to reach and encourage participation in the onsite survey from low income households throughout the state. The workshop also provided the opportunity to obtain public input on the types of energy efficiency measures that should be given greater emphasis in the onsite survey.

A second public workshop was held in San Francisco on January 26, 2004, which also coincided with a regular meeting of the LIOB. The purpose of this workshop was to provide an update on Phase II, which has moved into the full-scale onsite data collection phase by this time. The study team presented information on:

- **Staffing:** Phase II had successfully recruited a pool of qualified schedulers, interviewers and auditors for this project. At one time, over 30 individuals had been hired and were working full-time on this aspect of the project. These staff had diverse backgrounds in social science research, customer service, and energy efficiency service. Many (over 10) different languages, ethnicities and races represented among the staff hired for this aspect of the project, as shown in Table 3-1.

Table 3-1
Language, Ethnicity and Race of Survey Team

	Schedulers	Auditors	Interviewers
Spanish	3	2	7
Korean	1	2	1
Vietnamese	1	1	3
Chinese	2	2	3
Filipino	1		2
African-American		1	1
Other		3	2

- **Training:** The second public workshop was also used to provide an update on the final training session held in December 2003 in the Los Angeles area. There were two additional training sessions held in Northern California (Oakland and Sacramento) in November 2003.

- **Pre-test:** The study team provided an update on the pre-test results for both the phone-scheduled and the canvassing survey approaches. Highlights from the pre-test suggested that, while there were many challenges involved with the data collection aspect of this project – i.e., no shows and cancellations, languages and cultural "logistics," relative effectiveness of canvassing in some areas and not in other – the study benefited from a solid team, that worked very well together, and that households recruited for the study were responding well to the survey length, content and incentive.

- **Web-based tracking system:** This study team also provided an overview of the web-based survey tracking system, which was being used to monitor recruitment and survey completion efforts. This system was designed to access information from both the phone-scheduled and canvassing databases in real-time, allowed for information to be shared with and obtained from the survey crews throughout the state, and offered a secure and convenient way to communicate important information about the study (e.g., schedule changes, updated survey materials and forms, "chat" pages, etc.). In addition, the web-based tracking system was used to provide access to various administrative reports (e.g., number of households recruited, surveys completed, crew schedules, etc.). Access to this component of the tracking system was provided to the Commission project manager and other key staff.

- **Full-scale survey implementation.** The study team provided the public with an update on the full-scale data collection activities. By January 2006, more than 400 onsite surveys had been completed with low income households located mostly in PG&E's service territory. These surveys provided a good representation of both urban and rural areas, multiple dwelling types (i.e., single family, small and large multi-family, and mobile homes), and CARE participants and non-participants. The study team also provided an update on the canvassing efforts that had been initiated in Southern California in early January 2006.

- **Quality control and data entry.** Finally, the study team provided an overview of the quality control and data entry procedures that had been developed for this project. These included administrative quality control procedures, technical reviews of the completed survey responses (both the customer interview and the energy audit), and the process and procedures for data entry.

A third public workshop was held in Los Angeles on April 27, 2004, which also coincided with a regular meeting of the LIOB. The purpose of this workshop was to provide an update on survey implementation activities (goal of 1,500 surveys completed in early April 2004), the summary of the results of the debriefing held in late April 2004 with members of the survey team, the management team, and the Commission, and a progress report on the remaining project activities (e.g., quality control and data entry, analysis and reporting).

3.3 Updating Eligible Population and Program Penetration Estimates

The following conditions must be met for an individual household to be eligible for the CARE and LIEE Programs:

- The household must have income at or below the established income standard for its household size. *[Income Eligibility]*

- The household must have an account with a regulated utility or the household must pay an energy bill based on sub-metering to an entity that has an account with a regulated utility (CARE), or must live in a master-metered housing unit where more than a certain share of the households have incomes below the established standard. *[Program Eligibility]*

In 2003, when the initial estimates of eligible population and penetration were calculated, there was a difference between CARE and LIEE Program eligibility. At that time, LIEE income standards were higher than CARE income standards for households in which the head of household was elderly or disabled.

Utility companies have information on the number of residential customers in their service territories. However, they do not have consistent information on customers that would allow them to determine the number of residential customers that are income-eligible for their programs. Other data sources must be used to make those estimates.

There are a number of data sources and procedures that could be used to estimate the number of CARE and LIEE program eligible households in California. Athens Research has used one such procedure to develop estimates for SCE, SoCal Gas, SDGE, and PGE. The procedure initially developed for this study builds on that basic method designed by Athens Research.

The approach initially used in this study better served the needs of the study and made a modest improvement in the quality of the estimates.[1] First, because we accounted for a household's utility bill status (i.e., does the household pay an electric and/or gas bill), we were able to develop eligibility for any geographic area (even in areas without regulated utilities) and can furnish an unduplicated count of households that are program eligible (even when they are served by more than one utility). This allowed us to develop an overall statewide estimate of program eligibility, as well as individual estimates for the utilities. In addition, our review of the Athens Research method suggested that there was a small bias in the approach that results from a failure to account for differential rates of utility payment patterns by income. This caused the Athens Research method to slightly overestimate the eligible population and thereby underestimate the CARE and LIEE penetration rates.

However, it is important to note that the Athens Research procedure furnished the foundation on which the procedure for this study was built and that the estimate furnished by Athens Research have served the

[1] In addition, since the Special Census tabulations were used in our 2003 method, we were able to more accurately predict the population eligible for the LIEE Program in 2003 by accounting for both the age and disability status of the head of household. At that time, the Athens Research method accounted for age but not for disability status. Appendix A contains a detailed description of our initial estimation approach.

CPUC effectively in furnishing good quality information on the number of program eligible customers for each of the four major regulated utilities.

The estimation approach used in this study was reviewed by an expert in the field of small area estimation. Alan Zaslavsky, PhD, a professor at Harvard who served on the National Panel on Estimates of Poverty for Small Geographic Areas for the Committee on National Statistics, conducted a peer review of the estimation methodology used in this report. His review suggested that the estimation methodology made use of the available resources in an appropriate way. He identified several data sources that could be used to improve the method. However, those data sources are either restricted in use to the federal government (e.g., small area IRS tax records and Food Stamp participation data) or were not yet available (e.g., the American Community Survey).

There are three steps in the process for developing an updated estimate of the number of CARE and LIEE eligible households:

- Special Census Tabulations – We requested special tabulations from the Census Bureau that provided information on the number of households that were CARE and LIEE eligible in 2000 for each Census Block Group in California.

- Census Tabulation Updates – We obtained Block Group updates for the number of households and the distribution of household income, household size, and age from Claritas for 2003. We used an iterative proportional fitting procedure to update the special Census tabulations to match the Claritas statistics for 2003.

- Census 2000 5-Percent Public Use Microdata Sample (PUMS) Eligibility Ratios – We used updated PUMS files to assess the share of households that are income eligible in tabulation cells that included the income standard for the target household size.

The second and third steps in the process are performed at the ZIP code level. Data suppression at the block group level results in estimation errors if the work is done at the block group level. The outputs of step three can be cumulated for any geographic area to estimate the number of CARE and LIEE eligible households.

When developing estimates for specific utilities, estimates of the share of households in each ZIP code that are program eligible are multiplied by the utility count of customers in that ZIP code. This procedure calibrates the estimates to the actual number of customers in a ZIP code that use the utility of interest.

For any year, the procedures can be further updated using the current year data from Claritas, and for utility estimates, updated counts of utility customers. This report provides updated estimates for 2006 using data provided by Athens Research on behalf of PG&E, SCE, SCG and SDG&E.

Program penetration estimates were determined by dividing the number of program participants by the estimated total number of program-eligible households. The results of the population and penetration estimation analyses are presented in Section 5.

3.4 Conducting On-Site Data Collection

This section provides an overview of the approach to conducting the on-site data collection. We have structured this description as follows:

- Sample Design
- Survey Design
- Training
- Recruitment
- Sample Management
- Household Qualification and Customer Interview
- Detailed Audit and Housing Survey
- Quality Control
- Debriefing

3.4.1 Sample Design

The sample for the on-site data collection task was designed to meet several objectives:

- Ensure that all eligible households in the covered areas are represented.
- Allocate data collection resources efficiently to meet the project objectives.
- Ensure that the sampling probabilities for different segments of the eligible population can be determined, so that the sample expansion can weight each segment appropriately.

An additional objective is to ensure minimum sample sizes for segments of particular interest, such as CARE participants and non-participants, racial and ethnic groups, population density categories (i.e., urban vs. rural), and utility service territories.

Allocating resources efficiently for on-site data collection typically required a clustered design. A basic principle of efficient design is to use lower sampling rates for clusters where the cost per surveyed home is higher. At the same time, all eligible homes need to have a known, positive probability of being included in the sample.

To meet these objectives, our sample design was structured as follows:

1. The total sample size was set at 1,500 completed sites.

2. The Primary Sampling Units (PSUs) were zip codes areas. The PSUs were stratified by predominant utility service territory, as well as by factors that determined the cost per completed onsite survey. The sample allocation across the PSU strata was based on the number of anticipated eligible homes in each PSU, and the unit cost.

3. For each selected PSU, we obtained lists of all residential customers in the PSU from the utilities (including individually-metered and master-metered residential customer accounts). Also from utility lists, we identified which customer accounts were currently enrolled in CARE. (A later step was taken to determine which customer accounts in our sample had participated in the LIEE Program in the past five years. This information was not used to inform the sample design but rather describe the sample characteristics.)

4. We then selected a sample of Secondary Sampling Units (SSUs), which represented smaller geographic areas within each selected PSU. Stratification and allocation for SSUs was similar to that for PSUs.

5. Within each selected PSU and SSU, we then set completion targets for CARE participants and non-participants. We drew five times the participant target, and 10 times the non-participant target.

6. We recruited from the selected participant and non-participant lists to meet the targets set for each group within each PSU and SSU. Recruitment was implemented using ordered lists from the random sample, and the detailed information on sample disposition was captured in the tracking database.

Within this overall scheme, we were able to control the allocations to particular subgroups of interest in different ways. The allocation by utility service territory was controlled by stratifying the PSUs by predominant service territory (i.e., the service territory covering most of the homes in the PSU). We also stratified for the overlapping service territories of SCE and SCG, as well as for areas where the two IOUs do not overlap. With this approach, it was possible to ensure (approximately) a minimum sample size for each service territory.

The allocation by factors such as race or ethnicity was not as easily controlled. Stratifying PSUs by racial or ethnic composition would not have ensured the proportions that would occur in the completed sample. On the other hand, the only way to ensure specific target numbers were met by race and ethnicity was to require the recruiters to meet quotas set for these factors, which introduced other bias problems.

The final sample design allowed for higher coverage rates to particular ethnic and/or racial groups without setting specific quotas. Our final approach gave extra weight to the subgroups of interest in selecting the SSUs and the PSUs. For example, if a goal was for Chinese households to occur in the sample at twice the rate they occur among eligible households, then the allocation factor would count each Chinese household twice as much as a non-Chinese household. Thus, SSUs with high proportions of Chinese households would have an increased chance of being in the sample. However, the screening process within SSUs would not give preference to Chinese households.

3.4.1.1 PSU Definition

The size of each zip code area was estimated by the number of households below 150 percent of poverty according to the 2000 Census. Census data are provided by "zip code tabulation area," which is the collection of Census blocks that approximates the zip code region. Thus, the measure of size we used served as a good proxy for the target variable, but differed from that target in several respects:

- The area for which the size measure was available was not exactly the area from which households were selected.
- The data were three years old.
- We used 150 percent of poverty rather than 175 percent, which is closer to the program eligibility cut-off. We estimated a nearly linear relationship between the two values, so that the sampling efficiency was not affected.

3.4.1.2 PSU Stratification

The PSUs were then stratified by:

1. Predominant service territory (i.e., the service territory that has most of the population in the zip code area);
2. Household density (i.e., households per square mile); and
3. Low-income incidence (i.e., households below 150 percent of FPL as a fraction of total number of households).
4. Recruitment method (i.e., pre-scheduled appointments, canvassing)
5. Targeted number of visits per day per crew.

The service territory strata were defined as: PG&E, SDG&E, SCE excluding SCG, SCG excluding SCE, and the overlap of SCE and SCG.

The PSU household density and low-income incidence strata were designed to take into account both how densely populated the area was and how difficult it would be to find qualified low-income households. We defined these strata as shown in Table 3-2. For example, we defined the "Very Dense" strata to include two categories of PSUs: those with greater than 3,000 homes per square mile and greater than 20% low-income incidence, and those with greater than 1,500 homes per square mile and greater than 30% low-income incidence. Conversely, we created two strata for PSUs with a lower level of low-income incidence. We created the "Sparse" stratum to include PSUs with between 200-500 homes per square mile and greater than 10% low-income incidence, and the "Very Sparse" stratum, which included PSUs with less than 200 homes per square mile and greater than 10% low-income incidence. The strata labeled "Low Incidence" included PSUs of any household density but with low-income incidence of less than 10%. These were the "needle in the haystack" PSUs, where we knew low-income households existed but we assumed it would be significantly more costly to identify and recruit them for the study.

Table 3-2
Definition of Household Density and Low Income Incidence Strata

Strata/	Household Density (Number of Homes / Sq. mi.)	Low Income Incidence (Percent of Households Below 150% of FPL)
Very Dense	> 3,000	> 20%
	> 1,500	> 30%
Dense	> 3,000	10-20%
	1,500-3,000	10-30%
Sprawl	500-1,500	>10 %
Sparse	200-500	> 10%
Very Sparse	< 200	> 10%
Low Incidence	Any	< 10%

3.4.1.3 SSU Definition and Selection

In the "Very Dense" stratum, each of the PSUs was further divided into SSUs of approximately ¼ square mile. These SSUs were created as Census block groups and, when necessary, partial block groups. Two SSUs were selected from each selected PSU, with probability proportional to size (pps).

3.4.1.4 Recruitment and Completion Rate Assumptions

The next step in the sample design process was to integrate assumptions regarding recruitment and targeted number of completed surveys per day. For example, we planned to use canvassing in the highly dense areas but assumed only three surveys could be completed per day (per crew). In other areas with lower levels of low-income incidence, we planned to screen and make pre-scheduled appointments over

the telephone. The targeted number of completions per day reflected the density of the area – i.e., we assumed four surveys per day in somewhat dense areas, three in the "Sprawl" areas, and so on. For the "Low Incidence" stratum, we assumed only one survey per day because these respondents would be difficult to identify and most likely not reside near any other qualified respondents. Table 3-3 shows the assumptions for recruitment method and completion targets by strata.

Table 3-3
Assumptions for Recruitment Method and Completion Targets by Strata

Strata	Household Density (Number of Homes / Sq. mi.)	Low Income Incidence (Percent of Households Below 150% of FPL)	Recruitment Method	Targeted Number of Completed Surveys Per Day
Very Dense	> 3,000	> 20%	Canvass	3
	> 1,500	> 30%		
Dense	> 3,000	10-20%	Phone	4
	1,500-3,000	10-30%		
Sprawl	500-1,500	>10 %	Phone	3
Sparse	200-500	> 10%	Phone	2
Very Sparse	< 200	> 10%	Phone	1
Low Incidence	Any	< 10%	Phone	1

3.4.1.5 Sample Allocation

As described above, the PSUs (and SSUs) were stratified into six density/incidence strata with assumptions regarding the recruitment methods and completion targets per stratum.

The total sample of 1,500 homes was allocated to these strata in proportion to the "allocation factor" given by:

$$A_{uk} = F_{uk} D_k \Big/ \sqrt{c_k}$$

where:

F_{uk} = fraction of low-income households in service territory u, density/incidence of stratum k,

D_k = estimated design effect for stratum k, and

c_k = unit cost per completed interview for households in stratum k.

The design effect D_k was unknown, but was estimated subjectively, on a relative basis, as follows:

1. The high-density strata were assumed to have about half the efficiency (twice the design effect) it would otherwise have had because of the SSU clustering within the PSU.

2. The next stratum was assumed to have a slightly lower efficiency because of the larger number of completes per cluster.

3. The two low-density strata were assumed to have lower efficiency because they had fewer total households in each cluster, so that the sample cluster of three was allocated to a smaller fraction of the population.

The sample allocation by density/incidence strata is shown in Table 3-4.

Table 3-4
Sample Allocation by Density/Incidence Strata

Strata	Recruitment Method	Targeted Number of Completed Surveys Per Day	Relative Cost	Percent of LI Population	Sample Size	Percent of Sample
Very Dense	Canvass	3	1.0	31%	768	51%
Dense	Phone	4	1.0	20%	276	18%
Sprawl	Phone	3	1.3	15%	162	11%
Sparse	Phone	2	1.8	6%	66	4%
Very Sparse	Phone	1	3.8	20%	186	12%
Low Incidence	Phone	1	4.1	8%	48	3%

Because of the need to round to whole clusters within each utility's service territory, the final allocation across density/incidence strata was slightly different, as shown in Table 3-4.

3.4.1.6 Developing the Household Frame

For each selected PSU and SSU, we obtained the lists of residential service addresses and master-metered accounts within that zip code from the appropriate utility(ies). Along with these lists, we also obtained the rate code from which we identified CARE participation. For the master-metered accounts, we also obtained a count of the number of units at the premise and, where available, the number of units enrolled in CARE.

Table 3-5
Final Sample Allocation by Utility and Density/Incidence Strata

Strata	PG&E	SCE Only	SCE/SCG Overlap	SCG Only	SDG&E	Total
Very Dense	132	24	312	240	54	762
Dense	96	4	112	32	32	276
Sprawl	63	0	72	9	18	162
Sparse	27	3	27	3	9	69
Very Sparse	114	9	45	9	6	183
Low Incidence	24	0	18	3	3	48
Total	456	40	586	296	122	1,500

3.4.1.7 CARE and Non-CARE Targets

For each service territory and density/incidence cell, we set CARE and non-CARE sampling targets. These targets were based on the estimated CARE penetration rate for the cell.

Establishing separate targets for CARE and non-CARE respondents was helpful for several reasons:

- Explicit targets for non-CARE ensure that these households, which are harder to find, are nonetheless appropriately represented in the sample. It was assumed that CARE participants would have different characteristics from non-participants. In particular, it was possible that linguistically isolated and other hard-to-reach households would be found more prevalently among non-participants than among CARE participants.

- Because of the lower incidence of eligible homes among non-CARE households, recruitment costs for these homes would be higher. Setting separate targets allowed for a more efficient allocation between CARE and non-CARE, using an allocation formula analogous to that for the PSU sample. Thus, the CARE households could be sampled at a higher rate than non-CARE households. However, these rates would be controlled and adjusted for in the estimation.

- Even with uniform sampling rates, there are operational efficiencies to separating the easily identified eligible homes from the pool from which many must be screened for each eligible home identified.

With only 3 or 4 households to be visited in each PSU, it was not possible to allocate fixed proportions of CARE and non-CARE homes at the PSU level. Instead, the non-CARE target was randomly determined

for each PSU, such that the expected sum of these PSU targets matched the overall target for the PSU sampling cell.

3.4.1.8 PSUs with No SSU Subsampling

For the phone-screened PSUs, subsampling between the PSU and household selection was not done. A simple random sample of homes 20 times the target number for the PSU was selected for CARE homes. The number selected from addresses not on the CARE list was m times the non-CARE target, where

$m = 20/i_{non}$ and

i_{non} = estimated incidence of eligible homes among non-CARE accounts.

This sample constituted the screening and recruitment pool.

In drawing the recruitment pool by simple random sample, each master-metered account was effectively entered in the frame multiple times, according to the indicated (or estimated) number of units on the account. We designated a standard protocol for selecting units within a master-metered account. For each such account that has one or more units selected for the recruitment pool, we obtained individual unit addresses from a reverse directory and applied the within-account selection protocol to select individual units.

3.4.1.9 PSUs with SSU Subsampling

For the high-density PSUs, where recruitment was accomplished by canvassing, SSUs were selected as described above. All residential service addresses in the PSU were geocoded to assign them to the block groups that define SSUs. After SSUs were selected, the selection of households within SSUs for the recruitment pool was similar to the selection within PSUs for the phone-recruited PSUs.

Thus, the canvassers were given an explicit list of addresses to contact within each SSU. The canvasser was required to record the disposition of each of these addresses. This procedure helps to avoid very tight clustering of the completed sample and reduces “interviewer convenience” bias.

3.4.1.10 Final Sample Disposition

Table 3-6 presents the final disposition of the sample across the utility service territory and density/incidence strata.

Table 3-6
Final Sample Disposition by Utility Service Territory and Density/Incidence Strata

Strata	PG&E	SCE	SCE/SCG	SCG	SDG&E	Total
Very Dense	130	145	228	214	50	767
Dense	105	4	94	46	34	283
Sprawl	65	0	76	12	26	179
Sparse	30	4	27	7	13	80
Very Sparse	109	7	48	12	5	180
Low Incidence	23	0	16	3	3	45
Total	462	160	489	294	130	1,534

3.4.2 Survey Design

A number of steps were taken to design the formal data collection instruments for the on-site data collection task, including:

- Defining the information requirements
- Determining the correct terms and language to use in a questionnaire
- Mapping out the sequence of questionnaire sections
- Drafting the survey instruments
- Conducting internal review and field pre-tests
- Revising, finalizing and monitoring survey instruments and procedures.

The first step began as part of the Phase I effort and the RFP for Phase II clearly articulated the information requirements for this study. Our proposal mapped these information requirements to specific study objectives. Table 3-7 displays this mapping.

A second yet critical step in the survey design task was to determine the correct terms and language to use in the actual questionnaire. To obtain a realistic and sensitive approach to the survey wording, we drew on our extensive experience in designing energy surveys targeting the general residential population as well as specific low-income segments. In addition, the initial survey drafts were reviewed by a panel of experienced survey design professionals.[2]

[2] Survey instrument review was conducted by project team members from APPRISE Inc. who have developed survey instruments for similar low-income needs assessment studies (e.g., LIHEAP and REACH Programs), as well as the national Residential Energy Consumption Survey (RECS). In addition, Ms. Carolyn Miller provided an independent review of the survey instruments. Ms. Miller holds a Master of Arts in Applied Social Research from the University of Michigan and was trained in survey research methods at the University of Michigan Survey Research Center.

Of particular concern in this study were challenges related to securing respondent trust and translating survey questions in multiple languages. For example, because many of the up-front questions in our screening approach related to sensitive issues such as household income and household size, we took great care in crafting these recruitment questions so that respondents were able to maintain as much privacy as possible while at the same time providing adequate information to qualify their household for the study.

The final survey instruments were translated into the following non-English languages:

- Spanish
- Chinese
- Vietnamese
- Korean
- Tagalog

We recognized early on that certain demographic and energy-related questions would not easily translate from one language to another. Similarly, response interpretation tends to vary by language and needed to be taken into account when designing pre-coded answer categories. It was critical to address these issues in the survey design task to ensure accuracy and consistency in data collection.

We were successful in addressing the idiosyncrasies of translating questionnaires into multiple languages by engaging many levels of review in the translation process. We used a number of different, specialized translation services – for example, for the Spanish language translation, we used a highly-qualified individual with whom we have had prior success translating our household demographic and energy-related surveys. For the non-Spanish language translations, we used the services of a professional translation firm. Energy experts reviewed the translated materials and made modifications to ensure that the technical information translated consistently and accurately. Finally, the actual staff assigned to administer the materials in-language made further modifications to improve consistency and accuracy.

Table 3-7
Information Requirements Mapped to Study Objectives

Information Requirement	Study Objectives		
	Estimating Potential	Characterizing Population	Identifying Needs & Concerns
Primary language		X	
Ethnic group		X	
Ability to read		X	
Composition of household		X	
Employment status of household		X	
Master metered low-income households	X	X	
Water heating fuel	X	X	
Age of housing structure		X	
Square footage of housing unit		X	
Presence of air conditioner		X	
Appliance performance			X
Condition of housing stock			X
Security			X
Hardship and comfort			X
Eligibility data (e.g., income, household size, age, etc.)	X	X	
Need for weatherization measures	X	X	
Awareness of programs			X
Sources of information			X
Perceptions of programs			X
Barriers to participation			X
Customer perceptions of programs			X
Willingness to participate	X		

Copies of all onsite survey materials are provided in Appendix B.

3.4.3 Training

Well-trained interviewers are essential to data collection efficiency, control and quality. In addition to using experienced field interviewers, we conducted an intensive training program with all outreach specialists and field engineers assigned to this project. Three training sessions were held prior to full-scale survey implementation – the first was held in Oakland and included a formal pre-test of all survey materials and procedures. The second training session was held in Sacramento and the final session was held in Irwindale.

Each training session was schedule over the course of one full week, with the first two days reserved for classroom-style training, followed by a full two days of in-field training, and another day back in the office/meeting room for debriefing and wrap-up.

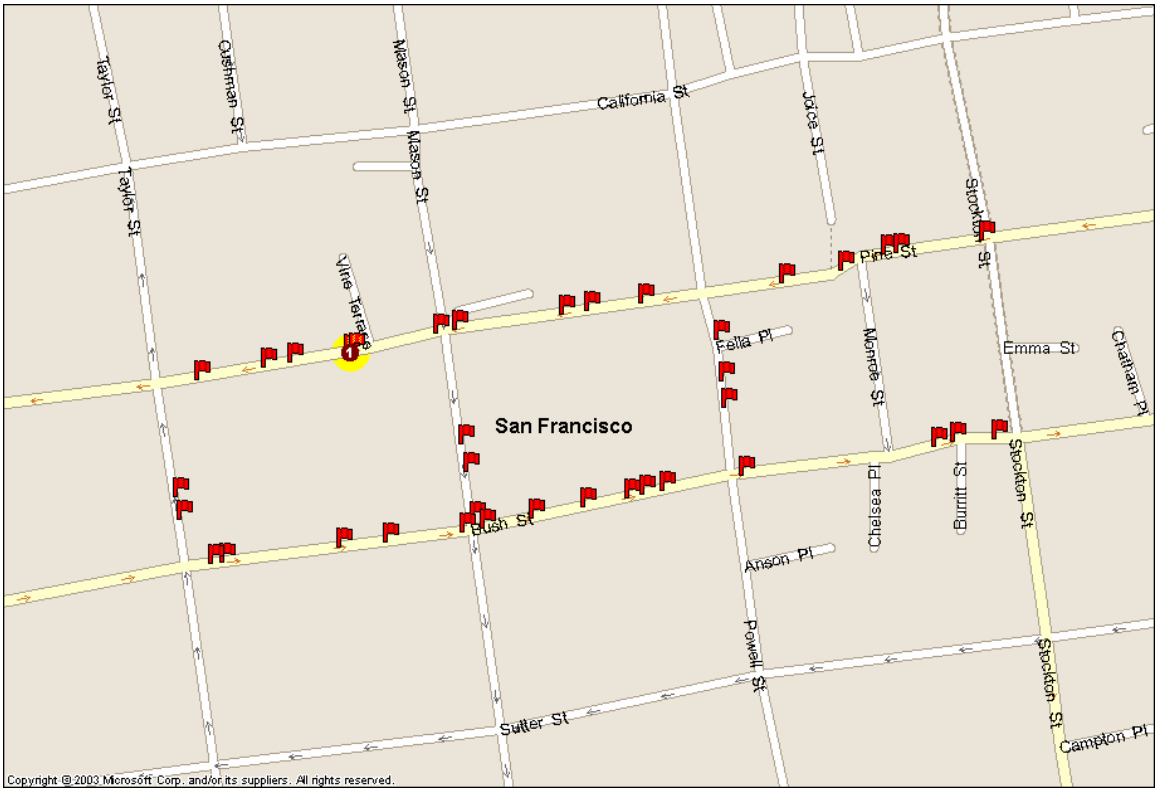
The initial training session in Oakland provided the feedback necessary to make adjustments to the survey instruments and field procedures and protocols prior to subsequent training sessions. In addition, daily evaluations were integrated into the training schedule to obtain more immediate feedback from the training participants. The planned role-playing exercises and in-field training provided senior staff the opportunity to observe survey implementation procedures in practice and make adjustments to the protocols as required. We incorporated active, in-class training that combined lecture-style presentation with activities that actively involved participants in order to increase comprehension and retention.

3.4.4 Recruitment

Recruitment was conducted in two distinct ways: (1) door-to-door or canvassing in neighborhoods with relatively high housing density and likely incidence of household income-eligibility, and (2) telephone recruitment in areas where housing is less dense and income-eligibility is less likely.

In the case of canvassing, survey teams would approach sampled neighborhoods with pre-printed recruitment lists. These lists were sorted using mapping software that helped produce the best “walking route.” Figure 3-1 presents a sample print-out of a canvassing route. Canvassing teams were instructed to only attempt to recruit households whose addresses were on the pre-printed lists. Canvassing was completed during the hours of 9:00am to approximately 6:00pm (including Saturdays). In some cases, canvassing teams would work past 6:00pm to meet their goals for a particular area or if a potential respondent requested that the team return after 6:00pm to complete the survey.

Figure 3-1
Sample Canvassing Route



Telephone recruitment was accomplished using pre-sorted lists from our in-house tracking database. These lists were sorted in random order within a sampled neighborhood (zip code). Telephone recruiters attempted to contact customers and schedule appointments for the survey teams. Scheduled appointments were made during the same hours worked by canvassing teams (including Saturdays), and appointments were often scheduled after 6:00pm to meet a goal for a particular area or at the request of an interested respondent. Telephone recruiters often left messages and provided a toll-free number for potential respondents to call back if interested in participating in the survey.

3.4.5 Sample Management

Sample disposition was continuously monitored and updated by our recruitment staff and field crews, as well as by the survey supervisor and project manager. Our project tracking software contained a number of different alerts, notifications, and management reports that aided this task. Aspects of sample management included:

- **Tracking of call/contact disposition.** Each call or canvassing attempt was tracked to ensure adherence to sampling protocols and to manage the disposition of the sample. The number of

attempts to call/contact the customer was recorded as well as the outcome of each attempt. Telephone recruiters entered this information into the tracking software as calls were made, whereas canvassing teams entered this information at the end of each day via the Internet (our database was accessible to field crews via a secured web link). Up to three attempts were required during different times of the day before a customer was removed from the recruitment lists.

- **Tracking of appointment/canvassed site status.** Field crews were responsible for updating the database daily with the status of scheduled appointments or canvassed sites. Missed or cancelled appointments were rescheduled or replaced as soon as possible while crews were still working in nearby neighborhoods. As goals in specific neighborhoods were reached, crews were assigned to work new areas either by scheduled appointments or via canvassing.

- **Tracking of refusals and survey disqualification.** An important element of sample management involved the tracking of information regarding customers who were contacted but ultimately chose not to or were not qualified to participate in the survey. This is necessary to accurately account for non-response bias, as well as to help assess and understand barriers to program participation. Customers who refused to participate in the survey were coded in several different ways. For example, some were coded as an "immediate refusal" (they hung up or refused prior to asking any screening questions) while others refused to provide the needed household and/or income information to screen for eligibility. Customers who allowed the screening questions but were deemed ineligible for the survey were coded as such and information collected regarding household size, income, and elderly/disability status was recorded in the tracking database.

- **Verification of survey completion.** We conducted a small, random sample of verification interviews to ensure that interviews were actually conducted and ensure that all questions were asked. This helped keep track of field operations, as well as served as an important step in the overall quality control (QC) process.

3.4.6 Data Collection

The data collection effort was carried out using two-person teams, consisting of an experienced interviewer (or outreach specialist) and a trained energy auditor. Each was responsible for one of two primary stages or types of data collection. The first stage involved an in-depth interview with the head of the household and/or a member of the household who was responsible for the management of household finances such as energy bills. This first stage also involved the collection of household characterization and needs assessment data. The second stage consisted of the energy audit and involved the collection of more detailed information about the home and the components of energy use, as well as the condition of the housing stock and the need/feasibility for energy efficiency measure installations. The following describes the types of data collected during each stage of the effort.

- **Household Characterization and Needs Assessment Data**

  - Initial household demographics
    - Number years in current and prior residence
    - Home ownership status (own, rent)
    - Utility bill payment (paid to utility, landlord, other)
    - Household composition/description (number of household members by age disposition, single- vs. two-parent household)
    - Marital status of respondent
    - Languages spoken in home, primary language spoken in home

  - Needs assessment data
    - Frequency of access to various information sources (e.g., TV, radio, newspaper, Internet, community organizations, events, etc.)
    - Sources for information on energy conservation and assistance in helping pay utility bills
    - Awareness of CARE and LIEE Programs, participation in programs, and satisfaction with programs
    - Willingness to participate in CARE and LIEE Programs, and willingness to provide income documents required for program participation
    - Participation in other public assistance programs (Medi-Cal, WIC, Healthy Families, other)
    - Perceptions regarding willingness to participate in public assistance programs
    - Perceptions regarding sources for paying energy bills and bill paying habits/history
    - Perceptions regarding household comfort levels in winter and summer, as well as ability to manage comfort levels
    - Assessment of health of household members and perceptions regarding health problems due to energy-related household conditions
    - Assessment of household safety and security and perceptions regarding security issues due to energy-related household conditions

  - Additional household demographics and housing information
    - Building/home vintage
    - Household race and ethnicity
    - Educational attainment of respondent
    - Employment status for household members
    - Disability status for household members

- Literacy
- Household income level and discussion of income sources
- Respondent gender

- **Energy Audit**

  - General dwelling information
    - Dwelling type indicator (e.g., single-family, multi-family, mobile home)
    - Number of units (for multi-family)
    - Number of rooms
    - Dwelling square footage

  - Heating system information
    - Fuel type, system type, age, and condition
    - Percent of heat supplied by each system type
    - Indicator for shared systems

  - Cooling system information (where applicable)
    - System type, age, condition
    - Number of non-central systems and use of covers during winter

  - Water heater information
    - System type, age, location, condition
    - Indicator for shared systems
    - Indicator for water heat tank and pipe wrap feasibility
    - Indicator for low-flow showerhead and faucet aerator feasibility
    - Existing water heater temperature
    - Number of weekly hot showers, baths, clothes washer loads

  - Building shell information
    - Foundation/floor type, condition, indicator for caulking feasibility
    - Wall types, existing r-values, condition, indicator for caulking feasibility
    - Ceiling types, area, condition, existing r-values, proposed r-values, existing and proposed attic ventilation, indicator for caulking, weatherstripping and fan feasibility
    - Duct types, linear feet, location, condition
    - Door types, condition, indicator for weatherstripping feasibility
    - Window pane type, condition, indicator for caulking/weatherstripping feasibility

- Other appliance/equipment information
  - Number of refrigerators and freezers by type, size, defrost indicator, age, location, grounding indicator, overall condition
  - Number of programmable thermostats, usage patterns, temperature settings (winter vs. summer)
  - Type of range/oven, condition, usage patterns
  - Lighting usage patterns, number of existing bulb/fixture types, indicator for CFL feasibility
  - Presence of other energy-using equipment or appliances, such as dishwashers, clothes washers, clothes dryers, swimming pools, spas or hot tubs, TVs, stereos, aquariums, computers, etc.

3.4.7 Quality Control

Our approach to quality control involved a few key steps to ensure that our careful attention to survey instrument design and our diligent approach to training is ultimately reflected in the final analysis dataset. The final analysis dataset consists of the verified, coded and cleaned SAS database that was analyzed to produce the results in this report. The key elements to our quality control approach are described below:

- Pre-data entry review and editing. To ensure the accuracy of the entered data, we conducted extensive review and QC on all completed survey materials. Questionnaires were reviewed and edited by experienced in-house QC specialists to correct any entries that may cause confusion for data entry staff and diminish accuracy for overall analysis dataset. Problems identified through the QC review were discussed with the survey supervisor as well as the appropriate data collection team.

- Data entry. We used a procedure referred to as the "key-and-verify data entry method" to input the data. In this method, data entry screens lead the keypuncher through the input process. After the entire survey is entered, it is re-entered by a second keypuncher. The second entry person is alerted of any discrepancy between what was entered initially and what is entered in the second round as the information is entered. The keypuncher must fix the discrepancy before proceeding with the remainder of the survey.

- Data auditing and data cleaning. A full array of quality assurance procedures were used to developing the final analysis database. We customized our in-house cleaning routines to check for inconsistent responses, missing or skipped responses, and out-of-range responses. We also developed and input the post-codes for open-ended responses.

- Verification. As discussed above, a random sample of respondents were re-contacted to ensure that surveys were actually completed and that all survey questions were asked. In a few cases, key questions were re-administered to check on the accuracy and completeness of collected survey data.

3.4.8 Debriefing

At the CPUC's request, we held a formal debriefing meeting with staff who had been involved in the collection of on-site data. The objectives of this meeting were to:

- Share observations from the field research staff that may not necessarily have been captured on the data collection forms,
- Further explore some of the meaning and context underlying the open-ended question responses related to household needs and barriers to participation, and
- Identify "lessons learned" for planning and conducting future needs assessment studies.

The meeting was held in Pasadena, California on April 28, 2004. Field staff who were involved in both the in-depth respondent interviews as well as the detailed energy audits attended. A total of 20 staff participated, 10 interviewers and 10 auditors. Also participating were KEMA's Project Manager, scheduling supervisor, survey design and training manager, and lead data analyst. The supervisor of the field interviewers also participated in the meeting, and a member of the CPUC staff observed.

The meeting opened with each participant offering their "most memorable moment" from having been involved in the on-site data collection effort. This was meant to "break the ice" and facilitate subsequent discussions about what was memorable in a positive and negative way, and why.

Next, the interviewers and auditors were separated to facilitate discussions of particular relevance to each group. The interviewer discussion centered on issues associated with willingness to participate. We intended to capture interviewer perspectives on the reasons why some households do not or are unwilling to participate in the programs. We also wanted to see if the interviewers observed any systematic differences between those likely to participate and those not likely to participate. Again, the purpose was to share observations from the perspective of the interviews and to capture any issues that may not have been recorded on the survey instruments.

The auditor discussion focused on issues related to structural and measure feasibility. In addition, auditors were asked for feedback on the onsite data collection form and its effectiveness in capturing the full extent of barriers to participation.

The results of the interviewer and auditor discussions were reported in a summary memo and submitted to the CPUC after the debriefing. The CPUC was advised that these results are to be regarded as qualitative in nature and not meant to replace the detailed analysis and results from the full, representative sample of over 1,500 respondents. The memo was meant to provide a summary of the issues as perceived by the interviewers and auditors. Most interviewers and auditors were basing their observations on surveys conducted in limited geographic areas of the state. Also, due to interviewer language capabilities, some of the perceptions of interviewers were limited to only a few ethnic/racial groups. Finally, interviewer and auditor perceptions may have been affected by their expectations going into the study, past experiences on similar or related issues, and events that occurred most recently or were unique in one way or another.

A copy of the debriefing memo is included in Appendix B.

3.5 Characterizing the Low Income Population

This task involved describing the low-income population in terms of its economic, demographic, housing, and geographic characteristics. Information on these characteristics can be used to modify designs of future LIEE and CARE programs to better serve the needs of the target populations.

Table 3-8 contains the list of data used to characterize the low-income population, as well as the sources from which each data element was obtained. These data were analyzed and the results have been reported in Section 4. Detailed characterization results are contained in Appendix C.

The Census 2000 5-Percent Public Use Microdata Sample (PUMS) was a primary source of data utilized in the characterization task. Microdata contains Census information at the person and housing unit level. The microdata are a subsample of the full census sample that received the census long form questionnaire (approximately 15.8 percent of all housing units).

To preserve respondent confidentiality the Census 2000 microdata is only available to the public through the PUMS. The PUMS data contain the majority of the person and household information recorded on long-form questionnaires. However some data are not available to the public due to the limitations of sample size, geographic identification, and confidentiality protection. The PUMS data exist in 1-percent and 5-percent samples. Nationwide, the Census 2000 5-percent sample provides information for over 14 million people and over 5 million housing units. The California PUMS sample used in this analysis contains information for nearly 600,000 households, which represent more than 11.5 million households.

Additional characterization data was collected during the on-site survey via the HENS questionnaire and the energy audit, and from utility billing records. This data was collected for the 1,534 respondents and dwellings including in the on-site survey sample but is representative of the entire low-income population in California.

Table 3-8
Data Elements and Sources for Characterizing Low-Income Population

	Source of Data			
Demographics	**Census**	**HENS**	**Audit**	**Other[1]**
Race/ethnicity	X	X		
Language	X	X		
Literacy[2]		X		X
Household size and composition	X	X		
Employment	X	X		
Education	X	X		
Elderly/disability status	X	X		
Public assistance program participation	X	X		
Home ownership status	X	X		
Utility bill payment indicator		X		X
Household energy expenditures	X			X
Household energy burden		X		X
Housing tenure		X		X
Housing density	X	X		X
Dwelling Characteristics				
Dwelling type	X		X	
Dwelling vintage	X		X	
Space heating fuel	X		X	
Presence of AC			X	X
Water heating fuel			X	X
Dwelling size			X	X
Annual energy consumption				X
Seasonal energy consumption				X
Above baseline energy consumption ratio				X
Individual or master-metered			X	X

[1] Other data sources include: utility billing records and data from the recent statewide Residential Appliance Saturation Survey (RASS).

[2] Additional data was collected on literacy rates in California from the National Adult Literacy Survey (NALS).

3.6 Conducting the Needs Assessment

The needs assessment task provides insight on low-income household needs, wants and concerns in order to inform program design. Phase I outlined the key components of the needs assessment task and discussed the kinds of information to be collected. Phase I characterized this task as two distinct pieces, the first having to do with the general energy-related needs and concerns of eligible households, and the second focusing more on household perceptions of the programs, including willingness to participate and barriers to participation.

The needs assessment involved a number of interrelated analyses along these themes:

- Assessment of Energy-Related Burdens and Concerns – Addresses the relative energy burden experienced by different customer segments, as well as energy insecurity.
- Determination of Energy-Related Needs – Documents the need for energy efficiency measures as identified through the on-site energy audit, as well as the energy savings potential determined for these measures. Also addresses related household needs concerning health, safety and comfort.
- Program Perceptions – Assesses channels of information dissemination and satisfaction with the CARE and LIEE programs to help in targeting outreach and identify any obvious gaps in program implementation.
- Barriers to Participation – Identifies barriers to participation in the CARE and LIEE programs, including program awareness, participation process, reluctance to accept aid, and fear or distrust. Also addresses differences in perceived barriers across customer segments.
- Willingness to Participate – Establishes baseline levels of willingness to participate in the CARE and LIEE programs. Also assesses participation in other public assistance programs as evidence of willingness to participate in CARE and LIEE (and as an indicator for determining the effectiveness of auto-enrollment activities).

This following describes our approach to carrying out the analyses in each of these areas. Detailed survey results pertaining to the needs assessment are included in Appendix D.

3.6.1 Energy-Related Burdens and Concerns

Our assessment of energy-related burden and concerns focused on two key areas:

- The high cost of energy faced by low-income households relative to their total income (or, *energy burden*), and

- The difficulties faced by low-income households in meeting their energy needs and paying their energy bills (or, *energy insecurity*).

Energy burden was defined as the portion of total household income that goes toward paying utility bills. Energy burden was calculated as the ratio of energy expenditures to total household income. Energy expenditure data was requested from the four major California IOUs and customers for whom valid data was obtained were included in the analysis. Data on household income levels was collected during the HENS interview.

Variations in energy burden across household income levels, demographics, and dwelling locations were included in this assessment. In addition, energy burden was analyzed to determine any significant impacts related to seasonal variations and above-baseline consumption levels.

Energy insecurity was assessed using survey responses regarding difficulties faced by respondents in meeting their household's energy needs. Based on responses to the questions, respondents were placed in one of five energy insecurity groups, ranging from "thriving" (secure) to "in crisis" (insecure). These five groups represent the "energy insecurity scale," which is a version of the scale developed by Roger Colton and modified by APPRISE Inc. for the National Energy Assistance Directors Association LIHEAP Study

3.6.2 Energy-Related Needs

The energy-related needs identified through this study have been assessed in two ways. First, we documented the need for specific energy efficiency measures that were identified in detailed energy audits conducted on our sample of 1,534 dwellings. We also assessed the energy savings potential from these measures to highlight the need for a given measure relative to its contribution toward the total energy savings potential for all eligible dwellings.

Determining the need for energy efficiency measures entailed an assessment of the current stock of energy efficiency measures present in eligible dwellings, including those not currently included in the existing programs. Feasibility of energy efficiency measure installations was addressed in the context of the program's existing guidelines (e.g., structural feasibility, home/equipment ownership, etc.). An assessment of the condition of the housing stock was also conducted, including an evaluation of the age and condition of major energy-using equipment and key components of the building shell. The need for program measures, such as furnace repairs and replacement, refrigerator replacement, and building shell repairs and improvements, was included in this assessment. The primary source for this assessment was the detailed energy audit data collected for the dwellings in our survey sample. We also drew on our extensive knowledge of LIEE Program guidelines in conducting this assessment.

Specifically, this assessment addressed the following types of measures:

- Energy efficient appliance measures (programmable thermostats and refrigerators)
- Cooling equipment measures (central air conditioner replacement and maintenance, room air conditioner replacement and maintenance, evaporative cooler replacement and maintenance, and whole-house fans)
- Natural gas furnace measures (replacement, repair, filter)
- Minor home repairs (window pane, door, and wall repair and replacement)
- Lighting measures (CFLs and porchlights)
- Water heating measures (water heater replacement, pipe insulation, tank wrap, faucet aerators, and low-flow showerheads)
- Infiltration measures (caulking, weatherstripping, ceiling insulation, duct sealing, and room air conditioner/evaporative cooler covers)

The second type of energy-related needs we assessed in this study addresses household concerns about health, safety and comfort. In addition to achieving measurable energy and bill savings impacts, the LIEE Program is designed to reduce hardship and enhance comfort for participating households. Hardship is defined as "adverse impacts on the comfort, health, and safety of low-income customers that can be mitigated by access to low-income energy efficiency programs and services." As part of the overall assessment of energy-related needs, we address the various health, safety and comfort issues identified through this effort.

3.6.3 Program Perceptions

Phase II was designed to provide information that can be used to refine outreach strategies to increase awareness and overall participation among the eligible low-income population. As such, a key component of the needs assessment included the investigation of information channels frequently accessed by eligible customers, as well as identification of the existing sources they regularly look to for information about energy conservation and bill payment assistance. Effective outreach activities and program messaging are likely to include those information channels and sources currently being used and accessed by the target population.

In addition, Phase II included an assessment of reactions to and satisfaction with the program from the perspective of recent participants. While recent, formal evaluations of the LIEE Program have provided a broader assessment of these important issues, this assessment also addressed participant perceptions in order to ensure the programs are meeting the needs of participating customers.

3.6.4 Barriers to Participation

The needs assessment also fully explored issues that pose barriers to participation among the eligible population. Phase I identified a number of potential barriers and each was explicitly addressed through this study. These potential barriers include:

- Lack of awareness and misunderstanding of program eligibility criteria, benefits
- Language
- Fear (distrust among elderly, immigrant residency issues)
- Welfare stigma and reluctance to accept aid
- Participation process (application, multiple visits, income documentation)

Additional barriers to participation in the LIEE Program have to do with the structural conditions and equipment/appliance performance factors of the home. These barriers were assessed as part of the analysis of need for energy efficiency measures (see above) and the assessment of energy efficiency potential (see below).

3.6.5 Willingness to Participate

Finally, the needs assessment addressed perceptions of the programs' value by exploring willingness to participate among the eligible (non-participating) population. Willingness to participate was determined based on responses to a number of direct and indirect questions, including:

- Direct questions regarding willingness to participate in CARE and LIEE Programs

- Direct questions regarding willingness to provide information necessary to verify eligibility (e.g., income documentation)

- Indirect questions regarding willingness to participate in other public assistance programs (e.g., Medi-Cal, WIC, Healthy families, etc.)

- Indirect questions regarding barriers to participation that could affect willingness to participate in CARE and LIEE (e.g., requirements too confusing, difficult to apply, distrust of government programs, reluctant to accept aid, etc.)

In this assessment, we calculated indicators of willingness to participate in the CARE and LIEE Programs based on the direct questions, and provided evidence in support of these results based on responses to the indirect questions related to participation in other public assistance programs. Participation in other public assistance programs was explored both as an indicator of willingness to participate in CARE and LIEE, as

well as a measure of the likely effectiveness of programs designed to "auto-enroll" customers who are participating in one or more public assistance programs into the CARE and LIEE Programs.

The ultimate measures of willingness to participate in CARE and LIEE have been used to update the population and energy savings potential estimates.

3.7 Estimating Energy Savings Potential

Energy efficiency potential estimates for the LIEE program were derived from the analysis of detailed energy audits completed for our sample of 1,534 dwellings, and combined with measure-specific impact estimates from the 2001 LIEE Program Impact Evaluation.[3]

3.7.1 Current Year Potential Estimates

Savings potential, for the current year, is estimated as a function of measure applicability, the current need for a measure, and the savings from installing a measure.

$$Savings\ Potential = \sum_h \sum_i w_h A_{h,i} N_{h,i} S_i$$

Where:

w_h = the expansion weight for home *h*
$A_{h,i}$ = the applicability of measure i in home *h*
$N_{h,i}$ = the need for measure *i* in home *h*
S_i = the per-unit savings for measure *i*

Measure applicability is based on the presence of an end use that the measure affects and the feasibility of installing the measure. For example, the applicability of cooling savings for ceiling insulation depends of both the presence of air conditioning and an accessible attic in the home. For some measures, such as refrigerators and CFLs, applicability was essentially 100%.

The need of a measure was determined as part of the home audits for homes where the measure was feasible. For equipment, surveyors determined whether or not units (such as air conditioners or refrigerators) were in need of repair or replacement. For weatherization measures (caulking, weather stripping, minor home repairs), surveyors determined whether the current building shell condition was adequate or was in need of repair/tightening.

[3] KEMA conducted both the 2000 and 2001 impact evaluations of the LIEE Program on behalf of the four major California IOUs. Copies of these reports and the estimates of measure-level impacts are available at www.calmac.org.

Finally, unit savings were developed for each measure and building type, based on recent LIEE Program evaluation results. Table 3-9 shows the measures addressed in the analysis, along with the end uses they affect.

Table 3-9
Measures Addressed in the Savings Potential Analysis

Measure	End Use
Central Air Conditioner (CAC)	Cooling
CAC Maintenance	Cooling
Caulking	Cooling, Heating
Ceiling Insulation	Cooling, Heating
Duct Sealing	Cooling, Heating
Evap Cooler	Cooling
Evap Cooler Maintenance	Cooling
Minor Home Repair	Cooling, Heating
Programmable Thermostat	Cooling, Heating
Room Air Conditioner (RAC)	Cooling
RAC Maintenance	Cooling, Heating
Weather Stripping	Cooling, Heating
Whole House Fan	Cooling
Evap Cooler Cover	Heating
Furnace Filter	Heating
Furnace Repair	Heating
Furnace Replace	Heating
CFL	Lighting
Porch Light	Lighting
Refrigerator	Refrigeration
Faucet Aerators	Water Heating
Low Flow Showerhead	Water Heating
Water Heater Blanket	Water Heating
Water Heater Pipe Wrap	Water Heating
Water Heater Replacement	Water Heating

In addition to calculating total energy savings potential, we also developed estimates of savings potential that was available for the LIEE Program. This estimate was calculated as a function of the total savings potential and the customers' willingness to participate in the LIEE Program:

$$Available\,Savings\,Potential = \sum_h \sum_i w_h \times Savings\,Potential_{h,i} \times Willingness\,to\,Participate_h$$

Where w_h is the expansion weight for home h, and Savings $\text{Potential}_{h,i}$ is the estimated savings potential for measure *i* in home *h*, and Willingness to Participate_h is the probability that home *h* would be willing to participate in the LIEE Program.

3.7.2 Future Year Potential Estimates

Energy savings potential, over time, was estimated for a fixed low income population and a fixed level of program activity using the following relationship:

$$\begin{aligned} \textit{Savings Potential}_t &= \textit{Savings Potential}_{t-1} \\ &+ \textit{Addition Potential from Measure Decay}_t \\ &- \textit{Savings From Naturally Occuring Energy Efficiency}_t \\ &- \textit{Program} - \textit{Related Savings}_t \end{aligned}$$

Thus savings potential in year t is a function of the previous year's potential, adjusted for measure decay and both program and non-program measure installations. The analysis was conducted at the measure level to capture varying measure lives, where the measure decay rate was specified as 1/(measure life).

3.7.3 Measure Life

As part of the energy efficiency potential analysis, we reviewed measure lives currently being utilized by the LIEE Program to determine if they were appropriate for our analysis. We compared current measure life estimates with various sources, including:

- Utility residential EUL (effective useful life) studies,
- The CPUC Energy Efficiency Policy Manual,
- The 2001 DEER Update Study, and
- The National Energy Audit Tool (NEAT).

We found that the current measure lives utilized by the LIEE Program were in line with measure lives reported in other sources. Thus, we made no changes to the measure lives currently being utilized by the LIEE Program. We note that a much more detailed and focused study addressing low-income program measure lives could provide better evidence for the appropriateness of the current assumptions.

3.8 Updating Population and Potential Estimates Over Time

This study also included a task to develop methods to update eligible population estimates and track energy savings potential over time. We describe the recommended methods in Section 10. Specifically, we developed methods for determining the following:

- Number of eligible households for the CARE and LIEE Programs

- Penetration of the CARE and LIEE Programs
- Number of eligible households for the CARE and LIEE Programs by age and ethnicity
- Penetration of the CARE and LIEE Programs by age and ethnicity
- Energy savings potential for the LIEE Program

3.8.1 Program Population and Penetration Estimates

Methods for tracking the number of eligible CARE and LIEE households and the overall program penetration are relatively straightforward and are similar to the method developed in this study for 2003 estimates. Census records and commercial databases that are linked to the Census can be used to develop estimates of the eligible population as of a given reporting date. To the extent that prior participation is a factor in eligibility (i.e., LIEE), data on households previously served will also be accounted for. Estimates of the eligible population in a given year can be compared with program participation levels to determine annual penetration in that year or cumulative penetration over time.

Determining program eligibility by age and ethnicity can easily be developed from the same sources used to track the overall eligible population. However, estimation of penetration by these factors can only be accomplished if comparable data is collected for participants. Such data could be collected for all participants at intake (or a later date), obtained for a sample using responses to a phone or on-site survey, or estimated by program staff and contractors. However, currently, the Commission does not allow the utilities to collect such data as part of the application process.

3.8.2 Energy Savings Potential Estimates

Developing methods to estimate LIEE Program energy savings potential over time is a much more complex task. In Section 3.5.2, we described how future potential is estimated from the current potential. This analysis assumes that the total eligible and applicable population is stable over time. We refer to this approach as the "steady state analysis." The steady state assumption is reasonable as a basis for projecting potential in the future, where migrations in and out of the eligible population cannot be predicted, and the primary concern is the difference between having the program in place and not.

For tracking the savings potential over time, however, the changes in the eligible population must be taken into account. The eligible population in a particular future year can be calculated using the methods described above. The program accomplishments for each year will be known from program participation tracking data. The basic methodology described in Section 3.5.2 can be modified to utilize this information on the actual population and program activities.

To account for actual program accomplishment, we simply apply the projection formula from Section 3.5.2 for each successive year t, using the actual program accomplishment as well as the most recent tracking estimates of savings potential. This gives the current savings potential based on the most recent

information, assuming no change in the eligible population. We then calculate an additional increment to account for the changing population.

We have developed an approach to account for changes in the eligible housing stock and population sub-groups (e.g., age and ethnicity). These methods are discussed in more detail in Section 8.

4. Characterization

This section provides the detailed results of the characterization task. As mentioned above, the objectives of this task were to describe the low-income population in terms of its geographic, economic, demographic, and housing characteristics.

Much of the data behind the characterization task was developed from the onsite survey undertaken in late 2003/early 2004. As mentioned above, the onsite data collection effort was carried out using two-person teams, consisting of an experienced interviewer (or outreach specialist) and a trained energy auditor. Each was responsible for one of two primary stages or types of data collection. The first stage involved an in-depth interview with the head of the household and/or a member of the household who was responsible for the management of household finances such as energy bills. The second stage consisted of the energy audit and involved the collection of more detailed information about the home and the components of energy use, as well as the condition of the housing stock and the need/feasibility for energy efficiency measure installations.

Additional information has been used to produce this characterization, including data available from the Census 2000 PUMS files, utility billing records, and the most recent California Residential Appliance Saturation Study (RASS, 2004), which KEMA conducted on behalf of the California Energy Commission (CEC), the major IOUs and LADWP.

We begin this section by defining the population being characterized and then present a summary of the key highlights:

- How large is California's low income population?
- Where are these low income households located?
- How are these low income households distributed demographically – what are their racial and ethnic characteristics, what languages do they speak, are they mostly senior citizens or large families, are there many household members with disabilities, etc.?
- What types of homes do these low income households occupy – are they smaller and older than residential housing stock in general? What are the end-use, appliance, and building shell characteristics of these dwelling units?

Following this summary, subsequent sections present additional detail. A full set of cross-tabulations from the onsite survey will be delivered with the Final Report. Section 7 integrates the results of the characterization, needs assessment and energy savings potential analyses and provides recommendations for program targeting, outreach, design and delivery.

4.1 Defining the Population

This study was designed in 2003 at a time when the low income energy assistance programs in California were using program eligibility criteria that are slightly different from today. At that time, income eligibility for the CARE Program was set at 175% of the Federal Poverty Guidelines. The same criteria applied for the LIEE Program, except for elderly households or disabled households where the income criteria was set at 200% of the Federal Poverty Guidelines. In November 2005, these criteria changed such that all households at or above 200% of the Federal Poverty Guidelines – regardless of elderly or disability status – are eligible to participate in these programs.

We have updated our estimates of the eligible population based on these new criteria. However, we do not expect there to be significant differences in the underlying demographic and housing characteristics of the low income population that was eligible for the programs in late 2003/early 2004 and the population that is currently eligible[4]. Therefore, throughout this report, we use the label "low income household" to signify the population that the programs have been – and will continue to be – designed to reach.

4.2 Size of California's Low Income Population

Across California, there are 4 million households eligible for the CARE and LIEE Programs. This equates to nearly 30% of California's total population of residential households.

Table 4-1 presents information on the eligible population for the investor-owned utilities. CARE and LIEE Program eligibility is shown for three different standards – 175% of poverty, 200% of poverty, 225% of poverty and 250% of poverty. Under the current program eligibility standards (yellow shaded rows), about 1.6 million of PG&E's residential customers are eligible for the CARE Program and 1.9 million are eligible for LIEE. For SCG, between 1.8 and 2.0 million households are eligible for the CARE and LIEE Programs. Between 335,000 and 400,000 of SDG&E's residential customers are eligible for the programs, and around 1.4 million of SCE's residential customers are eligible for the programs.

Table 4-2 presents similar information for the small multi-jurisdictional utilities (SMJUs), as well as SMUD and LADWP[5]. Over 80,000 of the nearly 209,000 residential customers served by the SMJUs are eligible for CARE and LIEE. Approximately 42% of LADWP's residential customers and 31% of SMUD's residential customers are eligible for the programs.

[4] Other data sources have been investigated to verify that these underlying characteristics have not changed since late 2003/2004. These other data sources have included the Current Population Survey (CPS), the American Community Survey (ACS) and commercially available datasets from vendors such as Claritas. However, we found that these other data sources are limited in several important ways – i.e., none are available by utility, most are not comprehensive, and some are no more recent than the onsite survey completed as part of the needs assessment.
[5] Eligibility estimates are presented for 2005 as information for 2006 was unavailable.

Table 4-1
CARE and LIEE Eligible Population Estimates for IOUs (2006)[1]

	Total Households Technically Eligible for CARE [2]	CARE Eligible Households				Percent of Total Households Eligible for CARE			
		175% of Poverty	200% of Poverty	225% of Poverty	250% of Poverty	175% of Poverty	200% of Poverty	225% of Poverty	250% of Poverty
Statewide	**12,192,996**	**3,472,062**	**4,012,010**	**4,552,593**	**5,042,759**	**28.5%**	**32.9%**	**37.3%**	**41.4%**
PG&E (total)	**5,349,538**	**1,373,501**	**1,601,238**	**1,824,749**	**2,033,573**	**25.7%**	**29.9%**	**34.1%**	**38.0%**
PG&E (electric and gas)	3,160,349	745,100	870,432	993,826	1,110,554	23.6%	27.5%	31.4%	35.1%
PG&E (electric only)	1,341,454	398,813	463,571	524,653	581,534	29.7%	34.6%	39.1%	43.4%
PG&E (gas only)	847,735	229,588	267,235	306,270	341,485	27.1%	31.5%	36.1%	40.3%
SCE	**4,240,631**	**1,163,278**	**1,351,845**	**1,546,370**	**1,723,938**	**27.4%**	**31.9%**	**36.5%**	**40.7%**
SCG	**5,267,327**	**1,526,428**	**1,762,569**	**1,999,184**	**2,212,895**	**29.0%**	**33.5%**	**38.0%**	**42.0%**
SDG&E (total)[3]	**1,203,806**	**284,585**	**335,015**	**387,934**	**436,465**	**23.6%**	**27.8%**	**32.2%**	**36.3%**
SDG&E (electric accounts)	1,203,806	284,585	335,015	387,934	436,465	23.6%	27.8%	32.2%	36.3%
SDG&E (gas accounts)	831,970	197,453	233,302	270,922	304,998	23.7%	28.0%	32.6%	36.7%

Table 4-1 (continued)
CARE and LIEE Eligible Population Estimates for IOUs (2006)[1]

	Total Households Technically Eligible for LIEE [2]	LIEE Eligible Households				Percent of Total Households Eligible for LIEE			
		175% of Poverty	200% of Poverty	225% of Poverty	250% of Poverty	175% of Poverty	200% of Poverty	225% of Poverty	250% of Poverty
Statewide	**12,192,996**	**3,472,062**	**4,012,010**	**4,552,593**	**5,042,759**	**28.5%**	**32.9%**	**37.3%**	**41.4%**
PG&E (total)	**6,137,507**	**1,608,354**	**1,868,594**	**2,123,930**	**2,361,586**	**26.2%**	**30.4%**	**34.6%**	**38.5%**
PG&E (electric and gas)	3,160,349	745,100	870,432	993,826	1,110,554	23.6%	27.5%	31.4%	35.1%
PG&E (electric only)	1,443,690	435,344	504,540	569,825	630,359	30.2%	34.9%	39.5%	43.7%
PG&E (gas only)	1,533,468	427,910	493,622	560,279	620,673	27.9%	32.2%	36.5%	40.5%
SCE	**4,271,645**	**1,175,521**	**1,365,633**	**1,561,751**	**1,740,615**	**27.5%**	**32.0%**	**36.6%**	**40.7%**
SCG	**5,826,634**	**1,742,079**	**2,005,118**	**2,268,290**	**2,504,248**	**29.9%**	**34.4%**	**38.9%**	**43.0%**
SDG&E (total)	**1,343,769**	**336,196**	**394,242**	**454,856**	**510,022**	**25.0%**	**29.3%**	**33.8%**	**38.0%**
SDG&E (electric accounts)	1,343,769	336,196	394,242	454,856	510,022	25.0%	29.3%	33.8%	38.0%
SDG&E (gas accounts)	1,045,003	275,016	322,179	371,333	415,340	26.3%	30.8%	35.5%	39.7%

[1] Source: 2006 data developed by John Peterson of Athens Research under subcontract to the IOUs.

[2] Technical eligibility distinguishes individually metered from submetered/subunit households. CARE and LIEE programs have different requirements with regard to submetered households (i.e., submetered households are eligible for CARE, whereas LIEE requires that 80% of the units in a submetered property must be income eligible in order to qualify for the program). Differences in technical eligibility for CARE and LIEE could not be determined statewide but have been provided for each utility.

[3] The SDG&E total estimates are based on the electric tariff counts.

Table 4-2
CARE and LIEE Eligible Population Estimates for SMJUs, LADWP and SMUD (2005)[1]

	Alpine Natural Gas	Bear Valley Electric	Mountain Utilities	PacifiCorp	Sierra Pacific	Southwest Gas[2]	West Coast Gas[3]	LADWP	SMUD
CARE Eligibility									
All Residential Customers Technically Eligible for CARE	4,640	7,772	185	31,347	24,652	140,482	na	1,442,936	493,681
All Residential Customers Technically and Demographically Eligible for CARE									
175% of Poverty	1,031	2,742	46	14,000	6,037	46,317	na	551,011	137,157
200% of Poverty	1,248	3,187	54	15,467	7,328	53,550	na	615,280	156,832
250% of Poverty	1,725	3,884	71	18,337	9,926	67,595	na	732,935	200,649
Percentage of All Residential Customers Eligible for CARE									
175% of Poverty	22%	35%	25%	45%	24%	33%	na	38%	28%
200% of Poverty	27%	41%	29%	49%	30%	38%	na	43%	32%
250% of Poverty	37%	50%	38%	58%	40%	48%	na	51%	41%
LIEE Eligibility									
All Residential Customers Technically Eligible for LIEE	4,640	7,772	185	31,347	24,652	140,482	na	1,442,936	493,681
All Residential Customers Technically and Demographically Eligible for LIEE									
175% of Poverty	1,031	2,742	46	14,000	6,037	46,317	na	551,011	137,157
200% of Poverty	1,248	3,187	54	15,467	7,328	53,550	na	615,280	156,832
250% of Poverty	1,725	3,884	71	18,337	9,926	67,595	na	732,935	200,649
Percentage of All Residential Customers Eligible for LIEE									
175% of Poverty	22%	35%	25%	45%	24%	33%	na	38%	28%
200% of Poverty	27%	41%	29%	49%	30%	38%	na	43%	32%
250% of Poverty	37%	50%	38%	58%	40%	48%	na	51%	41%

[1] Source: 2005 analysis completed by John Peterson of Athens Research under subcontract to the IOUs.
[2] Southwest Gas includes customers formerly served by Avista.
[3] Data unavailable for West Coast Gas.

4.3 Geographic Summary

California's low income population is split among two geographic extremes – nearly half live in densely populated areas (i.e., more than 1,500 households per square mile), while about one in five lives in very sparsely populated areas (i.e., less than 200 households per square mile). California's low income population is distributed within these geographic extremes somewhat more frequently than the residential population as a whole, although these differences are not significant.

One in four of California's low income households live in the Central Valley climate region (climate zones 11, 12 or 13).[6] About half live in Southern California, split almost equally between the South Inland (climate zones 9 and 10) and the South Coast (climate zones 6, 7 and 8) climate regions. Sixteen percent live in the North Coast climate region (climate zones 1-5), 5% live in the Desert climate region (climate zones 14 and 15), and 2% live in the Mountain climate region (climate zone 16).

4.4 Demographic Summary

The average household income among all low income households included in this study is about $22,000, the average household size is 3.5, and the average household income per person is $8,411. With respect to household income and size characteristics, California's low income population is distributed as shown in Table 4-3.

Table 4-3
Household Size and Income Data for California's Low Income Households

(Source: HENS 2004)

Household Size	Percent of Low Income Households[1]	Average Household Income	Average Household Income Per Person
1 person	20%	$15,177	$15,177
2 persons	21%	$20,206	$10,103
3 persons	14%	$22,151	$7,383
4 persons	16%	$23,989	$5,997
5 or more persons	29%	$25,454	$4,289
All Households	**100%**	**$21,601**	**$8,411**

[6] California is divided into 16 climate zones for Title 24 Building Code compliance purposes. These 16 climate zones are grouped into six "climate regions" – Central Valley, Desert, Mountain, North Coast, South Coast and South Inland. See Section 4.6.1 for a climate zone map.

Two out of every three low income households in California can be classified as a "families" – there is at least one child living in the home. Many (35%) are small families, with up to four household members, and 29% are large families, with five or more household members. Eighteen percent of all low income households are comprised of "seniors only" (60 years or older), and the remaining 17% consist of households where no children and no seniors are living in the home.

While the majority of California's residential population categorizes its race and ethnicity as White, there is no majority racial and ethnic group among low income households. The most predominant racial/ethnic category among California's low income population is Hispanic (42%), followed by White (31%). A similar percentage of low income households characterize themselves as African-American (10%) or Asian (9%). Seven percent characterized their race/ethnicity as "other" (e.g., Native American, Pacific Islander, etc.).

For two out of every five low income households in California, English is not the primary language spoken. While the most predominant non-English language is Spanish, more than 30 different non-English languages are spoken in the households represented in this study. These languages range from the relatively common Asian (e.g., Cantonese, Tagalog) and European (e.g., Russian, Armenian) languages, to the less common (e.g., Arabic, Hindi, Samoan, Turkish, etc.).

Overall, many of California's low income households are not currently employed – one in four is retired, one in five is on permanent or temporary disability, and another 20% are unemployed. Over half of California's low income households are limited to a high school education (or less).

Elderly and disabled persons are commonly represented among California's low income population – one in three household members is elderly, and one in four is disabled. Nearly one in five suffer from some type of hearing, vision or other physical disability and 15% are mentally or emotionally disabled. For 20% of all low income households, the responsibility for making energy payments on behalf of the household lies with a disabled household member.

4.5 Housing Summary

Home ownership is much less common among California's low income households as compared to the residential population as a whole. Only 35% of low income households own their homes, whereas roughly two thirds of all California households (65%) own their homes. Most low income households live in single family (43%) or large multi-family (43%) dwellings. A limited number of low income households live in smaller multi-family dwellings (7%), and only 6% live in mobile homes. About 3% of low income households live in master-metered dwellings (electric and/or gas).

Low income dwellings are much smaller than those occupied by the typical residential household. Two thirds of all low income households live in housing units that are less than 1,000 square feet, whereas in

the residential population as a whole, only 20% live in housing units of this size. Housing occupied by low income households is about as old as housing occupied by residential customers in general. Over half of all low income housing was built prior to 1970, which is similar to all housing in California.

Table 4-4 summarizes the types of major end-use equipment and appliance holdings in dwellings occupied by California's low income population. As shown, natural gas is used most often for space (68%) and water (76%) heating, cooking (71%), and laundry (55% for clothes washers, 32% for clothes dryers).

Table 4-4
Summary of Major Equipment and Appliance Holdings in Low Income Dwellings
(Source: HENS 2004)

Percent of Low Income Households	Electricity	Natural Gas	Propane	Solar	Wood	None/Not Applicable
Primary Space Heating Equipment	18%	68%	3%	0%	3%	9%
Water Heating Equipment[1]	6%	76%	3%	1%	0%	14%
Cooling Equipment	52%	3%	0%	0%	0%	45%
Refrigerator	100%	0%	0%	0%	0%	0%
Stand-Alone Freezer	10%	0%	0%	0%	0%	90%
Range/Oven[2]	34%	71%	2%	0%	0%	0%
Dishwasher	2%	27%	2%	0%	0%	69%
Clothes Washer	4%	55%	3%	0%	0%	38%
Clothes Dryer	27%	32%	1%	0%	0%	40%

[1] Includes households that do not pay for hot water, but water heating fuel is unknown.
[2] Includes households that use both electricity and natural gas for range/ovens.

Most households use natural gas forced hot air furnaces (39%) or wall units (28%) as their primary system for space heating. Another 15% use electricity for their primary space heating systems (e.g., heat pumps, wall units, portable heaters). Much of this equipment, especially the natural gas systems, is over 20 years old.

Over half of all low income households (55%) use some type of equipment for space cooling. One in five low income households use a central air conditioning system, and another 20% use room air conditioners. Seven percent have evaporative coolers, and 5% are using heat pumps. Many of these systems are over 20 years old, especially the evaporative coolers and room air conditioners

Most of the water heating equipment used in low income dwellings (43%) is over 10 years old. As mentioned above, a small percentage of low income households (3%) are master-metered and, as a result, do not pay the utility company directly for the energy used in the dwelling unit. In addition, nearly one third of all low income households do not pay for hot water as part of their utility service.

Most low income households live in dwelling units with flat ceilings (as opposed to vaulted or sloped), and about half of all low income dwelling units have some type of attic space above the ceiling. Across all low income households, the average dwelling unit has about 900 square feet of ceiling area with an average ceiling insulation level of R-11. This insulation level varies according to the type of ceiling present in the dwelling, and units with attic space above the ceilings are generally larger and better insulated. Many of these attics are already well ventilated (41%), although for about half of the dwelling units, ventilation is not applicable. The average dwelling unit occupied by low income households has existing wall insulation with a rating of about R-9; about one in five has no existing wall insulation.

Most low income households live in dwellings with slab foundation (49%), and about one quarter live in dwellings with crawl-space or basement foundations. Only about one in five low income households live in dwellings with duct systems. These systems are comprised of, on average, over 10 linear feet of round tubing (as opposed to square) located in attics or other crawl spaces.

Most of the exterior doors in low income dwelling units are solid core (50%) or hollow core (41%); only 8% are insulated metal. The majority of low income dwellings units (80%) have single-pane windows. About one in five (23%) have double-pane windows and none have triple-pane windows.

More than one third of all low income households have programmable thermostats installed in the dwelling unit to control their heating systems (36%) and about one quarter have programmable thermostats to control their cooling systems (23%). Only a small percentage of low income households, however, are using the programmable features of their thermostats.

The majority of low income households use only one refrigerator (90%) that is grounded (92%) and located in a conditioned space (96%). Most refrigerators have doors on the top and bottom (74%) and a frost-free freezer compartment (85%). About half (52%) are between 17-20 cubic feet in size and another 35% are over 20 cubic feet. About two thirds of all refrigerators used by low income households (65%) are 10 years old or less. Only 10% of all low income households use stand-alone freezers.

Most low income households use natural gas ranges/ovens (71%), and about one third use electricity for these cooking appliances. About one third use automatic dishwashers and about 60% have laundry equipment, most of which is fueled by natural gas.

Finally, the average low income household has approximately 16 lighting fixtures or lamps. Thirteen of these contain incandescent light bulbs, two contain CFLs, another is a fluorescent fixture and the last is an

incandescent porch light. Across all low income households, just over one third (36%) already use CFLs and about 8% use CFL porch lights.

4.6 Detailed Characterization Results

This section presents a detailed discussion of the characterization results, for the low income population overall as well as by utility. Section 7 integrates the results from the characterization task, the needs assessment, and the energy savings potential analysis and provides recommendations for program targeting, outreach, design and delivery. Additional characterization results are provided with the full set of cross-tabulations included in Appendix C.

4.6.1 Geographic Distribution of California's Low Income Population

About half of California's low income households live in densely populated areas, characterized by 1,500 or more households per square mile, as shown in Table 4-5. These households are typically located in the greater Los Angeles metropolitan area or the San Francisco Bay Area. Eighteen percent of low income households live in sprawling areas (between 500 and 1,500 households per square mile), such as the Central Valley. The remaining households live in sparse (8%) or very sparse (23%) areas, defined as having 500 or fewer households per square mile. The low income population is distributed fairly similarly throughout the entire population of California residents. Low income households are somewhat more likely to live in very densely or very sparsely populated areas.

Table 4-5 also demonstrates the distribution of low income households by utility. As shown, the vast majority of SCG's low income households (81%) are located in dense or very densely populated areas. PG&E's low income households are most likely located in very sparsely populated areas (less than 200 households per square mile).

Table 4-5
Distribution of California Households by Housing Density
(Source: U.S. Census 2000, HENS 2004)

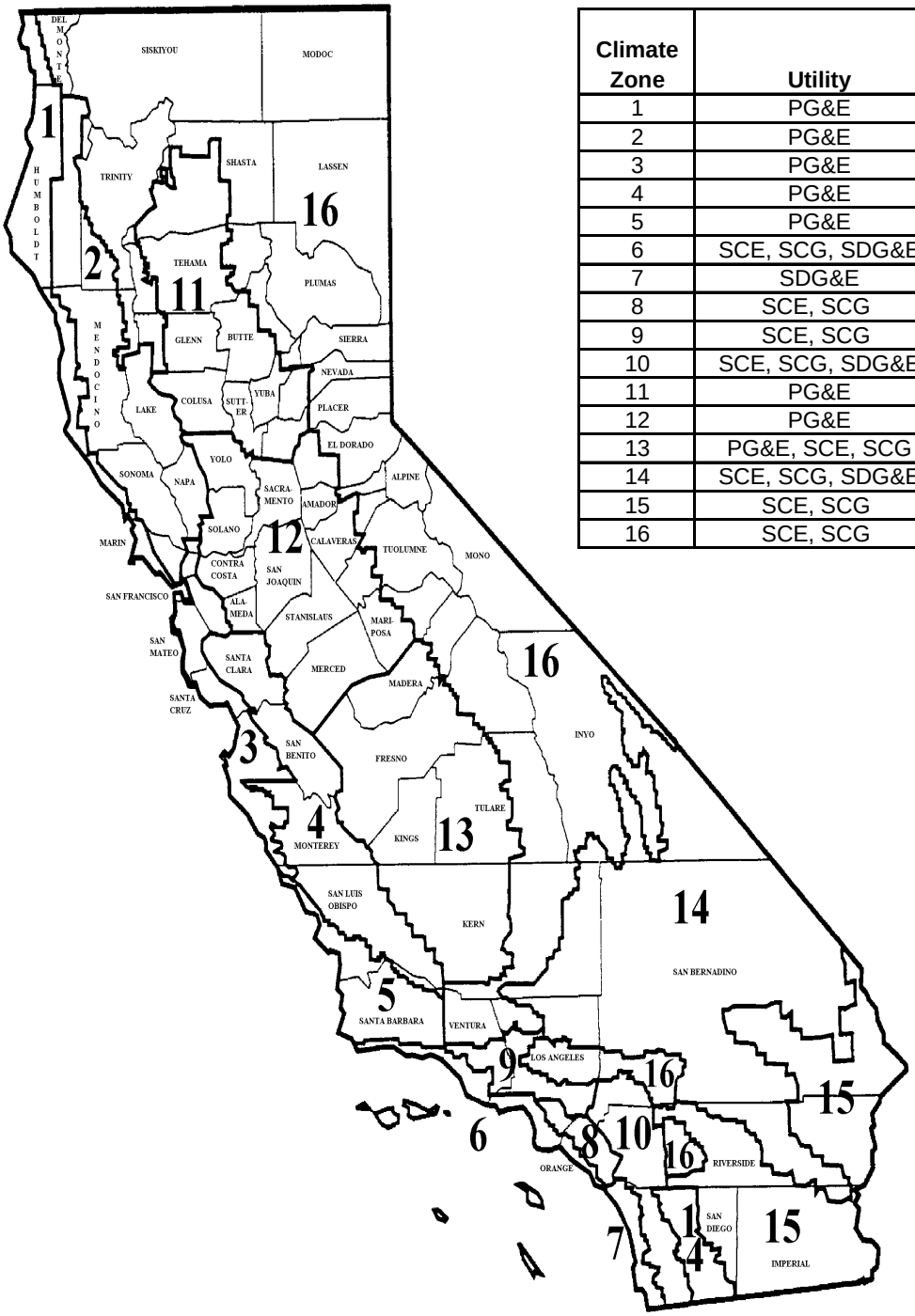
Housing Density	Percent of All California Households	**Percent of Low Income Households**[1]	*Percent of Low Income Households by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
Very Dense (>3000 hh/sq mi)	21%	**23%**	12%	17%	22%	51%	24%
Dense (1500-<3000 hh/sq mi)	28%	**28%**	27%	25%	33%	30%	23%
Sprawl (500-<1500 hh/sq mi)	22%	**18%**	16%	21%	22%	12%	30%
Sparse (200-<500 hh/sq mi)	10%	**8%**	8%	12%	9%	3%	12%
Very Sparse (<200 hh/sq mi)	20%	**23%**	36%	25%	14%	4%	11%
Urban / Rural							
Urban (>=1500 hh/sq mi)	49%	**51%**	40%	41%	55%	81%	47%
Rural(<1500 hh/sq mi)	51%	**49%**	60%	59%	45%	19%	53%

Table 4-6 shows a distribution of all low income households in California according to climate regions (and associated climate zones). As shown, one quarter of all low income households live in the Central Valley region (climate zones 11, 12 and 13). Over half of the low income households live in the South Coast and South Inland climate regions (climate zones 6-10). Figure 4-1 displays a map of California's climate zones, along with a list of climate zones by utility and the percent of low income households living in each climate zone.

Table 4-6
Distribution of California's Low Income Population by Climate Region and Climate Zone
(*Source: HENS 2004)*

Climate Region (Climate Zone)	**Percent of Low Income Households**	*Percent of Low Income Households by Utility*				
		PG&E	SCE	SCE/SCG	SCG	SDG&E
Central Valley (11, 12, 13)	**25%**	59%	3%	1%	0%	0%
Desert (14, 15)	**5%**	0%	17%	12%	5%	1%
Mountain (16)	**2%**	1%	8%	1%	0%	0%
North Coast (1, 2, 3, 4, 5)	**16%**	40%	0%	0%	0%	0%
South Coast (6, 7, 8)	**24%**	0%	40%	38%	31%	70%
South Inland (9, 10)	**28%**	0%	33%	49%	64%	29%

Figure 4-1
Distribution of California's Low Income Population by Climate Zone
(Source: CEC Building Standards, Title 24)



Climate Zone	Utility	Percent of Low Income Households
1	PG&E	1%
2	PG&E	1%
3	PG&E	9%
4	PG&E	5%
5	PG&E	1%
6	SCE, SCG, SDG&E	7%
7	SDG&E	6%
8	SCE, SCG	12%
9	SCE, SCG	18%
10	SCE, SCG, SDG&E	10%
11	PG&E	6%
12	PG&E	13%
13	PG&E, SCE, SCG	5%
14	SCE, SCG, SDG&E	3%
15	SCE, SCG	3%
16	SCE, SCG	2%

4.6.2 Demographic Characteristics of California's Low Income Population

Households who are eligible for low income energy assistance programs in California are demographically different from residents of the state as a whole. The following is a summary of the key demographic characteristics of California's low income population. Section 4.7 provides additional results for key segments.

Race/Ethnicity

As part of the onsite survey, the outreach specialist asked a set of questions to capture household race and ethnicity data. These questions were worded and administered in a manner consistent with the U.S. Census to allow for comparisons. The question sequence begins by asking the respondent if he/she considers him/herself "Spanish/Hispanic/Latino," and then the interviewer reads from a list of races and asks the respondent to indicate which he/she considers him/herself to be (allowing more than one race to be selected). We used the results from these questions to develop the race/ethnicity variable discussed in this section.

According to the 2000 U.S. Census, the majority of California's residential population was characterized as White (58%). Unlike the residential population, there is no majority racial and ethnic group among California's low income households. As shown in Table 4, the most predominant racial/ethnic category among the low income population is Hispanic (42%), followed by White (31%). A similar percentage of low income households characterize themselves as African-American (10%) or Asian (9%). Table 4-7 also shows differences by utility.

Table 4-7
Distribution of California Households by Race/Ethnicity
(Source: U.S. Census 2000, HENS 2004)

Race/ Ethnicity	Percent of All California Households	**Percent of Low Income Households[1]**	*Percent of Low Income Households by Utility*				
			PG&E	**SCE**	**SCE/ SCG**	**SCG**	**SDG&E**
White (non-Hispanic)	58%	**31%**	35%	28%	26%	26%	43%
African-American	7%	**10%**	11%	7%	10%	10%	13%
Asian	10%	**9%**	10%	11%	6%	14%	5%
Hispanic	22%	**42%**	37%	46%	52%	44%	37%
Other	3%	**7%**	8%	8%	6%	6%	2%

[1] Sample Size: n=1,517

Languages Spoken

English is the primary language spoken in the majority of California's low income households, as shown in Table 4-8. However, for about 38% of the low income population, English is not the primary language spoken. The most predominant non-English language spoken in California's low income households is Spanish. SCG low income households are the least likely to speak English as a primary language, and SDG&E low income households are most likely to speak English as a primary language.

Table 4-8
Distribution of California Households by Primary Language Spoken
(Source: U.S. Census 2000, HENS 2004)

Primary Language	Percent of All California Households	**Percent of Low Income Households**[1]	*Percent of Low Income Households by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
English	67%	**62%**	68%	68%	56%	49%	71%
Non-English	33%	**38%**	32%	32%	44%	51%	29%
- Spanish	19%	**29%**	23%	23%	36%	37%	27%
- Asian	7%	**6%**	7%	7%	5%	7%	3%
- Other	7%	**3%**	3%	2%	4%	8%	0%

Over half of all low income households speak a language other than English (58%). Over 30 different languages are spoken by the low income households represented in the needs assessment survey. These languages are listed in Table 4-9. As shown, 93% of all low income households speak English, 43% speak Spanish, 10% speak an Asian language, and about 5% speak a European language (other than Spanish).

Table 4-9
Distribution of Languages Spoken in Low Income Households
(Source: HENS 2004)

Language Spoken	Percent of Low Income Households[1]	*Percent of Low Income Households by Utility*				
		PG&E	SCE	SCE/SCG	SCG	SDG&E
English	**92.7%**	**90.8%**	**96.2%**	**94.1%**	**92.9%**	**92.7%**
Non-English	**57.8%**	**51.9%**	**54.8%**	**63.8%**	**69.6%**	**50.3%**
Spanish	**42.7%**	**36.5%**	**43.9%**	**52.5%**	**46.1%**	**41.3%**
Asian	**10.1%**	**10.4%**	**10.2%**	**7.7%**	**13.3%**	**6.5%**
Cantonese	2.4%					
Tagalog	2.3%					
Vietnamese	1.9%					
Korean	1.6%					
Mandarin	1.4%					
Hindi	0.6%					
Samoan	0.5%					
Japanese	0.4%					
Cambodian	0.3%					
Indonesian	0.3%					
Thai	0.2%					
Hmong	0.1%					
European	**5.2%**	**4.9%**	**2.1%**	**3.1%**	**9.4%**	**6.8%**
Russian	1.1%					
French	1.0%					
Portuguese	0.9%					
Armenian	0.8%					
German	0.6%					
Hebrew	0.6%					
Polish	0.6%					
Italian	0.5%					
Other Eastern European	0.3%					
Swedish	0.3%					
Turkish	0.1%					
Greek	0.1%					
Middle Eastern	**1.2%**	**0.2%**	**0.4%**	**1.3%**	**3.5%**	**1.4%**
Arab	0.6%					
Farsi	0.6%					
Other	**1.4%**	**1.8%**	**0.5%**	**1.3%**	**1.9%**	**0.0%**

Linguistic Isolation

The Census defines linguistic isolation as "a household in which no person 14 years old and over speaks only English and no person 14 years old and over who speaks a language other than English speaks English 'Very Well'." As shown in Table 4-10, California's low income households are more likely to be classified as linguistically isolated than the general residential population. Isolated households predominantly speak Spanish in the home. Since this information comes from the U.S. Census, a breakdown by utility is not available.

Table 4-10
Distribution of California's Linguistically Isolated Households
(Source: U.S. Census 2000)

Linguistic Isolation	Percent of All California Households	**Percent of All Low income Households**
Not isolated	90%	81%
Spanish isolation	6%	13%
Indo-European isolation	1%	2%
Asian isolation	3%	4%
Other isolation	<1%	<1%

Literacy

An English-language literacy assessment[7] was conducted as part of the onsite data collection effort undertaken as part of this study. This involved an assessment of each respondent's ability to read and answer questions regarding the CARE Program application, as well as a sample letter sent to households submitting incomplete CARE applications. Respondents were scored on specific items as well as given an overall subjective literacy score. The scores were combined and the results are presented in Table 4-11.

[7] Literacy was assessed among non-English speaking households. However, due to the relatively small sample sizes and inconsistencies in the method employed to conduct the assessment, the results cannot be included in an overall assessment of literacy.

Table 4-11
Literacy Assessment Results for California's Low Income Population
(Source: HENS 2004)

Literacy Assessment	Percent of Low Income Households[1]	*Percent of Low Income Households by Utility*				
		PG&E	SCE	SCE/ SCG	SCG	SDG&E
Literate	**85%**	89%	82%	84%	78%	87%
Illiterate	**8%**	4%	12%	9%	13%	4%
Uncertain	**7%**	7%	6%	7%	8%	9%
[1] Sample Size: n=1,196						

As shown, 85% of respondents whose interviews were conducted in English were determined to be literate. For 7% of the respondents, we were unable to determine literacy and for 8% we determined that the respondent was illiterate. Table 4-11 also shows the literacy assessment results by utility. A slightly higher percentage of low income respondents in SCE and SCG's service territories were determined to be illiterate.

It should be noted that our figure of 85% literate for California's low income population is somewhat higher than other estimates – for example, the National Adult Literacy Survey (NALS) determined that around 75% of California's entire residential population demonstrated the minimum level of literacy (Level 1). "Level 1" literacy is defined by NALS as the minimal level of skill in document, prose and quantitative proficiencies. Though all adults at this level display limited literacy skills, many are successful in performing simple, routine tasks involving brief and uncomplicated texts and documents. For example, they were able to total the entries on a deposit slip, locate the time or place of a meeting on a form, and identify a piece of specific information in a brief news article. "Level 1" literacy seems an appropriate measure of literacy required to complete the application process required for both the CARE and LIEE Programs.

Household Income

As described above, this study was designed to characterize and assess the needs of California's low income population. As such, households were defined as low income based on program eligibility criteria in place during 2003 and recruited for the onsite survey using these same eligibility criteria. While this definition is slightly different than what is being used today, it still serves as a good proxy for the population of low income households in California.

Keeping in mind that all respondents to the onsite survey were, by definition, "low income," Table 4-12 presents the household income distribution among California's low income population. As shown, the average low income household in California earns less than $22,000 per year. The per capita income, on

average, is about $8,400. As shown in Table 4-12, SCE low income households have the lowest overall household income, while SCG households have the lowest household income per person. In general, these two utilities serve what appear to be the poorest of the low income households, whereas PG&E and SDG&E low income households have slightly higher incomes.

Table 4-12
Distribution of California's Low Income Households by Income
(Source: HENS 2004)

	All Low Income Households	PG&E	SCE	SCE/ SCG	SCG	SDG&E
Less than $5,000	**4%**	5%	3%	3%	4%	7%
$5,000 to $9,999	**13%**	14%	17%	10%	12%	7%
$10,000 to $14,999	**17%**	18%	21%	16%	14%	19%
$15,000 to $19,000	**17%**	15%	18%	20%	20%	16%
$20,000 to $24,999	**17%**	16%	10%	17%	22%	20%
$25,000 to $29,999	**11%**	9%	14%	14%	11%	8%
$30,000 to $34,999	**8%**	9%	7%	7%	8%	11%
$35,000 to $39,999	**4%**	3%	5%	7%	5%	5%
$40,000 to $45,999	**3%**	4%	2%	3%	1%	1%
$46,000 to $49,999	**1%**	2%	0%	1%	2%	1%
$50,000 or more	**4%**	5%	3%	2%	1%	5%
Average Household Income	**$21,601**	$22,384	$20,139	$21,625	$21,034	$21,434
Average Household Income Per Person	**$8,411**	$9,076	$8,465	$7,624	$7,363	$9,009

These results were derived from survey questions that were administered as follows. First, the outreach specialist handed each respondent a card that contained a list of sources from which household income is typically derived. These sources included those that were being used by the programs at the time to verify household income, as listed in Table 4-13.

Table 4-13
Household Income Sources Used to Determine Eligibility in CARE and LIEE
(Source: HENS 2004)

Wages or Salaries	TANF (AFDC)
Food Stamps	Child Support
Cash and/or Other Income	Spousal Support
Unemployment Benefits	Disability Payments
Workers Compensation	Social Security, SSI, SSP
Interest and/or Dividends from Savings Accounts, Stocks or Bonds, Retirement Accounts)	Rental or Royalty Income
School grants, scholarships, or other aid used for living expenses	Profit from Self-Employment (IRS Form Schedule C, Line 29)
Pensions	Insurance Settlements
Legal Settlements	

The outreach specialist then asked about (or read) each type of income source and recorded all that were mentioned. The outreach specialist followed up by asking each respondent to think about all the types of income earned by the household in the past 12 months and then read the list of categories shown in Table 4-13 above. The actual list went on up by progressively larger increments until the last category of "$150,000 or more" was read.

Household Size

Table 4-14 displays household size information for California's low income households. As shown, large households (5 or more persons) are much more prevalent among California's low income population, as compared to the state's population overall. This is particularly true for the overlap SCE/SCG area.

Table 4-14
Distribution of California Households by Household Size
(Source: U.S. Census 2000, HENS 2004)

Household Size	Percent of All California Households	**Percent of Low Income Households**	*Percent of Low Income Households by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
1 person	24%	**20%**	24%	21%	18%	14%	25%
2 persons	30%	**21%**	22%	26%	14%	20%	20%
3 persons	16%	**14%**	14%	11%	15%	16%	13%
4 persons	15%	**16%**	12%	18%	14%	21%	20%
5 or more persons	16%	**29%**	28%	24%	40%	28%	22%

Household Composition

In addition to capturing data on the number of household members, the onsite survey also recorded the age of each household member. These results were combined to profile the composition of each low income household in terms of the number of children, elderly household members, etc.

Table 4-15 shows the distribution of different types of households among California's low income population. As shown, about two thirds of the low income population is comprised of households classified as "families" (at least one child is living in the home) – 35% are small families (2-4 household members), and 29% are large families (5 or more household members). Another 18% are defined as "seniors" (only seniors reside in the home). The remaining 17% consist of households where no children and no seniors are living in the home.

Table 4-15
Distribution of California's Low Income Households by Household Composition
(Source: HENS 2004)

Household Composition	**Percent of Low Income Households**	*Percent of Low Income Households by Utility*				
		PG&E	SCE	SCE/ SCG	SCG	SDG&E
Small families (2-4)	**35%**	34%	35%	33%	42%	31%
Large families (5+)	**29%**	28%	24%	40%	28%	22%
Seniors only	**18%**	23%	17%	18%	10%	17%
Adults (age 35-59)	**11%**	10%	17%	6%	13%	17%
Young adults (age 18-34)	**6%**	5%	7%	3%	7%	14%

"Families" are more common among SCE/SCG and SCG low income households, and least common among SDG&E households. "Seniors only" are most prevalent among PG&E households, and least prevalent among SCG households. SDG&E has the highest percentage of "young adult" households, where all household members are between the ages of 18 and 34.

Household Elderly/Disabled Status[8]

As part of the onsite survey, the outreach specialist asked a set of questions to capture the age of the head of household, as well as an indication of whether or not any of the members of the household suffer from a physical or mental disability. The specific questions used to assess the household's disability "status" include:

- Do any of the people in this household 18 years or older have any of the following long-lasting conditions:
    - Blindness, deafness or a severe vision or hearing impairment, or
    - A condition that substantially limits one or more basic physical activities such as walking, climbing stairs, reaching, lifting or carrying?

- Because of a physical, mental, or emotional condition lasting 6 months or more, does any person in this household 18 years or older have trouble:
    - Learning, remembering, or concentrating,
    - Dressing, bathing, or getting around inside the house, or
    - Going outside the home alone to shop or visit a doctor's office?

As shown in Table 4-16, nearly one in every two low income households contains a member who is either elderly and/or disabled. PG&E households are most likely to contain elderly and/or disabled household members, whereas SCE and SCG households are least likely to contain elderly and/or disabled household members.

[8] Prior to November 1, 2005, income eligibility criteria for the CARE and LIEE Programs varied depending on whether or not there are elderly and/or disabled household members. While these no criteria no long apply to the programs, the information is still useful for assessing the needs of these important segments of the low income population.

Table 4-16
Distribution of California's Low Income Households by Elderly/Disabled Household Status
(Source: HENS 2004)

Elderly/Disabled Household Status	Percent of Low Income Households	Percent of Low Income Households by Utility				
		PG&E	SCE	SCE/ SCG	SCG	SDG&E
No elderly/no disabled household members	**52%**	42%	61%	56%	62%	54%
Elderly household member	**21%**	20%	18%	26%	22%	17%
Disabled household member	**14%**	19%	12%	11%	8%	19%
Elderly and disabled household member	**13%**	18%	10%	7%	8%	9%
Type of Disability						
Hearing/Vision/Physical	**23%**	34%	15%	15%	12%	23%
Mental/Emotional	**15%**	20%	14%	8%	11%	16%
Bill Payment Responsibility						
Household member with disability	**22%**	35%	17%	12%	13%	22%

Table 4-16 also displays information about the types of disability faced by low income households. Overall, 23% of low income households contain a member who has a hearing, vision or physical disability, and 15% of low income households have a member who is mentally and/or emotionally disabled. Finally, among all low income households, 22% contain a member who is disabled and also responsible for paying the utility bill.

Employment

The onsite survey also captured information on household employment. Specifically, the outreach specialist asked each respondent to indicate how many different household members (18 years or older) were in the following "employment situations:"

- Employed (working for pay)
- Temporarily laid off from work
- On temporary disability
- On permanent disability
- Unemployed or looking for work
- Retired

- Helped without pay in a family business or farm for 15 hours or more
- Work at home without pay
- Student
- Self employed
- Other (Specify)

Based on the results of the onsite survey, about two-thirds of California's low income households (64%) have at least one household member who is employed. This compares to nearly 80% of the residential population as a whole (according to 2000 Census). As shown in Table 4-17, SCG low income households are more likely to have members who are employed (77%), as compared to PG&E (55%). Retirees are most prevalent among SCE households (32%), and non-working households on temporary/permanent disability are most common among PG&E households (18%). These percentages sum to more than 100% because the question was asked for all household members.

Table 4-17
Distribution of California Households by Employment Status
(Source: U.S. Census 2000, HENS 2004)

Employment Status	Percent of All California Households	**Percent of Low Income Households**	*Percent of Low Income Households by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
Employed	78%	**64%**	55%	68%	65%	77%	69%
Unemployed	n/a	**18%**	22%	11%	16%	17%	11%
Retired		**26%**	24%	32%	29%	23%	23%
Disability		**18%**	26%	15%	15%	9%	12%
Student		**5%**	4%	5%	5%	5%	6%

Education

Educational attainment among low income households for California's low income energy assistance programs is vastly different from the residential population as a whole. As shown in Table 4-18, many heads of low income households have not completed high school (30%). Among California's residential population as a whole, nearly two-thirds have completed college-level courses (62%), as compared to 44% of its low income households. SCE/SCG low income households are among the least highly educated and SCE low income household are among the least educated.

Table 4-18
Distribution of California Households by Employment Status
(Source: U.S. Census 2000, HENS 2004)

Education	Percent of All California Households	Percent of Low Income Households	*Percent of Low Income Households by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
Bachelor's degree (or more)	30%	**15%**	14%	13%	8%	23%	15%
Some college	32%	**29%**	33%	24%	22%	27%	40%
High school graduate	19%	**27%**	29%	33%	30%	19%	15%
Less than high school graduate	20%	**30%**	24%	30%	40%	31%	30%

Tenure

As part of the onsite survey, low income households were asked how long they have lived in their current and prior homes. A household who has been living in its current home for two years or less, and lived in its prior home for two years or less, was characterized as part of this study as a household who tends to "move often." As shown in Table 4-19, 17% of all of California's low income households were characterized in this way. Overall, 38% of California's low income households have lived in their current home for two years or less and 11% have lived in their current home for 20 or more years. SCG and SDG&E low income households were most likely to have moved twice within the last four years.

Table 4-19
Distribution of California Households by Tenure
(Source: HENS 2004)

Number of Years in Current Home	Percent of Low Income Households	*Percent of Low Income Households by Utility*				
		PG&E	SCE	SCE/ SCG	SCG	SDG&E
Less than 2 years	**38%**	42%	35%	31%	40%	38%
20 years or more	**10%**	11%	4%	11%	12%	13%
Moves Often*	**17%**	14%	16%	11%	22%	26%

* Defined as a household that has been living in its current home for two years or less, and lived in its prior home for two years or less.

We were able to use similar data from the recent California RASS study on the state's population as a whole to confirm the findings from the onsite survey. As shown in Table 4-20, there is evidence that housing tenure among low income households in California is relatively short-term. For example, nearly two thirds of all low income households have been living in their current home five years or less, as compared to less than half of the overall residential population in the state. In addition, only 13% of all low income households have lived in the current home for more than 15 years, as compared to 25% of the overall residential population.

Table 4-20
Distribution of California Households by Tenure in Current Home
(Source: California RASS 2004, HENS 2004)

Years Lived in Current Home	Percent of All California Households	**Percent of Low Income Households**
Less than 2 years	26%	**37%**
3 – 5 years	22%	**25%**
6 – 10 years	17%	**16%**
11 – 15 years	10%	**8%**
16 – 20 years	7%	**3%**
More than 20 years	18%	**10%**

Energy Costs

We used 2000 U.S. Census data to compare energy expenditures among California's low income population to the state's residential population overall. While we obtained (and used in other analyses) actual energy consumption and cost information for the sample of households included in this study, we needed to use the Census data to make this overall comparison for a few reasons. First, as discussed in Section 5.4, we do not have the complete energy cost picture for all households in our sample. At best, we have electricity and gas expenditures for households served both fuels by the same utility company (e.g., PG&E, SDG&E). We also have electricity and gas bills for households served by different utilities (e.g., SCE, SCG). But we only have energy bills for the four investor-owned utilities, none of the larger municipal utilities (e.g., LADWP, SMUD) and none of the small multi-jurisdictional utilities (e.g., PacifiCorp, Southwest Gas).

In addition, we only have information on households who pay their energy bills directly to a utility company (i.e., individually metered and non-master metered rental properties). In some cases, a household may pay for all of its electricity consumption, and none of its gas (when the dwelling unit is

master-metered for gas). In other cases, a household might pay for only a portion of the fuel used by the dwelling. For example, many low income households do not pay for the fuel used to heat the water to the entire building (see Section 5.6.3 below). In all of these cases, it is assumed that a share of the costs for these energy services is included in the rent for the dwelling. As such, the utility data does not accurately reflect the total cost of energy services being provided to (and paid for by) the household.

Finally, we do not have energy cost information for non-utility fuels such as propane, oil, coal or wood. As such, we do not have a complete picture of the total energy costs experienced by the households who use these fuel sources.

With that background, Table 4-21 presents our best information for comparing the energy costs experienced by low income households with that of the state's residential population as a whole. As shown, annual energy costs experienced by California's low income households are somewhat lower than that experienced by the general population. For example, about one quarter of low income households spend less than $500 per year (or about $42 per month) on energy costs. Only about 16% of the state's overall residential population spends this amount. At the other extreme, nearly 40% of California's residential population spends more than $100 per month (or $1,250 annually) on energy costs, which compares to only about 25% of low income households who spend this amount. Using the midpoint of each range, the average low income household spends nearly $950 on annual energy costs (or nearly $80 per month), which compares to just about $1,200 per year (or $100 per month) for the average residential household.

Table 4-21
Distribution of California Households by Annual Energy Costs
(Source: U.S. Census 2000)

Annual Energy Costs	Percent of All California Households	Percent of Low Income Households
$1 – $249	5%	**10%**
$250 – $499	11%	**17%**
$500 – $749	16%	**20%**
$750 – $999	14%	**15%**
$1,000 – $1,249	16%	**13%**
$1,250 – $1,499	8%	**7%**
$1,500 – $1,999	14%	**9%**
$2,000 or greater	17%	**10%**
Average (midpoint)	$1,175	**$948**

4.6.3 Housing Characteristics of California's Low Income Population

The housing characteristics of California's low income households are very different from residents of the state as a whole. The following is a summary of the key housing characteristics of California's low income population. Section 4.7 presents significant differences for important population segments.

Home Ownership

Eligibility in many of the low income energy assistance programs available to California's low income households varies according to home ownership and whether or not the dwelling unit is individually-metered or sub-metered. Much as an existing building condition or use of a certain appliance makes a dwelling eligible (or ineligible) to receive an upgrade, whether or not the household owns their home or lives in a master-metered dwelling unit are often key determinants of the types of energy efficiency measures that can be installed.

Results from the onsite survey on home ownership are compared to 2000 Census data for the population as a whole in Table 4-22. As shown, two thirds of all households in California (65%) own their homes as compared to only 35% of California's low income households. In addition, about 3% of low income

households live in master-metered rental properties, as compared to 1% in the overall residential population. SCG low income households are most likely to live in rental properties, and the most likely to live in master-metered rental properties. PG&E low income households are the most likely to own their homes.

Table 4-22
Distribution of California Households by Home Ownership
(Source: RASS 2003, HENS 2004)

	Percent of All California Households	**Percent of Low Income Households**	*Percent of Low Income Households by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
Own	63%	**35%**	44%	28%	35%	21%	32%
Rent (individually metered)	36%	**62%**	53%	68%	64%	72%	65%
Rent (master metered)	1%	**3%**	3%	4%	0%	7%	3%

Dwelling Type

Very much correlated to home ownership, the type of dwelling unit occupied by low income households is a key determinant in program and measure eligibility. As shown in Table 4-23, most low income households live in either single family (43%) or large, multi-family (43%) dwellings. This is very different from California's residential population as a whole. SCG low income households are much more likely to live in multi-family dwellings, whereas PG&E low income households are most likely to live in single family dwellings.

Table 4-23
Distribution of California Households by Dwelling Type
(Source: RASS 2003, HENS 2004)

Dwelling Type	Percent of All California Households	**Percent of Low Income Households**	*Percent of Low Income Households by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
Single family	64%	**43%**	55%	21%	52%	28%	38%
Multi-family (2-4 Units)	8%	**7%**	10%	6%	6%	4%	6%
Multi-family (5+ Units)	23%	**43%**	28%	54%	41%	66%	50%
Mobile home	6%	**6%**	6%	18%	1%	0%	6%

Size of Home

Table 4-24 compares home square footage for all California households, California's low income households, and low income households by utility. As shown, low income households live in homes that are considerably smaller than the average California household. For example, two thirds of all low income households live in homes that are less than 1,000 square feet. PG&E low income households live is slightly larger homes as compared to the other utilities.

Table 4-24
Distribution of California Households by Size of Home
(Source: RASS 2003, HENS 2004)

Square Footage	Percent of All California Households	**Percent of Low Income Households**	*Percent of Low Income Households by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
Less than 500	5%	**14%**	11%	24%	11%	12%	15%
500-999	24%	**53%**	46%	53%	59%	61%	59%
1,000-1,999	50%	**28%**	33%	21%	28%	25%	19%
2,000-2,999	16%	**4%**	6%	1%	2%	2%	6%
3,000 or more	4%	**2%**	4%	0%	0%	0%	1%

Age of Home

While there are likely differences at a local level, overall, California's low income households tend to live in homes that are just as old as housing occupied by the general population in the state. As shown in Table 4-25, over half of all low income households (51%) live in homes that were built prior to 1970, which is similar to the residential population as a whole. PG&E low income households are most likely to live in homes that are newer (built within the last ten years), whereas SCG low income households are most likely to live in homes that are older (built over 35 years ago).

Table 4-25
Distribution of California Households by Age of Home
(Source: RASS 2003, HENS 2004)

Age of Home	Percent of All California Households	Percent of Low Income Households	*Percent of Low Income Households by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
10 years or less (1995-2003)	5%	**5%**	17%	1%	5%	2%	7%
11-35 years (1970-1994)	44%	**42%**	33%	63%	40%	33%	53%
More than 35 years (Built before 1970)	53%	**51%**	50%	36%	56%	65%	40%

Major End-Uses

This section presents the characteristics of the major end-use equipment and systems in low income dwellings – heating, cooling and water heating. The need for, as well as energy savings potential from, the applicable energy efficiency measures is described in Section 5.7 and 6. All results have been integrated in Section 7 to develop recommendations for program targeting, outreach, design and delivery.

Space Heating Systems

The needs assessment survey captured the following information about the heating systems being used by low income households:

- The type of heating system and fuel used (e.g., electric baseboard, natural gas furnace, wood stove, etc.)
- Indicator if more than one heating system used
- Percent of total heat provided by each system
- Age of each system
- Condition of equipment (i.e., good, fair, needs repair/maintenance, needs replacement)[9]

Table 4-26 presents results for heating systems by fuel type. As shown, the majority of low income households use natural gas for heating (72%). About one in four (26%) low income households use electricity for some type of heating need. Propane is used by 7% of all low income households, and the

[9] This type of information was collected onsite by the energy surveyor for all end-use equipment and major household appliances in order to develop estimates of the need for and energy savings potential from applicable energy efficiency measures. While we mention it here as something that was collected onsite, we present the results for these type of data in Section 5 (need for energy efficiency measures) and 8 (energy savings potential estimates).

same percentage (7%) uses wood for heating. A few households use oil heating systems, although these households represent less than 1% of the total population. In 9% of all low income households, we found no space heating equipment or systems during the onsite survey.

Table 4-26
Type of Fuels Used by Heating Equipment/Systems in Low Income Households
(Source: HENS 2004)

Heating Fuel	*Percent of Low Income Households Using Heating Fuel*			Percent of Low Income Households Using Heating Fuel	**Percent of Low Income Households Using Primary Heating Fuel**
	Equipment/ System 1	Equipment/ System 2	Equipment/ System 3		
Natural Gas	68%	4%	0%	72%	68%
Electric	17%	8%	1%	26%	18%
Propane	3%	2%	2%	7%	3%
Wood/coal	2%	4%	1%	7%	3%
Oil	<1%	<1%	<1%	<1%	<1%
No heating equipment/ systems	9%	-	-	9%	9%

Table 4-26 also shows the *primary heating equipment/system* used by low income households. This was determined based on information gathered from the respondent about the percent each type of equipment/system is used for heating, as well as the energy surveyor's observation of the actual equipment/systems used.

More detailed information on the specific types of heating equipment and systems identified onsite is shown in Table 4-27. As shown, the most common natural gas heating systems are hot air furnaces (40%) and space heaters or wall units (28%). Ten percent of all low income households use portable electric heaters, and another 6% use heat pumps. Five percent of low income households have propane-fired hot air furnaces and 5% have wood-burning fireplaces.

Table 4-27
Types of Heating Equipment/Systems Used by Low Income Households
(Source: HENS 2004)

Heating Fuel	Type of Heating Equipment/ System	Percent of Low Income Households Using Heating Equipment/ Systems	Percent of Low Income Households Using Primary Heating Equipment/ Systems
Electric	Portable Heaters	10%	6%
	Heat Pump	6%	6%
	Wall/Floor Heaters	4%	3%
	Hot Air Furnace	2%	2%
	Resistance/Baseboard	3%	1%
	Other Electric	1%	1%
Natural Gas	Hot Air Furnace	40%	39%
	Space Heaters/Wall Units	28%	26%
	Hot Water Radiator/Baseboard	2%	2%
	Other Gas	1%	1%
	Fireplace	1%	0%
	Steam	<1%	0%
	Stove/Stove Insert	<1%	0%
Oil	Space Heaters	<1%	0%
	Other Oil	<1%	0%
Propane	Hot Air Furnace	5%	2%
	Space Heaters	1%	0%
	Other Propane	<1%	0%
	Hot Water Radiator/Baseboard	<1%	0%
	Fireplace	<1%	0%
	Steam	<1%	0%
Wood or Coal	Fireplace	5%	1%
	Stove/Stove Insert	2%	1%
	Other Wood/Coal	<1%	0%
	Furnace	<1%	0%
	Hot Water Radiator/Baseboard	<1%	0%
No heating equipment/systems		9%	9%
Sample Size		1,534	

Space Cooling Systems

Just over half of all low income households (55%) use some type of air conditioning equipment or system. About one in five households (20%) use central electric air conditioning systems, and another 20% use room air conditioning equipment. Five percent use heat pumps, another 7% use evaporative coolers and 3% use natural gas cooling equipment.

The energy surveyor also determined the age of the cooling equipment/systems, as shown in Table 4-28. Nearly one in five low income households (17%) use cooling equipment/systems that are less than 10 years old, and 19% use equipment/systems that are 10-19 years old. Thirteen percent of low income households use cooling equipment/systems that are between 20-29 years old, and 5% use equipment/systems that are 30 or more years old. The remaining 45% do not use cooling equipment/systems.

Table 4-28
Types and Age of Cooling Equipment/Systems Used by Low Income Households
(Source: HENS 2004)

Type of Cooling Equipment/Systems	Percent of Low Income Households	Age of Cooling Equipment/System[1]			
		<10 years	10-19 years	20-29 years	30 or more years
Central Air Conditioners	**20%**	8%	7%	4%	1%
Heat Pumps	**5%**	2%	2%	1%	0%
Natural Gas Air Conditioners	**3%**	1%	1%	1%	0%
Room Air Conditioners	**20%**	5%	7%	6%	2%
Evaporative Coolers	**7%**	1%	2%	1%	2%
No AC	45%				

[1] Reflects age of central system if both central and room units are used. Sample size: n=1,473

Water Heating Systems

The needs assessment survey also collected information on water heating equipment/systems, such as:

- Whether or not household pays for water heating
- Type of water heater (by fuel type)
- Age of water heater

Most low income households pay for water heating (70%). This was determined by observing the type of water heating system installed and asking households whether the cost to heat their water was included in their utility bills or in their rent. Table 4-29 shows the distribution of water heating equipment/system types for households that pay directly for hot water, as well as for those that do not.

As shown, natural gas is used for water heating by the majority of low income households (76%). Six percent use electricity for water heating, 3% use propane and 1% have solar water heating systems. Data was unavailable on the water heating fuel type for low income households that do not pay for this service (13%).

Table 4-29
Type of Fuel Used for Water Heating in Low Income Households
(Source: HENS 2004)

Water Heating Fuel	All Water Heating Equipment/ Systems[1]	Do Not Pay for Hot Water	Pay for Hot Water
Electricity	6%	1%	5%
Natural Gas	76%	15%	61%
Propane	3%	0%	3%
Solar	1%	0%	0%
Unknown	13%	13%	0%
All Water Heating Equipment/Systems	100%	30%	70%

[1] Sample Size: n=1,520

Table 4-30 shows the distribution of water heating equipment/systems by fuel type and age. As shown, 43% of all low income households use water heating equipment/systems that are over ten years old. About one quarter (27%) use water heaters that are less than six years old, and another 29% use equipment/systems that are between 6-10 years old.

Table 4-30
Types of Fuel Used for and Age of Water Heating Equipment/Systems in Low Income Households
(Source: HENS 2004)

Water Heating Fuel	Age of Water Heating Equipment/Systems[1]					
	< 1 year	1-5 years	6-10 years	11-15 years	16-20 years	More than 20 years
Electricity	0%	1%	2%	2%	1%	1%
Natural Gas	5%	19%	26%	25%	10%	4%
Propane	0%	2%	1%	0%	0%	0%
Solar	0%	0%	0%	0%	0%	0%
All Water Heating Equipment/ Systems	5%	22%	29%	28%	11%	4%
[1] Sample Size: n=1,277						

In addition, the energy surveyor also collected information on the condition of water heater, the existence of tank wrap and feasibility to wrap tank where none present, the existence of insulation on water heating pipes and feasibility to add insulation where none present, the number of showerheads and low-flow showerheads already installed, and the number of faucets and energy saving faucet aerators already installed, and the water heater temperature set point. The results are presented in Section 5, where we discuss the need for a variety of energy efficiency measures, and Section 8, where we present the analysis of energy savings potential for applicable measures.

Building Shell Characteristics

The energy surveyor collected a great deal of information related to the building shell and other related characteristics of low income dwellings, such as ceilings and attic spaces, walls, foundation, duct systems, and exterior doors and windows. This information was collected for the specific dwelling unit in which the low income household lived.

Ceilings

The energy surveyor collected data on up to three different ceiling types, as shown in Table 4-29. Most low income households (88%) were observed onsite to only have one ceiling type for the purposes of determining the need for ceiling insulation measures. As such, for simplicity, we only report subsequent results for the first ceiling type (which also was recorded as the largest ceiling area measured onsite).

As shown in Table 4-31, the majority of low income households (70%) live in dwellings with flat roofs – 40% with no attic space and 30% with attic space. Another 21% have vaulted or sloped ceilings with attic space, and 9% have vaulted/sloped ceilings with no attic space.

Table 4-31
Type of Ceilings in Low Income Dwellings

Type of Ceiling	Percent of Low Income Households		
	Ceiling 1	Ceiling 2	Ceiling 3
Vaulted/Sloped (No Attic)	9%	2%	0%
Vaulted/Sloped (With Attic)	21%	2%	0%
Flat (No Attic)	40%	5%	0%
Flat (With Attic)	30%	3%	0%
Other	1%	0%	1%
Only one ceiling type	0%	88%	99%
[1] Sample Size: n=1,533			

Across all low income households, the average dwelling unit has about 900 square feet of ceiling area and existing insulation with an approximate value of R-11. This insulation level varies according to the type of ceiling, as shown in Table 4-32. The results indicate that ceiling types with attic space are generally larger and better insulated.

Table 4-32
Level of Insulation by Ceiling Type in Low Income Dwellings

Type of Ceiling	Average Ceiling Insulation R-Value	Average Ceiling Square Footage
Vaulted/Sloped (No Attic)	9	824
Vaulted/Sloped (With Attic)	12	1,053
Flat (No Attic)	7	738
Flat (With Attic)	16	1,063
Other	8	539
All Low Income Households	11	910
[1] Sample Size: n=1,311		

In addition, the energy surveyor collected information on whether or not there was adequate ventilation in the attic space. For half of the low income households (50%) surveyed, attic ventilation was not applicable or feasible given the conditions observed onsite. For 41% of the households, attic ventilation was already present and for 9% attic ventilation was not present.

The need for (additional) attic ventilation was limited to 11% of all low income households, as shown in Table 4-33. Nearly all of these opportunities are in dwellings with flat-roof attic spaces. As mentioned above, for half of all low income households this measure was not applicable and for 38% it was not needed.

Table 4-33
Presence of Attic Ventilation in Low Income Dwellings
(Source: HENS 2004)

Type of Ceiling	Presence of Attic Ventilation		
	Existing	Not Existing	Not Applicable
Vaulted/Sloped (No Attic)	2%	1%	6%
Vaulted/Sloped (With Attic)	17%	1%	3%
Flat (No Attic)	1%	2%	38%
Flat (With Attic)	21%	6%	2%
Other	0%	0%	1%
All Low Income Households	41%	9%	50%
Sample Size[1]	618	171	717

[1] Sample Size: n=1,506

The energy surveyor also collected information on the feasibility for adding attic fans and whole house fans (in addition to determining whether any attic ventilation systems were already installed, as discussed above). As shown in Table 4-34, adding these fans is technically feasible for about one quarter of all low income households. This varies according to utility, with feasibility highest among SCE/SCG low income households. Feasibility is lowest for SCE low income households.

Table 4-34
Attic Fan and Whole House Fan Feasibility in Low Income Dwellings by Utility

	Percent of All Low Income Households[1]	*Percent of Low Income Households by Utility*				
		PG&E	SCE	SCE/ SCG	SCG	SDG&E
Attic Fan Feasibility	27%	27%	17%	39%	23%	26%
Whole House Fan Feasibility	23%	23%	13%	30%	20%	35%
[1] Sample Size: n = 1,506						

Walls

The energy survey also collected information on the existing level of wall insulation. As shown in Table 4-35, nearly all low income households (96%) live in dwellings with less than an R-19 value of existing wall insulation – 18% have no wall insulation (R-0), 25% have on average R-8, and 53% have on average R-12. Only 4% of all households were observed to have wall insulation at or above R-19. The average low income household has approximately R-9 of existing wall insulation.

Table 4-35
Level of Wall Insulation in Low Income Dwellings by Utility

Existing Wall Insulation R-Value	Percent of Low Income Households	*Percent of Low Income Households by Utility*				
		PG&E	SCE	SCE/ SCG	SCG	SDG&E
No insulation (R-0)	18%	32%	9%	7%	7%	19%
R-1 --> R-10	25%	27%	29%	18%	18%	44%
R-11 --> R-18	53%	38%	60%	71%	69%	36%
R-19 --> R-30	4%	3%	3%	5%	6%	0%
Existing Wall Insulation R-Value	**Average R-Value**	*Average R-Value by Utility*				
		PG&E	SCE	SCE/ SCG	SCG	SDG&E
No insulation (R-0)	0	0	0	0	0	0
R-1 --> R-10	8	8	7	7	7	7
R-11 --> R-18	12	12	11	12	12	12
R-19 --> R-30	19	20	19	20	19	-
[1] Sample Size: n=1,440						

Table 4-33 shows similar information according to utility. The only significant differences are for PG&E low income households, where there are considerably more homes with no existing wall insulation, and for SCE, SCE/SCG and SCG low income households, where there are more homes with above R-11 wall insulation.

Foundation

The energy surveyor also collected information on the type of building foundation for each low income dwelling unit. As shown in Table 4-36, about half of all low income households (49%) live in dwellings with slab foundation. Another 23% have crawl-space foundations, and 4% have basements. For 23% of the dwelling units in the sample, the low income household we surveyed did not live on the first floor of the property and, as such, no data on the type of foundation was collected. For 5%, mobile home skirting was listed as the foundation type.

Table 4-36
Type of Foundation in Low Income Dwellings by Utility

Type of Foundation	Percent of Low Income Households[1]	*Percent of Low Income Households by Utility*				
		PG&E	SCE	SCE/ SCG	SCG	SDG&E
Slab	49%	48%	46%	62%	43%	42%
Crawl	23%	32%	8%	21%	17%	24%
Basement	4%	3%	8%	1%	8%	1%
Mobile home skirting	5%	6%	18%	0%	0%	7%
Not applicable (not on ground floor)	23%	14%	23%	23%	40%	26%

[1] Sample Size: n=1,532

Table 4-36 also presents results by utility. As shown, SCE/SCG low income households are most likely to live in dwellings with slab foundation, and 40% of SCG low income households live in dwellings for which the foundation type was not applicable (e.g., the household does not live on the ground floor).

Ducts

The energy surveyor collected information related to duct systems for which it would be applicable or feasible to install (added) insulation. As shown in Table 4-37, overall, duct systems are present in only 17% of all low income households. The majority of these duct systems are comprised of over 10 linear feet of round tubing (as opposed to square) located in attics or other crawl spaces. The table also shows

the applicability and features of duct systems by utility. As shown, duct systems are least common among low income households in the SCG and SCE/SCG overlap service territories.

Table 4-37
Summary of Duct System Applicability and Features for Low Income Dwellings

Applicable Duct System		Percent of Low Income Households[1]	*Percent of Low Income Households by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
Yes		17%	24%	11%	7%	4%	40%
No		83%	76%	89%	93%	96%	60%
Duct System Features		**Percent of Low Income Households with Applicable Duct Systems[2]**	*Percent of Low Income Households with Applicable Duct Systems by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
Duct Type	Round	79%	79%	61%	83%	56%	96%
	Square	21%	21%	39%	17%	44%	4%
Duct Location	Attic	69%	68%	56%	46%	94%	86%
	Basement	4%	3%	12%	13%	0%	0%
	Crawl Space (unspecified)	17%	22%	16%	0%	6%	6%
	Floor	3%	3%	8%	0%	0%	0%
	Walls	7%	4%	8%	41%	0%	7%
Linear Feet	Less than 10	7%	8%	2%	0%	0%	15%
	11-24	44%	30%	65%	72%	52%	77%
	25 or more	48%	62%	34%	28%	48%	8%

[1] Sample Size: n=1,534
[2] Sample Size: n=223

Doors

The energy surveyor collected data on the types of exterior doors in low income dwelling units. As shown in Table 4-38, half of all low income households (50%) have solid core exterior doors, followed by

hollow core (41%), patio (33%), panel glass (22%), and insulated metal (8%). Table 20 also presents this information by utility. As shown, SCG low income households are most likely to have hollow core doors, SDG&E low income households are most likely to have solid core doors, and SCE/SCG low income households are most likely to have insulated metal doors.

Table 4-38
Type and Condition of Exterior Doors in Low Income Dwellings

Type of Exterior Doors	Percent of Low Income Households[1]	*Percent of Low Income Households by Utility*				
		PG&E	SCE	SCE/ SCG	SCG	SDG&E
Hollow Core	41%	39%	38%	43%	50%	28%
Solid Core	50%	49%	56%	51%	42%	65%
Insulated Metal	8%	8%	4%	11%	8%	2%
Patio	33%	34%	34%	30%	30%	21%
Panel with Glass	22%	25%	20%	25%	19%	19%

[1] Sample Size: n=1,534

Windows

The majority of low income households (80%) have single-pane windows. About one in five (23%) have double-pane windows and none have triple-pane windows. Table 4-39 shows the type of windows in all low income households as well as by utility. As shown, PG&E low income households are much more likely to have double pane windows installed (44%).

Table 4-39
Types of Windows in Low Income Dwellings by Utility

Type of Window	Percent of Low Income Households[1]	Percent of Windows	*Percent of Low Income Households by Utility*				
			PG&E	SCE	SCE/ SCG	SCG	SDG&E
Single pane	80%	77%	54%	89%	95%	97%	92%
Single pane (with storm)	2%	1%	2%	3%	0%	0%	0%
Double pane	23%	21%	44%	8%	5%	3%	8%
Triple pane	0%	0%	0%	0%	0%	0%	0%

[1] Sample Size: n=1,511

Appliances

Programmable Thermostats

More than one third of all low income households have programmable thermostats installed in their homes to control their heating systems (36%) and about one quarter have programmable thermostats to control their cooling systems (23%). Only a small percentage of low income households, however, are using the programmable features of their thermostats, as shown in Table 4-40. Ten percent of all low income households use the programmable features of their heating thermostats, and 8% use the programmable features of their cooling thermostats.

Table 4-40
Presence and Use of Programmable Thermostats in Low Income Dwellings

Type of Heating Thermostat	Sample Size	Percent of All Low Income Households	Primary Heating Equipment/System Fuel				
			Electricity	Natural Gas	Propane	Wood/Coal	None
Manual	922	55%	60%	61%	29%	90%	0%
Programmable	425	36%	41%	39%	71%	10%	0%
None	153	9%	0%	0%	0%	0%	9%
Heating Thermostat Use							
Program	94	10%	3%	13%	3%	5%	0%
Do not program	331	27%	37%	27%	68%	5%	0%
Manual	922	55%	60%	61%	29%	90%	0%
None	153	9%	0%	0%	0%	0%	9%
Type of Cooling Thermostat	Sample Size	**Percent of All Low Income Households**	**Cooling Equipment/System Type**				
			Central AC	Heat Pumps	Room AC	Evaporative Coolers	None
Manual	408	29%	44%	49%	71%	74%	0%
Programmable	224	23%	56%	51%	29%	26%	0%
None	840	47%	0%	0%	0%	0%	47%
Cooling Thermostat Use							
Program	63	8%	23%	19%	4%	4%	0%
Do not program	161	16%	33%	32%	25%	23%	0%
Manual	408	29%	44%	49%	71%	74%	0%
None	840	47%	0%	0%	0%	0%	47%

The energy surveyor also collected information on the day, evening and nighttime set points for both the heating and cooling periods. These results are shown in Table 4-41.

Table 4-41
Thermostat Set Points in Low Income Dwellings

Heating Thermostat Set Point	Sample Size	**Average Set Point**	**Heating Thermostat Use**		
			Program	Do Not Program	Manual
Day	1012	64	67	64	64
Evening	1013	67	70	66	66
Night	1018	64	69	65	62
Cooling Thermostat Set Point	Sample Size	**Average Set Point**	**Cooling Thermostat Use**		
			Program	Do Not Program	Manual
Day	593	77	77	74	76
Evening	591	78	77	75	79
Night	594	80	79	77	81

Table 4-42 shows the results for types of thermostats and thermostat set points by utility. As shown, the majority of SDG&E's low income households (75%) have (heating) programmable thermostats installed in their homes; however, only 8% are using the programmable features.

Table 4-42
Thermostat Usage and Set Points in Low Income Dwellings by Utility

Heating Thermostat	Percent of Low Income Households	*Percent of Low Income Households by Utility*				
		PG&E	SCE	SCE/ SCG	SCG	SDG&E
Manual	54%	60%	51%	59%	61%	12%
Do Not Program	29%	25%	26%	22%	16%	67%
Program	10%	14%	4%	5%	10%	8%
None	9%	2%	19%	14%	12%	13%
Average Heating Set Point						
Day	64	66	65	63	63	62
Evening	67	67	68	66	67	63
Night	64	65	64	62	64	64
Cooling Thermostat						
Manual	29%	39%	26%	25%	24%	2%
Do Not Program	16%	11%	22%	21%	14%	25%
Program	8%	10%	3%	6%	9%	6%
None	47%	40%	49%	49%	52%	67%
Average Cooling Set Point						
Day	77	77	74	76	77	80
Evening	78	77	78	79	79	79
Night	80	78	80	82	81	79

Refrigerators

The energy surveyor collected information about the number, type, size, location, and age of refrigerators being used by low income households. Overall, the majority of low income households use only one refrigerator (90%) that is grounded (92%) and located in a conditioned space (96%). Most refrigerators have doors on the top and bottom (74%) and a frost-free freezer compartment (85%). About half (52%) are between 17-20 cubic feet in size and another 35% are over 20 cubic feet. About two thirds of all refrigerators used by low income households (65%) are 10 years old or less. Characteristics of refrigerators in low income households are summarized in Table 4-43.

Table 4-43 also displays the characteristics of refrigerators by utility. As shown, PG&E low income households are more likely to have more than one refrigerator per household (20%) and less likely to have refrigerators that are grounded (85%). SDG&E low income households are the most likely to have newer refrigerators (less than 6 years) (45%) and the least likely to have refrigerators in need of repair, maintenance or replacement (4%).

Table 4-43
Characteristics of Refrigerators in Low Income Dwellings

Number of Refrigerators	Percent of All Refrigerators in Low Income Dwellings	Sample Size	Percent of Low Income Households by Utility				
			PG&E	SCE	SCE/SCG	SCG	SDG&E
One	90%	1,365	85%	96%	91%	94%	93%
Two or three	10%	130	15%	4%	9%	6%	7%
Style							
Single door	6%	86	9%	3%	4%	7%	2%
Top/bottom doors	74%	1,177	75%	75%	75%	67%	87%
Side-by-side doors	25%	345	26%	23%	26%	29%	14%
Size							
Small (<17 cu ft)	18%	294	20%	15%	18%	18%	18%
Medium (17-20 cu ft)	52%	769	59%	44%	43%	42%	68%
Large (>20 cu ft)	35%	528	30%	42%	45%	42%	16%
Type of Defrost							
Frost-free	85%	1,288	93%	81%	76%	75%	99%
Partial frost-free	4%	51	7%	1%	2%	2%	1%
Manual	13%	222	4%	18%	23%	24%	1%
Location							
Conditioned space	96%	1,468	97%	94%	95%	95%	97%
Unconditioned space	6%	101	8%	6%	4%	5%	5%
Grounded							
Yes	92%	645	86%	91%	94%	97%	92%
No	8%	54	14%	9%	6%	3%	8%
Age							
<6 years	35%	523	34%	32%	37%	34%	45%
6-10 years	30%	473	31%	31%	31%	30%	26%
11-15 years	21%	343	23%	21%	21%	20%	14%
16+ years	13%	192	12%	16%	10%	16%	16%

Stand-Alone Freezers

As shown in Table 4-44, the majority of low income households do not have a stand-alone freezer. Of the 10% who do, about half (55%) are using upright models and 45% have chest freezers. Many are between 13-20 cubic feet (59%) or over 20 cubic feet (25%). Over two-thirds are manual defrost, 60% are located in conditioned space, and most (61%) are under 11 years old.

Table 4-44
Characteristics of Stand-Alone Freezers in Low Income Dwellings

Number of Stand-Alone Freezers	**Percent of All Low Income Households**	Sample Size
None	90%	1411
One	10%	104
Two – Four	0%	6
Style	**Percent of All Stand-Alone Freezers**	Sample Size
Chest	45%	56
Upright	55%	54
Size		
Small (<13 cu ft)	16%	26
Medium (13-20 cu ft)	59%	49
Large (>20 cu ft)	25%	35
Type of Defrost		
Manual	68%	70
Frost-free	32%	40
Location		
Conditioned space	60%	61
Unconditioned space	40%	49
Age		
<6 years	40%	36
6-10 years	21%	27
11-15 years	22%	30
16+ years	17%	17

Range / Oven

The energy surveyor collected information on the fuel used by the range and/or oven. As shown in Table 4-45, most low income households use natural gas ranges and/or ovens (71%), 34% use electricity, and only 2% use propane. Electricity use for these appliances is highest among low income households in PG&E and SDG&E service territories.

Table 4-45
Range / Oven Fuel and Operating Condition

Fuel Used by Range/Oven	Percent of All Low Income Households[1]	*Percent of All Low Income Households by Utility*				
		PG&E	SCE	SCE/ SCG	SCG	SDG&E
Electric	**34%**	52%	33%	12%	10%	46%
Natural Gas	**71%**	%	63%	94%	96%	%
Propane	**2%**	3%	4%	0%	0%	4%

[1] Sample Size: n=1,528

Dishwashers, Clothes Washers and Clothes Dryers

About one third of low income households (31%) use automatic dishwashers, two thirds use clothes washers (62%), and over half use clothes dryers (60%). Table 4-46 shows the distribution of these appliances by fuel type and utility. PG&E low income households are most likely to use all three appliances, SCE low income households are least likely to use dishwashers, and SCG low income households are least likely to use clothes washers and clothes dryers.

Table 4-46
Dishwashers, Clothes Washers and Clothes Dryers in Low Income Dwellings

Type of Appliance	Percent of Low Income Households[1]	*Percent of Low Income Household by Utility*				
		PG&E	SCE	SCE/SCG	SCG	SDG&E
Dishwasher						
Electric	**2%**	5%	2%	0%	0%	0%
Gas	**27%**	34%	15%	25%	21%	33%
Propane	**2%**	4%	1%	0%	0%	5%
No Dishwasher	**68%**	56%	83%	75%	79%	63%
Clothes Washer						
Electric	**4%**	8%	3%	0%	1%	1%
Gas	**55%**	69%	35%	60%	37%	57%
Propane	**3%**	5%	4%	0%	0%	5%
No Clothes Washer	**38%**	18%	58%	40%	63%	38%
Clothes Dryer						
Electric	**27%**	49%	11%	16%	9%	7%
Gas	**32%**	22%	38%	47%	30%	44%
Propane	**1%**	0%	0%	0%	0%	4%
No Clothes Dryer	**41%**	29%	50%	37%	62%	45%

[1] Sample Sizes: n=1,338

Other Household Appliances

Table 4-47 provides information on the types of other appliances used by low income households. As shown, nearly all low income households have at least one color TV, a DVD/VCR, and a stereo. About half have a personal computer, a portable fan, and/or a ceiling fan. Most households (86%) are equipped with smoke detectors.

Table 4-47
Other Appliance Holdings in Low Income Households

Type of Household Appliance	Percent of Low Income Households[1]	Number of Appliances		
		One	Two	Three+
Microwave Oven	**96%**	100%	0%	0%
Color TV	**99%**	23%	37%	39%
B&W TV	**2%**	2%	0%	0%
Stereo	**89%**	56%	23%	10%
DVD/VCR	**92%**	34%	35%	23%
Personal Computer (PC)	**54%**	45%	8%	1%
Aquarium	**5%**	5%	1%	0%
Portable Fan	**56%**	33%	16%	7%
Ceiling Fan	**50%**	28%	9%	13%
Humidifier	**4%**	4%	0%	0%
Dehumidifier	**1%**	1%	0%	0%
Water Bed	**1%**	1%	0%	0%
Well Pump	**3%**	2%	0%	0%
Smoke Detector	**86%**	43%	21%	22%
Carbon Monoxide Detector	**8%**	7%	1%	0%
Medical Equipment	**5%**	3%	1%	1%

[1] Sample Size: n=1,534

Lighting

The final section of the energy survey addressed lighting. The energy surveyor collected information on the type of lighting used by the household. As shown in Table 4-48, the average low income household has approximately 16 lighting fixtures or lamps. Thirteen of these contain incandescent light bulbs, two contain CFLs, another is a fluorescent fixture and the last is an incandescent porch light. Across all low income households, just over one third (36%) already use CFLs and about 8% use CFL porch lights. Most households that already have CFLs have between one and four of them, while 9% of all low income households have five or more.

Table 4-48
Characteristics of Lighting Used by Low Income Households

Type of Lighting	Percent of Low Income Households[1]	Average Number of Fixtures/ Lamps	Number of Lighting Fixtures/Lamps					
			0	1-4	5-10	11-15	16-20	>20
All Lighting	**100%**	16	0%	5%	28%	31%	14%	23%
Incandescent Lamps	**99%**	13	1%	15%	33%	26%	11%	13%
CFLs	**36%**	2	64%	27%	6%	2%	1%	0%
Fluorescent Fixtures	**40%**	1	60%	37%	3%	0%	0%	0%
Halogen Lamps	**15%**	0	85%	15%	0%	0%	0%	0%
Incandescent Porch Fixtures	**35%**	1	65%	33%	1%	0%	0%	0%
CFL Porch Fixtures	**8%**	0	92%	8%	0%	0%	0%	0%
Lighting Controls	**4%**	0	96%	4%	0%	0%	0%	0%

[1] Sample Size: n=1,531

Tables 4-49 and 4-50 show the lighting results by utility. CFL usage is highest among PG&E low income households – about half already use them and, across all of PG&E's low income households, the average number of CFLs used is three. Halogen lighting is most common among SDG&E low income households, with 37% using at least one. Porch lighting is used the least among SCE, SCE/SCG and SCG low income households. Finally, as shown in Table 4-50, PG&E and SDG&E low income households use significantly more lighting overall than other low income households.

Table 4-49
Types of Lighting Used by Low Income Households by Utility

Type of Lighting	Percent of Low Income Households[1]	*Percent of Low Income Households by Utility*				
		PG&E	SCE	SCE/SCG	SCG	SDG&E
Incandescent Lamps	**99%**	99%	99%	99%	99%	99%
CFLs	**36%**	49%	23%	36%	21%	30%
Fluorescent Fixtures	**40%**	50%	38%	29%	29%	46%
Halogen Lamps	**15%**	20%	13%	4%	8%	37%
Incandescent Porch Fixtures	**35%**	55%	21%	13%	8%	60%
CFL Porch Fixtures	**8%**	12%	3%	10%	3%	12%
Lighting Controls	**4%**	5%	4%	4%	0%	9%

[1] Sample Size: n=1,531

Table 4-50
Average Number of Lighting Fixtures/Lamps Used by Low Income Households by Utility

Type of Lighting	Average Number of Fixtures/Lamps[1]	PG&E	SCE	SCE/SCG	SCG	SDG&E
All Lighting	**16**	21	13	13	12	17
Incandescent Lamps	**13**	15	10	11	10	13
CFLs	**2**	3	1	1	1	1
Fluorescent Fixtures	**1**	1	1	1	1	1
Halogen Lamps	**0**	0	0	0	0	1
Incandescent Porch Fixtures	**1**	1	0	0	0	1
CFL Porch Fixtures	**0**	0	0	0	0	0
Lighting Controls	**0**	0	0	0	0	0

[1] Sample Size: n=1,531

4.6.4 Energy Use Characteristics of California's Low Income Population

This section presents a summary of the energy consumption characteristics of California's low income households. In addition, comparisons to the energy consumption patterns of the average residential household are made using information from the most recent statewide RASS Study. The following sections present comparisons of annual electricity and natural gas consumption, as well as comparisons of seasonal and above-baseline energy consumption patterns.

Annual Energy Consumption

Table 4-51 compares average electricity and gas usage for individually metered low income households with the usage for a typical residential household. As shown, annual energy consumption is lower for low income households than for the residential population as a whole.

Table 4-51
Average Annual Electricity Usage
(Source: RASS 2004, Utility Billing Records 2004)

Energy Consumption	All California Households	Low Income Households
Electric	5,914 kWh	**5,797 kWh**
Natural gas	431 therms	**370 therms**
Sample Size: RASS n=19,726 (electric), n=17,435 (gas); HENS n=988 (electric), n=936 (gas)		

Seasonal Energy Consumption

Table 4-52 shows the breakdown of gas usage among low income households during the winter (i.e., December - February.) Almost half use less than 100 therms during the winter for heating, water heating and other applicable end-uses. About one quarter use 200 therms or more during the winter. Table 4-53 shows electricity usage in winter among eligible households. About one quarter use less than 750 kWh in the winter, while the majority use more than 750 kWh.

Table 4-52
Total Winter Gas Usage (Therms)
(Source: Utility Billing Records 2004)

Total Winter Gas Usage	Percent of Low Income Households[1]
0 therms	<1%
1 – 100 therms	42%
100 – 199 therms	36%
200 therms or more	22%
[1] Sample Size: n=964	

Table 4-53
Total Winter Electric Usage (kWh)
(Source: Utility Billing Records 2004)

Total Winter Electric Usage	Percent of Low Income Households[1]
Less than 750 kWh	25%
750 – 1,499 kWh	39%
1,500 kWh or more	36%
[1] Sample Size: n=988	

Table 4-54 and 4-55 present summer (i.e., July – September) gas and electricity usage for low income households. About 4 percent of low income households do not use natural gas in the summer. The majority of low income households use less than 50 therms during the summer. Only 11 percent use more than 100 therms. Almost one-quarter of low income households use between 100 and 750 kWh during the summer, while the majority use more than 750 kWh.

Table 4-54
Total Summer Gas Usage (Therms)
(Source: Utility Billing Records 2004)

Total Summer Gas Usage	Percent of Low Income Households[1]
0 therms	4%
1 – 49 therms	51%
50 –99 therms	35%
100 therms or more	11%
[1] Sample Size: n=934	

Table 4-55
Total Summer Electric Usage (kWh)
(Source: Utility Billing Records 2004)

Total Summer Electric Usage	Percent of Low Income Households[1]
Less than 750 kWh	23%
750 – 1,499 kWh	36%
1,500 kWh or more	41%
[1] Sample Size: n=988	

Above-Baseline Energy Consumption

Table 4-56 and Table 4-57 present additional information on low income household electricity and gas usage, showing the percentage of usage that is above baseline. Utility ratepayers in California are billed for electricity and gas usage based on a tier system. Customers are charged different rates depending into which tier their usage falls. The first tier or the "baseline" covers usage up to a certain threshold, based on the utility customer's climate zone and heating system fuel. The price per therm or kWh is the lowest for usage falling within the baseline or first tier. Usage that exceeds the first tier, or above-baseline usage, is charged a higher price. Natural gas is billed based on two tiers: baseline and above-baseline. Electricity prices were split into several tiers as a result of the energy crisis. To shield low-income

customers from the steep prices charged for the highest tiers, the Commission ordered the utilities to charge CARE participants the second tier usage rate for any usage that exceeds the first tier or baseline.

As shown in Table 4-56, about three quarters of low income households use more than their baseline allotment of natural gas. More than one third of homes use 20% or more than their baseline. Electricity above-baseline usage is not as prevalent among low income households, as shown in Table 4-57. About half of low income household electricity usage falls into the second or higher usage tier.

Table 4-56
Total Gas Above Baseline Ratio
(Source: Utility Billing Records 2004)

Total Gas Above Baseline Ratio	Percent of Low Income Households[1]
0 percent	23%
1 – 5 percent	14%
6 – 10 percent	9%
11 – 20 percent	18%
21 – 30 percent	16%
31 – 40 percent	8%
41 – 50 percent	6%
51 – 60 percent	3%
Greater than 60 percent	3%

[1] Sample Size: n=932

Table 4-57
Total Electric Above Baseline Ratio
(Source: Utility Billing Records 2004)

Total Electric Above Baseline Ratio	Percent of Low Income Households[1]
0 percent	47%
1 – 5 percent	13%
6 – 10 percent	6%
11 – 20 percent	12%
21 – 30 percent	5%
31 – 40 percent	8%
41 – 50 percent	5%
51 – 60 percent	3%
Greater than 60 percent	1%
[1] Sample Size: n=988	

5. Needs Assessment

This section presents the results of this study pertaining to the energy and non-energy related needs of California's low income population. Sections of the needs assessment will provide:

- **An analysis of program eligibility, participation, and penetration rates –** How many of California's residential households are eligible for the CARE and LIEE programs? What if the program eligibility criteria were expanded beyond the current criteria, or constrained to the criteria used by earlier programs? How many eligible customers have participated in the programs to-date? How has this rate of participation changed over time? What penetration rates have the programs achieved to-date? How many customers are eligible for the programs but are not participating?

- **An analysis of energy burden –** What percent of total household income is spent on energy among California's low income population? What are the characteristics of those households with the greatest energy burden? What are some of the most effective ways for the programs to reduce energy burden among those with the greatest need?

- **An analysis of energy insecurity –** What portion of California's low income population frequently experiences difficulty keeping up with energy payments and is often threatened with service disconnection? What segments of the population are the most energy insecure? What factors contribute to this insecurity? What are some of the most effective ways for the programs to address energy insecurity?

- **An analysis of concerns related to health, safety and comfort** – What are the concerns among California's low income population related to health, safety and comfort that the CARE and LIEE programs can address? What segments of the population are more likely than others to exhibit these concerns? What are the most effective ways to target these segments and what kinds of program services can be offered to alleviate these concerns?

- **An analysis of the need for energy efficiency measures** – What types of energy efficiency measures are feasible (i.e., based on structural conditions and equipment/appliance performance factors) and needed (i.e., based on baseline conditions) among California's low income population? How do these needs vary among different segments of the population? Which measures would provide the greatest energy savings benefits to California's low income population overall and which would provide significant benefit to certain segments (e.g., elderly, rural, mobile home residents, etc.)?

- **An analysis of willingness to participate and barriers to participation** – What portion of California's low income population is willing to participate in programs like CARE and LIEE?

How does that compare to other public assistance programs? What are the key barriers to participation among California's low income population? How do these barriers vary by different characteristics (e.g., demographic, housing type, geography, etc.)? What are some of the most effective ways for the programs to overcome these barriers and increase program participation?

- **An analysis of accessibility –** Through what channels are low income households typically reached by the programs? Are certain segments more easily reached through existing channels? What are the characteristics of those segments that are not as easily reached through these existing channels? What types of outreach and recruitment strategies could be developed to reach these "hard to reach" segments?

Section 7 provides a synthesis of the results of the characterization, needs assessment, and energy savings potential analyses. We provide recommendations for key segments of the low income population that should be targeted with energy assistance programs and strategies for reaching these segments.

5.1 Estimates of California's Eligible Low Income Population

In order to set the stage for this discussion of needs, we presented information on the size of the population eligible for the CARE and LIEE programs in Section 4. In this section, we present historical information on participation levels for both CARE and LIEE. We then present the results of analysis of program penetration over time. Since program eligibility, participation, and penetration rates over time are a function of remaining need, it is appropriate to provide this discussion prior to the presentation of the needs assessment results.

5.1.1 CARE and LIEE Program Participation Levels

Using data supplied by the four major IOUs, we have summarized historical CARE program participation rates, from 1993 to 2006 in Figure 5-1 and Table 5-1. As shown, these utilities have been successful in enrolling a very large number of customers in CARE since 1993.

- Participation among SCG's customers peaked in 1995 to nearly 740,000 customers and then dipped down in the late 1990's to about 500,000. Beginning in 2001, CARE participation rose dramatically culminating in over 1.3 million SCG customers enrolled in 2006.

- SCE customer participation in CARE grew steadily through the 1990's and then increased dramatically in 2001 to about 730,000 customers. By year-end 2006, SCE customer participation in CARE reached over one million households.

Figure 5-1
Summary of Annual CARE Program Participation by IOU (1993-2006)

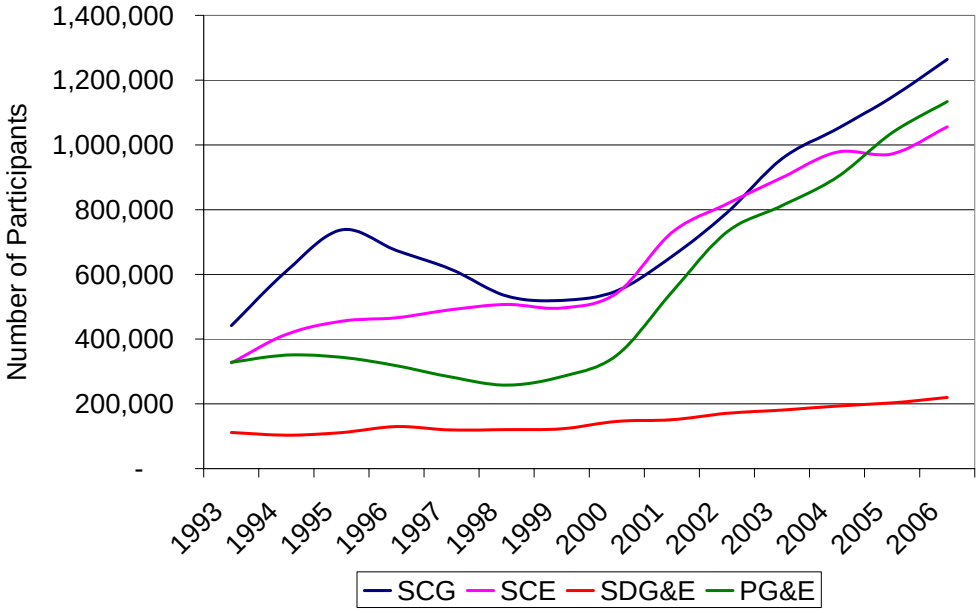


Table 5-1
Summary of Annual CARE Program Participation by IOU (1993-2006)

	PG&E	SCE	SCG	SDG&E
1993	328,491	326,526	441,831	111,510
1994	350,605	414,828	610,170	103,672
1995	344,149	455,188	737,410	111,218
1996	317,998	466,296	673,553	129,831
1997	282,701	491,045	614,942	119,508
1998	257,945	507,188	533,362	120,548
1999	284,276	496,271	519,511	123,137
2000	350,194	542,175	549,158	145,764
2001	545,175	729,367	655,446	151,121
2002	731,107	817,637	790,592	170,815
2003	812,204	899,148	957,602	181,028
2004	900,264	977,760	1,049,767	193,524
2005	1,037,618	972,188	1,148,334	203,292
2006	1,133,663	1,055,710	1,264,264	220,010
Source: Counts of participation were obtained from the IOUs in May 2004, November 2005, and July 2007.				

- SDG&E experienced fairly steady increases in CARE participation during 1993-2006 with about 220,000 participants by year-end 2006.

- Participation in CARE among PG&E's customers was slowly decreasing in the late 1990s and picked up again beginning in 2000 to about 350,000 customers. PG&E experienced a dramatic increase in participation during 2001-2006, with over one million customers participating by year-end 2006.

Information on CARE participation is limited for the SMJUs and not available for LADWP and SMUD. Table 5-2 displays the available information for each SMJU according to the most recent sources reviewed.

Table 5-2
Summary of Annual CARE Program Participation by SMJU (2003-2006)

	Alpine Natural Gas	Bear Valley Electric	PacifiCorp	Sierra Pacific	Southwest Gas	West Coast Gas
2003	23	1,569	3,336	1,108	22,576	40
2004	26	1,559	4,445	1,277	25,487	45
2005	31	1,302	5,346	1,507	32,200	38
2006	38†	1,059	7,576	1,604	38,939	34*

† Projected

* As of March 31, 2006

Sources:

Peevey, M. R. (CPUC), 2005. "Opinion Approving Low Income Energy Efficiency and California Alternative Rates for Energy (Care) Programs for 2005 for Pacificorp, Southwest Gas Corporation, Sierra Pacific Power Company, Avista Corporation, Southern California Water Company (Bear Valley Electric Service), Alpine Natural Gas Operating Company, and West Coast Gas Company." Mailed July 25, 2005.

West Coast Gas Company, Inc., 2006. "Application of West Coast Gas Company for Approval of Program Years 2007 and 2008 Low-Income Assistance Program Budgets." Filed June 1, 2006.

Pacific Power, 2007. "Care Alternate Rates for Energy Program and (CARE) and CARE Expanded Program for Group Living Facilities Progress Report." May 1, 2007.

Sierra Pacific, 2007. "Annual Low-Income Progress Report." May 1, 2007.

Southwest Gas Corporation, 2007. "Low-Income Assistance Programs 2006 Annual Report." May, 2007.

Golden State Water Company, 2007. "R. 04-01-006, Annual Low Income Progress Report -2006" (and attachments). May 1, 2007.

Alpine Natural Gas Operating Company, 2006. "Application of Alpine Natural Gas Company Operating Company No. 1, LLC. PY 2007-2008 Low Income Energy Efficiency [SIC] Plan and California Alternative Rates for Energy Program Budgets." June 1, 2006.

Peevey, M. R. (CPUC), 2006. "Order Adopting Small Utility Budgets for Administration of LIEE and CARE Programs." Mailed December 15, 2006.

Since 1994, the four major California IOUs have provided over 1.5 million households with services through the LIEE Program. Figure 5-2 displays cumulative participation in the LIEE Program during 1994-2006.

Table 5-3 displays annual LIEE participation levels for each utility from 1994 through 2005. On average, the four IOUs provided LIEE services to nearly 150,000 households per year during this time frame. Differences by utility are summarized below:

- Participation in PG&E's LIEE Program remained fairly constant over time at around 40,000 dwellings per year, with minor dips in 1998 and 2001 down to about 30,000 dwellings. PG&E's program spiked to nearly 57,000 dwellings in 2002.

- Participation in SCE's LIEE Program has varied over the last ten years. Starting off with a high of nearly 96,000 treated dwellings in 1994, participation dropped to under 50,000 dwellings in 1995. Participation remained steady during 1996-1998, increased gradually during 1999-2001, and then dropped again significantly in 2002 and 2003. Participation has picked up again during 2004-2005.

- SCG experienced fairly modest increases in participation during 1994-2000, but during 2001-2005, the utility saw a rather dramatic increase in participation per year with annual participation peaking in 2003 at nearly 57,000 dwellings.

- SDG&E's participation levels increased gradually during the 1994-2003 with a spike in 2001.

Information on LIEE participation is limited for the SMJUs and not available for LADWP and SMUD. Table 5-4 displays the available information for each SMJU according to the most recent sources reviewed.

Figure 5-2
Summary of Cumulative LIEE Participation by IOU (1994-2006)

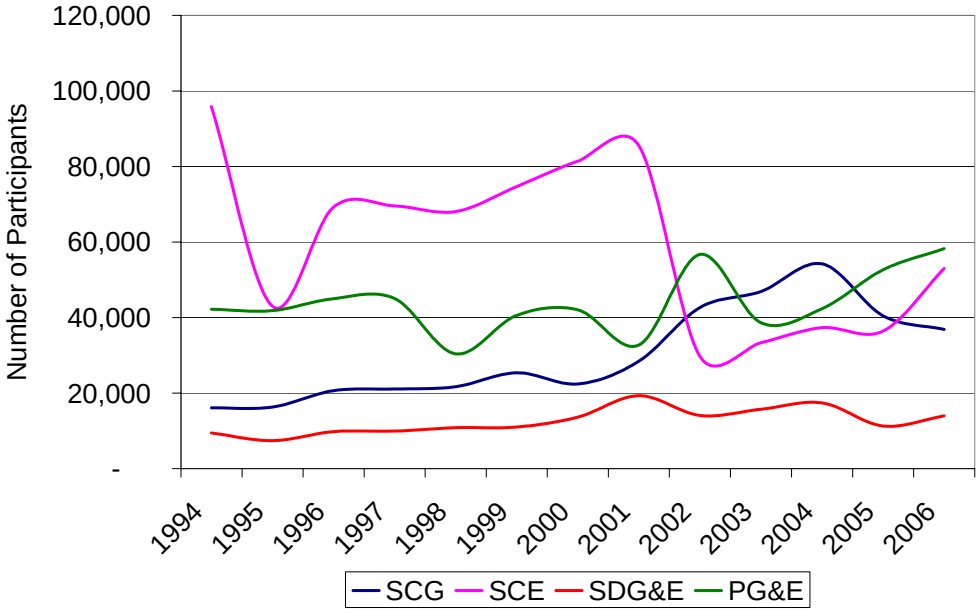


Table 5-3
Summary of Annual LIEE Program Participation by IOU (1994-2006)

	PG&E	SCE	SCG	SDG&E
1994	42,189	95,896	16,075	9,453
1995	41,837	42,977	16,327	7,395
1996	45,015	69,236	20,664	9,824
1997	45,033	69,569	21,073	9,931
1998	30,391	68,056	21,686	10,838
1999	40,604	74,694	25,390	10,993
2000	42,038	81,401	22,429	13,660
2001	32,740	85,509	28,457	19,315
2002	56,698	29,685	42,667	14,089
2003	38,631	33,348	46,900	15,706
2004	42,380	37,341	54,221	17,431
2005	52,648	36,419	40,477	11,266
2006	58,250	53,004	36,852	13,965
Annual Average*	43,727	59,780	30,248	12,605
Cumulative Total	568,454	777,135	393,218	163,866

* Annual average reflects participation over the 13 year period (January 1, 1994 through December 31, 2006).
Source: Counts of participation were obtained from the IOUs in May 2004, November 2005, and July 2007.

Table 5-4
Summary of Annual LIEE Program Participation by SMJU (2003-2006)

	Alpine Natural Gas	Bear Valley Electric	PacifiCorp	Sierra Pacific	Southwest Gas*	West Coast Gas
2003	n/a	n/a	92	160	843	n/a
2004	14	68	15	119	913	n/a
2005	16	85	70	119	738	n/a
2006	**	6	29	84	798	n/a

* Data for Southwest Gas includes Avista.

n/a = The LIEE programs for Alpine Natural Gas and Bear Valley Electric were not in effect until 2004. West Coast Gas does not offer the LIEE Program.

** 2006 participation data for Alpine Natural Gas not available.

Participation refers to the number of homes “treated” through program (i.e., energy efficiency measures and energy education services have been provided). The number of “weatherized homes” (i.e., weatherization measures have been provided) would be a subset of the “treated homes.”

Sources:

Peevey, M. R. (CPUC), 2005. "Opinion Approving Low Income Energy Efficiency and California Alternative Rates for Energy (Care) Programs for 2005 for Pacificorp, Southwest Gas Corporation, Sierra Pacific Power Company, Avista Corporation, Southern California Water Company (Bear Valley Electric Service), Alpine Natural Gas Operating Company, and West Coast Gas Company." Mailed July 25, 2005.

Pacific Power, 2007. "Care Alternate Rates for Energy Program and (CARE) and CARE Expanded Program for Group Living Facilities Progress Report." May 1, 2007.

Sierra Pacific, 2007. "Annual Low-Income Progress Report." May 1, 2007.

Southwest Gas Corporation, 2007. "Low-Income Assistance Programs 2006 Annual Report." May, 2007.

Golden State Water Company, 2007. "R. 04-01-006, Annual Low Income Progress Report -2006" (and attachments). May 1, 2007.

Peevey, M. R. (CPUC), 2006. "Order Adopting Small Utility Budgets for Administration of LIEE and CARE Programs." Mailed December 15, 2006.

5.2 Estimates of CARE and LIEE Program Penetration

Using the information on the eligible population presented in Section 4 and the program participation data shown above, estimates of CARE and LIEE Program penetration have be calculated as shown in Table 5-5. For CARE, year-end 2006 penetration ranged from 66% for SDG&E to 78% for SCE. Annual penetration for LIEE ranged from 2-4%, which is consistent with prior years.

Table 5-5
Estimates of Annual CARE and LIEE Program Penetration (2006)

	CARE Eligible Households (200%)	CARE Participants	**Annual CARE Penetration**	LIEE Eligible Households (200%)	LIEE Participants	**Annual LIEE Penetration**
PG&E	1,601,238	1,133,663	**71%**	1,868,594	58,250	**3%**
SCE	1,351,845	1,055,710	**78%**	1,365,633	53,004	**4%**
SCG	1,762,569	1,264,264	**72%**	2,005,118	36,852	**2%**
SDG&E*	335,015	220,010	**66%**	394,242	13,965	**4%**

* SDG&E CARE penetration estimate is based on the electric tariff counts of CARE participants and the electric service counts of CARE eligible households.

Information on program penetration by SMJU is presented in Table 5-6 for the program year 2005. Complete information for 2006 was not available.

Table 5-6
Estimates of Annual CARE and LIEE Program Penetration by SMJU (2005)

Program Penetration Rates	**Alpine Natural Gas**	**Bear Valley Electric**	**PacifiCorp**	**Sierra Pacific**	**Southwest Gas***	**West Coast Gas**
CARE	2%	41%	35%	21%	60%	n/a
LIEE	1%	3%	<1%	2%	1%	n/a

* Southwest Gas includes Avista.
n/a = Data for West Coast Gas not available.

5.3 Energy Burden

This section presents an analysis of energy burden. Specifically,

- What percent of total household income is spent on energy among California's low income population?
- What are the characteristics of those households with the greatest energy burden?
- What are some of the most effective ways for the programs to reduce energy burden among those with the greatest need?

Energy burden is defined as the portion of total household income that goes toward paying utility bills. Energy burden is calculated as the ratio of energy expenditures to total household income. Energy expenditure data was requested from the four major California IOUs, and customers for whom valid data was obtained were included in the analysis. Data on household income levels was collected during the HENS interview.

5.3.1 Average Household Energy Burden

On average, we found that low income households in California typically spend about 4% of their total household income on energy. The average household in this calculation spends about $950 per year for energy and earns about $23,000. These calculations used household income data obtained from respondents in the HENS survey and household energy expenditures data obtained from IOUs. The period of analysis for energy burden is program year 2003.[10]

The results for energy burden are analyzed for several categories of households:

- *Electric only*: Annual energy expenditures as a percent of total household income when the household has only electric service (i.e., does not use natural gas for major end-uses such as space heating, water heating and/or cooking);
- *Combined electric and natural gas:* Annual energy expenditures as a percent of total household income when the household receives electric and natural gas service from the same utility; and
- *Separate electric and natural gas:* Annual energy expenditures as a percent of total household income when the household receives electric service from one utility and natural gas service from another.

[10] We recommend the Commission request updated energy cost and consumption information for CARE and LIEE participants and develop updated estimates of energy burden for 2006. A detailed scope of work for conducting this follow-up work has already been submitted to the Commission.

It is important to consider these distinctions because households in the sample use different energy mixes and, as a result, have different energy expenditures. Some households are electric-only; that is, they only pay one energy bill and that is for electric service to the home. Some households have both electric and natural gas service and pay one energy bill to the local combined electric and natural gas utility company. Other households have both electric and natural gas service but pay two different energy companies for these services.

The results of our analysis of average energy burden by IOU are presented in Table 5-10. As shown in the blue shaded cells, energy burden among electric only households ranges from 2.8% for SCE customers, to 3.3% for SDG&E customers, and as high as 5.3% for PG&E customers. Energy burden (as shown in the yellow shaded cells) ranges from 4.0% to 4.9% for combined electric and natural gas customers of PG&E and SDG&E respectively. Households receiving electric service from SCE and natural gas service from SCG have a combined energy burden of 4.3% (as shown in the pink shaded cells).

Other households in our sample receive electric and/or natural gas service from one of the four major IOUs, but also receive service from a utility not included in our sample (e.g., a SMJU, a municipal utility like LADWP or SMUD, etc.). For these customers, we are missing part of the household's energy expenditures and, as a result, can only present a partial picture of the average household's energy burden in Table 5-7 (as shown in the non-shaded cells).

Energy burden was analyzed, overall, for electric only households and for households that receive both electric and natural gas service[11]. Overall, the average energy burden does not differ between these two types of households – for electric only households, the average energy burden is 4.2% and for households using both electricity and natural gas the average energy burden is also 4.2%. As mentioned above, average energy burden is highest among electric only households in PG&E's service territory (5.3%) and, for households using electricity and natural gas, average energy burden is highest in SDG&E's service territory (4.9%).

[11] In this analysis, we only included electric only households and households for which we had data for both electric and natural gas energy expenditures (the shaded rows in Table 5-10). Therefore, these results include households receiving electric service only from PG&E, SCE or SDG&E, and households receiving electric and natural gas service from PG&E or SDG&E, and households receiving electric service from SCE and natural gas service from SCG.

Table 5-7
Summary of Energy Burden by Type of Service and IOU

	Sample Size	Average Energy Burden			Average Annual Energy Bill			Average HH Income
		All Energy	Electricity	Natural Gas	Average Annual Total Bill	Average Annual Electric Bill	Average Annual Gas Bill	
PG&E (n=438)								
Electric and gas customers	229	4.0%	2.5%	1.4%	$968	$616	$352	$24,402
Gas customers (with electric service provided by another utility)	67	na	na	1.5%	na	na	$353	$23,882
Electric customers (with gas service provided by another utility)	46	na	3.7%	na	na	$624	na	$16,831
Electric only customers	68	5.3%	5.3%	0.0%	$1,074	$1,074	$0	$20,440
SCE (n=191)								
Electric customers (with gas service provided by another utility, not SCG)	140	na	2.7%	na	na	$550	na	$20,259
Electric only customers	32	2.8%	2.8%	0.0%	$548	$548	$0	$19,647
SCE/SCG (n=324)								
Electric and gas customers	303	4.3%	2.8%	1.5%	$940	$606	$333	$21,655
SCG (n=381)								
Gas customers (with electric service provided by another utility, not SCE)	356	na	na	1.4%	na	na	$292	$20,559
SDG&E (n=118)								
Electric and gas customers	58	4.9%	3.6%	1.2%	$982	$731	$251	$20,121
Electric customers (with gas service provided by another utility)	26	na	3.3%	na	na	$808	na	$24,297
Electric only customers	20	3.3%	3.3%	0.0%	$870	$870	$0	$26,743

5.3.2 Characteristics of Households with Greatest Energy Burden

In order to identify significant differences across different segments of the low income population, households were grouped into three categories based on their energy burden:

- Low energy burden (< 2.5%)
- Moderate energy burden (2.5% to 5.0%)
- High energy burden (More than 5%)

Table 5-8 shows the distribution of energy burden according to these categories. Overall, 27% of households spend less than 2.5% of their total household income on energy. Just less than one third (31%) spend between 2.5 and 5.0% of their total household income on energy, and 43% spend more than 5% of their total household income on energy. The average energy burden in this highest category is 8.4%.

This table also shows the distribution of energy burden for electric only and electric and gas households according to these low, moderate and high categories. As shown, the highest category of energy burden is exhibited by electric only households – on average, these households pay 13.5% of the total household income for electricity service. However, this segment only makes up 5% of all low income households in the sample. Comparatively, average energy burden is about 8.4% for the highest category of energy burden among electric and gas households. This segment represents 43% of all low income households.

Table 5-9 presents the same information but by utility. As shown, the percentage of low income households in each of the three energy burden categories by utility is not significantly different from the overall population.

The next step in the analysis of energy burden is to characterize segments of the low income population that exhibit relatively high energy burden that could be used to identify and/or deliver targeted program outreach. This involves an analysis of differences in the underlying geographic, demographic, housing, and energy-use characteristics for low income households within the highest energy burden category (i.e., spend more than 5% of total household income on energy).

Keeping in mind that this highly burdened segment represents 43% of the overall low income population, Table 5-10 presents a summary of some of the characteristics of those segments with the greatest energy burden. As shown, nearly two thirds of households living in sparsely populated areas (61%) have energy burden greater than 5%. Programs targeting households located in the most rural and remote areas are likely to reach those households with the greatest need relative to energy burden, as well as a sizable portion of the low income population (31%). Comparatively, low income households living in mobile homes also represent a segment with the greatest need relative to energy burden; however, only 3% of the overall low income population lives in mobile homes.

Table 5-8
Summary of Energy Burden Results by Category (Low, Moderate and High)

Type of Energy Service	Energy Burden Category	Number of Responses (Unweighted)	Percent of Low Income Households [1] (Weighted)	Average Energy Burden
All Households	Low energy burden (<2.5%)	192	27%	1.6%
	Moderate energy burden (2.5 - 5.0%)	254	31%	3.6%
	High energy burden (>5.0%)	265	43%	8.4%
	All Households	711	100%	4.2%
Electric and gas households	Low energy burden (<2.5%)	152	21%	1.6%
	Moderate energy burden (2.5 - 5.0%)	210	25%	3.6%
	High energy burden (>5.0%)	228	38%	7.9%
	All Electric and Gas Households	590	100%	4.2%
Electric only households	Low energy burden (<2.5%)	40	6%	1.4%
	Moderate energy burden (2.5 - 5.0%)	44	6%	3.7%
	High energy burden (>5.0%)	37	5%	13.5%
	All Electric Only Households	121	100%	4.2%

[1] Percentage of households based on weighted sample and, as such, may not correspond to percentages based on unweighted sample.
Note: Table only includes results for electric only households and households for which data was available for both electric and natural gas service (either from the same utility, i.e., PG&E and SDG&E, or from SCE and SCG).

Table 5-9
Summary of Energy Burden by Category (Low, Moderate, High) and IOU

Utility	Type of Energy Service	Energy Burden Category	Number of Responses (Unweighted)	Percent of Low Income Households [1] (Weighted)	Average Energy Burden
PG&E	Electric and Gas	Low energy burden (<2.5%)	66	11.5%	1.5%
		Moderate energy burden (2.5 – 5.0%)	72	9.2%	3.8%
		High energy burden (>5.0%)	91	21.4%	7.2%
	Electric Only	Low energy burden (<2.5%)	20	2.8%	1.3%
		Moderate energy burden (2.5 – 5.0%)	24	2.7%	3.8%
		High energy burden (>5.0%)	24	3.6%	14.3%
SCE	Electric Only	Low energy burden (<2.5%)	11	1.6%	1.4%
		Moderate energy burden (2.5 – 5.0%)	13	2.1%	3.3%
		High energy burden (>5.0%)	8	0.7%	10.4%
SCE/SCG	Electric and Gas	Low energy burden (<2.5%)	74	8.2%	1.7%
		Moderate energy burden (2.5 – 5.0%)	117	12.5%	3.5%
		High energy burden (>5.0%)	112	13.2%	8.9%
SDG&E	Electric and Gas	Low energy burden (<2.5%)	12	1.4%	1.4%
		Moderate energy burden (2.5 – 5.0%)	21	3.1%	3.6%
		High energy burden (>5.0%)	25	3.5%	9.4%
	Electric Only	Low energy burden (<2.5%)	9	1.2%	1.7%
		Moderate energy burden (2.5 – 5.0%)	7	1.2%	4.0%
		High energy burden (>5.0%)	5	0.2%	7.1%
All Households			**711**	**100%**	**4.2%**

[1] Percentage of households based on weighted sample and, as such, may not correspond to percentages based on unweighted sample.
Note: Table only includes results for electric only households and households for which data was available for both electric and natural gas service (either from the same utility, i.e., PG&E and SDG&E, or from SCE and SCG).

Table 5-10
Segments of the Low Income Population with Greatest Energy Burden

		Percent of Households Spending More than 5% on Energy	Segment Size (Percent of Low Income Population)
All Low Income Households		*43%*	--
Housing Density	Households living in sparsely populated areas	61%	31%
Climate Region	Central Valley	63%	25%
Race/Ethnicity	White	51%	34%
	Other	52%	8%
Literacy	Illiterate (English language)	66%	7%
Household Composition	Seniors only	50%	18%
	Disabilities	56%	27%
Household Income	Less than $15,000	73%	35%
Dwelling Type	Single Family	51%	44%
	Mobile Homes	78%	6%
AC System	Have central AC or heat pump	58%	25%
Heating System	Natural Gas	50%	75%
Energy Use	High annual electricity consumption (>7,000 kWh/year)	75%	27%
	High annual natural consumption (>500 therms/year)	70%	26%
	Above-baseline electricity consumption	60%	52%
	Above-baseline gas consumption	50%	75%
	High summer electricity consumption (>1,500 kWh/summer months)	65%	41%
	High winter electricity consumption (>1,500 kWh/winter months)	65%	36%
	High winter natural gas consumption (>500 therms/winter months)	75%	25%

5.4 Energy Insecurity

This section presents an analysis of energy insecurity. Specifically,

- What portion of California's low income population frequently experiences difficulty keeping up with energy payments and is often threatened with service disconnection?
- What segments of the population are the most energy insecure?
- What are some of the most effective ways for the programs to address energy insecurity?

Energy insecurity was determined based on responses to survey questions designed to determine how difficult or easy it has been for low income households to meet their energy needs. Based on responses to the questions, respondents were placed in one of five energy insecurity groups, ranging from "thriving" (secure) to "in crisis" (insecure). These five groups represent the "energy insecurity scale," which is a modified version of the scale developed by Roger Colton and modified by APPRISE Inc. for the National Energy Assistance Directors Association LIHEAP Study.

The series of questions used to develop the energy insecurity scale were administered as follows:

> "These next questions get at how difficult or easy it has been for you to meet your household's energy needs for the past 12 months. I am going read a list of things that may or may not have happened in your household. Please tell me if, in the past 12 months, they happened: almost every month, some months, one to two months, or not at all. (*If clarification needed:* By "almost every month" I mean 10 or more months in a 12-month period. Some months means 3 to 9 months.) In the past 12 months:
>
> - Did you worry that you wouldn't be able to pay your home energy bill?
> - How often did you cut back on what you consider to be basic household necessities?
> - How often did you borrow money from a friend or relative to pay your home energy bill?
> - How often did you skip paying your home energy bill or pay less than the whole amount due?
> - How often were you threatened with disconnection of electricity, natural gas or home heating fuel delivery?
> - How often did you close off part of your home because you could not afford to heat or cool it?

- How often did you keep your home at a temperature that you felt was unsafe or unhealthy at any time of the year?
- How often did you leave your home for part of the day because it was too hot or too cold?
- How often did you use your kitchen stove or oven to provide heat?
- How often did you use a kerosene space heater to provide heat?"

In addition, a final question related to energy insecurity was asked of respondents: "Has your electricity ever been disconnected."

Table 5-11 displays the results from these questions. As shown, the most common occurrence related to energy insecurity was the need to "cut back on basic household necessities." Over half of the respondents (57%) have at some time during the year had to cut back on basic household necessities in order to meet their need for energy. Just about half (49%) reported that they have worried about paying their energy bill at least once during the past year, 37% reported that they had skipped paying an energy bill in the past year and 31% have had to borrow money from friends and/or relatives to pay their energy bills.

About one in five respondents reported that they have had to close off part of their homes because they could not afford to keep it cool or warm, and a similar percentage reported that they have had to leave their home for part of the day because it was too cold or hot. Only 15% reported that they have kept their homes at an unsafe or unhealthy temperature (in order to control energy costs).

Finally, 22% of the survey respondents reported that in the past twelve months they have been threatened with disconnection of energy service, and only 5% reported that they had ever been disconnected.

5.4.1 Average Household Energy Insecurity

Using responses to these questions, we determined each household's place on an "energy insecurity scale." This scale ranges from "in crisis" to "thriving." Households "in crisis" would have reported one or more of these items occurring "almost every month," or they would have reported having had their electricity shut off because they were unable to pay the electric bill. Households deemed "thriving" would have reported that none of these items occurred over a 12-month period.

Overall, the results indicate that the majority of eligible low-income households are classified as either "in crisis" (28%) or "vulnerable" (38%), the two most insecure categories on the scale (Figure 5-3).

Table 5-11
Survey Results for Energy Insecurity Questions

How frequently do / have you or someone else in your household...?	Percent of All Low Income Households				
	Almost every month	**Some months**	**1 or 2 months per year**	**Never**	**Sample Size**
Worry about paying energy bill	14%	18%	17%	51%	1,519
Cut back on basic household necessities	18%	24%	14%	43%	1,519
Borrow money from friend / relative to pay energy bill	3%	11%	16%	69%	1,517
Skip paying energy bill	5%	15%	17%	63%	1,513
Been threatened with disconnection of energy	2%	7%	12%	78%	1,516
Close off part of home because could not afford to condition it	8%	8%	4%	80%	1,511
Keep home at unsafe or unhealthy temperature	2%	9%	4%	85%	1,508
Leave home for part of the day because too hot or too cold	2%	12%	8%	79%	1,518
Use your kitchen stove / oven to provide heat	2%	7%	5%	87%	1,518
Use kerosene space heater to provide heat	0%	1%	0%	98%	1,514
	Yes		**No**		
Has your electricity ever been disconnected?	5%		95%		1,521

Figure 5-3
Summary of Results for Energy Insecurity – All Low Income Households
Source: HENS Survey (n=1482)

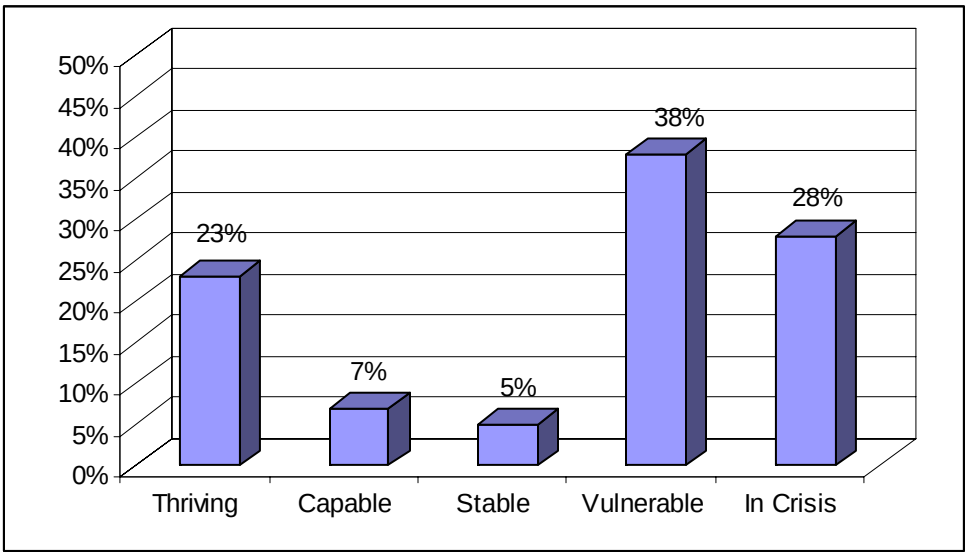


Table 5-12 displays the results for each of the energy insecurity items for two groups of households. The first group was labeled *"secure"* because they were considered to be "thriving," "capable," or "stable" based on the energy insecurity scale. The second group combined households deemed "vulnerable" or "in crisis" into a category labeled *"insecure."* As shown, the most meaningful differences between the two groups are that insecure households are more likely to be cutting back on basic household necessities in order to meet their energy needs, and insecure households are somewhat more likely to be worrying about paying their energy bill, skipping an energy payment, and threatened with service disconnection.

Figure 5-4 shows the energy insecurity results by utility. As shown, PG&E and SDG&E households are more insecure than the average low income household, whereas SCG and SCE households are somewhat more secure than the average low income household.

Figure 5-5 shows differences in energy insecurity by climate region. As shown, low income households living in the North Coast and Central Valley Coast climate regions are among the most energy insecure. Low income households living in the Desert climate region are also more energy insecure than the average low income household, but these households only comprise about 6% of all low income households in the state.

Table 5-12
Key Differences between Secure and Insecure Households

	Percentage of Low Income Households		
	Secure	**Insecure**	**All Households**
Worry about paying energy bill	21%	64%	49%
Cut back on basic household necessities	0%	86%	57%
Borrow money from friend / relative to pay energy bill	11%	41%	31%
Skip paying energy bill	10%	50%	37%
Been threatened with disconnection of energy	0%	44%	22%
Close off part of home because could not afford to condition it	3%	29%	20%
Keep home at unsafe or unhealthy temperature	1%	23%	15%
Leave home for part of the day because too hot or too cold	5%	30%	21%
Use your kitchen stove / oven to provide heat	0%	20%	13%
Use kerosene space heater to provide heat	1%	2%	2%
Electricity service has been disconnected	0%	7%	5%

Figure 5-4
Energy Insecurity Results by Utility

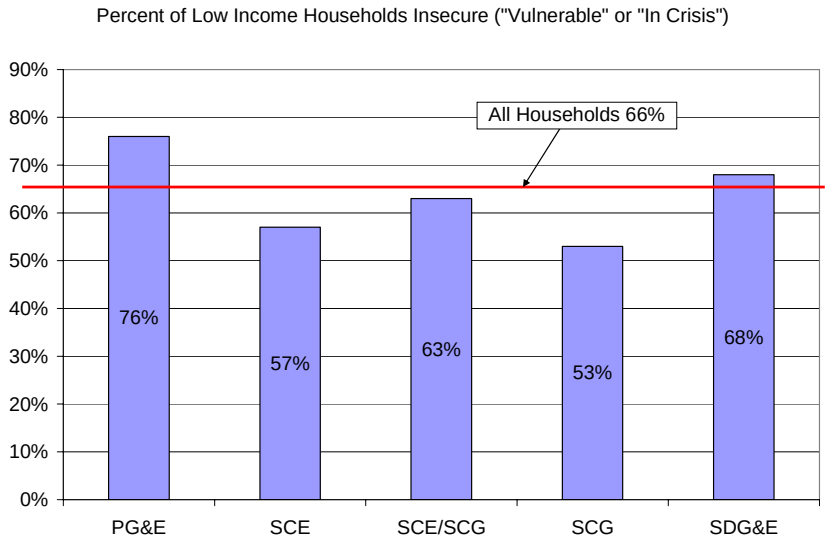
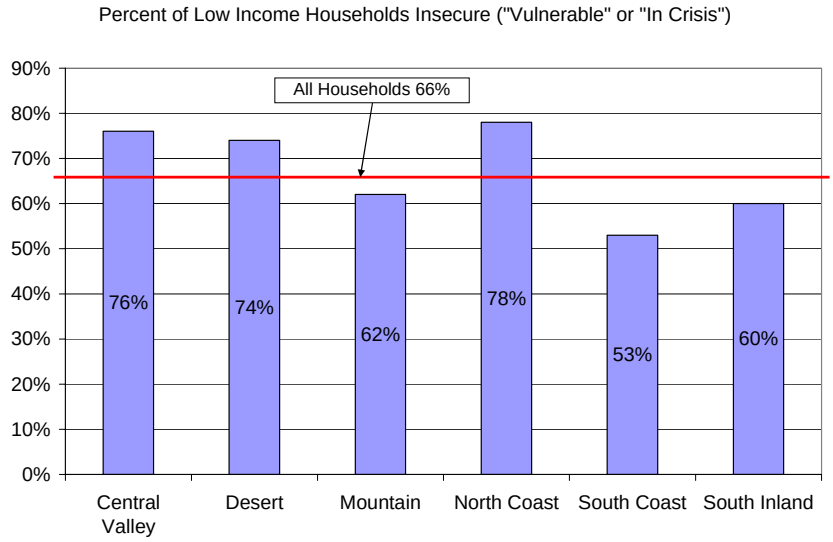


Figure 5-5
Energy Insecurity Results by Climate Region



As presented above for energy burden, it is helpful to identify differences in the underlying geographic, demographic, housing, and energy-use characteristics for those low income households that are either "vulnerable" or "in crisis" in order to develop targeted marketing and outreach strategies.

Keeping in mind that, overall, 66% of all low income households were deemed insecure, Table 5-13 presents a summary of some of the characteristics of the most insecure segments. As shown, three quarters of low income households living in sparsely populated areas (75%) are insecure. This segment represents 31% of all low income households. Comparatively, 75% of low income households living in mobile homes are insecure, but this segment represents only 3% of all low income households.

Table 5-13
Segments of the Low Income Population that are the Most Energy Insecure

		Percent of Households that are "Insecure"	Segment Size (Percent of Low Income Population)
All Low Income Households		*66%*	--
Housing Density	Households living in sparsely populated areas	75%	31%
Climate Region	Central Valley	76%	25%
Race/Ethnicity	African-American	74%	11%
	Other	73%	8%
Household Composition	Large households (5+ household members)	74%	29%
	Disabilities	77%	27%
Household Income	Less than $15,000	72%	35%
Dwelling Type	Single Family	73%	44%
	Small Multifamily (2-4 units)	74%	7%
	Mobile Homes	74%	6%
AC System	Have evaporative cooler	77%	7%
Energy Use	High annual electricity consumption (>7,000 kWh/year)	80%	27%
	High annual natural consumption (>500 therms/year)	77%	26%
	Above-baseline electricity consumption	76%	52%
	High summer electricity consumption (>1,500 kWh/summer months)	77%	41%
	High winter electricity consumption (>1,500 kWh/winter months)	78%	36%
	High winter natural gas consumption (>500 therms/winter months)	74%	25%
Energy Burden	Spend more than 5% of household income on energy	82%	43%

5.5 Non-Energy Benefits

The needs assessment survey addressed a number of concerns related to comfort, health, and safety. This section presents an analysis of these concerns.

5.5.1 Comfort

The needs assessment survey asked the following questions:

- How comfortable is your home during summer/winter?
- Are you able to make yourself comfortable during summer/winter?
- How often do you find your home too cold, too drafty, too hot, or too stuffy during the winter?

Table 5-14 presents the results to these questions. Overall, the majority of low income households (86%) expressed at least one concern related to comfort. The most notable concerns during the winter months related to homes that are too cold or too drafty. These are key areas that the LIEE Program can address through the installation of energy efficiency measures.

Table 5-14
Low Income Household Concerns Related to Comfort During Winter and Summer

	Percent of Households	Number of Responses	Sample Size
Have at least one concern related to comfort	*86%*	*240*	*1,517*
Not comfortable in winter	18%	264	1,526
Not always able to be comfortable in winter	13%	196	1,520
Home can be too cold during winter	70%	1,043	1,524
Home can be too drafty during winter	50%	765	1,516
Home can be too hot during winter	13%	191	1,516
Home can be too stuffy during winter	39%	556	1,517
Not comfortable in summer	26%	393	1,503
Not always able to be comfortable in summer	22%	339	1,494

Significant differences in results by utility are shown in Figures 5-6 through 5-8. As shown, low income households living in PG&E's service territory are the most likely to report concerns related to comfort during the winter months. Concerns related to homes being too stuffy during winter are most common

among low income households living in the service territories of SCE and SDG&E. There were no other significant differences by utility for concerns related to comfort in the summer or winter months.

Figure 5-6
Low Income Household Concerns Related to Comfort – By Utility

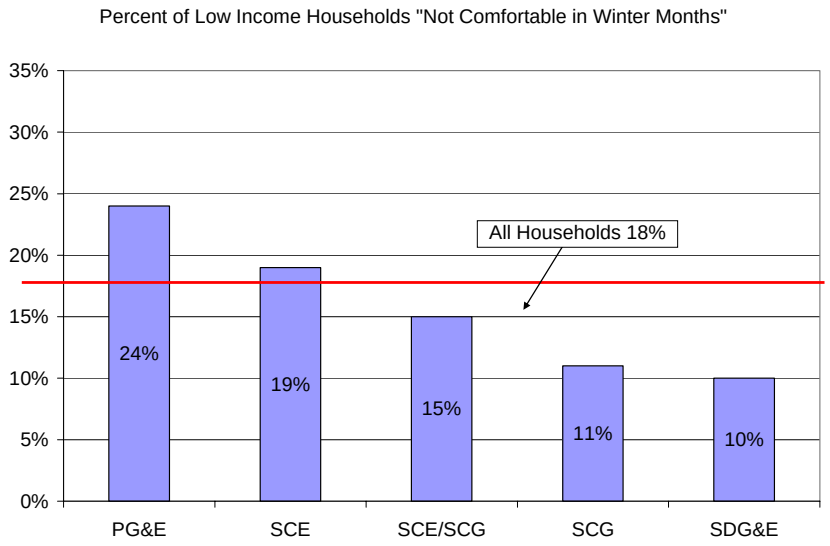


Figure 5-7
Low Income Household Concerns Related to Comfort – By Utility

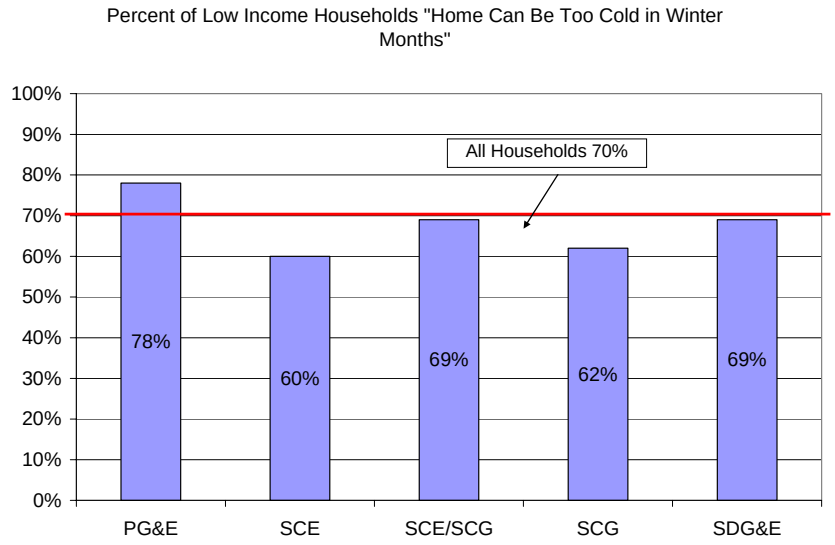
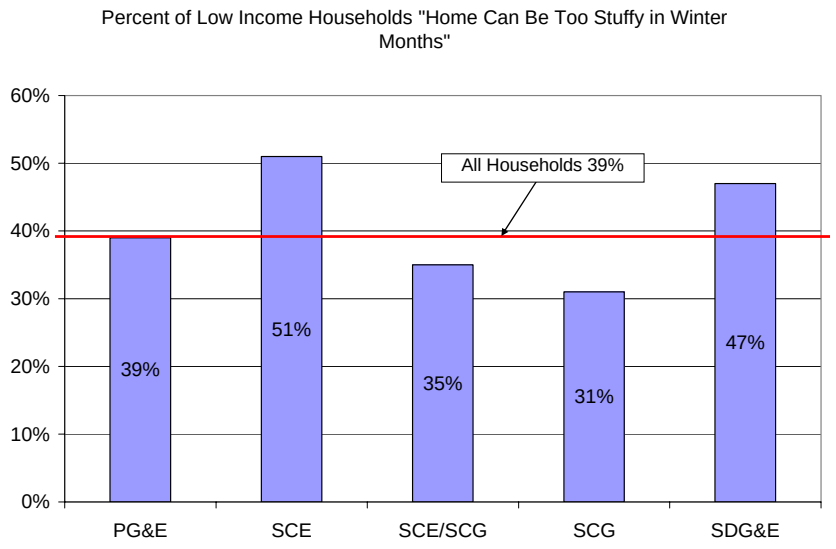


Figure 5-8
Low Income Household Concerns Related to Comfort – By Utility



Figures 5-9 and 5-10 show significant results by housing density. As shown, low income households located in sparsely populated areas are the most likely to have concerns related to comfort in the winter, and households located in more suburban areas (i.e., "sprawl") are the most likely to feel their homes are too stuffy in the winter.

Figure 5-9
Low Income Household Concerns Related to Comfort – By Housing Density

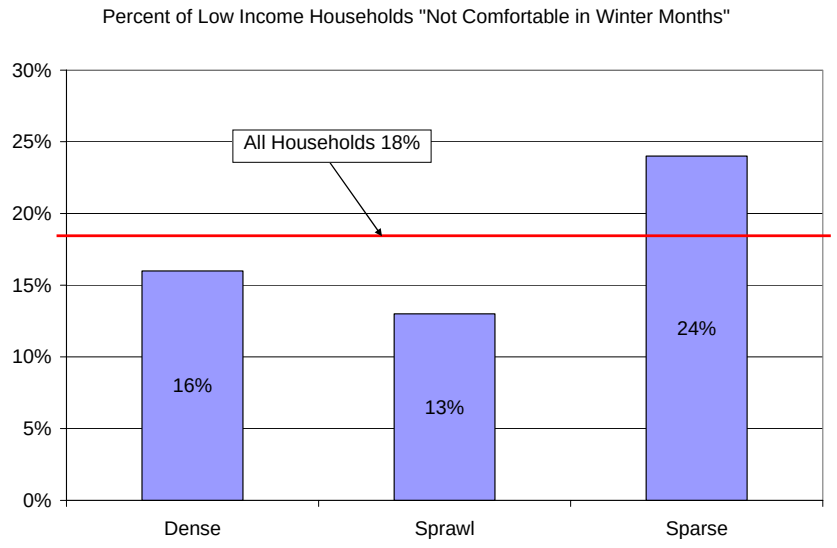
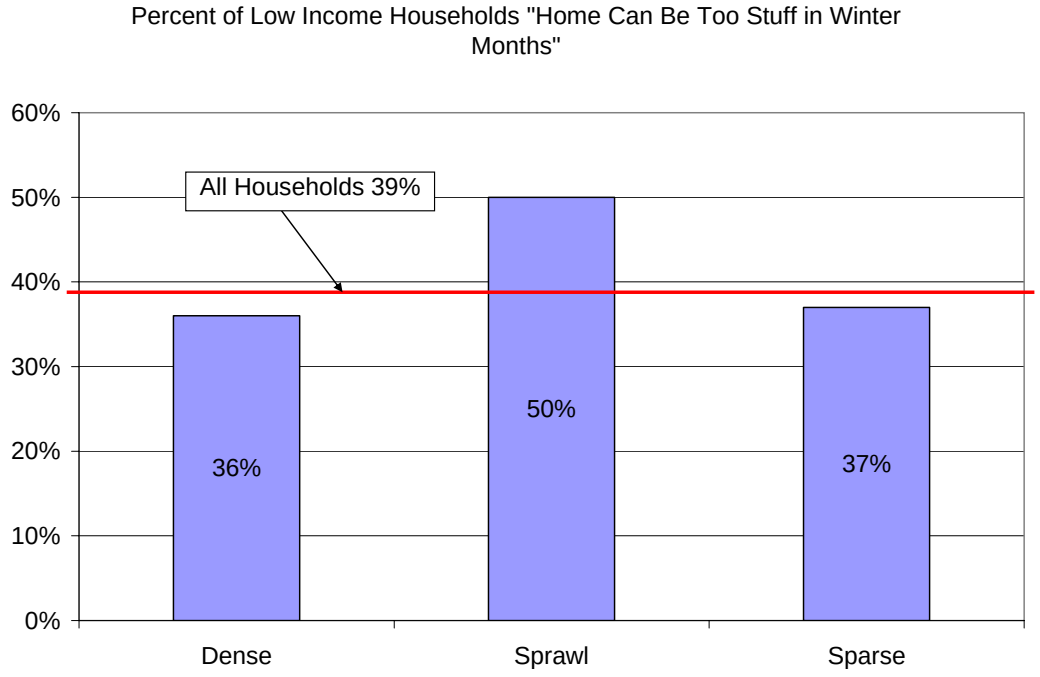


Figure 5-10
Low Income Household Concerns Related to Comfort – By Housing Density



Significant results by climate region are shown in Figures 5-11 and 5-12. Sample sizes for both the Desert and Mountain climate regions are small, although the results are statistically significant.

Figure 5-11
Low Income Household Concerns Related to Comfort – By Climate Region

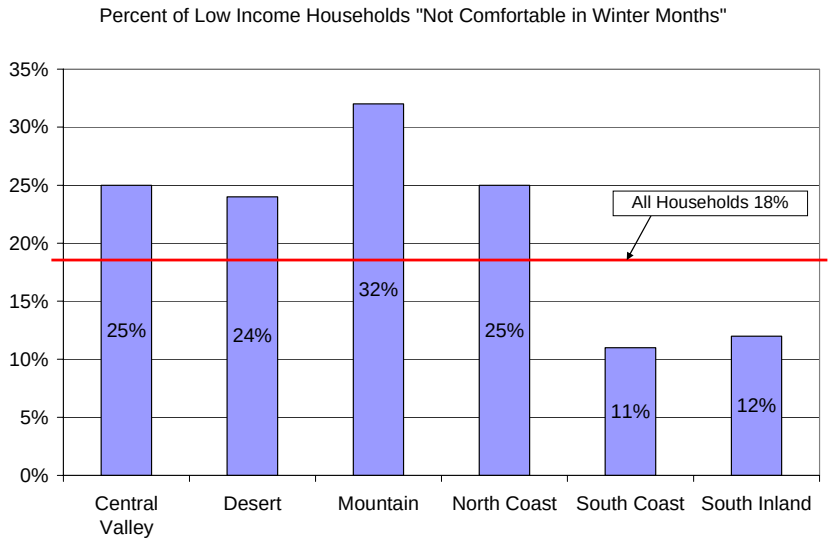
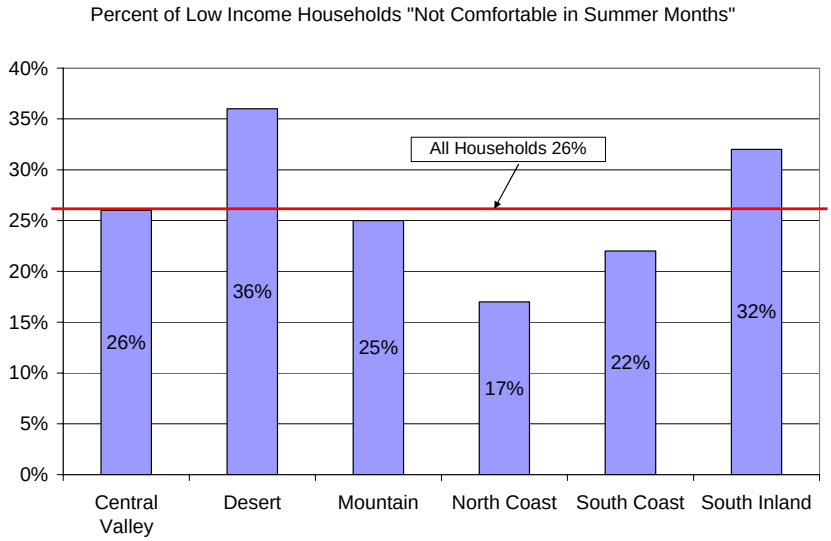


Figure 5-12
Low Income Household Concerns Related to Comfort – By Climate Region



As mentioned above, the majority of low income households (86%) express some type of concern related to comfort. Segments of the low income population that are most likely to have concerns related to comfort are summarized in Table 5-15. As shown, nearly all Hispanic households (93%) are concerned about comfort and this segment represents 37% of the overall low income population. A similar percentage of all households that use wood or coal for heating also expressed concerns related to comfort, but this segment only represents 3% of the overall low income population.

Table 5-15
Segments of the Low Income Population with Greatest Concerns Related to Comfort

		Percent of Households With Concerns Related to Comfort	Segment Size (Percent of Low Income Population)
All Low Income Households		*86%*	--
Housing Density	Households living in suburban areas ("sprawl")	92%	18%
Climate Region	North Coast	92%	16%
Race/Ethnicity	Hispanic	93%	37%
Language Spoken	Asian	91%	10%
Household Composition	Adult Households (35-59)	92%	11%
Dwelling Type	Small Multifamily (2-4 units)	97%	7%
AC System	Have evaporative cooler	93%	7%
Heating System	Wood or coal	92%	3%
Heating System Age	30 years or more	91%	24%
Energy Insecurity	"In Crisis"	93%	28%

5.5.2 Health

The needs assessment survey asked a question designed to learn the frequency with which households have had health problems related to a number of factors. These factors included: impurities in drinking water; home is too cold in winter; home is too hot in the summer; air quality; and the way home is heated (e.g., dirty furnace, fireplace, oven).

Table 5-16 shows the results from these questions. As shown, one in four low income households has had a health problem that they have attributed to a condition in their home. Most common are health problems related to homes being too cold or too hot, or homes with poor air quality.

Table 5-16
Low Income Household Concerns Related to Health

	Percent of Households	Number of Responses	Sample Size
Any health problem	*26%*	*381*	*1,480*
Health problems from impurities in water	2%	26	1478
Health problems from being too cold	18%	286	1510
Health problems from being too hot	8%	119	1508
Health problems from air quality	7%	107	1493
Health problems from heat source	2%	41	1501

Households reporting having these health problems were then asked to describe the specific health problems they have had. The following is a summary of the results of these questions:

- *Impurities in drinking water:* Most low income households who have experienced health problems due to impurities in their drinking water indicated that these problems were gastrointestinal.

- *Home is too cold in winter:* The majority of low income households who have had health problems due to their homes being too cold in the winter indicated that they have had colds, flus and related symptoms (sore throat, coughing, congestion, fever). A few (less than 30 households) also report asthma or other breathing problems, allergies, arthritis or pneumonia as illnesses they have experienced as a result of their homes being too cold.

- *Home is too hot in the summer:* Households who have had illnesses during the summer months because their homes are too hot reported similar health problems – e.g., colds and flus, asthma,

allergies, etc. In addition, some households have experienced heat-related illnesses such as dehydration, heat exhaustion, nausea and dizziness, high blood pressure, and general discomfort.

- *Air quality:* Allergies, asthma, and other breathing problems are among the most common health problems related to air quality. Ten households specifically mentioned illnesses they have experienced due to the presence of mold.

- *Heating source:* Health problems related to a heating source include colds, headaches, asthma and other breathing problems.

Overall, 26% of all low income households have experienced at least one health problem that they have related to a condition in their home (e.g., impure drinking water, too cold/too hot, air quality, etc.). Table 5-17 presents the results of analysis completed for different segments of the low income population. This table shows those segments of the low income population that are most likely to have experienced health problems caused and/or aggravated by a condition in their homes.

Table 5-17
Segments of the Low Income Population Most Likely to Have Health-Related Concerns

		Percent of Households With Health-Related Concerns	Segment Size (Percent of Low Income Population)
All Low Income Households		*26%*	--
Household Composition	Household member with a physical or mental disability	42%	27%
Household Income	Total household income less than $15,000	36%	35%
Dwelling Type	Small Multifamily (2-4 units)	44%	7%
Size of Home	Very Small (<500 square feet)	31%	14%
Type of AC System	Room air conditioners	33%	20%
Heating Fuel	Electric	33%	19%
Energy Insecurity	“In Crisis”	41%	28%

5.5.3 Safety and Security

Questions included in the needs assessment that addressed low income household feelings toward safety and security included:

- Generally, how secure is your home?
- What are the main reasons you don't feel your home is secure?
- What would you change about your home to make it more secure?

Overall, most low income households (69%) reported that they felt secure in their homes. That is, only 31% of all low income households reported that, generally, they do not feel very secure in their homes. As shown in Figures 5-13 and 5-14, safety and security were most likely to be a concern for low income households living in PG&E's service territory, especially for households located in the Central Valley and North Coast climate regions.

Figure 5-13
Low Income Household Concerns Related to Overall Safety / Security – By Utility

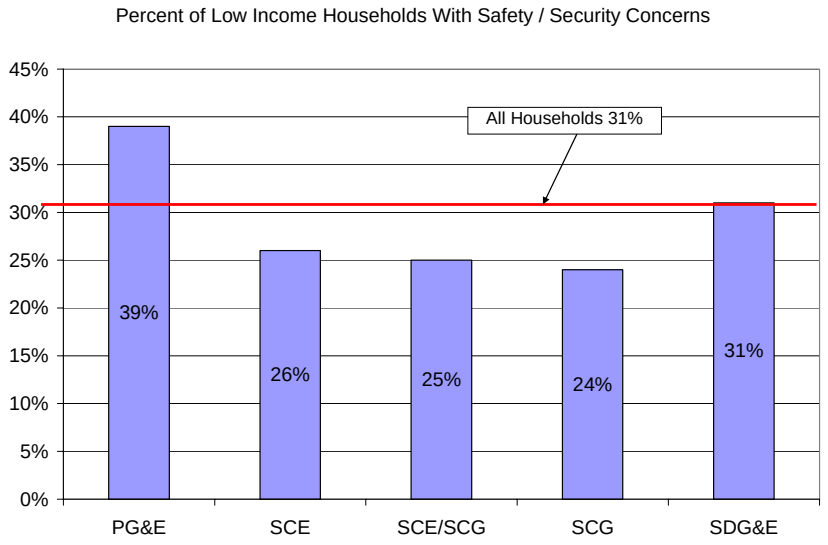


Figure 5-14
Low Income Household Concerns Related to Overall Safety / Security – By Climate Region

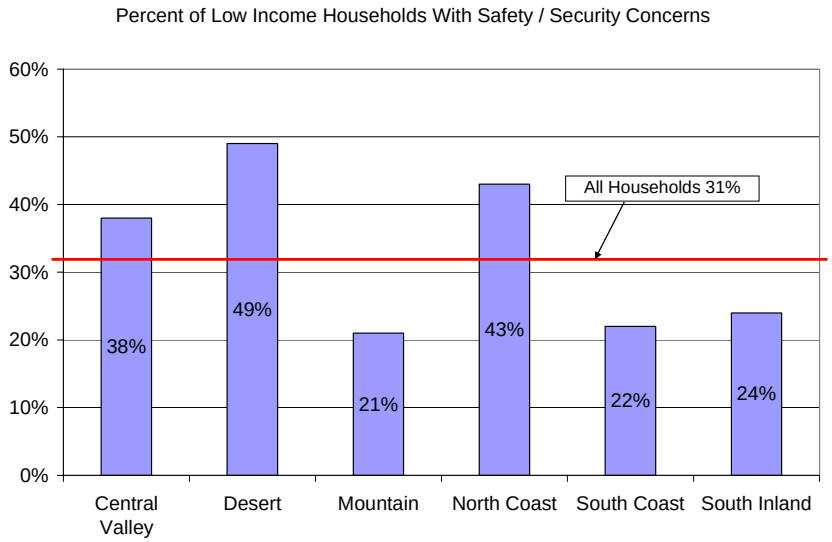


Table 5-18 presents results for other segments of the low income population who were the least and the most likely to have overall concerns related to safety and security.

Table 5-18
Segments of the Low Income Population Most Likely to Have Safety and Security Concerns

		Percent of Households With Safety & Security Concerns	Segment Size (Percent of Low Income Population)
All Low Income Households		*31%*	--
Household Composition	Young adult households (age 18-34)	42%	6%
Age of Home	Homes built in 1940 or earlier (over 60 years old)	41%	13%
Size of Home	Very small (<500 square feet)	41%	14%
Energy Burden	Spend 5% or more of household income on energy	43%	43%
Energy Insecurity	"In Crisis"	41%	28%
Health	Concerns related to health	49%	26%

Low income households that expressed concerns related to safety and security were asked about the main reasons for their concerns and what changes, if any, they feel could be made to their homes to make them feel more safe and secure. Based on these responses, of the low income households that indicated they

had concerns related to safety and security, only about half (48%) reported their concerns were related to aspects of their home that could be improved the programs like LIEE – broken windows and doors, poor / lack of exterior security lighting, make other repairs to the home, etc. Tables 5-19 and 5-20 present these results; the highlighted cells represent areas that the LIEE Program can address.

Table 5-19
Low Income Household Reasons for Safety / Security Concerns

Reasons for Safety / Security Concerns	Percent of Households with Safety/Security Concerns
Concern LIEE Program can address	***48%***
Windows not secure	24%
Door not secure	18%
Main gate not secure	10%
Bad lighting	2%
Concern LIEE Program cannot address	***52%***
Location has been burglarized / vandalized	23%
Neighborhood / location	20%
Weapons / drugs / gangs / violence	7%
No alarm system	4%
Live alone / isolated	4%
Old / unsafe apartment	4%
Heavy traffic	2%
Other	3%

Table 5-20
Changes to Address Low Income Household Safety / Security Concerns

Changes to Address Safety / Security Concerns	Percent of Households with Safety/Security Concerns
Concern LIEE Program can address	***48%***
Install more/better locks on doors and windows	47%
Install/use security lighting outside home	23%
Replace/repair broken windows	21%
Replace/repair broken doors	18%
Make other repairs	1%
Concern LIEE Program cannot address	***52%***
Add security bars or grills to windows and doors	15%
Security gate	8%
Nothing	6%
Move away	4%
Install security cameras	2%
Get a dog	2%
Patrolling more often	2%
Fake alarm sign	1%
Other	8%

5.6 Need for Energy Efficiency Measures

This section describes the results of the analysis of the need for energy efficiency measures among the low income population. Specifically, we address the following research questions:

- What types of energy efficiency measures are feasible (i.e., based on structural conditions and equipment/appliance performance factors) and needed (i.e., based on baseline conditions) among California's low income population?
- How do these needs vary among different segments of the population?
- Which measures would provide the greatest energy savings benefits to California's low income population overall and which would provide significant benefit to certain segments (e.g., elderly, rural, mobile home residents, etc.)?
- What are some of the most effective ways for the programs to deliver these energy savings benefits?

The analysis of the need for energy efficiency measures entailed an assessment of the current stock of energy efficiency measures present in program-eligible dwellings through detailed energy audits. The energy audits also addressed the structural condition of the housing stock and equipment/appliance performance factors, including an evaluation of the age and condition of major energy-using equipment and key components of the building shell. The need for specific LIEE Program measures, such as furnace repairs and replacement, refrigerator replacement, and building shell repairs and improvements, was also included.

Table 5-21 presents a concise summary of the results of the analysis of need for energy efficiency measures. We provide more details on each of these measure types in the following subsections. For each type of measure, we present an assessment of the "need" for the measure – that is, the percent of low income dwellings for which the measure is technically feasible and needed according to the structural conditions and performance factors we observed on-site. Section 6 presents the results from the energy savings potential analysis for each of the measures needed in low income dwellings.

Table 5-21
Summary of Need for Energy Efficiency Improvements in Low Income Dwellings

Energy Efficiency Improvement	Sample Size	Percent of Low Income Households in Need of Measure	
		Conservative	Based on Age or Other Factor
Heating System Repair/Replacement	1,287	11%	46%
Cooling System Repair/Replacement	1,468	9%	33%
Cooling System Filter Replacement	1,469	11%	29%
Water Heating System Replacement	1,265	7%	51%
Water Heater Tank Wrap	1,271	65%	65%
Water Heater Pipe Insulation	1,274	71%	71%
Low Flow Showerheads	1,518	37%	37%
Energy Saving Faucet Aerators	1,517	67%	67%
Water Heater Set Point Reduction	1,210	45%	45%
Ceiling Insulation	1,295	35%	35%
Attic Ventilation Measures	1,506	11%	11%
Ceiling Repair Measures	1,534	15%	15%
Ceiling Perimeter Caulking	1,534	14%	14%
Attic Access Weatherstripping	1,534	16%	16%
Wall Insulation	1,440	18%	43%
Wall Repair Measures	1,440	22%	22%
Wall Caulking	1,440	20%	20%
Foundation Repair Measures	1,532	23%	23%
Foundation Perimeter Caulking	1,532	21%	21%
Duct Sealing	1,534	4%	4%
Exterior Door Repair Measures	1,534	9%	56%
Exterior Door Weatherstripping	1,534	55%	55%
Window Repair/Replacement	1,511	3%	16%
Window Weatherstripping	1,524	27%	27%
Programmable Thermostat (Heating)	1,500	55%	82%
Programmable Thermostat (Cooling)	1,472	29%	45%
Refrigerator Maintenance/Replacement	1,534	5%	34%
Stand-Alone Freezer Maintenance/Replacement	1,534	1%	4%
Range/Oven Repair/Replacement	1,528	9%	59%
CFLs	1,534	83%	83%
CFL Porch Lights	1,534	35%	35%

5.6.1 Space Heating Measures

As discussed in Section 4, over half of all low income households are using natural gas hot air furnaces or wall units as their primary heating source. Another 15% use electricity for their primary space heating systems (e.g., heat pumps, wall units, portable heaters). The energy surveyor determined the age and overall operating condition of these heating equipment/systems. Table 5-22 presents the results of analysis of both of these factors. As shown, 11% of all low income households use heating equipment/systems that are 20 years or older and in need of repair, maintenance or replacement (green shading). Overall, about half (46%) of all space heating equipment/systems are 20 years or older (light green shading).

Table 5-22
Age and Condition of Heating Equipment/Systems in Low Income Household
(Percent of Low Income Households)[1]

Age of Heating Equipment/System	Operating Condition of Heating Equipment/System			
	Good	Fair	Needs Repair/ Maintenance	Needs Replacement
Less than 10 years	22%	4%	1%	0%
10-19 years	7%	17%	3%	1%
20-29 years	4%	18%	4%	1%
30 or more years	2%	11%	4%	2%
No heating equipment/system	9%			

[1] Sample Size: n=1,287

5.6.2 Space Cooling Measures

As presented in Section 4, about half of all low income households (55%) use some type of air conditioning equipment or system and many of these systems are either central air conditioners or room air conditioners. Table 5-23 compares the information obtained about the age of the cooling equipment/systems with the energy surveyor's assessment of the operating condition of the equipment/systems, as well as the condition of the air conditioner filters.

As shown, 9% of all low income households use relatively old cooling equipment/systems that are in need or repair, maintenance or replacement. Eleven percent of all low income households use cooling equipment/systems for which the filter is in need of maintenance or replacement.

Table 5-23
Age and Condition of Cooling Equipment/Systems in Low Income Households
(Percent of Low Income Households)[1]

Age of Cooling Equipment/System	Operating Condition of Cooling Equipment/System			
	Good	Fair	Needs Repair/ Maintenance	Needs Replacement
<10 years	14%	3%	0%	0%
10-19 years	5%	11%	3%	0%
20-29 years	1%	7%	2%	2%
30 or more years	0%	3%	1%	1%
No AC	45%			
Age of Cooling Equipment/System	**Condition of Filter**			
	Good	Fair	Needs Maintenance/ Replacement	Not Applicable
<10 years	9%	3%	2%	3%
10-19 years	3%	8%	5%	3%
20-29 years	1%	5%	3%	3%
30 or more years	1%	2%	1%	1%
No AC	45%			

[1] Sample Size: n = 1,468 for operating condition and n=1,469 for filter

5.6.3 Water Heating Measures

As presented in Section 4, the majority of water heating systems in low income dwellings use natural gas and more than half are 10 years old or newer. Based on the energy surveyor's observations onsite, only about 7% of the water heating equipment/systems used by low income households were in need of repair, maintenance or replacement. As shown in Table 5-24, many of the older water heaters (i.e., over 10 years old) were found to be in good or fair operating condition.

Table 5-24
Age and Condition of Water Heating Equipment/Systems in Low Income Households
(Percent in Low Income Households)[1]

Age of Water Heating Equipment/Systems	Operating Condition of Water Heating Equipment/System			
	Good	Fair	Needs repair/ maintenance	Needs replacement
< 1 year	5%	0%	0%	0%
1-5 years	19%	2%	0%	0%
6-10 years	16%	13%	0%	0%
11-15 years	7%	19%	1%	1%
16-20 years	1%	8%	2%	0%
More than 20 years	0%	2%	2%	1%
All Water Heating Equipment/Systems	49%	44%	5%	2%

[1] Sample Size: n=1,265

In addition, the energy surveyor determined the need for several other water heating measures, as summarized below:

- Overall, two thirds of low income households (65%) use water heating equipment/systems that are in need of insulating blankets or tank wraps. The remaining households either already have tank wraps installed (21%) or, based on the energy surveyor's inspection, tank wraps cannot be installed (14%) due to the type/age of the existing water heating equipment/system. Brand new water heating equipment/systems (i.e., less than one year old) are the least likely to need this measure, although the majority of water heating equipment/systems between 6-10 years old are in need of this measure.

- Nearly three quarters of low income households (71%) are in need of insulation for water heating pipes. About 18% of the remaining low income households do not need this measure because their water heating pipes are already wrapped and for 11% this measure is not applicable/feasible. The need for this measure is greatest among low income households who do not pay for their water heating (it is included in their rent) and who use water heating equipment/systems that are over 10 years old.

- About one third of all low income households (37%) are in need of (additional) low-flow showerheads. About one quarter (27%) are in need of only one low-flow showerhead, and another 10% have a need for two or more low-flow showerheads. There are no meaningful differences related to the need for this measure across different types of equipment/systems.

- Energy saving faucet aerators could be used by about two thirds of low income households (67%). On average, these low income households could use two energy saving faucet aerators per home – 15% could use one, 33% could use two, and 19% could use three or more. The need for this measure is greatest among low income households who do not pay for their water heating (it is included in their rent) and who use water heating equipment/systems that are over 10 years old.

- Finally, the energy surveyor also collected data on the temperature at which water heating equipment/systems is set to heat the water. Overall, 45% of the low income households have the temperature of their water heating equipment/systems set to above 120°F. This is more common among households who pay for their hot water, as opposed to those where the cost of heating water is included in the rent payment.

5.6.4 Building Shell Improvement Measures

Ceiling Measures

The energy surveyor assessed the practicality of adding additional insulation based on the ceiling types and the level of existing insulation. Overall, for two-thirds of all low income households (65%), the energy surveyor determined that it was impractical to add additional insulation. As shown in Table 5-25, homes for which the energy surveyor determined that additional ceiling insulation would be impractical have, in general, higher levels of existing insulation.

Table 5-25 also shows the existing R-value and square footage for areas where adding ceiling insulation is feasible. As shown, approximately one in five low income households (20%) have a need for additional insulation for an average 1,100 square foot flat-roof attic space with R-13 of existing insulation. For an additional 12%, insulation could be added to an average 900 square foot vaulted/sloped roof attic space with R-10 existing insulation. Overall, ceiling insulation can be added to 35% of all dwellings occupied by low income households.

Table 5-25
Potential for Adding Ceiling Insulation to Low Income Dwellings

Type of Ceiling	Ceiling Insulation Can Be Added			Not Practical to Add Ceiling Insulation		
	Percent of All Low Income Households[1]	Average Existing Ceiling Insulation R-Value	Average Existing Ceiling Square Footage	**Percent of All Low Income Households[1]**	Average Existing Ceiling Insulation R-Value	Average Existing Ceiling Square Footage
Vaulted/Sloped (No Attic)	1%	7	1,072	9%	10	792
Vaulted/Sloped (With Attic)	12%	10	927	10%	15	1,184
Flat (No Attic)	2%	10	926	36%	7	728
Flat (With Attic)	20%	13	1,107	9%	21	986
Other	0%	19	416	0%	4	582
All Low Income Households	35%	12	1,031	65%	11	847

[1] Sample Size: n=1,295

In addition, the energy surveyor collected information on whether or not there was adequate ventilation in the attic space. For half of the low income households (50%) surveyed, attic ventilation was not applicable or feasible given the conditions observed onsite. For 41% of the households, attic ventilation was already present and for 9% attic ventilation was not present.

The need for (additional) attic ventilation was limited to 11% of all low income households, as shown in Table 5-26. Nearly all of these opportunities are in dwellings with flat-roof attic spaces. As mentioned above, for half of all low income households this measure was not applicable and for 38% it was not needed.

Table 5-26
Potential for Attic Ventilation in Low Income Dwellings
(Percent of All Low Income Households)[1]

Type of Ceiling	Presence of Attic Ventilation			Need for (Additional) Attic Ventilation		
	Existing	Not Existing	Not Applicable	Needed	Not Needed	Not Applicable
Vaulted/Sloped (No Attic)	2%	1%	6%	0%	2%	6%
Vaulted/Sloped (With Attic)	17%	1%	3%	1%	17%	3%
Flat (No Attic)	1%	2%	38%	0%	2%	38%
Flat (With Attic)	21%	6%	2%	10%	16%	2%
Other	0%	0%	1%	0%	0%	1%
All Low Income Households	41%	9%	50%	11%	38%	50%

[1] Sample Size: n=1,506

The energy surveyor also collected information on the condition of the ceilings, and the need for caulking around the ceiling perimeter, weatherstripping around the attic access door, and attic fans. Table 5-27 presents a summary of the findings for these measures. As shown, 15% of all low income households need ceiling repairs, 14% need (additional) caulking around the ceiling perimeter, and 16% need (additional) weatherstripping around the attic access door. It would also be feasible to add attic fans or whole house fans in about one quarter of all low income households (27% and 23%, respectively).

Table 5-27
Potential for Additional Ceiling Improvement Measures in Low Income Dwellings

		Percent of All Low Income Households	Sample Size
Ceiling Condition	Good	85%	1,248
	Fair	13%	260
	Poor	2%	26
Need for Ceiling Perimeter Caulking	None	86%	1,297
	Moderate	13%	216
	Significant	1%	21
Need for Attic Access Weatherstripping	None	45%	712
	Moderate	13%	193
	Significant	3%	39
	Not Applicable	40%	590
Feasibility for Attic Fans	Yes	27%	430
	No	73%	1,085
Feasibility for Whole House Fans	Yes	23%	369
	No	77%	1,148

Wall Measures

As shown in Section 4, nearly all low income households (96%) live in dwellings with less than R-19 of existing wall insulation – 18% have no wall insulation (R-0), 25% have on average R-8, and 53% have on average R-12. Only 4% of all households were observed to have wall insulation at or above R-19. The average low income household has approximately R-9 of existing wall insulation. A conservative estimate for adding wall insulation would apply to 18% of all low income households – that is, only those dwellings without any existing insulation. An additional 25% of low income households might benefit from adding wall insulation because they currently have less than R-11 installed.

Table 5-28 shows that most of the walls were observed to be in "good" condition and not in need of caulking measures. Overall, 22% of all low income households have a need for wall improvement

measures and 20% need caulking. The greatest need for these measures is found among low income households with no existing wall insulation (R-0).

Table 5-28
Condition of Walls and Need for Caulking in Low Income Dwellings

Level of Existing Wall Insulation	Percent of Low Income Households[1]	Condition of Walls			Need for Caulking		
		Good	Fair	Poor	None	Moderate	Significant
No insulation (R-0)	18%	52%	41%	7%	58%	37%	5%
R-1 --> R-10	25%	80%	14%	6%	81%	17%	2%
R-11 --> R-18	53%	86%	13%	1%	88%	12%	1%
R-19 --> R-30	4%	80%	20%	0%	91%	9%	0%
All Low Income Households	100%	78%	19%	3%	80%	18%	2%

[1] Sample Size: n=1,440

Foundation Measures

The energy survey collected information on the building foundation for each low income household included in the needs assessment sample. Table 5-29 presents the results pertaining to the types of foundation observed, the condition of the foundation and floors, and the need for caulking around the foundation perimeter.

Table 5-29
Types and Condition of Foundation in Low Income Dwellings

Type of Foundation	Percent of All Low Income Households by Foundation Type[1]	Condition of Foundation/Floors			Foundation Perimeter Caulking		
		Good	Fair	Poor	Not Needed	Moderate	Significant
Slab	49%	82%	17%	**1%**	83%	16%	2%
Crawl	23%	65%	31%	4%	67%	29%	4%
Basement	4%	69%	30%	1%	77%	21%	2%
Mobile home skirting	5%	n/a					
Not applicable[2]	23%	n/a					
All Low Income Households	100%	77%	21%	2%	78%	19%	2%

[1] Sample Size: n=1,532
[2] Dwelling unit not located on ground floor.

As shown, about half of all low income households (49%) live in dwellings with slab foundation. Another 23% have crawl-space foundations, and 4% have basements. For 23% of the sample, the low income household we surveyed did not live on the first floor of the property and, as such, no data on the type of foundation was collected. For 5%, mobile home skirting was listed as the foundation type. These latter two categories were excluded from the analysis of need for foundation measures.

Table 5-29 also shows that most of the relevant foundation types were observed to be in "good" condition – 82% of the low income households living in homes with slab foundation, 65% with crawl spaces, and 69% with basements. Similarly, most of the low income households live in homes where there is a need for foundation perimeter caulking.

Duct Sealing Measures

As mentioned in Section 4, duct system insulation measures are applicable or feasible in only 17% of all low income households. The energy surveyor also assessed the extent to which there were significant leaks in the existing duct systems and, overall, leaky duct systems were observed in only 4% of low income households. Table 5-30 presents the results of the energy surveyors' recommendations regarding duct sealing for these dwellings. As shown, in 21% of the low income households with applicable duct systems, the energy surveyor determined that leaks were present. However, for many of these systems the surveyor did not recommend duct sealing as the leaks were not significant enough to warrant duct sealing measures.

Table 5-30
Potential for Duct Sealing Measures in Low Income Dwellings

Duct System Leaks	Percent of Low Income Households with Applicable Duct Systems
None	79%
Minor (Duct Sealing Not Recommended)	13%
Major (Duct Sealing Necessary)	8%
[1] Sample Size: n=223 (households with applicable duct systems)	

Exterior Door Measures

The energy surveyor collected data on the types of exterior doors in low income dwelling units, as well as the overall condition of the doors and whether or not there was a need for door weatherstripping measures. As shown in Table 5-31 across all exterior door types, few low income households have exterior doors in need of repair or replacement (9%), whereas about half (55%) need weatherstripping.

Table 5-31
Type and Condition of Exterior Doors in Low Income Dwellings

Type of Exterior Doors	Percent of All Low Income Households	Sample Size	Door Condition				Door Weatherstripping		
			Good	Fair	Needs Repair	Need Replacement	None	Moderate	Significant
Hollow Core	41%	615	20%	16%	4%	1%	21%	16%	3%
Solid Core	50%	817	43%	38%	5%	1%	29%	17%	4%
Insulated Metal	8%	110	24%	19%	4%	1%	4%	2%	1%
Patio	33%	416	35%	22%	5%	1%	23%	7%	2%
Panel with Glass	22%	338	27%	22%	5%	2%	12%	7%	3%
All Low Income Households	100%	1,534	44%	47%	7%	2%	48%	44%	11%

Window Measures

As discussed in Section 4, the majority of low income households (80%) have single-pane windows and about one in five (23%) have double-pane windows. The energy surveyor recorded information about the need for window measures according to the percent of all windows for the entire dwelling unit. As shown in Table 5-33, 84% of all windows in low income households were observed to be in good condition, and 73% of all windows did not need weatherstripping and caulking. Table 5-32 also shows that low income dwellings with single pane windows have a greater need for window improvement measures.

Table 5-32
Window Types and Condition in Low Income Dwellings

Type of Window	Percent of Low Income Households[1]	Percent of Windows	Condition of Windows[1]				Need for Weatherstripping[1]		
			Good	Fair	Need glass replacement	Need window replacement	None	Moderate	Significant
Single pane	80%	77%	82%	15%	1%	2%	70%	26%	4%
Single pane (with storm)	2%	1%	79%	21%	0%	0%	75%	22%	3%
Double pane	23%	21%	92%	7%	1%	0%	86%	16%	2%
Triple pane	0%	0%	0%	0%	0%	0%	0%	0%	0%
All Windows			84%	13%	1%	2%	73%	24%	3%

[1] Sample Size: n=1,511 for window condition and n=1,524 for need for weatherstripping

5.6.5 Appliances

Programmable Thermostat Measures

As presented in Section 4, more than one third of all low income households have programmable thermostats installed in their homes to control their heating systems (36%) and about one quarter have programmable thermostats to control their cooling systems (23%). Only a small percentage of low income households, however, are using the programmable features of their thermostats, as shown in Table 5-33. Ten percent of all low income households use the programmable features of their heating thermostats, and 8% use the programmable features of their cooling thermostats. In addition to replacing the manual heating and cooling thermostats, there is a need to provide education and training to low income households that may not currently be getting the energy savings benefits from using the programmable features of their heating and cooling thermostats.

Table 5-33
Presence and Use of Programmable Thermostats in Low Income Dwellings

Type of Heating Thermostat	Sample Size	Percent of All Low Income Households	Primary Heating Equipment/System Fuel				
			Electricity	Natural Gas	Propane	Wood/Coal	None
Manual	922	55%	60%	61%	29%	90%	0%
Programmable	425	36%	41%	39%	71%	10%	0%
None	153	9%	0%	0%	0%	0%	9%
Heating Thermostat Use							
Program	94	10%	3%	13%	3%	5%	0%
Do not program	331	27%	37%	27%	68%	5%	0%
Manual	922	55%	60%	61%	29%	90%	0%
None	153	9%	0%	0%	0%	0%	9%
Type of Cooling Thermostat	**Sample Size**	**Percent of All Low Income Households**	**Cooling Equipment/System Type**				
			Central AC	Heat Pumps	Room AC	Evaporative Coolers	None
Manual	408	29%	44%	49%	71%	74%	0%
Programmable	224	23%	56%	51%	29%	26%	0%
None	840	47%	0%	0%	0%	0%	47%
Cooling Thermostat Use							
Program	63	8%	23%	19%	4%	4%	0%
Do not program	161	16%	33%	32%	25%	23%	0%
Manual	408	29%	44%	49%	71%	74%	0%
None	840	47%	0%	0%	0%	0%	47%

The energy surveyor also collected information on the day, evening and nighttime set points for both the heating and cooling periods. These results are shown in Table 5-34.

Table 5-34
Thermostat Set Points in Low Income Dwellings

Heating Thermostat Set Point	Sample Size	**Average Set Point**	**Heating Thermostat Use**		
			Program	Do Not Program	Manual
Day	1012	64	67	64	64
Evening	1013	67	70	66	66
Night	1018	64	69	65	62
Cooling Thermostat Set Point	Sample Size	**Average Set Point**	**Cooling Thermostat Use**		
			Program	Do Not Program	Manual
Day	593	77	77	74	76
Evening	591	78	77	75	79
Night	594	80	79	77	81

Refrigerators

As discussed in Section 4, the energy surveyor collected information about the number, type, size, location, age, and overall condition of refrigerators being used by low income households. Overall, about two thirds of all refrigerators used by low income households (65%) are 10 years old or less, and about half were found to be in "good" condition (53%).

The need for refrigerator replacements was determined both according to the LIEE Program requirements (i.e., any refrigerator over 10 years old can be replaced), as well as taking into account the energy surveyor's assessment of the overall operating condition of the refrigerator. These results are shown in Table 5-35. If only the program criteria were used, about one third of all refrigerators in low income dwellings (34%) would be eligible for replacement through the LIEE Program. However, if one looks strictly at the existing refrigerator's operating condition, then only 5% of all refrigerators should be replaced.

Of course, there are energy savings benefits to be achieved if older refrigerators in poor operating condition are replaced. But it may not be appropriate to replace older equipment in "fair" or especially "good" operating condition (24% of all refrigerators) simply based on the program's existing equipment

age criteria. A more reasonable estimate, therefore, would be refrigerators in poor operating condition that are also over 10 years old, or 11% of all refrigerators in low income dwellings.

Table 5-35
Refrigerator Age and Operation Condition in Low Income Dwellings
(Percent of Low Income Households)[1]

Refrigerator Operating Condition	Refrigerator Age				
	< 6 Years	6-10 Years	11-15 Years	16+ Years	All Refrigerators
Good	30%	16%	5%	2%	53%
Fair	5%	14%	12%	5%	36%
Needs repair, maintenance	0%	0%	2%	4%	6%
Needs replacement	0%	0%	2%	3%	5%
All Refrigerators	35%	30%	21%	13%	100%

[1] Sample Size: n=1,534

Stand-Alone Freezers

As discussed in Section 4, very few low income households (10%) have stand-alone freezers. Of those who do, most are under 11 years old and in "good" or "fair" operating condition. Across all low income households, there are very few opportunities to replace stand-alone freezers, as shown in Table 5-36.

Table 5-36
Stand-Alone Freezer Age and Operation Condition in Low Income Dwellings
(Percent of Low Income Households)[1]

Freezer Operating Condition	Freezer Age				No Freezer	All Freezers
	<6 years	6-10 years	11-15 years	16+ years		
Good	4%	0%	1%	0%	0%	5%
Fair	0%	2%	1%	1%	0%	4%
Needs repair, maintenance	0%	0%	0%	1%	0%	1%
Needs replacement	0%	0%	0%	0%	0%	0%
No Freezer	0%	0%	0%	0%	90%	90%
All Freezers	4%	2%	2%	2%	90%	100%

[1] Sample Size: n=1,534

Range / Oven

As presented in Section 4, most low income households use natural gas ranges and/or ovens (71%), and 34% use electric ranges/ovens. Only about 9% of these appliances were found to be in need of repair, maintenance or replacement, and an additional 50% were only in "fair" condition. Table 5-37 displays these results.

Table 5-37
Range / Oven Fuel and Operating Condition

Fuel Used by Range/Oven	Percent of All Low Income Households[1]	Operating Condition of Range/Oven			
		Good	Fair	Needs Repair, Maintenance	Needs Replacement
Electric	34%	17%	15%	1%	1%
Natural Gas	71%	27%	38%	5%	2%
Propane	2%	1%	1%	0%	0%
All Low Income Households	100%	41%	50%	6%	3%

[1] Sample Size: n=1,528

Lighting

As discussed in Section 4, the average low income household has approximately 16 lighting fixtures or lamps. Thirteen of these contain incandescent light bulbs, two contain CFLs, another is a fluorescent fixture and the last is an incandescent porch light. Across all low income households, just over one third (36%) already use CFLs and about 8% use CFL porch lights. Most households that already have CFLs have between one and four of them, while 9% of all low income households have five or more.

Clearly, these data indicate there is significant remaining potential to increase the number of CFLs used by low income households. In fact, our energy surveyors found that, on average, ten (additional) CFLs could be installed in the incandescent fixtures used by low income households. However, a more reasonable approach would be to assume that up to four CFLs are needed. This is the current LIEE Program requirement and it is typically used as the maximum number of CFLs distributed through direct-install programs. The assumption is that after four, the marginal benefit from CFLs is significantly reduced because the bulbs are no longer put into the highest use fixtures.

Table 5-38 shows a conservative estimate of the remaining potential for CFLs among low income households. As mentioned above, two thirds of all low income households (64%) do not currently use any

CFLs. Another 19% could use between one and three CFLs. Only 17% of all low income households would not benefit from additional CFLs.

Table 5-38
Potential for Additional CFLs in Low Income Dwellings

Number of CFLs Needed	Percent of All Low Income Households[1]
0	17%
1	4%
2	6%
3	9%
4	64%

[1] Sample Size: n=1,531

As shown above in Table 5-21, about one third of all low income households (35%) currently use incandescent porch lights and only 8% are using CFL porch lights. Table 5-39 shows the potential for CFL porch lights among low income households, assuming up to two CFL porch lights can be installed in each low income household that already has porch lighting. Again, this is a conservative estimate based on the LIEE Program's current requirements.

Table 5-39
Potential for CFL Porch Lights in Low Income Dwellings

Number of CFL Porch Lights Needed	Percent of All Low Income Households[1]
0	65%
1	12%
2	23%

[1] Sample Size: n=1,531

5.7 Barriers and Willingness to Participate in Low Income Energy Assistance Programs

This section presents an analysis of barriers and willingness to participate in energy assistance programs among low income households in California. Specifically, this section addresses the following research questions:

- What are the key barriers to participation among California's low income population?
- How do these barriers vary by different characteristics (e.g., demographic, housing type, geography, etc.)?
- What portion of California's low income population is willing to participate in programs like CARE and LIEE?
- How does that compare to other public assistance programs?
- What are some of the most effective ways for the programs to overcome these barriers and increase program participation?

5.7.1 Barriers to Participation

A critical component to this study was the full exploration of issues and factors that pose barriers to participation in low-income energy assistance programs, such as CARE and LIEE, among the eligible population. Phase I identified a number of potential barriers and each was explicitly addressed through this study. These potential barriers include:

- Lack of awareness and misunderstanding of program eligibility criteria, benefits
- Participation process (application, multiple visits, income documentation)
- Fear (e.g. distrust among elderly, immigrant residency issues)
- Welfare stigma and reluctance to accept aid

There are additional barriers to participation in the LIEE Program that have to do with the structural conditions and equipment/appliance performance factors of the home. These barriers were assessed as part of the analysis of need for energy efficiency measures (see Section 5.7 above).

A discussion of the non energy-related barriers to program participation follows.

Awareness

A number of questions were asked during the survey to determine awareness of the CARE and LIEE Programs. Responses to these questions were analyzed to determine the extent to which lack of awareness serves as a barrier to participation. Statistical significance for different demographic and dwelling characteristics is reported where appropriate.

Awareness of CARE Program

Respondents were asked a series of questions designed to determine their awareness of the CARE Program:

- Are you aware of any programs that help customers pay their energy bills by providing discounts or by paying part of the bill?
    - (If yes) What programs have you heard of? Any others? (Verbatim)
- (If unaware) Have you heard of the CARE Program, which stands for California Alternative Rates for Energy?
    - (If yes) What have you heard about it? Anything else? (Verbatim)
- (If still unaware) Your local electric and gas utility offers a program called "CARE," which gives some customers a 20% discount on their electric or gas utility bill. Have you heard of this program?

Overall, 43% of low income households were aware of CARE prior to being prompted with follow-up questions to probe further on awareness. An additional 15% reported that they were aware of a program similar to CARE, but only after being prompted with these follow-up questions.

As part of the study design, about half of the respondents to the onsite survey were known to be already enrolled in CARE and the other half were thought to be non-participants. Table 5-40 shows how the data on CARE awareness lines up with actual CARE participation. As shown, 60% of the non-participating respondents were not aware of CARE, representing a significant barrier to participation among customers who have yet to enroll in the program. Interestingly, 26% of CARE participants were unaware of the program, despite records indicating that their household was enrolled.

Table 5-40
Awareness of CARE Program by CARE Participation

	CARE Participant	CARE Non-Participant	Total
Aware	74%	40%	58%
Not aware	26%	60%	42%
Sample Size	769	761	1,530

Figures 5-15 through 5-17 illustrate how awareness of CARE varies across different customer segments. These results are statistically significant. As shown, lack of awareness is most frequently a barrier among non-English speaking households, Asian households, and households living in densely populated areas.

Figure 5-15
Awareness of CARE Program by Household Language

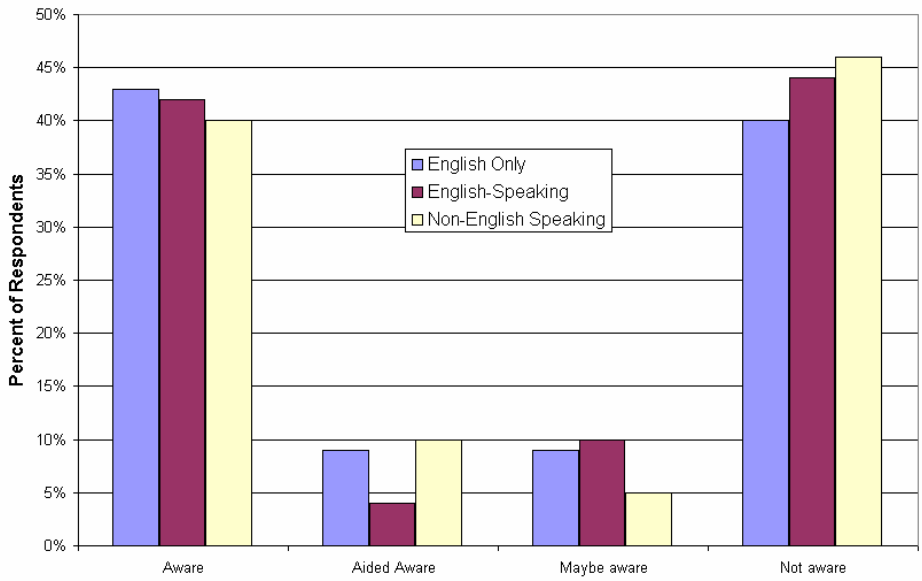


Figure 5-16
Awareness of CARE Program by Household Race/Ethnicity

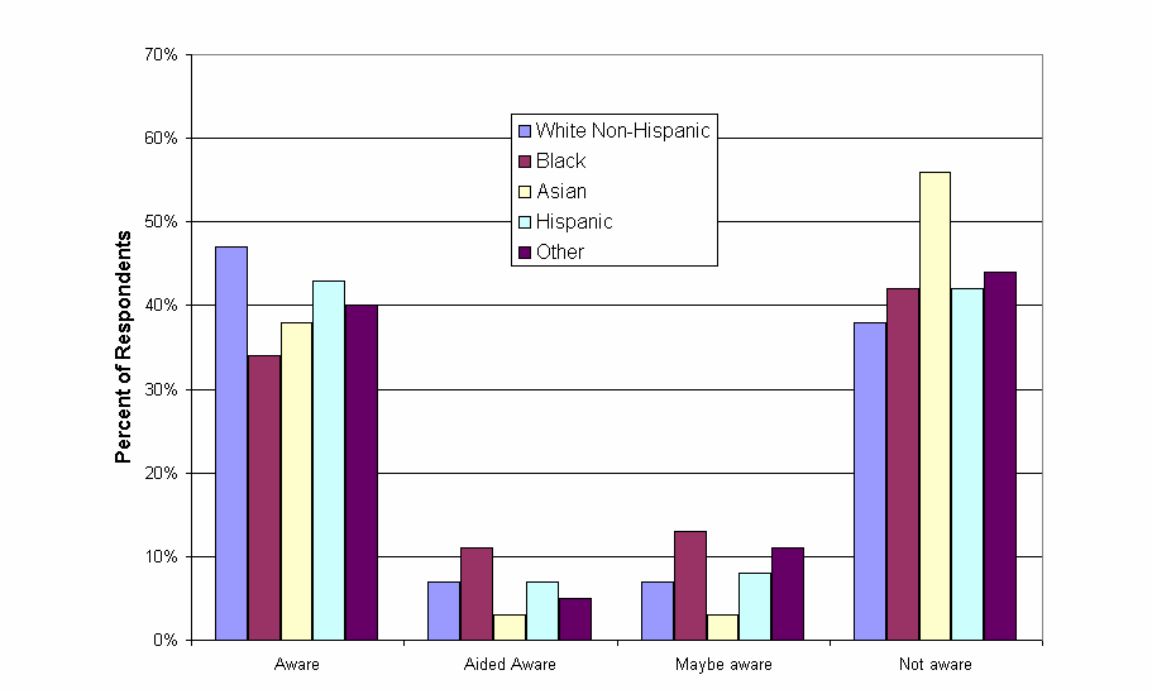
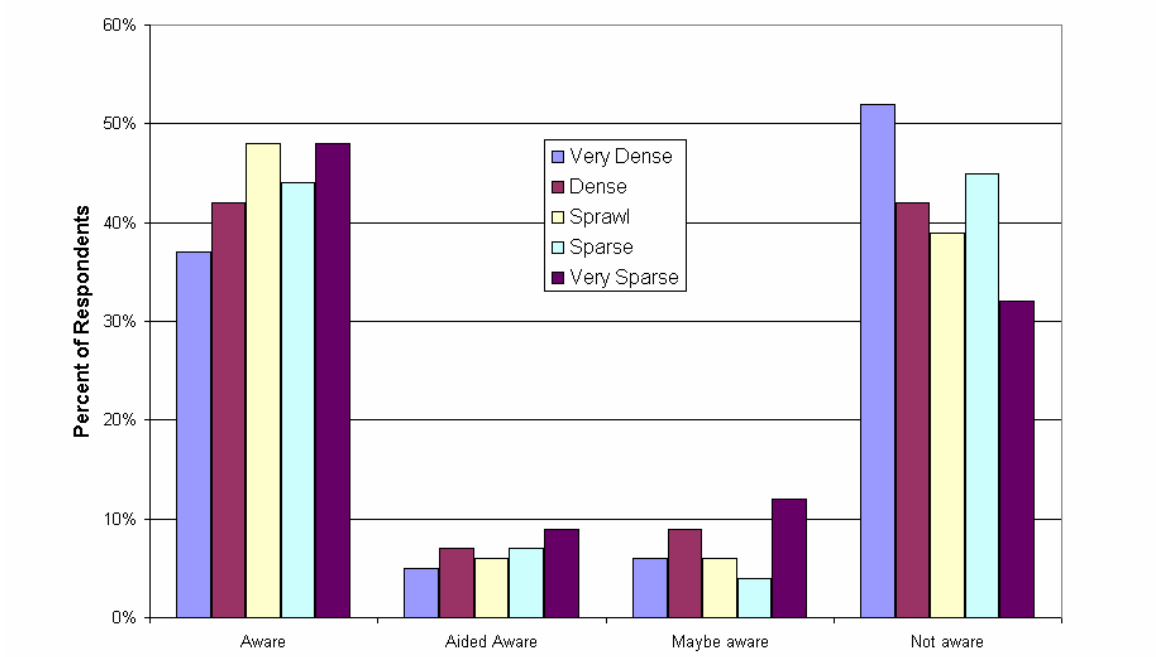


Figure 5-17
Awareness of CARE Program by Population Density



Awareness of LIEE Program

Respondents were asked a series of questions designed to determine their awareness of the LIEE Program:

- Are you aware of any programs that help customers cut back on their energy use by sealing air leaks, insulating attics, replacing appliances or changing lights, at no cost to the customer?
- (If yes) What programs have you heard of? Any others? (Verbatim)
- (If unaware) Your local electric and gas utilities offer a program that helps households use less energy. The program does this by sealing air leaks, insulating attics, and fixing or replacing some energy using equipment. Depending on the utility, this can be replacing light bulbs, refrigerators air conditioners, or fixing heating systems. Have you ever heard of this program?

Overall, only 7% of the survey respondents were aware of LIEE prior to being prompted with the more probing follow-up question. An additional 20% reported that they were aware of a program similar to LIEE but only after being prompted with this question. Overall, the majority of respondents (73%) reported that they were unaware of the LIEE Program.

Once the onsite survey was completed, we were successful in matching 17% of the dwellings in the sample to utility LIEE Program participation records from 1998-2003. As shown in Table 5-41, just over half of these dwellings (54%) are currently occupied by households who are aware of the LIEE Program. Among the dwellings that have not been treated through the program in the past five years, the majority of the current occupants (79%) are unaware of the LIEE Program representing a significant opportunity for program outreach. However, occupant awareness does not appear to be the primary barrier for 21% of the non-participating respondents.

Table 5-41
Awareness of LIEE Program by LIEE Participation

	LIEE Participant	LIEE Non-Participant	Total
Aware	54%	21%	27%
Not aware	44%	79%	73%
Sample Size	251	1,247	1,498

Table 5-42 shows how awareness of LIEE varies by dwelling type and home ownership. As shown, awareness among respondents who live in single-family homes is slightly higher than among residents in multi-family and other dwelling types. Awareness among respondents who live in mobile homes is significantly higher overall. Despite this small sample size for mobile homes and other dwelling types, the differences presented in Table 5-42 are statistically significant.

Table 5-42
LIEE Awareness by Dwelling Type and Home Ownership

Dwelling Type	Aware	Not Aware	Sample Size
Single Family	28%	72%	621
Multi-family (2-4)	24%	76%	114
Multi-family (5+)	23%	77%	683
Mobile Home	46%	54%	60
Home Ownership	**Aware**	**Not Aware**	**Sample Size**
Own	34%	66%	473
Rent	23%	77%	1,021

Awareness of LIEE is also shown in Table 5-42 to be considerably higher among homeowners as compared to renters. As shown, 77% of renters were unaware of LIEE as compared to 66% of homeowners. This difference is also statistically significant.

There are also differences in LIEE Program awareness among households of different demographics. For example, Figure 5-18 illustrates how awareness of LIEE is lowest among non-English speaking households. Figure 5-19 shows how awareness of LIEE is lowest in the more densely populated areas and the very sparsely populated areas. These results are statistically significant. There were no statistically significant differences in LIEE Program awareness across different racial/ethnic groups.

Figure 5-18
LIEE Program Awareness by Household Language

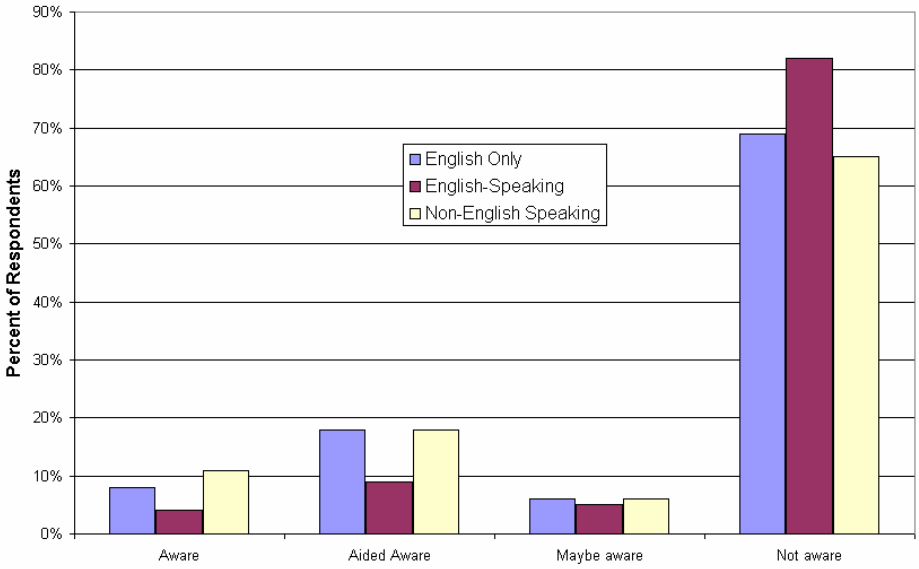
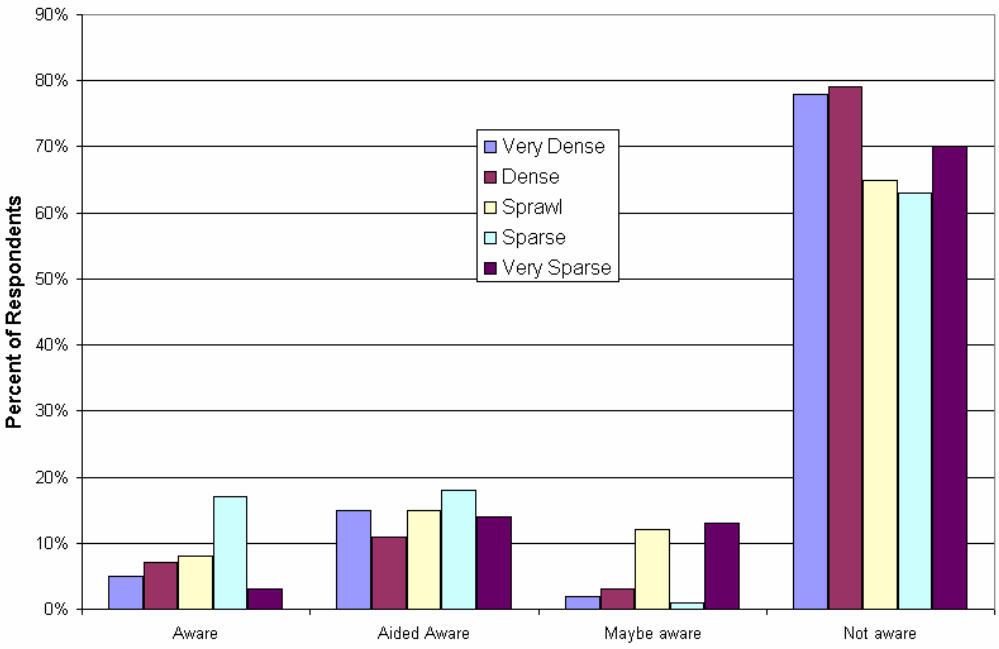


Figure 5-19
LIEE Program Awareness by Population Density



CARE and LIEE Application Process

Those respondents who were aware they were participating in the CARE and LIEE Programs were asked a series of questions about the program, including their opinions on the application process and overall satisfaction with the program. Overall, 80% reported that it was "not at all difficult" to complete the CARE application. Others felt it was "not too difficult" (17%) or "somewhat difficult" (3%). Less than one percent reported that the CARE application process was "very difficult."

The following types of households were more likely to report difficulty with the CARE application process:

- Households that do not speak English
- Disabled households
- Two-parent households
- SDG&E customers and PG&E customers

Differences across other demographic and dwelling characteristics were not statistically significant.

Overall, 71% of the respondents who were aware they were participating in the CARE program reported that they were "very satisfied" with the program. About one quarter (26%) reported being "somewhat satisfied" and 3% reported being "not too satisfied." Less than one percent mentioned that they were "not at all satisfied" with the CARE Program.

The following types of households were more likely to report dissatisfaction with the CARE Program:

- Households that do not speak English
- African-American households
- Respondents living in multi-family buildings with 2-4 units
- Households living in less densely populated areas
- SDG&E and PG&E customers

Differences across other demographic and dwelling characteristics were not statistically significant.

Very few of the respondents in the sample were aware that their home was treated through the LIEE Program. In fact, only 6% of the respondents overall reported that their current home had been part of the program. (This compares to 17% of the dwellings in the sample that were matched against utility billing records as having been treated through one of the four major IOU programs in the past five years.) Given the relatively high occupancy turnover for low-income dwellings, this difference is not surprising. Nevertheless, because only 6% (or 94 respondents) recalled participating in LIEE, only these respondents could be asked follow-up questions about the program.

Overall, few of these LIEE participants indicated that they experienced difficulties with either the application or scheduling processes, and most mentioned that they were very satisfied with participating in the program:

- 67% reported that providing the income documents required for participation in LIEE was "not at all difficult"
- 73% reported that it was "not at all difficult" to schedule an appointment to install the LIEE program measures
- 78% reported that they were "very satisfied" with participating in the LIEE program.

Due to the relatively small sample size of LIEE participants, differences in responses among different low-income segments were not statistically significant.

Other Barriers to Participation

A series of questions was asked of low income households to gauge their overall perceptions regarding participation in "public assistance programs." First, households were asked the following open-ended question to set the stage for a series of closed-ended questions. The exact question sequence is summarized as follows:

- As you know, there are programs to help people pay for things like housing, food or healthcare. Assuming you were eligible for a program and needed the services, how would you feel about participating in it? (Verbatim)
- Now, I'm going to read some statements other people have made about participating in assistance programs. Please tell me if you "strongly disagree," "somewhat disagree," "somewhat agree," or "strongly agree." (Read statements)
    - There are no programs to help households like mine.
    - The forms they want me to fill out are confusing.
    - It bothers me to have people from the government or utility in my home.
    - It is difficult to gather the papers to prove my income.
    - If I participate in these types of programs people will be able to tell me what to do and how to live my life.
    - It is difficult to apply for most programs.
    - It takes too long to get services from most programs.
    - Someone else in this household is against participating in these programs.
    - I would be embarrassed if my neighbor or friends knew I was participating in these types of programs.

- I worry that my application information will be given to government agencies.
- I don't like to use programs because there are other people who need them more than me.

These statements closely map to many of the barriers to participation identified in Phase I (e.g., distrust or fear, reluctance to take aid, "welfare stigma," perceptions regarding participation process, etc.).

In the following sections we present the results of the analysis for these statements. We present first the overall findings, followed by results for specific customer segments, including CARE participants, ethnicity/race, housing density and language.

Overall Findings

Table 5-43 presents the results for the agreement/disagreement statements described above. As shown, the most common barriers have to do with perceptions (or misperceptions) regarding the program participation process. For example, 23% of the respondents overall strongly agreed with the statement "It takes too long to get services from most programs," and 20% agreed with "It is difficult to apply for most programs." Another 10% perceived the application process (filling out forms) to be confusing and 6% held the perception that it would be difficult to provide documentation to verify income. This latter barrier may also reflect a certain amount of fear or distrust among households not willing to provide income information due to IRS, immigration or other governmental concerns.

Table 5-43
Barriers to Participation in Public Assistance Programs

Type of Barrier	Statement	Percent Strongly Agreeing	Sample Size
Participation process	It takes too long to get services from most programs.	23%	1,270
Participation process	It is difficult to apply for most programs.	20%	1,344
Welfare stigma, reluctance to accept aid	I don't like to use programs because there are other people who need them more than me.	18%	1,485
Fear or distrust issues	I worry that my application information will be given to government agencies.	15%	1,490
Participation process	The forms they want me to fill out are confusing.	13%	1,321
Awareness, misunderstanding of program eligibility, benefits	There are no programs to help households like mine.	10%	1,397
Fear or distrust issues	If I participate in these types of programs people will be able to tell me what to do and how to live my life.	8%	1,445
Participation process	It is difficult to gather the papers to prove my income.	6%	1,496
Welfare stigma, reluctance to accept aid	I would be embarrassed if my neighbor or friends knew I was participating in these types of programs.	4%	1,502
Fear or distrust issues	It bothers me to have people from the government or utility in my home.	3%	1,498
Welfare stigma, reluctance to accept aid	Someone else in this household is against participating in these programs.	3%	1,213

A considerable number of respondents expressed fear or distrust concerning these types of programs. For example, 15% strongly agreed with the statement, “I worry that my application information will be given to government agencies.” Another 8% worried that participation in these types of programs would mean that “…people will be able to tell me what to do and how to live my life” and 3% expressed concern with having “…people from the government or utility in my home.”

Other respondents reported barriers having to do with the “welfare stigma” or a more general reluctance to accept aid. For example, 18% strongly agreed with the statement, “I don't like to use programs because there are other people who need them more than me.” Only a few respondents (4%) strongly agreed with the statement, “I would be embarrassed if my neighbor or friends knew I was participating in these types

of programs" and 3% strongly agreed that "Someone else in this household is against participating in these programs."

Finally, only about 10% of the respondents strongly agreed with the statement, "There are no programs to help households like mine." This barrier addresses a general lack of awareness of the criteria for eligibility for these types of programs and the benefits these programs can offer qualified participants.

The following sections discuss differences in responses regarding barriers to participation across different customer segments.

CARE Participants

We found there to be small but statistically significant differences in responses regarding barriers to participation between CARE participants and non-participants. These differences help explain (to some extent) how the CARE program may have been effective in removing certain barriers to participation. These results may also reflect underlying differences between the participating and non-participating population and can be useful in designing future outreach efforts. In all cases, the differences in reported agreement between CARE participants and non-participants are small and only those with statistical significance are discussed below.

Generally, CARE participants exhibited statistically different (weaker) levels of agreement with barriers statements related to aspects of the program application and participation processes. For example, CARE participants were less likely than non-participants to strongly agree with the following statements regarding the participation process:

- It takes too long to get services from most programs.
- It is difficult to apply for most programs.
- The forms they want me to fill out are confusing.

This implies that CARE participants found these participation issues to be less of a concern than perceived by non-participants to be barriers.

The only barrier statement having to do with the participation process with which CARE participants exhibited statistically different (stronger) levels of agreement had to do with the difficulty required to document and verify household income. However, the overall level of agreement with this statement is low (6%) and the statistical difference in agreement between participants and non-participants is slight (7% and 6%, respectively) albeit significant.

CARE participants were less likely to agree with the statement, "It bothers me to have people from the government or utility in my home," which may reflect CARE participants perceptions that the program is

not intrusive. It may also reflect a subtle difference between the underlying characteristics of the non-participating population as they relate to issues of fear and distrust. However, there were no other statistical differences in the responses to other statements concerning fear and distrust implying there may not be a fundamental difference in the underlying population.

Generally, non-participants were more likely to exhibit statistically different (stronger) levels of agreement with statements regarding a reluctance to accept aid. For example, non-participants were significantly more likely to strongly agree with the statement, "I don't like to use programs because there are other people who need them more than me." This represents a significant difference in the underlying non-participating population and one which may be difficult if not impossible to overcome even with more effective program targeting and outreach.

Non-participants were also somewhat more likely than CARE participants to agree with the statements related to the "welfare stigma" (e.g., "I would be embarrassed if my neighbor or friends knew I was participating in these types of programs," and "Someone else in this household is against participating in these programs"). Again, while the differences in agreement are small, the statistical significance implies that there may be an important underlying difference among the non-participating population that has to do with a reluctance to accept assistance or be associated with programs providing public welfare benefits.

Finally, non-participants were also more likely to strongly agree with the statement, "There are no programs to help households like mine." This likely reflects the more general lack of awareness among non-participants that there are relevant, beneficial programs (like CARE) for which they are eligible.

Ethnicity/Race

Barriers Related to Fear or Distrust. There is little to no evidence of a difference between White households and non-White households regarding barriers related to fear or distrust. Non-White households were slightly more likely to strongly agree with the statement, "If I participate in these types of programs people will be able to tell me what to do and how to live my life." There was no difference between racial and ethnic groups with regard to being fearful of giving information to government agencies, or having utility or government workers in one's home. Therefore, this a relatively weak indication from these data that non-White households fundamentally have more issues with fear and distrust. Instead, these results may reflect more of a fundamental desire to "left alone."

Perceptions Regarding Application and Participation Processes. There is strong evidence of a difference between White and non-White households in perceptions regarding the participation process. For example, non-White households were more likely to strongly agree with the following statements:

- The forms they want me to fill out are confusing.

- It is difficult to gather the papers to prove my income.
- It is difficult to apply for most programs.

It is possible that these differences uncover underlying cultural issues or distinctions between racial and ethnic groups. It is more likely, however, that these differences point to barriers that have more to do with English language capabilities (see discussion below).

Reluctance to Accept Aid and "Welfare Stigma." There is strong evidence that White households are more likely to exhibit a reluctance to accept aid and be concerned about the "welfare stigma" as compared to non-White households. For example, White households were more likely to agree with the following statements:

- I don't like to use programs because there are other people who need them more than me.
- I would be embarrassed if my neighbor or friends knew I was participating in these types of programs.

Language

Barriers Related to Fear or Distrust. With regard to issues of fear and distrust, there is significant evidence of a difference between households that are unable to speak English (and those that are capable but may also speak other languages). This difference is particularly evident as it relates to the fear of giving information to government agencies and the desire to be "left alone." For example, 33% of non-English speaking households strongly agreed with this statement, "I worry that my application information will be given to government agencies," as compared to only 10% of English speaking households. Non-English speaking households were also somewhat more likely than participants (14% vs. 5%, respectively) to agree with the statement, "If I participate in these types of programs people will be able to tell me what to do and how to live my life."

Perceptions Regarding Application and Participation Processes. There is strong evidence of a difference between non-English speaking and English-speaking households in terms of their perceptions regarding the application and participation processes. For example, non-English speaking households were more likely to strongly agree with the following statements:

- The forms they want me to fill out are confusing.
- It is difficult to apply for most programs.

As mentioned above, these differences highlight challenges perceived by non-English speaking households when considering in participating in public assistance programs such as CARE and LIEE.

Reluctance to Accept Aid and "Welfare Stigma." There was no evidence of any difference in perceptions regarding these types of barriers across households speaking different languages.

Housing Density

Barriers Related to Fear or Distrust. With regard to issues of fear and distrust, there is evidence of a few significant differences:

- Households living in sparsely populated areas are more likely to be concerned that their application information will be provided to (other) government agencies. This is consistent with social theories that suggest that some families move to (or remain in) rural areas to "be left alone" and "off the radar screen" for government activities .

- Households living in more suburban areas were more likely to be bothered by the need to have utility or government workers in their home. These households were also less likely to believe that participating in these programs means being told "what to do and how to live my life." Although differences across the density groups is slight, the statistical significance may point to an underlying trend toward independence in suburban areas that they know what is best for their home and are only interested in assistance provided on their terms when they ask for it.

Perceptions Regarding Participation and Application Processes. There is some evidence to suggest that there may be a need to tailor the program procedures so they are more in-line with perceptions and expectations of households living in urban vs. rural areas:

- Households living in densely populated areas were the least likely to agree with the statement, "It takes too long to get services from most programs." This may reflect that households in densely populated areas are used to getting relatively immediate access to the services available through public assistance programs, and/or it could reflect that households in suburban and sparsely populated areas are more sensitive to the fact that it takes more time to deliver these types of services in non-urban areas. As such, it is possible that households living in urban vs. rural neighborhoods may have expectations regarding how the programs might be delivered that are consistent with their general expectations regarding the timeliness of delivery for other types of household services.

- Households living in sparsely populated areas tend to more strongly agree that application forms are confusing and are less likely to have difficulty documenting their household income. This might imply a need to simplify the requirements for participation among rural households (especially as an attempt to mitigate the increased cost of reaching these customers).

Reluctance to Accept Aid and "Welfare Stigma." There is some evidence of difference in perceptions regarding these types of barriers:

- Households living in sparsely populated areas are more likely to be reluctant to participate in these programs because of the belief that "there are other people who need them more than me." This is consistent with anecdotal evidence from the recruitment and field data collection effort. Schedulers and interviewers often commented that attempts to recruit for the survey in rural areas was sometimes met with a general disbelief that households like theirs could/would be eligible for these types of programs. This may also point to a general indication that rural households are less likely to perceive a need for the program, despite being eligible, and as such may not be a priority for targeted outreach efforts. It may be more effective to increase general awareness efforts in rural areas and then let those households who believe they have a need for the program seek it out.

- There is evidence of the "welfare stigma" perception among households living in suburban areas. That is, these households were most likely to strongly agree with the statement, "I would be embarrassed if my neighbor or friends knew I was participating in these types of programs."

5.7.2 Willingness to Participate

Another critical element of the needs assessment addressed perceptions of the programs' value by exploring willingness to participate among the eligible (non-participating) population. Willingness to participate was determined based on responses to a number of direct and indirect questions, including:

- Direct questions regarding willingness to participate in CARE and LIEE Programs

- Direct questions regarding willingness to provide information necessary to verify eligibility (e.g., income documentation)

- Indirect questions regarding participation in other public assistance programs (e.g., Medi-Cal, WIC, Healthy families, etc.)

- Indirect questions regarding barriers to participation that could affect willingness to participate in CARE and LIEE (e.g., requirements too confusing, difficult to apply, distrust of government programs, reluctant to accept aid, etc.)

Some of these issues were introduced above as part of the barriers to participation discussion. In this section, we more specifically address willingness to participate in the CARE and LIEE Programs, and provide evidence in support of these results based on responses to the indirect questions related to participation in other public assistance programs.

Willingness to Participate in CARE

In this section we address willingness to participate in the CARE Program. In the survey, the direct question regarding willingness to participate in CARE was asked after respondents were queried about their awareness of the program. For those who were unaware of the program, the following description was provided:

- Your local electric and gas utility offers a program called "CARE," which gives some customers a 20% discount on their gas or electric utility bill. Have you heard about this program?

Non-participating customers were then asked the direct question:

- Assuming your household was eligible, how willing would you be to participate in the program now? Would you say you'd be:
    - Not at all willing
    - Only a little willing
    - Somewhat willing
    - Very willing?

The results of the willingness to participate calculation indicate an overall, very high level of interest in the program. The majority of low income households (79%) indicated that they would be "very willing" to participate, with an additional 17% reporting they would be "somewhat willing." Two percent reported that they were "only a little willing," and another 2% reported being "not at all willing" to participate.

We found no statistical differences in reported willingness to participate in CARE across racial/ethnic groups, housing density, or languages spoken in the home.

Willingness to Participate in LIEE

In this section, we address willingness to participate in the LIEE Program. In the survey, the direct question regarding willingness to participate in LIEE was asked after respondents were queried about their awareness of the program. For those who were unaware of the program, the following description was provided:

- Your local electric and gas utilities offer a program that helps households use less energy. The program does this by sealing air leaks, insulating attics, and fixing or replacing some energy using equipment. Depending on the utility this can be replacing light bulbs, refrigerators, air conditioners, or fixing heating systems.

Non-participating customers were then asked the direct question:

- Assuming your household was eligible, how willing would you be to participate in the program now? Would you say you'd be:
    - Not at all willing
    - Only a little willing
    - Somewhat willing
    - Very willing?

The results of the willingness to participate calculation indicate an overall, very high level of interest in the program. The majority of respondents (72%) indicated that they would be "very willing" to participate, with an additional 20% reporting they would be "somewhat willing." Three percent reported that they were "only a little willing," and another 5% reported being "not at all willing" to participate.

While there are no differences in willingness to participate in LIEE according to where households live, there are some differences in willingness to participate in LIEE across racial/ethnic groups and among the languages spoken in the home. Table 5-44 presents the results for willingness to participate in LIEE by household race and ethnicity. These differences are statistically significant and suggest that Black and Hispanic households are more likely to be "very willing" to participate, whereas Asian households were the least likely. For example, only 53% of all non-participating Asian households reported that they would be "very likely" to participate in LIEE. These findings are consistent with results for households who speak non-English languages. These households are among the least willing to participate.

Table 5-44
Willingness to Participate in LIEE by Household Race/Ethnicity

	White (Non-Hispanic)	**Black**	**Asian**	**Hispanic**	**Other**
Not at all willing	5%	1%	6%	1%	4%
Only a little willing	3%	1%	3%	3%	1%
Somewhat willing	20%	13%	38%	16%	17%
Very Willing	72%	85%	53%	80%	73%
Sample Size	373	155	156	604	121

Participation in Other Public Assistance Programs

In this section we explore participation in other public assistance programs as both an indicator of willingness to participate in CARE and LIEE, as well as a measure of the likely effectiveness of programs designed to "auto-enroll" customers who are participating in one or more public assistance programs into

the CARE and LIEE Programs. The other programs we specifically addressed with survey respondents include:

- Medi-Cal
- Women Infants & Children (WIC)
- Healthy Families Programs (HFP)

These programs represent examples of public assistance programs with eligibility requirements that are similar to those for CARE and LIEE and should provide a good "test" for the likely effectiveness of auto-enrollment arrangements between and among these programs.

As shown in Table 5-45, the results suggest that participation in these other programs is relatively high. For Medi-Cal, 74% of the respondents are already participating or willing to participate. For respondents who are eligible for WIC and HFP, most are either already participating or would be willing to participate.

Table 5-45
Participation and Willingness to Participate in Public Assistance Programs

Medi-Cal	**Percent of Low Income Households**
Not at all willing	9%
Only a little willing	2%
Somewhat willing	15%
Very willing	74%
Women, Infants and Children (WIC) Program	**Percent of Low Income Households**
Not applicable (no children)	59%
Not at all willing	6%
Only a little willing	1%
Somewhat willing	6%
Very willing	28%
Healthy Families Program (HFP)	**Percent of Low Income Households**
Not applicable (no children under 20)	59%
Not at all willing	4%
Only a little willing	1%
Somewhat willing	8%
Very willing	28%

As shown in Table 5-46, only 17% of current Medi-Cal participants are not already enrolled in CARE. Similarly, of those who are eligible for WIC and HFP, only 17% and 7% of participants in these programs respectively are not already enrolled in CARE.

Table 5-46
Comparison of Participation in CARE with Other Public Assistance Programs

Participating in Medi-Cal?	CARE Participant	CARE Non-Participant
Yes	30%	17%
No	24%	30%
Participating in WIC?	**CARE Participant**	**CARE Non-Participant**
Yes	24%	17%
No	29%	30%
Participating in HFP?	**CARE Participant**	**CARE Non-Participant**
Yes	12%	7%
No	43%	38%

5.8 Program Accessibility

This study was designed to provide information that can be used to refine outreach strategies to increase awareness and overall participation among the eligible low-income population. Effective outreach activities and program messaging are likely to include those information channels and sources currently being used and regularly accessed by the target population. As such, a key component of the needs assessment analyses included the investigation of information channels frequently accessed by eligible customers, as well as identification of the existing sources they regularly look to for information about energy conservation and bill payment assistance.

This section presents an analysis of program accessibility – that is, the channels through which low income households can be and/or have been reached by the low income programs available in the state. Specifically, the research questions addressed in this section include:

- Through what channels are low income households typically reached by the programs?
- Are certain segments more easily reached through existing channels?
- What are the characteristics of those segments that are not as easily reached through these existing channels? What types of outreach and recruitment strategies could be developed to reach these "hard to reach" segments?

5.8.1 Frequently Used Information Channels

As shown in Table 5-47, there are a variety of information channels with which to reach low income households with program information and messages. For example, about half of the respondents in the sample reported that they read the daily, weekly or local newspapers, access the Internet, and attend religious services on a somewhat regular basis. Other information channels used or accessed less regularly include: attending athletic events, visiting local community centers, participating in community or trade association meetings, volunteering with local organizations, and visiting the local library.

There are some interesting and statistically significant findings related to specific customer segments. For example, CARE participants as opposed to non-participants are less likely to frequently access the Internet and volunteer at local events. Households living in more densely populated areas (vs. more rural areas) are less likely to frequently read a weekly community newspaper and regularly attend religious services. Non-English speaking households were more likely to attend religious services, participate in community or trade association meetings, and visit the local library on a more regular basis. These types of results can be used to inform the design of localized program marketing campaigns and to communicate segment-specific program messages.

Table 5-47
Frequency of Use for Selected Information Channels

Information Channel	Frequency of Use	Percent	Information Channel	Frequency of Use	Percent
Daily Newspaper (n=1,530)	Never	49%	**Community Newspaper** (n=1,523)	Never	49%
	Once per week	16%		Once per month	15%
	2 - 4 days per week	13%		2 - 4 times per month	23%
	5 days	3%		More than 4 times/month	13%
	6 days	2%			
	7 days per week	17%			
Internet (n=1,520)	Never	49%	**Athletic Event** (n=1,524)	Never	75%
	Less than 1 hour/week	10%		Once per month	5%
	1 - 7 hours/week	21%		2 to 6 times	12%
	8 - 14 hours/week	10%		7 to 12 times	3%
	More than 15 hours/week	10%		More than 12 times	6%
Community Center (n=1,523)	Never	74%	**Religious Service** (n=1,523)	Never	40%
	Once per month	7%		Once per month	5%
	2 to 6 times	12%		2 to 6 times	17%
	7 to 12 times	2%		7 to 12 times	6%
	More than 12 times	5%		More than 12 times	31%
Community/ Trade Meeting (n=1,521)	Never	72%	**Volunteer** (n=1,523)	Never	75%
	Once per month	6%		Once per month	4%
	2 to 6 times	10%		2 to 6 times	10%
	7 to 12 times	3%		7 to 12 times	3%
	More than 12 times	9%		More than 12 times	8%
Library (n=1,522)	Never	57%			
	Once per month	5%			
	2 to 6 times	19%			
	7 to 12 times	8%			
	More than 12 times	11%			

5.8.2 Non-English Language Information Channels

Respondents were asked if they access information from sources produced or published in non-English languages. As indicated in Table 5-48, a fair number of respondents watch non-English TV stations, listen to non-English radio broadcasts, and read non-English daily or local newspapers.

Table 5-48
Non-English Language Information Channels

	Percent of All Respondents
Watch TV in non-English language	32%
Listen to radio in non-English language	28%
Read daily paper in non-English language	13%
Read weekly/local paper in non-English language	15%
Number of Respondents	1,534

In all cases, Spanish is the most common non-English language in which respondents are accessing information through these media channels. Table 5-49 shows the primary language spoken in the home for respondents who reported accessing information in non-English languages.

Table 5-49
Non-English Language Information Channels by Primary Language Spoken in the Home

	Spanish	Chinese	Vietnamese	Korean	Other
Watch TV in non-English language	24%	1%	1%	1%	3%
Listen to radio in non-English language	22%	1%	1%	1%	1%
Read daily paper in non-English language	6%	1%	<1%	<1%	1%
Read weekly/local paper in non-English language	9%	1%	<1%	<1%	1%

5.8.3 Frequently Used Energy Conservation Information Channels

Respondents were asked to indicate where they would go or who they would talk to if they were looking for information on energy conservation or ways to lower their energy bills. As shown in Table 5-50, utility sources were the most commonly mentioned channels. The majority of respondents (69%) reported that they would call their local utility company for information on energy conservation. Others would refer to their utility bill (12%), access their utility's website (8%), or visit their local utility office (4%). A fair number of respondents (13%) reported that they rely on "word of mouth" channels for information about energy conservation (e.g., friends, relatives). Others reported accessing information about energy conservation from the media (5%), other websites (4%), trades people (3%), and community organizations (2%).

Table 5-50
Frequently Used Energy Conservation Information Channels

	Frequency of Use	CARE Participants	Households in Densely Populated Areas	Non-English Speaking Households
Call Utility	63%	+	+	
Friend/Relative	13%			+
Utility Bill	11%		–	–
Utility Website	8%	–	+	–
Media	4%	+		
Other Website	4%	–		–
Utility Office	4%		+	+
Trade Person	2%	–		–
Community Events	2%	+		
Don't Know	8%			

+ indicates segment reported higher than average use of information channel
- indicates segment reported lower than average use of information channel

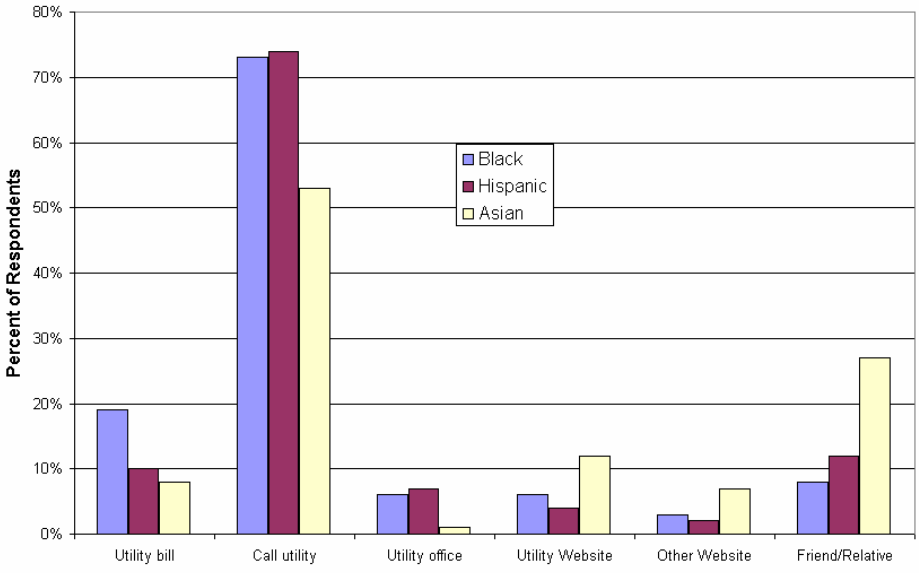
Table 5-50 also presents statistically significant findings related to specific customer segments. For example, CARE participants (vs. non-participants) are more likely to call their utility, use media sources, and ask community organizations for information on energy conservation. CARE participants are less likely to visit utility or other websites or contact a contractor or other tradesperson for information about energy conservation.

Households in densely populated areas (vs. more rural households) are more likely to call their utility, access their utility website, or visit their local utility office. These respondents are less likely to read utility bill inserts for this type of information.

Non-English speaking households are more likely to ask friends/relatives or visit their local utility office for more information on energy conservation. These households are less likely to refer to their utility bill inserts, visit utility or other websites, and consult with contractors or other trades people.

The sources respondents reported using to learn about energy conservation also varied by racial/ethnic groups, as shown in Figure 5-20. For example, while all households are very likely to call their utility for information about energy conservation, Asian households are the least likely to use this source. Asian households are also least likely to refer to utility bill inserts or go to their local utility office. Instead, Asian households are more likely to ask friends and relatives, and access information via their utility or other websites. The results presented in Figure 5-20 are statistically significant.

Figure 5-20
Frequently Used Sources of Information on Energy Conservation by Race/Ethnicity



5.8.4 Recall of Utility Bill Inserts and Messages

Respondents were asked a series of questions to learn how often they read the inserts included in their utility bills. These inserts often contain information about the CARE and LIEE Program. As shown in Table 5-51, a considerable percentage of respondents indicated that they always (19%) or often (22%) read the inserts that come with their utility bills. However, 22% mentioned that they rarely read the utility bill inserts and 36% reported that they never do. Table 5-51 also shows that CARE participants are more likely to report they always read utility bill inserts, whereas non-English households and Asian households are more likely to report they never read them.

Table 5-51
Recall of Utility Bill Inserts and Messages

	Percent of Respondents	CARE Participants	Households in Densely Populated Areas	Non-English Speaking Households	Hispanic Households
How often read bill inserts?					
Never	36%			+	+
Rarely	22%				
Often	22%				
Always	19%	+			
When last read bill insert?					
Within Month	67%				
2-3 Months	23%				
4+ Months	10%				
What was message on bill insert?					
CARE	17%		+		
LIEE	3%				
Other Program	39%	+	–		+
Budget Billing	4%		–		+
Safety	7%			–	–
Rates	8%	–	+		
Energy Conservation Information	33%		+		

+ indicates segment more likely than others to report response
- indicates segment less likely than others to report response

Respondents who reported that having read the inserts in their utility bills were then asked to indicate when was the last time they recall reading a utility bill insert. As shown in Table 5-51 above, most report having read a utility bill insert within the past month. Another 23% mentioned that they read a utility bill insert within the last two or three months, and for the remaining 10% it had been four or months since they last read a utility bill insert. There are no significant differences across customer segments with regard to when respondents last read utility bill inserts.

Table 5-51 also provides results regarding the messages that respondents recall being part of their most recent utility bill insert. As shown, many respondents recall messages related to other energy conservation programs and energy conservation information in general (e.g., tips on saving energy). About 17% recall reading about CARE and 3% recall reading about LIEE. Others recall reading general information about rates and tariffs (8%), electric safety (7%), and the budget billing or levelized payment plan (4%). Statistically significant findings across customer segments are also reported in Table 5-51.

5.8.5 Sources for Bill Payment Assistance

Respondents were also asked to indicate where they would go or who they would look to if they needed help paying their energy bills. As shown in Table 5-52, most respondents (55%) reported that they would look to their utility for this type of assistance. Nearly one quarter (24%) mentioned they would ask friends or relatives for assistance. Some respondents would go to state or county agencies (6%), local CAP or other community organizations (7%), or to church groups (8%). Eight percent of respondents reported that there was "nowhere" for them to go if they needed help paying the utility bills, and 7% reported that they did not know of any place they could go. Statistical differences across customer segments are also presented in Table 5-52.

Table 5-52
Sources for Getting Help Paying Utility Bills

	Percent of Respondents	CARE Participants	Households in Densely Populated Areas	Non-English Speaking Households	Black Households
Nowhere	8%	+	–		
Utility	55%		+	+	–
State/County agencies	6%	+	–	–	–
CAP/Community organization	7%		–		
Church	8%	+	–		
Friends, relatives	24%	–	+	–	
HEAP/LIHEAP	2%	+			+
Don't know	7%		+		
+ indicates segment more likely than others to report response - indicates segment less likely than others to report response					

6. Energy Savings Potential

This section presents results of the energy savings potential analysis. Energy savings potential is defined as the possible energy savings that could be achieved through the installation of all feasible measures that are identified for the low income population. First we show base year potential results by measure and by key market segment. We then show estimates of potential for the next 10 years assuming current low income population levels and current program participation levels.

6.1 Base Year Savings Potential

As discussed in Section 3, energy savings potential is a function of measure applicability, measure need, and measure savings, as well as the number of low income homes. Table 6-1 summarizes the base year savings potential calculation that was developed for each home in the study and extrapolated to the low-income population using the survey expansion weights.

Overall, electricity savings potential is estimated at 641 GWh and natural gas savings potential is estimated at 94 million therms. For electricity, the measures with the largest potential are CFLs, new refrigerators, and ceiling insulation. Ceiling insulation and water heater blankets are the measures with the largest natural gas potential.

Table 6-2 summarizes total savings potential and available savings potential, which is defined as savings potential for households who are willing to participate in the LIEE Program (see Section 4). Overall, available potential is estimated at 584 GWh (91% of total potential) and 81 million therms (90% of total potential). Average savings potential per home is estimated to be 150 kWh and 22 therms. These per home impacts are fairly comparable to average savings per home being achieved by the current LIEE Program.[12]

Using results of the onsite surveys, combined with customer billing data, we estimate that total low income energy use in California to be about 22,000 GWh and 1,300 Mth. Available potential is estimated to be about 2.6 percent of total electricity usage and about 6.6 percent of total natural gas usage. Thus, the average home would be saving about 2.6 percent off their electric bill and 6.6 percent off their natural gas bill by implementing the applicable energy efficiency measures identified in this study. Some homes will have much more, while the savings potential in other homes may be negligible. Results are summarized in Table 6-3.

[12] For example see: Impact Evaluation Of the 2000 Statewide Low-Income Energy Efficiency (LIEE) Program, Volume 1, KEMA-XENERGY and Business Economic Analysis and Research, April 2002. In this study, average annual savings per home were estimated to be 175 kWh and 24 therms.

Table 6-1
Summary of the Energy Savings Potential Calculation – Annual Impacts

Fuel	Measure	End Use	Savings Units	Homes	Average Applicability	Avg. Need	Unit Savings	Savings Potential
Electricity	Central Air Conditioner (CAC)	Cooling	kWh	3,905,934	0.306	0.002	246.3	630,880
	CAC Maintenance	Cooling	kWh	3,905,934	0.306	0.070	39.0	3,266,593
	Caulking	Cooling	kWh	3,905,934	0.548	0.258	3.5	1,937,809
	Ceiling Insulation	Cooling	kWh	3,905,934	0.350	0.490	116.2	77,950,655
	Duct Sealing	Cooling	kWh	3,905,934	0.105	0.163	24.2	1,612,226
	Evap Cooler	Cooling	kWh	3,905,934	0.073	0.082	280.6	6,482,522
	Evap Cooler Maintenance	Cooling	kWh	3,905,934	0.073	0.121	23.7	812,562
	Minor Home Repair	Cooling	kWh	3,905,934	0.548	0.359	11.4	8,808,320
	Programmable Thermostat	Cooling	kWh	3,905,934	0.266	0.398	5.6	2,330,310
	RAC Maintenance	Cooling	kWh	3,905,934	0.204	0.132	14.2	1,500,996
	Room Air Conditioner (RAC)	Cooling	kWh	3,905,934	0.204	0.129	117.3	12,039,376
	Weather Stripping	Cooling	kWh	3,905,934	0.548	0.557	3.3	3,970,966
	Whole House Fan	Cooling	kWh	3,905,934	0.144	0.843	75.0	35,473,922
	Caulking	Heating	kWh	3,905,934	0.170	0.197	13.1	1,712,001
	Ceiling Insulation	Heating	kWh	3,905,934	0.086	0.419	227.1	32,110,292
	Duct Sealing	Heating	kWh	3,905,934	0.022	0.184	64.6	1,007,724
	Evap Cooler/AC Cover	Heating	kWh	3,905,934	0.013	1.000	6.6	343,413
	Furnace Filter	Heating	kWh	3,905,934	0.092	0.263	11.0	1,042,203
	Minor Home Repair	Heating	kWh	3,905,934	0.170	0.342	28.1	6,379,948
	Programmable Thermostat	Heating	kWh	3,905,934	0.022	0.143	6.9	83,919
	Weather Stripping	Heating	kWh	3,905,934	0.170	0.500	16.5	5,465,381
	CFL	Lighting	kWh	3,905,934	0.792	1.000	68.7	212,492,312
	Porch Light	Lighting	kWh	3,905,934	0.309	1.000	51.5	62,043,912
	Refrigerator	Refrigeration	kWh	3,905,934	0.999	0.045	720.1	126,014,055
	Faucet Aerators	Water Heating	kWh	3,905,934	0.061	0.546	31.3	4,053,485
	Low Flow Showerhead	Water Heating	kWh	3,905,934	0.061	0.326	81.6	6,346,547
	Water Heater Blanket	Water Heating	kWh	3,905,934	0.048	0.835	107.7	16,804,919
	Water Heater Pipe Wrap	Water Heating	kWh	3,905,934	0.049	0.777	46.1	6,799,664
	Water Heater Replacement	Water Heating	kWh	3,905,934	0.061	0.023	190.0	1,048,315
	Total							640,565,225
Natural Gas	Caulking	Heating	Therms	3,905,934	0.691	0.320	1.7	1,455,824
	Ceiling Insulation	Heating	Therms	3,905,934	0.440	0.529	31.2	28,402,740
	Duct Sealing	Heating	Therms	3,905,934	0.104	0.211	8.1	689,116
	Evaporative Cooler/AC Cover	Heating	Therms	3,905,934	0.060	0.835	0.9	167,602
	Furnace Filter	Heating	Therms	3,905,934	0.394	0.292	1.7	749,791
	Furnace Repair	Heating	Therms	3,905,934	0.394	0.127	32.2	6,305,337
	Furnace Replace	Heating	Therms	3,905,934	0.394	0.037	49.6	2,853,272
	Minor Home Repair	Heating	Therms	3,905,934	0.691	0.438	4.5	5,337,135
	Programmable Thermostat	Heating	Therms	3,905,934	0.394	0.427	1.0	648,951
	Weather Stripping	Heating	Therms	3,905,934	0.691	0.629	2.1	3,520,507
	Faucet Aerators	Water Heating	Therms	3,905,934	0.761	0.712	3.1	6,542,040
	Low Flow Showerhead	Water Heating	Therms	3,905,934	0.759	0.402	7.7	9,134,865
	Water Heater Blanket	Water Heating	Therms	3,905,934	0.620	0.757	10.3	18,823,028
	Water Heater Pipe Wrap	Water Heating	Therms	3,905,934	0.647	0.813	4.1	8,395,908
	Water Heater Replacement	Water Heating	Therms	3,905,934	0.762	0.015	17.5	765,114
	Total							93,791,227

Table 6-2
Total and Available Savings Potential by Measure – Annual Impacts

Fuel	Measure	End Use	Savings Units	Savings Potential Total	Savings Potential Per Home	Available Potential* Total	Available Potential* Per Home	Percent Available
Electricity	Central Air Conditioner (CAC)	Cooling	kWh	630,880	0.16	627,279	0.16	99%
	CAC Maintenance	Cooling	kWh	3,266,593	0.84	3,155,770	0.81	97%
	Caulking	Cooling	kWh	1,937,809	0.50	1,839,688	0.47	95%
	Ceiling Insulation	Cooling	kWh	77,950,654	19.96	72,159,720	18.47	93%
	Duct Sealing	Cooling	kWh	1,612,226	0.41	1,547,642	0.40	96%
	Evap Cooler	Cooling	kWh	6,482,521	1.66	6,403,070	1.64	99%
	Evap Cooler Maintenance	Cooling	kWh	812,562	0.21	700,050	0.18	86%
	Minor Home Repair	Cooling	kWh	8,808,320	2.26	8,263,208	2.12	94%
	Programmable Thermostat	Cooling	kWh	2,330,310	0.60	2,236,659	0.57	96%
	RAC Maintenance	Cooling	kWh	12,039,377	3.08	11,128,542	2.85	92%
	Room Air Conditioner (RAC)	Cooling	kWh	1,500,996	0.38	1,276,466	0.33	85%
	Weather Stripping	Cooling	kWh	3,970,966	1.02	3,778,366	0.97	95%
	Whole House Fan	Cooling	kWh	35,473,922	9.08	33,368,853	8.54	94%
	Caulking	Heating	kWh	1,712,001	0.44	1,493,661	0.38	87%
	Ceiling Insulation	Heating	kWh	32,110,293	8.22	29,484,231	7.55	92%
	Duct Sealing	Heating	kWh	1,007,724	0.26	1,007,724	0.26	100%
	Evap Cooler/AC Cover	Heating	kWh	343,413	0.09	312,569	0.08	91%
	Furnace Filter	Heating	kWh	1,042,203	0.27	1,018,565	0.26	98%
	Minor Home Repair	Heating	kWh	6,379,948	1.63	5,748,881	1.47	90%
	Programmable Thermostat	Heating	kWh	83,919	0.02	76,755	0.02	91%
	Weather Stripping	Heating	kWh	5,465,381	1.40	4,976,771	1.27	91%
	CFL	Lighting	kWh	212,492,312	54.40	184,890,857	47.34	87%
	Porch Light	Lighting	kWh	62,043,911	15.88	54,454,076	13.94	88%
	Refrigerator	Refrigeration	kWh	126,014,054	32.26	122,122,440	31.27	97%
	Faucet Aerators	Water Heating	kWh	4,053,485	1.04	3,836,444	0.98	95%
	Low Flow Showerhead	Water Heating	kWh	6,346,547	1.62	6,082,374	1.56	96%
	Water Heater Blanket	Water Heating	kWh	16,804,917	4.30	15,383,963	3.94	92%
	Water Heater Pipe Wrap	Water Heating	kWh	6,799,664	1.74	6,056,916	1.55	89%
	Water Heater Replacement	Water Heating	kWh	1,048,315	0.27	1,048,315	0.27	100%
	Subtotal	Cooling	kWh	156,817,135	40.15	146,485,312	37.50	93%
	Subtotal	Heating	kWh	48,144,882	12.33	44,119,157	11.30	92%
	Subtotal	Other	kWh	435,603,205	111.52	393,875,385	100.84	90%
	Total		kWh	640,565,222	164.00	584,479,854	149.64	91%
Natural Gas	Caulking	Heating	Therms	1,455,824	0.37	1,348,313	0.35	93%
	Ceiling Insulation	Heating	Therms	28,402,739	7.27	26,055,455	6.67	92%
	Duct Sealing	Heating	Therms	689,116	0.18	548,263	0.14	80%
	Evap Cooler Cover	Heating	Therms	167,602	0.04	154,528	0.04	92%
	Furnace Filter	Heating	Therms	749,791	0.19	689,680	0.18	92%
	Furnace Repair	Heating	Therms	6,305,337	1.61	5,437,780	1.39	86%
	Furnace Replace	Heating	Therms	2,853,272	0.73	2,621,431	0.67	92%
	Minor Home Repair	Heating	Therms	5,337,135	1.37	4,870,265	1.25	91%
	Programmable Thermostat	Heating	Therms	648,951	0.17	604,735	0.15	93%
	Weather Stripping	Heating	Therms	3,520,507	0.90	3,178,991	0.81	90%
	Faucet Aerators	Water Heating	Therms	6,542,040	1.67	5,754,171	1.47	88%
	Low Flow Showerhead	Water Heating	Therms	9,134,865	2.34	7,943,186	2.03	87%
	Water Heater Blanket	Water Heating	Therms	18,823,028	4.82	16,639,867	4.26	88%
	Water Heater Pipe Wrap	Water Heating	Therms	8,395,908	2.15	7,515,909	1.92	90%
	Water Heater Replacement	Water Heating	Therms	765,113	0.20	747,080	0.19	98%
	Subtotal	Heating	Therms	50,130,274	12.83	45,509,443	11.65	91%
	Subtotal	Water Heating	Therms	43,660,954	11.18	38,600,213	9.88	88%
	Total		Therms	93,791,227	24.01	84,109,656	21.53	90%

* Available savings potential is defined as the energy savings potential per year for households willing to participate in the LIEE Program.

Table 6-3
Summary of Total Annual Energy Usage and Savings Potential as a Percent of Usage
(for Low Income Households)

Electricity	Low Income Homes with Electric Service	3,905,934
	Average kWh per Home per Year	5,653
	Total Annual Electricity Use (GWh/Yr)	22,080
	Available Electricity Savings Potential (GWh/Yr)	584
	Percent Savings Potential	2.6%
Natural Gas	Low Income Homes with Natural Gas Service	3,479,275
	Average Annual Therms per Home per Year	367
	Total Annual Natural Gas Use (Mth/Yr)	1,277
	Available Natural Gas Savings Potential (Mth/Yr)	84
	Percent Savings Potential	6.6%

We acknowledge that savings potential identified in this study is conservative, as it is associated with measures that low income customers "need." For example, we limit refrigerator and air conditioner replacement to units that were identified as "in need of replacement" by auditors (regardless of age[13]) and limit CFL measures to a maximum of 4 units per home.[14] If these restrictions are relaxed by focusing on all refrigerators and air conditioners over 10 years old and allowing up to 10 CFLs per home, the savings potential estimates increase significantly. Total electric savings potential increases from 641 GWh to 1,964 GWh, and available savings potential increases from 584 GWh to 1,763 GWh. About 70% of the increase comes from refrigerators, with another 20% from CFLs, with the remaining 10% increase coming from air conditioners. (For the sensitivity analysis, we assumed that the per-unit CFL savings would remain constant, but it is more likely that per-unit impacts would decline as more CFLs are installed per home, since additional lights would be placed in lower-usage fixtures.)

Tables 6-4 through 6-8 show available savings potential by key market segments:

- Utility
- Dwelling type
- Household density group
- Ethnicity group
- Climate zone (Title 24)

[13] CFL impacts are based on LIEE Program impact evaluation results, thus the impact estimates reflect typical LIEE Program install rates and operating conditions.
[14] Savings potential was discounted 20% for replacement of refrigerators under 10 years of age. It is expected that much of the savings from replacing newer refrigerators would result from the removal of poorly functioning units.

As Table 6-4 shows, customers in the PG&E area have the largest available electric savings potential at 256 GWh, followed by customers in the SCE area, with estimated potential at 210 GWh. The higher available savings potential per home in the SCE area is driven by measures affecting cooling loads, which are higher on average in the SCE area.

Customers in the PG&E area also account for the largest natural gas savings potential at 43 million therms, followed by customers in the SCG area at 37 million therms. While there are more applicable homes in the SCG area, the savings potential per home is higher in the PG&E service territory, which is a result of measures that can affect the higher PG&E space heating loads.

Table 6-4
Available Potential by Utility

	Available Electric Potential			Available Gas Potential		
Utility	# Homes (mil.)	GWh	kWh/Home	# Homes (mil.)	Mth	Thm/Home
PG&E	1.6	256	160	1.6	43	27
SCE	1.2	210	172			
SCG				2.0	37	19
SDG&E	0.3	39	122	0.3	4	13
Other	0.8	80	104			
Total	3.9	584	150	3.9	84	22

Table 6-5 shows that available savings potential for both electricity and natural gas is highest for single family homes, reflecting their generally larger size. While there are more qualifying multi-family homes, the savings per home is much higher for single family dwellings.

Table 6-5
Available Potential by Dwelling Type

Dwelling Type	# Homes (Millions)	Electricity		Natural Gas	
		GWh	kWh/Home	Mth	Thm/Home
Multi-family	2.0	206	105	23	12
Mobile Home	0.2	30	137	5	22
Single Family	1.7	349	203	56	33
Total	3.9	584	150	84	22

Table 6-6 shows that savings potential is generally highest in the denser population areas where there is a bigger concentration of low-income homes. However, available electricity savings potential is also quite high in the "very sparse" density area. Many of these customers do not use electricity or natural gas for space heating, and therefore have not been as affected by the LIEE Program. Available electricity savings per home is higher in the sparser density areas, reflecting a higher proportion of single-family homes.

Table 6-6
Available Potential by Household Density Group

Household Density Group	# Homes (Millions)	Electricity		Natural Gas	
		GWh	kWh/Home	Mth	Thm/Home
Very Dense	0.9	99	111	16	18
Dense	1.1	154	140	28	26
Sprawl	0.7	95	136	15	21
Sparse	0.3	65	202	9	27
Very Sparse	0.9	171	193	16	18
Total	3.9	584	150	84	22

Table 6-7 shows available savings potential by ethnicity group. The largest savings potential is in the White Non-Hispanic and Hispanic groups, mainly due to the larger number of qualified homes in these groups.

Table 6-7
Available Potential by Ethnicity Group

Race-Ethnicity	# Homes (Millions)	Electricity		Natural Gas	
		GWh	kWh/Home	Mth	Thm/Home
White Non-Hispanic	1.2	215	180	24	20
Black	0.4	46	116	11	28
Asian	0.4	35	95	5	15
Hispanic	1.6	246	152	37	23
Other	0.3	40	151	6	24
Don't Know-Refused	0.1	3	40	0.4	5
Total	3.9	584	150	84	22

Table 6-8 shows total available potential by CEC Title 24 climate zone, and Table 6-9 shows space conditioning potential by the same climate zones. Overall savings potential tends to correlate with the number of home in a climate zone. Savings potential per home tends to vary as a result of temperatures (as reflected in cooling degree days and heating degree days).

Table 6-8
Total Available Potential by CEC Title 24 Climate Zone

Climate Zone	Cooling Deg. Days	Heating Deg. Days	# Homes (Millions)	Electricity		Natural Gas	
				GWh	kWh/Home	Mth	Thm/Home
1	0	4,149	0.02	6.6	329	0.9	46
2	426	3,232	0.03	5.7	164	0.5	14
3	38	2,792	0.37	41.9	114	9.3	25
4	283	2,512	0.18	17.1	97	4.6	26
5	34	2,704	0.04	9.0	228	2.0	50
6	321	1,669	0.26	32.0	125	3.5	14
7	470	1,430	0.23	29.4	128	3.7	16
8	720	1,551	0.45	48.7	108	8.6	19
9	948	1,487	0.70	82.8	118	13.1	19
10	1,268	1,799	0.38	44.0	117	5.6	15
11	1,325	2,841	0.25	39.7	157	5.5	22
12	792	2,812	0.50	79.8	159	14.3	29
13	1,930	2,355	0.21	61.2	291	6.3	30
14	1,769	3,107	0.10	35.7	346	3.7	36
15	4,015	950	0.11	40.0	370	1.7	16
16	255	5,593	0.07	10.9	148	0.8	11
Total			3.91	584.5	150	84.1	22

Table 6-9
Space Conditioning Potential by CEC Title 24 Climate Zone

Climate Zone	Cooling Deg. Days	Heating Deg. Days	# Homes (Millions)	Electricity		Natural Gas	
				GWh	kWh/Home	Mth	Thm/Home
1	0	4,149	0.02	0.0	0	0.7	35
2	426	3,232	0.03	0.8	22	0.3	10
3	38	2,792	0.37	0.5	1	7.1	19
4	283	2,512	0.18	1.3	7	3.4	19
5	34	2,704	0.04	0.0	0	1.3	34
6	321	1,669	0.26	0.03	0.1	0.7	3
7	470	1,430	0.23	0.6	2	1.8	8
8	720	1,551	0.45	1.3	3	2.2	5
9	948	1,487	0.70	12.6	18	4.9	7
10	1,268	1,799	0.38	10.6	28	1.4	4
11	1,325	2,841	0.25	21.0	83	4.3	17
12	792	2,812	0.50	24.2	48	10.2	20
13	1,930	2,355	0.21	27.5	131	3.7	18
14	1,769	3,107	0.10	14.6	142	2.2	21
15	4,015	950	0.11	30.9	286	0.7	6
16	255	5,593	0.07	0.5	7	0.5	7
Total			3.91	146.5	38	45.5	12

6.2 Future Year Savings Potential

In order to gain insight into changes in low-income energy savings potential over time, we extended the base year (2003) savings estimates discussed above over a ten-year period. This analysis factors in measure decay over time as well as the effects of continuing the LIEE Program over the next 10 years. In the analysis, we held both the current low-income population estimates and the current LIEE Program levels constant over the forecast horizon.

6.2.1 Assessment of LIEE Program Penetration

In order to assess measure decay, we first assessed what current level of energy efficiency was due to the LIEE Program. We then assumed that Program-related energy efficiency would decay over time at a rate of one-over-the-measure-life. (For example, a measure with a 10 year measure life would have a decay of 1/10 or 10% per year.) Energy efficiency levels that were not related to the LIEE Program were assumed to be related to naturally occurring energy efficiency practices and would not decay over time. In this case, we assume that customers would continue to maintain or repurchase measures on their own as they have done in the past.

To assess the extent of LIEE Program effects, we looked at historic Program accomplishments and compared the number of homes treated, by measure, with the number of applicable homes that needed or did not need measures. Table 6-10 summarizes the effects of the LIEE Program relative to saturations of measures in the low-income population. As the table shows, the LIEE Program appears to be responsible for 25% or more of the measure installations for CFLs, evaporative cooler/AC covers, faucet aerators, low flow showerheads, CFL porch lights, and weather stripping.

6.2.2 Savings Potential Based on Current Low Income and LIEE Program Levels

Figures 6-1 and 6-2 show the results of our extension of the potential analysis for a ten-year period (base year 2003 through 2012). Electric energy savings potential is shown to increase by about 50% before factoring in the energy-reducing effects of the LIEE Program measure installations and to decrease by about 11% after accounting for Program accomplishments (net of program measure decay). Natural gas savings potential is shown to increase by about 19% without the energy-reducing measures installed through the LIEE Program and to decrease by about 4% after accounting for the Program. The factors affecting changes in electricity savings potential are the decay, and subsequent LIEE Program installation, of refrigerators and CFLs. For natural gas, furnace and showerhead replacements and minor home repairs account for the biggest changes over time. These components are explored further below.

Table 6-10
LIEE Accomplishments Relative to Low Income Efficiency Levels

Measure	Number of Homes				LIEE Fraction (LIEE/Have Measure)	Measure Life (Years)
	Where Measure is Applicable	Who Need Measure	Who Have Measure	Who Received LIEE Treatment		
CAC	1,193,722	2,562	1,191,160	5,721	0.005	18
CAC Maintenance	1,193,722	83,740	1,109,982	0	0.000	4
Caulking	3,363,886	995,173	2,368,713	389,928	0.165	5
Ceiling Insulation	2,057,562	1,051,018	1,006,544	51,039	0.051	25
CFL	4,406,444	3,092,931	1,313,513	609,334	0.464	8
Duct Sealing	489,729	100,926	388,803	18,817	0.048	25
Evap Cooler	283,206	23,103	260,104	51,449	0.198	7
Evap Cooler Cover	286,239	247,672	38,567	18,566	0.481	3
Evap Cooler Maintenance	283,206	34,251	248,955	794	0.003	4
Faucet Aerators	3,208,546	2,245,530	963,016	354,570	0.368	5
Furnace Filter	1,900,819	544,501	1,356,318	52,439	0.039	5
Furnace Repair	1,539,704	195,799	1,343,905	15,165	0.011	10
Furnace Replace	1,539,704	57,512	1,482,192	33,857	0.023	22
Low Flow Showerhead	3,203,146	1,269,705	1,933,441	533,476	0.276	10
Minor Home Repair	3,363,886	1,409,402	1,954,484	480,341	0.246	10
Porch Light	1,284,041	1,205,800	78,241	19,914	0.255	20
Programmable Thermostat	1,625,036	669,693	955,343	10,174	0.011	12
RAC	798,306	102,658	695,648	1,651	0.002	15
RAC Maintenance	798,306	105,477	692,829	0	0.000	4
Refrigerator	3,901,689	174,994	3,726,695	325,830	0.087	15
Water Heater Blanket	2,607,282	1,987,519	619,764	90,627	0.146	5
Water Heater Pipe Wrap	2,716,398	2,201,709	514,689	33,837	0.066	15
Water Heater Replacement	3,216,593	49,359	3,167,235	11,838	0.004	13
Weather Stripping	3,363,886	2,030,540	1,333,346	389,928	0.292	5
Whole House Fan	560,661	472,754	87,907	343	0.004	20

Figure 6-1
Low Income Electricity Savings Potential

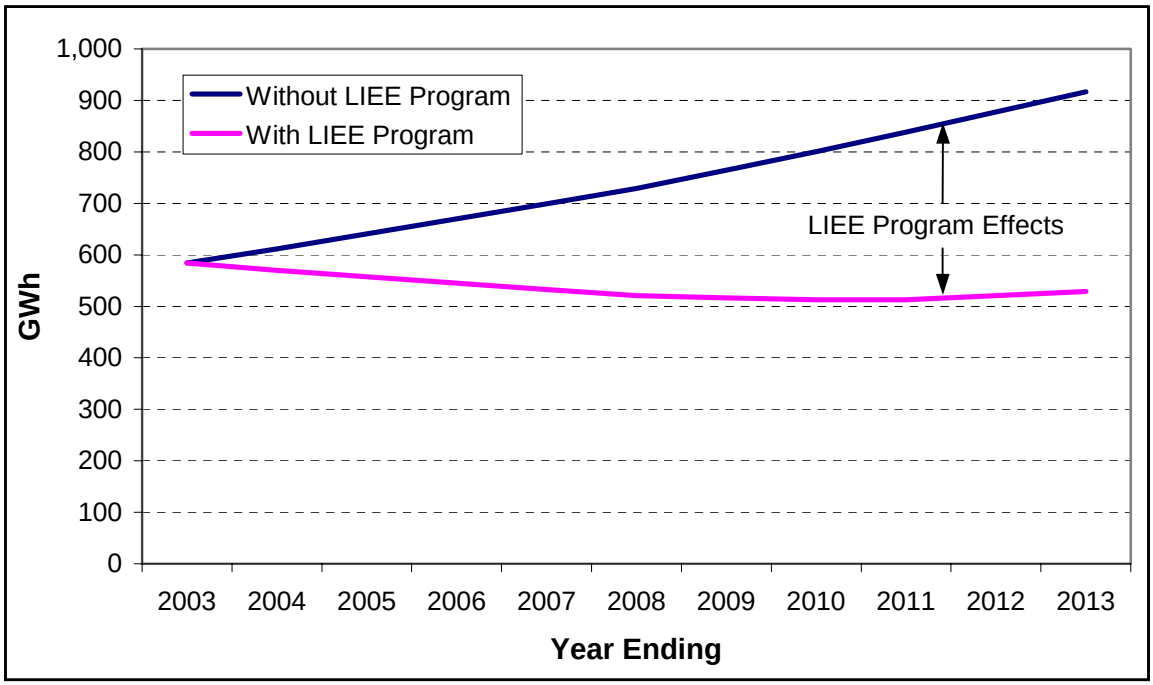
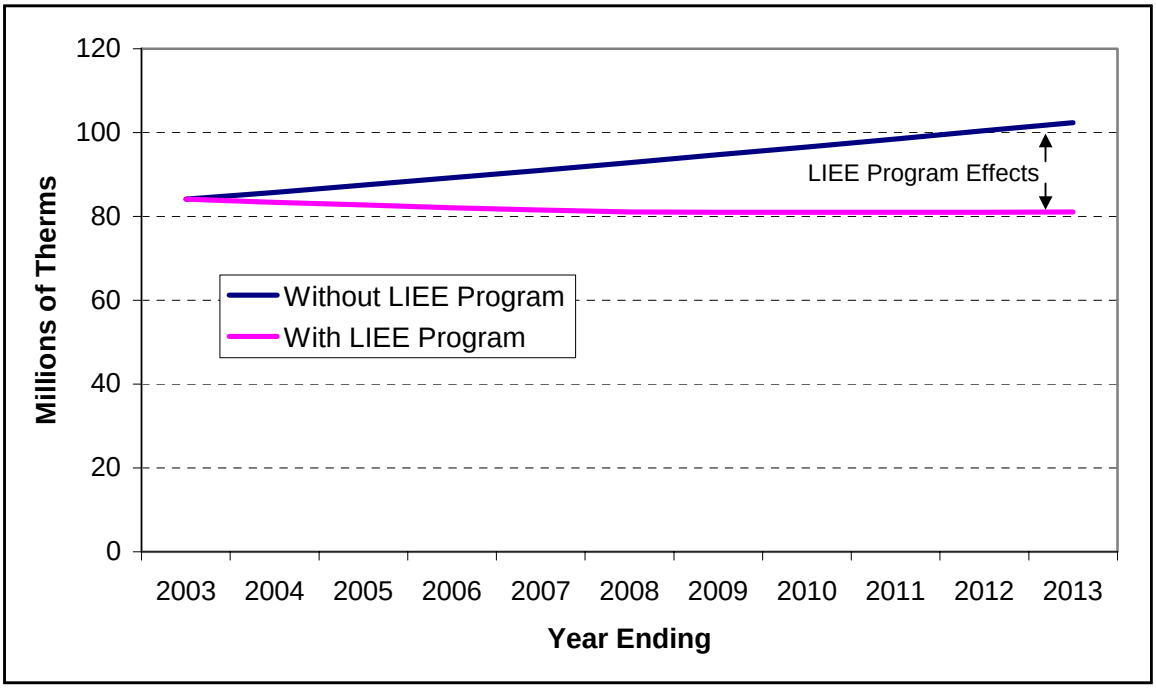


Figure 6-2
Low Income Natural Gas Savings Potential



Tables 6-11 through 6-14 further explore changes in energy savings potential over time. In each table we start with base year 2003 energy savings potential, then add increases in potential due to measure decay and subtract decreases in potential due to LIEE Program accomplishments to arrive at net energy savings potential in 10 years. Lacking better information on how the LIEE Program may operation over time, we assumed the current mix of measures remains fixed.

- Table 6-11 shows changes in potential by measure. For electricity, the LIEE Program has the biggest impacts on lighting and refrigerators. Current Program installation levels are more than offsetting the effects of measure decay for CFLs and especially for refrigerators. For natural gas, the furnace replacement and low flow showerhead measures are doing the best at capturing available potential.

- Table 6-12 shows changes in potential by utility. Overall, changes in potential over time would be fairly similar for the investor-owned utilities, based on current LIEE Program impact levels.

- Table 6-13 shows changes in potential by dwelling type, with mobile homes grouped with single family homes for purposes of the analysis. It appears that current LIEE Program impacts are doing a somewhat better job at capturing single family energy efficiency potential versus potential in multifamily dwellings.

- Finally Table 6-14 shows changes in potential by dwelling type and end use. It appears that current LIEE Program impacts are most effectively targeting refrigerators in single family homes. This shows up in the table as a fairly significant capturing of refrigeration potential over time.

Table 6-11
Energy Savings Potential Over 10 Years – By Measure

Fuel	Measure	Base 2003 Potential (a)	Increases Due to Decay (b)	LIEE Program Impacts (c)	Net 2013 Potential (a+b-c)	% Change in Potential 2003 to 2013
Electricity Units: GWh	CAC	0.6	13.1	13.6	0.1	-77%
	CAC Maintenance	3.2	0.0	0.0	3.2	0%
	CFL	184.9	46.7	55.5	176.1	-5%
	Caulking	3.3	3.2	0.6	5.9	76%
	Ceiling Insulation	101.6	2.3	1.9	102.1	0%
	Duct Sealing	2.6	1.8	3.2	1.2	-52%
	Evap Cooler	6.4	11.9	13.2	5.1	-20%
	Evap Cooler Cover	0.3	0.0	0.0	0.3	-6%
	Evap Cooler Maintenance	0.7	0.1	0.2	0.5	-27%
	Faucet Aerators	3.8	0.0	1.0	2.8	-26%
	Furnace Filter	1.0	0.2	0.1	1.2	15%
	Low Flow Showerhead	6.1	0.0	4.8	1.3	-78%
	Minor Home Repair	14.0	6.6	5.6	15.0	7%
	Porch Light	54.5	1.8	6.1	50.1	-8%
	Programmable Thermostat	2.3	1.7	2.2	1.8	-21%
	RAC	11.1	0.2	1.1	10.3	-8%
	RAC Maintenance	1.3	0.0	0.0	1.3	0%
	Refrigerator	122.1	226.2	268.6	79.7	-35%
	Water Heater Blanket	15.4	1.2	0.7	15.9	3%
	Water Heater Pipe Wrap	6.1	0.1	0.8	5.3	-12%
	Water Heater Replacement	1.0	0.2	0.3	1.0	-6%
	Weather Stripping	8.8	3.9	2.0	10.6	21%
	Whole House Fan	33.4	0.0	0.3	33.1	-1%
	Total	584.5	321.2	381.8	523.9	-10%
Natural Gas Units: Mth	Caulking	1.3	0.9	0.4	1.8	37%
	Ceiling Insulation	26.1	0.4	1.5	24.9	-4%
	Duct Sealing	0.5	0.1	0.6	0.1	-89%
	Evap Cooler Cover	0.2	0.1	0.1	0.1	-37%
	Faucet Aerators	5.8	0.0	0.5	5.3	-8%
	Furnace Filter	0.7	0.1	0.3	0.6	-18%
	Furnace Repair	5.4	0.6	0.6	5.4	-1%
	Furnace Replace	2.6	4.8	5.3	2.1	-20%
	Low Flow Showerhead	7.9	0.0	5.2	2.7	-66%
	Minor Home Repair	4.9	1.4	3.3	3.0	-38%
	Programmable Thermostat	0.6	0.2	0.6	0.2	-70%
	Water Heater Blanket	16.6	1.8	0.4	18.0	8%
	Water Heater Pipe Wrap	7.5	0.1	0.0	7.6	1%
	Water Heater Replacement	0.7	1.1	1.1	0.7	-4%
	Weather Stripping	3.2	0.9	0.8	3.3	5%
	Total	84.1	12.4	20.3	76.2	-9%

Table 6-12
Energy Savings Potential Over 10 Years – By Utility

Fuel	Utility	Base 2003 Potential (a)	Increases Due to Decay (b)	LIEE Program Impacts (c)	Net 2013 Potential (a+b-c)	% Change in Potential 2003 to 2013
Electricity Units: GWh	PG&E	255.7	128.3	182.9	201.1	-21%
	SCE	210.0	119.2	157.7	171.5	-18%
	SDG&E	39.0	34.3	41.3	32.0	-18%
	Other*	79.8	39.4	0.0	119.3	49%
	Total	584.5	321.2	381.8	523.9	-10%
Natural Gas Units: Mth	PG&E	43.0	4.0	7.7	39.4	-8%
	SCG	36.8	7.7	11.7	32.8	-11%
	SDG&E	4.3	0.7	1.4	3.6	-17%
	Total	84.1	12.4	20.7	75.8	-10%

* "Other" includes LADWP and SMUD, who have natural gas customers served by IOUs.

Table 6-13
Energy Savings Potential Over 10 Years – By Dwelling Type

Fuel	Dwelling Type	Base 2003 Potential (a)	Increases Due to Decay (b)	LIEE Program Impacts (c)	Net 2013 Potential (a+b-c)	% Change in Potential 2003 to 2013
Electricity Units: GWh	Multifamily	206.1	115.3	113.6	207.9	1%
	Single Family	378.4	205.9	268.3	316.0	-16%
	Total	584.5	321.2	381.8	523.9	-10%
Natural Gas Units: Mth	Multifamily	23.4	3.1	4.9	21.5	-8%
	Single Family	60.7	9.4	15.8	54.2	-11%
	Total	84.1	12.4	20.7	75.8	-10%

Note: Mobile Homes are included with Single Family homes.

Table 6-14
Energy Savings Potential Over 10 Years – By Dwelling Type and End Use

Fuel	Dwelling Type	End Use	Base 2003 Potential (a)	Increases Due to Decay (b)	LIEE Program Impacts (c)	Net 2013 Potential (a+b-c)	% Change in Potential 2003 to 2013
Electricity Units: GWh	Multifamily	Cooling	29.7	14.8	13.7	30.8	4%
		Heating	16.5	6.2	1.6	21.1	28%
		Lighting	95.5	15.4	25.1	85.8	-10%
		Refrigeration	48.4	78.6	69.4	57.6	19%
		Water Heating	15.9	0.4	3.7	12.6	-21%
	Single Family	Cooling	116.8	20.4	22.9	114.3	-2%
		Heating	27.6	3.7	5.9	25.5	-8%
		Lighting	143.9	33.0	36.5	140.4	-2%
		Refrigeration	73.7	147.6	199.1	22.1	-70%
		Water Heating	16.5	1.1	3.9	13.7	-17%
	Total		584.5	321.2	381.8	523.9	-10%
Natural Gas Units: Mth	Multifamily	Heating	9.0	2.4	2.6	8.8	-2%
		Water Heating	14.5	0.7	2.4	12.8	-12%
	Single Family	Heating	36.5	7.1	10.9	32.8	-10%
		Water Heating	24.1	2.3	4.9	21.5	-11%
	Total		84.1	12.4	20.7	75.8	-10%

7. Results Integration and Recommendations

The preceding sections have provided the results of the characterization, needs assessment, and energy savings potential analysis. This section begins by presenting the results of the segmentation analysis. The segmentation task has identified important subgroups within the low income population based on their underlying geographic, demographic, housing, and energy use characteristics. By segmenting the population into meaningful groups, we gain a better understanding of how to reach and provide low income households with program services that are needed and will provide the most benefit. At the end of this section, we provide a list of recommendations for program targeting, outreach, design and delivery.

7.1 Segmentation Analysis

This section describes the results of segmentation analysis performed for the Phase II Low Income Needs Assessment Study. The segmentation analysis was completed to identify groups within the overall low income population that should be explicitly targeted by the programs based on their need for program services, their willingness to participate in the programs, and their accessibility through outreach and delivery channels that are currently being used by the programs. The underlying characteristics of these various groups were further analyzed to identify differences that could help guide development of effective program targeting, outreach and delivery strategies.

Clearly, the segment of the low income population that is already participating in the CARE and/or LIEE programs is an important segment as it represents the characteristics of low income households that have already successfully been recruited for the programs. Similarly, the segment of the low income population that has yet to participate in CARE and/or LIEE but would be willing to represents a promising group that should be targeted by future programs. Finally, the segment of the low income population that is unwilling to participate the programs and/or has little need for them represents a less promising group that will be more difficult to recruit and unlikely to experience significant benefits.

The first segment is referred to as "Participant," as it contains low income households who have already enrolled in CARE and/or LIEE. The second and third segments are referred to as "Most Promising" and "Less Promising" as they contain households that should be more and less (respectively) actively targeted through program outreach efforts. The following sections discuss these segments, followed by a summary of the recommendations for program targeting, outreach and delivery strategies.

7.1.1 "Participant" v. "Non-participant" Segments

One of the most important variables of interest for this type of analysis is whether or not a low income household is already participating in CARE and/or LIEE. By looking for differences between program participants and non-participants, we can gain insight into the types of low income households the programs have been successfully reaching. We then look at the characteristics of non-participants, and see

how they differ from participants, to identify any gaps in program outreach or delivery that should be addressed to encourage greater participation in the programs. Table 7-1 presents a summary of these statistically significant differences; the following discusses these findings.

Geographic Characteristics. There are significant differences by climate region and climate zone that would indicate the programs have been particularly successful in enrolling low income households from specific areas. For example, low income households located in the Desert climate region represent only about 5% of the overall population of low income households in the state. However, 7% of all of the participants live in this climate region (as compared to only 2% of non-participants). This means that, despite this region's small contribution to the overall size of the low income population in California, participation from the eligible low income households in this region has outpaced non-participation significantly. Most of this activity is coming from climate zone 14 and less so from climate zone 15 (see Figure 7-1 for the map of climate zones to climate regions). In addition, participation from low income households living in climate zone 4 has outpaced by non-participation by nearly four-to-one.

When taking a closer at these regions and climate zones, we see that some of the counties in these areas have been particularly effective in enrolling participants at somewhat higher rates. For example, participation from low income households living in Riverside County, which stretches into Desert (climate zone 15) climate region, has been significantly higher than non-participation in this area. We see a similar result for San Bernardino County, where one third of its low income population lives in the Desert climate region (mostly climate zone 14, some climate zone 15). In addition, we see participation outpacing non-participation in the counties of Santa Clara (North Coast, climate zone 4) and Orange (South Coast, mostly climate zone 8).

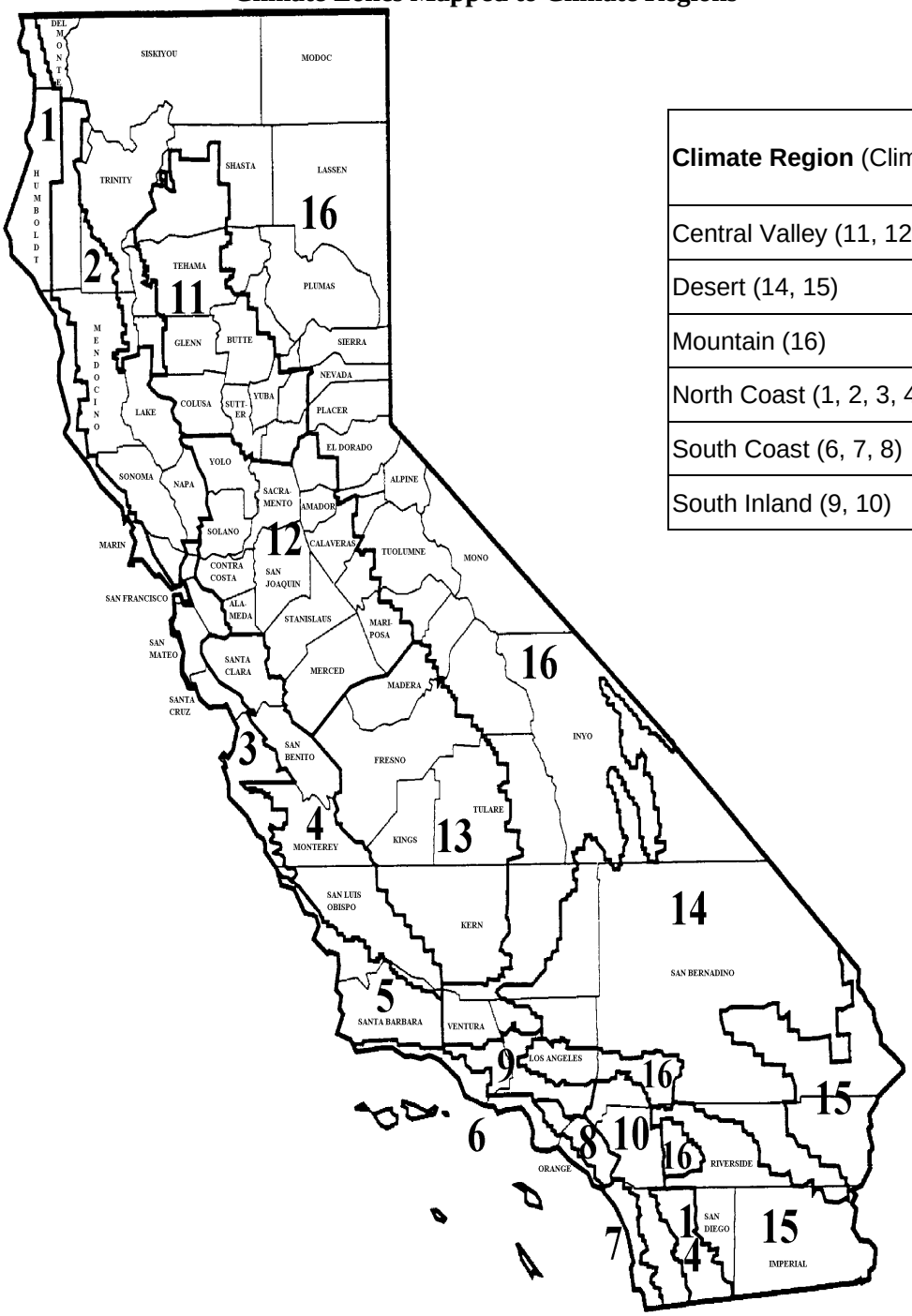
Table 7-1
Summary of Geographic, Demographic, Housing and Energy Use Characteristics
For Participating and Non-participating Low Income Households

	Participants	**Non-participants**
Geographic Characteristics		
Climate Region	Desert	Central Valley
Climate Zone	4	12
County	Riverside, Santa Clara, San Bernardino, Orange	Sacramento, San Diego
Housing Density	Rural	Urban, densely populated areas
Demographic Characteristics		
Race/ethnicity	Hispanic	White
Languages Spoken	Spanish	English only
Education	High school courses (no degree)	Colleges courses/degree
Household Composition	Large families (5+)	Young adult households
Special Needs Households	Household member with disability	--
Household Income	Very poor (<$15,000/year)	--
Housing Characteristics		
Home Ownership	--	--
Dwelling Type	Small multi-family (2-4)	Mobile homes
Age of Home	Built before 1970	Built between 1970-1994
Size of Home	Very small homes (<500 sqft)	Very large homes (>1,500 sqft)
Type of AC System	None	Central AC
Age of AC System	< 10 years	--
Heating Fuel	--	Propane
Age of Heating System	--	--
Type of Heating System	Gas wall units	Propane furnace
Water Heating Fuel	Gas	Propane
Age of Water Heater	--	--
Pay for Hot Water	--	--
Foundation Type	Slab	Above-ground floor dwelling units, mobile home skirting
Ceiling Type	Vaulted with attic space	Flat with no attic space
Duct Systems	--	--
Window Type	--	--

Table 7-1 (continued)
Summary of Geographic, Demographic, Housing and Energy Use Characteristics
For Participating and Non-participating Low Income Households

Energy Use Characteristics	**Participants**	**Non-participants**
Type of Energy Service	Use gas for major end-uses and appliances, combined electric and gas service	Electric only
Electricity Usage	--	High annual consumption (>7,000 kWh/year), high seasonal consumption (>1,500 kWh during winter, >1,500 kWh during summer), high above-baseline consumption
Gas Usage	--	High seasonal consumption (> 500 therms during winter)
Energy Burden, Insecurity and Hardship		
Energy Burden	Low (<2.5%)	Medium-High (>2.5%)
Energy Insecurity	In Crisis	Secure
Hardship	Comfort, health	Safety, security
Willingness to Participate and Barriers to Participation		
Willingness to Participate	Participate in other public assistance programs, aware of other programs like CARE and LIEE	--
Barriers to Participation	--	Welfare stigma, income documentation awareness
Accessibility		
Outreach Channels	Non-English media (TV, radio, newspapers), utility bill, religious events	Internet (access more than twice/day)
Delivery Channels	Community-based organizations/events, religious organizations/events, school organizations/events, government organizations/ agencies	Word-of-mouth (e.g., friends & family, trades people, landlords, banks)

Figure 7-1
Climate Zones Mapped to Climate Regions



Climate Region (Climate Zone)
Central Valley (11, 12, 13)
Desert (14, 15)
Mountain (16)
North Coast (1, 2, 3, 4, 5)
South Coast (6, 7, 8)
South Inland (9, 10)

The one region that has not kept pace appears to be the Central Valley climate region and, in particular, climate zone 12 (which stretches north to Yolo County, down to Merced, and spans east-west from Contra Costa to Amador counties). Climate zone alone accounts for 12% of the total low income population in the state, yet 15% of all non-participating households are from this region. When taking a closer look, we see a significant difference in participation rates (versus non-participation) in Sacramento County. Here, only 3% of all participants live in Sacramento County (compared to 7% of non-participants). Again, while these differences may be small they are statistically significant and provide evidence that – everything else equal – the programs could be more effective in expanding participation in these areas. We discuss later how, for this region in particular, everything else may not be equal and there may be some unique challenges to expanding participation in this region.

Another county for which participation seems to be lagging somewhat behind non-participation is San Diego (and, in particular, climate zone 7). About 6% of all participants live in this county as compared to 10% of non-participants. We do not find evidence that there are unique challenges to expanding participation from this region and, as such, more aggressive strategies should be encouraged.

Although not shown in Table 7-1, there are certain counties that have had very limited participation rates (0% across the total population of participants). These counties include (sample size shown in parentheses): Imperial (12), Lake (3), Monterey (10), San Mateo (3), Santa Cruz (7), Shasta (6), and Solano (4). Of course, our sample sizes for these counties are very small and, in fact, for some of these counties, the underlying low income population is also very small. Nevertheless, the sample sizes and population are not too small for us to see statistical differences between the current level of participation versus non-participation.

These results should not be interpreted as a criticism of the efforts to target the programs in these areas; instead, we conclude that efforts to expand the programs in these areas (as opposed to others) may have greater success since the current participation levels are relatively low (as opposed to others). Of course, it is possible that there are unique barriers to participation in these areas that will make recruitment efforts more difficult. However, we do not see it anything obvious in the data. For example, while it is true that some of these areas are rural and remote, participation in other rural and remote areas has not been lacking.

In addition, some of these counties – both rural and non-rural – have a relatively low rate of low income incidence (i.e., the number of low income households per square mile), and as such, trying to locate them is a little like finding a "needle in the haystack." Outreach efforts that work well in areas where there is a high concentration of low income households (e.g., canvassing, referrals from community-based organizations, "word-of-mouth", etc.) will not be as effective in these areas. In addition, any sort of "mass market advertising" (e.g., bill inserts, English and non-English language media advertising) may be

particularly ineffective (and costly) as the number of non-qualified households who hear about the programs, apply, and then get turned away is likely to be significant.

It is also possible that these counties might have a higher percentage of generally disinterested yet eligible households. There may also be barriers to participation that the program just cannot overcome (e.g., distrust, fear, "welfare stigma," etc.). However, as discussed in the Section 7.1.2, we do not see any evidence that this is the case for these counties in particular.

So, while the sample sizes and population represented by these counties is small, we must conclude that recruitment efforts for these areas should continue and perhaps new and more effective ways to target and successfully enroll households from these areas should be developed. Based on the geographic characteristics alone, we cannot offer any specific recommendations for targeting and outreach. However, we have provided other recommendations for reaching households with some of the same underlying demographic, housing and energy use characteristics as households living in these areas. We should expect these strategies to work in these particular counties as well as they do in other areas where these underlying characteristics exist. As such, we encourage the Commission to continue to require the utilities to look for and implement creative and cost-effective channels through which to locate eligible households from these counties.

Housing Density. There is some evidence that the programs have not been as successful as they can be in encouraging participation in the more densely populated, urban areas. While it is true that just over half of the state's low income population resides in these urban areas, a slightly higher percentage of non-participants (54%) as compared to participants (49%) reside in these areas. While this result is statistically significant, it has little meaning on its own and should be interpreted cautiously. Later, we describe how targeting densely populated areas will reach a similar percentage of the "most promising" and "less promising" segments. As such, while there are good opportunities to expand participation within urban areas, there will also be challenges as discussed in the next section.

Race, Ethnicity and Languages Spoken. There is significant evidence that the programs have been very effective in targeting and enrolling Spanish-speaking, Hispanic families. Nearly half of all participants are Hispanic (as compared to just about one third of non-participants). Similarly, half of all participants speak Spanish, whereas only about one third of non-participants speak Spanish. Non-participating households are much more likely to be White and speak English only (i.e., they do not speak any languages other than English). These results would indicate that the programs have done a good job encouraging participation from within the Hispanic, Spanish-speaking community and should continue to expand these efforts. This result is confirmed later when we demonstrate that Hispanic, Spanish-speaking households are among the most promising for the programs in the future based on their needs, interest and accessibility. In addition, we will show below that targeting White, primarily English-speaking neighborhoods may be challenging due to some important willingness to participate and accessibility barriers.

Family Composition. The programs have been particularly effective in reaching and meeting the needs of relatively large-sized "families" (i.e., households with five or more members, including seniors and children under the age of 18). The utilities should be credited for their successful efforts to enroll and assist these large families, as not only do these households have limited household resources (which, in this case, need to be stretched to provide for many household members) but they also have other important burdens and responsibilities (e.g., caring for elderly family members, raising children).

As shown in Table 7-1, the programs appear to have been less successful in encouraging participation from "young adult" households (i.e., all household members are between the ages of 18 and 34). As we demonstrate later, the utilities should not necessarily take this as a directive to expand participation within this group. As it turns out, these types of households do not hold much promise in terms of willingness to participate in and expected benefits from the programs. And it is not surprising that they haven't been enrolled in large numbers as they very rarely access the types of outreach and delivery channels used to promote the programs. As such, we can conclude that (a) the programs have been effective in discouraging participation from these types of households, and/or (b) the households themselves have been successful in avoiding the programs altogether.

Education and Income. As intended, the programs have been very successful in enrolling some of the poorest households as well as those with limited educational backgrounds. Two of every five households participating in the program can count on less than $15,000 a year in total household income. This compares to one quarter of the non-participating low income households. Similarly, over half of all non-participating low income households have completed college level courses and/or obtained college degrees. Only one third of participating households have achieved this level of education. While there is still room to expand participation in both of these areas, the utilities should be given credit for enrolling a significant share from these important demographic segments.

Low income households with higher levels of education (i.e., have taken college courses, obtained a college or advanced degree) are well represented within the non-participating segment. Again, as demonstrated in the next section, there is evidence that efforts to recruit these households may be difficult and potentially without significant benefit for either the households individually or the programs in general.

Energy Burden, Energy Insecurity and Non-Energy Benefits. The programs have enrolled a significantly larger share of households in the lowest energy burden category (i.e., than 2.5% of total household income is spent on energy). At first, this does not seem like an intuitive result since the programs are designed to address the needs of and provide benefits to the most burdened of households throughout the state. However, it is possible that the overall energy burden within this group has been reduced as a direct result of participating in the program – the CARE discount reduces the overall rate by

20% and shields participants from higher tier energy charges, and the LIEE program provides energy saving measures that, on average, can reduce the customers' bill by 5-10%. It may also be possible that, as the programs mature, they are enrolling more households with relatively low energy burden. In the end, this may not be best strategy for meeting needs and providing maximum benefits. We discuss this further below.

Additional evidence that the programs are providing significant benefit to those with the greatest need can be found in the analysis of energy insecurity. Over one third of all participating households are "in crisis" according to the energy insecurity scale developed as part of this study. This means that these households have frequently cut back on basic household necessities in order to meet their energy needs, and often worry about paying their energy bill, skip an energy payment, and/or are threatened with service disconnection. A larger share of participating households find themselves "in crisis" as compared to non-participants. This is a particularly meaningful difference that plays a significant role in defining the "most promising" and "less promising" segments described below.

Finally, participating households have greater concerns about comfort and health issues as do non-participants. At first, this may seem counter-intuitive – shouldn't participants have less of these types of concerns as a result of participating in the programs? But, the same logic does not apply here as discussed above for energy burden. This is because very few participants have been treated through the LIEE Program; most are enrolled in CARE. We would expect participation in LIEE to reduce comfort and health concerns and it is highly possible that it has (or at least made an attempt). There are just too few LIEE participants represented in this study to draw any conclusions about the effectiveness of that program in reducing these concerns. Evaluations of the LIEE Program should take a close look at the non-energy benefits achieved and their effect on participants' overall concerns regarding comfort and health issues.

The results for non-participants (i.e., medium-high energy burden, limited energy insecurity) have provided one the most important factors for defining the "most" and "less" promising segments (as discussed in the next section). In brief, households with significant energy burden (and energy insecurity) have been assigned to the most promising segment, whereas households with relatively lower energy burden and energy insecurity form the basis for the less promising segment.

Housing and Energy Use Characteristics. There are several housing characteristics that stand out as having a greater representation among participants than non-participants. For example, participants are more likely than non-participants to live in dwelling units that:

- Are very small (less than 500 square feet)
- Are part of a small multi-family (2-4 units) structure

- Are relatively old (built before 1970)
- Receive both electric and gas service (as opposed to electric only)
- Use natural gas for water heating and other appliances
- Use gas wall units for space heating
- Do not have air conditioning equipment/systems or (if they do) it is relatively new (<10 years)
- Have slab foundation and/or vaulted attics with attic space

Non-participants, on the other hand, have many similar characteristics although those that stand out and are significantly (statistically) different include:

- Non-participants are more likely to live in mobile homes or very large single-family homes (>1,500 square feet)

- Propane is more often used for space heating and/or water heating

- Non-participants exhibit relatively high annual electricity consumption, high seasonal consumption (winter and summer) for both electricity and natural gas, and high above-baseline electricity consumption

- Electricity consumption Non-participants are more likely to have central air conditioning equipment/systems

- Non-participants are more likely to live in above-ground floor dwelling units, mobile home skirting (no foundation) and/or dwelling units with flat ceilings and no attic space

Many of these non-participant housing characteristics point to opportunities that the program could be taking advantage of (e.g., mobile homes, central air conditioning equipment/systems, high annual, seasonal and above-baseline energy consumption, etc.), while others potentially explain why the household has yet to participate (e.g., propane use, no opportunity for comprehensive foundation/ceiling improvement measures). We discuss these issues further in the next section.

Willingness to Participate and Barriers to Participation. Participants are more likely than non-participants to be aware of and have participated in other public assistance programs, including energy assistance programs like CARE and LIEE. This is another indication that the programs have been effective in recruiting households in need of (and who seek out) assistance. Given that non-participants are not as aware of nor have they participated in these types of programs could mean that they are being missed. It could also mean that they do not wish to participate. These issues are explored further in the next section.

Non-participants were more likely to report barriers to participation that the program may not be able to completely overcome. For example, many non-participating low income households would be embarrassed and/or refuse to participate in these types of programs, which we have categorized as a "welfare stigma" barrier. In addition, many non-participating households would be unwilling to participate in these types of programs because of the income documentation requirements. As discussed further in the next section, it is important to make sure all households who are eligible for these programs are aware of them, that they clearly understand what is and is not required of them to qualify, and they understand how and why they are being asked to participate. If they are still unwilling or not interested in participating, then it is likely that there are others who would be better served.

Outreach and Delivery Channels. In addition, it is worth mentioning that the programs appear to have been successful in reaching low income households through effective outreach and delivery channels. For example, participants are more likely than non-participants to read their utility bills and frequently access non-English media sources (e.g., TV, radio and/or newspapers written in non-English languages). In addition participants indicate that they frequently look to community-based organizations and government agencies for bill payment assistance, information on energy conservation and ways to lower energy bills. Non-participants are less likely to indicate this. Therefore, we can conclude that the programs have been at least partially successful in reaching households through channels they frequently access and, potentially, even more effective at engaging local resources to more cost-effectively reach and deliver program services.

7.1.2 "Most" v. "Less" Promising Segments for Targeting Future Programs

In this analysis, we look at the energy- and non-energy related needs of non-participating households to ensure that strategies to target those households who have yet to participate will result in meeting the greatest need (and potentially achieve the most benefit) for the services offered. As such, we also consider how interested these households would be in participating, whether or not there are barriers to participation that the programs can overcome, and whether or not they are likely to reached through existing outreach and delivery channels (or whether new strategies are needed).

Non-participating households have been assigned to one of two segments based on these criteria. The "less promising" segment, by definition exhibits a reluctance to participate, expresses barriers to participation that the program may or may not be able to overcome, is not expected to achieve significant energy savings or bill savings benefits, and is unlikely to be reached through the program's existing outreach and delivery channels.

The "most promising" segment (again, by definition) exhibits the following characteristics:

- **Need –** Overall, this group exhibits the highest levels of energy insecurity, energy burden and need for energy efficiency measures. Customers in this group also tend to have higher than

average energy bills, stemming from high levels of above-baseline and seasonal energy consumption.

- **Willingness –** In addition to being willing to participate in CARE and/or LIEE, this group has demonstrated that they would be highly likely to participate in these programs based on their past/current participation in other public assistance programs (e.g., Medical, Healthy Families, etc.). There are much less likely to have significant barriers to participation that the programs should be able to easily overcome.

- **Accessibility –** This group represents households that would be most easily accessed through existing program outreach and recruitment channels. The channels include a wide range of both utility and community-based strategies.

Table 7-2 presents a summary of the geographic, demographic, housing, and energy use characteristics of the low income households assigned to these two groups. In addition, we present some of the underlying characteristics that have been used to define the two segments – need for measures, energy savings potential, willingness to participate, access to outreach/delivery channels, etc. The following discussion sets the context for our final conclusions and recommendations from the segmentation analysis, which is presented at the end of this section.

Geographic Characteristics. There is strong evidence from the segmentation analysis that certain geographic areas represent better targets than others for future program outreach and delivery. For example, if we start with the climate regions that represent the most and least promising areas, we find that the Central Valley climate region (climate zones 11-13) represents the most promising region overall (i.e., willing to participate, no barriers to outreach of delivery channels, likely to achieve program benefits, etc.). The South Inland climate region (climate zones 9-10) represents a less promising region overall based on these factors.

Looking a little more closely at climate zones and counties within these larger climate regions, we can potentially identify even smaller promising segments to target the programs to those with the greatest need and likely benefit going forward. For example, climate zones 11 and 12 represent areas with great promise and, within this region, the Sacramento County area appears to hold the most significant promise. Low income households within this county are, overall, statistically more likely than other low income households throughout the state to have a need for the programs' services, be willing to participate, and relatively easy to access through the existing outreach and delivery channels.

Table 7-2
Summary of Geographic, Demographic, Housing and Energy Use Characteristics of "Most" and "Less" Promising Segments

	Most Promising Segment	Less Promising Segment
Geographic Characteristics		
Climate Region	Central Valley	South Inland
Climate Zone	12, 13	6, 9, 11
County	Sacramento	Butte, Yuba, Los Angeles, Orange
Housing Density	--	--
Demographic Characteristics		
Race/ethnicity	Hispanic, Black	White, Asian, Other
Languages Spoken	--	--
Education	High school courses (no degree)	College courses/degree
Household Composition	Large families (5+)	Adult or young adult households
Special Needs Households	Household member with disability	--
Household Income	--	--
Housing Characteristics		
Home Ownership	--	--
Dwelling Type	--	Large multi-family (5+)
Age of Home	Built between 1970-1994	Built since 1994
Size of Home	Smaller homes (<1000 sqft)	Larger homes (>1000 sqft)
Type of AC System	Evaporative Coolers	Room AC
Age of AC System	--	--
Heating Fuel	Natural Gas	Propane
Age of Heating System	> 20 years	< 20 years
Type of Heating System	Gas Furnace	Propane Furnace, Gas Wall Units, Heat Pumps
Water Heating Fuel	Natural Gas	--
Age of Water Heater	--	--
Pay for Hot Water	Yes	No
Foundation Type	Slab, crawl space	Above-ground floor dwelling units
Ceiling Type	Flat with attic space	Vaulted or flat with no attic space
Duct Systems	--	--
Window Type	--	--
Energy Use Characteristics		
Type of Energy Service	Use gas for major end-uses and appliances, combined electric and gas service	Electric only
Electricity Usage	--	--
Gas Usage	> 500 therms/year, high above-baseline gas use (winter)	--

However, targeting low income households in Sacramento County will obviously need to be coordinated with the local municipal utility, SMUD. If PG&E is already working very closely with SMUD and the local agencies to provide coordinated services, then is an apparent need to expand this effort. If, on the other hand, it has been difficult for PG&E, SMUD and the local agencies to coordinate the delivery of services in this area, then there appears to be a missed opportunity here.

Taking another look at specific climate zones and counties, we found that low income households who live in the counties of Butte and Yuba (climate zone 11, Central Valley) and Los Angeles and Orange (climate zone 6/South Inland, and 9/South Coast) are statistically more likely to be in the less promising segment. This result is consistent with some of the demographic and other characteristics of low income households in the less promising segment, as discussed in the next section, which are common characteristics of low income households from these counties.

Demographic Characteristics. As shown in Table 7-2, key demographic characteristics of low income households in the most promising segment – e.g., Hispanic households, larger families (5+ members), and households with limited educational backgrounds – are consistent with the characteristics of low income households that are already participating in the programs, as discussed above in Section 7.1.1. This means that efforts to expand the programs to the more promising areas will likely be just as successful with little modification to the existing outreach and delivery channels.

In addition, the results of the segmentation analysis also indicate that households with disabilities and African-American households demonstrate significant need for the programs' services, and would be willing and relatively straightforward to recruit. It is true that these households are also very well represented among the current population of participants, but not statistically more significantly than other types of low income households. Therefore, if the programs expand their efforts to target these key groups, they will reach those with the greatest need, interest and accessibility.

As mentioned above, some of the key demographic characteristics of low income households in the less promising segment are consistent with the underlying characteristics of households living in the counties also represented in this segment. For example, low income households found in the less promising segment tend to White, comprised of "young adults" only (age 18-34), have higher educations, and live in relatively larger and/or newer homes. They also tend to use electricity and/or propane for major end-uses and appliances (see discussion below). These characteristics are entirely consistent with the demographic and housing characteristics of low income households living in the counties of Butte and Yuba.

In addition, the less promising segment is also comprised of low income households that tend to be Asian, live in large multi-family buildings (5 or more units), do not pay for hot water, and/or occupy above-ground dwelling units with no foundation and vaulted/flat ceilings with no attic space). This is consistent

with the demographic and housing characteristics of low income households living in some of the areas in Los Angeles and northern Orange Counties (climate zones 6 and 9).

Housing Characteristics. As shown in Table 7-2, and discussed somewhat above, many of the housing characteristics exhibited by low income households in the most and less promising segment are consistent with the opportunities (or lack of) for energy saving and other program benefits. For example, in the most promising segment, we find more low income households who live in relatively small, older dwelling units (but not the oldest). Natural gas usage is even more common among the most promising segment, and is used for space heating, water heating and other major appliances. As a result, this segment exhibits relatively high annual natural gas consumption (>500 therms per year) and relatively high above-baseline natural gas consumption during the winter months. This segment is more likely to be comprised of dwelling units that are equipped with relatively old heating systems (over 20 years) and evaporative coolers, and configured such that foundation and ceiling insulation measures might be applicable. These factors certainly contribute to the relatively high energy savings potential that is part of the underlying definition for this segment.

Similarly, the housing characteristics exhibited by the less promising segment confirm the lack of energy savings benefits that defines this segment. As mentioned above, low income dwelling units in this segment are often part of larger, multi-family complexes and are often located above-ground with little opportunity for foundation or ceiling insulation measures. These dwelling units are often provided electric-only service from one utility; room air conditioners and heat pumps are more common among this segment. In addition, low income households in this segment more often use propane for heating end-uses, non-electric end-use equipment (e.g., hot air furnaces, wall units). None of this equipment is older than or in worse condition that the average low income household and low income households in this segment are no more significantly burdened by high energy costs than the average low income household. Therefore, it is easy to see how these housing and energy use characteristics combine to produce little opportunity for energy savings benefits for this less promising segment.

Energy-Related Needs and Benefits. Table 7-3 shows the characteristics of both the most and less promising segments in terms of need for energy efficiency measures, energy savings potential, and other non-energy benefits. As shown, and by definition, the most promising segment exhibits a greater need for more comprehensive energy efficiency measures – air conditioning equipment repair, maintenance and replacement; water heater tank and pipe insulation; wall insulation, repair and weatherstripping; ceiling insulation, repair, ventilation, caulking and weatherstripping; door repairs and weatherstripping; window repairs and weatherstripping; refrigerator replacements; and CFL porch light installations. By contrast, the less promising segment is not likely to need many of the measures in this comprehensive list; in fact, the only measure that this segment was more likely to need is CFLs and, interestingly, more low income households in this segment already have between one and three CFLs installed, so the opportunity to delivery even this relatively low-impact measure is limited.

Table 7-3
Summary of the Need for Energy Efficiency Measures, Willingness to Participate, and Accessibility Characteristics in "Most" and "Less" Promising Segments

	Most Promising Segment	Least Promising Segment
Need for Energy Efficiency Measures		
AC Measures	Equipment repair, maintenance and replacement	
Heating System Measures	--	--
Water Heating Measures	Water heater tank and pipe insulation	
Wall Measures	Added insulation, repair, weatherstripping	
Ceiling Measures	Insulation, repair, ventilation, caulking and weatherstripping	
Door Measures	Repair, weatherstripping	
Window Measures	Repair, replacement, weatherstripping	
Appliance Measures	Refrigerators, CFL porch lights	CFLs
Energy Savings Potential		
Electricity	High	Low
Gas	High	Low
Other Benefits		
Energy Burden	> 5%	<2.5%
Energy Insecurity	In Crisis	Secure
Reduced Hardship	Comfort, health	Safety, security
Willingness to Participate and Barriers to Participation		
Willingness to Participate	Aware of CARE, willing to participate in CARE and LIEE, participate in other public assistance programs	Not very willing to participate in CARE
Barriers to Participation	Process	Income documentation, welfare stigma
Accessibility		
Outreach Channels	Utility bills, non-English media (TV, radio, newspaper), local/community newspaper, word-of-mouth	Internet
Delivery Channels	Community-based organizations	--

Again, by definition, low income households in the most promising segment (as compared to the less promising segment) spend a greater portion of their total household income on energy, are considered "in crisis" from an energy insecurity perspective, and have greater concerns related to comfort and safety. Less promising segments are defined as generally "secure" in terms of their ability to manage their household's energy bills, perhaps as a direct result of their relatively lower overall energy burden, and are more concerned about the safety and security of their home than they are about the condition of their home as it relates to comfort and health issues.

Willingness and Barriers to Participation. Table 7-3 also shows some of the other characteristics that were used to define the most and less promising segment, including willingness and barriers to participation. As shown, the most promising segment is very willing to participate in the programs, and has participated in other types of public assistance programs. Many are already aware of at least the CARE Program. Given that awareness is not a significant barrier for this group, there appears to be a real (not just perceived) barrier related to the application process. Many of these households agreed with statements like, "The application forms are confusing," "It's difficult to apply for the programs," and "It takes too long to get services from most programs." The program will need to overcome these barriers in order to encourage participation from this most promising segment. Recent changes put into place for the Winter Initiative (e.g., qualification based on neighborhood, automatic enrollment in LIEE if eligible for CARE, etc.) should help reduce the participation process barriers.

Less promising households, by definition, are not very willing to participate in at least the CARE Program and exhibit barriers that may be difficult for the program to overcome. First, the "welfare stigma" barrier – which essentially stems from agreement with statements such as, "Someone in my household is against participating in programs like these," "I'd be embarrassed if people knew I was participating in these types of programs," and "Other people need these programs more than me" – is probably not something the program can do much about. It is important to make sure all households who are eligible for the programs are aware of them and provide a compelling description of the benefits households can expect to receive from participation. However, beyond that, the program – and the needs of other low income households who are more interested in and have greater opportunity for benefit – is better served by not pushing to have these households enrolled.

In addition, low income households in the less promising segment have expressed reluctance to participate because of the verification requirement related to household income. These households generally were in agreement with the statement "It's difficult to get papers to prove my income," and/or they reported that they would be "not at all willing" to participate in the programs if they were required to provide income documentation. There could be some underlying fear or distrust issues behind these statements, in which case there won't be much the programs can do to overcome these feelings. But there

could also be (and likely are) misunderstandings about what exactly is required – e.g., for CARE, low income households simply need to self-certify and only a portion will be verified at a later date; for LIEE, low income households only need to show the income documentation to outreach specialists but do not have to "hand-over" any of these documents to the utilities. Beyond making these requirements as clear as possible, and putting in place streamlined processes to minimize the hassles involved, there may not be much more that can be done to overcome this type of barrier. As long as there is a step that requires a household to prove his/her household income, the programs are not likely to be successful in enrolling low income households who feel this strongly about it. Nevertheless the Commission should encourage the utilities to investigate creative ways to make this process as painless as possible.

Outreach and Delivery Channels. Finally, we see from Table 7-3 that low income households in the most promising segment often access the types of outreach and delivery channels used by the program to recruit participants – e.g., these households frequently read their utility bill inserts and local/community newspapers, they frequently access non-English media sources, and they often seek out information about bill payment assistance and energy conservation programs through community-based organizations and "word of mouth" channels. As mentioned above, the program would not need to modify its existing outreach and delivery channels in order to encourage greater participation from the most promising segment.

The less promising segment, on the other hand, rarely accesses the same types of outreach and delivery channels as used by the programs. They rarely read their utility bills and do not engage in local or community-based events. As such, it is not surprising that they are not particularly aware of at least the CARE Program.

7.2 Recommendations

This section presents a concise summary for effectively reaching and serving the needs of low income households with the CARE and LIEE Programs. Our recommendations are organized around three central themes:

- Establishing an optimal CARE Program penetration target,
- Determining the optimal LIEE Program design, and
- Achieving optimal program delivery through targeted outreach that addresses the unique characteristics and needs of California's low income population.

Additional recommendations on program tracking needs, methods for updating population and penetration estimates over time, and methods for updating energy savings potential estimates over time are provided in Section 8.

7.2.1 Establishing an Optimal CARE Program Penetration Target

When this study was initially designed, the utilities were operating under a goal set forth by the Commission to achieve 100% CARE Program penetration. At year-end 2003, we estimated that the utilities had achieved over 70% penetration and one utility (SCE) had reached 88% penetration. Since that time, the program has changed its eligibility standards to increase the total number of low income households eligible for both CARE and LIEE. Using these new criteria, the utilities are now reporting penetration estimates of: 61% (PG&E), 73% (SCE), 65% (SCG), and 57% (SDG&E).

This study was designed to help determine at what point the optimal CARE Program penetration can be declared "achieved." In the preceding sections, we have presented results that suggest that this optimal level cannot be determined based on only on estimates of how many households are eligible and how many households are participating. We can conclude this for three primary reasons:

- There are segments of the low income population who are currently enrolled in CARE but not necessarily obtaining significant benefits – nearly one in every five low income household in the state is currently enrolled in CARE but experiences very low energy burden (spends less than 5% of their total household income on energy) and/or is not "In Crisis" or "Vulnerable" according to the energy insecurity scale. While many of these households receive benefits from CARE that they truly need, spending limited program resources on these households may not be entirely optimal.
- And, there are segments who are eligible for the CARE Program and not currently enrolled, but for whom the program would provide insignificant benefit. Again, efforts to try to enroll these

households may not be entirely optimal given that penetration levels are already quite high and these households will be difficult (and expensive) to locate. The results from this study indicate that these households are not necessarily geographically clustered in ways that make them easy to identify and reach efficiently. We estimate that approximately 20% of all low income households in the state might fall into this category.

- Finally, there are still other segments who may or may not benefit from the program but do not want to participate. They do not participate in other types of public assistance programs, and they feel there are barriers to participating in CARE that the programs cannot possibly overcome. Using the information collected through the onsite survey, we estimated that 10% of all low income households would be unwilling or unlikely to participate in CARE.

Thus, a conservative starting point for the optimal CARE Program penetration would be 90%. This varies by utility: PG&E – 92%, SCE – 92%, SCG – 82%, and SDG&E – 91%. This is the percentage of the low income population that is eligible for, would be interested in, and would likely benefit from participation.

If we also consider that it may not be optimal to have low income households enrolled in CARE for whom significant need or benefit can be demonstrated, this would produce a starting point for the optimal CARE Program penetration of 86% (or, by utility, PG&E – 86%, SCE – 95%, SCG – 76%, and SDG&E – 85%).

We recommend that the Commission modify its existing 100% penetration goal. Given the results presented above, it just does not seem reasonable. Plus, getting anywhere close to 100% might be easier for some utilities than for others (e.g., SCE v. SCG) but none of them are likely to achieve that target exactly. We recommend a target of 95% for SCE, 90% for PG&E and SDG&E, and a slightly lower target for SCG of 80%. The utilities should be encouraged to exceed these targets where possible.

7.2.2 Determining Optimal LIEE Program Design

As discussed in Section 6, the energy savings estimates developed in this study are conservative in that they reflect only measures that were determined to be "needed" by households. Older refrigerators and air conditioners that were in good working condition were not included in the savings potential estimates and CFL installations were capped at four per household. Expansion of the measure base to include more CFLs per home and replacement of all refrigerators and air conditioners over 10 years old could triple the potential estimates. However, given that program funds are limited each year, including these measures might possibly mean that fewer dwellings will be treated unless the Commission increases the utilities' LIEE Program budgets.

Nevertheless, important measures for the LIEE Program looking forward will continue to be CFLs, refrigerators, air conditioners, ceiling insulation, and water heating measures. The utilities should be

required to monitor savings from the refrigerator replacement measure as the stock of older, less-efficient units is depleted, thus reducing the per-unit savings of future replacements. Also, increasing the number of CFLs installed in each home may lead to increased savings, but declines in per-unit savings are likely as measures are installed in lower-usage fixtures.

In the interest of establishing an optimal LIEE Program design, the Commission should encourage the utilities to "think out of the box" and develop creative and cost-effective ways to deliver greater and more immediate energy savings benefits to low income households at lower costs. This is important because the needs assessment has shown only a small portion of low income households are in need of comprehensive, energy efficiency upgrades and most, in fact, on average, all low income households have an immediate need for relatively low-cost (low impact) measures. For example, there are a lot of low income dwelling units with little need for measures other than low-cost items such as CFLs, CFL porch lights, low-flow showerheads, etc.

Currently, the programs go to considerable expense qualifying these leads, installing a few items, and then essentially walking away with little benefit for both the program and, ultimately, the participating household. Essentially, the process used to identify and qualify households who only have a need for a few of these low cost items is that same as that which is used to identify and qualify households who have much more significant needs (e.g., new heating or cooling systems, major weatherization, insulation and home repairs, etc.).

While in densely populated, urban areas, or other areas with a high concentration of low income households, it may not matter that this process is the same. Some type of canvassing ("door to door" or neighborhood blitz) approach is the most appropriate way to identify eligible households and screen for feasible measures. However, in less densely populated areas, areas where there are not a lot of low income households per square mile, and (especially) the most remote areas, it can be incredibly costly to serve households using the same process as in other areas.

In the spirit of trying to establish an optimal LIEE Program design – which presumably would be to provide immediate energy savings benefits to as many low income households as possible at the lowest possible cost – the Commission must encourage the utilities to find better, more efficient and less expensive ways to deliver energy saving measures so that the limited resources available for the programs can be spent providing more immediate and comprehensive treatment to the much smaller segment of the low income population who needs it and will benefit from it.

As mentioned above, the need for CFL measures is very high – almost all low income households would benefit from at least one CFL installation. An alternative approach to delivering CFLs could be something as simple as a direct mail campaign. For example, the utilities could mail a letter to all CARE participants (or, in areas with high low income incidence, all households in a given zip code or other such designation) and request that the household fill out a short survey (application) to see if they qualify for additional

services. All household receiving the letter will be sent a CFL if they mail back the survey within a reasonable timeframe. The message in the letter might tie in the benefits of energy efficient exterior lighting (e.g., CFL porch lights), as safety and security is a common concern among many low income households.

This short survey would include, in addition to the needed household income/size information required for program qualification, a set of check boxes that could be used to easily identify energy saving opportunities in the home – e.g., do you have any porch lights or security lighting outside your home? does your house have an attic? how old is your main heating system? The questions and the survey itself need to be kept very simple if it is to be effective, and it will probably need to be in English and Spanish, with other languages printed and mailed to targeted areas. This type of short survey may sound too simple to be very useful, but even simple check boxes can provide enough basic information to program implementation staff for developing plans for follow-up visits.

This letter/survey could be sent to households enrolled in CARE to see if their home would benefit from LIEE measures, as well as sent to CARE non-participants in an attempt to sign them up for that program. If a household does not qualify based on income (for CARE or LIEE), they will still be mailed a CFL as a "thank you" for their interest in the programs. If they do qualify for CARE, they are immediately enrolled and then asked if they would be interested in meeting with a program implementation contractor to see what additional opportunities might exist.

A cost-effective verification strategy for the CFLs mailed to non-qualified customers would be to have the program implementation contractors visit these households within 1-3 months of having mailed the CFL to ensure it is installed and is being used. (This visit can be "batched" within the contractors' regular schedules to maintain efficiency.) If the household does not have more than 4 CFLs already, the contractor can install additional bulbs (up to 4 per home) and conduct a short survey to ensure there are no other eligible measures that could be installed. While onsite, the contractor can also install other simple, low-cost measures when they are needed (e.g., low flow showerheads, faucet aerators, etc.) and check the water heater set point to see if it can be lowered. If the household is already using a programmable thermostat, the contractor can verify that the programmable features are engaged. If they are not, the contractor should be trained to provide compelling and effective instruction to the household about how to use the thermostat properly and why it is important to do so. (See below for additional recommendations related to programmable thermostat measures.)

This approach, or something similar, could potentially reduce the costs associated with qualifying leads especially in rural areas and areas with few low income households per square mile. For one, each household who sends back a survey (application) gets a CFL, which (if installed) provides immediate energy savings benefits for very little cost. In addition, the "verification visits" are really pre-qualified visits to provide additional measures and verify any additional opportunities for follow-up. Also, this approach might be better than "cold calling" as it provides qualified leads from interested households (i.e., households that took the time to complete the survey and were interested in the CFL).

An alternative approach would be to simply mail each CARE participant, or all households within a targeted area defined by high low income incidence, a CFL as part of the survey packet. That way, even if the survey is not returned, the program delivered the measure to those who needed it and were likely eligible to receive it through the program. This approach has the advantage of creating an incentive for the household to complete the survey right from the start. In addition to providing this immediate benefit, this approach gives the household something they can "touch and feel" and shows them that even one light bulb can make a difference. This should be very motivating. This approach also demonstrates to them that the utilities know low income households need this type of measure, that they are committed to finding simple and easy ways to help meet their needs, and that they are not necessarily interested in verifying the household's income and/or requiring a home visit in order to provide them with this measure.

Of course, there are downsides to this approach (as with any approach like this, including the direct mail approach discussed above). For one, the utilities would not know if the household is truly eligible unless they mailed back the survey (application). This is particularly true for the more rural or "needle in the haystack" areas. In these areas, it might be more effective to require the completed survey prior to mailing the CFL. It is also possible that some portion of these households will not install the CFL, but many will.[15] In any case, it seems very likely that the disadvantages from these types of approaches do not outweigh the significant advantages of reduced program delivery costs and more immediate energy savings benefits.

We have developed another recommendation for improving the effectiveness of the current LIEE Program design. Essentially, there are many low income households that already have programmable thermostats installed and they are not currently using the programmable features. In fact, installing these measures today will not produce any benefit – to the program or to the end-user – if they were manually controlling their thermostat before the program installed a programmable device and they, essentially, continue to manually program it after. Even if a household manually sets their thermostat at reasonable temperature set points, there can still be energy savings benefits (not to mention potential demand response) benefits from a properly programmed thermostat that minimizes the impact from extreme

[15] Evaluations of alternative CFL program delivery methods indicate that somewhere between 70-80% of all CFLs delivered through direct mail and/or give away type campaigns are eventually installed.

patterns of "on/off" usage that are typical when thermostats – programmable or otherwise – are manually controlled.

The programs should consider developing a tailored educational campaign to improve the effectiveness of this measure. Since the need for greater education regarding the benefits of properly programmed thermostats is not unique to the low income population (i.e., the utilities are struggling with this problem across the entire residential, and to some extent the small commercial, sectors), there should be a coordinated effort to develop some type of training for installers, as well as educational collateral to leave behind with participating households. This material should also be mailed to households who recently received programmable thermostats through the program.

The educational component should be developed in cooperation with what other organizations, such as Energy Star, HVAC trade organizations, and programmable thermostat manufacturers, are doing to improve the energy savings benefits from these measures. In addition, this component of the program should be closely evaluated for its demand response potential. Programs such as SDG&E's Smart Thermostat pilot effort, as well as a similar program offered by SCE, have been evaluated to determine what the impacts can be achieved through remotely controlled thermostats. The CPUC might consider a pilot demand response thermostat program as part of LIEE to gather information to help determine its viability as a potential source for demand response impacts.

We have one final recommendation regarding establishing an optimal LIEE Program design. This recommendation addresses the way in which the utilities track information related to household-level participation and measure-level penetration over time. This study and prior evaluations of the LIEE Program have encountered difficulties related to tracking LIEE participation and measure penetration, which has limited the usefulness of the study and evaluation results.

For example, we were provided with a database containing LIEE participant records at the dwelling level for a five year period (1998-2003), and we were given measure-level information for the same period of time in report format (i.e., not in a database linked to the dwelling level records). As such, when we attempted to merge our survey database with the LIEE participant database, at best, we were only able to identify dwellings that had been treated through the program going back to 1998. This, combined with the fact that many households in our sample did not match back to the LIEE participant database, limited the way in which we could use LIEE participation information in the needs assessment analysis. Unlike CARE, where the majority of households are already enrolled and know that they are, many of the households in our sample may not know if their dwelling had been recently or not so recently treated through the LIEE Program. Without reliable information from the utilities, going back at least 10 years, we were limited in how we could use the LIEE participation data in the needs assessment analysis.

In addition, we were not provided LIEE measure-level participation information in database format that we could link to our survey database. We were essentially given measure counts by year, which we asked

for and used to develop estimates of energy savings potential (as discussed in Section 6). We knew that the utilities probably did not have complete and consistent databases of measure-level participation information that went back as far as 1998. Even if they had the information, it probably was not all in the same place or format[16], and the expense of having to identify, collect, evaluate, and integrate it into our analysis would have been extreme. Also, because we completed a detailed energy audit for each household in our sample, we already had all of the information we needed to develop an independent estimate of measure penetration.

However, it unreasonable to expect that this type of comprehensive, onsite survey will be completed each year to provide the information needed to track measure penetration over time. It is also unreasonable to expect that, each year, program evaluators will be able to complete this type of comprehensive survey so that they have an understanding of the baseline conditions and existing measure penetration levels. Without accurate and up-to-date baseline information, it is impossible to predict the true impact of the program and the anticipated savings participants are likely to realize on their bills.

In essence, the utilities need to be required to track detailed information about measure installations, that can be easily linked to participation information for the dwelling unit and that can be set up to maintain this link over time. This does not seem like an unreasonable recommendation and we believe, to some extent, the utilities are in the process of trying to improve their capabilities in this area.

However, this may not be enough. Additional systems need to be developed to track dwelling-level and measure-level information between and among the utilities providing the program services.[17] Because there is currently no way to completely account for participation at the dwelling level in areas where utilities overlap, there is no way to completely assess the comprehensiveness and equity of treatment provided to dwellings located in these overlap areas. This makes tracking dwelling-level treatment across utilities challenging in a given program year but even more so over time as utilities have provided (and will likely to continue to offer) different levels of program service with different program requirements from one year to the next.

SCE and SCG have been doing some work in this area (e.g., requiring that both SCE and SCG account numbers are collected during enrollment and then maintained in each utilities' databases so that the two could be linked). However, we do not know how effective this change has been in improving the

[16] For example, recent evaluations of the LIEE Program have had difficulties assembling complete measure-level information, even for just one (recent) year's worth of program data. Often, information related to measure installations is kept in separate databases, in different formats, and managed by different individuals at the utility. The evaluators may not know that the data they have been given is incomplete (e.g., missing records), or that there might have been better information available that they could have asked for had they known it existed.

[17] Ideally, these systems would also include the major municipal utilities, i.e., LADWP and SMUD, as well other significant providers of comparable services, i.e., LIHEAP agencies. While the Commission does not have jurisdiction over these entities, they should be brought to the table when discussing the system requirements and strongly encouraged to provide data extracts that could be integrated into the system once developed.

completeness and quality of information available for participants in these two utilities' programs. And, we do not believe any effort has been undertaken by the utilities to account for similar issues in other overlap areas.

Therefore, we strongly recommend that the Commission require the utilities to, at a minimum, improve and expand these practices. In addition, we suggest that the Commission needs to be more diligent in collecting similar information from the other utilities (e.g., SMJUs, municipal utilities) toward the end of developing a uniform, statewide tracking database.

While not a program design issue, *per se*, these recommendations are offered to allow the Commission to better monitor program design over time so that mid-course modifications can more easily be made with the best available information. In addition, these recommendations are made to improve the Commission's ability to ensure/verify that comprehensive and equitable treatment is provided to all low income households throughout the state. Finally, these recommendations are provided to assist future program evaluators in their efforts to fully understand and determine the true potential for energy efficiency that these programs should be expected to achieve over time.

7.2.3 Addressing the Unique Needs and Characteristics of California's Low Income Population

The preceding sections have provided recommendations for achieving the optimal program penetration targets for CARE, as well as the optimal program design for LIEE. This section presents recommendations for achieving the optimal delivery for both programs through targeted outreach that addresses the unique characteristics and needs of California's low income population.

Generally, the results of the needs assessment suggest that the programs have effectively targeted and provided services to low income households that have the greatest need. The outreach and delivery channels have been effective in addressing the wide range of characteristics exhibited in the population. There are few, if any, geographic or demographic groups that have been missed or overlooked. And, participation does not appear to be over-extended to one particular group.

Nevertheless, we offer the following recommendations for ensuring that, going forward, the programs continue to successfully address the needs of low income households for whom the programs would provide the greatest benefit.

"Keep up the good work!" and continue to actively recruit and enroll households in areas were the programs have already had success. This results of the segmentation analysis indicate that many of the non-participating low income households that hold great promise for the programs going forward exhibit the same (or similar) characteristics as those households who have already or are currently participating (e.g., Hispanic households, larger families, and households with limited educational backgrounds). The programs, should continue – and aggressively expand – its efforts to target these types of low income households as they represent those with the greatest need and interest in participating.

In addition, efforts to increase penetration within these demographic groups should require little modification to the existing outreach and delivery channels. The programs have been successful in reaching low income households through channels they frequently access and, potentially, even more effective at engaging local resources to more cost-effectively reach and deliver program services. The utilities should continue to use bill inserts and other direct mail efforts to encourage participation in the program, and continue to promote the programs via non-English media sources (e.g., TV, radio and/or newspapers written in non-English languages). The utilities should be credited for and encouraged to continue their work with local, community-based organizations and government agencies to cost-effectively generate qualified and quality leads for the programs.

Expand efforts to target households with special needs and African-American households. The results of the segmentation analysis indicate that households with disabilities and African-American households demonstrate significant need for the programs' services, and would be willing and relatively

straightforward to recruit. However, participation from these segments appears to be lagging behind need and, as such, more aggressive efforts to target these important groups should be pursued.

Ensure program penetration targets are in line with the opportunities on a local level. The segmentation analysis points to specific characteristics of low income households that are not likely to result in high levels of participation. For example, the "less promising" segment includes White households, "young adult" households (age 18-34), highly educated households, and households who live in relatively larger and/or newer homes. These households also tend to use propane for major end-uses and appliances. In addition, the less promising segment is also comprised of low income households that tend to be Asian, live in large multi-family buildings (5 or more units), do not pay for hot water, and/or occupy above-ground dwelling units with no foundation and vaulted/flat ceilings with no attic space).

These first set of characteristics appears to be consistent with the underlying demographic and housing characteristics of low income households living in the counties of Butte and Yuba, while this second set is similar to many of the demographic and housing characteristics of low income households living in some of the areas of southern Los Angeles and northern Orange Counties (climate zones 6 and 9).

This is not meant to imply that the program should avoid the Butte and Yuba Counties, or the relevant areas of Los Angeles and Orange Counties. It just means that the programs should probably not be expected to achieve very high levels of penetration from these areas (or other areas with similar demographic, housing and energy use characteristics) given the lack of opportunity, barriers to participate, and limits to accessibility.

Develop creative efforts to increase participation in remote areas and "needle in the haystack" areas. Other than where they live and how difficult (expensive) it would be to find them, we do not see any unique characteristics in these households that would indicate they are not interested in participating or would not benefit from the programs' services. However, the existing outreach and delivery efforts do not appear to have been as effective in these areas. We recommend the Commission work the utilities, local governments, and the relevant community-based organizations to develop creative and cost-effective channels through which locate eligible households from these areas.

More aggressive strategies are needed to achieve higher penetration in areas where there do not appear to any unique challenges to expanding participation. The example of San Diego County (climate zone 7, in particular) was mentioned above. Since we did not see any obvious differences in the underlying characteristics of the low income population in this county or climate zone, we cannot explain why participation is lagging. This is not meant to be a criticism of the efforts undertaken to encourage participation in this county (or others with similar percentages). Rather, we are suggesting that more aggressive efforts and strategies are likely to be successful in achieving higher penetration.

Recognize and encourage increased participation from large-sized families. These households have limited household resources (which are stretched across many household members) and other important burdens and responsibilities (e.g., caring for elderly family members, raising children). As such, the programs should be credited for the efforts to assist these families and continue to find new and innovative ways to serve these important members of the low income population.

The programs should not expand efforts to enroll low income households comprised of young adults (i.e., aged 18 and 34). The segmentation results suggest that types of households do not hold much promise in terms of willingness to participate. There also tend to be very limited energy efficiency opportunities in the dwellings they tend to occupy. Of course, this is not true for all households in this category. But reaching those that are interested or have greater need will require different strategies for outreach and delivery, as these households very rarely access the types of channels currently being used to promote the programs. A possible avenue for reaching these households might be via email campaigns or through the utility's website, as these households frequently access the Internet (i.e., more than twice per day).

Efforts to increase participation through methods like auto-enrollment will not provide dramatic increases in program penetration, but should be encouraged nonetheless. Many CARE and LIEE participants are already participating in other public assistance programs, such as MediCal, Healthy Families, etc., and vice versa. As such, auto-enrollment efforts are not likely to create significant increases in program participation from either perspective. Nevertheless, the programs should continue to leverage these channels to cost-effectively identify low income households who have a need for – and have already demonstrated a willingness to accept – the types of assistance and services provided by these programs.

Work closely with the municipal utilities and SMJUs in all areas where there is overlap to ensure the needs of low income households living these areas are being met. The segmentation results suggest that there is room to expand participation in areas served by more than one utility. For example, low income households living in the Sacramento County area stand out in the "most promising" segment as a group that is potentially being missed or overlooked. The Commission should require PG&E to document how it works with SMUD and other local agencies to provide coordinated services to low income households in this area. PG&E should make recommendations for how it plans to overcome difficulties (if any) it may have experienced to-date. The Commission should require PG&E to expand its efforts to coordinate with SMUD and other local agencies and provide a report on its progress.

While the example of Sacramento County was obvious from the segmentation results, the Commission should use this evidence to look for similar coordination issues in other overlap areas. We recommend that the Commission require each IOU and SMJU to provide the type of documentation described above for PG&E and, if warranted, direct these utilities to expand its efforts to coordinate with municipal

utilities providing energy (and other utility) services to a large portion of the low income population in the affected region.

Continue to target housing characteristics for which the LIEE Program can provide the greatest benefit. The following features of low income housing should (continue to) be targeted as they represent the most substantial opportunity for energy savings through the LIEE Program:

- Older dwelling units (but not the oldest), built between 1970 and 1994
- Natural gas usage for space heating, water heating and other major appliances.
- High annual natural gas consumption (>500 therms per year) and relatively high above-baseline natural gas consumption during the winter months.
- Old heating systems (over 20 years).
- Evaporative coolers.
- Configurations that would allow for foundation and/or ceiling improvement measures (e.g., basement or crawl space foundations, vaulted or sloped ceilings with attic space).

Low income housing with these characteristics tends to exhibit a greater need for more comprehensive energy efficiency measures, including air conditioning improvement measures, water heating efficiency upgrades, building shell efficiency improvements and repairs, refrigerators replacements, and CFL porch light installations.

Low income housing configurations that hold less promise for providing benefits through LIEE include larger, multi-family complexes (which provide little opportunity for foundation or ceiling insulation measures), and housing that is equipped with propane for heating end-uses (e.g., hot air furnaces, wall units). The only measure needed by low income households from this less promising group was CFLs, although most already at least one CFL installed which limits the available opportunity in these housing units even further.

Use annual energy consumption metrics, as well as seasonal and above-baseline benchmarks, to develop targeted marketing lists for CARE and LIEE recruitment efforts. There are many low income households who are not currently enrolled in CARE that use considerably higher amounts of energy (both electricity and natural gas). These non-participating households also exhibit high seasonal (winter and summer) and above-baseline consumption patterns. The utilities should use the results of the needs assessment to develop the appropriate criteria for these metrics (e.g., above 1,500 kWh during the winter months), and then develop recruitment lists to proactively target non-participating households who

meet these criteria. The Commission should require the utilities to report how many households are participating that meet or exceed these criteria.

Improved program application processes may be required to encourage increased participation from the most promising segment. Many non-participating households for which CARE and LIEE hold great promising going forward are already aware that the programs exist. Within this group, there appears to be a real (not just perceived) barrier related to the application process. Many of these households feel the applications are confusing, that it is difficult to apply, and that it takes too long to get the services from these types of programs. The Commission should review the success the utilities have been having with some of the application processing changes initiated through the 2005-2006 Winter Initiative (e.g., qualification based on neighborhood, automatic enrollment in LIEE if eligible for CARE, etc.). Areas with the greatest success should be expanded.

Some barriers simply cannot be overcome and resources may be better spent elsewhere. The programs should make every effort to make sure all households who are eligible for these programs are aware of them, that they clearly understand what is and is not required of them to qualify, and they understand how and why they are being asked to participate. If they are still unwilling to comply with the requirements and/or are otherwise not interested in participating, then the program outreach specialists should move on as it is likely that there are others who would be better served.

Consider energy insecurity, as well as energy burden, as key factors in determining whether or not CARE and LIEE are meeting the needs of California's low income population. CARE is designed to have a direct, measurable impact on customers' energy bills by providing a 20% rate discount and shielding participants from higher-tiered rates. In addition, the LIEE program provides energy saving measures that, on average, can reduce the customers' bill by 5-10%. As such, we would expect that energy burden should be lower for households currently enrolled in CARE and for those who have participated in LIEE. The needs assessment has shown this result. But, we do not know if CARE and/or LIEE has brought about this result, or if these households are in reality generally less burdened than non-participants.

In addition, we should also expect to see that participation in CARE (and to some extent LIEE) has had an impact on energy insecurity. That is, we would like to think that the monthly bill discounts and payment assistance has helped participating households better meet their basic energy needs, manage energy payments, and reduce service disconnections. However, the results of the needs assessment show that, in fact, CARE participants are more energy insecure than non-participants.

While it is important to report these results, we do not mean to suggest that CARE and LIEE have been ineffective because its participants exhibit lower energy burden and higher energy insecurity than non-participants. Instead, we have interpreted these results somewhat differently. First, the programs have

been very successful in enrolling low income households that are often “vulnerable” or “in crisis” and, without the programs, their situations would likely be much worse. Also, we should recognize that the benefits from the programs alone may not be enough to eliminate energy insecurity altogether, especially in light of the constraints faced by low income households each month as they try to manage limited resources.

Therefore, we recommend that energy burden and energy insecurity continue to be used to measure the effectiveness of the programs. And, we conclude based on the results of the needs assessment that both CARE and LIEE are providing benefits that are in line with the needs of California’s low income population.

8. Tracking Potential and Penetration Over Time

This section discusses the methods developed as part of this study to update eligible population estimates and track energy savings potential over time. Specifically, we developed methods for determining the following:

- Number of eligible households for the CARE and LIEE Programs
- Penetration of the CARE and LIEE Programs
- Number of eligible households for the CARE and LIEE Programs by age and ethnicity
- Penetration of the CARE and LIEE Programs by age and ethnicity
- Energy savings potential for the LIEE Program

8.1 Updating Program Population and Penetration Estimates

Methods for tracking the number of eligible CARE and LIEE households and the overall program penetration are relatively straightforward and are similar to the method developed in this study for 2003 estimates. Census records and commercial databases that are linked to the Census can be used to develop estimates of the eligible population as of a given reporting date. To the extent that prior participation is a factor in eligibility (i.e., LIEE), data on households previously served will also need to be accounted for. Estimates of the eligible population in a given year can be compared with program participation levels to determine annual in that year or cumulative penetration over time.

Determining program eligibility by age and ethnicity can easily be developed from the same sources used to track the overall eligible population. However, estimation of penetration by these factors can only be accomplished if comparable data is collected for participants. There are a number of different options for tracking this information:

- Enrollment Forms – Currently, CARE application forms do not capture demographic data on age and ethnicity for all enrolled customers. However, information on age and ethnicity could be collected by some of the utilities as part of the LIEE Program intake process. To track penetration among these important demographic groups, the utilities could be required to collect and report CARE and LIEE Program participation by age and ethnicity. (However, the Commission currently does not allow the utilities to collect ethnicity information during the application process.)

- Surveys of Participants – Estimates of participation among important demographic groups can be determined through periodic surveys. However, methods used to collect this information will need to account for any non-response bias especially among the demographic groups of interest (e.g., elderly, non-English speaking households).

- Geographic Analysis – Using the Special Tabulations of Census data purchased for this study, one could track the program participation rates for representative areas. By identifying and tracking program participation for areas populated by groups with low participation rates, one could assess progress without requiring further information from program participants.

Each of the options has both strengths and limitations. Expansion of the intake form would furnish the most reliable information, but it would be costly to implement such a system for the large number of program participants. A mail survey would be relatively inexpensive and could be expected to yield reasonable response rates. However, survey nonresponse might lead to questions of data validity. Geographic analysis would be informative, but only where the customers with program participation barriers are geographically clustered.

Among the available options, we recommend that the utilities use the mail survey to gather information about program participants. By using effective mail survey procedures, they should be able to achieve at least a 50% response rate for the survey. That should effectively minimize non-response bias.

Geographic analysis may be useful when program participation barriers appear to be related to neighborhood characteristics and/or when localized intervention strategies are employed to raise program participation rates. However, it does not appear to be an effective overall strategy for tracking the demographic dimensions of program participation.

8.2 Updating Energy Savings Potential Estimates

In Section 6, we presented estimates of future energy savings potential for the LIEE Program developed based on our estimates of the current potential. This analysis incorporates the "steady state" assumption that the total eligible and applicable population is stable over time. For tracking the savings potential over time, however, changes in the eligible population such as changes in housing stock and key demographics must be taken into account.

8.2.1 Accounting for Changes in Eligible Housing Stock

Changes to the housing stock of the eligible population can occur for several reasons:

- Dwelling units occupied by eligible households are demolished.
- Dwelling units are added to the eligible population due to households moving into a dwelling unit where the previous occupants were not eligible, or moving into a new dwelling unit.
- Dwelling units are removed from (or added to) the population because their occupants change from being eligible to being ineligible (or vice versa).

It is not practical to model the magnitudes and associated effects of each of these types of transitions. Instead, we focus on the net change in the number of eligible housing units. We assume that units moving in and out of the eligible population need each measure in the same proportion as would existing eligible units in the absence of the program. This assumption makes sense for units moving into the eligible population: these units can reasonably be assumed not to have been affected by the program, but to have similar characteristics otherwise.

For units moving out of the eligible population, some fraction of these units have been treated by the program. Thus, the need of the exiting units is that of the existing units with the program in place. Assuming, as we do, that their need corresponds to no program presence essentially ignores the fact that they take program accomplishments with them when they go. This simplification is needed because we do not know the numbers entering and leaving the eligible population each year, only the net change. The simplification introduces only a small error, unless the rate of removals from the eligible population is high, and/or the program accomplishment is substantial relative to the need in the absence of the program.

8.2.2 Overall Savings Potential Estimate

For the purposes of on-going tracking, energy savings potential in each successive year of the LIEE Program is estimated from current and prior-year information as:

$$
\begin{aligned}
\textit{Savings Potential}_t = \quad & [\textit{Savings Potential}]_{t-1} \\
& + (1/m)[\textit{Savings from Applicable Measures in Place}]_{t-1} \\
& - [\textit{Savings from Naturally Occurring Energy Efficiency in Existing Eligible Population}] \\
& - [\textit{Program-Related Savings}]_t \\
& + ([\textit{Eligible population}]_t - [\textit{Eligible population}]_{t-1}) \\
& \qquad x\ (\textit{Applicability})\ x\ (\textit{Availability})\ x\ (\textit{Need in absence of program})_{t-1.}
\end{aligned}
$$

We recommend that the formula be applied separately by dwelling unit type, with results then summed over dwelling unit types. Within a dwelling unit type, it is reasonable to assume that the applicability and availability of each measure will be the same in future years as has been determined in this study. This is likely to hold unless and until there are major shifts in the composition of the eligible population.

8.2.3 Tracking Savings Potential by Population Subgroup

The method above can provide savings potential by dwelling unit type for each utility. An additional step is required to track savings potential by dimensions other than dwelling unit type. The additional step is to decompose each dwelling type's savings potential into the categories of interest. This decomposition is

based on the distribution of that category within each dwelling type, according to the most recent Census data. Savings by each category are then summed over dwelling types.

For example, suppose potential is to be estimated by race/ethnicity category. The 2000 Census data provides the proportion of each dwelling type occupied by each race/ethnicity category. For each dwelling type, the total savings potential determined above is then allocated to race/ethnicity groups in these proportions. Summing across dwelling types for each race/ethnicity group then gives the total savings potential for the group.

The proportion of different types of dwelling units occupied by each category of interest is not likely to change much over time between decennial Censuses. If there is reason to believe a major shift has occurred, the reliability of this approach would be reduced.