REPORT
ON THE ASSESSMENT OF
PROPOSED NEW PROGRAM YEAR 2006
LOW INCOME ENERGY EFFICIENCY PROGRAM
MEASURES

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April 25, 2005

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Introduction

1.1 Background

California Public Utilities Commission (Commission) Decision (D.) 03-11-020, issued on November 13, 2003, ruled that new measures would be considered for the Low Income Energy Efficiency (LIEE) Program during the PY2006 program planning cycle. An Assigned Commissioner's Ruling (ACR) dated October 1, 2004, directed the LIEE Standardization Team (Team) to develop and submit a Phase 5 work plan, project schedule and budget.[1] The Team submitted this work plan on October 15, 2004. An ACR dated October 22, 2004 adopted the Phase 5 work plan and directed the Team to institute the process for considering new energy efficiency measures for inclusion in the 2006 LIEE Program.

On December 17, 2004, the Team released a solicitation requesting proposals for energy efficiency measures that could be considered for inclusion in the 2006 LIEE Program. The deadline to submit proposals for new measures was by close of business, January 31, 2005. In accordance with Section 2.3 of the solicitation, the Team provided notice of the list of the proposed measures that were submitted by respondents and being evaluated by the Team.

In response to the solicitation, four (4) proposals were submitted. Some proposals suggested more than one measure, and some proposals overlapped. The measures covered by these proposals were as follows:

- ***High Efficiency Central Air Conditioners.*** This measure involved the replacement of existing central air conditioners with high efficiency (SEER 13) units.
- ***Central Air Conditioner and Heat Pump Maintenance.*** As proposed, maintenance entailed checking and correcting the refrigerant charge and airflow in central air conditioners and central heat pumps.

[1] The October 1st Ruling directed the Team to file the Phase 5 workplan by October 8, 2004. However, a subsequent extension was granted until October 15, 2004.

- ***Duct Testing and Sealing.*** This measure entailed testing duct leakage and, for systems with excess leakage, sealing both supply and return ducts in a way that would yield a reduction in leakage equal to 15% of system air flow.
- ***Compact Fluorescent Lamps (CFLs).*** While CFLs are already offered through the LIEE Program, this proposal was to establish a master purchase plan for obtaining CFLs offered through the Program.

On February 4, 2005, a notice informing interested parties of the list of proposed measures was sent to all parties in service list R.04-01-006 and posted on the Low Income Oversight Board (LIOB) website.

In accordance with the terms of the solicitation, the Team assessed the measures proposed by the respondents for inclusion to the LIEE Program by using a two-step process. The first step entailed prescreening and the second involved a formal cost-effectiveness analysis. The Team completed its evaluation of the proposed measures using cost-effectiveness criteria approved by the Commission. This report presents the Team's findings and summarizes its key recommendations. The Team presented these findings and recommendations at two public workshops—one on April 8 in San Francisco and another on April 15 in San Diego. Summaries of those workshops are provided in Appendix A.

1.2 Summary of Recommendations

Based on its analysis of the proposed measures, the Standardization Team makes the following recommendations:

- Offer high efficiency central air conditioning only in climate zones 14 and 15.
- Offer duct testing and sealing for single family homes and mobile homes with gas space heating in all climate zones. Offer the measure for homes with electric space heating in climate zones 10-16. Do not offer this measure for multi-family homes.
- Offer central air conditioning diagnostics (tune-ups) in all climate zones other than 1, 2, 3 and 5.

1.3 Preview of the Report

The remainder of this report is organized as follows:

- Section 2 provides an overview of the process used to evaluate the proposed new measures.

- Section 3 presents the assumptions used in the formal analysis of cost-effectiveness;
- Section 4 summarizes the results of the analysis and presents the Team's recommendations.
- Appendix A provides the workshop results.

2

Overview of the Evaluation Process

2.1 Overview

The Standardization Team assessed the measures proposed for addition to the LIEE Program using a two-step procedure. The first step entailed pre-screening, while the second involved formal cost-effectiveness analysis. These steps of the process are described below. The formal analysis of the cost-effectiveness of the proposed measures is described in Sections 3 and 4.

2.2 Prescreening

In its solicitation for new measure proposals, the Team pointed out that prescreening might be necessary for budgetary reasons, and reserved the right to limit the number of measures considered for the Program. As noted in the solicitation, prescreening could take into account a variety of factors, including the ease of installation of the measure, the adequacy of evidence with respect to the impacts and costs of the measure, and the use of the measure in other programs. It was not necessary to impose such screens in the course of the evaluation. However, one proposal—the proposal for a master purchasing plan for a specific brand of compact fluorescent lamps—was eliminated from further consideration. The rationale for excluding this proposal was twofold. First, the proposal involved a specific product brand of a general measure already offered by the program. In spite of any advantages or disadvantages this brand may have over other options, the Team did not feel that it was within its purview to make recommendations with respect to brands. Second, the proposal was for a purchase plan, and the Team did not feel that the new measure solicitation process was the appropriate place for the consideration of such a plan.

2.3 Formal Cost-Effectiveness Analysis

The Standardization Team evaluated the three remaining proposed measures using a framework developed jointly by the Team and the Reporting Requirements Manual Working Group.[1] The framework was filed with the Commission on March 28, 2002 and approved by the Commission in D.02-08-034.

The cost-effectiveness framework uses two benefit-cost tests: a Utility Cost Test and a Modified Participant Cost Test. Both tests compare benefits and costs (for the utility and the participant respectively). Costs include the purchase cost of the measure plus the labor cost to install it. Benefits include energy saved plus a variety of non-energy benefits (NEBs), including comfort, water savings, health benefits, and others. These NEBs were assigned dollar values by a previous study conducted for the RRM Working Group and were incorporated into an Excel workbook for application to the assessment of measures.[2] Energy savings are converted to dollar values differently for the two tests. In the Modified Participant Test, energy savings are converted to bill savings through the use of retail energy prices. In the case of the Utility Cost Test, energy savings are converted to reductions in the utility's cost of providing the energy. This involves using avoided costs to value energy savings.

The general test recommended by the Cost-Effectiveness Subcommittee and adopted by the Commission entails comparing each utility's measure-specific benefit-cost ratio to that particular utility's overall program benefit-cost ratio. Where the measure-specific benefit-cost ratio is at least as high as a particular individual IOU's overall program ratio (as calculated by either the Utility Cost Test and/or the Modified Participant Test), the measure is included in the Program.[3] Measures that are already in the Program must pass one or the other of these tests in order to be retained. New measures must pass both tests in order to be added.[4]

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1 *Final Report for LIEE Program and Measure Cost-effectiveness*, Submitted by the Cost-effectiveness Subcommittee of the RRM Working Group and Standardization Project Team, March 28, 2002. The report is downloadable from http://www.ligb.org/DOCS/Final%20LIEE%20CE%20Report%20V2.doc,

2 The study was conducted for the Working Group by TekMarket Works, SERA, Inc., and Megdal Associates in 2001. It was further modified by the Cost-Effectiveness Subcommittee of the RRM Working Group and the LIEE Standardization Team in 2002. The original study and workbook can be downloaded from http://www.calmac org. See TekMarket Works, *The Low Income Public Purpose Test (LIPPT)*, May 25, 2001.

3 In the event that an individual utility's overall program benefit-cost ratio is greater than one, a measure is deemed cost-effective if it also has a benefit-cost ratio greater than one.

4 Guidelines for deciding on program measures were described in CPUC Decision 02-08-034. The Decision is downloadable from http://www.cpuc.ca.gov/static/official+docs/index.htm.

For the purposes of evaluating proposed new measures, the Standardization Team used the overall Program benefit-cost ratios resulting from the current analysis. The overall Program benefit-cost ratios developed during the previous analysis and presented in the June 2, 2003 report[5] differ only slightly from these, and the primary reason they differ is updated electric and gas retail rates incorporated into the current analysis. For convenience, these ratios are reproduced in Table 2-1. To illustrate the use of these program ratios, note that, in this current analysis, a new measure would need a Modified Participant Ratio of 0.56 or greater to pass that test in the PG&E service area. The same measure would need a Modified Participant Ratio of 0.92 or better to pass this test in the SCE service area.

As noted in its solicitation for new measures, the Team reserved the right to use estimates of measure costs, energy savings, and lifetimes other than those submitted by those proposing new measures, in order to evaluate proposals in a consistent manner. Section 3 documents the sources of such estimates and reasons for using them in the analysis. The Team also reserved the right to apply its judgment with respect to the allocation of NEBs to proposed measures.[6]

Table 2-1: LIEE Program Benefit-Cost Ratios

	Previous Analysis		Current Analysis	
Utility	Modified Participant Test	Utility Test	Modified Participant Test	Utility Test
PG&E	0.56	0.32	0.56	0.33
SCE	1.17	0.78	0.92	0.80
SDG&E	0.71	0.35	0.64	0.36
SCG	0.61	0.18	0.70	0.19

The Commission-approved cost-effectiveness guidelines used in this analysis also allow the Team to consider NEBs that may not be fully reflected by estimates contained in the NEB workbook.

The Team conducted the cost-effectiveness analysis at a very disaggregated level. For all measures, the analysis was done separately by utility, residence type and, where applicable, by fuel (electricity and natural gas). Since all proposed measures have impacts that are weather sensitive (that is, they affect heating and cooling), the analysis was conducted

5 LIEE Measure Cost-Effectiveness Final Report, June 2, 2003. This report can be accessed online at http://www.ligb.org/DOCS/Low%20Income%20Cost%20Effectiveness%20Final%20Report%20June%202,%202003.doc.

6 For example, for some measures, the workbook uses overall utility-specific assumptions about measure types to assign NEBs. Documentation of this is provided in the TekMarket Works report, Op. Cit.

separately by climate zone. As pointed out in the Team's solicitation, the following rules apply in the event that this disaggregated analysis yields cases where measures are cost-effective for some, but not all, categories:

1. When a measure is consistently cost-effective for some, but not all, residence types, the measure may be accepted for the residence type(s) for which it is cost-effective, but not others.
2. When a measure is consistently cost-effective for some, but not all, utility service areas, even in the same climate zones and for the same fuels, the measure may be accepted in all service areas if it is cost-effective in at least two, but rejected if it is cost-effective in fewer than two service areas.[7] This guideline is necessary, since cost-effective administration of the program requires a certain amount of consistency among utility areas.
3. When a measure is consistently cost-effective for one, but not both, fuels, the measure may be accepted for the fuel for which it is cost-effective, but not the other.
4. When a measure is consistently cost-effective for some, but not all, climate zones, the measure may be accepted in the climate zones for which it is cost-effective, but not the others.
5. When a measure's cost-effectiveness varies asystematically across climate zones, residence types and fuels, the Team will make judgments that come closest to preserving the spirit of the above guidelines.

[7] This guideline, along with other necessary rules of thumb, was developed by the LIEE Standardization Team for the PY2003 measure assessment. These guidelines and rules of thumb were discussed in the final report (Op. Cit) and in Commission Decision 03-11-020, which can be downloaded from http://www.cpuc.ca.gov/static/official+docs/index.htm.

3

Input Assumptions

3.1 Introduction

This section summarizes the assumptions used in the evaluation of proposed measures. As has been documented in several previous reports relating to cost-effectiveness, a variety of assumptions must be made in the process of developing Utility Test and Modified Participant Test scores for individual measures. These assumptions include both general assumptions about retail energy prices and avoided costs, as well as measure-specific assumptions relating to measure costs, lifetimes, energy impacts, and non-energy benefits (NEBs). Subsection 3.2 describes the general assumptions used in the evaluation, while Subsections 3.3, 3.4, and 3.5 describe measure-specific assumptions for central air conditioning, duct testing and sealing, and air conditioning diagnostics respectively. Finally, Section 3.6 provides a brief summary.

3.2 General Assumptions

The assessment of cost-effectiveness requires assumptions with respect to overall market conditions. Most importantly, it requires assumptions with respect to retail energy rates, which are used to conduct the Modified Participant Test, and avoided costs, which are employed in the Utility Test. These assumptions are considered below.

Energy Rates

Table 3-1 presents two sets of gas and electric energy rates, which have been adjusted to represent rates charged to low-income customers. The first set includes the rates that were used in the previous cost-effectiveness analysis for the LIEE program year 2003. The second set includes the rates that were recently provided by the utilities to be used in the current analysis of proposed measures. Note that this current analysis used the updated rates.

Table 3-1: Energy Rates

Utility	Used for 2003		Provided for 2005	
	Electric $/kWh	Gas $/therm	Electric $/kWh	Gas $/therm
PG&E	0.12	0.66	0.10	0.81
SCE	0.13		0.09	
SoCalGas		0.56		0.82
SDG&E	0.15	0.79	0.11	0.84

Avoided Costs

Two sets of avoided costs were available for use in this assessment. The first set consisted of the electric and natural gas avoided cost forecasts used in the 2003 measure assessment report. Those forecasts were the last ones approved by the Commission. The second set consisted of the new forecasts developed for the Commission by Energy and Environmental Economics, Inc. in 2004.[1] Insofar as the more recent forecast has not yet been approved by the Commission, the Team decided to use the first set. Table 3-2 presents the avoided cost forecasts used in the analysis.

[1] Energy and Environmental Economics, Inc., *Methodology and Forecast of the Long Term Avoided Costs for the Evaluation of California Energy Efficiency Programs*, prepared for the California Public Utilities Commission, October 25, 2004.

Table 3-2: Statewide Avoided Costs

Year	Electric $/kWh	Gas $/therm
2005	$0.07	$0.44
2006	$0.06	$0.47
2007	$0.07	$0.49
2008	$0.07	$0.51
2009	$0.07	$0.53
2010	$0.07	$0.55
2011	$0.08	$0.50
2012	$0.08	$0.52
2013	$0.08	$0.54
2014	$0.08	$0.55
2015	$0.09	$0.58
2016	$0.09	$0.61
2017	$0.10	$0.63
2018	$0.10	$0.66
2019	$0.11	$0.69
2020	$0.11	$0.72
2021	$0.12	$0.74
2022	$0.12	$0.76
2023	$0.13	$0.81

3.3 High Efficiency Central Air Conditioning

Proposals Submitted

Two proposals for reinstating high efficiency central air conditioning as an LIEE measure were submitted. One was submitted by Reliable Energy Management, Inc. and Tri-State Home Improvement, and the other was submitted by John Harrison Contracting, Inc. This measure was offered in the LIEE Program prior to 2004. While both proposals suggested offering this measure in SCE's service area, the Team evaluated the measure in all climate zones.

Input Assumptions for Central Air Conditioning

This subsection discusses sources of potential inputs to be used in analyzing the cost-effectiveness of central air conditioning in the LIEE program. The inputs discussed include installation costs, savings estimates, and NEBs.

Installation Costs

For comparison, Table 3-3 presents four sets of installation costs for central air conditioning. The first set includes the costs used in the previous cost-effectiveness analysis for the LIEE program year 2003. The second set includes the costs recently provided by the utilities for use in the current analysis of proposed measures. The third set includes two estimates of costs used in the proposal submitted by Reliable Energy Management and Tri-State Home Improvement. In order to provide a range of results, the proposal included an analysis that used an installation cost of $1,700 and a second analysis that used an installation cost of $2,400. The last column in Table 3-3 includes costs proposed by John Harrison Contracting.

Table 3-3: Comparison of Installation Costs for Central Air Conditioning

Utility	Used for 2003	Provided by Utilities for 2005	Proposed by Reliable Energy Management and Tri-State Home Improvement	Proposed by John Harrison Contracting
PG&E	$2,700.00	$2,700.00	$1,700.00 to $2,400.00	$2,600.00 (split) and $3,600 (package)
SCE	$2,644.00	$2,500.00		
SDG&E	$2,425.79	$2,400.00		

The installation costs submitted by the utilities for the 2005 analysis were used for the analysis, because they reflect actual program costs incurred during the time this measure was offered.

Estimates of Savings

Table 3-4 presents a comparison from three sources of electricity savings estimates for central air conditioning installed in a single family house. The first source is the KEMA 2001 Impact Evaluation.[2] In the previous 2003 cost-effectiveness analysis for the LIEE program, these impacts were used. Note that the KEMA study estimated savings only for those climate zones and residence types where air conditioner replacements were actually made during 2001. In order to derive a comprehensive set of estimates for all climate zones

[2] See *Impact Evaluation of the 2001 Statewide Low-Income Energy Efficiency (LIEE) Program*, submitted by KEMA, Inc. and Business Economic Analysis & Research, April 8, 2003. The report can be accessed on http://www.calmac.org.

and residence types, other estimates were extrapolated from the KEMA estimates based on relative cooling conditions.[3] Note that the proposal submitted by Reliable Energy Management, Inc. and Tri-State Home Improvement made use of these estimated savings.

The second source shown in Table 3-4 is a calculation based on a two-step procedure. First, a baseline level of central air conditioning energy usage is estimated; second, energy savings are computed as a percentage of baseline consumption. For the purposes of this analysis, baseline consumption is derived from the unit energy consumption (UEC) values developed for the latest California Residential Appliance Saturation Survey (RASS) study.[4] These estimates were derived by Title 24 climate zones for low-income single family dwellings. For the current evaluation of high efficiency air conditioning savings, the RASS UECs were inflated by 30% to reflect two factors. The first is that low-income homes qualifying for this measure would typically have lower efficiency equipment than an average low-income home. The second is that the UECs estimated statistically in the RASS study were based on a period coinciding with the energy crisis. As a result of the 20-20 program and other efforts to induce customers to conserve energy, air conditioning was undoubtedly lower than normal during that period.

In order to derive savings associated with these baseline estimates of air conditioning usage, a percentage savings value was applied to the adjusted UECs. The proposal from John Harrison Contracting provided a value of 20%, based on the assumption that the program would be replacing a 10 SEER air conditioner with one that was 13 SEER. This assumption would be appropriate if the installations were done on a replace-on-burnout basis, with savings calculated on the difference between new standard efficiency and high efficiency units. However, since installations in the Program involve early replacement, it was decided that savings should be based on the replacement of an existing model with a high efficiency model. Existing units are likely to have lower efficiencies than new units just meeting efficiency standards. To reflect this, it was assumed that existing (replaced) units would have an average SEER of roughly 8, and a savings percentage of 33.3% was used to reflect the savings from replacing an 8 SEER with a 13 SEER air conditioner. It should be noted that the use of a lower SEER to represent existing units was suggested in a public workshop as well as in the April 11, 2005 Low Income Oversight Board (LIOB) meeting, and the Team considered the suggestion a useful modification of the analysis.

[3] The extrapolation used for the current assessment was a refined version of the approach used in the Team's 2003 study.

[4] A UEC indicates the average annual energy usage per home for a specific end use.

The third source shown in Table 3-4 is the Database for Energy Efficiency Resources (DEER) database.[5] In particular, these estimates are taken from the 2001 DEER Update Study completed in 2001 by KEMA.[6] The initial DEER estimates represent the savings resulting from replacing a 10 SEER air conditioner with one that is 13 SEER. In order to make them comparable to the other values shown in Table 3-4, these estimates were adjusted proportionally to reflect the replacement of an 8 SEER with a 13 SEER. Insofar as the DEER estimates were based on CEC forecasting zones rather than Title 24 climate zones, these estimates were mapped to Title 24 climate zones for the purposes of this comparison.

5 This database has been compiled through a series of statewide projects funded by Public Goods Charges, and is used by utilities and third party administrators as a source of information on energy efficiency measure costs and savings.

6 See *2001 DEER Update Study*, prepared by XENERGY, Inc. (now KEMA), August 2001. This report can be accessed on http://www.calmac.org.

Table 3-4: Comparison of Savings Estimates for Single Family Central Air Conditioning (in kWh per year)

Title 24 Climate Zone	KEMA 2001 Program Annual Impacts	Annual kWh Savings Based on RASS UECs w/Income < $40k	DEER Annual kWh Savings
1	25[1]	20.36	90
2	69[1]	148.91	90
3	17	52.95	108
4	35[1]	231.71	93
5	94[1]	35.62	93
6	29[1]	202.47	103
7	90[1]	181.59	107
8	96	423.15	103
9	152	699.26	128
10	205	567.87	140
11	233	611.96	108
12	205	437.12	108
13	342	699.53	226
14	398	1,102.55	140
15	573	1,449.14	408
16	109[1]	296.04	90

[1] Extrapolated based on results for other climate zones, adjusted for temperature differences.

As noted earlier, the KEMA estimates of savings were used in the Team's last assessment of high efficiency air conditioning. These estimates are somewhat lower than the estimates derived from the adjusted RASS UECs, but this is to be expected. Statistical estimates like KEMA's reflect the tendency for air conditioner usage to increase when low-efficiency units are replaced by high-efficiency units. This is sometimes referred to as the "rebound effect." The estimates derived from the RASS UECs can be considered calibrated engineering estimates, and as such, they do not reflect any rebound effect. Both the KEMA impact evaluation estimates and the estimates from the RASS UECs are considerably larger than those developed for the DEER database.

The savings estimates derived from the RASS UECs were used for the purposes of the analysis. This choice is explained later in this section.

Non-Energy Benefits

In their proposal, Reliable Energy Management and Tri-State Home Improvement asserted that the NEBs used in the 2003 LIEE analysis were not appropriate. In particular, the 2003 analysis did not assign a property value NEB to central air conditioning. In addition, this proposer asserted that the NEBs assigned to central air conditioning were in some cases too conservative.

The workbook used to test measure cost-effectiveness calculates NEBs at the program level rather than the measure level. It then allocates the NEBs across measures using a weighting algorithm based on kWh savings. Thus, NEBs vary widely by climate zone and housing type, even within the same measure category. In order to compare the results with the proposed values, Table 3-5 presents the per-unit NEBs derived from the workbook for single family homes, along with those proposed by Reliable Energy Management and Tri-State Home Improvement.

Note that the proposed value of $1,275 for a property value NEB is based on a calculation of 75% of the installed cost of the replacement air conditioner, with an assumed installed cost of $1,700. The proposed value of $404 for a comfort NEB represents the present value of an assumed comfort value of $35 per year over an 18-year life of the measure. The proposer states that he took the "other" NEB from the SCE cost-effectiveness workbook.

Table 3-5: Comparison of NEBs for Single Family Central Air Conditioning (in present-value dollars)

Title 24 Climate Zone	From NEB Workbook			Proposed by Reliable Energy Management and Tri-State Home Improvement			
	Comfort NEB	Other NEBs	Total Workbook NEB	Comfort NEB	Property Value NEB	Other NEBs	Total Proposed NEB
8	2	6	8	404	1,275	8	1,687
9	4	9	13	404	1,275	13	1,692
10	5	13	18	404	1,275	17	1,696
13	6	16	22	404	1,275	21	1,700
14	7	16	23	404	1,275	22	1,701
15	14	35	49	404	1,275	47	1,726

The above table highlights two major differences between the NEBs used in the Team's analysis and those provided by Reliable Energy Management and Tri-State Home Improvement. These differences are considered below.

First, the proposer's assumed comfort benefit is considerably higher than the one derived from the NEB Workbook. While the comfort NEB used in the Team's initial evaluation of high efficiency central air conditioning was derived from a CPUC-accepted study, this NEB may understate the comfort benefit in the event that there is a significant amount of rebound inherent in the savings estimates made by KEMA for the 2001 Program. The difference between the RASS-based estimates (which ignore rebound) and the KEMA estimates (which reflect any rebound effect) suggest that this may be the case. As a means of accounting for this effect, the Team adopted the use of the RASS-based savings estimates.

Second, the proposer assumed a substantial property value benefit, while the previous evaluation did not assign a property value to this measure. In the NEB study, the rationale for not assigning a property value benefit to this measure was that the increase in property value associated with air conditioner replacements is theoretically the capitalized value of the stream of future energy savings associated with the replacement, and thus double-counts the energy savings used in the analysis. While this is a common assumption, the Team recognizes that there may be some additional property value stemming from the fact that the unit is new (over and above being efficient). As a result, the Team incorporated a property value NEB for central air conditioning. The property value NEB was derived in the following manner. First, an average amount of $300 was assumed to represent the residual amount (other than the stream of bill savings already represented in the analysis) of property value resulting from upgrading an air conditioner to a newer, more efficient model. This average amount is lower than the proposed value of $1,275 in order not to duplicate the bill savings resulting from the installation. This average amount was then distributed across climate zones using a ratio developed from the RASS UECs, which included the specific central air conditioner UEC for each climate zone over the average central air conditioner UEC for all climate zones. (This approach captures the fact that such NEBs are higher in areas with high cooling requirements than in areas with moderate cooling requirements.) This resulted in a per-unit NEB for each climate zone.

Measure Lifetime

For this measure, an expected useful life of 18 years was used. This lifetime is taken from the CALMAC Workshop Report of September 2000. Applying this lifetime to the early replacement of air conditioners probably overstates the lifetime of savings, insofar as the replaced units are at least ten years old. On the other hand, air conditioners in low income homes may be kept longer prior to replacement than those in other homes, so the degree of overstatement may not be very large.

Title 24 Requirements

In the February 25, 2005 LIOB meeting attended by the Team, one of the members of the LIOB suggested that high efficiency air conditioning be combined with duct testing and

sealing for the purpose of the cost-effectiveness analysis. The rationale for this suggestion was that as of October of 2005, Title 24 will require duct testing and sealing when central air conditioning units are replaced in some climate zones. After discussing this idea with the member of the Board who raised it, the Team decided to restrict the analysis to the impacts and cost of the central air conditioning unit itself. The primary reason for this decision was that the Team anticipated recommending duct testing and sealing as a free-standing measures for 2006, and used the costs and savings associated with this measure to support its recommendation. To be consistent, the savings from central air conditioning replacement should be incremental to any savings from duct testing and sealing. Of course, it was also recognized that there will be some cases where duct testing and sealing will not be provided as a Program measure because it is not feasible (e.g., if initial duct leakage is already fairly low), and Title 24 standards will still apply because the standards for duct testing and sealing required by Title 24 are somewhat different than the standards for a free-standing Program measure.[7] However, without knowing the initial condition of duct losses for cases covered by Title 24, it is difficult to estimate the energy savings from these cases. It should also be noted that savings from duct sealing under Title 24 will be accompanied by additional costs of compliance, so including both costs and savings from duct testing and sealing would have an uncertain effect on the cost-effectiveness of high efficiency air conditioning.

3.4 Duct Testing and Sealing

Proposals Submitted

Synergy submitted a proposal to reinstate duct testing and sealing, a measure that was offered briefly under the LIEE Program until its discontinuation as a result of the 2003 measure assessment. Synergy assumed that duct sealing would reduce duct air loss from 29% to 15%.

Input Assumptions

Installation Costs

Synergy estimated the cost of duct testing and sealing at approximately $350, based on a 1996 reference (Haskell, 1996). The actual cost of duct testing and sealing during the period when the LIEE Program offered this measure varied considerable across utilities, but averaged roughly $400. For the purposes of this analysis, it was assumed that the combination of testing costs and sealing costs *for homes that are actually sealed* averaged $600. This includes an inspection cost of $100 both before and after sealing. The percentage of homes tested that were also sealed was assumed to be 80%.

[7] Title 24 requires ducts to be sealed to no more than a critical percentage of duct losses, whereas the installation standards may also require that initial duct losses exceed some reference value.

Energy Savings

Synergy provided estimates of duct testing/sealing savings only for mobile homes in three climate zones. In order to facilitate the assessment of this measure in all residence types and climate zones, the Team had to adopt an approach to developing a more comprehensive set of estimates of savings. One option was to use the estimates developed by KEMA in its evaluation of the impacts of the 2001 LIEE program. These estimates were used in the 2003 assessment, and contributed to the recommendation to drop this measure from the Program. There is no reason to doubt the KEMA estimates for that program year; however, one could argue that the low estimates were the result of contractor practices that may not have maximized savings. In order to allow for this possibility and give the benefit of the doubt to the proposed measure, a new set of estimates of impacts was developed for this assessment. The approach used for this purpose involved three initial steps:

- Estimates of central space heating and air conditioning UECs for low-income households were developed from the RASS database. These estimates were available by residence type and Title 24 climate zone.
- These UECs were increased by 30% across the board to reflect two factors: first, that homes with leaky ducts use more space conditioning energy; and second, as explained earlier, that the RASS UECs were felt to be artificially low because of the energy crisis. The resultant values were used as estimates of baseline (pre-sealing) usage.
- Percentage savings were developed using the DEER study conducted by KEMA in 2001. According to the engineering analysis conducted by KEMA, space heating savings were roughly10% in single family homes and 1% in multi-family homes. The lower level of space heating savings in multi-family homes resulted from the fact that ducts tend to be in conditioned space in these dwellings. The analysis also implied air conditioning savings of approximately 9% in single family homes and 7% in multifamily homes. It should be recognized that these percentage savings estimates are lower than those assumed by Synergy. In its original proposal, Synergy suggested a savings percentage of 10%; in correspondence received after proposals were due, Synergy estimated a savings rate of 16.9%, based on a study by Robert Mowris.[8]
- Percentage savings were applied to baseline consumption in order to obtain estimated savings.

The results of this analysis are presented in Table 3-6. These estimates should be interpreted as savings associated with duct testing and sealing in homes with the end uses in question.

[8] See *Evaluation Measurement and Verification Report for the Comprehensive Hard-to-Reach Mobile Home Energy Savings Programs*, Prepared by Robert Mowris & Associates, August 19, 2004, page 36.

Table 3-6: Savings Estimates for Duct Sealing

T24 Cl. Zone	Single Family			Multifamily			Mobile Home		
	ESH (kWh)	GSH (thrms)	AC (kWh)	ESH (kWh)	GSH (thrms)	AC (kWh)	ESH (kWh)	GSH (thrms)	AC (kWh)
1	121.13	31.38	5.50	6.06	1.36	2.72	121.13	36.08	5.50
2	182.14	39.70	40.21	8.97	1.63	22.21	277.58	38.49	41.48
3	290.19	36.52	14.30	5.48	1.87	5.34	125.31	27.85	13.00
4	146.49	29.43	62.56	6.57	1.15	26.69	133.09	19.69	51.35
5	187.80	42.75	9.62	4.22	2.05	3.04	118.52	46.06	8.10
6	116.32	22.42	54.67	8.79	1.20	35.33	116.32	16.73	60.14
7	96.85	17.09	49.03	4.38	0.67	26.61	96.85	19.42	52.68
8	132.36	20.36	114.25	2.78	0.79	57.53	100.14	21.76	93.87
9	150.48	23.14	188.80	5.06	0.88	79.89	150.48	24.66	133.51
10	180.61	25.56	109.69	4.21	1.40	66.59	180.61	24.39	88.47
11	176.65	29.95	165.23	6.17	1.45	86.51	139.42	22.35	136.76
12	249.87	34.44	118.02	10.78	1.55	49.18	193.58	28.33	103.61
13	182.55	30.34	188.87	9.73	1.54	103.74	153.99	24.47	157.48
14	242.65	29.77	297.69	6.65	1.52	151.23	256.28	30.25	289.96
15	129.77	14.78	391.27	5.87	0.71	290.55	129.77	18.15	401.53
16	313.49	50.86	79.93	25.88	2.44	36.48	262.19	55.15	69.96

In order to use the savings estimates to assess the proposed measure, two more adjustments were necessary:

- First, it had to be recognized that not all homes with ducts have central air conditioning. As a result, air conditioning savings were multiplied by the percentage of homes with central systems that have central air conditioning. This percentage varied across residence types and across climate zones.
- Second, it had to be recognized that the estimates in Table 3-6 implicitly assume that sealing takes place, but not all homes that are tested will qualify for sealing. The Team assumed that 80% of homes tested will also be sealed. This is somewhat higher than experienced when the measure was offered, but it was decided to err on the positive side. This percentage was applied to all space heating and air conditioning savings.

The estimates of effective savings after these two additional adjustments are presented in Table 3-7 and Table 3-8.

Table 3-7: Savings Estimates for Duct Sealing Adjusted for Analysis for Homes with Central Electric Space Heating

Title 24 Climate Zone	Single Family		Multi-Family		Mobile Home	
	ESH (kWh)	AC (kWh)	ESH (kWh)	AC (kWh)	ESH (kWh)	AC (kWh)
1	96.90	4.40	4.85	2.17	96.90	4.40
2	145.71	21.03	7.17	11.62	222.07	21.69
3	232.16	0.69	4.38	0.26	100.25	0.63
4	117.19	25.02	5.25	10.68	106.47	20.54
5	150.24	1.10	3.38	0.35	94.82	0.93
6	93.06	27.46	7.03	17.75	93.06	30.21
7	77.48	20.50	3.51	11.13	77.48	22.03
8	105.89	60.93	2.22	30.68	80.11	50.06
9	120.38	105.07	4.05	44.46	120.38	74.30
10	168.23	94.96	3.40	59.20	168.23	79.90
11	141.32	82.61	4.94	43.25	111.54	68.38
12	199.89	58.54	8.63	24.40	154.86	51.39
13	146.04	106.18	7.79	58.32	123.19	88.53
14	194.12	154.80	5.32	78.64	205.03	150.78
15	103.82	313.01	4.69	232.44	103.82	321.23
16	250.80	31.06	20.70	14.17	209.76	27.19

Table 3-8: Savings Estimates for Duct Sealing Adjusted for Analysis for Homes with Central Gas Space Heating

Title 24 Climate Zone	Single Family		Multi-Family		Mobile Home	
	GSH (therms)	AC (kWh)	GSH (therms)	AC (kWh)	GSH (therms)	AC (kWh)
1	25.10	0.21	1.09	0.11	28.87	0.21
2	31.76	10.72	1.30	5.92	30.79	11.06
3	29.21	0.72	1.50	0.27	22.28	0.66
4	23.54	13.17	0.92	5.62	15.75	10.81
5	34.20	0.85	1.64	0.27	36.85	0.72
6	17.94	9.89	0.96	6.39	13.39	10.88
7	13.67	8.99	0.54	4.88	15.54	9.65
8	16.29	36.37	0.63	18.31	17.41	29.88
9	18.51	81.18	0.71	34.35	19.73	57.41
10	24.41	98.05	1.46	61.13	24.00	82.50
11	23.96	99.87	1.16	52.29	17.88	82.66
12	27.56	76.77	1.24	31.99	22.67	67.39
13	24.27	111.96	1.23	61.50	19.57	93.35
14	23.82	186.52	1.22	94.75	24.20	181.68
15	11.82	296.09	0.57	219.87	14.52	303.86
16	40.69	42.83	1.95	19.55	44.12	37.49

Non-Energy Benefits

Synergy did not propose any values for NEBs of duct sealing in its proposal. The Team used the NEBs derived from the NEB workbook.

Measure Lifetime

For this measure, an expected useful life of 25 years was used. This lifetime is taken from the CALMAC Workshop Report of September 2000.

3.5 Air Conditioner Maintenance

Proposals Submitted

Synergy also submitted a proposal to offer air conditioner maintenance under the LIEE Program. This service would entail checking and tuning the refrigerant charge and air flow on central air conditioners and heat pumps.

Input Assumptions

Installation Costs

Synergy suggested an installed cost of $125 to $150 for this measure. The upper end of this range was used for the purpose of the analysis.

Energy Savings

Insofar as air conditioner maintenance has not been offered under LIEE, no impact estimates were available for the measure. As a result, it was necessary to develop new estimates. Synergy provided very useful input to this process. The steps taken to estimate savings were as follows.

- Estimates of air conditioner usage were obtained from the RASS database for low-income households. These estimates were increased by 30% to reflect two influences. First, low-income homes are likely to have relatively poorly maintained air conditioners, and consequently they can be expected to use more energy than implied by the RASS estimates.[9] Second, as noted earlier, the UECs were estimated for a period when energy usage was probably artificially low. The adjusted air conditioning UECs were used as baseline consumption values.
- Second, an assumed percentage savings value was developed, taking into account Synergy's input. Synergy used what it considered a conservative estimate of 13% savings in its analysis of the impacts of air conditioner maintenance. This estimate was based on DOE-2 modeling. Synergy cited several studies in support of this estimate: the DEER study, a study conducted by ACEEE, and the Robert Mowris study cited earlier. The percentage savings in these three studies were, respectively, 12%, 17%, and 16.3%. In light of this range, the Team decided to use an estimate of percentage savings of 15%, which is roughly the average of the three studies.

Table 3-9 presents the estimated savings used in the analysis.

[9] While the RASS UECs were derived specifically for low-income homes, no information on maintenance was available for any of the surveyed homes. As a result, the low-income RASS UECs implicitly assume average maintenance levels.

Table 3-9: Savings Estimates for Air Conditioning Diagnostics (kWh)

Title 24 Climate Zone	Single Family	Multi-Family	Mobile Home
1	9.16	5.82	9.16
2	67.01	47.58	69.13
3	23.83	11.45	21.66
4	104.27	57.20	85.58
5	16.03	6.51	13.50
6	91.11	75.70	100.23
7	81.72	57.02	87.80
8	190.42	123.27	156.44
9	314.67	171.20	222.52
10	182.81	142.68	147.46
11	275.38	185.37	227.94
12	196.70	105.40	172.68
13	314.79	222.31	262.46
14	496.15	324.06	483.27
15	652.11	622.60	669.22
16	133.22	78.17	116.61

Non-Energy Benefits

Synergy did not propose any values for NEBs of air conditioner maintenance in its proposal. The Team used the NEBs derived from the NEB workbook.

Measure Lifetime

For this measure, an expected useful life of ten years was used. This lifetime is taken from the CALMAC Workshop Report of September 2000.

3.6 Summary

This section reviewed the assumptions used in the analysis of cost-effectiveness of the three proposed measures. General market assumptions were provided by the utilities. Measure-specific assumptions were derived from a variety of sources, including materials submitted by the proposers. In general, the cost and impact assumptions are similar to those suggested by the firms submitting proposals. The only proposal identifying NEBs related to high efficiency air conditioning. While the Team found the proposed NEB estimates to be high, an alternative was developed and incorporated into the model for central air conditioning. Section 4 presents the results of the use of these assumptions in the assessment of cost-effectiveness of the proposed measures.

4

Results

4.1 Benefit Cost Ratios

This section presents the results of cost-effectiveness testing for the three new measures proposed for the LIEE program. The following tables present the results:

- Table 4-1 presents the results for central air conditioning,
- Table 4-2 presents the results for duct sealing in homes that have central electric space heating,
- Table 4-3 presents the results for duct sealing in homes that have central gas space heating, and
- Table 4-4 presents the results for air conditioning diagnostics.

Where installation of a measure in a particular housing type and climate zone was found to be cost-effective, the benefit-cost ratio is highlighted. As described in Section 3, this was determined by comparing the measure ratio to the overall program ratio. If the measure ratio was found to be at least as high as the program ratio, the measure ratio for that particular housing type and climate zone was deemed cost-effective.

Table 4-1: Cost Effectiveness Ratios for High Efficiency Central Air Conditioning

Program T24 Zone	PG&E						SCE						SDG&E					
	Participant Test 0.56			Utility Test 0.33			Participant Test 0.92			Utility Test 0.80			Participant Test 0.64			Utility Test 0.36		
	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF
1	0.01	0.01	0.01	0.00	0.01	0.01												
2	0.08	0.11	0.11	0.04	0.05	0.05												
3	0.02	0.04	0.04	0.01	0.02	0.02												
4	0.09	0.14	0.17	0.04	0.06	0.08												
5	0.01	0.02	0.03	0.00	0.01	0.01												
6	0.12	0.16	0.15	0.06	0.08	0.07	0.12	0.16	0.14	0.07	0.09	0.08						
7													0.12	0.19	0.18	0.05	0.08	0.08
8							0.19	0.25	0.30	0.11	0.14	0.18						
9							0.27	0.35	0.50	0.16	0.21	0.29						
10							0.32	0.34	0.40	0.19	0.20	0.24	0.45	0.47	0.56	0.19	0.20	0.24
11	0.30	0.37	0.45	0.14	0.17	0.21												
12	0.17	0.28	0.32	0.08	0.13	0.15												
13	0.36	0.43	0.51	0.17	0.20	0.24	0.35	0.41	0.50	0.21	0.24	0.29						
14	0.53	0.79	0.81	0.24	0.37	0.37	0.51	0.76	0.78	0.30	0.45	0.46	0.70	1.05	1.08	0.30	0.44	0.46
15							0.98	1.06	1.03	0.58	0.62	0.60	1.35	1.45	1.42	0.57	0.62	0.60
16	0.13	0.19	0.22	0.06	0.09	0.10	0.12	0.18	0.21	0.07	0.11	0.12						

Table 4-2: Cost Effectiveness Ratios for Duct Sealing in Houses with Electric Space Heating

Program T24 Zone	PG&E						SCE						SDG&E					
	Participant Test 0.56			Utility Test 0.33			Participant Test 0.92			Utility Test 0.80			Participant Test 0.64			Utility Test 0.36		
	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF
1	0.02	0.34	0.34	0.01	0.19	0.19												
2	0.06	0.81	0.55	0.04	0.46	0.31												
3	0.02	0.33	0.77	0.01	0.19	0.44												
4	0.05	0.42	0.47	0.03	0.24	0.27												
5	0.01	0.32	0.50	0.01	0.18	0.28												
6							0.08	0.39	0.38	0.05	0.26	0.26						
7													0.06	0.42	0.42	0.03	0.20	0.20
8							0.10	0.41	0.53	0.07	0.28	0.36						
9							0.15	0.62	0.71	0.10	0.41	0.48						
10							0.20	0.79	0.83	0.13	0.53	0.56	0.27	1.06	1.12	0.13	0.50	0.53
11	0.16	0.60	0.74	0.09	0.34	0.42												
12	0.11	0.68	0.86	0.06	0.39	0.49												
13	0.22	0.70	0.84	0.12	0.40	0.47	0.21	0.67	0.80	0.14	0.45	0.54						
14							0.27	1.13	1.11	0.18	0.76	0.74	0.36	1.52	1.49	0.17	0.72	0.71
15							0.75	1.35	1.32	0.50	0.90	0.89	1.01	1.81	1.78	0.48	0.86	0.85
16	0.12	0.79	0.93	0.07	0.45	0.53	0.11	0.75	0.89	0.07	0.50	0.60						

Table 4-3: Cost Effectiveness Ratios for Duct Sealing in Houses with Gas Space Heating

Program T24 Zone	PG&E						SCG						SDG&E					
	Participant Test 0.56			Utility Test 0.33			Participant Test 0.70			Utility Test 0.19			Participant Test 0.64			Utility Test 0.36		
	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF
1	0.03	0.78	0.67	0.01	0.37	0.32												
2	0.05	0.86	0.89	0.03	0.41	0.42												
3	0.04	0.60	0.79	0.02	0.29	0.37												
4	0.04	0.46	0.68	0.02	0.22	0.32	0.04	0.77	1.15	0.02	0.26	0.39						
5	0.04	0.99	0.92	0.02	0.47	0.44	0.08	1.80	1.67	0.03	0.61	0.57						
6							0.05	0.65	0.87	0.02	0.22	0.30						
7							0.03	0.76	0.67	0.01	0.26	0.23	0.04	0.55	0.48	0.02	0.23	0.21
8							0.03	0.85	0.79	0.01	0.29	0.27						
9							0.03	0.96	0.90	0.01	0.33	0.31						
10							0.07	1.17	1.19	0.02	0.40	0.41	0.31	1.13	1.21	0.14	0.50	0.54
11	0.20	0.75	0.97	0.11	0.38	0.49												
12	0.14	0.83	0.99	0.08	0.42	0.50												
13	0.24	0.83	1.02	0.13	0.42	0.52	0.06	0.95	1.18	0.02	0.32	0.40						
14							0.06	1.18	1.16	0.02	0.40	0.40	0.44	1.56	1.57	0.21	0.70	0.71
15							0.03	0.71	0.58	0.01	0.24	0.20	0.96	1.77	1.65	0.45	0.82	0.76
16	0.12	1.31	1.23	0.06	0.63	0.60	0.10	2.15	1.98	0.03	0.73	0.68						

Table 4-4: Cost Effectiveness Ratios for AC Diagnostics

Program T24 Zone	PG&E						SCE						SDG&E					
	Participant Test 0.56			Utility Test 0.33			Participant Test 0.92			Utility Test 0.80			Participant Test 0.64			Utility Test 0.36		
	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF	MF	MH	SF
1	0.04	0.06	0.06	0.02	0.04	0.04												
2	0.29	0.43	0.41	0.19	0.28	0.27												
3	0.07	0.13	0.15	0.05	0.09	0.10												
4	0.35	0.53	0.64	0.23	0.34	0.42												
5	0.04	0.08	0.10	0.03	0.05	0.06												
6	0.47	0.62	0.56	0.30	0.40	0.37	0.40	0.52	0.48	0.34	0.46	0.41						
7													0.44	0.68	0.63	0.25	0.38	0.35
8							0.64	0.82	0.99	0.56	0.71	0.87						
9							0.89	1.16	1.64	0.78	1.01	1.43						
10							1.07	1.12	1.33	0.93	0.98	1.16	1.58	1.66	1.98	0.89	0.93	1.11
11	1.14	1.41	1.70	0.74	0.91	1.11												
12	0.65	1.06	1.21	0.42	0.69	0.79												
13	1.37	1.62	1.94	0.89	1.05	1.26	1.16	1.37	1.64	1.01	1.19	1.43						
14	2.00	2.98	3.06	1.30	1.94	1.99	1.69	2.52	2.59	1.47	2.20	2.26	2.51	3.74	3.84	1.41	2.10	2.15
15							3.25	3.49	3.40	2.83	3.04	2.96	4.82	5.18	5.04	2.70	2.90	2.83
16	0.48	0.72	0.82	0.31	0.47	0.53	0.41	0.61	0.70	0.36	0.53	0.61						

4.2 Discussion of Results

The above tables were evaluated using the rules of thumb for determining cost-effectiveness presented in Section 2. New measures are required to pass both the Modified Participant Test and the Utility Test in order to be considered for the program. Each measure is discussed separately below.

Central Air Conditioning

The results for central air conditioning show that this measure is cost-effective (that is, passes both tests) only in Climate Zone 14 in the PG&E and SDG&E area for single family and mobile home residences and in Climate Zone 15 in the SDG&E area for all housing types. It also passes the Participant Test and barely falls short of passing the Utility Test for multifamily residences in Climate Zone 14 in the SDG&E area. The measure also passes the Modified Participant Test in Climate Zone 15 for all housing types in the SCE area, although it does not pass the Utility Test. The Team's recommendation is to offer it for all three residence types in Climate Zones 14 and 15.

Duct Testing and Sealing

This measure was evaluated separately for homes that have central electric space heating and for homes that have central gas space heating. For homes with central electric space heating, the measure was found to be cost-effective in the following situations:

- PG&E zone 2 mobile homes,
- PG&E zone 3 single family,
- PG&E zones 11 through 13 and zone 16, single family and mobile homes,
- SCE zone 15 single family and mobile homes,
- SDG&E zone 10 and 14 single family and mobile homes, and
- SDG&E zone 15 all housing types.

For homes with central gas space heat, this measure was found to be cost-effective in most cases for single family and mobile homes. For homes with electric space heat, the measure was found to be cost-effective in Climate Zones 10-16. It was not found to be cost-effective for multifamily homes in any area except SDG&E Climate Zone 15.[1]

Air Conditioning Diagnostics

Air conditioning diagnostics was found to be predominantly cost-effective. Exceptions include Climate Zones 1, 2, 3, and 5, and, for SCE only, Climate Zone 6 and 16.[2] To some

[1] Note from Section 3, Table 3-7, air conditioning savings estimates are particularly high for climate zone 15.

[2] Benefit-cost ratios for SDG&E and SCE are both high in climate zones 14 and 15. However, they are somewhat higher for SDG&E, although the analysis used the same savings estimates and installation costs

extent, the failure of this measure in Climate Zones 6 and 16 for SCE is due to the high program benefit-cost ratio for this utility. Based on the overall results, The Team proposes (on a preliminary basis) to offer this measure in all residence types and in all climate zones other than the most moderate (Climate Zones 1, 2, 3 and 5).

4.3 Summary of Recommendations

The following are recommendations regarding adoption of the proposed new measures based on the discussion presented above.

- Offer high efficiency central air conditioning only in climate zones 14 and 15.
- Offer duct testing and sealing for single family homes and mobile homes with gas space heating in all climate zones. Offer the measure for homes with electric space heating in Climate Zones 10-16. Do not offer this measure for multifamily homes.
- Offer central air conditioning diagnostics (tune-ups) in all climate zones other than 1, 2, 3 and 5.

It should be understood that the implementation of these recommendations will necessitate the development of policy rules on when these measures should be installed. These rules take the form of non-feasibility conditions, and will be integrated into both the Weatherization Installation Standards (WIS) Manual and the Policy & Procedures (P&P) Manual. It should also be recognized that specific standards for installation of these measures will be outlined in the PY 2006 WIS Manual. These standards will be designed to be consistent with the assumptions used in the analysis of cost-effectiveness.

For high efficiency air conditioning, for instance, replacement units will be SEER 13s, and conditions on existing units may be imposed to ensure that savings consistent with those assumed in this analysis are realized. In the case of air conditioner diagnostics and tune-ups, standards will ensure that the measure is designed to yield the general level of savings assumed in our analysis. For duct testing and sealing, standards will be constructed to elicit the reduction in duct flow leakages assumed in the proposal for its reinstatement into the Program as well as in the assessment of its cost-effectiveness.

for both utilities. Note that the difference primarily stems from the way the NEB workbook assigns NEBs to various measures. In particular, certain NEBs are calculated based on assumptions and other program parameters and these may differ across utilities. While some of the issues related to the calculation of NEBs were addressed in the previous LIEE measure analysis study, it was not within the scope of that study, nor is it within the scope of this current study to document or revise the NEB workbook.

Appendix A

Summary of Public Workshops

April 8, 2005 in San Francisco

April 15, 2005 in San Diego

Public Workshop – April 8, 2005
Preliminary Cost Effectiveness Results
of New Measures Proposed for Inclusion in 2006 LIEE Program

On April 8, 2005, the Joint Utilities Standardization Project Team (Team) held a Public Workshop in San Francisco to discuss the preliminary cost-effectiveness results for the new measures proposed for inclusion in the 2006 Low-Income Energy Efficiency (LIEE) program. California Public Utilities Commission (Commission) Decision (D.) 03-11-020 directed the Team to hold public workshops on the new measure assessment.

The presentation was conducted by Fred Sebold, the Team consultant. The following interested parties attended the workshop:

Fred Sebold – Itron
Kathy Wickware – SoCalGas & SDG&E
Gregg Lawless – SoCalGas & SDG&E
Josie Webb – CPUC Energy Division
Bill Holloway – PG&E
Frances Thompson – PG&E
Mary O'Drain – PG&E
James O'Bannon – RHA
Roberto Del Real – SCE
Mauricio Blanco – SCE
Gilbert Escamilla – CPUC ORA
Greg Redican – Community Action Agency of Santa Maria
William Parker – Community Action Agency of Santa Maria

The following interested parties participated in the workshop via teleconference:

Ron Garcia – Reliable Energy Management
Richard Villasenor – The East Los Angeles Community Union (TELACU)
Dennis Osmer – Central Coast Energy Services
Becky Ezerle – Pacific Power
Marcia Cecristosro – Pacific Power

Fred Sebold provided a brief overview of the proposed new measure assessment. This overview included discussion of the four measures proposed by the respondents to the solicitation. A copy of the workshop presentation is attached.

William Parker asked what is the definition of a multi-family dwelling. Fred Sebold responded that the definition of multi-family is 5 or more units under a single roof.

Richard Villasenor asks whether duct sealing is being considered as a whole picture, meaning not just leaky ducts. He asked whether indoor air quality is considered because there are a lot of really old ducts out there. Richard would like to see replacement of old

ducts. Fred Sebold responded that interested parties can propose this as a new measure which can be assessed.

Ron Garcia asked what is the effect on the LIEE program based on the new Title 24 standards for duct testing and sealing which becomes effective on October 1, 2005. Fred Sebold responded that the Team is currently reviewing this new Title 24 standard and will make recommendations to the Policy & Procedures (P&P) Manual to the Commission. Also Ron asked if the Team evaluated A/C replacement along with the duct testing and sealing requirements included in the Title 24 standards which become effective October 1, 2005. Fred Sebold commented that the Team had not but that they could look into the feasibility of doing so.

William Parker asked if asbestos was considered for duct test and sealing. Fred Sebold responded that the LIEE measures will need to pass feasibility. Health, safety, and hazards are included for feasibility. Asbestos is definitely a hazard. There is currently a policy in the P&P manual.

This discussion concluded the workshop.

PUBLIC WORKSHOP
APRIL 15, 2005

JOINT UTILITIES LOW-INCOME ENERGY EFFICIENCY (LIEE) STANDARDIZATION PROJECT TEAM

On April 15, 2005, the Joint Utilities Standardization Project Team (Team) held a Public Workshop in San Diego to discuss the preliminary cost-effectiveness results for the new measures proposed for inclusion in the 2006 Low-Income Energy Efficiency (LIEE) program. California Public Utilities Commission (Commission) Decision (D.) 03-11-020 directed the Team to hold public workshops on the new measure assessment.

The presentation was conducted by Fred Sebold, the Team consultant. The following interested parties attended the workshop:

Fred Sebold – Itron
Darryl Johnson – CAP of San Bernardino County
Kathy Wickware – SoCalGas & San Diego Gas &Electric
Gregg Lawless – SoCalGas & San Diego Gas &Electric
Josie Webb – CPUC Energy Division
Frances Thompson – Pacific Gas & Electric
Mary O'Drain – Pacific Gas & Electric
James O'Bannon – RHA
Roberto Del Real – Southern California Edison
Mauricio Blanco – Southern California Edison
Gilbert Escamilla – CPUC/ORA

The following interested parties participated in the workshop via teleconference:

Ron Garcia – Reliable Energy Management
Mike Wren - Reliable Energy Management

To commence the Workshop, Fred Sebold announced that the Team is committed to holding meetings which will be open to the public. This commitment was announced earlier at the Low-Income Oversight Board meeting held on April 11, 2005. In the interest of openness, the Team pointed out that there was a Team meeting held on April 14, 2005, to specifically address the process and procedures of these open meetings. No other issues were discussed at the April 14th meeting. Ron Garcia mentioned that he believes that the Team should be able to conduct meetings separate from the public meetings. Ron plans to formally make this recommendation.

Fred Sebold provided a brief overview of the proposed new measure assessment. This overview included discussion of the four measures proposed by the respondents to the solicitation. A copy of the workshop presentation is attached.

Darryl Johnson asked if high efficiency air conditioners were considered for climate zone 10. Fred Sebold responded that this measure was considered for all climate zones. Climate zone 10 is not as extreme as climate zone 15 or some of the other climate zones.

Darryl Johnson asked that for duct testing and sealing what accounts for the results for multi-family dwellings. Fred Sebold responded that the results are driven by two factors:
1) In multi-family dwellings, duct losses are more likely to stay in conditioned space, and
2) Multi-family energy use for space heating and air conditioning tend to be lower than single family homes or mobile homes.

Darryl Johnson commented that hopefully the Team would keep in mind that even though energy savings may be lower for multi-family residents, these savings are still important to multi-family residents who tend to have lower incomes. Fred Sebold responded that there have been studies conducted by J. J. Hirsch and Associates and it has been referenced in the March 29, 2005 Preliminary Cost Effectiveness Report.

The workshop was concluded.

LIEE Standardization Project

Workshop on Assessment of Proposed New Measures

April 8, 2005

April 15, 2005

New Measure Procedure

- **New Measure Assessment Process Outlined in October 15, 2004 Filing for Phase V**
- **New Measure Solicitation Released 12/17/04**
- **New Measure Proposals Due 1/31/05**
- **Proposal Evaluation**
  - Pre-Screen all Proposals
  - Subject Measures to Cost-Effective Analysis
  - Prepare Report with Team Findings and Recommendations
- **Preliminary Results Made Available to the Public on March 29, 2005; Revised Recommendations to be Presented Today**
- **Conduct Public Workshops**
  - 4/08/05 San Francisco and 4/15/05 San Diego
- **File Recommendations 4/30/05**

Proposals Submitted

1. **Synergy**
   - Duct Testing and Sealing
   - Central AC Diagnostics
2. **Autocell Electronics**
   - Bulk Purchase of Compact Fluorescent Lamps (CFLs)
3. **Reliable Energy Management, Inc. and Tri-State Home Improvement**
   - High Efficiency Central AC
4. **John Harrison Contracting, Inc.**
   - High Efficiency Central AC

Pre-Evaluation of Measures

- **CFL Proposal Not Evaluated**
  - Measure Already in Program
  - Proposal for Bulk Purchase
  - Lead-free CFLs (already have lead abatement in Program)
  - Specific Brand

- **Measures Analyzed for Cost-Effectiveness**
  - High Efficiency Air Conditioning
  - Duct Testing and Sealing
  - Air Conditioner/Heat Pump Diagnostics/Tune-Up

Cost-Effectiveness Analysis

Method Used to Evaluate Cost Effectiveness

- **Framework Developed by Standardization Team and Reporting Requirement Manual (RRM) Working Group**
- **Framework Described in Final Report for LIEE Program and Measure Cost-Effectiveness (March 28, 2002)**
- **Framework approved by the Commission in D.02-08-034**
- **Two Benefit-Cost Tests used in Framework**
  - Utility Cost Test
  - Modified Participant Cost Test

Cost-Effectiveness Analysis (continued)

- **Costs Included:**
  - Cost of Measure (Used Proposer Info and Independent Estimates)
  - Installation Cost (Used Proposer Info and Independent Estimates)
- **Benefits Included:**
  - Value of Energy Saved (Used Proposer Info and Independent Estimates)
  - Non-Energy Benefits (from NEB Workbook, based on Study by TechMktWorks and SERA)
    - Comfort
    - Water Savings
    - Health Benefits
    - Other

Preliminary Recommendations

- **Offer high efficiency central air conditioners in Climate Zone 15**

- **Offer duct testing and sealing in all climate zones for single family homes and mobile homes with gas space heating. Offer in Climate Zones 10-16 for single family homes and mobile homes with electric space heating. Do not offer for multifamily homes.**

- **Offer central air conditioning diagnostics in all climate zones except 1, 2, 3, and 5**