Valuing Hardship: Developing a New Cost Effectiveness Test for Low Income Energy Efficiency Programs

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ABSTRACT

Low Income Energy Efficiency (LIEE) programs are equity-based programs, and are not usually held to the same strict cost effectiveness standards to which other publicly-funded energy efficiency programs are subject. Nevertheless, there is significant public interest in demonstrating that low income energy programs are cost effective, providing value and benefits for both the low income customers *served* by the programs and the non-participating ratepayers *paying* for the programs. In order to better assess the overall cost effectiveness of LIEE programs offered by the California utilities, the California Public Utilities Commission (CPUC) ordered the California investor-owned utilities to develop a cost effectiveness test for LIEE programs that incorporates the concept of "hardship." To guide this effort, Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric Company, Southern California Electric Company, Southern California Gas Company, the CPUC Office of Rate Payers Advocates, the CPUC Energy Division, and a small group of consultants (TecMRKT Works, Skumatz Economic Research Associates, and Megdal and Associates) formed the Cost Effectiveness Study Team. The new Low Income Public Purpose Test (LIPPT) was developed by the Team and used by the utilities on their LIEE programs for the first time in April 2001. This paper describes the test.

Project Background

Low Income Energy Efficiency (LIEE) programs, as equity-based programs, are not usually held to the same strict cost effectiveness standards to which other publicly-funded energy efficiency programs are subject. Nevertheless, there is significant public interest in demonstrating that low income programs are indeed effective programs, providing value and benefits for low income customers. In addition, California regulators recognize that the interests of both the customers being *served* by the low-income energy efficiency program (LIEE) and the non-participating ratepayer *paying* for the programs must benefit from the LIEE programs. In order to better assess the overall cost effectiveness of LIEE programs offered by the California utilities, the California Public Utilities Commission (CPUC) ordered the California investor-owned utilities to develop a cost effectiveness test for LIEE programs that incorporates the concept of "hardship." Pacific Gas and Electric Company (PG&E) managed the development of this new test on behalf of PG&E, San Diego Gas and Electric Company, Southern California Electric Company, and Southern California Gas Company. To guide this effort, the four utilities, the CPUC Office of Rate Payers Advocates, the CPUC Energy Division, and a small group of consultants formed the Cost Effectiveness Study Team.

TecMRKT Works was hired to design the new test to measure the cost effectiveness of California's low-income energy efficiency programs and measures funded by the public benefits charge on energy utility bills. The TecMRKT Works team included Skumatz Economic Research Associates

(SERA) and Megdal and Associates. The test was completed and filed by March 31, 2001[1] and implemented on the LIEE programs proposed for 2001 in May 2001.

The Cost Effectiveness Study Team completed the following four tasks to develop the new cost effectiveness test for California's LIEE programs:

1. Conducted a literature review and assessment of the tests currently employed throughout the United States and elsewhere to assess the cost effectiveness of LIEE programs and measures;
2. Identified appropriate and relevant non-energy benefits for inclusion in a cost effectiveness test for LIEE programs and measures, including hardship and its components (comfort, health and safety) as recently defined by the Reporting Requirements Manual (RRM) Working Group;
3. Performed an assessment of methodologies for quantifying and weighting the identified non-energy benefits; and
4. Developed a new cost effectiveness test for assessing LIEE programs and measures that takes hardship and other appropriate non-energy benefits into account.

Overview of the Low Income Public Purpose Test (LIPPT)

The cost effectiveness test quantifies the range and value of all applicable energy and non-energy benefits associated with a specific program or low income service and the economic impact of that service on the key impact areas (such as economic benefits, environmental benefits, health and safety benefits, utility benefits, and other benefits) as appropriate to the individual program or service.

The test is a multi-perspective, single integrated test that calculates a cost benefit ratio of LIEE programs and measures, including the non-energy benefits, where appropriate benefit values have been derived. Program costs included in the test are consistent with the cost reporting methods and forms presented in the California Bill Savings Report, filed February 1, 2001 and revised March 5, 2001.[2] The test includes a wide range of non-energy benefits that can be attributed to the LIEE programs, such as health and safety and hardship benefits.

The actual form of the test was the subject of much discussion by the Team. The Team discussed the pros and cons of developing 1) a single, multi-perspective, integrated test that would calculate the cost benefit ratio of LIEE programs, or 2) a series of non-energy benefit adders to use with existing cost-effectiveness tests. In the end, the Team decided to develop a single, integrated test with non-energy benefit variables that may be turned on or off. The resulting test can stand on its own, but has the added flexibility of allowing the user to run the non-energy benefits as adders to existing utility cost benefit tests already in use.

The Team also considered basing the test on the value of the energy savings from the LIEE programs as experienced by the customer rather than the avoided cost to the utility. Some team members felt this provided a more accurate reflection of program benefits from the public's perspective. Early versions of the test were valued based on bill savings to the customer. However, the Team was concerned that a test based on bill savings that included benefits valued from utility and societal perspectives as well as the participant perspective would not provide a meaningful end result, and in the end the contractor was instructed to include the value of the avoided energy savings from the LIEE programs as experienced by the utility, rather than the bill savings to the participant.

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[1] Low-Income Public Purpose Test (The LIPPT), Final Report. TecMRKT Works, Skumatz Economic Research Associates, Inc., and Megdal & Associates. Prepared for the RRM Working Group's Cost Effectiveness Subcommittee, (April 3. 2001).

[2] Joint Utility Low Income Energy Efficiency Program Costs and Bill Savings Standardization Report. Equipoise Consulting, (February 1, 2001, revised March 5, 2001).

The LIPPT should be considered a work in progress. Although the parameters of the new test are complete and presented in detail in the project report, it should be remembered that this is a new cost effectiveness test that has never been performed before. The Team fully expects to discover areas that require more discussion and fine-tuning as the utilities attempt to run the test for the first time for inclusion in the 2001 Annual Earnings Assessment Proceeding (AEAP).

The Purpose of the Low Income Public Purpose Test

The California Low Income Public Purpose Test (LIPPT) was designed to assess the cost effectiveness of California's low-income energy efficiency programs from a public benefits perspective. The LIPPT is a new tool designed to inform public review of the overall cost effectiveness of low-income energy efficiency (LIEE) programs from a much wider perspective than previous tests. Previous tests have taken a limited or more narrowly defined approach for examining a LIEE program's cost effectiveness, focusing on the costs and energy benefits associated with a program from a specific point of reference. For example, the Utility Cost Test focuses on the program costs and the benefits to the utility, the stockholders, and the ratepayers, while the Participant Test focuses on the program costs and the benefits to the participants. The Total Resource Cost (TRC) Test and the Public Purpose Test (PPT) are intended to assess the overall benefits and costs to all parts of society.

The LIPPT is intended to be a variation from the Public Purpose Test. It differs from the PPT in its inclusion of several of the major non-energy benefits specific to LIEE programs. Currently, PPT calculations used for the utilities' energy efficiency programs include very limited non-energy benefits because of measurement difficulties and controversies among parties in the program proceedings.

The LIPPT has a specific low income focus and is designed to provide a different set of cost effectiveness information. Users of previous tests will see a significant difference between these tests and the LIPPT. The LIPPT is designed to include a broader range of non-energy benefits obtained across a wide segment of the "public," a category including the utility, the shareholders, the ratepayers, program participants, and society at large. The purpose of the LIPPT is to count the appropriate energy and non-energy benefits that are derived from a LIEE program, without double counting these benefits. Specifically, the test includes costs associated with program design, management, implementation, evaluation, oversight and other cost categories that are directly or indirectly associated with the program. The Benefits built into the test include the energy-associated benefits from the utility's avoided cost perspective as well as non-energy benefits that are produced as a result of the program for the utility, the participant and for society in general.

Because the purpose of the test is to examine the cost effectiveness of the LIEE programs from a public benefits perspective, the non-energy portion of the test includes a wide range of impact categories, and is not restricted to examining benefits that may only be associated with one section of the "public," such as the participant, or the utility conducting the program. For purposes of this test, "public" refers to the public at large, including the combination of the utility, the participant, the non-participant, and other parts of the society that may benefit by the program. As a result, users of the LIPPT will notice that the test has components common to the utility, societal, and participant tests.

However, the LIPPT test should not be confused with, or viewed as simply a revision to these tests. It is a new, stand-alone test that incorporates some of the categories of variables that are also incorporated into other tests. The LIPPT test also includes non-energy benefits that are not included in the standard tests. The test provides non-energy benefit results classified as utility, societal and participant benefits. It takes a more inclusive approach when compared to other tests and examines a wider range of benefits across all three perspectives. The LIPPT is a tool that is designed to both inform public purpose policy decision makers of the benefits of specific low income programs, as well as compare the benefits of different utility low income programs.

The general equation for the California LIPPT cost effectiveness test is:

Cost Effectiveness = (Energy Benefits + Non-energy Benefits) / Cost(s),

Where:

- **Energy Benefit** is the net present value of all program related energy benefits over the life of the measure
- **Non-energy Benefit** is the net present value of all program related non-energy benefits (including negative benefits) over their expected life
- **Cost** is the net present value of all program related costs

The non-energy benefits included in the LIPPT can substantially change the cost benefit ratio for a given LIEE program. In conducting tests using program costs and energy savings data for an imaginary LIEE program, the cost benefit ratios grew from .7 to 1.5 when the program associated non-energy benefits were included. That is, the non-energy benefits acted to more than double the cost benefit ratio, demonstrating that the non-energy benefits can be equal to or greater than the energy benefits associated with the imaginary program.

What the LIPPT does *not* do is just as important as what the test *does* do. The LIPPT is not designed to examine the cost effectiveness of programs from a load or demand reduction perspective, or to analyze the comparative costs associated with power generation or power acquisition. The energy savings included in the LIPPT are consumption saving rather than demand reduction values. As a result, the LIPPT it is not designed to make resource acquisition or allocation decisions, or to support decisions associated with reducing energy demand.

The LIPPT is currently a fully functional working model, and has just been used by PG&E, San Diego Gas and Electric Company, Southern California Electric Company, and Southern California Gas Company for the first time in May 2001. However, the LIPPT is only the first version of a low-income public purpose test, and additional modifications to the test will be incorporated as more research is conducted to document the non-energy benefits associated with California's LIEE programs. The current test (version one) is based on the best information available at the time of development.

Non-Energy Benefits (NEBs) Included in the Low Income Public Purpose Test

Determining which benefits to include and exclude in the test was an iterative process involving many presentations and long discussions among the Team and the RRM Working Group. To develop the recommendations and the model, the consultant conducted a detailed examination of the literature documenting and/or evaluating a wide range of program benefits associated with low-income programs. In developing the NEB recommendations, the consultant reviewed more than 125 publications and interviewed scores of experts in the field to develop a list of benefits that could reasonably be considered to result from California's low-income programs. Included in this review were past studies recommending methods to assess hard-to-measure benefits (including Skumatz and Dickerson (1999), and Skumatz, Dickerson, and Coates (2000), and Hall (1999 and 1998)), studies that identified methods and priorities for future research (including Megdal (1994), Skumatz (1996), Hall (1998), and Green and Skumatz (2000)), and the array of methods used to calculate estimates.

Following these efforts, the consultants developed an operational draft test. After much discussion by the by the RRM Working Group, the final test included only those benefits with sufficient California-specific data, or relevant proxies. When judgments needed to be made pertaining to methods

or benefit values, the RRM Working Group elected to err on the side of conservatism so that benefits would not be over-estimated.

The test is built so that individual benefit values can be turned "on" or "off" as needed by each user. This flexibility allows each utility to use the test in a way that best meets the reporting needs of the utility, and, at the same time, provides a uniform framework for comparing programs across service territories and between utilities. The following Table 1 presents the list of NEBs that were considered for the LIPPT and indicates which benefits were actually included in the current computations for the LIPPT test. The NEB module includes computation methods for all these benefits; however, as described below, some NEB categories were selected "off" because of poor data or other reasons. The model retains the flexibility for the utilities to include (or exclude) additional benefits categories as data improves. In addition, the NEB module includes the ability to "scale" the benefits to small- and large-scale programs.

Table 1 Non-Energy Benefits (NEB) categories considered for LIPPT

Benefit Category and description	Included or excluded in LIPPT
Utility benefits	
Reduced Carrying Cost on Arrearages (7A) valued in terms of the cost to the utility	Included
Lower Bad Debt Written Off (7B) valued at utility costs	Included
Fewer shutoffs (7C) valued at utility costs	Included
Fewer reconnects (7D) valued at utility costs	Included
Fewer notices (7E) valued at utility costs	Included
Fewer customer calls (7F) valued at utility costs	Included
Lower collection costs (7G) valued at utility costs	Not included because separate data were not available
Reduction in gas emergency calls (7H) valued at utility costs	Included
Insurance savings	Not included to avoid double counting and because data weren't available
Transmission and/or Distribution savings (7J)	Excluded because the energy savings computations used in the LIPPT test incorporate these benefits
Reduced Subsidy (7K) valued at utility and ratepayer savings	Included
Societal benefits	
Economic Impacts (8A) measured in state- or public benefits terms	Not included because supporting data were unreliable
Emissions / environmental Impacts (8B) measured in public benefits terms	Excluded because the avoided cost used in the energy savings computations for the LIPPT test include this benefit.
Health and Safety Benefits (8C) valued at amortized installation cost	Included, but zero value because no H&S measures are included in the LIEE program.
Water and Wastewater savings (8D) valued at avoided societal costs	Included conceptually, but zero value because of short life.
Participant benefits	
Program incentives	Included, if applicable
Participant Water and wastewater bill savings (9A)	Included
Participant value from fewer shutoffs (9B)	Included

Participant value from fewer calls to the utility valued as time savings (9C)	Included
Fewer reconnects (9D) valued in saved time and costs for participants	Included
Property value benefits from program-provided home repairs (9E)	Included
Fewer fire losses to participants and society (9F)	Included
Fewer health-related expenses from health and safety improvements (9G)	Included, but zero value because no health and safety measures are included in the default LIEE programs.
Participant savings from fewer moves (9H)	Included
Fewer lost sick days from work (9I)	Included
Reduced transactions costs (9J)	Excluded because underlying data weak
Improved comfort, noise, and similar benefits to participants (9K)	Included
Reduced other hardship benefits – control over bill and energy use (9K)	Included

Determining Non-Energy Benefit Values

The overall method for computing benefits is similar for all NEB categories and was based on previous work for the utilities (Skumatz (1996, 1997), Skumatz and Dickerson (1998)). The value or cost of the benefit category "before" the program is multiplied by the "impact" or "change in incidence" expected because of the program's actions. This provides an estimate of the savings or non-energy benefit associated with the program. The NEBs included in the LIPPT were calculated in terms of dollars "per participant household" per year. This method makes it easier to scale benefits up or down based on program participation rates and puts all benefits in the same terms, allowing comparisons of relative impacts and importance. The determination of each benefit's value was made using several different techniques as appropriate for each NEB category. Each of the non-energy benefits was valued in one of the following three ways.

In the first method, each utility was asked to provide data on costs associated with billing, arrearages, debt, connects, disconnects and costs associated with customer interactions. For the utility benefits associated with LIEE programs, the calculated value of the benefit used in the test are derived from these utility-specific cost data. Each utility uses its own utility-specific cost data to feed the LIPPT model. To attribute the utility-specific costs to a LIEE program, the Team used published program evaluations estimating the expected occurrence of the benefit in a LIEE program. These estimated incidences of the benefit were then multiplied by the cost of the incidences as calculated using the utility-specific cost data.

The second method was used to calculate non-energy benefits when actual cost or savings values were not available from the utilities. For these benefits, estimates of benefit values reported in the literature for low-income or residential programs were used. In many cases, the literature search identified a wide range of benefit estimations. In these instances, the most relevant study or estimation method that could conservatively be equated to California's low income program benefits was used. The calculation methods and the source of the benefit estimations are included in the program report and referenced in the working model of the test.

The third method for valuing benefits primarily applied to participant benefits that could not be quantified through the literature or through utility cost data. These benefits include comfort, hardship and similar benefits associated with participation. For estimating these benefit values, the consultants conducted a survey of California low-income program participants. Participants were asked how much

they would be willing to pay for the increased comfort or the reduced hardship associated with program participation. These benefits and benefit values ranged from a low of a negative $12.62 per participant for the added hassles associated with participation to a high of $31.67 per year per household for their increased comfort as a result of the installed measures.

The values associated with specific NEBs using these methods are reflected in the following Tables 2 through 5 and provide an estimation of the expected benefits associated with an imaginary LIEE program implemented in California. Actual values will be different for each program. A description of the methods used to derive the estimates is provided in the following sections.

Table 2 Example of utility non-energy benefits in LIEE programs

Utility-Related Benefits: Benefits Valued At Utility Costs And Savings			
	NEB Category	**Annualized Benefits per Participant**	**Horizon for Benefit (in years)**
7A	Reduced Carrying Cost on Arrearages (interest)	$3.76	10
7B	Lower Bad Debt Written Off	$0.48	10
7C	Fewer Shutoffs	$0.05	10
7D	Fewer Reconnects	$0.02	10
7E	Fewer Notices	$1.49	10
7F	Fewer Customer Calls	$1.58	10
7G	Lower Collection Costs	$0.00	10
7H	Red'n in emergency gas service calls	$0.07	10
7I	Utility Health & Safety - Insurance savings only	$0.00	10
7J	Transmission and/or distribution savings (distribution only)	$0.00	10
7K	Utility Rate Subsidy Avoided (CARE) payments	$2.77	10
	Subtotal	**$10.22**	

Table 3 Example of societal non-energy benefits in LIEE programs

Societal / Public Benefits: Benefits Beyond Utility And Participants			
	NEB Category	**Annualized Benefits per Participant**	**Horizon for Benefit (in years)**
8A	Economic impact (direct and indirect employment)	$0.00	1
8B	Emissions / Environmental	$0.00	10
8C	Health and Safety Equipment (CO and Other H&S)	$0.00	7
8D	Water and wastewater (avoided)	$0.00	3
	Subtotal	**$0.00**	

Table 4 Example of participant non-energy benefits in LIEE programs

Participant Benefits: Benefits Accruing To And Valued At Participant Values And Costs			
	NEB Category	**Annualized Benefits per Participant**	**Horizon for Benefit (in years)**
	Program rebate (directly from assumptions above)	$0.00	1
9A	Water/sewer savings	$5.65	3
9B	Fewer shutoffs	$0.17	3
9C	Fewer Calls to the utility	$0.18	10
9D	Fewer reconnects	$0.08	10
9E	Property value benefits	$17.80	10
9F	Fewer fires	$2.44	10
9G	Indoor Air quality (CO-related)	$0.00	7
9H	Moving costs / mobility	$1.30	10
9I	Fewer Illnesses and lost days from work/school	$3.78	10
9J	Reduced transactions costs (limited measures)	$0.00	0
9K	Net Household Benefits from Comfort, Noise, net of negatives	$6.44	10
9K	Net Household Benefits from Additional Hardship Benefits	$2.57	10
	Subtotal	**$40.41**	

Table 5 Summary example of net present value for non-energy benefits for LIEE

Summary Of All Non-Energy Benefits		
	Annualized Benefits per Participant	**Net Present Value of Benefits**
Utility-Related NEBs: Benefits Valued at Utility-avoided Costs, Savings, or Values	$10.22	$368,460
Societal/Public NEBs: Benefits beyond those accruing to Utility or Participants	$0.00	$0
Participant NEBs: Benefits to Participants, Valued at Participant Costs and Values	$40.41	$1,456,291
Sum of Non-Energy Benefits (NEBs) Valued from All Perspectives	**$50.63**	**$1,824,751**

Estimating Non-Energy Benefits (NEBs)

In order to calculate cost-effectiveness estimates for the California LIEE Programs, the consultants developed a quantitative spreadsheet modeling approach for estimating non-energy benefits. This modeling approach was then applied to derive cost-effectiveness estimates for a low-income

weatherization and education program. The methodology and quantitative estimates that were developed served several purposes:

- To identify and quantify the categories of non-energy benefits associated with the program;
- To estimate the full range of benefits from the program, including benefits from three separate perspectives: utility, participant, and society;
- To provide information and a modeling approach to internalize non-energy benefits into program decision making; and
- To use the estimates as inputs to computations of cost-effectiveness.

The non-energy benefits were calculated and presented in terms of per household savings, first year savings, and net present value over the program analysis period. Sources for the savings included both the measure installation effects (such as lower usage, more efficient equipment, etc.) and education components.

Trying to assess non-energy benefits for a broad public benefits test is complicated. Great care was taken to assure that the included benefits were based on credible and defensible data, that the benefits were comprehensive, and that the benefits were non-overlapping. The analysis recognized that one program impact could lead to benefits accruing to several stakeholders associated with the program. For example, a reduced number of calls (because bill payments improve) saves staff time for the utility and saves time and hassle for the participant; similarly, water savings reduce participant bills and provide societal savings. To make sure all benefits were recognized and to keep the valuation methods clear, the analysis employed a construct for valuing benefits from the perspectives of each of the different market actors that benefit from the program. This was crucial in making sure the test did not duplicate or double-count benefits. Thus, benefits were organized into three perspectives, representing three different valuation methods:

- **Utility-related benefits** are valued at the savings or avoided costs to the utility. The types of values assigned include savings in labor costs from fewer bill-payment related activities, and similar types of savings associated with a reduction in utility efforts.
- **Public or Societal benefits** are benefits that do not directly accrue to participants or to the utility, but are beneficial to society in general. Examples include environmental benefits, regional economic multipliers, and similar types of benefits.
- **Participant benefits** are benefits received by the households participating in the program. These include benefits that save time for participants, such as non-energy bill savings, reduced calls to the utility company to have their power reconnected, reduced moves from homes as a result of keeping the power turned on and other similar benefits. In valuing benefits that are savings to participant's time, the time-savings are valued at the California minimum wage. This benefit category included difficult-to-measure benefits related to hardship and comfort.

Applying distinctly different valuation methods for the different sets of benefits helped assure that benefits were not double-counted, and that all appropriate NEBs were considered and included. These three NEB valuation categories identified the classifications of benefits included in the LIPPT.

In some cases, benefits could properly apply to more than one category. For example, the estimated benefits from reduced bill-related calls made by the utility were included in the *utility* benefits estimations, but estimated benefits from reduced bill-related calls from participants to the utility accrued to the *participant* benefits estimations. In this example, both the utility and the participant benefits from reduced energy-related calls were included, because both are caused by the program, and the estimated

benefits are non-overlapping. Similarly, savings were estimated from shutoffs and reconnects using both utility and participant valuation methods as these benefits also apply across both categories. From the utility side, the net savings in utility labor that is not reimbursed by customer reconnect fees was estimated. From the participant side, these reconnect fee payments (if any) were included, as well as the time associated with reconnection activities and lost service related to the shutoff. Throughout the report, care was taken to maintain a distinction between the benefits estimated across different categories of beneficiaries and to value them in an appropriate and non-overlapping manner.

Developing the Non-Energy Benefits Component of the LIPPT

A great many evaluation reports were reviewed for this effort. Unfortunately most of these reports did not provide well-documented estimates for the non-energy benefit categories needed for this study. Many of the reports were based on speculations or identified non-energy benefit categories for which further research was needed to document the existence of the benefit. It is clear that additional research is needed to quantify many non-energy benefits to the level needed for a cost effectiveness test. However, the LIPPT uses only those non-energy benefits for which the RRM Working Group agreed that sufficient supporting research already exists and for which a quantifiable value was identified.

Terms and Units for NEBs: What the LIPPT Is Computing

The NEB module of the LIPPT computes the benefits using two basic inputs: (1) the "per-participant" cost or benefit (in dollar terms) is multiplied by (2) the "change in incidence" expected from the program. One of the problematic aspects of previous work on NEBs is that different benefits are measured in different and varying units. Some researchers present benefits in present value terms, others in annual terms, and so on; in fact, several studies mix units of measure within the same report. This makes it difficult to readily determine which non-energy benefits have relatively large or small per participant impacts. The development of the LIPPT presents all benefits in the same terms; estimated annual benefits for an average participating household, rather than a mixture of present values, annual program benefits, one-time benefits, etc.

The literature presents much of the analysis in both dollar terms and "percentage adder" terms. The "adder" term usually identifies a benefit as a percent of a specific program characteristic, such as the cost of program installed energy efficiency measures, the cost of a certain subset of measures, the cost of the program as a whole, or some other baseline from which a percent of costs are calculated and assigned as the value for the non-energy benefit being examined. Given that the goal of this project was to develop a new cost-effectiveness test that uses the best documented values for calculating non-energy benefits, the LIPPT presents the NEB estimates in dollar terms rather than as percentages of program related costs.

Horizons or Time Periods for the Benefits – Annualizing and NPV

The annual benefits included in the LIPPT were translated to net present value terms based on their expected lifetimes, and appropriate discount rates. The LIPPT computations required information on two "horizons". The first was the number of years the specific NEB benefits are expected to last. These expected lifetimes were used to translate benefits that could accrue for varying periods of time to comparable "annualized" benefits. In some cases, benefits were assumed to occur annually over the life of the achieved energy savings, such as a reduction in pollution as a result of the associated energy

[3] As previously demonstrated in models and estimates developed in Skumatz (1996), (1997), (1998), and others.

savings. Measure lifetimes – whether the items wear out or are removed – served as the limit to the appropriate horizon for other benefits. For example, the NEB research showed that many water-related measures are removed prematurely, eroding the life expectancy and horizon for water-related benefits. Thus, based on the research, horizons for water-measure benefits were set at three years.

For other benefits, a professional judgment was made to determine the appropriate time horizon of the benefit. For example, some people argue that arrearage reductions last as long as the energy savings; after all, the reductions in bills remain as long as the energy savings lasts, continuing to help residents avoid arrearages and payment difficulties.[4] Others argue that billing, payment, and shut-off related benefits should only be counted for a few years.[5]

To make the presentation as clear and as consistent as possible and to establish conservative values that can withstand challenge, the LIPPT was constructed so that most benefits have similar lifetimes over which the non-energy benefit is calculated. A non-energy benefit calculation period of seven or ten years was set for all benefits except for the water-related benefits (which had customer-acceptance issues). The lifetime for water-related benefits was set at three years.

Perspective-related discount rates were applied to these "annualizing" computations. Utility benefits were discounted using 8.15% as the discount rate. For annualizing societal or public benefits, a discount rate of 3% was used, a rate that represents the longer-term view usually assigned to public benefits. A higher discount rate was used to annualize participant benefits. The Team discussed values from 10% to 25% and agreed on a value of 18% to provide a conservative value for the cost of borrowing money for low-income customers. In some cases, participant benefits measured as a one-time benefit (essentially, a net present value in themselves) were included. In those cases, the discount rates and program evaluation lifetimes were applied to turn the benefit into annualized terms, which were ultimately summed back up into the NPV that was included in the LIPPT test.

The second time horizon required is the time period over which the benefit is amortized: 10 years, 20 years, or another time period. This is the period over which the benefit is calculated when computing the net present value for the stream of benefits calculated using the methods described in the text below. That is, although the benefit may only last 3 years, the benefit is amortized over a longer period to calculate the net present value of the benefit over the life of the program. This allows the net present value of the non-energy benefits to be equalized over the life of the program impacts and provides a method for comparing non-equivalent programs to one another.

The final items needed for the computations of the total net present value (NPV) were the discount rate to be applied to the test (used to translate future benefits into present values), and the number of participants in the program. The overall discount rate used assumed an overall LIPPT societal discount rate of 8.15%

In summary, the proxy values for the NEBs were presented as dollar benefits in annual terms per average participating household. These values were then converted into total net present value (NPV) terms and used in the computation of the LIPPT, and the benefit-cost ratio assessment.

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[4] One additional enhancement would be to reduce the energy savings (and related benefits) over time by the degree of technical degradation associated with the measures. This is a very appropriate and straightforward enhancement.

[5] There are several reasons a shorter horizon might be adopted. First, arrearage and other impact studies have tended to be one-year or one-time impact studies, so no studies have tried to demonstrate lasting impacts. Second, small reductions in energy costs might not be sufficient to provide a lasting impact on the participant's ability to manage their household budgets effectively. Also, since program participants move frequently and other low-income persons may not reoccupy a "treated" dwelling, the program may only have a short-term impact on low-income participants' bills. The consumers themselves may be responsible for the continuation of good payment behavior, as opposed to this being a continued benefit that is attributable to the program. However one study (Hall, 1999) using participant bill payment histories for a mid-western utility weatherization program documented continued bill payment improvements more than a year after program participation.

Results

PG&E and the other California utilities ran the test with real data for the first time in April 2001. PG&E's results are presented in Table 6 below.

Table 6 Summary of LIEE Cost Effectiveness (Ratio of Benefits over Costs)

	PY 2000 (Recorded)			PY 2001 (Planned)		
	Utility Cost Test	**Total Resource Cost Test**	**LIPPT (4)**	**Utility Cost Test**	**Total Resource Cost Test**	**Participant Test**
Energy Efficiency (1)	-	-	-	0.66	0.66	1.90
Energy Efficiency (2)	-	-	-	0.49	0.49	1.90
Energy Efficiency (3)	0.33	0.33	0.62	-	-	-

(1) Using market clearing price with on-peak and off-peak escalation.
(2) Using market clearing price with on-peak only escalation.
(3) Using marginal costs recommended by the California Board for Energy Efficiency.
(4) The California Low Income Public Purpose Test (LIPPT).

The jury on the new low income cost effectiveness test is still out. The results are still being analyzed and have not yet been fully addressed or adopted by the CPUC. In summary, the results show that including even conservative estimates of non-energy benefits increases the benefit-cost ratio – almost doubling the value – and that participants realize significant value from the LIEE program beyond the energy savings. The LIPPT project enhanced previous work and demonstrated that credible estimates can be developed for a wide range of important non-energy benefit categories, including benefits to the utility, to society, and to participants.

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