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METHODOLOGICAL APPROACH TO DETERMINING THE COST-EFFECTIVENESS OF COORDINATED PARTNERSHIPS

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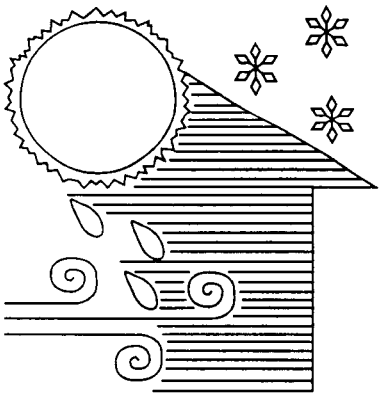

WEATHERIZATION ASSISTANCE PROGRAM

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EXECUTIVE SUMMARY

As governments at all levels become increasingly budget-conscious, expenditures on low-income, demand-side management (DSM) programs are being evaluated more on the basis of efficiency (i.e., cost-effectiveness)—at the expense of equity considerations. Budgetary pressures have also caused government agencies to emphasize resource leveraging and coordination with electric and gas utilities as a means of sharing the expenses of low-income programs. The increased involvement of electric and gas utilities in coordinated low-income DSM programs, in turn, has resulted in greater emphasis on estimating program cost-effectiveness.

The objective of this study is to develop a methodological approach to estimate the cost-effectiveness of coordinated low-income DSM programs, given the special features that distinguish these programs from other utility-operated DSM programs.

The general approach used in this study was to (1) select six coordinated low-income DSM programs from among those currently operating across the United States, (2) examine the main features of these programs, and (3) determine the conceptual and pragmatic problems associated with estimating their cost-effectiveness. The energy savings of all six programs were found to be significant: annual energy savings for the three gas DSM programs ranged from 409 to 635 ccf (hundred cubic feet) per dwelling, and for the three electric DSM programs savings ranged from 2,282 to 3,323 kWh (kilowatt-hours) per dwelling. Costs for the six programs ranged widely from $1,539 to $4,950 per dwelling.

Three types of coordination between government and utility cosponsors were identified. At one extreme, local agencies operate "parallel" programs, each of which is fully funded by a single sponsor (e.g., one funded by the U.S. Department of Energy and the other by a utility). At the other extreme are highly "coupled" programs that capitalize on the unique capabilities and resources offered by each cosponsor. In these programs, agencies employ a combination of utility and government funds to deliver weatherization services as part of an integrated effort. In between are "supplemental" programs that utilize resources to supplement the agency's government-funded weatherization, with no changes to the operation of that program. The result is more weatherized homes, more comprehensive weatherization, or both.

The five perspectives from which cost-effectiveness is typically measured, originally developed for use in California, provide the foundation for developing an evaluation methodology for these types of programs.[1] However, the California tests must be adapted to meet the unique

[1] California Public Service Commission and California Energy Commission (1987). We recognize different frameworks exist in which DSM programs can be evaluated. Our objective in this study, however, is to examine the special features of coordinated low-income DSM programs using the framework provided by the California tests.

features of coordinated low-income programs. Five features of these programs are especially important in determining cost-effectiveness:

- **Determining benefits to participating low-income households**. The benefits of coordinated low-income programs to participants typically are different from those obtained by participants in other utility-run, DSM programs. Instead of paying incentives to customers that are typically matched by customer contributions, the typical low-income program involves a payment in kind through the direct installation of measures such as new furnaces and insulation. Besides energy-related benefits (e.g., lower gas or electric bills), these in-kind payments may also lead to other types of benefits to participants (e.g., higher housing values). In estimating cost-effectiveness, it is important to identify the types of participant benefits for which the tests are being applied. For example, if energy benefits are the only ones applicable, the annual flow of energy savings from the in-kind payments are the most appropriate measure of participant benefits in the cost-effectiveness calculus. Participant benefits must be carefully defined to avoid double counting.

- **Treating government expenditures**. An important consideration in estimating the cost-effectiveness of a coordinated low-income program from a utility's standpoint is the level from which the government expenditure is made. If the expenditure of government funds is only distantly related to the determination of a utility's rates, there is no justification for including the government expenditures as part of the nonparticipant costs of the programs (e.g., federal funds for an investor-owned utility). However, the justification for including these costs becomes greater as the level of government funding approaches the utility's service territory (e.g., local government funds spent in coordination with a municipal utility's DSM program).

- **Distinguishing between program and utility cost-effectiveness**. Because a utility benefits from government expenditures on DSM programs in its service territory even if it does not co-fund the program, an important consideration in estimating cost-effectiveness for a utility is its incremental contribution to the coordinated program—i.e., the incremental benefits and costs of its out-of-pocket program expenditures. Therefore, it is necessary to divide the benefits and costs of a coordinated low-income program into those attributable to the utility (incremental effects) and those attributable to the total program (inclusive effects).

- **Allocating energy and capacity savings across cosponsors**. In determining the energy and capacity savings attributable to a utility's contribution to a coordinated program, empirical evidence indicates that the amount depends on the type of coordination: parallel, supplemental, or coupled. Because the magnitude of savings is important in estimating cost-effectiveness, special attention must be paid to this variable. Costs associated with the DSM program also need to be allocated across cosponsors.

- **Including Arrearage Reduction**. Arrearage reductions are an important cash-flow by-product of running low-income DSM programs. To obtain an accurate estimate of the benefits of this reduction, utilities must conduct a billing analysis.

To assess the impact of these program attributes in estimating cost-effectiveness, we simulated the cost-effectiveness of a hypothetical—but representative—coordinated low-income DSM program under varying input assumptions. The major conclusion of this exercise is that improperly accounting for the peculiarities of coordinated low-income programs can drastically alter the

estimates of cost-effectiveness, even changing bottom–line conclusions regarding the program's performance.

The results of the six case studies and the sensitivity analysis of the hypothetical program suggest that current data collection activities by government agencies and utilities need to be enhanced if valid estimates of the cost-effectiveness of coordinated low–income DSM programs are to be obtained. Three areas of improvement are stressed:

- **Allocation of energy and capacity savings across cosponsors.** Data collection and analysis need to be designed to enable estimation of the energy and capacity savings attributable to a utility's contribution. In "parallel" programs, all of the savings can be assigned to the utility. In "supplemental" programs, the method of allocation depends on how the utility funds are used. If they are used to weatherize additional homes, then savings can be divided proportionately according to level of investment in energy-conservation measures. If they are used to conduct more comprehensive weatherization, and the savings before and after the utility's involvement cannot be compared, then the relationship between level of investment and savings may need to be calibrated. In "coupled" programs, comparing before and after savings may enable a valid allocation. Otherwise, engineering analysis of the altered program features can guide the allocation of savings.

- **Measurement of net bill reductions.** To implement the recommendation that bill reductions be measured in "net" rather than "gross" terms, it is valuable to collect data on control groups of low–income households. Control groups can be drawn from eligible nonparticipants, applicants waiting to be weatherized, or past participants of low-income programs.

- **Estimation of administrative costs.** Our suggested cost-effectiveness tests require that government and utility expenditures be subdivided into program outlays (which primarily benefit participants) and administrative costs (which have broader societal benefits). It is recommended that administrative costs be defined to include both installation-related overhead and program management costs. Excluded from this definition are program expenditures on the purchase of weatherization materials and on–site labor.

In conclusion, government agencies and utilities can coordinate their low-income DSM efforts in many different and mutually beneficial ways. Low-income DSM partnerships may involve two or more cosponsors and they may be parallel, supplemental, or coupled. This diversity challenges evaluators to develop standardized, yet flexible cost-effectiveness methodologies. Our suggested inclusive and incremental versions of the five California standard practice tests offer a broad spectrum of perspectives and measures from which many different types of coordinated DSM programs can be assessed.

ABSTRACT

Over the past decade, electric and gas utilities have substantially increased their investment in demand-side management (DSM) programs for low-income customers. This growth has provided an opportunity for government-funded weatherization programs to work with utilities to deliver jointly funded DSM services. It has also created a need to develop a methodology for estimating the cost-effectiveness of programs that are co-funded.

The objective of this study is to develop a methodological approach to estimate the cost-effectiveness of coordinated low-income DSM programs. Six coordinated low-income DSM programs were selected from among those currently operating across the United States in order to examine the main features of those programs and determine the conceptual and pragmatic problems associated with estimating cost-effectiveness.

Five perspectives from which cost-effectiveness is typically measured, originally developed in California, provide the foundation for developing an evaluation methodology for these types of programs. A simulation was performed to test the cost-effectiveness of a hypothetical—but representative—coordinated low-income DSM program. It was conducted with varying input assumptions to determine the parameters that have the most influence on cost-effectiveness.

California standard practice was adapted to address the following five issues:

- Determining benefits to participating households;
- Treating government expenditures;
- Distinguishing between program and utility cost-effectiveness;
- Allocating energy and capacity savings across co-sponsors; and
- Accounting for arrearage reductions.

I=ncremental and inclusive versions of the cost-effectiveness tests were created. Because coordinated low-income programs involve multiple sponsors, it is useful to distinguish between the cost-effectiveness of the program as a whole and the cost-effectiveness of the utility's contribution. Estimating the cost-effectiveness of the total program involves the measurement of total or inclusive costs and benefits, and provides a useful overview of the total investment in the program. Estimating the cost-effectiveness of the utility's investment involves the measurement of incremental costs and benefits, allowing a utility to compare its investment in the low-income DSM program with other investments the utility is considering, including other DSM programs.

1. INTRODUCTION AND SUMMARY

1.1 OBJECTIVE OF THE STUDY

The objective of this study is to develop a methodological approach to estimating the cost-effectiveness of utility demand-side management (DSM) programs for low-income customers that are coordinated with government-sponsored energy conservation programs.[1] The reason that these types of DSM programs have been singled out for study is that, as governments at all levels become more budget conscious and more apt to encourage cost-sharing of these programs with electric and gas utilities, measurement of the cost-effectiveness of coordinated programs becomes more prominent.

The U.S. Departments of Energy (DOE) and Health and Human Services (HHS) both fund energy programs for low-income households. HHS has created federal incentive funds that reward leveraging of funds between local agencies and electric and natural gas utilities. DOE has proposed to establish a similar leveraging incentive fund for its low-income Weatherization Assistance Program. In addition, some state legislatures have appropriated funds for weatherization that are contingent on the expenditure of matching utility resources. Leveraging, of course, increases the level of coordination between local assistance agencies and electric and gas utilities.

1.2 APPROACH USED IN THE STUDY

To accomplish the study's objective, six coordinated low-income DSM programs were selected for in-depth study. The programs were sampled from an inventory of 31 coordinated programs that was compiled for this project. The final six were chosen from among the 31 based on a range of criteria that included (1) the availability of data on energy savings and (2) geographical and fuel diversity. Three electricity and three natural gas DSM programs were included.

A hypothetical, coordinated low-income DSM program was then defined using the features and financial relationships of the six case-study programs. The hypothetical program was used to illustrate changes in cost-effectiveness arising from different interpretations and measurements of benefits and costs.[2]

"California Standard Practice" for estimating the cost-effectiveness of DSM programs was the starting point for the analysis.[3] The tests used in this paradigm define the four main perspectives from which the cost-effectiveness of DSM programs was viewed:

- the participants in the DSM program ("participant test");
- other customers of the utility that do not participate in the program ("nonparticipant test" or "ratepayer impact measure");

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[1] In a companion document (Hill and Brown, 1994), the methodology is developed and illustrated in greater detail.

[2] The cost-effectiveness of the six case-study programs was not estimated because of incomplete data, particularly the absence of data on utility-specific avoided costs for energy and capacity.

[3] California Energy Commission and California Public Service Commission (1987).

- both participants and nonparticipants ("total resource cost test"); and
- the utility exclusively ("utility cost test" or "revenue requirements test").

For completeness and consistency with the California approach, we also considered cost-effectiveness from the standpoint of U.S. society as a whole ("societal test"), and ran a sensitivity case accounting for the reduction of environmental emissions as a result of running a DSM program. Because the focus of this study is on a cash-flow definition of cost-effectiveness, we did not emphasize state-level or national-level costs and benefits. In the same vein, we did not attempt to quantify some important—but not easily quantified—benefits of low-income DSM programs such as increases in comfort, productivity, and health and safety.

We then showed how we adapted the California tests to arrive at our suggested tests, which are tailored to the needs of coordinated low-income programs, including:

- the use of net—rather than gross—energy and capacity savings resulting from DSM programs; and
- the distinction between total program cost-effectiveness (called the "inclusive test") and the cost-effectiveness of the utility's contribution (called the "incremental test").

Using these suggested tests, we illustrate how different assumptions about the primary features of coordinated low-income programs will change the measured cost-effectiveness. Benefit-cost ratios were used to illustrate our points, but other measures of cost-effectiveness could have been used as well.[3] The main features include:

- quantifying the benefits to the participants of low-income DSM programs;
- allocating energy savings between government and utility cosponsors;
- treating the government's expenditure in the benefit-cost calculus;
- estimating cost-effectiveness for programs that involve coordination between local levels of government; and
- including arrearage reductions as benefits of low-income DSM programs.

We also conducted a sensitivity analysis, showing how changes in other assumptions can affect estimates of cost-effectiveness. These assumptions pertain to discount rates, the useful lives of weatherization measures, avoided costs of DSM programs, environmental externalities, and arrearage reductions. Finally, key cost-effectiveness issues associated with natural gas, low-income programs were examined — in particular, the determination of avoided capacity costs.

[3] In a companion practices manual to this study, other cost-effectiveness measures are used (Hill and Brown, 1994).

1.3 OVERVIEW OF RESULTS

1.3.1 Common Features of Coordinated Low-Income Programs

Annual energy savings for the three gas DSM programs ranged from 409 to 630 ccf (hundred cubic feet) of gas per dwelling, and they ranged from 2,282 to 3,323 kWh (kilowatt-hours) of electricity per dwelling for the three electric DSM programs. Costs ranged from $1,539 to $3,887 per dwelling. Three types of coordinated low-income programs were identified (parallel, supplemental, and coupled), which involve varying degrees of cooperation between government and utility cosponsors.

- **Parallel Programs**. In these cases, the local weatherization agency operates two parallel programs—one funded by government grants and the other funded by utility contracts. The utility simply employs the agency as a subcontractor to deliver DSM services to low-income households. The utility-funded program is coordinated in the sense that some of the same staff and equipment are used by both programs.

- **Supplemental Programs**. These programs use utility funds to supplement the agency's government–funded weatherization program, with no changes to the operation of that program. The result is more weatherized homes, more comprehensive weatherization, or both.

- **Coupled Programs**. These programs employ a combination of utility and government funds to deliver weatherization services as part of an integrated program that is distinct from the agency's preexisting government-funded program. This type of program has the potential to outperform parallel and supplemental programs by taking advantage of the unique capabilities of each cosponsor.

Despite the existence of different modes of cooperation, ten features were found to be common to a majority of the coordinated programs. These commonalities are:

- A public utilities commission-mandated or encouraged establishment of the utility's low-income DSM program.

- The full program was launched without pilot testing, based on prior residential DSM experience.

- The local agency plays a major role in client recruitment, supplemented by the utility.

- Client targeting focuses on households that consume a lot of energy and are in arrears.

- Client eligibility is verified by the local agency.

- The audit used in the coordinated program is the same as the audit used in the DOE-funded Weatherization Program. The local agency either conducts the audits or provides the energy analysis information so that the utility can produce savings-to-investment ratios for individual measures and determine the scope of work for each home.

- Bulk purchasing and/or competitive subcontracting result in low costs.
- Multiple funding sources are used to weatherize homes. Utility funds tend to be limited to administrative costs and the more cost-effective energy-saving measures; they are not usually spent on structural repairs.
- Multiple inspections are conducted.
- If there is a program evaluation, it is paid for or conducted by the utility.

1.3.2 Methodological Issues

The data in Table 1.1 summarize the results of the study's assessment of a hypothetical coordinated low-income DSM program. The data show that the only difference between the results using California standard practices and our inclusive test relates to the energy-savings benefits to participants. Using gross savings in the California practice results in a benefit-cost ratio of 16.40 for the participant test. Using net energy savings in our inclusive test, the ratio increases to 20.50.

Table 1.1 Summary of Benefit-Cost Ratios for a Hypothetical Program

Scenario	Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost
California Test	16.40	0.52	2.91	2.91	3.00
Net Energy Savings	20.50	0.52	2.91	2.91	3.00
Base					
Inclusive	20.50	0.52	2.91	2.91	3.00
Incremental	20.50	0.37	1.06	1.06	1.00
Capital Benefits					
Inclusive	12.94	0.52	6.88	6.88	3.00
Incremental	12.94	0.52	2.91	2.91	1.00
Local Government Funding					
Inclusive	20.50	0.37	1.06	1.06	3.00
Incremental	20.50	0.37	1.06	1.06	1.00
Allocation of Savings					
Inclusive	20.50	0.52	2.91	2.91	3.00
Incremental	20.50	0.44	1.60	1.60	1.50
Arrearage Reductions					
Inclusive	20.50	0.58	3.27	3.27	3.37
Incremental	20.50	0.42	1.20	1.20	1.12

In addition to these energy-savings benefits, low-income households also may receive capital-improvement benefits in the form of new furnaces, insulation, air-conditioners, roofs, and the like. Including different types of benefits of a low-income program determines the cost-effectiveness of the program from the standpoint of the participant. Using the total value of the government's and the

utility's program outlays as a surrogate for capital benefits (in Table 1.1) rather than the flow of energy savings over the useful life of the investment (as was done in the base case in Table 1.1) results in a lower value of the benefit-cost ratio for the participant test.

Assuming that the government funding source is a municipality rather than the national government significantly lowers the cost-effectiveness estimate using the inclusive versions of the ratepayer impact measure and the total resource cost test. The lower benefit-cost ratios are due to the inclusion of government expenditures in the calculations.

The results in Table 1.1 suggest that the allocation of savings to the utility's and the government's investment in the program is a key factor in determining cost-effectiveness. Assuming a 50-50, utility-government share—rather than a 33-67 allocation—significantly increases the financial attractiveness of the program from the standpoint of the utility.

Finally, including an estimate of benefits from arrearage reductions significantly increases the attractiveness of low-income programs from four of the five perspectives. The benefit-cost ratios increase for the ratepayer impact measure, the total resource cost test, the societal test, and the utility cost test for both the inclusive and incremental versions.

1.3.3 Using the Tests in Practice

Treatment of government expenditures on low-income DSM programs in the cost-effectiveness calculus depends on the level of government and type of utility. If federal funds are used by a local utility, the expenditures should not be treated as "costs" for either the ratepayer impact measure or the total resource cost test. At the other extreme, the expenditures would be treated as "costs" if local-government funds were used by a locally owned utility.

Fixed formulae cannot be provided for determining the values of many benefit and cost categories because they depend on specific program features. For example, the allocation of (1) energy savings to participants and (2) avoided energy and capacity costs of utilities to a utility's incremental investment depends on the type of program and its maturation (e.g., existing vs. new).

However, for other benefit and cost categories, we make two recommendations. First, an estimate of benefits from arrearage reductions should be included and treated in a manner similar to avoided energy and capacity costs. Arrearage reductions are an important cash-flow benefit to utilities that run low-income programs. Second, an imputed value for the time spent by participants in the program should be included as "costs" in the total resource cost test only if a value for participants' time is imputed for the utility's other DSM programs.

A two-stage screening procedure is suggested in Chapter 6 for using the inclusive and incremental tests in practice. In the first stage, the inclusive test is used to determine a threshold percentage value for utility investment in the program—i.e., a percentage beyond which the program's benefit-cost ratio for the total resource cost and utility cost tests would be less than 1.0. In

the second stage, the incremental test is used to determine the cost-effectiveness of the utility's investment in the program. Here, a distinction must be made between existing programs and new ones. The allocation of energy savings and avoided costs is crucial for these two types of programs.

1.3.4 Data-Collection Requirements

The results of the six case studies and the sensitivity analysis of the hypothetical program suggest that current data collection activities by government agencies and utilities must be adapted to capture the key features of coordinated programs if valid estimates of cost-effectiveness are to be obtained. One of the most important difficulties of estimating cost–effectiveness is determining the amount of savings attributable to a utility's investment in a coordinated low–income program. Other data collection improvements are needed to estimate net rather than gross bill reductions and to distinguish administrative costs from program outlays.

1.4 REMAINDER OF THE REPORT

The remaining chapters provide further detail on the approach outlined above. In Chapter 2, we discuss the six case studies: how they were selected, their main features, and a synthesis of the strengths and weaknesses of their operation. The six cases are discussed in greater detail in Appendix A.

Key conceptual and pragmatic issues associated with estimating the cost-effectiveness of DSM programs are discussed in Chapter 3. We begin by discussing two different paradigms for determining the attractiveness of DSM programs: the least-cost paradigm (the California tests are part of these) and the most-value paradigm, which includes both least-cost features and the value of the program to its participants. Next we discuss the features of coordinated low-income DSM programs that differentiate these programs from other DSM programs run by electric and gas utilities. We then suggest modifications to the cost-effectiveness tests generally used by electric and gas utilities when evaluating these low-income programs. We conclude the section by discussing key issues in estimating the cost-effectiveness of low-income programs. Although many of these issues pertain to estimating the cost-effectiveness of all DSM programs (e.g., valuing avoided energy and capacity costs and treating externalities), others are more specific to estimating the cost-effectiveness of coordinated low-income DSM programs (e.g., apportioning program benefits and costs across cosponsors and estimating reductions in arrearages).

In Chapter 4, we suggest modifications to the California tests generally used by electric and gas utilities to evaluate DSM programs and we present our suggested tests. These tests employ the same perspectives as the California tests. However, they distinguish between inclusive and incremental versions to reflect the existence of cosponsorship, and they use different categories of benefits and costs to reflect the unique features of low-income programs.

A summary of the results of applying the tests to a hypothetical program is presented in Chapter 5. More detailed results of the simulations are presented in Appendix B.

Conclusions and recommendations are provided in Chapter 6. We offer suggestions for using the tests in practice and suggest some ways in which data can be collected in a manner consistent with the use of the tests.

2. CASE STUDIES OF SIX COORDINATED PROGRAMS

2.1 SELECTION OF SIX CASE STUDIES

The first step in the process of selecting six coordinated programs for analysis involved the creation of an inventory of coordinated low-income programs across the United States. Several sources were used to identify these programs, including (1) databases compiled for the National Weatherization Evaluation (Mihlmester, et al., 1992), (2) a review of the literature (Brown, 1990), and (3) input from members of the Project Advisory Committee. The result was a compilation of information on 31 coordinated programs (see Table 2.1).

Table 2.1 Inventory of 31 Coordinated Programs

Agency or Program Name	Utility(s)
CAP Services	Wisconsin Gas, Wisconsin Power and Light, and Wisconsin Public Service Corporation
Stoneleigh Housing*	Niagara Mohawk Power Corporation
The Opportunity Council	Puget Sound Power and Light
Housing Authority and Community Service Agency	Eugene Water and Electric Board
Greater Erie Community Action Committee	National Fuel Gas Distribution Corporation
EL-ADA	Idaho Power Company (1989)
Direct Assistance Program*	Southern California Edison
Project Choice	Minnegasco
Customer Assistance Project*	Pennsylvania Electric Company
Washington Low-Income Program*	Pacific Power and Light
Salt Lake City CAP	Utah Power and Light (1989)
Connecticut Weatherization Program (WRAP)	Northeast Utilities and Yankee Energy Systems
Operation Threshold	Iowa Public Service (1989)
SCOPE	Columbia Gas
Chronic Arrearages Pilot Program*	Northwest Natural Gas, Portland General Electric, and Pacific Power and Light
EL-ADA	Idaho Power Company (1991)
Community and Economic Development Association of Cook County	Northern Illinois Gas (1989)
Community and Economic Development Association of Cook County	Northern Illinois Gas (1991)
Ocean Inc.	Jersey Central Power and Light (1989)
Northern Tier Community Action Corporation	Pennsylvania Electric Company (1989)
Northern Tier Community Action Corporation	West Penn Power Company (1989)
Scranton/Lackawanna Human Development Agency	Pennsylvania Power and Light
Salt Lake Community Action Program	Utah Power and Light (1991)
Operation Threshold	Iowa Public Service (1991)
Operation Threshold	Midwest Gas (1991)
Operation Threshold	People's Natural Gas (1991)
Operation Threshold	Iowa Electric (1991)
Operation Threshold	Interstate Power (1991)
Utility Low Income Energy Efficiency Program*	New York State Electric and Gas
Customer Assistance Program*	Philadelphia Electric Company
M-200 Program*	Minnegasco (1992)

*These programs involve multiple agencies.

The second step in the selection process involved the creation of a list of selection criteria. With the assistance of Project Advisory Committee members, the following criteria were identified.

- Measured energy savings should suggest that the program is successful.
- Preference should be given to programs with existing benefit-cost estimates.
- Include gas and electric DSM programs.
- Include programs with different client selection procedures.
- Give priority to innovative programs, all else being equal.
- Give priority to programs that are still operating.
- Include programs that were created as a response to a public utilities commission mandate, and some that were not.
- Include at least one program where multiple parties are involved (e.g., multiple utilities, multiple government agencies).
- A regional cross-section of programs is desirable.
- Include at least one program that focuses on reducing utility arrears through weatherization.
- Include at least one electric DSM add-on to a gas DSM program.
- Include one audit reimbursement program.
- Include one agency that operates parallel weatherization programs (e.g., one for utility, one for DOE—one for gas utility, one for electric).
- Give priority to agencies and utilities that have exhibited enthusiasm for participation in the project.

Application of these criteria to the 31 programs resulted in a short list of nine coordinated programs. These programs were then rank-ordered by a formal mail balloting of the Project Advisory Committee. The final six programs (listed at the top of Table 2.1 and shown in Figure 2.1) are weatherization programs. They include an energy audit of each participating house and the installation of minor measures (such as caulking and weatherstripping) as well as major measures (such as insulation, storm windows, and furnace replacements). None of the case study programs involve only low-cost/no-cost measures such as lighting retrofits, low-flow showerheads, client education, and budget counseling.

The slate of six programs meets most of the selection criteria. First, and most important, each of the programs has generated significant energy savings based on analysis of utility billing data (often in conjunction with engineering estimates), as shown in Figure 2.2. First-year savings ranged

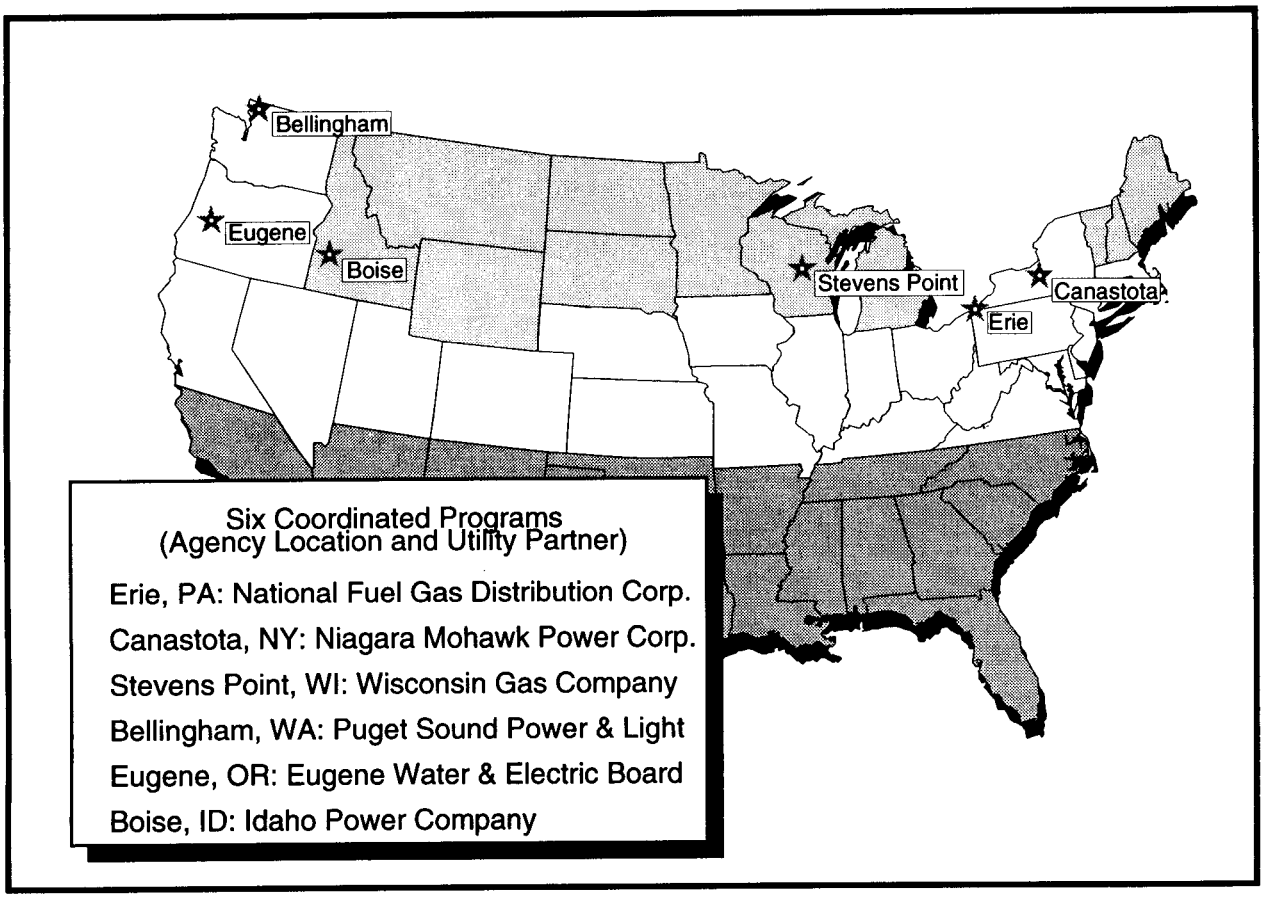

Fig. 2.1 Six Case Studies of Coordinated Low-Income DSM Programs

from 409 to 635 ccf (hundred cubic feet) per dwelling for the three gas DSM programs, and from 2,282 to 3,323 kWh (kilowatt-hours) per dwelling for the three electric DSM programs. These savings are generally higher than the annual savings experienced by participants in DOE's 1989 Weatherization Program, which ranged from 182 to 235 ccf/dwelling for gas-heated homes located in moderate or cold climates respectively, and from 2,479 to 2,686 kWh/dwelling for electrically heated homes located in moderate or cold climates respectively (Brown, et al., 1993).

The six programs include three electric utilities, two gas utilities, and one combined utility. Thus, diversity of fuel was achieved. The programs are also diverse in terms of goals (e.g., arrearage reduction vs. energy savings), client selection (e.g., high energy users vs. first–come, first–served), delivery of services (e.g., parallel vs. coupled programs), public utilities commission intervention (e.g., mandated vs. voluntary programs), and the number and types of cosponsors. The extent of cosponsorship by DOE, utilities, and other organizations is displayed in Figure 2.3. Total program costs per weatherized dwelling ranged from $1,539 to $4,950. This represents a much greater investment level than is typical of utility-operated low-income weatherization programs. (Power, et

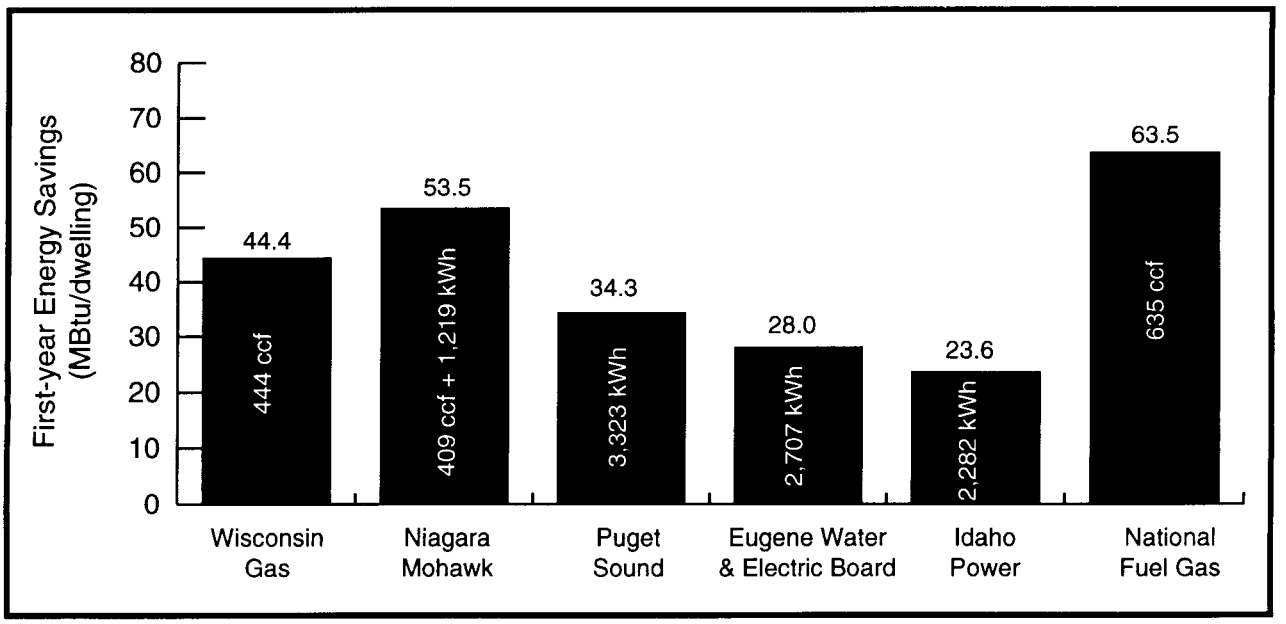

Fig. 2.2 First-Year Energy Savings of the Six Coordinated Programs

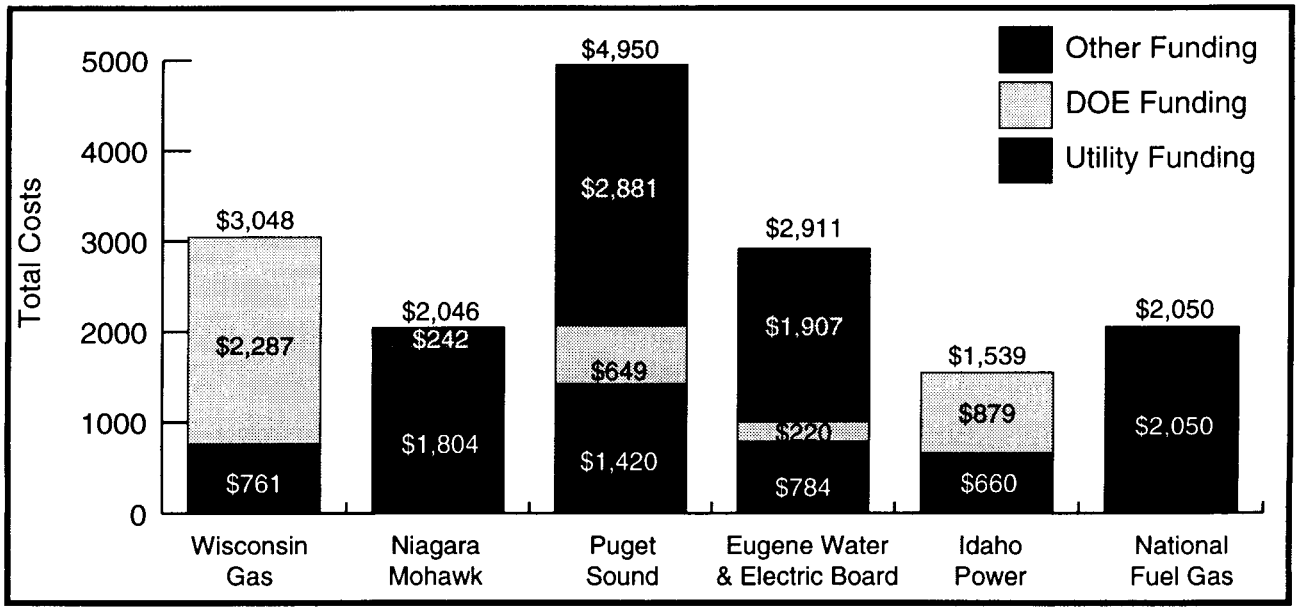

Fig. 2.3 Costs of the Six Coordinated Programs by Source of Funding

al., 1992, estimated that an average of $407 per weatherized dwelling was spent in utility-operated weatherization programs in 1989.) The range of costs of the six coordinated programs is also high relative to the amount typically spent in DOE's Weatherization Program, which averaged $1,550 in 1989 (Brown, et al., 1993).

Several of the programs have innovative features (e.g., focus on mobile homes, installation of low-cost furnace replacements). All of the programs are operating today, and each of their program managers was an enthusiastic participant in this study.

The final slate of six programs does not include two types of programs that were targeted by the selection criteria: audit reimbursement programs and electric DSM add-ons to gas DSM programs. Energy-savings estimates for such programs could not be found. In addition, regional diversity is achieved only to a limited extent. East-West representation is achieved, but North-South diversity is not. We were unable to find a coordinated program operating in a hot climate that had significant energy savings based on measured data.

2.2 OVERVIEW OF THE MAIN FEATURES OF THE SIX PROGRAMS

2.2.1 Summary of Each Program

The six coordinated programs are briefly described below. Each of these summaries provides an overview of the program's main features and any characteristics that might require special consideration when assessing cost-effectiveness.

Wisconsin Gas Company's Coordinated Program. This Wisconsin program is a collaborative effort between the Wisconsin Gas Company and CAP Services, a local agency responsible for weatherizing a nine-county area in rural Wisconsin. The first efforts at cooperation between community-based agencies and utilities in Wisconsin were established as a result of a 1982 mandate by the Public Service Commission of Wisconsin. Initial efforts by utilities to develop and implement low-income weatherization included sharing information between the utilities and CAP Services. Formal agreements to fund CAP Services low-income weatherization installations started in 1986. CAP Services operates two weatherization programs concurrently. One is funded entirely by DOE and includes only those energy conservation measures approved by DOE's Weatherization Assistance Program. The coordinated program, in contrast, installs energy conservation measures that meet DOE eligibility and additional measures that are not eligible for DOE funding (such as water heater replacements) but are installed using utility funds.

The coordinated program is designed to reduce gas consumption and arrearages. Participants are recruited from the lists of persons receiving funds from the national Low-Income Home Energy Assistance Program (LIHEAP). Preference is given to the incidence of arrearage, high energy use, and occupancy by elderly or handicapped persons and children under six years of age.

Blower doors are used by the weatherization crews in 98% of all installations to find leakage areas for sealing, to measure air leakage rates, and to determine when to stop work using cost-

effectiveness guidelines.[1] CAP Services uses the Wisconsin Energy Conservation Corporation (WECC) audit to select measures for installation according to energy use reductions and resulting cost effectiveness. Common measures include attic insulation, air leakage control, and space heating system retrofits. In addition, an increasing number of weatherized homes receive high-density wall insulation and low-cost furnace replacements (both are now installed in approximately 30% of recently weatherized dwellings).

CAP Services uses in-house crews for all installations, including heating technicians for testing and installation of space-heating measures. The cost to the agency is estimated at $400 to $800 less than the cost of using commercial contractors. All of the program's co-funders believe that because of the rural environment, substantial reductions in overhead costs, particularly travel time, and in-take, are possible, which would be excessive if multiple visits and contacts from the individual participants were necessary.

Niagara Mohawk's Power Partnership Program. The Power Partnership Program is a collaborative program involving 16 local agencies and the Niagara Mohawk Power Corporation (Niagara Mohawk) in Syracuse, New York. It was initiated in 1989 as a pilot program. After a thorough evaluation, the pilot was converted into a fully operational program two years later.

The 1992 coordinated program with Stoneleigh Housing is the subject of this case study. The goal of this program is to provide a cost-effective package of services that will enable program participants to increase their control over energy usage and costs. Client selection criteria include higher than average energy consumption and significant bill payment arrearage.

The program provides conventional weatherization as well as extensive client energy education and budget counseling. The weatherization measures are installed by Stoneleigh Housing, while Niagara Mohawk provides the education and counseling during two in-home sessions. Niagara Mohawk paid for more than 90% of the program's total 1992 costs of $2,046 per dwelling. Owner investments account for the remainder.

Puget Sound Power and Light's Coordinated Program. In 1984, Puget Sound Power and Light (Puget Power) initiated coordinated programs with 10 local community action agencies located in Western Washington. The 1989 coordinated program with the Opportunity Council, which serves three rural counties, is the subject of this case study. The utility's main motivation is to purchase the least-cost power. A secondary motivation is to enable their low-income customers to participate in a

[1] Blower doors are variable-speed fans equipped with a frame and shroud that permits them to fit inside a variety of door frames. Instrumentation includes pressure gauges that enable the operator to determine the flow of air through the fan as well as the pressure the fan induces on a dwelling. Since leakier houses require more air flow to induce a given pressure difference, blower doors can measure the relative leakiness of a house. When used as a diagnostic instrument, they can also reveal the location of many leaks, thus providing a clear target for air sealing.

pre-existing Puget Power residential DSM program. This program provides for a 71.8% grant from Puget Power for energy conservation measures with the participant paying 28.2% of the cost. Cost sharing for DSM measures by low-income households is a substantial, well-documented barrier to participation. Puget Power recognized this problem and actively sought a coordinated program in which their low-income customers could participate. In the coordinated program, DOE funds cover the required participant cost share.

The main channel of client recruitment for the coordinated program is referrals from LIHEAP. On the Washington State LIHEAP information form there is a question asking the applicants if they are interested in free weatherization.

Weatherization measures are installed according to an energy–savings–per–dollar investment criterion and are restricted to measures that can be installed under DOE's Weatherization Program. The agency conducts its own audit on each house and also completes an energy analysis form, which Puget Power uses to conduct its own audit and prepare a work order for the agency. The weatherization measures used in the coordinated program include insulation (attic, wall, and floor), sealing air leakages, water-heating systems measures, and window repairs and replacements. Window work is done in a majority of homes and represents 60% of materials costs. Besides the utility and agency, the participants in this joint program include LIHEAP, the State's Energy Match Maker Fund, and the Bonneville Power Administration. These multiple partners enable a high level of expenditure per house, averaging $4,950 in 1989.

Eugene Water and Electric Board's Coordinated Program. The Eugene Water and Electric Board (EWEB — a municipal utility) and the Housing Authority and Community Service Agency of Lane County in Western Washington have operated a coordinated low-income weatherization program since 1983. EWEB sought a contractor to implement the low-income portion of the Bonneville Power Administration's Residential Weatherization Program within its service area. Prior to the agency's involvement, low-income participation in the program was minimal. EWEB felt that a human services agency would be an effective outreach mechanism for this segment of its client base.

The coordinated program operates primarily on a first–come, first–served basis, with some preference given to households with elderly or handicapped occupants or children under six years of age. No specific priorities are given to households with high levels of electricity consumption or with arrears. However, the outreach procedures used to attract participants orient the program towards these two groups.

None of the installation work is done by agency employees. Instead, weatherization measures are installed entirely by subcontractors, who win contracts through periodic competitive solicitations. These subcontractors have tended to be companies that specialize in windows and/or insulation.

The agency operates two weatherization programs concurrently. One is funded entirely by DOE and uses a priority list to select measures. The agency's coordinated program considers the same measures as the stand–alone program. However, it is able to install more measures because of the leveraged EWEB funds. The coordinated program uses an audit that EWEB developed for the Residential Weatherization Program. On average, structural repairs account for approximately 10% of total installation costs; these are financed primarily by DOE, thereby enabling the weatherization of some homes that otherwise could not participate.

Idaho Power Company's Coordinated Program. In 1989, the Idaho Power Company initiated coordinated programs with eight local agencies in Idaho. The 1992 coordinated program with the EL-ADA Community Action Agency serving three counties in Southwest Idaho is the subject of this case study. The goal of the program is to help reduce the electricity consumption of high use, low-income Idaho Power customers. The client recruitment and selection procedure uses LIHEAP and utility field staff referrals for intake. Preference is given to elderly and handicapped customers, and to excessive energy users. A high proportion of participants in recent years have lived in mobile homes, reflecting the nature of low-income housing in this area.

Upon acceptance to the program, the State Weatherization Program's audit is applied to the client's dwelling. Using the audit results, the utility will fund 50% of measures meeting a 1.0 savings–to–investment ratio plus a $75 administration fee per dwelling. Approximately 40% of the coordinated program's direct costs are spent on windows. Other major weatherization measures are ceiling and floor insulation. Materials costs are low as the result of a statewide bulk–purchasing system organized by the State's Weatherization Program.

National Fuel Gas Company's Low-Income User Reduction Program. This case study describes the 1991 Low-Income User Reduction Program (LIURP), which was mandated by the Pennsylvania Public Utilities Commission in 1988, funded by the National Fuel Gas Distribution Corporation (NFG), and delivered through the Greater Erie Community Action Committee. The recruitment and selection of participants in this program are designed to target clients with a potential for high energy savings. The criteria are high consumption, high arrears, income qualification, occupancy longer than a year, and a positive payment behavior.

The NFG program uses the WECC audit and a blower door as its primary diagnostic tools. Based on the WECC audit, the combined weatherization measures must meet a seven-year payback as dictated by the PUC. The coordinated program utilizes subcontracted labor, selected through a bidding process, to install all measures. Sidewall insulation appears to contribute significantly to the program's high savings.

NFG pays for all of the costs of weatherizing homes through this program; there is no intermingling with DOE funds. The agency concurrently operates a program that is funded entirely by DOE; this stand–alone program also uses the WECC audit.

NFG utilizes billing data from participating households to determine the effectiveness of its program in decreasing natural gas consumption and arrears. For 1991 participants, the average amount of arrears before weatherization was $419. After weatherization, the average amount of arrears was $197, a reduction of $221 per dwelling in the first year.

2.2.2 Common Features of the Coordinated Programs

The case studies document great diversity in the nature of the six coordinated programs. Clearly there is no single model of successful collaboration between utilities and government-sponsored conservation efforts. Nevertheless, several features are common to a majority of the coordinated programs. These are discussed below and summarized in Table 2.2.

Table 2.2 Ten Common Features of the Six Coordinated Programs

(1)	Public utilities commission mandates or encourages establishment of the utility's low-income weatherization program.
(2)	Full program is launched without pilot testing, based on prior residential DSM experience.
(3)	Local agency plays major role in client recruitment, supplemented by utility. Recruitment typically involves LIHEAP rosters
(4)	Client targeting focuses on households that consume a lot of energy and are in arrears, while DOE's Weatherization Program usually does not.
(5)	Client eligibility is verified by the local agency.
(6)	The audit used in the coordinated program is usually the same as the audit used in DOE's Weatherization Program. Local agency either conducts the audits or provides the energy analysis information so that the utility can produce savings-to-investment ratios for individual measures.
(7)	Bulk purchasing and/or competitive subcontracting result in low costs.
(8)	Multiple funding sources are used to weatherize homes. Utility funds tend to be limited to administrative costs and the more cost-effective energy-saving measures; they are not usually spent on structural repairs.
(9)	Multiple inspections are conducted.
(10)	If there is a program evaluation, it is paid for or conducted by the utility.

PUC Involvement. Public utilities commissions (PUCs) have been involved in the creation of a majority of the six coordinated programs. In two cases (National Fuel Gas and Wisconsin Gas), PUC mandates led to the program's creation. In two other cases (Niagara Mohawk and Idaho Power), regulatory commissions encouraged the establishment of low-income programs. In none of these

cases did the commissions require that the programs be delivered in collaboration with government-sponsored conservation programs.

Pilot Programs. In only one of the six programs (Niagara Mohawk) was the coordinated program pilot tested before being launched in full. In this case, the coordinated program was quite different for the agency's stand–alone program. In two cases (Puget Power and Eugene Water and Electric Board), the utilities had residential weatherization programs in existence already, and these were used as models for the low-income coordinated programs. In the other three cases, the combined experience of the agency and utility staff was deemed sufficient to launch a full-scale coordinated program. Thus, start-up costs generally were small and did not include pilot testing.

Client Recruitment. Usually, the local agency is primarily responsible for client recruitment. This is true for Wisconsin Gas, Eugene Water and Electric Board, Puget Power, National Fuel Gas, and Idaho Power. In each of these cases, LIHEAP rosters are a key source of applicants to the coordinated program. Recruitment responsibilities are shared more evenly between agencies and utilities in the case of Niagara Mohawk, where potential clients are identified by the utility's consumer advocate and credit and collections department as well as by local and state agencies, including LIHEAP rosters. Similarly, National Fuel Gas plays an active role in identifying and recruiting high energy users.

Client Targeting. Client targeting in the coordinated program tends to be stronger and different from that of the local agency's pre-existing program. For example, the Wisconsin Gas coordinated program targets high gas users, while the DOE program operates on a first-come, first-served basis. Similarly, the NFG criteria for participation include high consumption and high arrears, while the DOE program does not. The Niagara Mohawk program is not limited to high energy consumers, but it does target households with high arrears, which is likely to overlap substantially with the population of high energy consumers. Similarly, the EWEB program draws some of its participants from a budget–counseling program operated by EWEB for its high–arrears customers.

Verification of Client's Income Eligibility. The verification of client income eligibility is typically the responsibility of the local agency. This takes advantage of the agency's strong ties with other social service agencies, such as those run by HHS, which have access to the necessary records.

Audit Procedures. In four of the six cases, the same audit is used in the local agency's coordinated program and its DOE–funded Weatherization Program. One of these four cases is the NFG program, which uses the same audit as the agency's pre-existing program, but the coordinated program uses a more stringent cost-effectiveness threshold.

In the two programs where different audits are used (EWEB and Puget Sound), the local agencies provide the utilities with energy analysis information on each house and the utilities complete a heat–loss analysis (approved by the Bonneville Power Administration) to determine eligible measures. These utility calculations provide the basis for work orders, which are returned to the local agencies. The Puget Sound program is the only instance where two different audits are completed for each house. The utility completes its Bonneville-approved audit, and the local agency conducts its state-approved audit.

Weatherization Costs. Many of the agency and utility program managers believe that the coordinated programs' costs are lower than could be achieved through energy services companies. The Idaho Power program, for instance, benefits from bulk procurements organized by the state's weatherization program. The EWEB program benefits from the agency's periodic competitive solicitations, which result in contracts with low-bid subcontractors. CAP Services is a leader in the nation in the purchase of low-cost furnace replacements, which benefits the Wisconsin Gas program.

Multiple Funding Sources. In five of the six coordinated programs, multiple funding sources are used to weatherize each house. The NFG coordinated program is the one exception; in this program, homes are weatherized by the local agency entirely with NFG funds. The Niagara Mohawk program uses utility resources and owner contributions.

In the four cases where utility and government sources are used, utility funds tend to be limited to administrative costs (both at the utility and the agency) and energy-saving measures. Utility funds are not used for structural repairs. Instead, the programs draw on DOE and other resources for repairs and rehabilitation.

Multiple Inspections. In five of the six coordinated programs, inspections of 100% of the weatherized homes are conducted by both local agency staff and utility staff. In two cases the agency uses blower door tests on all (Wisconsin Gas) or some (Niagara Mohawk) of the weatherized homes to assess the quality of the air sealing. In several cases, a sample of homes receives an additional inspection by the agency or utility as a further quality–control check. The utilities tend to focus their inspections on the installation of measures that they paid for, while the agency is responsible for inspecting the total job.

Program Evaluation. In the two cases where the coordinated programs have been evaluated (NFG and Niagara Mohawk), these evaluations were paid for or conducted by the utility. Program evaluation is a natural role for the utility partners, since they have ready access to the necessary energy consumption data. In addition, the active involvement of public utility commissions in several programs has promoted the evaluation of these programs. Thus, a statewide evaluation is underway

in Wisconsin, the NiMo pilot program was evaluated and its current coordinated program will be evaluated, and the NFG coordinated program has been assessed.

2.3 STRENGTHS AND WEAKNESSES OF THE SIX PROGRAMS

The utilities and agencies managing each of the six coordinated programs indicated that the strengths of their programs far outweigh any weaknesses. In addition to this common overall assessment, many of the same advantages and disadvantages were noted during the case study interviews (Table 2.3). At the same time, the programs are diverse enough that only a few of these typical strengths and weaknesses apply to all of the programs.

Table 2.3 Common Strengths and Weaknesses of Coordinated Low-Income DSM Programs

Strengths	Weaknesses
Less duplication of agency and utility efforts.	Confusion by program participants and eligible households over roles and responsibilities of local agency, utility, and subcontractor.
Lower costs due to the ease of recruitment by agencies, income-qualifying clients, and economies of scale associated with materials and labor.	Bureaucratic process adds to costs and tends to slow down weatherization work.
Ease of recruitment due to low-income community's trust of local nonprofit agencies.	
Utility staff helps identify needy clients and assists with recruitment.	Agency must search for utility customers and spend more time ensuring that the heating fuels meet the utility's criteria.
Ability to weatherize homes that require repair.	
More comprehensive weatherization and greater energy savings due to expenditure of additional funds per weatherized home.	
Access to sophisticated equipment and trained weatherization professionals, particularly when the local agency conducts the work.	
Utility promotes greater emphasis on energy savings in terms of client and measure selection and evaluations.	Some types of clients may go unserved.
Multiple inspections assure quality.	Multiple inspections are redundant and expensive.

The coordinated programs benefit from the ***elimination of duplicative tasks*** that the operation of separate utility- and government-funded programs would require. For instance, the

coordinated programs rely primarily on recruiting participants from the same sources that the agency has already established — in the majority of cases, these are LIHEAP rosters. Utility staff tend to supplement this recruitment effort, in a more or less aggressive fashion, with referrals from inquiring customers and field representatives, and analysis of customer records to identify customers with high energy consumption or high arrears. Income qualification, audits, and installation of measures are the responsibility of the local assistance agencies.

The elimination of duplication, however, is not complete, and ***some redundancies exist***. In many programs, inspections are conducted by both the utility and the agency on 100% of the jobs. Additional spot inspections are conducted by agency staff and State Weatherization Program inspectors, too, in most of the coordinated programs. While these multiple inspections may improve the quality of the work, they are also costly. Utility program managers should consider inspecting only a sample of homes, once they feel confident about the overall quality of the work. Similarly, in one program (NFG), both the agency and utility conduct post-weatherization audits on each participating house. This appears to be redundant.

A related problem resulting from the involvement of multiple partners is ***confusion by program participants and eligible households over utility and agency roles and responsibilities***. This appears to be particularly problematic when the utility and agency also run stand–alone low-income weatherization programs, as is the case with the Eugene Water and Electric Board. It may also be exacerbated by the involvement of subcontractors.

The coordinated programs offer several ***cost advantages***. In particular, there are savings from the centralized recruitment and income-qualification activities led by the agencies. In addition, bulk purchases and large, competitive subcontracts for supplemental labor offer considerable reductions in material and labor costs.

On the other hand, some ***cumbersome bureaucratic procedures*** add to program costs and slow down the delivery of weatherization services. For example, in several of the programs, the agency completes an audit or an energy analysis, then the utility uses this information to prepare work orders identifying measures that it will pay for, and then the agency has these installed. This passing back and forth of information can slow down the process by requiring multiple parties to review each audit. A more efficient approach would be for the utility and PUC to approve general rules by which the agency could determine how much the utility will contribute, as is done in the Idaho Power coordinated program.

Utilities rarely find it in their best interest to pay for incidental structural repairs to enable weatherization, such as fixing a roof prior to installing attic insulation. However, by leveraging the resources of DOE's Weatherization Assistance Program, federal dollars can be used to repair homes that are thereby able to take advantage of utility funding. Thus, coordinated programs ***allow homes***

that require repairs prior to weatherization to participate in utility-funded low-income DSM programs.

In addition to allowing more homes to be weatherized, coordinated programs also ***enable more comprehensive weatherization*** per home. Both of these effects increase energy and demand savings.

Coordinated programs provide utilities with ***access to trained weatherization professionals and associated equipment***, which is often quite sophisticated and conducive to high-quality weatherization. In many regions of the country, there is a scarcity of such DSM capability. In addition, community action agencies are often uniquely qualified to tackle the problems associated with substandard shelter (*Home Energy*, Nov./Dec., 1991, p. 12).

Finally, the utility's involvement in coordinated low-income programs tends to result in ***greater emphasis on energy savings*** in terms of client and measure selection and program evaluations. This reorientation has advantages and disadvantages. On the one hand, it may lead to lower costs of conserved energy and other energy-related measures of success. On the other hand, it may cause some types of clients to go unserved, such as customers who are conscientious about their fuel use and payments.

This review of program characteristics, strengths, and weaknesses suggests that there are three prototypical approaches to the design and operation of coordinated programs (Table 2.4). Each prototype involves a different type of cooperation between utilities and government-funded local agencies. These differences require different approaches to estimate program cost-effectiveness.

In parallel programs, the weatherization jobs are completely funded by the utility. As a result, all of the program's benefits and costs can be attributed to the utility's investment. In supplemental programs, utility funds are used to supplement preexisting government resources in the delivery of low-income DSM services. In this type of program, benefits and costs can be allocated between cosponsors either in proportions that match their levels of funding, or in a manner that reflects the program's increasing or decreasing returns to funding. Evaluating coupled programs is the most difficult because the utility's involvement transforms the nature of the government-sponsored conservation program. The assignment of program benefits and costs between cosponsors is therefore complicated by the need to estimate what benefits and costs would have occurred if the utility had not participated in the program. These types of coordinated programs are discussed further in subsequent sections of this report.

Table 2.4 Three Types of Coordinated Programs

1.	**Parallel Programs (NFG, Niagara Mohawk)**
	In these cases, the local weatherization agency operates two parallel programs—one funded by government grants and the other funded by utility contracts. The utility simply employs the agency as a subcontractor to deliver DSM services to low-income households. The utility-funded program is coordinated in the sense that some of the same staff and equipment are used by both programs.
2.	**Supplemental Programs (EWEB, Idaho Power)**
	These programs use utility funds to supplement the agency's government–funded weatherization program, with no changes to the operation of that program. The result is more weatherized homes, more comprehensive weatherization, or both.
3.	**Coupled Programs (Wisconsin Gas, Puget Power)**
	These programs employ a combination of utility and government funds to deliver weatherization services as part of an integrated program that is distinct from the agency's preexisting government-funded weatherization program. This type of program has the potential to outperform parallel and supplemental programs by taking advantage of the unique capabilities of each cosponsor.

3. KEY ISSUES IN ESTIMATING COST-EFFECTIVENESS

3.1 WHAT IS COST-EFFECTIVENESS?

Historically, equity considerations have been the motivating force for governments to provide low-income households with energy conservation measures. That is, as part of their social welfare activities, governments at all levels—but especially DOE and HHS at the federal level—have retrofit the homes of low-income customers to lower their energy bills and conserve energy in the process.

Recently, efficiency (i.e., cost-effectiveness) considerations have been given more emphasis in determining the appropriateness of expending funds for low-income DSM programs. One motivating force for that change has been shrinking budgets at all levels of government, which have caused policymakers to require quantitative measures of program performance. Budgetary pressures have also led government agencies to increase their emphasis on resource leveraging and coordination. In particular, policymakers have attempted to strengthen the ties of government-funded weatherization programs with electric and gas utilities as partners in low-income programs. Leveraging utility resources has resulted in a greater need to justify expenditures on the basis of measured cost-effectiveness. Finally, many state regulatory commissions are now requiring utilities under their jurisdiction to pay more attention to low-income DSM programs. This trend has contributed to a growing interest by regulators and utilities in measuring the cost-effectiveness of low-income DSM programs.

In determining cost-effectiveness, the costs of low-income programs are compared with their benefits. The question becomes: What costs and what benefits? To answer this question, a brief review of utility planning is helpful.

Prior to the 1980s, utilities (particularly electric utilities) engaged in least-cost planning, minimizing supply costs given forecasts of their customers' growth in demand for energy. Load curves were assumed to be exogenous in planning. By minimizing the cost of providing electricity, the objective of utilities was to minimize the price of electricity to customers.

As utilities began to intervene on the customer's side of the meter by running DSM programs, this least-cost/least-price planning paradigm evolved into one involving minimization of the cost of providing energy services. In response to this changing paradigm, the California Public Utilities Commission and California Energy Commission developed a methodology —including set of perspectives—to measure the cost-effectiveness of utility-run DSM programs: (1) the utility exclusively and (2) participants, nonparticipants, and their sum (which may or may not include societal effects). The resulting planning paradigm—integrated resource planning (IRP)—is the combination of traditional least-cost supply planning and demand-side planning. By focusing on the total resource cost test in this paradigm, the industry's emphasis switched from least-cost of supplying energy to least-cost of supplying energy services.

In developing the perspectives from which to measure the cost-effectiveness of DSM programs and recommending various cost and benefit categories to include in their tests, the authors of California's *Standard Practice Manual* acknowledged the limitations of their tests.[1] A key limitation is the static nature of the tests: there is no provision for the dynamic price effects of running DSM programs.

Recognizing this deficiency, several authors (Hobbs, 1991; Borlick, 1994; Braithwait and Caves, 1994) have suggested that evaluation of DSM programs include responses to price changes to accurately estimate the effects of the programs on both participants and nonparticipants. By including price effects through various uses of consumers' surplus, the authors switch emphasis of evaluating DSM programs from cost to value, from costs to net benefits, from a financial analysis to an economic one.

Our objective in this study, however, is not to advance the overall framework by which DSM programs are evaluated. Rather, our objective is to examine how the special features of coordinated low-income DSM programs impinge on the application of California's standard practice. Hence, we do not consider the price and consumers' surplus effects of running DSM programs.

3.2 THE FIVE CALIFORNIA COST-EFFECTIVENESS TESTS

Recognizing differences in perspectives for cost-effectiveness, the California Public Utilities Commission and California Energy Commission (1987) developed five tests (or perspectives) to evaluate DSM programs. The benefit and cost categories for each of the five tests (marked with an 'X') are summarized in Table 3.1.

- The ***Participant Test*** measures the net financial impact of a DSM program on participating customers, including any payments received from a utility and any out-of-pocket costs incurred by the participants. It is designed to indicate the economic attractiveness of the program to the participating customer.

- The ***Ratepayer Impact Measure (Nonparticipant Test)*** measures the impact of a DSM program on electricity or gas rates. It reflects the difference between the change in total revenues paid to a utility and the change in total costs to a utility resulting from the DSM program. If revenues decrease more than costs decrease, for instance, then rates will rise. This test is also called the "No Losers Test."

- The ***Total Resource Cost (TRC) Test (All Ratepayers Test)*** captures the net change in benefits and costs of a DSM option for all utility customers; in essence, it is the sum of the participant and nonparticipant tests. Since all ratepayers are considered, transfer payments between program participants and nonparticipants are ignored. This test is also called the "All Ratepayers Test."

- The ***Societal Test*** includes the total costs and benefits of the program, including those not directly reflected in the revenues or costs of the utility running the program. This test attempts to capture *all* the benefits and costs of a DSM program, including externalities.

[1] California Public Utilities Commission and California Energy Commission (1987).

- The ***Utility Cost Test (Revenue Requirements Test)*** measures the net change in the out-of-pocket costs of a utility resulting from a DSM program. This test is also called the Utility Revenue Requirements test because it measures the change in revenue requirements.

Table 3.1 Five California Tests for Cost-Effectiveness

	Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
Benefits:					
C Bill Reductions (Gross)	X				
C Utility Incentives	X				
C Tax Credits	X				
U Avoided Energy and Capacity Costs		X	X	X	X
S Externalities				X	
Costs:					
C Program Costs Paid by Participants	X		X	X	
U Utility Program Costs		X	X	X	X
U Utility Incentives		X			X
U Revenue Loss (Net)		X			
G Tax Credits			-X[a]		
S Externalities				X	

Sources of benefits and costs: C — Customer; U — Utility; G — Government; S — Society as a Whole.

[a] The California *Standard Practice Manual* recommends that tax credits be treated as a negative cost.

The five tests have different objectives and therefore capture the financial aspects of DSM programs from different perspectives. The participant test, for example, measures the net benefits exclusively from the standpoint of the participants in a DSM program and provides a good indication of the receptivity of different customers to a program. The ratepayer impact measure is the only test that captures the change in revenues resulting from a DSM program and so is widely used to determine a program's effect on electricity and gas rates. The total resource cost test measures effects on the sum of customers' and utility's benefits and costs. The societal test views cost-effectiveness from the broadest perspective. The utility cost test, on the other hand, focuses more narrowly on the net change in revenues required by a utility as a result of changes in its costs from running the program.

Clearly, the appropriate use of any of these tests depends on the objective(s) of the utility. If the goal is to minimize rates for all of its customers, the second measure is the most appropriate. If the goal is to minimize costs, the third, fourth, and fifth tests are appropriate, albeit with different cost perspectives.

3.3 SPECIAL FEATURES OF COORDINATED LOW-INCOME DSM PROGRAMS

Although the five California tests are comprehensive in capturing perspectives from which cost-effectiveness is determined, they have varying degrees of applicability to different types of DSM programs. For example, all of the tests can be applied to estimate the cost-effectiveness of (1) conservation, (2) load management, and (3) fuel-substitution programs. However, only the participant test and ratepayer impact measure can be applied to estimate the cost-effectiveness of (4) load-building programs.

The tests also have varying degrees of applicability for estimating the cost-effectiveness of different types of programs within these four categories, including conservation programs for low-income households. In this section, we examine five special features of coordinated DSM programs that are not addressed directly in the California standard practice tests. These features must be given special attention to accurately measure cost-effectiveness.

3.3.1 Benefits to Participating Low-Income Households

The nature of the DSM measures installed in low-income programs—and, therefore, the ensuing benefits—often differ significantly from those of other DSM programs. These differences are illustrated below.

In running an efficient lighting program, for example, an electric utility might provide a cash incentive (e.g., a rebate) to participants in the program for purchasing compact fluorescent light bulbs. When evaluating the cost-effectiveness of the program from the standpoint of participants, a

benefit of the program is the incentive paid by the utility to customers purchasing the more-efficient light bulbs. In determining the cost-effectiveness of the program, benefits to participants are valued at the dollar amount of the incentive payment.

On the other hand, if the program involves an in-kind contribution by the utility to participants rather than incentive payments (e.g., the installation of energy-efficient lights and fixtures at no cost to participants), the benefits of the program to participants can be valued in one of two ways: (1) the value of the in-kind contribution (i.e., the cost of the bulbs and fixtures, a "stock" variable) or (2) the energy savings to participants resulting from that contribution (i.e., the reduction in energy bills, the "flow" of energy savings over the life of the bulbs and fixtures).

Low-income programs typically involve such in-kind contributions. However, unlike the typical lighting program, the low-income conservation measures may have significant nonenergy benefits. Besides reducing energy bills, the measures (donated in kind) oftentimes improve the structural integrity of homes (e.g., repaired roofs or new doors and windows), thereby increasing home values. The key point here is to determine the types of benefits that are to be measured when applying the tests. Using the "flow" of energy savings over the life of the measures may not capture all of the benefits that accrue to the low-income households as a result of the retrofits.

3.3.2 Treatment of Government Expenditures

The majority of low-income DSM programs cosponsored by government agencies use DOE or HHS funds. However, some program funding comes from state and local sources; indeed, a low-income program could be funded exclusively at the local level. The treatment of government expenditures in determining the cost-effectiveness of these co-funded programs by electric and gas utilities depends on the government funding source and the ownership of the utility (discussed in the next section). The most important point to consider in the treatment of government expenditures is the purpose for which the tests were devised.

In Table 3.2, we illustrate how government expenditures derived from federal sources should be treated using the five California cost-effectiveness tests for any type of utility (i.e., investor owned or publicly owned). Participants benefit from government program outlays on DSM measures as a result of reduced utility bills. Their benefits also may include capital improvements that extend beyond the life-cycle value of reduced utility bills. Benefits from reduced bills are not included in the total resource cost (TRC) test because they are offset totally by reduced revenues to the utility.

As shown in Table 3.2, if funded by DOE, HHS, or any other federal government agency, the amount of these outlays cannot be considered a "cost" for participants in determining cost-effectiveness. Furthermore, they are not a "cost" for nonparticipants. The reason is rooted in the definition of the nonparticipant test. The nonparticipant test measures the amount by which revenues (or rates) must be increased to compensate for the revenues lost by running the low-income DSM

program. The expenditure of federal funds for coordinated programs is not a direct cost to the utility or its ratepayers in running the DSM program. Including it as a "cost" in the nonparticipant (i.e., Ratepayer Impact Measure) test distorts the purpose for which the tests were developed and the perspective from which they are measured.

Table 3.2 General Framework for Treating Government Program Outlays in Determining Cost-Effectiveness

	Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
Benefits:					
Bill Reductions	X				
Costs:					
Government Program Outlays					

The NYS Public Service Commission, and perhaps other states, have adopted an alternative procedure for treating government program outlays and administrative costs. It considers government expenditures as costs in the Societal Test. Because the NYS Public Service Commission's definition of total resource costs includes the societal component, its interpretation of the TRC test also includes government expenditures. This interpretation is inconsistent with the authors' recommendations regarding the treatment of government expenditures. The only exception to the general framework described in Table 3.2 that the authors recommend occurs when the source of government funding and the ownership of the utility are commensurate. This exception is described below.

3.3.3 Utility Ownership

In Table 3.3, we note various relationships between the ownership of the utility running a low-income DSM program and the source of government co-funding for that program. Ownership and the source of government funding make a difference in estimating the cost-effectiveness of a low-income program.

To illustrate, compare the following two cases: (1) an investor-owned utility in a given service territory cosponsoring a low-income DSM program with federal tax funds and (2) a municipally owned utility cosponsoring a program with tax funds provided from the municipality. The former case is an example of the costs and benefits discussed above as described in Table 3.2.

Table 3.3 Ownership of Utility and Source of DSM Cosponsorship

Ownership	Possible Government Cosponsors of DSM Programs		
	Federal	State	Local
Investor-Owned	X	X	X
State-Owned	X	X	X
City-Owned	X	X	X

The latter case presents other issues in applying cost-effectiveness tests. The ratepayers of the utility are also the sole taxpayers of the municipality. These same ratepayers are also the sole owners of the utility. Therefore, ratepayer-taxpayer-utility owner funds are being used to finance a program for the low-income portion of this same constituency. The allocation of tax funds and cosponsorship issues are not important in this case. The utility funds used in the DSM program and the tax funds used for the same program are derived from the same source: the owners of the utility. The costs and benefit categories for this case are illustrated in Table 3.4. In contrast to the other case (Table 3.2), here the government program outlays are "costs" for the ratepayer impact measure and the TRC test. This case will be the subject of a sensitivity analysis in Chapter 5.

Table 3.4 Treatment of Local Government Program Outlays in Determining Cost-Effectiveness

	Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
Benefits:					
Avoided Energy Bills	X				
Costs:					
Government Program Outlays		X	X		

In general, the closer the government funding source is to the ownership of the utility, the greater the likelihood that a government expenditure on a low-income DSM program will affect the costs for the utility in the ratepayer impact measure. This concept is illustrated graphically in Figure 3.1.

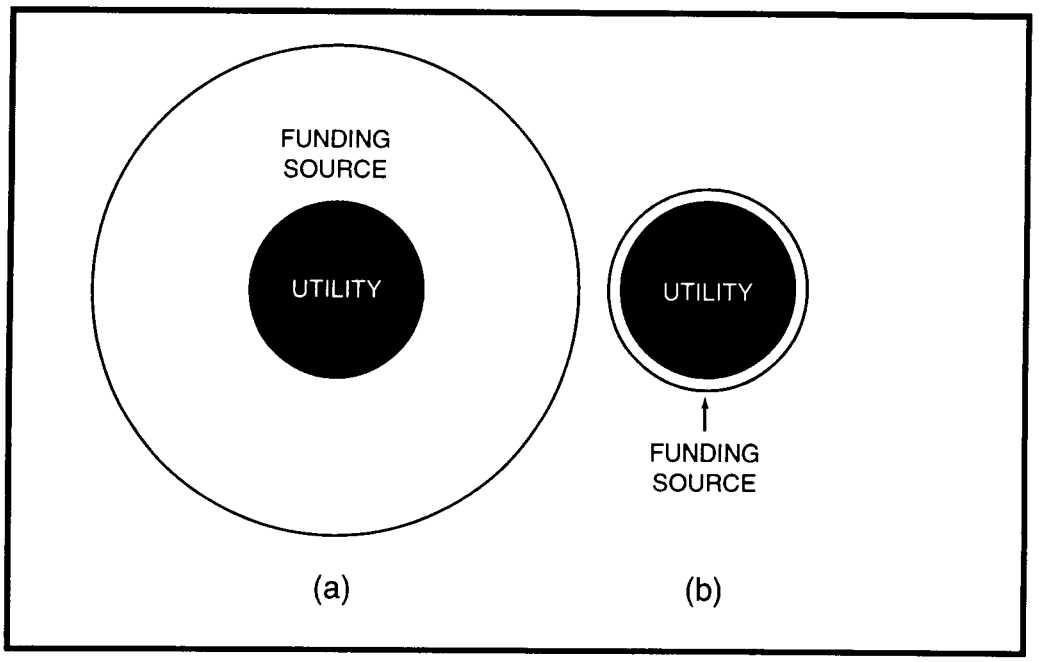

Fig. 3.1 Government Expenditures as Nonparticipant Costs: (a) Excluded and (b) Included

3.3.4 Allocation of Savings among Cosponsors

In estimating the reduction in participants' utility bills and the energy and capacity savings of running a typical DSM program (i.e., the avoided costs of the utility), electric and gas utilities often use engineering calculations to provide an initial estimate of savings. This initial assessment typically is adjusted after the performance of the program is evaluated. The same principles apply to low-income DSM programs.

A complicating factor in dealing with low-income programs, however, is the allocation of energy and capacity savings if the programs are co-funded by utilities and government agencies. Lacking a formal program evaluation of the savings attributable to each co-funder, the assumptions made about the allocation of those savings are critical in estimating the cost-effectiveness of the programs for electric and gas utilities.

The simplest assumption is that savings are proportional to the expenditures of each of the co-funders—i.e., a third of the total funding results in a third of the savings, a half results in a half, and so forth. And, in designing a new program, that may be the best initial assumption.[1] Experience with running low-income programs, however, suggests different relationships between funding and induced savings for an existing program. We illustrate four of these in Figure 3.2.

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[1] Evidence from the National Evaluation of DOE's Weatherization Program suggests that there is a proportional relationship between level of investment and magnitude of savings, for investment levels up to at least $3,000 (Berry and Brown, 1994).

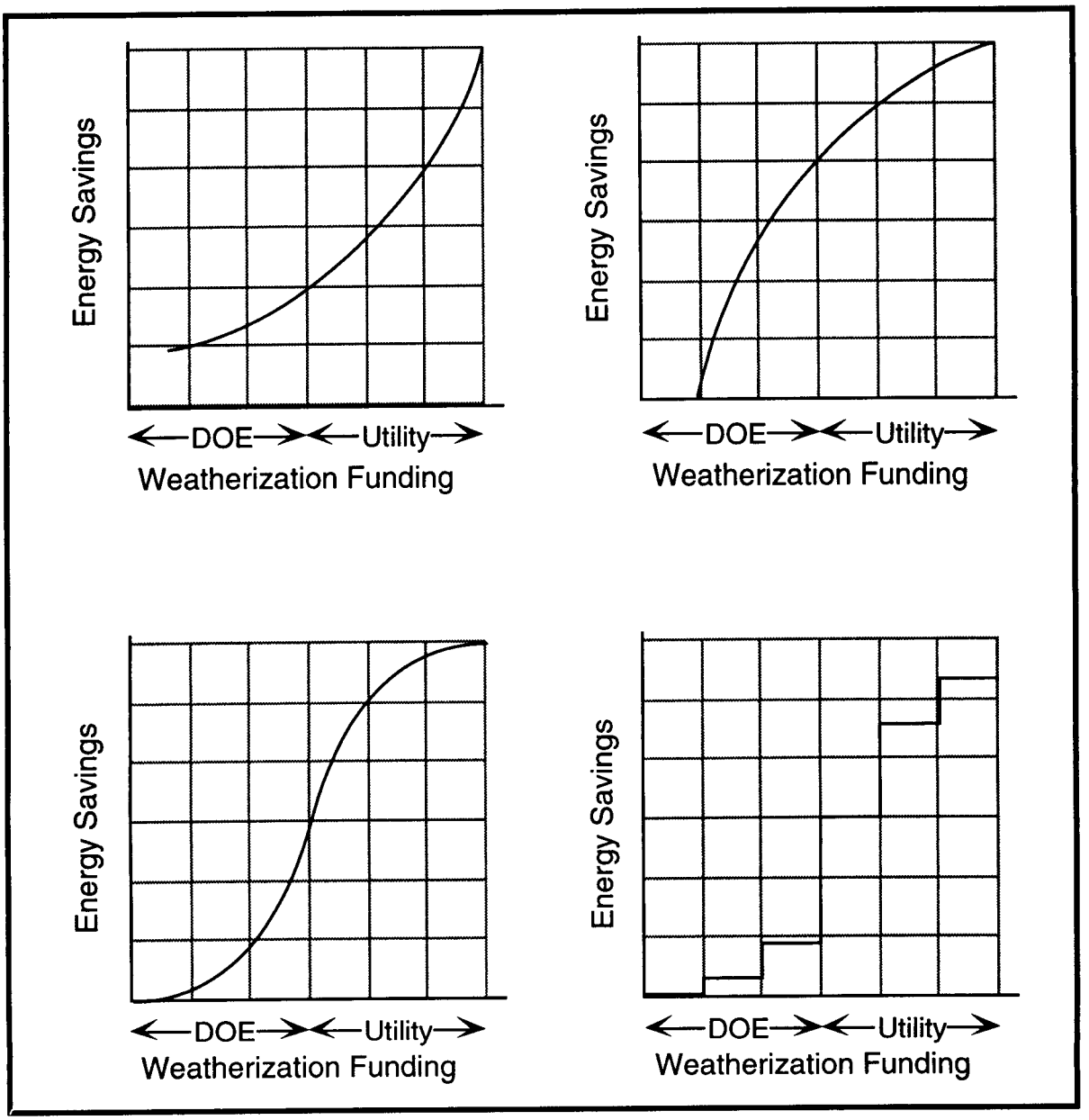

Fig. 3.2 Allocation of Energy Savings across Cosponsors

The top two relationships between energy savings and program funding illustrate increasing (upper left) and decreasing (upper right) returns to funding. In the increasing returns case, each dollar of low-income funding results in greater incremental energy savings. For the decreasing returns case, each dollar of incremental funding results in less incremental energy savings. The lower left relationship is a combination of the upper two, showing a logistic relationship between funding and savings. It reflects the existence of start-up costs, which result in an initially slow growth in energy savings, followed by a range of accelerated savings in which each additional dollar results in increasing energy savings. Finally, at some critical point, program funding switches from increasing

to decreasing returns. The lower right characterization represents a step-function relationship. This type of relationship exists when some critical conservation measures result in a dramatic amount of savings and when one conservation measure is a necessary condition for other types of savings. An example is the installation of a high-efficiency furnace, which could produce significant savings that could not be achieved by a comparable expenditure on any combination of less expensive measures.

In practice, of course, different programs result in different relationships between funding and energy savings. And in some cases, the same program run by different combinations of government agencies and utilities may result in different savings patterns. For example, the involvement of a utility in the operation of a local agency's weatherization program may cause the expenditure of government resources to generate greater energy savings. This could occur as the result of (1) stricter investment criteria, (2) a greater focus on energy conservation and less on health and safety, or (3) the selection of clients with a greater potential for savings. Figure 3.3 illustrates these relationships.

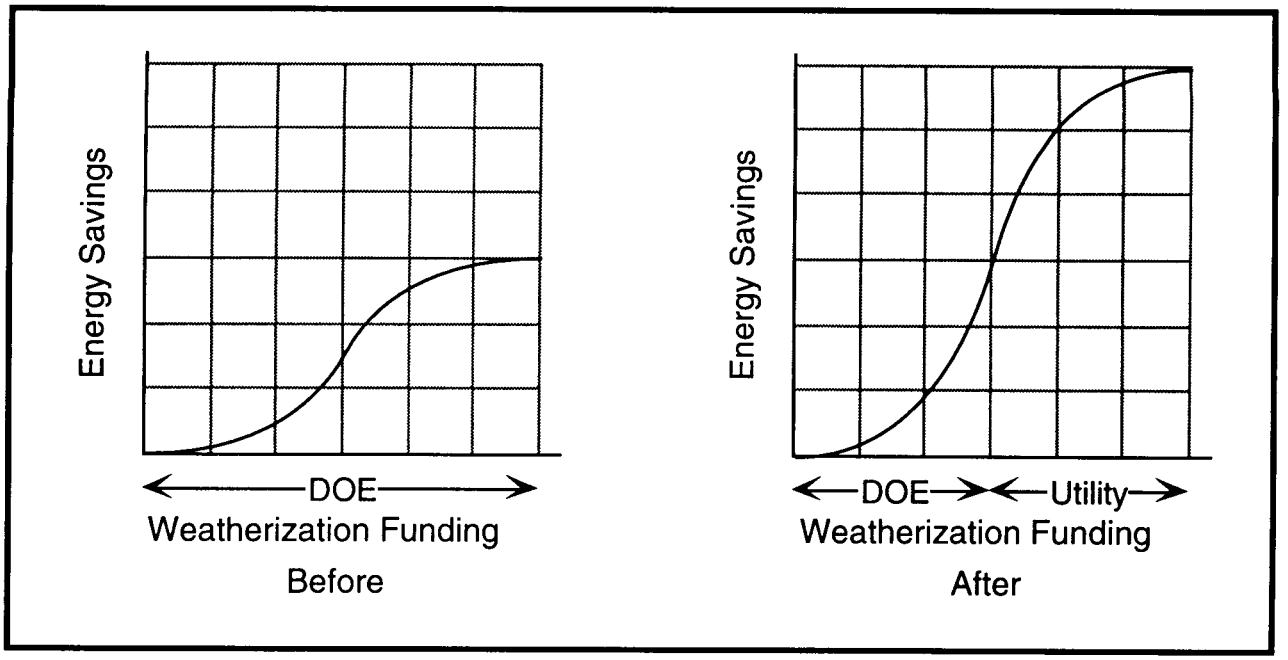

Fig. 3.3 Energy Savings Profile Before and After Utility Involvement

Lacking a thorough program evaluation, the assumptions made about the relationship between funding and energy and capacity savings are crucial in estimating the cost-effectiveness of low-income DSM programs run by electric or gas utilities. Assuming a linear relationship for an incremental contribution to an existing government-run program may make the low-income program seem more or less attractive to a utility than it is in reality. We address the importance of this issue in estimating the cost-effectiveness of a low-income DSM program in the sensitivity analyses in Chapter 5 and our recommendations in Chapter 6.

3.3.5 Arrearages and Other Cash-Flow Benefits

Because of characteristics of household members and the nature of energy conservation measures in a low-income DSM program, a number of other cash-flow benefits accrue to electric and gas utilities as a direct result of implementing these programs. For example, to the extent that the energy bills of low-income households are reduced as a result of running DSM programs, the more likely that arrearages will be reduced. Arrearage reductions, in turn, lead to costs savings for utilities. These savings typically include reductions in bad debt write-offs, lower collection costs, lower termination and reconnection costs, and possibly financing costs for accounts receivable. The interested reader is referred to Megdal (1994) for a more detailed discussion of these savings.

Unfortunately, electric utilities do not routinely estimate the extent that their low-income DSM programs generate benefits from reduced arrearages. In the sensitivity studies of Section 5, we use a value of $10.00 per customer per year as an estimate of arrearage reductions. According to the literature, this estimate may underestimate the average value for U.S. utilities (Brown *et al.*, 1993). In practice, utilities should conduct a billing study to estimate accurately this important benefit.

3.4 PRAGMATIC CONSIDERATIONS IN ESTIMATING COST-EFFECTIVENESS

3.4.1 Customer Costs and the Participant Test

In a typical low-income DSM program, the household's contribution to the program is time—i.e., the time required to fill out application forms, the time spent at home during installation of the conservation measures, and the like. Typically, there is no requirement that the low-income household make a cash expenditure to participate in the program. In purely out-of-pocket monetary terms, then, there are no program costs incurred by participants. Therefore, benefit-cost ratios from the participants' perspective are incalculable.

However, to obtain an estimate of the cost-effectiveness of the low-income program from the standpoint of the participant, a value must be placed on the time spent by low-income households in meeting the requirements of the program. For lack of a better alternative, time could be valued at the minimum wage rate ($4.25 per hour) with an estimate of the amount of time spent on meeting program requirements. We recognize, however, that the practice of imputing participant costs may not be consistent with the manner in which utilities and regulators treat other DSM programs. We discuss this issue further in Chapter 6.

3.4.2 Avoided Energy and Capacity Costs

Like all DSM programs, the dollar value of avoided energy and capacity costs are important benefits of implementing low-income programs. They represent the values of the stock of energy

investments and flow of energy saved as a result of implementing DSM programs. In practice, the degree of sophistication used to estimate avoided capacity and energy costs varies widely from simple static "guesses" of what those values are to very complex modeling systems. Research has shown that the method used to calculate avoided capacity and energy savings affects their estimated values (Hill, 1992). In practice, avoided costs typically represent most of the benefits of implementing a DSM program; thus, their estimated values are significant in determining the cost-effectiveness of the program.

Because the purpose of this study is to illustrate important concepts in determining the cost-effectiveness of coordinated low-income DSM programs and not to estimate the cost-effectiveness of any single program, the avoided energy and capacity costs used for the hypothetical program described in Chapter 5 were not rigorously estimated. Few of the utilities involved with the six coordinated programs described in Chapter 2 and Appendix A were able and willing to provide estimates of the value of an avoided unit of energy or capacity. In this study, we document the importance of obtaining an accurate estimate of avoided energy and capacity costs, but we do not prescribe a methodology.

3.4.3 Externalities

Externalities are activities that affect others for better or worse without those others paying or being compensated for the activity. Externalities exist when the private costs or benefits of production or consumption do not equal their social costs or benefits.

In energy planning, the externalities currently receiving the most attention are those related to the environmental costs of burning fossil fuels in electricity production. For determining cost-effectiveness, a recent survey of all PUCs (Cohen et al., 1990 and updated by the Energy Research Group, 1992) shows the extent to which state regulatory authorities require externalities to be considered in utilities' selection of resources.

Although environmental externalities receive the greatest attention, other costs and benefits external to utility-specific costs and benefits of producing energy are important as well. Another important class of externalities are those related to the macroeconomic effects of producing or consuming energy. For example, implementing DSM programs instead of operating or constructing electric generating plants may have regional and national employment effects. A decision not to construct a new power plant, for example, will result in a loss of future jobs and income. On the other hand, a DSM program generates employment. DSM programs also reduce imported petroleum requirements, thereby increasing energy security.

When considering low-income DSM programs, other externalities such as health, safety, and homelessness benefits become important. To the extent that these programs effectively increase the health and safety of low-income households, for example, they allow the members of these

households to become more productive in the work force. Clearly, this an external benefit of these programs.

The net effect of including all externalities in estimating cost-effectiveness is difficult to determine. The environmental effects of producing electricity, for example, generally favors resource options that do not use fossil fuels—such as implementing DSM programs. However, considering macroeconomic and other effects may alter that conclusion.

In one of the sensitivity studies of cost-effectiveness in Chapter 5, we illustrate how accounting for externalities can influence the estimates of cost-effectiveness.

3.4.4 Gross vs. Net Energy Savings

Two sets of forces can affect the energy consumption levels of households. In the absence of running DSM programs, natural forces (i.e., the secular trend) affect consumption. These natural events include changes in energy prices, national income, and its distribution. Another force affecting energy consumption is the effect of DSM programs. Segregating these two forces is important in determining the cost-effectiveness of DSM programs.

The forces are illustrated in Figure 3.4. The left side of the graph illustrates one prototypical case. Here, the "energy neutral" line depicts energy consumption in the absence of the two forces discussed above. Adding secular forces such as rising real energy prices lowers the level of consumption from what it would have been in the absence of those forces. Running a DSM program further reduces the level of consumption. The difference between actual observed energy consumption and what would have occurred if not for the two forces is the gross energy savings. The effect of a DSM program on consumption is the net amount of savings.

In contrast, the relationship between gross and net savings for low-income DSM programs can resemble the prototypical case characterized in the right side of the graph of Figure 3.4. In this case, the secular trend is higher than the energy neutral case because of influences such as the declining energy-integrity of low-income houses. In this case, net savings are larger than gross savings.

Irrespective of the magnitudes of gross and net energy savings, net savings should be used in calculating cost-effectiveness. The reason is that the cost-effectiveness measures are supposed to reflect the contribution of the DSM program on energy consumption—and not the amount that would have occurred in its absence.

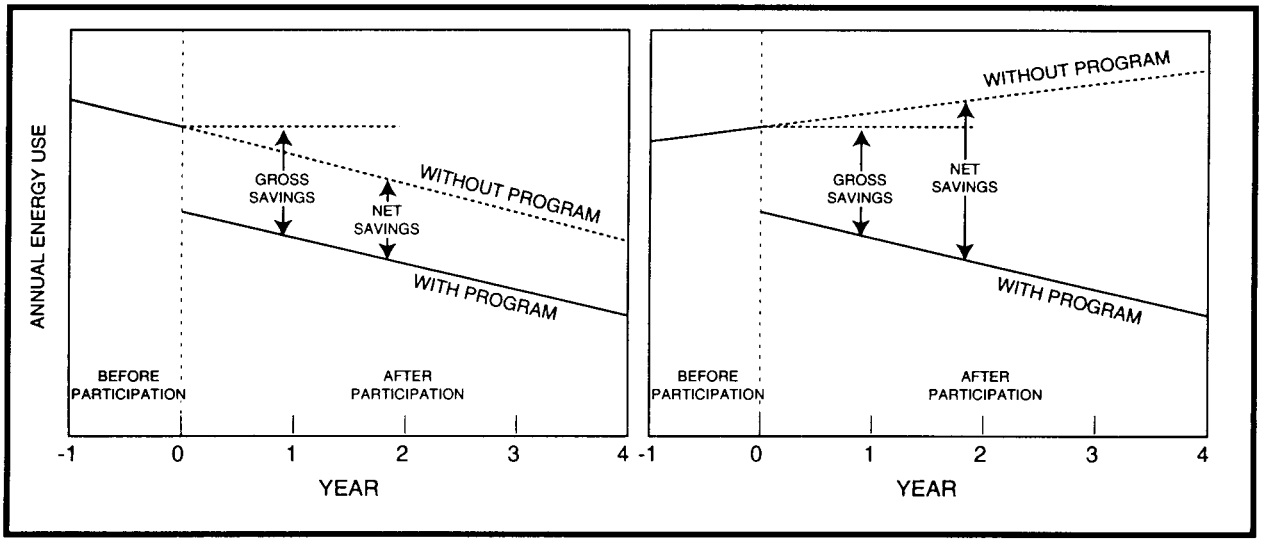

Fig. 3.4 Differences Between Gross and Net Energy Savings

4. SUGGESTED COST-EFFECTIVENESS TESTS FOR COORDINATED LOW-INCOME PROGRAMS

4.1 OVERVIEW

The five California tests for determining the cost-effectiveness of DSM programs are all-inclusive with respect to the perspectives from which cost-effectiveness should be determined. That is, by including participant and nonparticipant tests, the total resource cost test, the utility perspective exclusively, and the societal test, the authors of the California tests have exhausted nearly all possible perspectives.[1]

However, coordinated low-income DSM programs have inherent peculiarities that suggest that the California tests need to be adapted when evaluating these programs. Two important types of adaptations are discussed below: (1) modifications to the benefit and cost categories and (2) distinctions between inclusive and incremental effects.

4.1.1 Adaptations to the Benefit and Cost Categories

The categories of benefits and costs used in evaluating coordinated low-income programs need to differ from those used in the strict California tests. These recommended adaptations are shown in Table 4.1 and discussed below.

First, we recommend redefining the specification of bill reductions, one of the key participant benefits. In particular, we suggest using *net* bill reductions rather than *gross* bill reductions, as is specified in the California tests. In practice, this change affects the participant test. The justification for this adaptation was discussed in detail in Chapter 3.

Second, we recommend changing the treatment of government expenditures. Under the California tests, government activity was characterized as a tax credit and treated as a benefit for participants. In the total resource cost test, the benefit was treated as a negative cost as shown in Table 3.1. In our adaptation, we distinguish between government administrative costs and government program outlays. This distinction reflects the fact that government program outlays may create participant benefits that extend beyond the value of reduced utility bills. In particular, the labor and materials used to weatherize a home may result in a variety of "stock" benefits as discussed in Chapter 3. Such additional benefits would impact the participant, total resource cost, and societal tests. We also recognize, however, that the capital benefits may be of less value to the low-income household than the amount of the program outlay in determining cost-effectiveness.

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[1] When discussing perspectives external to the utility's service territory, many more perspectives than society's at the national level obviously could be invoked. Examples are U.S. regional (e.g., two states, four states), international regional (e.g., Southern hemisphere), and global.

Table 4.1 Suggested Tests for Estimating the Cost-Effectiveness of Coordinated Low-Income DSM Programs

	Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
Benefits:					
C Bill Reductions (Net) Inclusive Incremental	 X %				
C Other Participant Benefits from Utility Program Outlays	X		X	X	
C Other Participant Benefits from Government Program Outlays Inclusive Incremental	 X %				
C Benefits from Reduced Arrears Inclusive Incremental		 X %	 X %	 X %	 X %
U Avoided Energy and Capacity Costs Inclusive Incremental		 X %	 X %	 X %	 X %
S Positive Externalities				X	
Costs:					
C Imputed Participant Costs Inclusive Incremental	 X %		a	a	
U Utility Program Outlays		X	X	X	X
U Utility Administrative Costs		X	X	X	X
U Revenue Loss (Net) Inclusive Incremental		 X %			
G Govt. Program Outlays					
G Government Admin. Costs					
S Negative Externalities				X	

Sources of benefits and costs: C — Customer; U — Utility; G — Government; S — Society as a Whole

'X' indicates that a total monetary value for the program (i.e., government + utility effects) may be required for this benefit or cost category.

'%' indicates that a fraction of a monetary value (i.e., utility's effects) may be required for this benefit or cost category.

'a' Include only out-of-pocket participant costs, if any exist.

Third, we recommend that utility program costs also be disaggregated into program outlays and administrative costs. As with the government's program costs, our recommended tests (Table 4.1) allow for the possibility that the utility's program outlays may result in capital benefits to participants that exceed the value of the utility bill reductions. Once again, in some cases these participant benefits may be less than the program outlays.

4.1.2 Distinguishing Inclusive from Incremental Effects

Because coordinated low-income programs involve multiple sponsors—the utility and one or more government agencies—it is useful to distinguish between the cost-effectiveness of the program as a whole and the cost-effectiveness of the utility's contribution. Estimating the cost-effectiveness of the total program involves the measurement of total or "inclusive" costs and benefits, and does not consider the marginal impact of any single sponsor's contribution to the program. This aggregate approach provides a useful overview of the total investment in the program. Estimating the cost-effectiveness of the utility's investment involves the measurement of "incremental" costs and benefits. The results of these incremental tests are important because they can be used to compare the utility's investment in the low-income DSM program with other investments the utility is considering, including other DSM programs. The incremental tests reflect only the costs and benefits that result from the utility's cosponsorship of the coordinated program.

The need to distinguish between inclusive and incremental tests depends upon the nature of the program and the perspective being used to evaluate it. Inclusive and incremental effects do not differ in "parallel" programs, because the utility is fully funding the program in question (it is simply being run in parallel with one or more government-funded programs). In both "supplemental" and "coupled" programs, the incremental costs and benefits associated with the utility's investment will be less than the inclusive costs and benefits (except from the societal perspective, where they are the same, as discussed next).

The suggested inclusive and incremental tests, along with their cost and benefit categories, are characterized in Table 4.1. Only some of the categories of benefits and costs need to be disaggregated into inclusive and incremental effects. Entries with a "%" sign indicate ones in which an apportionment—or disaggregation—is required.

4.2 THE FIVE TESTS IN MORE DETAIL

In the next chapter, we estimate the cost-effectiveness of a hypothetical low-income DSM program. We use benefit-cost ratios as indicators of cost-effectiveness under different scenarios. That is, an increase in the benefit-cost ratio signifies a favorable effect, while a decrease indicates an unfavorable one.

This is done for illustrative purposes only. In real world applications, benefit-cost ratios may be misleading because they do not indicate the "size" of the resource, only the relative magnitudes of benefits and costs. In Table 4.2, we suggest measures of cost-effectiveness for each of the five tests. The tests and measures will be discussed in turn.

4.2.1 Participant Test

The primary purpose of this test is to determine whether or not a given DSM program will be financially attractive to a potential participant in the program. Given this objective, the benefit-cost ratio is the primary measure of cost-effectiveness for this test. However, if an added objective is to estimate the program's magnitude to compare with other prospective programs, net present value also is a good measure. Other measures are provided in Table 4.2.

As Table 4.1 indicates, the benefits included in this test are net bill reductions and any other participant benefits from the government and utility program outlays that exceed the value of reduced utility bills. The costs included in this test generally are limited to the imputed value of a participant's time. However, these imputed costs should only be used as an indicator of cost-effectiveness if imputed participant costs are part of the benefit-cost calculations of other DSM programs. This will be discussed further under the total resources cost test.

4.2.2 Ratepayer Impact Measure

Because the primary purpose of this test is to measure rate or revenue impacts, it is the only one of the five tests in which revenues are part of the calculus. This suggests that some measure of initial-year or lifecycle revenue impact is the best measure for this test. Other measures are listed in Table 4.2.

Benefits in this test include the reduction in utility costs that result from improved arrears, as well as the avoided energy and capacity costs that result from the DSM investments. Costs in this test include utility program and administrative costs as well as the revenues lost from reduced utility sales.

4.2.3 Total Resource Cost Test

As utilities and their regulators emphasize energy services—rather than therms or kWh—this test becomes increasingly important. The purpose of the test is to measure the total net expenditures (benefits minus costs) of the DSM program by participants, the utility, and the government. Therefore, an obvious primary measure of cost-effectiveness is the net present value. However, because of the importance of this test, the benefit-cost ratio is also suggested as a primary measure.

Benefits in this test include avoided energy and capacity costs, and benefits associated with reduced arrears. Costs in this test include utility program outlays and utility administrative costs. If as a matter of practice, the utility imputes a value for a participant's time in other DSM programs, the

practice should be extended to coordinated low-imcome programs. If the utility does not impute a value for participant's time as standard practice, it should not do so here. The value of a participant's time, then, is used only in the participant test.

Table 4.2 Suggested Measures of Cost-Effectiveness for each of the Tests

Primary	Secondary
PARTICIPANT	
Benefit-cost ratio	Discounted payback (years)
	Net present value
	Net present value (average participant)
RATEPAYER IMPACT MEASURE	
Lifecycle revenue impact per unit of energy (kWh or therm) or demand (kW)	Lifecycle revenue impact per customer
	Net present value
	Annual revenue impact (by year, per kWh, kW, therm or customer)
	First-year revenue impact (per kWh, kW, therm, or customer)
	Benefit-cost ratio
TOTAL RESOURCE COST	
Net present value	Levelized cost (cents or dollars per unit of energy or demand)
Benefit-cost ratio	
SOCIETAL	
Net present value	Benefit-cost ratio
UTILITY COST	
	Benefit-cost ratio
Net present value	Levelized cost (cents or dollars per unit of energy or demand)

4.2.4 Societal Test

The societal test is the most difficult of the five tests to interpret, and also the most difficult of the five tests to estimate in practice. First, there is the question of interpretation. From what

perspective is the societal test to be measured? The state in which the utility operates? Its region? The nation as a whole? Globally? Answers to these questions are important in estimating the cost-effectiveness of DSM programs because the categories of costs and benefits to be included in the calculus will change—depending on the perspective.

Under the generally accepted practice of using the nation as the perspective from which to estimate cost-effectiveness, the categories of costs and benefits are important. For benefits, an estimable effect of running DSM programs is the reduction in the amount of gas and/or electricity that is required—i.e., avoided energy and capacity costs. For low-income DSM programs, another important estimable effect is the reduction in arrears of low-income households. These two categories of benefits are also used in the total resource cost test. Other benefits of running DSM programs are those not internalized in the cost of producing electricity. They could be environmental (e.g., reduction in greenhouse gas emissions), macroeconomic (e.g., more employment installing DSM measures), national security (e.g., reduced dependence on foreign energy), and, in the case of low-income DSM programs, increased levels of comfort, safety, and productivity. The inclusion of any category of these externalities is jurisdictional. If they are included for other DSM programs, they should be included for low-income ones.

Determining society's costs of improving the energy efficiency of low-income households is a little more troublesome. Clearly, there are external costs (e.g., reduction in employment in energy-producing industries), and, similar to benefits, their inclusion in the cost-effectiveness calculus is jurisdictional. Clearly, from a national perspective, any government expenditures on the program are transfers: the costs to taxpayers are offset by the benefits received. The actual cost of a DSM program from the standpoint of the nation is the incremental amount of national resources needed to increase energy efficiency beyond the level which existed before the program was implemented. In practice, the utility's program outlays and administrative costs are usually used as a proxy for this incremental amount. To the extent that these costs capture this incremental amount, the more reliable the estimate of cost-effectiveness from society's perspective.

Because our focus in this study is on cash-flow categories of benefits and costs of low-income DSM programs and recognizing that treatment of most of the "external" benefit and cost categories is jurisdictional, we do not emphasize the societal test. Therefore, with one exception, the estimated cost-effectiveness for the total resource cost and societal tests in Chapter 5 is the same. The one exception is a case in which we include an estimate of environmental benefits of reduced greenhouse gas emissions.

The net present value of the DSM program is the recommended primary measure of cost-effectiveness for the societal test. The benefit-cost ratio is a secondary measure.

4.2.5 Utility Cost Test

The objective of this test is to estimate the change in revenue requirements resulting from implementation of a DSM program. The primary measure for this test is net present value. Important secondary measures include the levelized cost of producing energy. The change in revenue requirements is the net effort of avoided energy and capacity costs and all out-of-pocket expenditures by the utility on the program.

5. ESTIMATING COST-EFFECTIVENESS IN PRACTICE: A HYPOTHETICAL PROGRAM

5.1 DEFINITION OF THE HYPOTHETICAL ELECTRIC PROGRAM

In Table 5.1, we present the values of variables defining a hypothetical electric, coordinated low–income DSM program. Although the program represents an electric application, the principles are extended easily to gas programs. The special problems posed by gas programs are discussed in Section 5.4. Also, although the program defined in Table 5.1 is hypothetical, its profile of costs and benefits are illustrative of those found in the six case studies of coordinated low–income programs that were reviewed in Chapter 2.

The data in Table 5.1 show that the program consists of 100 participants with net annual energy savings of 2,500 kWh. Because of the nature of the secular trend of energy consumption, gross energy savings are only 2,000 kWh (see Section 3.4.5). Initially, we assume that the savings attributable to the utility's investment and that of the government are proportionate to their program outlays ($22,000 and $44,000). Therefore, the utility accounts for 83.3 MWh of savings and the government twice as much—166.7 MWh. To show the effect of that assumption on cost-effectiveness, we vary the relationship between investment and savings in the sensitivity analysis.

In this "base case," the only participant benefits resulting from the utility and government expenditures are utility bill reductions. It is assumed that the utility and government program outlays do not result in other additional benefits, such as increased property values, comfort, and safety. A sensitivity analysis is conducted to test the impact of assuming that the participant benefits in full from the utility and government program outlays, which subsume the value of any bill reductions.

The average residential price of electricity is assumed to be 5¢/kWh. Therefore, the annual reduction in utility bills is $12,500 (2,500 kWh*$0.05*100 participants). The avoided cost of energy is assumed to be 2.5¢/kWh, one-half the residential price of electricity. Therefore, avoided energy costs are $6,250 per year (2,500 kWh*2.5¢/kWh*100 participants).

Assuming a 60% conservation load factor, the 250 MWh of annual electricity savings for the 100 participants translates into 47.6 kW of load savings (250 MWh)/(8,760 hours per year)/(0.60 load factor). Assuming a combustion turbine as the avoided generating unit with an annual levelized cost of $40/kW/year, the avoided capacity savings are $1,904. Recognizing that the avoided generating unit on an electric power system is unique to that system, we change the assumption of a combustion turbine avoided unit to a coal unit in the sensitivity study.

Using the six case studies as a guide, we assume that the costs of administering the programs for both the utility and government are one-half of the program expenditures. Therefore, the utility and government expend $11,000 and $22,000, respectively, for administering their portions of the program.

Table 5.1 Hypothetical Coordinated Low-Income DSM Electric Program

Input Category	Value
Number of Participants	100
Gross Energy Savings Per Participant(kWh)	2,000
Net Energy Savings Per Participant (kWh)	2,500
Net Program Energy Savings (MWh)	250
Utility (MWh)[a]	83.3
Government (MWh)a	166.7
Residential Electricity Price (¢/kWh)	5.0
Reduction in Utility Bills ($)	12,500
Avoided Unit Energy Cost (¢/kWh)	2.5
Avoided Total Energy Cost ($)	6,250
Total Capacity Savings (kW)[b]	47.6
Avoided Unit Capacity Cost ($/kWYear)	40.00
Avoided Total Capacity Cost ($)	1,904
Utility Program Outlays ($)	22,000
Utility Administrative Costs ($)	11,000
Government Program Outlays ($)	44,000
Government Admin. Costs ($)	22,000
Discount Rates (%):	
Participant Test	12.0
Ratepayer Impact Measure	8.0
Total Resource Cost Test	4.5
Societal Test	4.5
Utility Cost Test	6.0
Useful Life of Retrofits (Years)	20

[a]Proportional to program outlays: utility—33%, government—67%

[b]Assumes a 60% conservation load factor

The discount rates chosen for each of the tests are merely indicative of relationships between the rates—and not a prescription for the amounts to be used when evaluating real-world programs. The rate used for the participant test is the largest of the five because individuals have relatively higher discount rates than a utility or society as a whole. In the low–income DSM program application, it could be argued that the rate should be much higher than 12% because we are dealing with low-income households, which require shorter payback periods. The rates used for the societal

and total resource cost tests are the lowest. To show the effect that discount rates have on cost-effectiveness, we double their amounts in a sensitivity study.

Finally, in the base scenario we assume that the useful lives of the retrofits made to the low-income homes are 20 years. Therefore, the energy and capacity savings for the utility persist for 20 years, and the participants benefit from 20 years of reduced bills. In the sensitivity analysis below, we lower the useful life to 10 years, showing the effect of that assumption on cost-effectiveness.

5.2 DEVIATION FROM CALIFORNIA TESTS

In Chapter 4, we suggested qualitatively how the California tests should be adapted to meet the special needs of coordinated low–income DSM programs. An important part of our adaptation is to suggest that both inclusive and incremental variants of the California tests be used. In this section, we show how a strict interpretation of the California tests evolves into our suggested tests. We then go on to show the results of a sensitivity analysis.

In Table 5.2, we show the inputs used to calculate benefit-cost ratios using a strict interpretation of the California tests and the inputs for the changes we suggest to arrive at our inclusive test. The only suggested change is the use of net—rather than gross—energy savings in calculating the energy-savings benefits to participants. As Table 5.2 indicates, using net energy savings increases the annual amount of participants' benefits from $10,000 to $12,500 per year.

The effects of using net savings on the five measures of cost-effectiveness are shown in Table 5.3. Including net—rather than gross—energy savings (200 MWh to 250 MWh of savings) increases the benefit-cost ratio in the participants test from 16.40 to 20.50. The benefit-cost ratios do not change for other measures of cost-effectiveness.

5.3 SENSITIVITY ANALYSIS

In estimating the financial attractiveness of coordinated low–income DSM programs, obtaining an accurate estimate of a number of variables is crucial to estimating the program's cost-effectiveness. Some variables are peculiar to coordinated low–income DSM programs (i.e., allocation of savings attributable to the utility and government, source of government funds, treatment of benefits to low-income households, leveraging of utility funds with those of the government, and inclusion of benefits from arrearage reductions). Other input assumptions are also very important, but are applicable to the general class of DSM programs (e.g., including or excluding environmental externalities, estimating avoided costs of DSM programs, using the proper discount rate, and determining a valid useful life for the low-income retrofits). In this section, we show the sensitivity of different values of these variables on the estimated cost-effectiveness of our hypothetical coordinated low–income program. Again, the benefit-cost ratio is the measure of cost-effectiveness.

Table 5.2 Summary of Inputs to Suggested Hypothetical Coordinated, Low-Income Electric Program

Input Category	Strict California Test	Net Energy Savings	Inclusive Test
Number of Participants	100	100	100
Gross Energy Savings per Participant (kWh)	2,000	NA	NA
Net Energy Savings per Participant (kWh)	2,500	2,500	2,500
Gross Program Energy Savings (MWh)	200	NA	NA
Net Program Energy Savings (MWh)	250	250	250
Residential Electric Price (¢/kWh)	5.0	5.0	5.0
Reduction in Utility Bills ($)	10,000	12,500	12,500
Annual Participant Benefits ($)	10,000	12,500	12,500
Total Capacity Savings (kW)	47.6	47.6	47.6
Unit Avoided Capac. Cost ($/kW/Year)	40.00	40.00	40.00
Total Avoided Capac. Cost ($)	1,904	1,904	1,904
Participant Cost ($)	0	0	5,100
Utility Program Outlays ($)	22,000	22,000	22,000
Utility Admin. Costs ($)	11,000	11,000	11,000
Government Program Outlays ($)	44,000	44,000	44,000
Government Admin. Costs ($)	22,000	22,000	22,000
Discount Rates (%):			
Participant Test	12.0	12.0	12.0
Ratepayer Impact Measure	8.0	8.0	8.0
Total Resource Cost Test	4.5	4.5	4.5
Societal Test	4.5	4.5	4.5
Utility Cost Test	6.0	6.0	6.0
Useful Life of Retrofits (Years)	20	20	20

NA - Not Applicable

Table 5.3 Benefit-Cost Ratios for the Strict California Tests and the Suggested Inclusive Tests

	Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
California Test	16.40	0.52	2.91	2.91	3.00
Net Energy Savings	20.50	0.52	2.91	2.91	3.00
Inclusive Test	20.50	0.52	2.91	2.91	3.00

In Table 5.4 we summarize the inputs used for the sensitivity analysis. The assumptions from Table 5.1 are used as the base case. The benefit-cost ratios for our suggested inclusive and incremental tests calculated from these input assumptions are shown in Table 5.5. The results are divided between the total effects of the coordinated program ("inclusive") and the effects attributable to the utility's investment ("incremental"). If there was no government funding (i.e., the utility paid for the entire program as is the case with "parallel" programs), the benefit-cost ratios would be identical for both the inclusive and incremental measures. All of the benefit-cost ratios in Table 5.5 represent singular results. That is, as the input assumptions in Table 5.4 indicate, each of the sensitivity studies is a single variant of the base case. There are no interactive effects in any of the sensitivity results.

Some general observations on the results in Table 5.5 are appropriate. First, consider the relative magnitudes of the benefit-cost ratios resulting from incremental vs. inclusive tests. For four of the perspectives (ratepayer impact measure, total resource cost test, societal test, and utility cost test), benefit-cost ratios are generally lower for incremental tests. This is because the incremental tests only include the benefits (i.e., bill reductions and avoided energy and capacity costs) and costs (i.e., imputed participant costs and lost revenues) attributable to the utility's investment. Also, the benefits that are excluded due to the apportioning across sponsors are generally greater than the excluded costs.

Table 5.4 Summary of Inputs for Sensitivity Analysis

Input Category	Base	Allocation of Savings	Local Govt. Funding	Utility Leveraging	Environ. Externalities	Arrearage Reduction
Reduction in Utility Bills ($)	12,500	12,500	12,500	16,666	12,500	12,500
Utility	4,167	6,250	4,167	8,333	4,167	4,167
Government	8,333	6,250	8,333	8,333	8,333	8,333
Avoided Energy Costs ($)	6,250	6,250	6,250	6,250	6,250	6,250
Avoided Capacity Cost ($)	1,904	1,904	1,904	1,904	1,904	1,904
Total Avoided Cost ($)	8,154	8,154	8,154	8,154	8,154	8,154
Utility	2,718	4,077	2,718	5,436	2,718	2,718
Government	5,436	4,077	5,436	5,436	5,436	5,436
Participant Benefits ($)	12,500 (Annual)	12,500 (Annual)	12,500 (Annual)	12,500 (Annual)	12,500 (Annual)	12,500 (Annual)
External Benefits ($)	0	0	0	0	0	0
Participant Costs ($)	0	0	0	0	0	0
Utility Program Outlays ($)	22,000	22,000	22,000	22,000	22,000	22,000
Utility Admin. Costs ($)	11,000	11,000	11,000	11,000	11,000	11,000
Reduction in Annual Cost ($)	0	0	0	0	0	0
Govt. Program Outlays ($)	44,000	44,000	44,000	44,000	44,000	44,000
Goverment Admin. Costs ($)	22,000	22,000	22,000	22,000	22,000	22,000
Discount Rates (%):						
Participant Test	12.0	12.0	12.0	12.0	12.0	12.0
Ratepayer Impact Measure	8.0	8.0	8.0	8.0	8.0	8.0
Total Resource Cost Test	4.5	4.5	4.5	4.5	4.5	4.5
Societal Test	4.5	4.5	4.5	4.5	4.5	4.5
Utility Cost Test	6.0	6.0	6.0	6.0	6.0	6.0
Utility Life of Retrofits (Yrs)	20	20	20	20	20	20

Table 5.4 (continued) Summary of Inputs for Sensitivity Analysis

Input Category	Higher Avoided Costs	Higher Discount Rates	Shorter Useful Life	Capital Benefits	Participant Costs Included
Reduction in Utility Bills ($)	12,500	12,500	12,500	NA	12,500
Utility	4,167	4,167	4,167	NA	4,167
Government	8,333	8,333	8,333	NA	8,333
Avoided Energy Costs ($)	6,250	6,250	6,250	6,250	6,250
Avoided Capacity Cost ($)	9,520	1,904	1,904	1,904	1,904
Total Avoided Cost ($)	15,770	8,154	8,154	8,154	8,154
Utility	5,257	2,718	2,718	2,718	2,718
Government	10,513	5,436	5,436	5,436	5,436
Participant Benefits ($)	12,500 (Annual)	12,500 (Annual)	12,500 (Annual)	66,000 (1 Year)	66,000 (1 Year)
External Benefits ($)	0	0	0	0	0
Participant Costs ($)	0	0	0	0	5,100
Utility Program Outlays ($)	22,000	22,000	22,000	22,000	22,000
Utility Admin. Costs ($)	11,000	11,000	11,000	11,000	11,000
Reduction in Annual Cost($)	0	0	0	0	0
Govt. Program Outlays ($)	44,000	44,000	44,000	44,000	44,000
Goverment Admin. Costs ($)	22,000	22,000	22,000	22,000	22,000
Discount Rates (%):					
Participant Test	12.0	24.0	12.0	12.0	12.0
Ratepayer Impact Measure	8.0	16.0	8.0	8.0	8.0
Total Resource Cost Test	4.5	9.0	4.5	4.5	4.5
Societal Test	4.5	9.0	4.5	4.5	4.5
Utility Cost Test	6.0	12.0	6.0	6.0	6.0
Utility Life of Retrofits (Yrs)	20	20	10	20	20

Table 5.5 Inclusive and Incremental Benefit-Cost Ratios: Sensivity Analysis of Variations from the Base Case

Scenario	Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost
Base					
Inclusive	20.50	0.52	3.36	3.36	3.00
Incremental	20.50	0.37	1.12	1.12	1.00
Allocation of Savings					
Inclusive	20.50	0.52	3.36	3.36	3.00
Incremental	30.76	0.44	1.68	1.68	1.50
Local Govt. Funding					
Inclusive	20.50	0.37	1.12	1.12	3.00
Incremental	20.50	0.37	1.12	1.12	1.00
Utility Leveraging					
Inclusive	20.56	0.55	4.48	4.48	4.01
Incremental	20.56	0.48	2.24	2.24	2.00
Environ. Externalities					
Inclusive	20.50	0.52	3.36	4.03	3.00
Incremental	20.50	0.37	1.12	1.34	1.00
Arrearage Reduction					
Inclusive	20.50	0.59	3.77	3.77	3.37
Incremental	20.50	0.42	1.26	1.26	1.12
Higher Avoided Costs					
Inclusive	20.50	1.01	6.50	6.50	5.81
Incremental	20.50	0.72	2.17	2.17	1.94
Higher Discount Rates					
Inclusive	12.49	0.47	2.46	2.46	2.07
Incremental	12.49	0.30	0.82	0.82	0.69
Shorter Useful Life					
Inclusive	15.51	0.48	2.04	2.04	1.93
Incremental	15.51	0.31	0.68	0.68	0.64
Capital Benefits					
Inclusive	12.94	0.52	10.08	10.08	3.00
Incremental	12.94	0.52	1.12	1.12	1.00
Participant Costs Inc.					
Inclusive	20.50	0.52	2.91	2.91	3.00
Incremental	20.50	0.37	1.07	1.07	1.00

The exception is the participant test, where benefit-cost ratios are typically the same from both the inclusive and incremental perspectives. This is because the participant benefits and costs are decreased by the same proportions as a result of their allocation across sponsors. If the net present value were used to measure the participant test results, the inclusive participant test would result in a higher value than the incremental participant test, since the magnitudes of the benefits are much greater in the inclusive test.

Second, consider the relative magnitudes of the benefit-cost ratios resulting from each of the five perspectives. The ratepayer impact measure is the only test that typically results in a benefit-cost ratio less than 1.0. In only one of the sensitivity cases (the inclusive test with higher avoided cost), is the hypothetical program cost-effective from the viewpoint of the nonparticipant. The participant test results in the most favorable benefit-cost ratios, with ratios ranging from 12.49 to 30.76.

The hypothetical program is almost always cost-effective based on both the incremental and inclusive versions of the total resource cost test. However, the benefit-cost ratios are less than 1.0 in two of the sensitivity analyses: when the DSM measures are assumed to produce savings for only 10 years and when the discount rates are doubled. The results for the societal test are almost always identical to those of the total resource cost test. The two exceptions are the incremental and inclusive versions that include a value for environmental externalities.

The pattern of results for the utility cost test is similar to that of the total resource cost test. The biggest difference between the benefit-cost ratios resulting from these two perspectives occurs with the assumption of local government funding. This dramatically decreases the cost-effectiveness of the program based on the incremental version of the total resource cost test, but does not influence the benefit/cost ratios of the utility cost test.

In the remainder of this section, we will discuss the results of each individual sensitivity analysis in greater detail.

5.3.1 Allocation of Savings

As discussed in Chapter 3, one of the most difficult parts of estimating the cost-effectiveness of coordinated low-income DSM programs for electric and gas utilities is allocating the energy savings to cosponsors. In the reference case, we assume that energy savings are proportional to levels of investment. However, in real-world settings, this is not necessarily the case. Funding outlays could result in increasing or decreasing returns depending on the type of program, type of investment, the party making the investment, the maturity of the program, etc.

Utilities and government agencies, however, do not typically collect this type of data. To illustrate the importance of obtaining accurate estimates of a utility's contribution to energy savings, we assume that the savings attributable to the utility investment increases by 50 percent in this sensitivity. That is, we assume increasing returns to the utility's portion of the investment.

From Table 5.5, the incremental tests are the only cost-effectiveness tests that are affected by this assumption in comparison with the base scenario because the total expenditures on the program and the total amount of savings are unaffected by the allocation of energy and capacity savings to the utility. The incremental versions of the participant, total resource cost, societal, and utility cost tests increase by 50 percent compared to the base case. This result is significant because the utility cost test is important for a utility in comparing low-income DSM alternatives with its other possible DSM and supply investments.

5.3.2 Local Government Funding

In the base scenario, we assume that decisionmaking for the federal government's contribution to the low-income program does not affect—or is not affected by—the ratepayers of the utility. That is, we assume that irrespective of the utility's involvement in the program, the federal government continues to fund low-income DSM programs. Therefore, the decision by a utility to participate in the program is an incremental one. Given the federal government's funding outlays, the utility conducts a cost-effectiveness assessment of its contribution to the program. The government's portion of the funding does not affect the rates of the utility.

However, there are cases in which these conditions may not apply. To illustrate this, we assume that government funding for the program is obtained from a locality, and the utility under question is municipally owned. Here, the circumstances of the reference case do not apply. Decisionmaking for both the government's and utility's contribution to the program is at the local level. Both decisions can affect rates and the ratepayers of the utility because the ratepayers are both taxpayers of the municipality and owners of the utility.

The benefit-cost results for this scenario shown in Table 5.5 indicate the importance of this feature in evaluating low-income DSM programs. Because both the government's and utility's outlays for the program can affect ratepayers, cost-effectiveness under both the ratepayer impact measure and the total resource cost test are significantly affected for the inclusive test. The benefit-cost ratios for the incremental results are unchanged from the base case because the utility's cost of running the program are included in both the inclusive and incremental tests.

5.3.3 Leveraging

Increasingly, government funding for low–income DSM programs is leveraged with that of a utility's. In determining cost-effectiveness under this condition, the benefit-cost ratios for all five tests improve from the base-case for both the inclusive and incremental perspectives. For the former, the reason is that program funding is higher if the utility participates. For the latter, the reason is that the utility is credited with more savings for its investment in the program.

5.3.4 Environmental Externalities

The avoided energy and capacity costs are increased by 15% from the base case to estimate the effects of environmental externalities. From Table 5.5, the inclusive and incremental benefit-cost ratios under the societal test improve in this sensitivity analysis. None of the other perspectives is affected by this change.

5.3.5 Arrearage Reduction

As discussed in Chapter 4, an important by-product of running low-income DSM programs is the reduction in arrears experienced by utilities from low-income households. That reduction, of course, is a benefit to the utility—i.e., it favorably affects its cash flow. For this sensitivity, we assume a levelized arrearage reduction of $10/customer/year. From Table 5.5, including that amount as a benefit improves the benefit-cost ratios for both the incremental and inclusive versions of four of the tests. The exception is the participant test.

5.3.6 Higher Avoided Costs

In this scenario, we assume that the avoided generating unit is a coal plant with an annual levelized cost of $200 per year rather than a combustion turbine with an annual levelized cost of $40. From Table 5.5, the values of the benefit-cost ratios for the nonparticipants, total resource cost test, societal test, and utility cost test improve significantly under this scenario. The benefit-cost ratio for the participant test does not change because avoided capacity costs are not part of the calculus of this measure.

5.3.7 Higher Discount Rates

As indicated in Table 5.4, the discount rates were doubled in this scenario. As shown in Table 5.5, this change significantly decreases the benefit-cost ratios for both the inclusive and the incremental versions of each of the five tests. The higher discount rates cause the incremental versions of the total resource cost test, societal test, and utility cost test to produce a benefit-cost ratio less than one.

5.3.8 Shorter Useful Life

In the base case, we assume that the conservation measures installed in the low-income DSM program last for 20 years and, therefore, that benefits and costs accrue over that 20-year period. In this scenario, we assume that the useful lives of the retrofits are only 10 years. Under this assumption, benefit-cost ratios decrease markedly under both the inclusive and incremental variants under all perspectives. The shorter assumed lifetimes cause the hypothetical program to become cost

ineffective based on incremental versions of the total resource cost test, societal test, and the utility cost test.

5.3.9 Capital Benefits

Recall that in the base case, the utility and government outlays are assumed to produce no benefits to participants other than the impact they have on reducing fuel bills. In this sensitivity, we assume that benefits to participants in the program are measured exclusively by their "stock" component (i.e., the cost of purchasing and installing the energy conservation measures), rather than the annual "flow" of reduced bills over the useful lives of the conservation retrofits. From Table 5.5, the only perspective affected by this assumption is the participant test—and it declines appreciably from the base case because the net present value of the bill reductions is greater than the value of the program outlays. If both "stock" and "flow" benefits were included, the benefit-cost ratio for the participant test would increase substantially.

5.3.10 Participant Costs

In the base case, the TRC and societal tests did not include the imputed value for the time spent by participants in the program. From Table 5.5, including imputed participants costs in these tests result in lower benefit-cost ratios. The benefit-cost ratios for the other three tests do not change.

5.4 SPECIAL PROBLEMS OF GAS UTILITIES

With the exception of kWh as the unit of measurement instead of therms or Mcf, the hypothetical program defined in Table 5.1 could pertain to a low–income DSM program of a natural gas utility. All of the other variables are relevant for a natural gas program.

However, it may be more difficult in many jurisdictions to estimate the avoided capacity costs for natural gas utilities. In these cases, the prevailing jurisdictional approach will determine the methodology and amount—if any—of avoided capacity costs for low–income, natural gas programs.

6. SYNTHESIS AND RECOMMENDATIONS

6.1 METHODOLOGICAL RECOMMENDATIONS

This section presents a number of recommendations regarding the methods to be used in evaluating the cost-effectiveness of coordinated low–income DSM programs.

6.1.1 Program and Utility Cost-Effectiveness

The ultimate objective of estimating the cost-effectiveness of coordinated low-income programs is not to determine social welfare. Rather, it is to determine the cost-effectiveness of a utility's participation in the program. Therefore, we recommend that the five tests originally developed for use in California ("inclusive tests" in our terminology) be disaggregated to reflect the utility's incremental contribution to the total program ("incremental tests" in our terminology).

6.1.2 Allocation of Savings Among Cosponsors

The key to accurately disaggregating the tests into inclusive and incremental portions is obtaining accurate estimates of the energy and demand savings attributable to both the government's and utility's investment. There is no hard-and-fast rule for estimating percentages in real-world applications. In our simulations, we originally assumed that energy savings attributable to the utility's investment were proportional to the amount of investment by the utility. Varying this in our sensitivity study showed the large impact this assumption has on cost-effectiveness estimates.

In real-world applications, the only way to measure accurately the effects of a utility's and government's investment is to collect data that distinguishes the two contributions. Collecting data properly is a primary recommendation of this study, discussed further in Section 6.3.

6.1.3 Benefits to Participants

Low-income participants receive two types of benefits from coordinated DSM programs. Inclusion of either—or both—depends on the objectives of the party developing the cost-effectiveness measure.

The first type of benefit is the flow of energy savings over the useful life of the in-kind contribution to low-income households. The second type of benefit is the value of the in-kind contribution made by both the utility and government. If the goal of the assessment is to estimate the energy benefits of the program exclusively, it is better to include only the estimated annual flow of energy savings as program benefits. An alternative would be to include the value of the in-kind contribution, which produces the savings and other benefits (i.e., the total program outlays of the utility and the government). That contribution may result in more than just energy benefits, such as comfort, shelter, increases in housing value, among others. To the extent that the objective of the

analysis is to include these non-energy benefits, the stock of capital is a good measure of benefits. Alternatively, the entire energy flow may be included with a portion of the stock.

6.1.4 Participant Costs

For participants in a typical low-income DSM program, out-of-pocket expenditures for materials or capital items typically are not required. However, an expenditure of time is required to accommodate the retrofit of the home. In the analysis conducted in this study, we imputed a cost for participants' time. Based on the examination of six coordinated programs in detail, for the simulations described in Chapter 5, we selected 12 hours valued at $4.25 per hour, the minimum wage. In practice, these imputed values should be based on the characteristics of individual programs.

In real-world applications, however, imputing a cost for a participant's time associated with a low-income DSM program should be consistent with the practice used for valuing participants' time in other DSM programs. If costs are imputed for the time spent by participants in other DSM programs, they should be imputed for low-income programs, as well. If they are not imputed for others, we recommend that they not be imputed for low-income programs.

6.1.5 Arrearage Reductions

Arrearage reductions from running a low-income DSM program result in estimable, administrative savings for a utility. Although available evidence suggests a wide range of possibilities for the value of these administrative savings attributable to arrearage reductions across the country, individual utilities can estimate the amount through billing analysis. We recommend that such estimates be included as part of the benefits of running a low-income DSM program. They should be treated the same as the avoided energy and capacity costs of running the program.

6.1.6 Treatment of Government Expenditures

The treatment of government expenditures in determining cost-effectiveness depends crucially on the level of government at which the expenditures are made and, to a lesser extent, the ownership of the utility. If the federal government is the source of funding of a low-income DSM program co-funded by an investor-owned electric or gas utility, the amount of government funding should not be treated as a cost for the ratepayer impact measure or the total resource cost test. This situation was depicted in Table 3.2. However, if a local government funds a program that is co-funded by a locally owned utility, government expenditures should be treated as a cost in the ratepayer impact measure or the total resource cost test. That situation was depicted in Table 3.4. The reason for treating the cases differently is their effect on electricity prices. In the former case, the decision to expend funds on the program was not made at the utility service-area level. In the latter, funding could affect rates.

6.1.7 Environmental Externalities

In our simplistic sensitivity analysis of environmental externalities, we examined a 20% "adder" for environmental benefits. In practice, approaches to the valuation of externalities range from simple methods (e.g., qualitative judgements or percentage adders) to sophisticated techniques (e.g., quantification of damage and/or mitigation costs). In addition, other externalities can be treated such as the employment effects of using certain resources. The problem is complicated even further when dealing with low-income DSM programs because of the special nature of some of their effects. Comfort and productivity are two important ones.

With the exception of the one sensitivity study on the benefits of not burning fossil fuels, the analysis of cost-effectiveness in this study was conducted on a cash-flow basis to the utility. In jurisdictions requiring more explicit treatment of externalities, the results may change depending on the nature of the externalities considered.

6.1.8 Avoided Costs

In this study, we took a simplistic, static view of avoided costs. We assumed a 2.5¢/kWh avoided energy cost, a $40/kW avoided capacity cost (approximating a combustion turbine), and performed one sensitivity study approximating an avoided coal unit (i.e., $200/kW). In the real world, of course, determining the actual avoided costs of employing a demand or supply resource is much more complex. Depending on the sophistication of the technique used, there could be dynamic interaction of all the variables over the 20-year planning horizon we used in this study. The importance of getting an accurate estimate of the amount of the avoided cost is crucial because it is the key benefit in determining cost-effectiveness. Again, the procedures used vary from jurisdiction to jurisdiction.

The problem is even more complicated for the avoided capacity costs of natural gas utilities. Due to recent changes in the natural gas industry, it is becoming increasingly difficult to estimate the avoided capacity costs of DSM programs. Because of the importance of avoided capacity costs in determining cost-effectiveness, an estimate is required. The methodology for making that estimate, however, varies from jurisdiction to jurisdiction.

6.2 THE SUGGESTED TESTS IN PRACTICE

In Figure 6.1, we suggest how the tests be used in practice. The inclusive test should be used to screen for cost-effective opportunities. If the benefit-cost ratio for the total program never exceeds 1.0 for any proportion of a utility's investment in the program using the total resource cost test and the utility cost test, the program should be dropped from consideration. If the ratio exceeds 1.0, the program should be screened for cost-effectiveness using the incremental test.

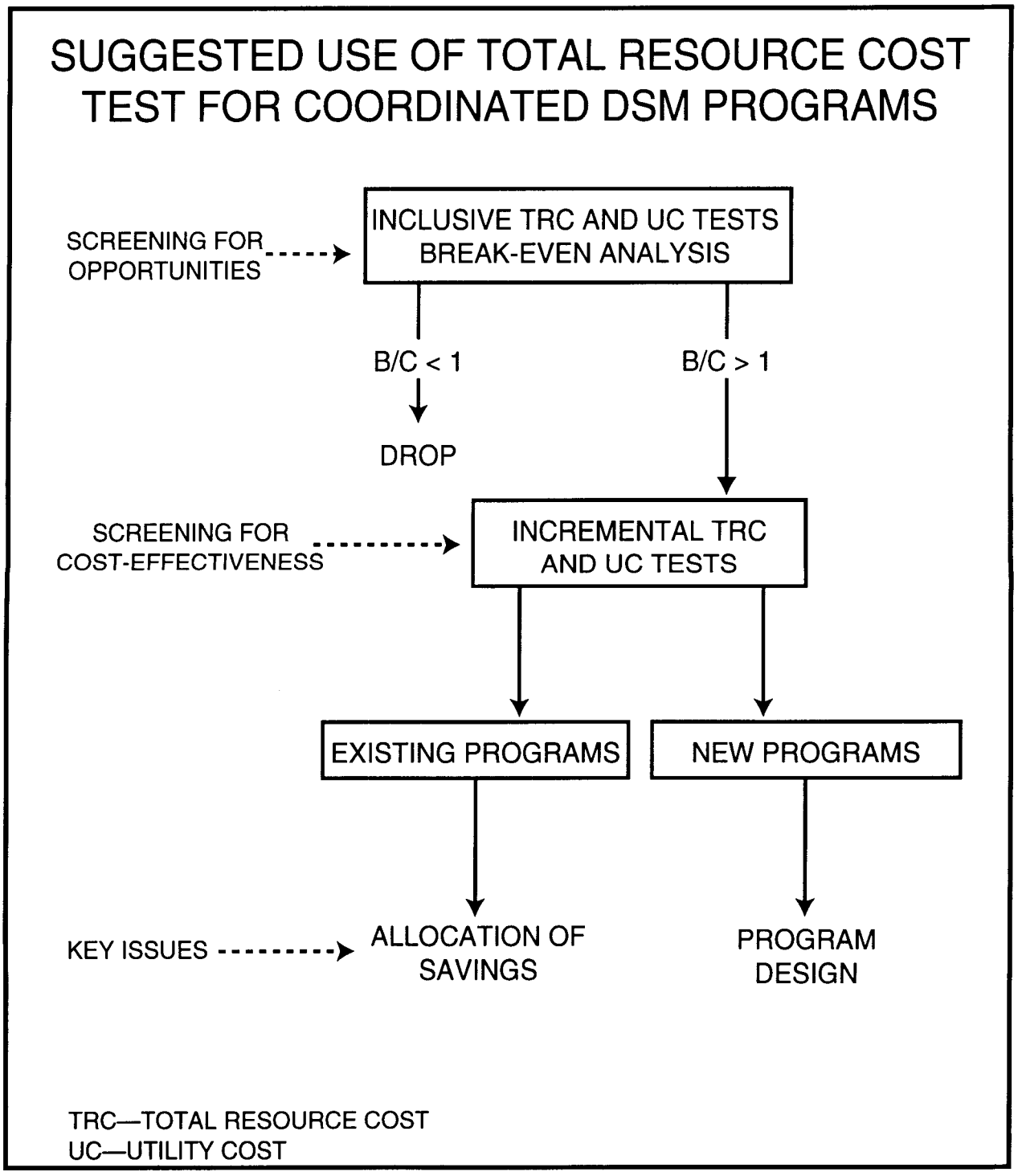

Fig. 6.1 Suggested Use of Cost-Effectiveness Tests for Coordinated DSM Programs

When using the incremental test, a distinction should be made between existing programs and new ones under consideration. For existing programs, a key issue is the allocation of total energy and capacity savings between the government agency and the utility. Will the utility's incremental

investment in the program result in decreasing, proportional, or increasing savings? The answer to that question depends on the features of the program and will vary from program to program.

Using the incremental total resource cost and utility cost tests for new programs raises a different set of questions in determining cost-effectiveness related to program design and, more generally, its conceptualization. The key consideration here is the negotiated agreement between the government agency and utility on the scope of the low-income program and how it will be administered. These negotiations are critical in determining the allocation of energy savings to the utility and, hence, the incremental cost-effectiveness to the utility. Should the allocated savings be proportional to the amount of investment for a new program? Or, if the utility does not invest in the program, will the program serve its customers? If the answer to this last question is "No", the utility's incremental investment is totally leveraged and its investment should be allocated all of the energy and capacity savings. Again, in practice, resolution of these issues depends on the nature of individual programs.

We illustrate use of the inclusive test to screen for opportunities in Figure 6.2. In the upper two graphs, the values of the benefit-cost ratio are plotted for various proportions of utility investment in the program from zero to one hundred percent for both the utility cost and total resource cost tests. The data used for the curves are based on the hypothetical program defined in Chapter 5. The difference between the two diagrams is the value of imputed customer costs. In the diagram on the upper left, imputed customer costs are not included in the benefit-cost calculus. They are included in the diagram on the upper right. These costs distinguish the utility cost and total resource cost tests. Also, as suggested in the previous section, arrearage reductions are included as benefits of the program.

Two conclusions emerge from the graphs in the upper part of the figure. First, by including imputed customer costs, the benefit-cost ratio for the total resource cost test is less than the corresponding values for the utility cost test for any given proportion of utility investment in the program. Second, the hypothetical program is cost-effective under both the utility cost and total resource cost tests for any percentage of utility investment in the program. Therefore, from Figure 6.1, this program passes the first hurdle of cost-effectiveness: there is a percentage of utility investment in the program that results in a benefit-cost ratio greater than 1.0. In this case, then, it would be cost-effective using both the utility cost and total resource cost tests for the utility to run the DSM program without co-funding by the government.

For other programs, however, this may not be the case. We illustrate this in in the bottom two graphs of Figure 6.2. The graph on the bottom left is the same as the one on the top left. The assumption underlying the graph on the bottom right is that total program costs increase from $99,000 to $198,000. In this case, any utility investment in the program beyond 60 percent results in benefit-cost ratios less than 1.0. Therefore, from Figure 6.1, if a utility invests more than 60 percent

in the program, it should be dropped from consideration. If it invests less than 60 percent, the program should be screened using the incremental test.

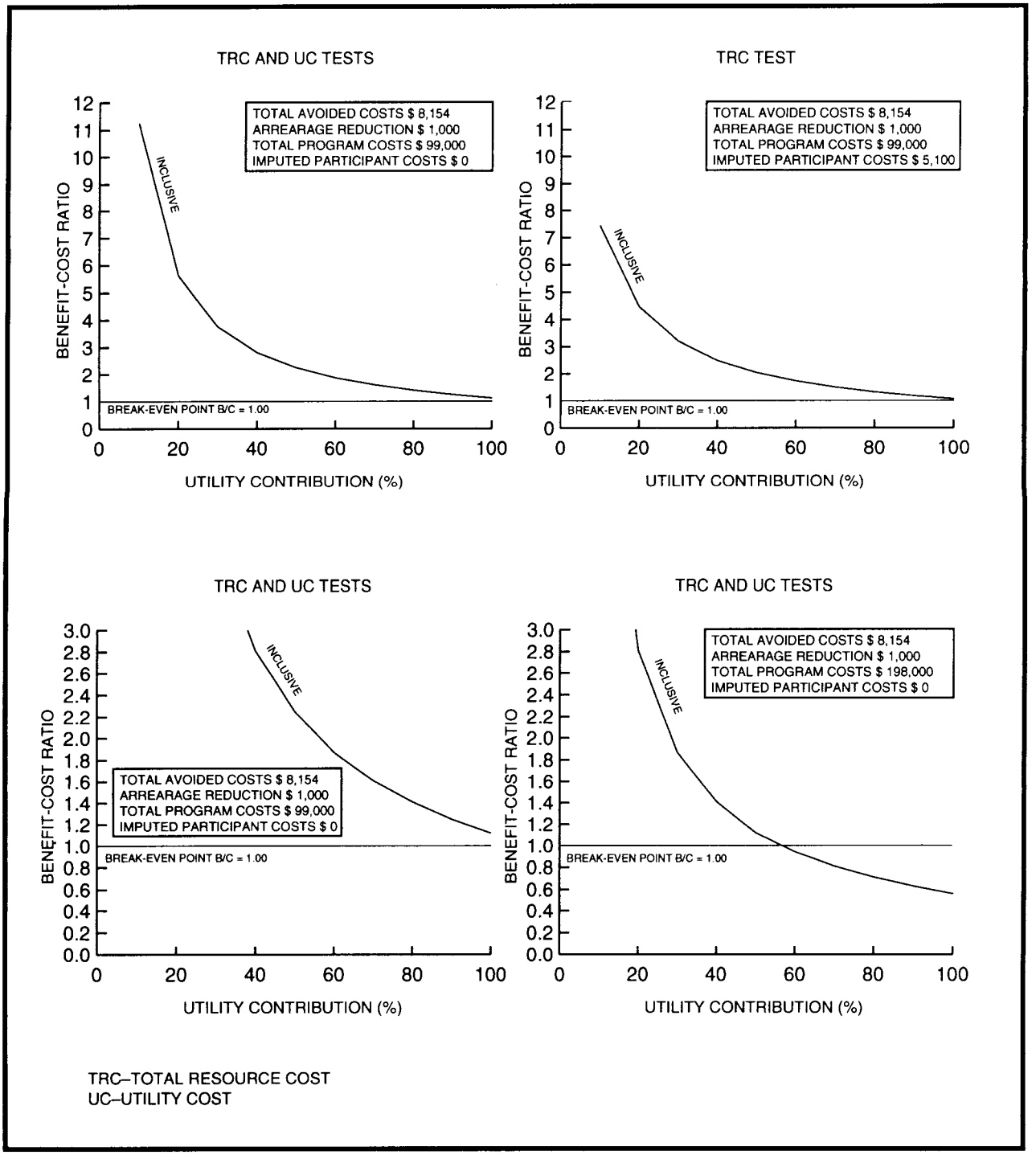

Fig. 6.2 Break-Even Analysis to Screen for Program Opportunities

We provide three examples of using incremental tests to screen for cost-effectiveness in Figure 6.3. In the upper graph, we plot the data from our hypothetical program that was defined in Chapter 5. Again, the incremental benefit-cost ratios for both the utility cost and total resource cost tests are the same because imputed costs are not included. They are also constant because we assume that the utility's funds are used to weatherize more low-income homes and, therefore, a proportional allocation of energy savings applies.[1] With a constant benefit-cost ratio of 1.12, the program is cost-effective under both the utility cost and total resource cost tests.

As discussed in Chapter 3, however, the assumption of proportional allocation of energy and capacity savings varies depending on the nature of the program. Assuming decreasing or increasing returns to the utility's investment, of course, would lead to varying benefit-cost ratios under different portions of a utility's investment. We illustrate a case of increasing returns in the middle graph of Figure 6.3. In this illustration, we assume that the utility's funds are used to apply more weatherization measures to homes that the government has already begun to weatherize. The graph shows a step functional relationship between the proportion of utility funding and cost-effectiveness. This is attributable to the lumpiness of investments—i.e., funding of conservation retrofits may not be a smooth curve.

In the bottom graph of Figure 6.3, we illustrate a case in which the utility's investment in the program is leveraged dollar-for-dollar with the investment of another government agency. In real-world applications, this could arise from matching funds from a state or municipality for the utility's funding of a coordinated federal-utility program. The state or locality matches every dollar the utility invests with the federal program. For our hypothetical program, this leveraging of state/local funds increases the benefit-cost ratio from 1.12 to 1.46 for all proportions of the utility's investment. Again, the benefit-cost ratio is constant for all percentages of investment because we assume a proportional allocation of savings.

6.3 DATA COLLECTION RECOMMENDATIONS

The results of the six case studies and the sensitivity analysis of the hypothetical program suggest that current data collection activities by government agencies and utilities need to be modified if valid estimates of the cost-effectiveness of coordinated low–income DSM programs are to be obtained. Three areas of improvement are stressed.

[1] Given fixed benefits of $8,154 per year and fixed costs of $99,000, 10 percent of their ratio results in the same benefit-cost ratios as 30 percent, and 60 percent, and so on.

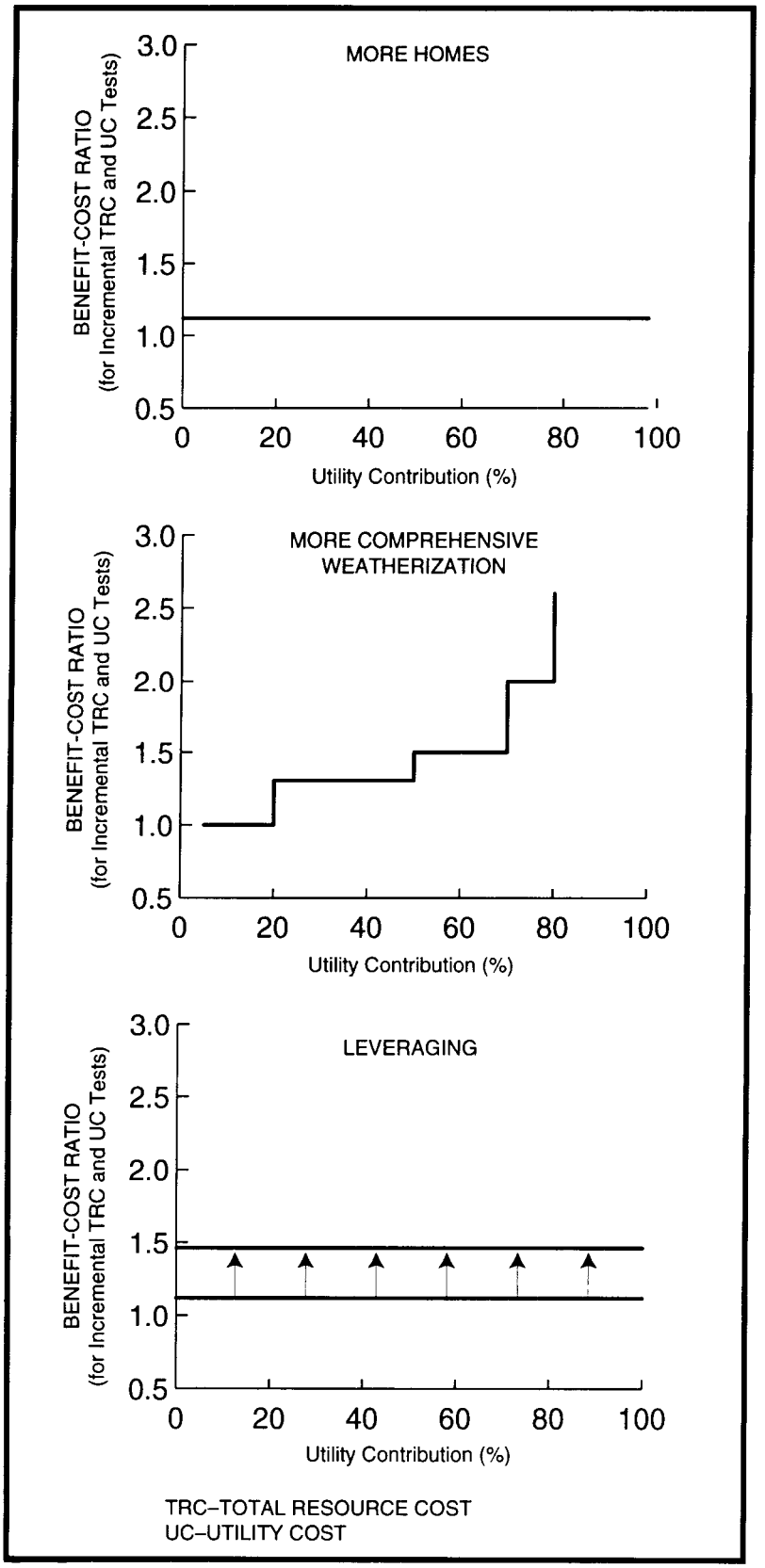

Fig. 6.3 Incremental Tests to Assess Cost-Effectiveness

6.3.1 Measurement of Net Bill Reductions

Our suggestion of using net bill reductions as the primary participant benefit necessitates the collection of additional data. To estimate net reductions requires knowledge of the levels of energy consumption that would have occurred in the absence of participation in the DSM program. Control groups are typically used for this purpose. Program-eligible nonparticipants, applicants waiting to participate, and past program participants are all possible control group options; each has a unique set of advantages and disadvantages (Berry et al., 1991). Alternatively, economic-engineering models can be used to estimate the impact of changing conditions on fuel consumption, such as prices and the aging of heating systems.

6.3.2 Estimation of Administrative Costs

Both government and utility expenditures need to be subdivided into program outlays and administrative costs, so that their benefits can be properly treated in the cost-effectiveness calculations. The National Weatherization Evaluation (Brown, et al., 1993) defined administrative costs to include:

- program management costs (including intake and eligibility activities, audits, inspections, contractor and crew management, and program evaluation) and
- installation-related overhead costs (including vehicles, travel time, equipment, field supervision, insurance, training, and contractor profit).

Excluded from this definition are the direct labor and materials costs dedicated to the on-site installation of DSM measures.

6.3.3 Allocation of Energy and Capacity Savings Across Cosponsors

Data collection and analysis need to be designed to enable estimation of the energy and capacity savings attributable to a utility's contribution. Estimation procedures will depend upon the nature of the program.

- The simplest case is "parallel" programs, where all of the savings achieved by participants in the utility-funded program are attributed to the utility.
- The allocation of savings due to "supplemental" programs depends on whether the utility funds are used to weatherize more homes or to conduct more comprehensive weatherization. *In the first case,* savings can be divided according to the proportion of costs invested by each cosponsor in the direct installation of energy-conservation and demand-reducing measures. This necessitates recordkeeping that enables these expenditures to be distinguished from expenditures on home repairs, rehabilitation, health, and safety measures. *In the second case,* savings per home before vs after the introduction of utility funds can be compared to estimate the impact of the utility's involvement. Alternatively, it may be possible to calibrate the relationship between investment level and savings in order to estimate the increment of savings attributable to the utility's expenditure.

- "Coupled" programs represent the most complicated case for allocating savings because the low-income program has been transformed by the involvement of the utility. One method of allocating savings is to compare savings per home before vs after the introduction of utility funds. If no "baseline" is available, it becomes necessary to estimate the savings that is due to each of the program's new features relative to its old ones (e.g., weatherizing high energy users vs. first-come, first served; installing new furnaces vs. lower expenditures on building envelope measures).

6.4 CONCLUSIONS

In conclusion, we have identified a wide array of utility-government low-income DSM partnerships, ranging from parallel, to supplemental, and coupled. Thus, government agencies and utilities can coordinate their efforts in many different and mutually beneficial ways. This same diversity challenges evaluators to develop standardized, yet flexible cost-effectiveness methodologies. The proposed inclusive and incremental versions of the five California standard practice tests offer a broad spectrum of perspectives from which many different types of coordination can be assessed.

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APPENDIX A

SUMMARY OF SIX CASE STUDIES

List of Coordinated Low-Income Programs

A.1 WISCONSIN GAS COMPANY'S COORDINATED PROGRAM

A.1.1 BACKGROUND

The first efforts at cooperation between local agencies and utilities in Wisconsin were established as a result of a 1982 mandtate by the Public Service Commission of Wisconsin. Initial efforts by utilities to develop and implement low-income weatherization included information sharing between the utilities and CAP Services. The formal agreements now used by the parties began with these initial efforts at communication. A utility staffer would call the agency to inform it about a low-income family in need of weatherization, and the agency would do the same. Formal agreements to jointly fund the CAP Services low-income weatherization installations started in 1986. As a result of this utility support, CAP Services has been operating two weatherization programs (i.e., DOE-only and coordinated) concurrently. One uses only DOE funding and includes only those energy-conservation measures (ECMs) eligible for DOE Weatherization Program funds. The second is the coordinated program, in which ECMs that meet DOE eligibility are installed, and additional measures that are not eligible for DOE funding (such as water–heater replacements) may be installed using utility funds. The coordinated program with the Wisconsin Gas Company is the subject of this case study.

A.1.1.1 The Agency

CAP Services is a multi-program community action agency that serves a large territory including Stevens Point, Wisconsin, and the surrounding towns and rural areas in central Wisconsin. Winters here are very cold and long, with an average of 8,107 heating degree days and 426 cooling degree days each year. The majority of fuel used for space heating is natural gas, which is used by about 85 percent of all homes in central Wisconsin.

The agency was established in 1966, along with many other similar programs, as one of President Johnson's "Great Society" programs through the enactment of the Economic Opportunity Act of 1964. CAP Services started with three programs: Manpower Demonstration Program, Community Food and Nutrition, and Head Start. The current chief executive, Karl Pnazek, was hired in 1976. There are presently 135 full-time equivalent staff persons providing a full range of human economic development programs. CAP Services presently has an annual budget of $4.8 million. Federal funds account for 80 percent of the total: 10 percent are from state funds; 5 percent are from local funds; and 5 percent are from private sources including utilities.

The agency presently has 65 separate contracts funding 20 different programs. The U.S. Department of Energy's Weatherization Assistance Program accounts for 12 percent of the total budget. This portion of CAP Service's budget has been shrinking both in percentage and absolute

terms over the past ten years. Ten years ago, DOE provided twice as much funding as it does today. At that time, 54 people worked in the agency's weatherization services department; it is presently staffed by 12 people. This reduction in DOE funding was the agency's primary motivation for establishing the coordinated programs through which utility funds can be accessed.

The agency goal is to promote self-sufficiency of low-income households in the community. Its Weatherization Program's goal is to reduce fuel bills by installing energy-conservation measures and by conducting education programs on energy efficiency. The coordinated program targets high energy users and is limited to customers of the participating utilities. The main goal of the coordinated programs is to use DOE funds to leverage utility funds to increase energy savings for low-income clients of CAP Services.

A.1.1.2 The Utility

Wisconsin Gas Company is a member of WICOR, Inc., a company that specializes in natural gas distribution and manufacturing. Wisconsin Gas is the State's oldest and largest natural gas utility, servicing more than 460,000 customers in the residential, commercial, and industrial sectors. The company is headquartered in Milwaukee. In 1989, the company's total throughput of gas was 1,178 million therms. The average residential retail rate of gas in 1989 was 55¢/ccf.[1]

The utility has a strong commitment to its low-income customers, appropriating approximately one-third of its total 1992 DSM expenditures to low-income weatherization projects (in excess of $4 million of a $14 million annual budget).[2] In an effort to provide energy information to these customers, the utility has developed a series of cooperative workshops with local agencies. The utility works with vocational and adult–education technical colleges, the University of Wisconsin Extension, and the Department of Health and Social Services to promote these classes. The workshops discuss a combination of the following issues:

- money management;
- energy conservation;
- credit establishment; and
- debt collections.[3]

A.1.1.3 The Housing Stock

About 85 percent of the housing stock served by the coordinated program are single-family homes, about 5 percent are duplex apartments, and 10 percent are mobile homes. There are very few

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1 Conversation with Luc Piessens, Wisconsin Gas, August 13, 1993.
2 IBID.
3 Wisconsin Gas Company, Conservation Program Manual, 1991.

multifamily buildings in the service territory, and it is rare to have one in the program. The typical home weatherized by CAP Services is 50 years old. Homes built after 1947 are scarcely represented. Many of the very old homes that are weatherized by CAP Services are characterized by little or no insulation in attics and walls.

A.1.2 WEATHERIZATION STAFF AND TRAINING

A.1.2.1 Weatherization Staff

The average installer of weatherization measures in the CAP Services crew has been in the job for more than ten years. There has been little in the way of turnover since 1976, although the agency has experienced layoffs due to reduced funding by DOE, the petroleum violation escrow (PVE) accounts, and Low-Income Home Energy Assistance Program (LIHEAP) funds. Additionally, a realignment of local agency boundaries statewide moved a former CAP Services county to another local agency. Five layoffs occurred during the past year including three installers and two support staff.

A.1.2.2 Training

CAP Services takes advange of as much technical training as the state makes available to crew staff. Crews typically receive training in-state on a rotating basis. There are competitions between crews at all agencies on a fully equipped weatherization crew truck involving installation skills. No additional training has been required to implement the coordinated program.

A.1.3 CLIENT RECRUITMENT AND SELECTION

Participants are recruited for the coordinated program with Wisconsin Gas from the lists of persons receiving LIHEAP funds. LIHEAP recipients must meet 150 percent of the poverty income criteria to qualify them for assistance. The next criterion is the utility customer's status: the applicant must be a customer of the Wisconsin Gas Company. High levels of energy use and occupancy by elderly persons, persons with disabilities, or children under six years of age are also criteria. Utility arrears are not a criterion, and no evaluations have been done to date to estimate the impact of weatherization on arrearage.

CAP Services works with the utility to correlate the customers in arrearage with the LIHEAP roster in an effort to identify low-income candidates for the cooperative project. Within Wisconsin Gas, this is done through the Early Identification Program (EIP). In the event that a person seeks weatherization without having received LIHEAP funds, they must complete the LIHEAP application form.

Installation priorities are set according to income per the LIHEAP application and energy use per utility bills from the last two heating seasons. Two years of data are used whenever possible to account for varying weather conditions and occupant changes.

Client recruitment and selection are handled mostly by CAP Services. Referrals are received by CAP Services from other agencies, service representatives of Wisconsin Gas, or direct client contact. The referrals to the agency are identified in terms of health and safety needs, and emergency heating–system replacements. Any referrals from the community are asked to apply for LIHEAP funds, and if their income qualifies, the intake procedure may be completed within 48 hours.

Recruitment procedures changed somewhat with the advent of the coordinated program. Utility involvement allows the agency to serve more people, such as income-eligible customers of the utility not captured in the agency's regular intake practices.

During 1989, 93 clients were served by the coordinated program. These clients were a subset of the agency's 366 weatherization participants in 1989. During 1992, 73 clients were served by the coordinated program. These clients were a subset of the 346 installations completed by CAP Services during that year.

Within the coordinated program, the regular client list is sorted by utility service area and correlated with the utility's EIP database identifying high energy bills. Many eligible buildings cannot be weatherized by CAP Services due to previous weatherization. The agency estimates that at current funding levels, it can serve only about 3 percent of the eligible population of utility customers.

Eligibility criteria for the DOE program have broadened over time, resulting in a larger population of income-eligible persons. In particular, the former requirement of a 12-month income history and 125 percent of poverty guidelines were changed by Wisconsin to 3 months and 150 percent. Also, furnace replacements are now included as an allowable DOE measure.

There are a few differences between the service area covered by the DOE-only program and the coordinated program. Different amounts of money are received from each of the three utilities for each utility service area, and only those utility-specific dollars may be spent for customers of that utility. Prior to receiving the utility funds, informal negotiations between the agency and the utility on behalf of low-income utility customers were conducted to have the utility install ECMs through a third-party contractor when, due to budget constraints, CAP Services was unable to provide these DOE-eligible services. As a result of the communication between the agency and the utility, low-income customers in need received weatherization services from the utility.

A.1.4 USE OF DIAGNOSTICS

Blower doors are used by the weatherization crews in 98 percent of all installations to find leakage areas for sealing, to measure air leakage rates, and to determine when to stop work using cost-effectiveness guidelines. The only situation where blower doors are not used is in the presence of a lit wood–burning heat source or in the presence of friable asbestos. Distribution system diagnostics are not used, but the crews are prepared to seal air ducts. Infrared scanning is used on a periodic basis in about 5 percent of all installations. Indoor air quality testing is not done. Heating efficiency tests are done for all installations along with heating–system safety inspections. Finally, an additional blower door test is conducted after weatherization. Before and after negative pressurization in the basement is also done, and the crew does a visual check during the first walk-through.

The diagnostic equipment is owned by CAP Services, paid for through DOE funds. Diagnostic procedures of the coordinated program are the same as those for the DOE-only program. They have not changed as a result of utility involvement.

A.1.5 INSTALLATION OF MEASURES

A.1.5.1 Selection of Weatherization Measures

CAP Services uses the Wisconsin Energy Conservation Corporation (WECC) audit to select measures for installation according to energy use reductions and resulting cost effectiveness. The same audit is used by CAP Services for jobs that do not involve utility funding. Only the DOE-approved measures are installed. Types of energy-efficiency measures include:

- insulation;
- air leakage control;
- water–heater system retrofits;
- mobile home cool seals;
- space–heating system retrofits and replacements; and
- education.

CAP Services uses in-house crews for all installations, including heating technicians for testing and installing space heating measures. The cost to the agency is estimated at $400 to $800 less than the cost of using commercial contractors. Also, high-density wall insulation, installed via the tubing method, is used. These efforts at reducing costs in installations help to improve the cost effectiveness of each unit.

Weatherization measures are determined by the WECC audit. Results of the audit are generated by computer and include CAP Services costs and the cost of the total package of ECMs. An optimal mix of measures is selected according to building information, fuel bills, and the dwelling needs.

The crews are empowered to make small adjustments as appropriate or to call the field coordinator or the main CAP Services office in Stevens Point for approval to install measures not listed on the bid sheet. A cost–effectiveness ratio of 1.2 is used to screen measures. The introduction of the coordinated program has not altered this procedure.

A.1.5.2 Warehousing and Materials Procurement

Vendors of all weatherization materials are selected by means of annual bids. Odd or atypical items are purchased locally. Daily usage sheets are maintained by crews conducting both the audit and installations. Inventory control is maintained by computer. CAP Services owns a warehouse to store materials, enabling the agency to buy in bulk at reduced prices.

A.1.6 QUALITY CONTROL

CAP Services crews conduct a final inspection for quality control in all installations. This includes a review of all ECMs installed before receiving the agency inspector's signature. The post-installation blower door tests are used to maintain quality and cost effectiveness. The coordinated program has not changed any quality–control procedures.

To date, the Wisconsin Gas coordinated program has not been evaluated by either the utility or the agency. In addition, no quantitative comparisons have been made with the DOE-only operation. The present reporting requirements include the daily bid sheet of measures to be installed. Energy savings estimates are included in the results of the WECC audit. A statewide study to measure estimated and actual consumption after installation is underway (by WECC).

A.1.7 LEVERAGING AND COOPERATIVE BENEFITS

CAP Services weatherization activities are funded by a combination of funds from DOE, PVE, LIHEAP, Wisconsin Gas Company, Wisconsin Power and Light, and landlords. In 1989, $836,991 was received from DOE, and $70,775 was received from Wisconsin Gas. In 1992, approximately $772,000 in DOE and PVE funds, $60,000 in utility funds, and $8,000 in landlord contributions were received. Utility funds represent an increase of only 9 percent over DOE funds, but it is likely that they induce significantly more energy savings. The additional energy savings are attributed to the coordinated program's emphasis on high energy users, as compared to the first-come first-served schedule of the DOE-only installations, and the ability to spend more on weatherization measures in homes where the potential for energy savings is great.

A.1.8 PROGRAM COSTS AND SAVINGS

During 1989, 366 homes were weatherized by CAP Services using a total DOE budget of $836,991 (or $2,287 per home). Ninety-three of these homes also benefited from utility

weatherization expenditures of $70,775, or $761 per home. Thus, utilities add 33 percent to the total expenditures per home, resulting in an average cost of $3,048.

A breakdown of these costs by type of expenditure (i.e., materials, labor, and administration) and by type of material (i.e., insulation, air leakage, etc.) is not available. However, a detailed accounting of 1992 costs is available (Tables A.1.1 and A.1.2). These 1992 figures are assumed to apply in the same proportions to the 1989 program. The results are shown in Table A.1.3.

During 1992, 346 installations were completed with DOE funding of $772,000. Simple division provides an average cost per installation of $2,231. There were 81 installations in the coordinated program included in those 346 units. The average cost for weatherizing each of these units was $2,868, or about $637 more per home than the cost of the DOE funded measures. The breakout of program funds for the DOE and coordinated programs is provided in Table A.1.1.

Table A.1.1 indicates that 37 percent of the utility's funding paid for weatherization materials and 64 percent paid for CAP Services' administrative labor and support costs. In contrast, 29 percent of DOE's funding paid for weatherization materials, 32 percent for labor, and 39 percent for CAP Services' administrative labor and support costs.

Table A.1.1 1992 Funding Allocation

	Sources of Funds:							
Types of Costs	DOE	Avg. per unit (N=346)	Utility	Avg. per unit (N=81)	Landlord	Avg. per unit (N=14)	Total	Avg. per unit (N=346)
Material	$223,880	$647	$18,520	$229	$4,415	$315	$246,815	$713
Labor	$247,040	$714	$27,832	$344	$6,571	$469	$281,443	$813
Admin. and Support	$301,080	$870	$5,150	$64	$1,221	$87	$307,451	$889
Total	**$772,000**	**$2,231**	**$51,502**	**$637**	**$12,207**	**$871**	**$835,709**	**$2,415**

Source: Interview held with Lee Duerst of CAP Services on May 26, 1993, Stevens Point, Wisconsin.

Table A.1.2 lists the expenses for different types of energy-related materials. The distribution of DOE expenditures across the five types of measures (insulation, air leakage, etc.), is

similar to the distribution of utility and landlord funds. The one notable difference is the utility's lower level of investment in air–leakage control.

Table A.1.2 1992 Materials Breakout

Materials	DOE	Average Per House	Utilities & Landlords	Average Per House
Insulation	$223,880	$647	$7,798	$82
Air Leakage	$76,119	$220	$459	$5
Water Heating	$11,194	$32	$1,147	$12
Mobile Home	$44,776	$129	$4,587	$48
Space Heating	$87,313	$252	$8,945	$94

Source: Interview held with Lee Duerst of CAP Services on May 26, 1993, Stevens Point, Wisconsin.

A.1.8.2 ENERGY SAVINGS

Energy savings estimated by the WECC audit for each dwelling are used to determine the selection of ECMs to be installed. The WECC audit is used to screen measures for cost effectiveness. A five- to eight-year estimated payback is usually obtained for all natural gas space–heating measures.

Energy savings estimates based on pre- vs. post-installation billing analysis are available for 29 homes weatherized during 1989. Annual consumption of natural gas prior to weatherization was 1,404 ccf. After weatherization, consumption dropped by 334 ccf to 1,070 ccf, or 24 percent. Since average installation costs for the coordinated program are 33 percent higher for the coordinated program, the savings of 334 ccf could be inflated by 33 percent. The resulting annual gross savings estimate for the coordinated program is 444 ccf for these 93 homes. The net savings are assumed to be the same.

There is reason to believe that the energy savings are significantly enhanced as a result of the extra materials available for installation in the coordinated program. Unfortunately, data are not currently available to compare the energy savings of the coordinated program and DOE funded installations. As a result, a linear relationship between total expenditures and energy savings is assumed.

Performance statistics for the Wisconsin Gas program are summarized in Table 1.3. Wisconsin Gas Company's residential rate was $0.55 per ccf in 1989, and the Wisconsin Public Service Commission estimated that the Company's avoided energy costs were $0.38 per ccf.

Table A.1.3 Summary of Costs and Benefits for the Wisconsin Gas Coordinated program

Program year:	1989
Number of utility-funded homes:	93
Net and gross energy saved per dwelling weatherized with DOE plus utility funds:	444 ccf/year of gas
Residential rate for Wisconsin Gas:	$0.55 per ccf
Avoided energy costs:	$0.38 per ccf[a]

		Sources of Funding:		
Types of Costs:		**DOE/WX**	**Wisconsin Gas**	**Totals**
Installation Costs:	Energy-related	$1,395	$274	$1,669
	Structural repairs	0	0	0
	Health and safety measures	0	0	0
	Subtotal	$1,395	$274	$1,669
Administration and Support Costs:	CAP Services	$892	$487	$1,379
	Wisconsin Gas	0	0	0
	Subtotal	$892	$487	$1,379
TOTAL COSTS:		**$2,287**	**$761**	**$3,048**

[a] Estimated by Paul Newman, Wisconsin Public Service Commission on July 24, 1993.

A.1.9 OVERALL ASSESSMENT OF THE PROGRAM

The coordinated program is very popular with the utility and agency staff interviewed. Negative comments were few in number and slight in significance. The primary strengths and weaknesses noted are presented in Table A.1.4.

All parties interviewed believed the coordinated programs had far more advantages than disadvantages. The agency is pleased to install more measures and possibly serve more clients. This achievement is directly in line with the stated mission of the agency. The utilities are pleased to work with CAP Services.

The coordinated program is described as a win/win activity by both parties. The utility gains support for utility programs through its funding of the coordinated program. The agency increases its services to the low-income community.

Table A.1.4 Strengths And Weaknesses of the Wisconsin Gas Coordinated program

STRENGTHS	WEAKNESSES
Less duplication of agency and utility efforts, which reduces travel and in-take costs in this rural area.	Agency must search for utility customers
Emphasis on high energy users, as compared to the first-come, first-served schedule in the DOE-only installations.	
More comprehensive weatherization.	Utility experiences slight loss of control over selection of weatherization measures.
High quality work by agency.	
Good utility cooperation and communication.	
Advances in the expertise of agency crews and staff.	
Client perception of enhanced value through "expert" endorsement of utility sponsorship.	

Source: Composite of interview responses for all parties.

There are several reasons for the success of the coordinated program. First, this agency has substantial experience in low-income weatherization, and the agency's leadership is strongly in support of the coordinated program. Second, the agency staff had already established good communications with utility staff through prior work. Third, the utilities and the agency both see advantages to all parties.

PERSONS INTERVIEWED:

Lee Duerst, CAP Services

Sue Peck, Wisconsin Gas Company

Karl Pnazek, Chief Executive, CAP Services

Tom McDowell, Public Service Commission of Wisconsin

Pat Seidel, Wisconsin Power & Light

Oscar Black, Wisconsin Public Service Company

A.2 NIAGARA MOHAWK'S POWER PARTNERSHIP PROGRAM

A.2.1 BACKGROUND

The Niagara Mohawk Power Partnership Program was initiated by the Niagara Mohawk Power Corporation as a pilot program in 1989. The goals of the pilot program were to (1) empower low-income participants to exercise increased control over their comfort, energy use, and costs, (2) provide NMPC with information that would assist the implementation of its system-wide program, and (3) field test a comprehensive package of energy management services, including energy education, a money–management exercise, and an affordable payment plan to determine the extent to which these activities would further increase energy savings and improve payment patterns beyond those achieved from weatherization alone (Harrigan, 1992).

The coordinated program was motivated by Niagara Mohawk's desire to broaden the coverage of their existing residential DSM programs to include low-income households. In 1987, as part of a rate settlement, customers were able to participate in a rebate program for high-efficiency heating equipment and appliances. Due to their limited financial resources, low-income households were unable to take advantage of this program.

The pilot program was administered by Niagara Mohawk, and was delivered by 11 local nonprofit agencies, which also were subgrantees of the DOE Weatherization Assistance Program. The pilot program serviced the homes of 255 Niagara Mohawk customers in seven counties in upstate New York.

A unique feature of the Niagara Mohawk Power Partnership Pilot Program was its experimental design and its emphasis on energy education and partnership between the utility and its client. The pilot proved to be an award-winning success, demonstrating energy savings as high as 30 percent in one sample group.

The New York Public Service Commission's subsequent call for utility involvement in low-income energy needs, coupled with Niagara Mohawk's strong demand-side management focus and its large number of low-income, payment-troubled customers, resulted in the translation of the pilot program into an ongoing partnership program implemented by local agencies.[1]

The current Power Partnership Program operates within 16 counties in Niagara Mohawk's combined gas and electricity service territory, and eight counties in its electricity-only territory. The program contracts with 16 local agencies to deliver low-income weatherization to Niagara Mohawk customers. To date, 657 households from the combined service territory have participated in the program, and there have been 1,100 participants from the electricity-only territory.

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[1] Recent Niagara Mohawk research indicates that more than a quarter of its customers could be deemed low-income, and almost half of these customers are in arrears.

The 1992 program with Stoneleigh Housing is the subject of this case study. However, due to incomplete information (particularly on energy savings), results from one of the pilot program's treatment groups are used to estimate the savings of the 1992 program. Thus, both the 1989 and 1992 programs are described in this case study.

A.2.1.1 The Agency

The local agencies in New York State work cooperatively with Niagara Mohawk and other utilities to service the low-income populations within their jurisdictions. The Niagara Mohawk coordinated program has increased the funding of participating agencies and boosted the credibility, staff expertise, and equipment available to both the utility and agency staff.

The partnership between Stoneleigh Housing and Niagara Mohawk began in 1989 with the cooperative pilot program. Unlike most subgrantees of DOE's Weatherization Program, Stoneleigh Housing is not a community action agency; rather, it is a non-profit housing agency specializing in low- and moderate-income housing, with an emphasis on assisting the elderly and handicapped. The agency's goal is to support safe and affordable housing within its jurisdiction. The area served by Stoneleigh Housing experiences high heating bills because of its harsh winters, which average 8,168 heating degree days each year. There is little need for air conditioning (with only 265 cooling degree days each year, on average).

During the 1989 pilot program, Stoneleigh Housing serviced 28 households; in 1992 it weatherized 23 homes as part of the Niagara Mohawk coordinated program. Stoneleigh Housing reports a current waiting list of 200 people.

A.2.1.2 The Utility

Niagara Mohawk is an investor-owned combination utility that provides energy services to the largest customer service area in the State of New York. It provides electricity service to over 1.5 million customers including: 1,378,500 residential, 145,000 commercial, 2,200 industrial, and 3,200 "other" electric customers. In addition, it provides gas service to 48,000 residential, commercial, and industrial gas customers.[2] The average electric and gas rates in 1989—the pilot program year—were 8.14¢/kWh and 6¢/ccf.[3] The utility's total generating capacity in 1992 was 5,577,000 kWh.

Niagara Mohawk's gas supply was enhanced in the early 1990s through a new agreement with the CNG Transmission Corporation. This new agreement allows Niagara Mohawk to purchase its gas supply directly at the wellhead, thereby decreasing the cost of gas to its customers. Furthermore, the agreement provides Niagara Mohawk with direct access to gas storage facilities that it would not otherwise have.[4]

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2 Niagara Mohawk Annual Report, 1991 and the Directory of Electric Utilities, 1993.
3 Niagara Mohawk Annual Report, 1991.
4 Ibid.

Since the late 1980s, Niagara Mohawk has actively promoted demand-side management (DSM) programs. Currently, the utility has 19 DSM programs for residential, farm, non–profit/public–sector and commercial/industrial customers. Several additional programs are in pilot stages. Niagara Mohawk's 1992 expenditures on DSM totaled $55.3 million, which accounted for approximately 1.9 percent of its revenue.[5] Since 1990, DSM programs have saved the utility 400 million kWh of electricity.[6]

The Power Partnership Program is Niagara Mohawk's only program exclusively targeted toward low-income customers. The 1992 Power Partnership Program budget was $2.1 million; this budget is separate from the utility's annual expenditure on DSM.

A.2.1.3 The Housing Stock

The majority of buildings weatherized under the coordinated program are single-family homes. Apartment buildings with more than four units are ineligible. The homes of many of Stoneleigh clients are in need of partial rehabilitation work. Most buildings weatherized are between 75 and 100 years old.

A.2.2 WEATHERIZATION STAFF AND TRAINING

A.2.2.1 Weatherization Staff

Niagara Mohawk draws its in-house staff for the coordinated program from the Consumers Affairs Division Outreach and Education staff. There are now seven regional weatherization coordinators involved in recruitment, in-take, and education. One of these is assigned, part-time, to the Stoneleigh Housing coordinated program.

In the coordinated program, Stoneleigh Housing crews conduct the energy audits and install energy-conservation measures. However, agency subcontractors may be used for specialized and infrequent tasks, such as boiler or furnace replacement. The utility requires that any subcontractors to the agency be licensed and bonded.

A.2.2.2 Training

A consultant provided Niagara Mohawk staff with intensive energy education sessions for the pilot program. Currently, staff receive training on blower–door testing, infrared scanners, contract management, heating systems, and customer outreach. Utility staff also receive computer training for the Targeted Investment Protocol System (TIPS), a mandatory feature of the weatherization process

5 *DSM Newsletter*, August 2, 1993.
6 Niagara Mohawk DSM Progress Report, 1992.

in the Power Partnership Program and the standard audit for New York State's DOE–funded Weatherization Program.[7]

Dave Trexler is the weatherization manager for Stoneleigh Housing. He has 12 years of weatherization experience. Crew chiefs have six to seven years of weatherization experience and crew members three to four years. Stoneleigh staff members receive TIPS weatherization training and diagnostic training on blower doors and infrared camera equipment from the New York State Department of State's Weatherization Assistance Office. In addition, Stoneleigh provides on-the-job training for furnace and blower door testing. The housing association staff has a negligible turnover, so staff are well experienced. Stoneleigh crew chiefs earn $18,000 per year, and beginning auditors earn between $14,000 and $15,000 per year.

A.2.3 CLIENT RECRUITMENT AND SELECTION

Client recruitment and selection for the coordinated program are consistent with DOE Weatherization Program rules and procedures, but they go beyond standard DOE practices by considering energy consumption and payment behavior. Criteria for selection include: household income (150 percent or less of the federal poverty guidelines), higher than average energy consumption, significant bill payment arrearage, occupancy by elderly or disabled persons, and single parents with dependent children. Program eligibility is limited to Niagara Mohawk combination customers. Potential clients are identified by Stoneleigh Housing or by the consumer advocate and credit and collections departments of Niagara Mohawk. Referrals are also provided by the New York State Department of Social Services and the Office of the Aging. In addition, Niagara Mohawk works with the Stoneleigh Housing to cross–check LIHEAP rosters and customer arrearage lists to identify low-income customers in need of weatherization.

Stoneleigh Housing uses its own client list as well as referrals from Niagara Mohawk to recruit potential clients for the coordinated program. The agency has developed its own referral form, known as the gas and electric (G&E) screen, to assist in determining eligibility. The G&E screen is a one-year billing history summary for Niagara Mohawk customers. It accentuates Niagara Mohawk combination customers with a history of arrears. Household income is then checked to verify program eligibility. Agency staff cross checks the Niagara Mohawk list of customers in arrears with their own assessment of need. Stoneleigh Housing programs give priority to households with young children and elderly or handicapped occupants, which meet the income guidelines for eligibility.

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[7] The objective of TIPS is to ensure the greatest energy savings per dollar of weatherization measure. The TIPS process analyses energy consumption data of one to four unit dwellings and characterizes the unit in terms of its comparative energy efficiency. The efficiency factor then determines the level of weatherization investment based on potential energy savings.

A.2.4 USE OF DIAGNOSTICS

The Power Partnership Program utilizes the standard New York State Department of Social Services DOE audit procedures (TIPS). Each agency conducts the TIPS process and blower–door testing in each installation. Other diagnostic measures used in conjunction with furnace and boiler work include: leak detectors for gas and carbon monoxide, infrared scanning, furnace efficiency testing, and furnace safety inspections.

Diagnostic equipment used by in-house crews has been purchased by the agency, using New York State and DOE funds. The coordinated program has demonstrated a communication process that results in improved weatherization techniques. Stoneleigh Housing and Niagara Mohawk have different goals for the coordinated program. Niagara Mohawk emphasizes the cost–effectiveness of ECMs selected for installation. Stoneleigh Housing emphasizes cost–effectiveness in terms of fuel savings as well as comfort. One example of better communication and its weatherization results is in the case of air infiltration measures.

A.2.5 INSTALLATION OF MEASURES

A.2.5.1 Description of Measures

In 1992, a variety of weatherization measures were installed by the Power Partnership Program, including: attic insulation (and attic ventilation); high-density wall insulation; air sealing and general caulking and weatherstripping of doors and windows; low-cost interior plastic for installation by residents over windows; water–tank wraps and water–pipe insulation; low-flow showerheads; and compact fluorescent light bulbs. In gas-heated homes, which represented the vast majority of participants in 1992, work was also conducted on the heating system, including: a clean and tune up of the heating system; heating system component retrofits; carbon monoxide testing; and automatic set–back thermostats.

The coordinated program dedicates limited resources to structural repairs and health and safety measures. Roofs are repaired and windows and doors are replaced only in emergency situations and when necessary to protect the integrity of the weatherization. Radon testing kits are left with the participant when the possible presence of a problem is indicated by cracked concrete or negative air pressures that would draw in radon.

In the initial years of Niagara Mohawk's DSM activities, the focus was on insulation and equipment replacement, rather than low-cost measures such as air-sealing. The effect of air-sealing measures on the very drafty homes of low-income clients is to reduce air infiltration and drafts, thereby increasing occupant comfort. When the occupant is comfortable, he or she is less likely to turn up the heat, so greater energy savings may be achieved. Air-sealing measures became a frequently installed measure as a result of local agency feedback. Thus, measures installed by

Stoneleigh Housing are not limited to only the most cost-effective ECMs, but are selected to conserve energy, reduce fuel bills, and increase client comfort.

A.2.5.2 Education

Energy management education is one of the key features of the Niagara Mohawk program. The Power Partnership Program provides each participating household with two in-home energy management sessions. The in-home sessions are tailored to individual energy consumption needs. The energy education coordinator (Niagara Mohawk staff) works with the customer to develop a mutual plan of action to empower households to use energy more efficiently, thereby reducing fuel costs without disturbing the preferred comfort level. This passage from a Niagara Mohawk publication describes the education program:

> ...In order to be effective in empowering clients to alter inefficient energy usage patterns, energy education must go beyond the simple transfer of information and incorporate strategies that promote behavioral change. The POWER PARTNERSHIP Program will provide each participating household with two in-home energy management education sessions. The in-home approach allows the Coordinator to interact with clients within the context of their own energy situation and to tailor the session content to clients' specific needs.

The general topics covered in the education sessions include:

- explanation of the house as a system;
- space heating management;
- hot–water heating management;
- principal electrical appliance usage; and
- proper usage and maintenance of installed weatherization measures.

Energy service coordinators at Niagara Mohawk also work with customers in arrears to determine a regular, affordable schedule payment plan. In addition, during the two in-home energy management sessions, the coordinators provide constructive feedback on the household's post-retrofit monthly energy consumption and bill payments.

A.2.5.3 Warehousing and Materials Procurement

Niagara Mohawk stores equipment and supplies in the utility warehouse. Stoneleigh Housing has its own storage facilities for its stock of weatherization materials and diagnostic equipment, enabling cost savings to be achieved through bulk purchasing.

A.2.5.4 Similarity with 1989 Pilot Program

Customers participating in the pilot program received the following services:

- Group One—no services.
- Group Two—weatherization assistance only.
- Group Three—weatherization, energy management education, a money management exercise, electric demand-side management (DSM) measures, and an affordable payment plan.
- Group Four—all services received by group three plus a feedback device that provides consumers with the costs of gas for space heating and water heating.

The measures installed in Stoneleigh Housing's 1992 coordinated program were quite similar to the measures provided to Group Three in the pilot program.

A.2.6 QUALITY CONTROL

Stoneleigh Housing crews conduct their own inspections and verify all completed installations with a signature on each job order sheet. The New York State Department of State staff inspect approximately 20 percent of the completed units.

A Niagara Mohawk staff person reviews approximately 10 percent of houses served prior to completion, and visits all participants for two energy–education sessions. Blower–door and infrared–scanner tests also are performed by Niagara Mohawk staff after weatherization on approximately 20 percent of the homes served. Additionally, Niagara Mohawk staff conduct a one–month, post-weatherization meter reading to analyze the impact of the weatherization measures on household energy costs. This analysis provides a lead-in for the energy education session.

A.2.6.1 The Work Order Process

Niagara Mohawk requires Stoneleigh Housing to work with the utility to select ECMs prior to initiating the weatherization of a home. Meetings between Charles Rubado (Director of the Power Partnership Program at Niagara Mohawk) and Dave Trexler (Weatherization Director at Stoneleigh Housing) are held to discuss the results of the audits and to select measures for funding through the coordinated program.

Before this process was initiated, the utility hired contractors to respond to work orders generated by the energy audit. Unfortunately, the contractors did not conduct an assessment of the thermal integrity of the house or the overall housing stock. The contractors did nothing to determine the most cost–effective and energy–efficient measures to install, but treated the work order as the only instruction.

The current practice requires a tracking form that lists all measures to be installed in a building and the status of each measure. Mr. Rubado enjoys this process because it brings the coordinated program staff at the utility and the agency closer together.

A.2.6.2 Utility/Customer Agreement

Niagara Mohawk draws up a contract with the customer that includes a description of the weatherization process, the person identified to install the measures, and an identification of any structural deficiencies in the housing stock. As part of this contract, the customer may agree to undertake specific efficiency measures (such as changing furnace filters and setting back their thermostat) to reduce fuel use as part of an affordable payment plan.

A.2.7 LEVERAGING AND COOPERATIVE EFFORTS

In 1992, Stoneleigh Housing received funding from three sources (Table A.2.1). Funds from each of these three sources were spent according to DOE rules and regulations for administrative, material, and labor costs.

Table A.2.1 Stoneleigh Housing/Power Partnership Budget

		Sources of Funds:		
Types of Costs		**DOE/PVE**	**Niagara Mohawk**	**Landlords**
Installation Costs:	Materials	105,400	20,026	15,810
	Labor	64,600	12,274	9,690
	Subtotal	**$170,000**	**32,300**	**25,500**
Administration Costs:		30,000	5,700	4,500
Total Costs:		**$200,000**	**$38,000**	**$30,000**

Source: Interview with Dave Trexler, June 27, 1993.

A total allocation of $200,000 was received by Stoneleigh from DOE's Weatherization Assistance Program and PVE grants. These funds paid for the weatherization of approximately 120 homes.

Landlord contributions for weatherization work in 1992 totaled $30,000. These funds resulted from the agency's requirement that landlords contribute at least 25 percent of the costs of weatherizing their rental units. Sometimes the agency receives 40 to 50 percent. It is unclear whether or not landlord funds were used to pay for any of the weatherization costs associated with the 23 participants in the 1992 coordinated program. If a proportionate amount were spent on these 23

participants, the landlord contribution would amount to approximately $210 per dwelling. Most of this funding ($178) pays for the installation of weatherization measures, while $32 covers administrative costs.

Niagara Mohawk contributed an additional $38,000 to Stoneleigh Housing in 1992. This paid for the weatherization of 23 dwellings, with an average expenditure of $1,652 per dwelling. Thus, the coordinated program's utility contribution enabled more houses to be weatherized. Except for the greater investment in energy education, it did not contribute to more comprehensive weatherization. Based on the nomenclature presented in Section 2, the coordinated program was a parallel program because the utility paid for all the costs associated with the weatherization of participating homes (except for owner contributions). At the same time, it was closely coordinated with the State's DOE–funded Weatherization Program. For example, DOE funds paid for the weatherization labor and materials that were used to weatherize the Niagara Mohawk program participants, and the utility subsequently reimbursed the State for these costs. In addition, Stoneleigh Housing reported to Niagara Mohawk through the New York State Department of State.

Since 1989, Stoneleigh Housing has received about $85,000 from Niagara Mohawk for low-income weatherization. This is described as a "considerable" amount of cash for this small agency. This increase in cash flow prevented staff from being laid off due to cuts in federal and state monies.

In addition to the agency's weatherization costs shown in Table A.2.2, Niagara Mohawk also experienced costs in conjunction with the coordinated program. These costs include coordination and administrative costs of $600 per weatherized dwelling (comprised of education costs of $425 per dwelling and other administrative costs of $175 per dwelling). In addition, utility start-up costs in 1992 included $3,500 for the purchase of equipment for coordinators, including an infrared scanner, meters, and other tools. This represents an additional cost of $152 for each of the dwellings weatherized in 1992.

Stand-alone costs for the utility's in-house low-income weatherization program are higher than for the coordinated program delivered by Stoneleigh Housing. For instance, average costs to conduct the energy audit and install infiltration measures, if provided by Stoneleigh Housing or other local agencies, average $1,200; these same tasks cost the utility approximately $1,700 per home if provided by a private contractor.

Table A.2.2 Summary of Costs and Benefits for the Niagara Mohawk Coordinated program

Program year:	1992
Number of program participants:	23
Natural gas saved per dwelling, per year:	445.3 (weatherized) - 36.6 (control) = 408.7 ccf
Residential gas rate for Niagara Mohawk:	$0.5772 per ccf
Avoided gas costs:	$0.3463 per ccf[a]
Electricity saved per dwelling, per year:	949 (Weatherized) + 470 (control) = 1,219 kWh
Residential rate for Niagara Mohawk:	$0.0892 per kWh
Avoided electricity costs:	$0.0357 per kWh[b]
Avoided electricity capacity:	0.232 KW[c]
Avoided electricity capacity cost:	$30/KW/year[d]

		Sources of Funding:			
Types of Costs:		**Niagara Mohawk**	**Owners**	**DOE/WX**	**Totals**
Installation Costs:	Energy-related (gas)	$750	$210	0	$960
	Lighting (electricity)	$70	0	0	$70
	Structural repairs	0	0	0	0
	Health and safety measures	0	0	0	0
	Subtotal	$820	$210	0	$1,030
Administration Costs:	Niagara Mohawk administration	$390	0	0	$390
	Niagara Mohawk-client education	$192	0	0	$192
	Niagara Mohawk-start-up	$152	0	0	$152
	Stoneleigh Housing	$250	$32	0	$282
	Subtotal	$984	$32	0	$1,016
TOTAL COSTS:		**$1,804**	**$242**	**0**	**$2,046**

a Assumes avoided energy costs are 60% of the residential price of natural gas.
b Assumes avoided energy costs are 40% of the residential price of electricity.
c Assumes a 60% load factor, and is calculated by dividing annual kWh savings by 5,256.
d Assumes marginal unit is a combustion turbine.

A.2.8 PROGRAM SAVINGS AND OTHER BENEFITS

A.2.8.1 Energy Savings

Gross savings estimates are not available for 1992. Instead, the 1989 pilot program is used to provide the basis for an estimate of the 1992 coordinated program's savings. As described previously, the measures installed in the 1992 coordinated program are most similar to the measures installed in Group Three of the 1989 pilot program.

The saving estimates for the four groups of low-income, payment-troubled customers participating in the pilot program are shown in Table A.2.3.

The Group Three households reduced their annual gas consumption by 445.3 ccf, which is a reduction of 25.9 percent of their pre-weatherization gas use. The control group households (Group One), on the other hand, decreased their consumption by only 36.6 ccf. Thus, the net savings in the first year after weatherization is estimated to be 408.7 ccf. The electricity savings were smaller in magnitude, reflecting the lower level of investment in electric DSM measures. Group Three households reduced their electricity consumption by 949 kWh, which is a reduction of 7.4 percent of their pre-weatherization gas use. The control–group households, on the other hand, increased their consumption by 270 kWh. Thus, the net savings of electricity in the first year after weatherization is estimated to be 1,219 kWh.

Table A.2.3 1989 Pilot Program Annual Savings

Group	Gas (ccf)	Saved (percent)	Gas ($)	Electric (kWh)	Saved (percent)	Electric ($)
1 (N=39)	36.6	1.6	$21.13	-270	-3.7	-$24.08
2 (N=47)	303.9	16.3	$175.41	511	4.5	$45.58
3 (N=47)	445.3	25.9	$257.05	949	7.4	$83.79
4 (N=47)	547.4	25.5	$315.96	620.5	7.1	$55.98

Source: Harrigan (1992)

Table A.2.3 summarizes the costs and benefits associated with the Niagara Mohawk's Power Partnership Program with Stoneleigh Housing.

A.2.9 STRENGTHS AND WEAKNESSES OF THE PROGRAM

The coordinated program is popular with the utility and local agency staff alike. Negative comments were few in number and slight in significance. The primary strengths and weaknesses noted are presented in Table A.2.4.

Table A.2.4 Strengths and Weaknesses of Niagara Mohawk's Power Partnership Program

Strengths	Weaknesses
The coordinated program offers a more comprehensive package than the agency's DOE–funded program because of the inclusion of client education.	The involvement of both local agency and utility staff can confuse the weatherization process and the customers.
The coordinated program forms a partnership between the utility and the low-income customer.	
The coordinated program provides the local agency with increased funding and additional assistance to clients.	The Department of State and Niagara Mohawk both finance furnace replacement programs. This can be confusing to the customer and offers another opportunity for coordination.
The program enhances Niagara Mohawk's image in the community.	

Source: Interviews with Niagara Mohawk and agency staff, May 26 and 27, 1993.

All parties interviewed reported that the coordinated programs had far more advantages than drawbacks. All agreed that there was a mutual benefit in improved weatherization approaches (especially the strong client education) for the low-income community. The agency has a strong appreciation for the program support and additional measures funded by the utility. The utility expressed appreciation for the agency crew's high–quality work, good communications, and problem resolution.

There are several reasons for the success of this program. Experience in weatherization installations for the low-income community means the agency can immediately respond to utility requests for service. The strong and enthusiastic support of the utility's Power Partnership Program coordinator was noted by Stoneleigh Housing staff, and this has had the effect of narrowing any potential communication gaps. Finally, the utility and the agency both realize the benefits of the coordinated program.

PERSONS INTERVIEWED:

Rick Gerardi	Weatherization Program Manager, New York State Department of State
Charles Rubado	Director, Power Partnership Program, Niagara Mohawk Power Corporation
Dave Trexler	Weatherization Manager, Stoneleigh Housing
Bob Napoli	Stoneleigh Housing

A.3 PUGET SOUND POWER AND LIGHT'S COORDINATED PROGRAM

A.3.1 BACKGROUND

In 1984, Puget Sound Power and Light (Puget Power) and the Opportunity Council (OC), began a cooperative arrangement to fund and deliver residential demand–side management (DSM) services to the low-income communities in the northwest area of Washington State. Since 1984, Puget Power's coordinated low-income residential DSM program has weatherized 5,114 homes, delivered through eight local community agencies. The 1989 coordinated program is the focus of this case study. Information on more recent program activities are provided for context and to underscore the evolving nature of the partnership.

The area served by the coordinated program experiences mild winters and cool summers with a high moisture content (5,638 heating degree days, 57 cooling degree days, and an average rainfall of 39 inches).[1] Though the area is not subject to extreme rainfall amounts, the average year in the Seattle area has 227 days of cloudy sky cover, 81 days of partly cloudy skies, and 57 days of clear skies. This combination of pronounced rainfall and few sunny days results in moisture problems for the housing stock.

A.3.1.1 THE AGENCY

The Opportunity Council operates a relatively small weatherization program, averaging approximately 175 jobs per year.[2] It serves three rural counties: Whatcom, San Juan, and Island counties. Two of the three counties are islands, which is an obstacle to servicing the territory. One country is connected to the mainland by water routes only, while the second (the longest island in the country—60 miles long) is connected to the mainland by a single bridge. Although OC operates offices in these counties, they are for in-take only and not to house weatherization staff and material.

A.3.1.2 THE UTILITY

Puget Sound Power and Light is an investor-owned electric utility, with 627,000 residential customers, 74,000 commercial customers, 3,000 industrial customers, and 1,000 "other" customers for a total of 705,000 customers. The average rate for electricity in 1989 was 4.64¢/kWh.[3] The average electricity use for Puget Power's residential customers was 13,430 kWh/year. Puget Power operates 93

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1 Heating degree day data was obtained from National Oceanic and Atmospheric Administration. The precipitation data was obtained from the *Weather Almanac*, sixth edition, 1992.

2 This is in comparison to the "average" DOE-funded local agency, which weatherizes approximately 250 dwellings per year. See Mihlmester et al. (1992) for more details.

3 In 1989 the first 600 kWh cost $0.0415, 601 to 1499 kWh cost $0.045/kWh, over 1500 cost $0.0528/ kWh. An average of $0.0464/kWh is assumed.

generating units with a total capacity of 1,868 MW; these include 79 hydro-turbine units, eight combustion turbine units, one steam turbine unit using oil, and five steam turbine units using coal.[4]

The utility's motivation for participating in the coordinated program is twofold. The main motivation is to purchase the least-cost power as mandated by a state regulatory ruling, WAC 480-100-251 requiring electric utilities to use least-cost accounting principles. The secondary motivation is to enable their low-income customers to participate in a preexisting Puget Power residential DSM program. The residential DSM program provides for a 71.8 percent grant from Puget Power for the cost of measures with the participant paying 28.2 percent of the cost. As is well documented, cost sharing by participants for DSM measures is a substantial barrier for the low-income community. The Opportunity Council convinced Puget Power of this problem and actively sought a program in which their low-income customers could participate.

A.3.1.3 Housing Stock

A typical dwelling weatherized by OC using leveraged funds from Puget Power in 1989 is 22 years old, has 1,160 square feet of conditioned space, no air conditioning, and 3.5 inhabitants. Most of these homes (83 percent) are single-family detached, 14 percent are small multifamily, and 3 percent are mobile homes.[5] As noted earlier, the housing stock in this region faces severe moisture problems: wood rot and structural damage associated with water leaks are common. This greatly complicates the weatherization job.

A.3.1.4 Other Collaborative Partners

Under the leadership of Michael Karp, who has been a longtime advocate of utility-sponsored low-income weatherization, the Opportunity Council has developed a portfolio of funding to provide low-income weatherization to its service area. In addition to Puget Power and DOE, the Opportunity Council leverages funds from the Bonneville Power Administration (BPA), Health and Human Services (HHS), and the State of Washington via the Energy Matchmakers program. Of these other partners, HHS is the greatest contributor, providing 39 percent of the funds used for weatherization by OC.

In 1989, OC's funding for weatherization came from the following sources:

- 39.2 percent — Low Income Heating Assistance Program (LIHEAP);
- 23.5 percent — Puget Sound Power and Light;
- 21.9 percent — DOE Weatherization Assistance Program;

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4 *Electric World*, 1991

5 Source: Brown, et al. (1993).

- 12.5 percent — Energy Matchmakers program[6]; and
- 3.2 percent — Bonneville Power Administration.

This breakdown excludes the agency's coordination of housing rehabilitation grants for dwellings approved for weatherization.[7]

The Energy Matchmakers program is operated by the State of Washington's Department of Community Development. It is designed to increase the resources available to Washington's communities for low-income weatherization by leveraging local matching dollars. The program's goals are:

- to lower energy consumption of low-income households and, as a result, to make residential space heating more affordable;
- to reduce the need for energy suppliers to obtain energy from more costly resources;
- to reduce uncollectible accounts of energy suppliers; and
- to coordinate with other low-income weatherization programs.

A community can access the Energy Matchmakers fund by providing a dollar-for-dollar match. Anticipated match providers include utilities, local governments, service organizations, and rental housing owners. The Energy Matchmakers program was implemented in 1987 and was originally funded entirely with petroleum violation escrow (PVE) funds. Funding for the 1991-93 program includes $8 million in state capital budget funds and $2 million of remaining PVE funds.

A.3.2 REGULATORY ACTIVITIES

Since 1980, the Washington Utilities and Transportation Commission (WUTC) has been an active force in promoting DSM programs in the state.[8] Of primary interest is the adoption of least-cost accounting principles for the electric utilities and the switch to the Total Resource Cost test from the Utility Cost test for Puget Power's conservation programs. The commission has also been active in an experimental decoupling mechanism, whereby profits are no longer determined entirely by sales of electricity.

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6 The Energy Matchmakers program currently accounts for 33% of OC's weatherization funding.

7 In the sample of dwellings used in this case study, 27% of the dwellings had received between $3,000 and $5,000 in house rehabilitation grants.

8 For a detailed discussion of WUTC DSM rulings, see Reed, Bron, and Deem (1993).

A.3.3 WEATHERIZATION STAFF AND TRAINING

A.3.3.1 Weatherization Staff

In 1989, 14 full-time equivalent employees were allocated in part to the DOE-funded program and in part to other weatherization funding sources. Of the 14 FTE's dedicated to the Weatherization Program, two are energy auditors, eight are envelope crew members, one works in outreach, one works in inventory, and two are involved with administration and management.

A.3.3.2 Training

The agency required no special training to implement the coordinated program. Training is provided periodically to the program's staff. For instance, since the introduction of blower doors to the Washington State Weatherization Program, the State has provided training to its agencies. The agency believes they have a high turnover rate for their crew members because of the nature of the job and the amount OC is able to pay for their services.

A.3.4 CLIENT RECRUITMENT AND SELECTION

The main channel of client recruitment for the coordinated program is referrals from LIHEAP. On the Washington State LIHEAP information form there is a question asking applicants if they are interested in free weatherization. From that, the clients are screened for acceptability into the coordinated program. The criterion for acceptance to the coordinated program is income at or below 125% of the federal poverty line, having "hard-wired" electric heating, and being a Puget Power customer. Referrals can also be made from Puget Power's field staff.

A.3.5 USE OF DIAGNOSTICS

Once a household is accepted into the program, a process of audit, bid, grant, weatherization, and inspection takes place. The first step is for an OC auditor to conduct a thorough energy analysis of the dwelling. The auditor collects information on the heating system and the dwelling structure. This is submitted on a coded sheet for computer input at Puget Power. Along with the energy analysis code sheet sent to Puget Power, OC prepares a weatherization audit summary, weatherization advisory form, a sketch of the dwelling, and cost estimates for the measures.

Puget Power receives this information from OC and begins the process of determining the grant size. Once Puget Power determines the grant allotment, a contract and payment terms are sent to OC for acceptance. The contract specifies how much Puget Power will pay for given measures as stated on the bid and the amount the participant is to pay (i.e., OC).

A.3.6 WEATHERIZATION MEASURES

The weatherization measures used in the coordinated program include insulation (attic, wall, and floor), air infiltration, water-heating systems measures, window repair and replacement, and minor structural repairs. Unfortunately, cost data are available only for aggregate categories of measures.

The percent of total material cost per measure is:

- insulation (26 percent);
- infiltration (13 percent);
- hot water system (15 percent);
- glass (46 percent);

Information from the National Weatherization Evaluation (Brown, et al., 1993) on a sample of homes weatherized by OC suggests that for homes receiving insulation:

- 64 percent receive attic insulation;
- 21 percent receive wall insulation; and
- 57 percent receive floor insulation.

Data from the National Weatherization Evaluation also suggest that costs associated with glass are window replacements, which are installed in approximately 46 percent of the dwellings. Smoke detectors and "other" health and safety measures were applied to 7 percent of the dwellings.

A.3.7 QUALITY CONTROL

Quality control is maintained through the use of inspections. Each partner in the coordinated program provides for its own inspection of the work. Though the client may be wearied by the number of inspections, the result is complete confidence by all parties in the quality of the job. The redundant inspection system may also act as a purveyor of trust and confidence between the partners by demonstrating performance over time. It should be noted that each of the funding partners (HHS, DOE, and Puget Power) only inspect for the measures that they fund. It is up to OC to control the quality of the total weatherization job, which is a routine procedure for OC's staff.

A.3.8 BENEFITS AND COST

A.3.8.1 Energy Savings

There are two sources of energy savings estimates for the coordinated program. One is a billing analysis conducted by Oak Ridge National Laboratory using data from the National Weatherization Evaluation. The other is Puget Power's engineering estimates of savings based upon contracted measures. Both are presented and discussed below.

Billing Analysis of Savings. The billing analysis consists of 13 percent sampling of the dwellings weatherized by OC in 1989, using some DOE money. PRISM (Fels, 1986) was used to normalize the consumption data for the effects of a mild or harsh winter. The average pre-weatherization normalized annual consumption for the sample is 20,341 kWh. The average post-weatherization normalized annual consumption for the sample is 17,981 kWh. The average gross normalized annual savings achieved is 2,360 kWh, which is 12 percent of pre-weatherization consumption.

The estimated net savings of the program are higher than the gross savings. Net savings are estimated by subtracting the gross savings of nonparticipants from the gross savings of participants. Two different nonparticipant groups are available from the National Weatherization Evaluation.

The first nonparticipant population is a national sample of 492 eligible non-participants that heat primarily with electricity, and who had applied for weatherization services in the spring of 1991. This national nonparticipant sample increased its electricity consumption by 963 kWh between 1989 and 1991. This mean value is statistically robust, but it represents the nation and not necessarily northwest Washington. Using this national sample of nonparticipants, it is estimated that the average dwelling weatherized by OC in 1989 saved 3,323 kWh in the first year after weatherization.

The second nonparticipant sample is a subset of the first. It contains 20 households that were on OC's weatherization waiting list in the Spring of 1991. This sample of households increased their consumption by 1,400 kWh from 1989 to 1990. Due to the small number of households this estimate is based upon, it is not used here even though the sample includes households from the coordinated program's territory. If it were used, the estimate of net savings would be greater than 3,323 kWh.

Engineering Estimates of Savings. Another approach to estimating the energy saved by the coordinated program is to use the engineering estimates submitted by Puget Power. Puget Power uses engineering estimates to determine grant amounts and for filing rate cases with WUTC. These estimates are based upon measures funded by Puget Power and not upon other measures with funds from DOE or other sources. Puget Power estimated that the average household saves 2,112 kWh in the first year after weatherization. Since Puget Power's funding is only responsible for a portion of the total dollars spent on a house, the engineering estimate is not a measure of total net energy savings, which should be higher.

The engineering estimate also does not take into consideration what consumption levels would have been had there not been a program. In addition, it does not reflect variations in the effectiveness of the installation and maintenance of weatherization measures, nor behavioral effects such as "take-back". However, they do provide a bench mark of incremental savings when compared to the billing history analysis.

A.3.8.2 Program Costs

A key to the success of OC's weatherization service is the holistic nature of the program. This is demonstrated by an average total cost of $4,950. As Tables A.3.1 depicts, Puget Power provide only a portion of the total funding OC expends per dwelling. Represented in the table is the DOE portion of the coordinated program. DOE funds are used, in part, to cover some of the participant investment for the Puget Program and to provide measures/services not covered under the Puget Program.

Puget Power pays 71.8 percent of agreed energy-conservation measures costs. OC uses the other three funding sources to cover the participant's 28.2 percent investment asked by Puget Power.[9] The total installation cost sponsored by Puget Power is $1,291 or 29% of the coordinated program.

OC leverages an average of $590 of DOE funding per dwelling unit for installation cost under the cooperative arrangement. The average DOE installation cost for the nation is $1,050. The lower investmnet per dwelling using DOE funds allows more dwellings to be serviced using federal funds and less dependency on the federal monies by OC.

Health and human Services is the largest sponsor of the work conducted by the OC with an average installation cost of $1,885 of the total $4,500 (42%) The final sponsor in the cooperative arrangement is the Energy Matchmaker Program with $734 in installation costs (16%). As denoted earlier for this case study year, the Energy Matchmaker Porgram currently operates at 33% of OC's weatherization budget.

Administration costs were calculated using a known and demonstrated rate of 10% of total installation costs by the OC.[10] This results in a total administration cost of $450, which breaks down as DOE $59, Puget Power $129, HHS $189, and Energy Matchmaker $73. This brings the total program costs to $4,950.

A.3.9 PROGRAM STRENGTHS AND WEAKNESSES

One indication of the program's effectiveness is the fact that Puget Power remains a committed partner in the cooperative agreement. On a routine basis, Puget Power checks to ensure that the utility is in the boundaries of its least-cost guidelines. If the program were not operating in an effective manor, Puget Power would certainly not be an active partner in this low-income DSM program.

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9 Using the average installation costs for Puget Power of $1,291, it can be derived that the average participant's investment is $507. Using the other three participating sponsors' installation cost as a guide to allocating the $507, we can assume that following breakdown: DOE $91, HHS $299, and Matchmaker $116.

10 The low administration rate is due, in-part, to the accounting of some overhead costs under the Labor and Program Support, section of the cost table. This method of accounting resembles the OC's system more accurately than the one used in the other case studies.

The main strengths of this coordinated program are a direct result of the effort and energy of the OC director and staff, who perform their jobs in a professional and extremely competent fashion.

Another strength is Puget Power's no-nonsense approach to low-income DSM. Puget Power enables OC to operate in an environment of cooperation with the utility.

Table A.3.1 Puget Sound Power & Light/The Opportunity Council

Program year:	1989
Number of program participants:	89
Net kWh saved per dwelling, per year:	3,323 kWh (gross = 2,360 kWh)
Residential rates:	4.64¢/kWh[a]
Avoided energy costs:	2.32¢/kWh[a]
Avoided capacity:	0.40 KW[b]
Avoided capacity cost:	$30/KW/year[c]

		Sources of Funds:				
Types of Costs:		**DOE**	**Puget Power**	**HHS**	**MM**	**Totals**
Installation Costs:	Energy-related materials	$236	$517	$754	$293	$1,800
	Labor & Other Program Support	$354	$775	$1,131	$440	$2,700
	Subtotal	**$590**	**$1,292**	**$1,885**	**$733**	**$4,500**
Administration Costs:[d] (including start-up and evaluation costs)	DOE - regular program	$59	0	0	0	$59
	Puget Power	0	$129[e]	0	0	$129
	Health & Human Svcs.	0	0	$189	0	$189
	Energy Matchmakers	0	0	0	$73	$73
	Subtotal	**$59**	**$129**	**$189**	**$73**	**$450**
Total Costs		**$649**	**$1,421**	**$2,074**	**$806**	**$4,950**

[a] In 1989 the first 600 kWh cost 4.15¢/kWh, 601 to 1499 kWh cost 4.5¢/kWh, over 1500 cost 5.28¢/kWh. An average of 4.64¢/kWh is assumed. Avoided energy costs are assumed to be 50% of this residential rate.

[b] Assumes a 60% load factor.

[c] Assumes marginal unit is a combustion turbine.

[d] Administration costs are estimated using a ratio of .2 direct cost to administration cost, consistent with Berry (1989).

[e] Includes administration fee and audit cost.

Table A.3.2 summarizes other strengths of the program including the holistic approach to weatherization taken by OC. This approach uses multiple funding sources that are applied to specific tasks in weatherization. Examples are the use of utility money only on proven energy conservation measures and the use of HHS funds to promote a safer and more hospitable home environment. DOE (and other non-utility) money is used to pay the participant's cash outlay (a clear example of leveraging), which goes towards the same measures approved by the utility, and helps funds additional measures beyond the utility's investment.

A final strength of the program is Puget Power's willingness to participate in enhancing the program. Puget Power is currently funding a pilot study that seeks to answer questions regarding weatherization of mobile homes, health and safety benefits, and optimal weatherization techniques.

Table A.3.2 Strengths And Weaknesses of the Puget Power Coordinated Program

STRENGTHS	WEAKNESSES
Multiple partners allows for holistic approach to weatherization.	Increased program administrative costs to coordinate multiple partners.
Utility funds increase emphasis on energy–conservation measures, thereby increasing the program's cost effectiveness.	Utility calculates funding based upon agency audit data. This increases paper work and lag time between audit and weatherization.
Allows low-income population to participate in utility's DSM program (DOE funds used to pay participant's cost).	Agency's normal in-take procedures, which rely on LIHEAP rosters, do not reach enough electrically heated dwellings.
Multiple inspections assure quality.	Multiple inspections are wasteful and lead to high administrative cost.
Structural repairs funded by external source.	
Highly skilled and proficient agency weatherization staff operating at zero profit.	

Weaknesses of the program are few. The only noted drawback echoed by both parties is the lack of participation by the natural gas utilities in the area. The absence of funding by those utilities prevents gas-heated low-income households in the region from receiving the levels of funding per dwelling that the electrically heated households enjoy. Gas-heated dwellings in the region are weatherized using DOE and HHS funds. However, utility sponshorship of the electrically heated

dwellings makes more DOE and HHS funds available to weatherize gas–heated dwellings. Thus, the coordinated program is indirectly helping to weatherize gas-heated dwellings in the region.

PERSONS INTERVIEWED:

Steve Crisp-Grieser	Housing Improvement Manager, the Opportunity Council
Chuck Eberdt	Energy Project Manager, the Opportunity Council
Michael Karp	Housing Director, the Opportunity Council
Laura Mozelewski	Housing Administration Manager, the Opportunity Council
Patti Pod	Low-Income DSM Coordinator, Puget Sound Power and Light
Carolyn Wyman	Energy Matchmaker Program Manager, Housing Division of the Department of Community Development, Washington State.

A.4 EUGENE WATER AND ELECTRIC BOARD'S COORDINATED PROGRAM

A.4.1 BACKGROUND

Since 1983 the Eugene Water and Electric Board (EWEB) and the Housing Authority and Community Service Agency (HACSA) of Lane County have operated a cooperative, low-income weatherization program. The area served by the program includes the city of Eugene in Western Oregon (home to the University of Oregon) and surrounding areas covering a total of nearly 250 square miles. With the national economic downturn of the late 1980's and early 1990's and a rapidly growing population due primarily to in-migration, the area has an increasing need for low-income weatherization. Western Oregon is noted for its mild winters (averaging 4,799 heating degree days –the fewest among the six case studies), its mild summers (with on average, only 261 cooling degree days per year), and its considerable rainfall.

A.4.1.1 The Agency

The Housing Authority and Community Service Agency is a large, multiprogram agency that delivers a variety of community services to Eugene and surrounding Lane County residents. Weatherization is one of its largest and oldest service programs; it was initiated with DOE funding in the late 1970's. Other programs include administration of over 2,000 Section 8 housing certificates, management of 761 public housing units, assisting approximately 8,000 families through the LIHEAP program annually as well as providing more than 95,000 lunches through a summer food program.

In 1989, HACSA had a weatherization budget of $942,600. Sources of government funding include DOE's Weatherization Program ($167,800), LIHEAP ($191,700), and PVE ($93,100). EWEB was (and remains today) the largest source of utility support, contributing $350,000 in 1989. Four additional utilities contribute to the weatherization of both gas–and electrically-heated dwellings, bringing the total base of utility funding to $490,000 in 1989. HACSA completed 337 weatherization jobs in 1989, 209 (or 62 percent) of which were completed as part of the coordinated program with EWEB. These 209 jobs resulted in the weatherization of 323 dwelling units. Over the ten-year lifetime of the coordinated program, HACSA has weatherized more than 1,500 dwellings. Participation rates for the coordinated program have declined slightly in recent years, due in part to difficulties with recruiting eligible households. Low-income weatherization appears to have reached near-saturation among the traditional participants in Lane County: owner-occupied single-family dwellings. Other segments of the low-income market are now being explored: renters and apartment tenants, in particular.

A.4.1.2 The Utility

The Eugene Water and Electric Board is a municipal utility. Its 1990 electrical system load was approximately 270 MW. More than half (60 percent) of this power is purchased from the Bonneville Power Administration (BPA), a federal power authority. Other resources include hydroelectric plants operated by EWEB (29 percent), a steam turbine generator for cogeneration (6 percent), and conservation (5 percent).

For the past decade the Northwest has experienced a situation of energy surplus, in which the availability of electrical resources has exceeded the demands of the region. Current projections, however, indicate that the region will need additional energy resources over the next two decades. In considering the types of resources available to meet the region's needs, BPA and the utilities it serves are guided by The Pacific Northwest Electric Power Planning and Conservation Act (P.L. 96-501), which gives conservation a high priority.

The cooperative weatherization program is run out of the Energy Management Services Department in the Electric Utility Division at EWEB. This is the same unit that operates the Residential Weatherization Program (RWP) for non-low-income households and other DSM programs.

The residential rate for electricity at EWEB is 3.7¢/kWh. Avoided energy costs are estimated to be half this residential price (or 1.85¢/kWh).

A.4.1.3 The Housing Stock

The low-income housing stock in Lane County tends to be 25 to 30 years old and in fair to poor quality. Quite a few apartment buildings in Eugene are occupied by University of Oregon students who would quality for participation. However, it is difficult to recruit 66 percent of these residents, in order to qualify entire buildings. As a result, the coordinated program has focused primarily on single-family homes and small multifamily buildings. Large multifamily buildings have made up only 1 percent or so of recent weatherization jobs, but this level is likely to rise as the result of a recently launched effort to qualify student-dominated apartment buildings near the University of Oregon. This new effort will also involve the solicitation of landlord contributions.

EWEB launched a mobile home program in 1990, which served residential customers of all incomes. As a result of this funding and DOE resources, mobile homes comprised 14 percent of the weatherization jobs completed by HACSA in 1992. The EWEB mobile home program has been discontinued, while the utility considers how to best serve this population.

A.4.1.4 Goals Of The Program

The coordinated program was initiated by EWEB, which contacted HACSA as the result of a referral from Oregon's Department of Housing and Community Services. EWEB sought a contractor

to implement the low-income portion of BPA's Residential Weatherization Program within its service area. The RWP is a BPA-supported DSM program that has operated throughout the Pacific Northwest since the early 1980's. Through this program, Bonneville and participating utilities offer substantial incentive payments for customers to have their homes weatherized. EWEB and BPA subsidize up to 85 percent of the costs of weatherization for non-low-income customers, and up to 100 percent for low-income customers. At the time HACSA was asked by EWEB to assist with the RWP, low-income participation in the program was minimal. EWEB felt that a human services agency such as HACSA would be an effective outreach mechanism for this segment of its client base.

In 1986, EWEB established its own low-income weatherization program Weatherization Plus. This program serves a subset of those low-income clients who call EWEB with a request for weatherization assistance. When a low-income customer calls the utility for weatherization assistance, the low-income account manager refers them to both programs (the program run cooperatively with HACSA and Weatherization Plus) and allows the customer to choose between them.

The goals of the coordinated program are the same for both the utility and the agency: to reduce energy consumption, promote energy awareness, increase comfort, and provide cost-effective weatherization for low-income residents of Lane County. Arrears reduction was not a goal until recently. Today, energy education and arrears reduction are increasingly viewed as important potential outcomes of the coordinated program.

A.4.2 WEATHERIZATION STAFF AND TRAINING

Craig Satein is the weatherization supervisor for the HACSA. He has been in the weatherization and energy–conservation business for more than a decade. Approximately eight additional staff members work on the weatherization program at HACSA, with responsibilities that include energy audits and inspections, outreach, client education, management, and clerical support. Two of these staff members have been part of the weatherization program for more than 10 years; another two members were hired with significant prior experience in the construction industry.

None of the installation work is done by HACSA employees. Instead, weatherization measures are installed entirely by contractors. Through competitive solicitations, HACSA signs contracts with several local companies. Each contractor has to be approved by EWEB; thus, they tend to be the same companies that EWEB uses in its generic Residential Weatherization Program.

HACSA's contractors have tended to be companies that specialize in windows and/or insulation. Contracts are competed periodically, in amounts that average $100,000 to $200,000. They are not bid on a house-by-house basis. Approximately 15 standard items are listed in the request for proposals, and the contract goes to the lowest bid for the package. The resulting contracts include clauses describing financial penalties if the contractor exceeds the completion deadline or repeatedly fails to correct deficiencies. The result has been low-cost weatherization work and many

repeat contractors. As new contractors have participated in the coordinated program, quality has periodically been uneven.

Training is a continuing feature of the coordinated program. In recent years, HACSA has paid for selected in-house and contractor crews to received training on heating and air conditioning systems, blower doors, high-density wall insulation, and client education. Some HACSA staff and contractors have participated in a BPA-sponsored training program on mobile–home weatherization. In addition, EWEB has supported some of HACSA's training needs.

A.4.3 CLIENT RECRUITMENT AND SELECTION

To be eligible for participation in the coordinated program, a household's income must be less than 125 percent of the poverty level and its home must have permanently installed electric heat, which was installed prior to December 1987. Under some conditions, applicants may be eligible if they have 220-volt electric space heaters and no other form of heating.

The coordinated program operates primarily on a first–come, first–served basis, with some preference given to households with elderly or handicapped occupants or children under six years of age. No specific priorities are given to households with high levels of electricity consumption or with arrears. However, the outreach procedures used to attract participants tend to orient the program towards these two groups. All applicants for energy assistance through HHS/LIHEAP are asked if they are interested in having their homes weatherized. This tends to attract participants with high electricity bills. In addition, the Oregon Partners in Energy (OPIE) program provides extensive budget counseling and client education to customers with high arrears, and refers them to the Residential Weatherization Program. EWEB also refers customers to the Residential Weatherization Program when they call in for assistance.

Due to increasing difficulties with client recruitment, EWEB has recently initiated an assessment of energy audits that did not result in weatherization. These households are being contacted to encourage their participation in the coordinated program.

When an income-eligible household applies to HACSA for weatherization, an EWEB accounting code is assigned if the applicant claims to have permanently installed electric heat. If the dwelling requires structural repairs, then LIHEAP funding may be used to complete the job. If the dwelling turns out to be ineligible for EWEB funding, then funds from DOE's Weatherization Program may be used to weatherize the structure. Thus, the utility and government funds operate both in parallel and in a supplemental mode.

A.4.4 USE OF DIAGNOSTICS

The use of diagnostic equipment in HACSA's weatherization program has steadily grown. Blower doors were first introduced into the program in 1989. They are now used in almost every

audit to identify critical air leaks, and they are used frequently to conduct a post-weatherization test during HACSA's inspection. Occasionally, distribution systems may be diagnosed with blower doors. Blower doors are not used by the contractors during the installation process.

Carbon monoxide testers and infrared scanners are used on a subset of the weatherization jobs, where conditions warrant them. Through Bonneville's Residential Weatherization Program, EWEB pays for radon tests to be conducted in about 60 percent of the homes weatherized by the coordinated program. In addition, EWEB pays for formaldehyde testing to be done in approximately half of the mobile homes it weatherizes. These tests are not part of HACSA's other weatherization jobs.

A.4.5 INSTALLATION OF MEASURES

The weatherization process involves the following steps. HACSA screens applicants for program eligibility and completes an energy analysis form that is sent to EWEB. EWEB estimates the kWh savings of each measure and specifies the eligible incentives (i.e., "buyback") that it will provide HACSA for weatherization. HACSA prepares a work order for issuance to a contractor. The work is then conducted and inspected, and payments are made. Some of these steps are described in more detail below.

A.4.5.1 Selection of Weatherization Measures

EWEB developed its own heat–loss methodology for use in the Residential Weatherization Program, and it was approved by BPA. HACSA completes an energy analysis form for each applicant to the coordinated program, describing in detail the nature of existing insulation, windows, doors, water heaters, heating systems, and distribution systems, as well as the dwelling's size and number of occupants. EWEB then performs the heat–loss calculations and authorizes the installation of specific energy-conserving measures.

Measures are ranked by HACSA based on the ratio of energy savings to costs, where costs include all the repairs associated with a measure (e.g., new windows or doors; roof and floor repairs; and electrical and plumbing work). All measures that can be financed by the program are installed. The dwelling's historic consumption of electricity is not considered during the audit process because of the additional expense that would be required.

HACSA's stand–alone weatherization program considers the same measures as the coordinated program. However, the coordinated program is able to install more measures because of the leveraged EWEB funds.

A.4.5.2 Rates of Installation of Weatherization Measures

The EWEB coordinated program emphasizes weatherization measures that improve the thermal integrity of the dwelling's envelope. Data is available from the National Weatherization Evaluation on a sample of 22 electrically heated homes that were weatherized by HACSA in 1989 as part of the coordinated program. Based on this sample, the coordinated program undertook general caulking and weatherstripping in 100 percent of the dwellings and targeted air sealing in 42 percent of these. Storm windows were a common feature of the program, with 84 percent of the dwellings receiving an average of 9 windows. Almost half of the total materials costs ($496 of $1,070 — or 46 percent) were spent on storm windows. In 84 percent of the dwellings attic insulation was added to existing insulation, and in another 5 percent of the jobs, attic insulation was installed for the first time. Other common weatherization measures include: wall and floor insulation (each was added to 32 percent of the dwellings); hot water pipe insulation (37 percent); fans (11 percent); and water heater tank insulation (5 percent). Some type of structural repair was made on 74 percent of the units, with replacement windows, floor repairs, and new doors being the most common. Altogether, structural repair materials account for 21 percent of the total materials costs ($226 of $1,070).

A.4.6 QUALITY CONTROL

Quality control is maintained by having every job inspected and signed off by a HACSA inspector. EWEB typically conducts one or two additional inspections of each job. In addition, BPA pulls approximately 30 files from the combined non-low income and the low–income programs (Weatherization Plus and HACSA) and reviews everything from the energy analysis to the actual installation in the field. BPA's reimbursements to EWEB are conditional upon "passing" this financial audit and finding no substantial installation errors.

During the early years of the coordinated program, EWEB used to check the HACSA audits for accuracy. As the auditors became more familiar with the audit procedures and greater trust developed between the two organizations, EWEB's reviews became less frequent.

A.4.7 ENERGY SAVINGS AND PROGRAM COSTS

A.4.7.1 Energy Savings

The total energy savings of the coordinated program have not been measured by either EWEB or HACSA. Based on a sample of 94 recent jobs, EWEB's audit estimates that an average of 5,603 kWh have been saved per dwelling unit. Prior research has shown that engineering estimates typically overestimate measured savings by as much as 50 to 100 percent (Brown and White, 1992; Keating, 1992).

An analysis of billing data for a sample of participants in the coordinated program is available from the National Weatherization Evaluation. In particular, pre- and post-weatherization

electricity consumption data are available for a random sample of 22 homes weatherized by the program in 1989. PRISM was used to normalize the consumption data for the effects of a mild or harsh winter, so that pre- and post-weatherization consumption could be compared. Prior to weatherization, this sample had an average annual electricity consumption of 18,713 kWh.[1] During the first year after weatherization, the sample's normalized annual consumption was only 16,969 kWh, resulting in an estimated gross savings of 1,744 kWh.

The net electricity savings attributable to the coordinated program was estimated by making a control group adjustment based on the National Weatherization Evaluation. The control group was composed of a national sample of 492 low-income households that had applied for weatherization services in the spring of 1991. Between 1988 and 1991, their normalized annual consumption of electricity increased by 963 kWh (or 14.5 percent). Thus, the coordinated program's net savings is estimated to be 2,707 kWh (1,744 + 963).

A.4.7.2 Program Costs

The total cost of weatherizing a dwelling in the coordinated program is estimated to be $2,911 (Table A.4.1). Twenty-two percent (or $632) of this total is estimated to be administrative and overhead costs, while 78 percent (or $2,279) is installation (labor and materials) costs. For DOE's low-income Weatherization Program nationwide, administrative and overhead costs are estimated to be $500 per dwelling, or 33 percent of total weatherization costs (Brown et al., 1993). Thus, the coordinated program's total cost of $632 is slightly larger in absolute terms, but smaller relative to the percent spent in the DOE Program.

There are two sources of administrative costs: EWEB and HACSA. EWEB contracts with HACSA to perform audits and material take-off calculations which reduce EWEB's administrative costs for $400 per dwelling in the generic program to $232 per dwelling in the cooperative program. BPA reimburses EWEB for approximately $156 of its $232 in administrative costs. this amount varies by the number of units in the weatherized dwelling. EWEB then uses these BPA administrative funds and other BPA program funds ot reimburse HACSA for $340 of its $400 in administrative costs. DOE covers the balance.

The coordinated program's administrative and overhead costs do not include any start-up or evaluation costs. The coordinated program was initiated without a pilot program. EWEB had already been operating the RWP for several years before HACSA was contracted to deliver weatherization services specifically to low-income customers. Thus, the participating groups felt that no pilot was required. The only start-up costs were incurred by HACSA auditors, who were required to be

[1] This is the "normalized annual consumption" based on PRISM.

certified under the BPA program. These costs were incurred nearly 10 years ago, and EWEB reimbursed HACSA for some of the associated training.

Table A.4.1 Summary of Costs and Benefits for the Eugene Water and Electric Board Coordinated program

Program year:	1989
Number of units weatherized:	323
Net kWh saved per dwelling, per year:	1,744 (weatherized) + 963 (control) = 2,707 kWh
Residential rate for EWEB:	3.7¢/kWh[a]
Avoided Energy Costs:	1.91¢/kWh[b]
Avoided Capacity:	0.515 KW[c]
Avoided Capacity Cost:	$44/KW/year[d]

		Sources of Funding:			
Types of Costs:		**BPA**	**EWEB**	**DOE**	**Totals**
Installation Costs:	Energy-related	$1,841	$212	0	$2,053
	Structural repairs	$66	0	$160	$226
	Health and safety measures	0	0	0	0
	Subtotal	$1,907	$212	$160	$2,279
Administration Costs: (including startup and evaluation costs)[e]	BPA	0	0	0	0
	EWEB	0	$232	0	$232
	HACSA	0	$340[f]	$60	$400
	Subtotal	$0	$572	$60	$632
Total Costs:		**$1,907**	**$784**	**$220**	**$2,911**

[a] Based on EWEB 1993 retail rate.
[b] Based on winter energy costs of BPA. The rate is expected to reach 4.17¢/kWh by the year 2009.
[c] Assumes a 60 percent load factor.
[d] Based on 1993 power costs of BPA.
[e] No start-up or evaluation costs for this program.
[f] These funds are passed through EWEB from BPA.

The total installation costs of $2,279 are composed of $1,070 in materials and $1,196 in installation-related labor. The materials costs are dominated by the costs of storm windows and doors (which average $496 per weatherized dwelling, based on the sample of 22 dwellings). Insulation is

the second largest materials cost, averaging $242 per dwelling. On average, structural repairs account for approximately 10 percent of total installation costs, and these are financed primarily by DOE.

The EWEB and HACSA program managers believe that the installation costs are perhaps 10 percent lower than they would be without the involvement of HACSA because of the large batch bidding that results in low-bid contracts. This impression is reinforced by the fact that EWEB's standalone program (Weatherization Plus) is slightly more expensive per weatherized dwelling.

A.4.8 OVERALL ASSESSMENT OF THE PROGRAM

EWEB and HACSA program managers believe that the strengths of the coordinated program far outweigh the weaknesses. The strengths and weaknesses of the coordinated program are listed in Table A.4.2.

Table A.4.2 Strengths and Weaknesses of the EWEB Coordinated program

Strengths	Weaknesses
More homes can be weatherized because HACSA has funds for repairs. Without repair funds, EWEB would have to walk away from many homes.	Confusion among customers about roles of EWEB, HACSA, and HACSA's subcontractors.
Assistance with client recruitment and screening for eligibility.	Additional time required to screen applicants for eligibility because of the requirement that participants have permanent electric heat.
Multiple inspections improve quality of work.	Multiple inspections are duplicative and wasteful, and lead to high administrative costs.
Ability to provide more comprehensive weatherization and hence greater energy savings.	Bureaucratic process tends to slow down weatherization work.
Low-bid approach to subcontracting has resulted in low costs.	Low-bid approach to subcontracting has resulted in ~~uneven~~ occasional unevenness in the quality of weatherization work.
Enhanced ability to meet BPA-mandated levels of participation.	
EWEB customers do not have to obtain two bids; HACSA does the contracting.	

Source: Composite of interview responses from EWEB and HACSA employees.

PERSONS INTERVIEWED

Marilynne Blakely	Residential Program Coordinator, Energy Management Services Department, Electric Services Division, EWEB
Kathy Grey	Supervisor, EWEB
Paula Fleitell	Resource Planner, EWEB
Bob Lorenzen	Residential Programs Manager, EWEB
Mat Northway	Manager, Energy Management Services, EWEB
Craig Satein	Weatherization Supervisor, Housing Authority and Community Service Agency of Lane County

A.5 IDAHO POWER COMPANY'S COORDINATED PROGRAM

A.5.1 THE AGENCY AND ITS SERVICE AREA

The coordinated program between EL-ADA Community Action Agency (EL-ADA) and Idaho Power Company (IPCO) first began in 1989 under a joint understanding between IPCO, the Idaho State Weatherization Office (ISWO), and the Idaho Public Utilities Commission. After closely examining other regional DSM efforts and the pre-established State effort, IPCO decided to supplement the State's Weatherization Assistance Program.[1] The State program is well developed, closely monitored and evaluated, and very dynamic. For example, since 1985, the State has utilized four audits, each one an improvement upon its predecessor.

A key factor in IPCO's decision to institute a coordinated program was its desire to use full-scale weatherization as the vehicle for reducing the electricity consumption of low-income households. Although utility-sponsored low-income DSM is not required by the State regulatory body, IPCO felt that in the absence of voluntary involvement, regulatory action would soon follow.

EL-ADA operates as one of eight Idaho local community agencies in the Idaho Power Low-Income Weatherization Assistance (LIWA) program. The coordinated program as delivered through El-ADA in 1992 is the topic of this case study.

This coordinated program covers a three-county area in Southwest Idaho. The regional climate can be characterized by cold winters (5,802 heating degree days) and hot summers (742 cooling degree days). With the exception of Boise, the region consists mostly of sparsely populated communities .

A.5.1.1 EL-ADA Community Action Agency

EL-ADA Community Action Agency operates a medium-sized weatherization program located in Boise. EL-ADA is a multi-purpose agency that delivers a variety of services to Southwest Idaho. Its weatherization program is staffed by six full-time equivalent employees (FTE) and operates under the guidance of the State weatherization office. This guidance includes a computerized audit and tracking system, weatherization guidelines, auditor certification, and a statewide bulk purchase agreement. The cooperative arrangement with IPCO has included approximately 19 percent of all dwellings served by EL-ADA since 1989.

[1] The State's Weatherization Assistance Program is funded by DOE.

A.5.1.2 Idaho Power Company

Idaho Power Company is an investor-owned electric utility headquartered in Boise, Idaho. In 1990, IPCO had 236,008 residential customers, 48,192 industrial, and 177 other customers. The average residential rate was $0.0469 per kWh (*Electric World*, 1991). IPCO for the most part is a hydro turbine utility, having part ownership of coal-fired steam turbines in Wyoming, Nevada, and Oregon and full ownership of gas– and oil–fired steam turbines in Idaho.

IPCO Numbers

- 1989 Net Sys Input 14,957,784,000 kWh
- 1989 Purchased 1,496,750,000 kWh 10 percent of input
- 1989 Sales 14,003,844,068 kWh
- Total Generating Capacity as of 1/1/90, 2,628,889 kw
- System Peaks (excluding exports)
  Summer: 2,246,000 kw
  Winter: 2,327,000 kw

SOURCE: *Electric World*, 1991.

As a primarily hydro-generating utility, IPCO is far less concerned with the need for capacity growth than it is with having enough fuel (water) to generate the needed energy. Capacity growth does remain a long-term planning issue for IPCO. The need for other forms of capacity growth to supplant hydroelectric capacity could become a concern if water resources become permanently scarce due to ever–increasing demand.

A.5.1.3 Housing Stock

The majority of dwellings served by EL-ADA under their DOE-funded weatherization program are mobile homes (52 percent). During the field work for this case study, the abundance of mobile homes was quite apparent. The remainder of the housing stock consists of single-family detached homes (41 percent), a few small multifamily units (7 percent) and a few large multifamily structures (less than 1 percent).

The population served by EL-ADA also has a high incidence of electric space–heating systems (38.6 percent versus 10 percent for DOE's Weatherization Program nationwide), high rates of air-conditioning equipment (53 percent window units, 22 percent central air, 2 percent both window and central, and 23 percent with no air-conditioning), and small average dwelling sizes (932 square feet versus 1,083 square feet nationwide or 14 percent smaller than average), due primarily to the large proportion of mobile homes.

A.5.2 REGULATORY ACTIVITY

Since January 1, 1993, the Idaho Public Utilities Commission has allowed ratebasing of DSM expenditures with no allowance for lost revenues due to DSM. DSM expenditures are charged back

to the customer class that participates in the DSM program. The commission does not consider lost revenues a reason for utilities not to participate in DSM.

A.5.3 WEATHERIZATION STAFF AND TRAINING

EL-ADA provides 100 percent of the weatherization staff to the coordinated program through a combination of in-house and contracted personnel. In-house staff includes an energy auditor, an envelope crew chief and member, and management and clerical support. The majority of the contract work involves furnace replacements, which are not part of the IPCO program.

State guidelines call for the auditor/inspector to be State certified. State certification consists of training, testing, and certification or re-certification. The certification process ensures that those participants who pass are knowledgeable in determining the energy efficiency of a dwelling, defining appropriate weatherization measures to improve the efficiency of the dwelling, and inspecting for quality of installed measures. To be certified, participants must demonstrate their knowledge through written, oral, and applied tests.

A.5.4 CLIENT RECRUITMENT AND SELECTION

The client recruitment and selection procedure involves the use of LIHEAP and IPCO field staff referrals for intake. EL-ADA is responsible for confirming income eligibility, according to the State's low-income definition and a primary electric heat source using IPCO power. No dwelling types are excluded by the coordinated program.

The State program uses a priority system to "...assure preference is given to elderly, handicapped, and excessive energy users..." (IDAHO Weatherization Assistance Program Operations Guidelines). The priority system uses six factors to rank a house between emergency and low priority (see Table A.5.1).

A.5.5 USE OF DIAGNOSTICS

Upon acceptance to the program, the State–developed audit is applied to the client's dwelling. The audit has undergone multiple changes in recent years to include technology advancements. Since 1985 when priority lists of measures were discontinued, four different State weatherization audits have been used with each one being a refinement of its predecessor. The most recent version, Energy Analysis 3 (EA-3) is a comprehensive protocol that features savings–to–investment ratio calculations (previous versions used simple payback) and realistic energy savings estimates.

Table A.5.1 Priority System for Selecting Clients

Priority Factors

•	Age and/or Infirmity	0 1 2 3
•	Condition of Home	0 1 2 3
•	Anticipated Benefit	0 1 2 3 4 5
•	Financial Situation*	0 1 2
•	Date Verification**	0 1 2
•	Other***	0 1 2

* Below 75% of the poverty line, 2 points; below poverty line but above 75%, 1 point; above poverty line and under DOE guideline, 0 points.

** Duration between income verification and audit date: 0-60 days, 0 points; 60-90 days, 1 point; over 90 days, 2 points.

*** Dwellings that receive financial contributions from utilities, landlords, or other sources such as housing rehabilitation receive additional points.

Source: *Idaho Weatherization Assistance Program Operations Guidelines*

Final Priority Rating

Sum of Points

10-15	Emergency
7-9	First or Highest
4-6	Second
0-3	Lowest

Source: *Idaho Weatherization Assistance Program Operations Guidelines*

EA-3 is based upon reducing home energy consumption through a comprehensive approach to weatherization. The first step of the EA-3 protocol is blower–door testing. Blower doors are used to identify dwellings with infiltration problems (those not meeting ASHRAE standards),[2] to identify infiltration sources, and as a cost-effectiveness guideline (when cfm_{50} reduction is less than 100 in one hour for a two-person crew). Blower doors are used to identify all cost-effective infiltration and general heat loss measures which include storm windows.

All dwellings receive a pre-weatherization heating system inspection. If no measures are applied to the heating system but the house receives infiltration reduction, a post-weatherization inspection is conducted to ensure occupant health and safety.

Using the results of that audit, IPCO will fund 50 percent of measures meeting a 1.0 savings–to–investment ratio (SIR) plus a $75 administration fee per dwelling. According to State regulation, all weatherization measures must meet the same SIR =1.0 guideline.

Understanding that engineering estimates tend to overestimate energy savings, the State weatherization office commissioned a study to analyze the difference between predicted savings and actual savings as measured by normalized billing analysis. The study revealed that the audit predicts on average a 26 percent energy savings over pre-weatherization consumption, while the billing analysis estimated a 10 percent energy savings. Unfortunately, the billing analysis was flawed by:

[2] The ASHRAE infiltration standard is a natural 15 cubic feet per minute per person or 0.35 air changes per hour.

- excluding participants from the analysis if their consumption did not precisely fit the PRISM model and
- not using a control group to adjust for external energy consumption trends.

A.5.6 WEATHERIZATION MEASURES

The measures usually installed under the coordinated program are the same as EL-ADA's regular DOE-funded weatherization. In 1992 under the coordinated program, the average direct cost spent per dwelling was $1,062, with IPCO contributing $608. Approximately 40 percent of the total direct costs were spent on windows. Since the program is driven by the State audit, it is safe to assume that the audit is responsible for this emphasis on window work. Details of the costs are provided in Table A.5.2.

Table A.5.2 Breakdown of Direct Costs, by Type of Weatherization Measure

Measure	Total	IPCO Share
Audit	$75	$75
Ceiling Insulation	$114	$58
Doors	$88	$44
Ducts	$26	$13
Floor Insulation	$201	$100
Furnace	$47	$0
Infiltration	$50	$24
Pipes	$26	$1
Repairs	$3	$0
Vents	$3	$0
Walls	$19	$10
Water Heater	$1	$0
Windows	$409	$209
TOTAL	**$1,062**	**$608**

A.5.7 QUALITY CONTROL

Visual post-weatherization inspections are conducted by both EL-ADA and IPCO on all dwellings in the program to ensure the quality of the weatherization work. The inspections are conducted separately; EL-ADA performs its inspection upon completion of each job and IPCO's inspection occurs weeks later. IPCO's inspection is not limited to the measures they fund but includes the whole weatherization job.

A.5.8 ENERGY SAVINGS AND PROGRAM COSTS

A.5.8.1 Energy Savings

Savings estimates are available from the audit procedure using the correction factor discussed earlier for the EL-ADA dwellings funded in part by IPCO. For the 60 dwellings weatherized by EL-ADA with some Idaho Power funds in 1992, an estimated 2,282 kWh was saved. Over the 20-year lifetime of the installed measures a total savings per dwelling of 45,640 kWh is estimated.

The estimated annual savings of 2,282 kWh is slightly higher than the nationwide net savings estimate for electrically heated homes, based on the National Weatherization Evaluation. It is much higher than the national estimate for mobile homes, which comprise more than half of IPCO's weatherized dwellings.

A.5.8.2 Program Costs

The per house costs for the coordinated program are lower than most low-income weatherization programs. Materials costs average $593 and labor costs average $394 per house, totaling $987 in installation costs. These low costs are probably due to the bulk purchasing system Idaho uses. This system assigns the purchasing of materials to one agency which then distributes materials to the remaining agencies.

With the inclusion of evaluation costs, the administrative costs of the coordinated program are estimated to be $552 per dwelling, which is slightly higher than the $500 national average. Table A.5.3 summarizes the energy benefits and program costs of IPCO's coordinated program.

A.5.9 STRENGTHS AND WEAKNESSES

The main strengths of this coordinated program are two-fold: (1) IPCO's utilization of the existing DOE Weatherization Program, and (2) EL-ADA's performing the calculation of IPCO's contribution. By funding the already existing weatherization program, little if any start-up costs were incurred by EL-ADA and IPCO. By having EL-ADA calculate IPCO's contribution, the extra administrative step of sending the data to the utility for calculation of funding is eliminated. This reduces paperwork and the time between when a house is audited and finally weatherized.

Ironically, the main weakness of this program is the use of the already existing weatherization program. By funding the program as is, the program is held to the rules and regulations of the existing program. Measures that may return a greater energy savings may not be available to Idaho Power under this type of arrangement. An example would be a measure that violates DOE's rule that, on average, at least 60% of installation costs must be spent on weatherization materials.

Table A.5.3 Summary Statistics for Idaho Power Company's Coordinated program

Program year:	1992
Number of program participants:	50
kWh saved per dwelling, per year:	2,282 kWh[a] (gross and net savings)
Residential rates:	4.64¢/kWh
Avoided energy costs:	1.86¢/kWh[b]
Avoided capacity:	0.74 KW[c]
Avoided capacity cost:	$30/KW/year[d]

		Sources of Funding:		
Types of Costs:		**DOE**	**IP**	**Totals**
Materials Costs:	Energy-related	$270	$320	$590
	Structural repairs	$3	0	$3
	Health and safety[e]	0	0	0
Labor:		$181	$213	$394
	Subtotal	$454	$533	$987
Administration Costs:[f]	EL-ADA	$425[g]	$75	$500
	Utility	0	$52	$52
	Subtotal	$425	$127	$552
TOTAL COSTS:		**$879**	**$660**	**$1,539**

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a Based on adjusted engineering estimates.
b Assumes avoided energy costs are 40 percent of the residential price of electricity.
c Assumes a 60 percent load factor.
d Assumes marginal unit is a combustion turbine.
e Idaho is very concerned with the health and safety of its low-income population. However, cost reporting is not separated to determine why a measure was installed (i.e. weatherization or health and safety).
f Includes evaluation costs, IPCO administration costs, and audit fee.
g This is based upon the average $500 administration cost per dwelling for all DOE–funded low-income weatherization minus the $75 fee paid by IPCO.

Table A.5.4 Strengths and Weaknesses of the Idaho Power Company's Coordinated program

Strengths	Weaknesses
Utility funds agency's preexisting weatherization program, "as is". Reduced start-up cost to the agency and utility by not having to additionally train staff or change current weatherization program structure.	Must adhere to rules and regulation of DOE's Weatherization Program.
Agency calculates utility's contribution which decreases the utility's paperwork and reduces coordination costs.	
Cosponsored evaluations have increased the program's performance while minimizing evaluation costs to each partner.	Evaluations lead to higher program costs.
Utility field staff help identify needy clients who would not have been part of the intake process if they were not LIHEAP clients.	Relies on LIHEAP rosters to select clients, which excludes many needy people.

PERSONS INTERVIEWED:

Genie Smith	Energy Conservation Coordinator, Idaho Power Company
Frank Morales	Weatherization Coordinator, EL-ADA Community Action Agency

A.6 NATIONAL FUEL GAS COMPANY'S LOW-INCOME USAGE REDUCTION PROGRAM

A.6.1 BACKGROUND

Under the Pennsylvania Public Utility Commission's (PAPUC) 1988 mandate for a statewide Low-Income Usage Reduction Program (LIURP), National Fuel Gas Distribution Corporation (NFG) began implementing a full-scale low-income weatherization program through a local agency area network. In 1989, NFG informed the PAPUC of its intention to deviate from the submitted plan[1] and began a more direct approach to the delivery of low-income weatherization. The approach NFG implemented involved a direct working relationship with the local agencies. The implementation of the PAPUC–mandated program funded by NFG and delivered through the Greater Erie Community Action Committee (GECAC) in program year 1991 is the focus of this case study.

An unusual feature of this coordinated program is the close working relationship that has developed between NFG's Erie Office and GECAC. With offices less than a block apart, the interaction between the two partners is tremendous and has resulted in clear objectives and responsibilities. In addition, the friendly atmosphere allows for frequent two-way communication, which helps spawn program improvements.

Being on the shores of Lake Erie, GECAC's service area is subject to lake–effect storms and a brutal northwestern wind. Extending from the city of Erie north along the shoreline to Buffalo, New York, the area is subject to some of the most severe winter weather in the nation. The ten-year average heating degree days, base 65 degrees Fahrenheit, for Erie, Pennsylvania, is 6,768, with cooling degree days averaging 265 per year.

A.6.1.1 The Agency

Greater Erie Community Action Committee is a nonprofit agency that provides a variety of social services to Erie and surrounding towns and rural areas. It operates a medium-sized Weatherization Assistance Program, serving approximately 345 dwellings in program year 1989,[2] up from 293 dwellings in 1986. The average number of applicants who were income-qualified and waiting for weatherization in 1989 ranged from 51 to 100. The weatherization program is one of many services delivered by GECAC to the community.

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1 The original plan that had begun operations had the utilities coordinating with one agency, which then distributed utility funds to various other agencies.

2 Source: Survey of Subgrantees, Mihlmester et al. (1992).

A.6.1.2 The Utility

National Fuel Gas Distribution Corporation is an investor–owned gas utility headquartered in Buffalo, New York, which serves Western New York State and Northwestern Pennsylvania. In fiscal year 1989, NFG purchased 144,087 million cubic feet of natural gas. In 1989, NFG serviced 691,842 customers (647,149 residential, 42,984 commercial, 1,186 industrial, and 523 transportation), totaling $855 million in annual revenue and delivered by 3,450 NFG employees. The combined population of the communities served by NFG was estimated at 2,311,082.

The Pennsylvania division of NFG serves the northwest region of the state. The LIURP program is managed by Zeke Nowicki, who is the assistant manager of Energy Management for NFG's Erie Office. Under his guidance, the program has continually changed to seek the most cost-effective low-income weatherization possible.

A.6.1.3 Housing Stock

Erie is an old community that at one point was the largest producer of freshwater fish in the nation. Many of Erie's buildings reflect this past era of dominance and the community's age. The average low-income dwelling in the area is 70 years old. This is older than the national average age of DOE-weatherized single-family dwellings, 42 years. According to the staff of GECAC, the housing stock in the area is also subject to severe moisture problems caused by proximity to Lake Erie. In combination, a harsh climate and an aging housing stock create the potential for high energy savings but with a high cost.

The community is dominated by single-family detached dwellings (75 percent), with small multifamily dwellings, some mobile homes, and duplexes accounting for the remainder. The coordinated program excludes mobile homes from participation because of the low energy savings associated with the weatherization of mobile homes. Also, the building code in the city of Erie does not allow for mobile homes as dwellings.

A.6.2 WEATHERIZATION STAFF AND TRAINING

In 1989 GECAC's weatherization staff consisted of 5.5 full-time equivalent (FTE) employees under DOE's Weatherization Assistance Program, and another 5.5 FTE employees funded by other sources. GECAC's management for the program consists of Nicholas Diplacido, administrative manager, and Sam Emanuele, who manages audits, installations, and quality control. Both come from home construction backgrounds.

In 1990, the coordinated program utilized both in-house labor and subcontracted labor for the installation of measures. A typical GECAC weatherization crew consisted of one crew chief and two workers. Subcontracted labor was utilized when GECAC's workload becomes excessive. Heating system modifications and glass work were subcontracted out to specialists, as needed.

Although no formal training was required by the utility, GECAC's weatherization staff were able to attend a training course offered by the state. NFG did provide blower door training at the start of the cooperative effort. The training was conducted by Brian Coyne, an NFG employee on staff in the Energy Management Department and who is an active organizer of the national Affordable Comfort Conference. NFG Erie's attendance at functions such as the Affordable Comfort Conference is indicative of the utility's positive attitude towards residential weatherization and low-income weatherization. The coordinated program emphasizes the use of advanced techniques, continual evaluation, and delivering a complete and comprehensive weatherization service.

A.6.3 CLIENT RECRUITMENT AND SELECTION

The recruitment and selection of clients under NFG's LIURP is designed to target clients with high potential for energy savings. The criteria are high energy consumption, high arrears, income qualification, occupancy longer than a year, and a positive payment behavior.[4] GECAC's stand–alone weatherization program utilizes a first–come first–served client intake procedure with no priority screening.[5]

The first criterion, high energy consumption, is based upon the highest absolute annual consumption. Those households served by the program normally consume more than 200 Mcf per year. Based on the National Weatherization Evaluation, those households who were consuming more than 200 Mcf before weatherization ranked in the highest consuming 15 percent of natural gas-heated dwellings served by DOE's Weatherization Program in 1989. The same population averaged energy savings of 45 Mcf (450 ccf) per dwelling per year. As will be noted later, the savings for DOE's weatherization participants consuming more than 200 Mcf closely resembles that of NFG's LIURP, supporting the claim that high energy consumption creates the potential for high savings.

The second criterion used in the selection of clients is arrears. Again, those with the high arrears are targeted over similar households with similar consumption levels. Additionally, the potential client must demonstrate consistent payments. This helps alleviate the problem of rewarding those who do not attempt to pay their bills with over $2,000 worth of free weatherization.

Nowicki felt that this system was preferable to using LIHEAP rosters, as they had previously done, because the rosters exclude many needy households. He also added that beginning in 1993, NFG field staff will be taking LIHEAP applications with them into the field. The purpose is to provide greater access to the LIHEAP program for those NFG customers for which travel is a barrier

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4 Though the household must be in arrears, NFG wishes to target those arrears customers who submit payments on a regular basis.

5 NFC tried using GECAC's waiting list of applicants for weatherization, but found that only a small percentage of the applicants were eligible for NFG's LIURP.

to participation. Referrals to the NFG's LIURP are also be made by various sources, but those clients referred are not given preferential treatment.

Of those selected by NFG for participation, 90 percent are truly eligible, with only 10 percent disqualified by income or for other reasons. Of that 90 percent, 55 to 60 percent receive weatherization. Approximately one-third are withdrawn from the program because they refuse, significant structural problems preventing weatherization, health and safety invalidation, they were planning to move, or their landlords would not sign on to the program.

A.6.4 USE OF DIAGNOSTICS

The NFG's LIURP and the agency's stand–alone program use both the WECC audit and a blower door as their primary diagnostic tools. In the stand–alone program, the WECC audit is administered using a benefit/cost guideline of 1.2, though only a 1.0 ratio is required. In the coordinated program, the WECC audit is applied to a dwelling with a benefit/cost guideline of 1.2, which allows measures such as wall insulation to be installed. The blower–door tests are used to find leaks, measure leaks, and to determine when to stop infiltration work; they are administered after insulation has been installed. NFG previously determined that much of the infiltration work was being covered over by the insulation work. They felt that this was redundant and inefficient.

A.6.5 WEATHERIZATION MEASURES

Weatherization measures installed under NFG's LIURP are dictated by the WECC audit, as dictated by the PAPUC. Overall the program delivers a wide range of measures. In 1991 GECAC began using high–density, instead of normal–density, wall insulation in their delivery of NFG's LIURP.

The most common measures installed by GECAC for NFG in 1991 are clean and tune–ups of furnaces, water–heating system measures, window air–infiltration reduction, and general air–infiltration reduction. Details of the costs are provided in Table A.6.1.

A component of NFG's LIURP is client education. The education is delivered and reinforced at the time of the audit, weatherization, and final inspection. In addition to teaching the client how to behave in an energy–conscious manner, the education component also seeks to explain the measures being installed and why they are being installed. Clients are encouraged to follow a staff member through the dwelling to view problem areas and upon installation the measures installed. At the end of each session, the client is prompted to demonstrate acquired knowledge through informal questioning. At the time of the final inspection by NFG, the client is again asked to review actions that reduce energy consumption at little or no cost to the client, such as changing filters, closing storm windows, and keeping registers clean.

Table A.6.1 Cost of Measures in 1991
(for 114 weatherized dwellings)

Measure	Percent of Dwellings Receiving Measure	Average cost per Measure when Installed
Wall insulation	38.8 %	$1227
Infiltration without a blower door	38.8 %	$347
Attic insulation	32.2 %	$401
Pre-audit with blower–door test	45.4 %	$127
Infiltration around windows	48.8 %	$100
Pre-audit without blower–door test	50.4 %	$90
Infiltration general	47.9 %	$72
Floor insulation	10.7 %	$241
Water Heating	54.5 %	$49
Major repairs	34.7 %	$44
Sill–box insulation	27.3 %	$44
Other repairs	29.8 %	$38
Infiltration with blower–door test	3.3 %	$298
Furnace duct work	18.2 %	$34
Clean and tune furnace	75.2 %	$82
Blower–door test	1.7 %	$35

A.6.6 QUALITY CONTROL

National Fuel Gas relies upon the use of multiple inspections and yearly evaluations to ensure the quality of the LIURP. GECAC is responsible for up to two inspections per dwelling, while NFG conducts one inspection.

GECAC conducts at least one inspection of each dwelling. Sometimes an additional inspection occurs, a surprise random inspection conducted during the installation process. Not all work sites receive a surprise inspection. The purpose is to review the procedures being implemented by the contractors in installing the measures and to verify the measures being installed. GECAC feels that this keeps the contractor/crew true to the contract, for the contractor never knows when Emanuele will arrive at a work site. For every inspection, GECAC conducts a post-weatherization inspection to verify that the job meets the specifications of the contract.

National Fuel Gas personnel also conduct a post-weatherization inspection to check for measures they asked to be installed, measures they were billed for, and the quality of those measures. Though this inspection may duplicate the GECAC post inspection, it helps NFG understand how its

funds are being spent. In addition, energy education reinforcement is delivered at this time. Often clients will express their opinions of the workmanship and program more openly to the utility inspector rather than GECAC or the contractor.

NFG utilizes billing data from participating households to determine the effectiveness of its program in decreasing natural gas consumption and arrears. Recently, NFG has been reviewing the possibility of using the billing data in connection with measures installed and other data to determine successes and problems in the program on a measure-specific basis.

A.6.7 BENEFITS AND COSTS

A.6.7.1 Energy Savings

As noted earlier, NFG conducts billing analyses on all dwellings in the LIURP. The analysis uses a normalization process to control for the effects of varying winter weather. In program year 1991, 71 units were served. An average first-year gross savings of 59 Mcf (590 ccf) per unit receiving full-scale weatherization was attained. The average pre-weatherization consumption was 244 Mcf with a post-weatherization consumption of 185 Mcf. The program has a 24.2 percent gross savings.

Using the control group of 1,322 gas-heated homes located in the moderate region, from the National Weatherization Evaluation, a net savings of 63.5 Mcf is estimated. This translates into a 25.8 percent net percent savings. (Since the program targets high consumers, a better comparison group would have a high level of consumption matched to the average participant in this coordinated program.) At the 1991 residential rate of $5.12/Mcf, this amounts to a first-year savings of $328. Calculated over a twenty-year period, the average NFG participant can expect to save 1,280 Mcf.

A.6.7.2 Arrearage Reduction

One of the main goals of NFG's LIURP is to reduce the level of arrears owed to the utility by program participants. This is accomplished through reducing the amount of energy consumed, which results in a lower bill to the consumer. For 1991 participants, the average amount of arrears before weatherization was $419. After weatherization, the average amount of arrears was $197, a reduction of $221 per dwelling in the first year.[6]

A.6.7.3 Program Costs

In the 1991 program year, 71 households received full-scale weatherization from NFG via GECAC, for a program cost of $145,550 or $2,050 per household.[7] Of the $2,050 per dwelling cost,

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6 Some of this reduction may be due to increased LIHEAP participation.

7 In program year 1991, NFG operated two low-income programs. Since there was some overlap in accounting and no actual difference in the delivery of the program, the two programs are combined for this report. The second program is no longer in existence.

$1,658 is paid to GECAC for intake, audit, education, and weatherization. $249 is spent on furnace replacements ($133) and furnace clean and tune-ups ($116). NFG spends an additional $15 per dwelling for the post-weatherization inspection and $15 for the client education that takes place at the time of the post-weatherization inspection. Administrative costs for the program are $128 per dwelling. Administrative costs contain an $11 per dwelling evaluation cost. These costs are summarized in Table A.6.2.

Table A.6.2 Summary of Costs and Benefits for the National Fuel Gas Coordinated Program

Program year:	1991
Number of program participants:	71[a]
ccf saved per dwelling, per year:	635 ccf (gross savings=590 ccf)
Residential rates:	$0.51/ccf ($5.12/Mcf)
Avoided energy costs:	$0.31/ccf ($3.07/Mcf)[b]
Avoided capacity:	0[c]

		Sources of Funds:		
Types of Costs:		**DOE**	**NFG**	**Totals**
Installation Costs:[d]	Weatherization	0	$1,658	$1,658
	Furnace replacement	0	$133	$133[f]
	Clean & tune-up furnace	0	$116	$116
	NFG client education	0	$15	$15
	Subtotal	**0**	**$1,922**	**$1,922**
Administration Costs:[e]	GECAC	0	0	0
	Utility	0	$113	$113
	NFG post inspection	0	$15	$15
	Subtotal	**0**	**$128**	**$128**
Total Costs:		**0**	**$2,050**	**$2,050**

a Number of program completions.
b Assumes avoided energy costs are 60 percent of residential rates.
c Assumes zero avoided capacity.
d Includes intake, audit, GECAC education, and weatherization.
e Includes evaluation costs of $11,712 for four years, divided by the number of dwellings treated in that time frame, multiplied by the number of 1991 GECAC-serviced dwellings. Start-up costs were already absorbed in previous program years.
f This average expenditure represents the replacement of six furnaces at an average expenditure of $1,574.

A.6.8 STRENGTHS AND WEAKNESSES

The main strengths of National Fuel Gas's LIURP as it is delivered by GECAC are the client selection procedures and the use of high–density wall insulation. Neither feature is found in GECAC's stand–alone program; they are most likely the main factors in the extremely high energy savings produced by the program.

Because the coordinated program is fully funded by NFG, it is not able to take advantage of possible opportunities afforded by joint DOE/utility funding. For instance, DOE funds could be used to address some of the structural repair needs of homes that can not be addressed with NFG funds. Alternatively, DOE funds could be used to install measures that fall short of NFG's benefit/cost threshold, but which meet GECAC's less rigorous requirements. These strengths and weaknesses are summarized in Table A.6.3.

Table A.6.3 Strengths And Weaknesses of the National Fuel Gas Coordinated program

STRENGTHS	WEAKNESSES
Utility staff identifies potential clients.	No coupling of NFG and DOE funds. Program could benefit from use of DOE funds for additional incidental repairs, client education, or furnace replacements.[a]
Utility selects clients that consume large amounts of natural gas and therefore offer high potential for energy savings.	
Utility benefits from agency's upstanding reputation in the low-income community.	
Agency involvement has resulted in the use of advanced diagnostics and measures.	
Cooperative environment has spawned program improvements.	
Utility conducts billing analysis of savings and arrearage reduction, which agency could not otherwise do.	

[a] During 1993, NFG and GECAC began to pool funds for furnace replacements, in some cases.

PERSONS INTERVIEWED:

Nicholas DiPlacido	Weatherization Manager, Greater Erie Community Action Committee
Sam Emanuele	Weatherization Specialist, Greater Erie Community Action Committee
Zeke Nowicki	Assistant Manager of Energy Management, National Fuel Gas, Erie, Pennsylvania

APPENDIX B

INPUT ASSUMPTIONS AND SIMULATION RESULTS:

BASE CASE AND ALTERNATIVE SCENARIOS

List of Tables

Table 1
Input Data
California Test
Hypothetical Utility

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions (Gross)	$10,000	$0	$0	$0	$0
C	Utility Incentives	$0	$0	$0	$0	$0
C	Tax Credits and Other Government	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Program Costs Paid by Participant	$5,100	$0	$0	$0	$0
U	Utility Program Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Utility Incentives	$0	$22,000	$22,000	$22,000	$22,000
U	Revenue Loss (Net)	$0	$12,500	$0	$0	$0
G	Tax Credits and Other Government	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 2
Output Data
California Test

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	10,000	5,100	8,154	45,500	8,154	33,000	8,154	33,000	8,154	33,000
Year 2	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 3	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 4	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 5	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 6	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 7	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 8	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 9	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 10	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 11	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 12	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 13	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 14	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 15	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 16	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 17	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 18	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 19	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 20	10,000	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Present Value	74,694	4,554	80,057	153,282	106,067	31,579	106,067	31,579	93,526	31,132
Net Present Value		70,140.9		(73,225.2)		74,487.8		74,487.8		62,393.7
B/C Ratio		16.403		0.522		3.359		3.359		3.004
Levelized Impact		$9,390		($7,458)		$5,726		$5,726		$5,440
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions (Gross)	$74,694	$0	$0	$0	$0
C	Utility Incentives	$0	$0	$0	$0	$0
C	Tax Credits and Other Government	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$80,057	$106,067	$106,067	$93,526
S	Positive External Benefits	$0	$0	$0	$0	$0
	TOTAL	$74,694	$80,057	$106,067	$8,154	$8,154
COSTS:						
C	Program Costs Paid by Participant	$4,554	$0	$0	$0	$0
U	Utility Program Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Utility Incentives	$0	$20,370	$21,053	$21,053	$20,755
U	Revenue Loss (Net)	$0	$122,727	$0	$0	$0
G	Tax Credits and Other Government	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0
	TOTAL	$4,554	$153,282	$31,579	$31,579	$31,132

Table 3
Input Data
California Test—Adjusted for Net Savings
Hypothetical Utility

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions (Gross)	$12,500	$0	$0	$0	$0
C	Utility Incentives	$0	$0	$0	$0	$0
C	Tax Credits and Other Government	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Program Costs Paid by Participant	$5,100	$0	$0	$0	$0
U	Utility Program Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Utility Incentives	$0	$22,000	$22,000	$22,000	$22,000
U	Revenue Loss (Net)	$0	$12,500	$0	$0	$0
G	Tax Credits and Other Government	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 4
Output Data
California Test—Adjusted for Net Savings

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	12,500	5,100	8,154	45,500	8,154	33,000	8,154	33,000	8,154	33,000
Year 2	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 3	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 4	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 5	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 6	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 7	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 8	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 9	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 10	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 11	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 12	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 13	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 14	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 15	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 16	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 17	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 18	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 19	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 20	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Present Value	93,368	4,554	80,057	153,282	106,067	31,579	106,067	31,579	93,526	31,132
Net Present Value		88,814.5		(73,225.2)		74,487.8		74,487.8		62,393.7
B/C Ratio		20.504		0.522		3.359		3.359		3.004
Levelized Impact		$11,890		($7,458)		$5,726		$5,726		$5,440
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions (Gross)	$93,368	$0	$0	$0	$0
C	Utility Incentives	$0	$0	$0	$0	$0
C	Tax Credits and Other Government	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$80,057	$106,067	$106,067	$93,526
S	Positive External Benefits	$0	$0	$0	$0	$0
	TOTAL	$93,368	$80,057	$106,067	$8,154	$8,154
COSTS:						
C	Program Costs Paid by Participant	$4,554	$0	$0	$0	$0
U	Utility Program Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Utility Incentives	$0	$20,370	$21,053	$21,053	$20,755
U	Revenue Loss (Net)	$0	$122,727	$0	$0	$0
G	Tax Credits and Other Government	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0
	TOTAL	$4,554	$153,282	$31,579	$31,579	$31,132

Table 5
Input Data
Base Case—Inclusive Test
Hypothetical Utility

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions (Gross)	$12,500	$0	$0	$0	$0
C	Utility Incentives	$0	$0	$0	$0	$0
C	Tax Credits and Other Government	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Program Costs Paid by Participant	$5,100	$0	$0	$0	$0
U	Utility Program Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Utility Incentives	$0	$22,000	$22,000	$22,000	$22,000
U	Revenue Loss (Net)	$0	$12,500	$0	$0	$0
G	Tax Credits and Other Government	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 6
Output Data
Base Case—Inclusive Test

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	12,500	5,100	8,154	45,500	8,154	33,000	8,154	33,000	8,154	33,000
Year 2	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 3	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 4	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 5	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 6	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 7	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 8	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 9	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 10	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 11	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 12	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 13	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 14	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 15	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 16	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 17	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 18	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 19	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 20	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Present Value	93,368	4,554	80,057	153,282	106,067	31,579	106,067	31,579	93,526	31,132
Net Present Value		88,814.5		(73,225.2)		74,487.8		74,487.8		62,393.7
B/C Ratio		20.504		0.522		3.359		3.359		3.004
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Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions (Gross)	$93,368	$0	$0	$0	$0
C	Utility Incentives	$0	$0	$0	$0	$0
C	Tax Credits and Other Government	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$80,057	$106,067	$106,067	$93,526
S	Positive External Benefits	$0	$0	$0	$0	$0
	TOTAL	$93,368	$80,057	$106,067	$8,154	$8,154
COSTS:						
C	Program Costs Paid by Participant	$4,554	$0	$0	$0	$0
U	Utility Program Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Utility Incentives	$0	$20,370	$21,053	$21,053	$20,755
U	Revenue Loss (Net)	$0	$122,727	$0	$0	$0
G	Tax Credits and Other Government	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0
	TOTAL	$4,554	$153,282	$31,579	$31,579	$31,132

Table 7
Input Data
Inclusive Base Case
Hypothetical Utility

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$12,500	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$5,100	$0	$0	$0	$0
U	Utility Program Outlays	$0	$11,000	$11,000	$11,000	$11,000
U	Utility Administrative Costs	$0	$22,000	$22,000	$22,000	$22,000
U	Revenue Loss	$0	$12,500	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 8
Output Data
Inclusive Base Case

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	12,500	5,100	8,154	45,500	8,154	33,000	8,154	33,000	8,154	33,000
Year 2	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 3	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 4	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 5	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 6	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 7	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 8	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 9	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 10	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 11	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 12	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 13	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 14	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 15	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 16	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 17	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 18	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 19	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 20	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Present Value	93,368	4,554	80,057	153,282	106,067	31,579	106,067	31,579	93,526	31,132
Net Present Value		88,814.5		(73,225.2)		74,487.8		74,487.8		62,393.7
B/C Ratio		20.504		0.522		3.359		3.359		3.004
Levelized Impact		$11,890		($7,458)		$5,726		$5,726		$5,440
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$93,368	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$80,057	$106,067	$106,067	$93,526
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$93,368	$80,057	$106,067	$8,154	$8,154
COSTS:						
C	Participant Costs	$4,554	$0	$0	$0	$0
U	Utility Program Outlays	$0	$10,185	$10,526	$10,526	$10,377
U	Utility Administrative Costs	$0	$20,370	$21,053	$21,053	$20,755
U	Revenue Loss	$0	$122,727	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$4,554	$153,282	$31,579	$31,579	$31,132

Table 9
Input Data
Incremental Base Case
Hypothetical Utility

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$4,167	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$2,718	$2,718	$2,718	$2,718
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$1,700	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$4,167	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 10
Output Data
Incremental Base Case

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	4,167	1,700	2,718	37,167	2,718	33,000	2,718	33,000	2,718	33,000
Year 2	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 3	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 4	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 5	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 6	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 7	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 8	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 9	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 10	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 11	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 12	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 13	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 14	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 15	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 16	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 17	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 18	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 19	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 20	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Present Value	31,125	1,518	26,686	71,468	35,356	31,579	35,356	31,579	31,175	31,132
Net Present Value		29,607.3		(44,782.1)		3,776.6		3,776.6		43.2
B/C Ratio		20.506		0.373		1.120		1.120		1.001
Levelized Impact		$3,964		($4,561)		$290		$290		$4
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$31,125	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$26,686	$35,356	$35,356	$31,175
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$31,125	$26,686	$35,356	$2,718	$2,718
COSTS:						
C	Participant Costs	$1,518	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$40,912	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$1,518	$71,468	$31,579	$31,579	$31,132

Table 11
Input Data
Inclusive Allocation of Savings
Hypothetical Utility

Note: Base case does not change.

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$12,500	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$5,100	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$12,500	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 12
Output Data
Inclusive Allocation of Savings

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	12,500	5,100	8,154	45,500	8,154	33,000	8,154	33,000	8,154	33,000
Year 2	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 3	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 4	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 5	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 6	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 7	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 8	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 9	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 10	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 11	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 12	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 13	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 14	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 15	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 16	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 17	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 18	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 19	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 20	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Present Value	93,368	4,554	80,057	153,282	106,067	31,579	106,067	31,579	93,526	31,132
Net Present Value		88,814.5		(73,225.2)		74,487.8		74,487.8		62,393.7
B/C Ratio		20.504		0.522		3.359		3.359		3.004
Levelized Impact		$11,890		($7,458)		$5,726		$5,726		$5,440
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$93,368	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$80,057	$106,067	$106,067	$93,526
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$93,368	$80,057	$106,067	$8,154	$8,154
COSTS:						
C	Participant Costs	$4,554	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$122,727	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$4,554	$153,282	$31,579	$31,579	$31,132

Table 13
Input Data
Incremental Allocation of Savings
Hypothetical Utility

Note: Base case plus utility gets higher allocation of savings

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$6,250	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$4,077	$4,077	$4,077	$4,077
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$1,700	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$6,250	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 14
Output Data
Incremental Allocation of Savings

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	6,250	1,700	4,077	39,250	4,077	33,000	4,077	33,000	4,077	33,000
Year 2	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 3	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 4	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 5	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 6	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 7	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 8	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 9	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 10	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 11	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 12	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 13	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 14	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 15	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 16	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 17	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 18	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 19	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Year 20	6,250	0	4,077	6,250	4,077	0	4,077	0	4,077	0
Present Value	46,684	1,518	40,029	91,919	53,033	31,579	53,033	31,579	46,763	31,132
Net Present Value		45,166.2		(51,890.4)		21,454.4		21,454.4		15,630.8
B/C Ratio		30.757		0.435		1.679		1.679		1.502
Levelized Impact		$6,047		($5,285)		$1,649		$1,649		$1,363
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$46,684	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$40,029	$53,033	$53,033	$46,763
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$46,684	$40,029	$53,033	$4,077	$4,077
COSTS:						
C	Participant Costs	$1,518	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$61,363	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$1,518	$91,919	$31,579	$31,579	$31,132

Table 15
Input Data
Inclusive Local Government Funding
Hypothetical Utility

Note: Base case plus government expenditures treated as costs for Ratepayer Impact Measure and Total Resource Cost tests.

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$12,500	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$5,100	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$12,500	$0	$0	$0
G	Government Program Outlays	$0	$44,000	$44,000	$0	$0
G	Government Administrative Costs	$0	$22,000	$22,000	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 16
Output Data
Inclusive Local Government Funding

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	12,500	5,100	8,154	111,500	8,154	99,000	8,154	33,000	8,154	33,000
Year 2	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 3	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 4	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 5	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 6	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 7	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 8	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 9	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 10	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 11	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 12	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 13	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 14	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 15	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 16	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 17	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 18	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 19	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 20	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Present Value	93,368	4,554	80,057	214,394	106,067	94,737	106,067	31,579	93,526	31,132
Net Present Value		88,814.5		(134,336.3)		11,329.9		74,487.8		62,393.7
B/C Ratio		20.504		0.373		1.120		3.359		3.004
Levelized Impact		$11,890		($13,682)		$871		$5,726		$5,440
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$93,368	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$80,057	$106,067	$106,067	$93,526
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$93,368	$80,057	$106,067	$8,154	$8,154
COSTS:						
C	Participant Costs	$4,554	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$122,727	$0	$0	$0
G	Government Program Outlays	$0	$40,741	$42,105	$0	$0
G	Government Administrative Costs	$0	$20,370	$21,053	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$4,554	$214,394	$94,737	$31,579	$31,132

Table 17
Input Data
Incremental Local Government Funding
Hypothetical Utility

Note: Same as base case

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$4,167	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$2,718	$2,718	$2,718	$2,718
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$1,700	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$4,167	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 18
Output Data
Incremental Local Government Funding

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	4,167	1,700	2,718	37,167	2,718	33,000	2,718	33,000	2,718	33,000
Year 2	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 3	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 4	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 5	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 6	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 7	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 8	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 9	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 10	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 11	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 12	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 13	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 14	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 15	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 16	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 17	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 18	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 19	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 20	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Present Value	31,125	1,518	26,686	71,468	35,356	31,579	35,356	31,579	31,175	31,132
Net Present Value		29,607.3		(44,782.1)		3,776.6		3,776.6		43.2
B/C Ratio		20.506		0.373		1.120		1.120		1.001
Levelized Impact		$3,964		($4,561)		$290		$290		$4
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$31,125	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$26,686	$35,356	$35,356	$31,175
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$31,125	$26,686	$35,356	$2,718	$2,718
COSTS:						
C	Participant Costs	$1,518	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$40,912	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$1,518	$71,468	$31,579	$31,579	$31,132

Table 19
Input Data
Inclusive Leveraging
Hypothetical Utility

Note: Base Case plus higher benefits and costs because of government leveraging

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$16,666	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$10,872	$10,872	$10,872	$10,872
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$6,783	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$16,666	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 20
Output Data
Inclusive Leveraging

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	16,666	6,783	10,872	49,666	10,872	33,000	10,872	33,000	10,872	33,000
Year 2	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 3	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 4	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 5	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 6	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 7	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 8	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 9	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 10	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 11	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 12	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 13	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 14	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 15	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 16	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 17	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 18	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 19	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Year 20	16,666	0	10,872	16,666	10,872	0	10,872	0	10,872	0
Present Value	124,486	6,056	106,743	194,185	141,422	31,579	141,422	31,579	124,701	31,132
Net Present Value		118,429.5		(87,441.9)		109,843.3		109,843.3		93,568.9
B/C Ratio		20.555		0.550		4.478		4.478		4.006
Levelized Impact		$15,855		($8,906)		$8,444		$8,444		$8,158
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$124,486	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$106,743	$141,422	$141,422	$124,701
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$124,486	$106,743	$141,422	$10,872	$10,872
COSTS:						
C	Participant Costs	$6,056	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$163,629	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$6,056	$194,185	$31,579	$31,579	$31,132

Table 21
Input Data
Incremental Leveraging
Hypothetical Utility

Note: Base Case plus higher benefits and costs because of government leveraging

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$8,333	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$5,436	$5,436	$5,436	$5,436
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$3,392	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$8,333	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 22
Output Data
Incremental Leveraging

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	8,333	3,392	5,436	41,333	5,436	33,000	5,436	33,000	5,436	33,000
Year 2	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 3	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 4	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 5	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 6	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 7	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 8	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 9	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 10	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 11	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 12	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 13	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 14	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 15	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 16	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 17	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 18	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 19	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Year 20	8,333	0	5,436	8,333	5,436	0	5,436	0	5,436	0
Present Value	62,243	3,029	53,371	112,370	70,711	31,579	70,711	31,579	62,350	31,132
Net Present Value		59,214.3		(58,998.7)		39,132.2		39,132.2		31,218.4
B/C Ratio		20.552		0.475		2.239		2.239		2.003
Levelized Impact		$7,928		($6,009)		$3,008		$3,008		$2,722
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$62,243	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$53,371	$70,711	$70,711	$62,350
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$62,243	$53,371	$70,711	$5,436	$5,436
COSTS:						
C	Participant Costs	$3,029	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$81,815	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$3,029	$112,370	$31,579	$31,579	$31,132

Table 23
Input Data
Inclusive Environmental Externalities
Hypothetical Utility

Note: Base Case plus environmental benefits

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$12,500	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$1,630	$0
COSTS:						
C	Participant Costs	$5,100	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$12,500	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 24
Output Data
Inclusive Environmental Externalities

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	12,500	5,100	8,154	45,500	8,154	33,000	9,784	33,000	8,154	33,000
Year 2	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 3	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 4	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 5	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 6	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 7	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 8	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 9	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 10	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 11	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 12	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 13	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 14	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 15	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 16	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 17	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 18	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 19	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Year 20	12,500	0	8,154	12,500	8,154	0	9,784	0	8,154	0
Present Value	93,368	4,554	80,057	153,282	106,067	31,579	127,270	31,579	93,526	31,132
Net Present Value		88,814.5		(73,225.2)		74,487.8		95,690.7		62,393.7
B/C Ratio		20.504		0.522		3.359		4.030		3.004
Levelized Impact		$11,890		($7,458)		$5,726		$7,356		$5,440
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$93,368	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$80,057	$106,067	$106,067	$93,526
S	Positive Externalities	$0	$0	$0	$21,203	$0
	TOTAL	$93,368	$80,057	$106,067	$9,784	$8,154
COSTS:						
C	Participant Costs	$4,554	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$122,727	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$4,554	$153,282	$31,579	$31,579	$31,132

Table 25
Input Data
Incremental Environmental Externalities
Hypothetical Utility

Note: Base Case plus environmental benefits

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$4,167	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$2,718	$2,718	$2,718	$2,718
S	Positive External Benefits	$0	$0	$0	$543	$0
COSTS:						
C	Participant Costs	$1,700	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$4,167	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 26
Output Data
Incremental Environmental Externalities

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	4,167	1,700	2,718	37,167	2,718	33,000	3,261	33,000	2,718	33,000
Year 2	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 3	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 4	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 5	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 6	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 7	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 8	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 9	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 10	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 11	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 12	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 13	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 14	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 15	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 16	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 17	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 18	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 19	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Year 20	4,167	0	2,718	4,167	2,718	0	3,261	0	2,718	0
Present Value	31,125	1,518	26,686	71,468	35,356	31,579	42,419	31,579	31,175	31,132
Net Present Value		29,607.3		(44,782.1)		3,776.6		10,839.9		43.2
B/C Ratio		20.506		0.373		1.120		1.343		1.001
Levelized Impact		$3,964		($4,561)		$290		$833		$4
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$31,125	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$26,686	$35,356	$35,356	$31,175
S	Positive Externalities	$0	$0	$0	$7,063	$0
	TOTAL	$31,125	$26,686	$35,356	$3,261	$2,718
COSTS:						
C	Participant Costs	$1,518	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$40,912	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$1,518	$71,468	$31,579	$31,579	$31,132

Table 27
Input Data
Inclusive—Includes imputed participant costs
Hypothetical Utility

Note: Base Case with customer costs

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$12,500	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$5,100	$0	$5,100	$5,100	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$12,500	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 28
Output Data
Inclusive—Includes imputed participant costs

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	12,500	5,100	8,154	45,500	8,154	38,100	8,154	38,100	8,154	33,000
Year 2	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 3	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 4	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 5	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 6	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 7	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 8	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 9	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 10	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 11	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 12	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 13	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 14	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 15	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 16	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 17	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 18	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 19	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 20	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Present Value	93,368	4,554	80,057	153,282	106,067	36,459	106,067	36,459	93,526	31,132
Net Present Value		88,814.5		(73,225.2)		69,607.4		69,607.4		62,393.7
B/C Ratio		20.504		0.522		2.909		2.909		3.004
Levelized Impact		$11,890		($7,458)		$5,351		$5,351		$5,440
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$93,368	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$80,057	$106,067	$106,067	$93,526
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$93,368	$80,057	$106,067	$8,154	$8,154
COSTS:						
C	Participant Costs	$4,554	$0	$4,880	$4,880	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$122,727	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$4,554	$153,282	$36,459	$36,459	$31,132

Table 29
Input Data
Incremental—Includes imputed participant costs
Hypothetical Utility

Note: Base Case with customer costs

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$4,167	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$2,718	$2,718	$2,718	$2,718
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$1,700	$0	$1,700	$1,700	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$4,167	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 30
Output Data
Incremental—Includes imputed participant costs

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	4,167	1,700	2,718	37,167	2,718	34,700	2,718	34,700	2,718	33,000
Year 2	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 3	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 4	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 5	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 6	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 7	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 8	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 9	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 10	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 11	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 12	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 13	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 14	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 15	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 16	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 17	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 18	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 19	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 20	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Present Value	31,125	1,518	26,686	71,468	35,356	33,206	35,356	33,206	31,175	31,132
Net Present Value		29,607.3		(44,782.1)		2,149.8		2,149.8		43.2
B/C Ratio		20.506		0.373		1.065		1.065		1.001
Levelized Impact		$3,964		($4,561)		$165		$165		$4
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$31,125	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$26,686	$35,356	$35,356	$31,175
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$31,125	$26,686	$35,356	$2,718	$2,718
COSTS:						
C	Participant Costs	$1,518	$0	$1,627	$1,627	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$40,912	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$1,518	$71,468	$33,206	$33,206	$31,132

Table 31
Input Data
Inclusive Higher Avoided Costs
Hypothetical Utility

Note: Base case plus coal in the avoided unit rather than combustion turbine

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$12,500	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$15,770	$15,770	$15,770	$15,770
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$5,100	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$12,500	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 32
Output Data
Inclusive Higher Avoided Costs

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	12,500	5,100	15,770	45,500	15,770	33,000	15,770	33,000	15,770	33,000
Year 2	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 3	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 4	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 5	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 6	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 7	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 8	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 9	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 10	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 11	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 12	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 13	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 14	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 15	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 16	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 17	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 18	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 19	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Year 20	12,500	0	15,770	12,500	15,770	0	15,770	0	15,770	0
Present Value	93,368	4,554	154,832	153,282	205,135	31,579	205,135	31,579	180,881	31,132
Net Present Value		88,814.5		1,549.8		173,556.2		173,556.2		149,748.6
B/C Ratio		20.504		1.010		6.496		6.496		5.810
Levelized Impact		$11,890		$158		$13,342		$13,342		$13,056
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$93,368	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$154,832	$205,135	$205,135	$180,881
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$93,368	$154,832	$205,135	$15,770	$15,770
COSTS:						
C	Participant Costs	$4,554	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$122,727	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$4,554	$153,282	$31,579	$31,579	$31,132

Table 33
Input Data
Incremental Higher Avoided Costs
Hypothetical Utility

Note: Base case plus coal in the avoided unit rather than combustion turbine

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$4,167	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$5,257	$5,257	$5,257	$5,257
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$1,700	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$4,167	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 34
Output Data
Incremental Higher Avoided Costs

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	4,167	1,700	5,257	37,167	5,257	33,000	5,257	33,000	5,257	33,000
Year 2	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 3	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 4	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 5	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 6	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 7	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 8	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 9	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 10	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 11	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 12	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 13	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 14	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 15	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 16	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 17	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 18	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 19	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Year 20	4,167	0	5,257	4,167	5,257	0	5,257	0	5,257	0
Present Value	31,125	1,518	51,614	71,468	68,383	31,579	68,383	31,579	60,297	31,132
Net Present Value		29,607.3		(19,853.8)		36,803.8		36,803.8		29,165.3
B/C Ratio		20.506		0.722		2.165		2.165		1.937
Levelized Impact		$3,964		($2,022)		$2,829		$2,829		$2,543
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$31,125	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$51,614	$68,383	$68,383	$60,297
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$31,125	$51,614	$68,383	$5,257	$5,257
COSTS:						
C	Participant Costs	$1,518	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$40,912	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$1,518	$71,468	$31,579	$31,579	$31,132

Table 35
Input Data
Inclusive Higher Discount Rates
Hypothetical Utility

Note: Base case with doubled discount rates

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$12,500	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$5,100	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$12,500	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 36
Output Data
Inclusive Higher Discount Rates

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	12,500	5,100	8,154	45,500	8,154	33,000	8,154	33,000	8,154	33,000
Year 2	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 3	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 4	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 5	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 6	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 7	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 8	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 9	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 10	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 11	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 12	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 13	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 14	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 15	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 16	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 17	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 18	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 19	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 20	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Present Value	51,378	4,113	48,344	102,559	74,434	30,275	74,434	30,275	60,906	29,464
Net Present Value		47,265.3		(54,215.0)		44,158.9		44,158.9		31,441.6
B/C Ratio		12.492		0.471		2.459		2.459		2.067
Levelized Impact		$11,499		($9,144)		$4,837		$4,837		$4,209
Real Discount Rate		24.00%		16.00%		9.00%		9.00%		12.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$51,378	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$48,344	$74,434	$74,434	$60,906
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$51,378	$48,344	$74,434	$8,154	$8,154
COSTS:						
C	Participant Costs	$4,113	$0	$0	$0	$0
U	Utility Program Outlays	$0	$18,966	$20,183	$20,183	$19,643
U	Utility Administrative Costs	$0	$9,483	$10,092	$10,092	$9,821
U	Revenue Loss	$0	$74,111	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$4,113	$102,559	$30,275	$30,275	$29,464

Table 37
Input Data
Incremental Higher Discount Rates
Hypothetical Utility

Note: Base case with doubled discount rates

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$4,167	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$2,718	$2,718	$2,718	$2,718
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$1,700	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$4,167	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 38
Output Data
Incremental Higher Discount Rates

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	4,167	1,700	2,718	37,167	2,718	33,000	2,718	33,000	2,718	33,000
Year 2	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 3	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 4	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 5	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 6	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 7	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 8	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 9	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 10	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 11	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 12	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 13	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 14	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 15	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 16	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 17	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 18	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 19	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 20	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Present Value	17,127	1,371	16,115	53,154	24,811	30,275	24,811	30,275	20,302	29,464
Net Present Value		15,756.5		(37,039.2)		(5,463.8)		(5,463.8)		(9,162.3)
B/C Ratio		12.493		0.303		0.820		0.820		0.689
Levelized Impact		$3,833		($6,247)		($599)		($599)		($1,227)
Real Discount Rate		24.00%		16.00%		9.00%		9.00%		12.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$17,127	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$16,115	$24,811	$24,811	$20,302
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$17,127	$16,115	$24,811	$2,718	$2,718
COSTS:						
C	Participant Costs	$1,371	$0	$0	$0	$0
U	Utility Program Outlays	$0	$18,966	$20,183	$20,183	$19,643
U	Utility Administrative Costs	$0	$9,483	$10,092	$10,092	$9,821
U	Revenue Loss	$0	$24,705	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$1,371	$53,154	$30,275	$30,275	$29,464

Table 39
Input Data
Inclusive Shorter Useful Life
Hypothetical Utility

Note: Base case with useful life of retrofits set at 10 years

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$12,500	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$5,100	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$12,500	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 40
Output Data
Inclusive Shorter Useful Life

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	12,500	5,100	8,154	45,500	8,154	33,000	8,154	33,000	8,154	33,000
Year 2	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 3	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 4	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 5	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 6	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 7	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 8	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 9	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 10	12,500	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Present Value	70,628	4,554	54,714	114,432	64,520	31,579	64,520	31,579	60,014	31,132
Net Present Value		66,074.2		(59,717.6)		32,941 4		32,941 4		28,882.1
B/C Ratio		15.510		0.478		2.043		2.043		1.928
Levelized Impact		$11,694		($8,900)		$4,163		$4,163		$3,924
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$70,628	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$54,714	$64,520	$64,520	$60,014
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$70,628	$54,714	$64,520	$8,154	$8,154
COSTS:						
C	Participant Costs	$4,554	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$83,876	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$4,554	$114,432	$31,579	$31,579	$31,132

Table 41
Input Data
Incremental Shorter Useful Life
Hypothetical Utility

Note: Base case with useful life of retrofits set at 10 years

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$4,167	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$2,718	$2,718	$2,718	$2,718
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$1,700	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$4,167	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 42
Output Data
Incremental Shorter Useful Life

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	4,167	1,700	2,718	37,167	2,718	33,000	2,718	33,000	2,718	33,000
Year 2	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 3	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 4	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 5	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 6	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 7	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 8	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 9	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 10	4,167	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Present Value	23,544	1,518	18,238	58,516	21,507	31,579	21,507	31,579	20,005	31,132
Net Present Value		22,026.6		(40,278.5)		(10,072.2)		(10,072.2)		(11,127.4)
B/C Ratio		15.512		0.312		0.681		0.681		0.643
Levelized Impact		$3,898		($6,003)		($1,273)		($1,273)		($1,512)
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$23,544	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$18,238	$21,507	$21,507	$20,005
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$23,544	$18,238	$21,507	$2,718	$2,718
COSTS:						
C	Participant Costs	$1,518	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$27,961	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$1,518	$58,516	$31,579	$31,579	$31,132

Table 43
Input Data
Inclusive Capital Benefits
Hypothetical Utility

Note: Base case but participant benefits become "stock" variables rather than "flow" variables

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$0	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$22,000	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$44,000	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$5,100	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$0	$0	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$12,500	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 44
Output Data
Inclusive Capital Benefits

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	66,000	5,100	8,154	45,500	8,154	11,000	8,154	11,000	8,154	33,000
Year 2	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 3	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 4	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 5	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 6	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 7	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 8	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 9	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 10	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 11	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 12	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 13	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 14	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 15	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 16	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 17	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 18	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 19	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Year 20	0	0	8,154	12,500	8,154	0	8,154	0	8,154	0
Present Value	58,929	4,554	80,057	153,282	106,067	10,526	106,067	10,526	93,526	31,132
Net Present Value		54,375.0		(73,225.2)		95,540.4		95,540.4		62,393.7
B/C Ratio		12.941		0.522		10.076		10.076		3.004
Levelized Impact		$7,280		($7,458)		$7,345		$7,345		$5,440
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$0	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$19,643	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$39,286	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$80,057	$106,067	$106,067	$93,526
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$58,929	$80,057	$106,067	$8,154	$8,154
COSTS:						
C	Participant Costs	$4,554	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$0	$0	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$122,727	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$4,554	$153,282	$10,526	$10,526	$31,132

Table 45
Input Data
Incremental Capital Benefits
Hypothetical Utility

Note: Base case but participant benefits become "stock" variables rather than "flow" variables

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$0	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$22,000	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$2,718	$2,718	$2,718	$2,718
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$1,700	$0	$0	$0	$0
U	Utility Program Outlays	$0	$0	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$4,167	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 46
Output Data
Incremental Capital Benefits

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	22,000	1,700	2,718	15,167	2,718	33,000	2,718	33,000	2,718	33,000
Year 2	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 3	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 4	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 5	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 6	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 7	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 8	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 9	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 10	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 11	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 12	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 13	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 14	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 15	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 16	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 17	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 18	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 19	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Year 20	0	0	2,718	4,167	2,718	0	2,718	0	2,718	0
Present Value	19,643	1,518	26,686	51,097	35,356	31,579	35,356	31,579	31,175	31,132
Net Present Value		18,125.0		(24,411.7)		3,776.6		3,776.6		43.2
B/C Ratio		12.941		0.522		1.120		1.120		1.001
Levelized Impact		$2,427		($2,486)		$290		$290		$4
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$0	$0	$0	$0	$0
C	Other Benefits from Utility Program Outlays	$19,643	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$26,686	$35,356	$35,356	$31,175
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$19,643	$26,686	$35,356	$2,718	$2,718
COSTS:						
C	Participant Costs	$1,518	$0	$0	$0	$0
U	Utility Program Outlays	$0	$0	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$40,912	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$1,518	$51,097	$31,579	$31,579	$31,132

Table 47
Input Data
Inclusive Base Case with Arrearage Reductions
Hypothetical Utility

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$12,500	$0	$0	$0	$0
U	Benefits From Arrears Reductions	$0	$1,000	$1,000	$1,000	$1,000
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$8,154	$8,154	$8,154	$8,154
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$5,100	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$12,500	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 48
Output Data
Inclusive Base Case with Arrearage Reductions

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	12,500	5,100	9,154	45,500	9,154	33,000	9,154	33,000	9,154	33,000
Year 2	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 3	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 4	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 5	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 6	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 7	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 8	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 9	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 10	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 11	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 12	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 13	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 14	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 15	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 16	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 17	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 18	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 19	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Year 20	12,500	0	9,154	12,500	9,154	0	9,154	0	9,154	0
Present Value	93,368	4,554	89,875	153,282	119,075	31,579	119,075	31,579	104,996	31,132
Net Present Value		88,814.5		(63,407.1)		87,495.7		87,495.7		73,863.6
B/C Ratio		20.504		0.586		3.771		3.771		3.373
Levelized Impact		$11,890		($6,458)		$6,726		$6,726		$6,440
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$93,368	$0	$0	$0	$0
U	Benefits From Arrears Reductions	$0	$9,818	$13,008	$13,008	$11,470
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$80,057	$106,067	$106,067	$93,526
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$93,368	$89,875	$119,075	$9,154	$9,154
COSTS:						
C	Participant Costs	$4,554	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$122,727	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$4,554	$153,282	$31,579	$31,579	$31,132

Table 49
Input Data
Incremental Base Case with Arrearage Reductions
Hypothetical Utility

	Category	Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$4,167	$0	$0	$0	$0
U	Benefits From Arrears Reductions	$0	$333	$333	$333	$333
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$2,718	$2,718	$2,718	$2,718
S	Positive External Benefits	$0	$0	$0	$0	$0
COSTS:						
C	Participant Costs	$1,700	$0	$0	$0	$0
U	Utility Program Outlays	$0	$22,000	$22,000	$22,000	$22,000
U	Utility Administrative Costs	$0	$11,000	$11,000	$11,000	$11,000
U	Revenue Loss	$0	$4,167	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative External Benefits	$0	$0	$0	$0	$0

Table 50
Output Data
Incremental Base Case with Arrearage Reductions

	Participant Test		Ratepayer Impact Measure		Total Resource Cost		Societal Test		Utility Cost Test	
	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Year 1	4,167	1,700	3,051	37,167	3,051	33,000	3,051	33,000	3,051	33,000
Year 2	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 3	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 4	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 5	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 6	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 7	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 8	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 9	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 10	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 11	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 12	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 13	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 14	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 15	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 16	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 17	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 18	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 19	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Year 20	4,167	0	3,051	4,167	3,051	0	3,051	0	3,051	0
Present Value	31,125	1,518	29,955	71,468	39,687	31,579	39,687	31,579	34,995	31,132
Net Present Value		29,607.3		(41,512.6)		8,108.3		8,108.3		3,862.7
B/C Ratio		20.506		0.419		1.257		1.257		1.124
Levelized Impact		$3,964		($4,228)		$623		$623		$337
Real Discount Rate		12.00%		8.00%		4.50%		4.50%		6.00%

Net Present Values:

Category		Participant Test	Ratepayer Impact Measure	Total Resource Cost	Societal Test	Utility Cost Test
BENEFITS:						
C	Bill Reductions	$31,125	$0	$0	$0	$0
U	Benefits From Arrears Reductions	$0	$3,269	$4,332	$4,332	$3,819
C	Other Benefits from Utility Program Outlays	$0	$0	$0	$0	$0
C	Other Benefits from Government Program Outlays	$0	$0	$0	$0	$0
U	Avoided Energy and Capacity Costs	$0	$26,686	$35,356	$35,356	$31,175
S	Positive Externalities	$0	$0	$0	$0	$0
	TOTAL	$31,125	$29,955	$39,687	$3,051	$3,051
COSTS:						
C	Participant Costs	$1,518	$0	$0	$0	$0
U	Utility Program Outlays	$0	$20,370	$21,053	$21,053	$20,755
U	Utility Administrative Costs	$0	$10,185	$10,526	$10,526	$10,377
U	Revenue Loss	$0	$40,912	$0	$0	$0
G	Government Program Outlays	$0	$0	$0	$0	$0
G	Government Administrative Costs	$0	$0	$0	$0	$0
S	Negative Externalities	$0	$0	$0	$0	$0
	TOTAL	$1,518	$71,468	$31,579	$31,579	$31,132

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