PA Consulting Group

State of Wisconsin Department of Administration Division of Energy

Focus on Energy Statewide Evaluation

Interim Benefit-Cost Analysis:
FY07 Evaluation Report

Final: February 26, 2007

Evaluation Contractor: PA Government Services Inc.

Prepared by: Miriam L. Goldberg, Chris Clark, Sander Cohan, KEMA Inc.

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1. EXECUTIVE SUMMARY

1.1 PURPOSE OF THIS REPORT

1.1.1 Initial Benefit-Cost Analysis

This report provides a benefit-cost analysis of the Wisconsin Focus on Energy Program (Focus). The report is based on evaluation findings from the first five years of program operations. The objective of this study is to provide relevant information to Wisconsin policymakers, regulators, utilities, and other stakeholders on the potential savings to be gained from current and future investments in energy efficiency and renewable energy.

As stated in the draft Vision and Mission statement by the Vision/Missions/Goals Committee:

> The mission of Focus is to develop and operate a range of sustainable energy efficiency and renewable energy programs. In partnerships with consumers, utilities, businesses, non-profit organizations and government at all levels, these programs will:
>
> - Reduce the amount of energy used per unit of production in Wisconsin while improving energy reliability.
> - Enhance economic development and make Wisconsin firms more competitive.
> - Reduce the environmental impact of energy use.
> - Expand the ability of markets to deliver energy efficient and renewable goods and services to consumers and businesses.
> - Deliver quantified financial returns on public investments in energy improvements.

The analysis presented here focuses on the value to the state of Wisconsin of energy-efficiency measures implemented as a result of Focus. This value includes savings on energy bills, associated benefits of the measures not related to energy bills, mitigation of environmental externalities, and economic impact.

This report is similar in structure and intent to a previous benefit-cost analysis completed in 2003. The analysis draws on prior Focus evaluation work to quantify in monetary terms the benefits and costs attributable to Focus.

1.1.2 Timeframe

Focus includes many long-term initiatives directed toward lasting changes in the state's energy-efficiency markets. As a result, any meaningful assessment of the benefits and costs of Focus must consider a multi-year timeframe. For this report, the analysis assumes that Focus will fund and manage these programs for 10 years beginning in 2001 (FY02). The total impact of these programs is measured for an additional 15 years after funding ends (FY26). Inputs and projections used for this analysis are based as much as possible on specific plans and evaluation findings to date.

1.2 APPROACH

1.2.1 Benefit-Cost Tests

This analysis takes a societal perspective to counting Focus benefits and costs. The "simple" BC test presented here is somewhat conservative. It counts as benefits only the avoided costs of well documented energy savings. These avoided costs include the value of avoided emissions for which active offset markets currently exist. The simple test is comparable to Total Resource Cost or Societal tests typically done in other states.

The "expanded" test used is intended to be more realistic by including a broader range of effects. However, including this broader set of effects requires using estimates that have somewhat less empirical certainty and that are not necessarily counted in other jurisdictions.

Costs in both tests are program spending, excluding incentive payments, and customer incremental costs for measures attributable to the programs.

The expanded BC test expands upon the simple test in several ways.

- Market effects are counted that are considered reasonably likely, but have not been rigorously or precisely quantified in impact analysis to date.
- Non-energy benefits (and costs) are included for all programs.
- Avoided emissions externality costs for expected future emissions offset markets are counted as a benefit.
- Benefits are valued in terms of their net impact on the economy, as determined from the economic impact analysis. The net economic impacts take into account the economic ripple effects on the Wisconsin economy of energy savings and associated non-energy and emissions effects.

1.2.2 Spending Scenarios

For this long-term analysis, conducted in the middle of the life of the program, it is necessary to establish meaningful assumptions of the levels and duration of future program spending. Two spending scenarios are considered.

- The low-funding version of the analysis assumes that spending levels will be similar to those observed in the first five program years. This version indicates the cost-effectiveness of the program as it has existed to date, but assumes a longer total program life. The low-funding scenario provides a minimum realistic benefit-cost assessment.
- The high-funding version assumes that spending rises based on the currently legislated funding levels for the remaining years. Under this scenario, we also count additional market effects that are reasonably likely under increased funding but have not been documented for the programs so far. Thus, the high-funding scenario provides a measure

of likely cost-effectiveness of the programs as they could proceed under current funding plans. [1]

1.3 KEY FINDINGS

1.3.1 Focus in Total

In terms of benefit-cost ratios, the low- and high-funding scenarios gave very similar results for Focus as a whole, as well as for the Business and Residential program areas and individual programs. We present the high-funding results as representing a more likely future path for the programs. The consistency with the low-funding results reduces possible concern that the cost-effectiveness would be overstated if future funding turns out to be less than currently planned.

Focus as a whole is projected to have positive net benefits for the state for all forms of the benefit-cost comparison conducted. For the expanded test, high-funding assumption, the projected net present value of 10 years of program operations over a 25-year horizon is a net benefit of $4.4 billion. The benefit-cost ratio for Focus as a whole is 5.3. Under the more conservative simple test, net benefits are $1.4 billion, with a benefit-cost ratio of 2.4.

1.3.2 Focus by Program Area

Figure 1-1 and Figure 1-2 shows the total projected benefits and costs of Focus to end users by program area for the simple and expanded tests, respectively. Tables 1-1 and 1-2 describe the values underlying the two figures. Both benefits and costs are expressed in terms of the net present value of the projected 25-year stream. [2]

[1] The funding levels under the High scenario are what is currently expected, but are lower than those assumed in the recent Technical Potential study conducted by the Energy Center of Wisconsin.

[2] Net present value" refers to standard financial terminology. This use is distinct from "net" in the sense of program attribution, net benefits (benefit minus cost), or net economic impacts.

Figure 1-1. Benefits and Costs by Program Area
25-Year Net Present Value ($000,000), Simple BC Test, High Funding

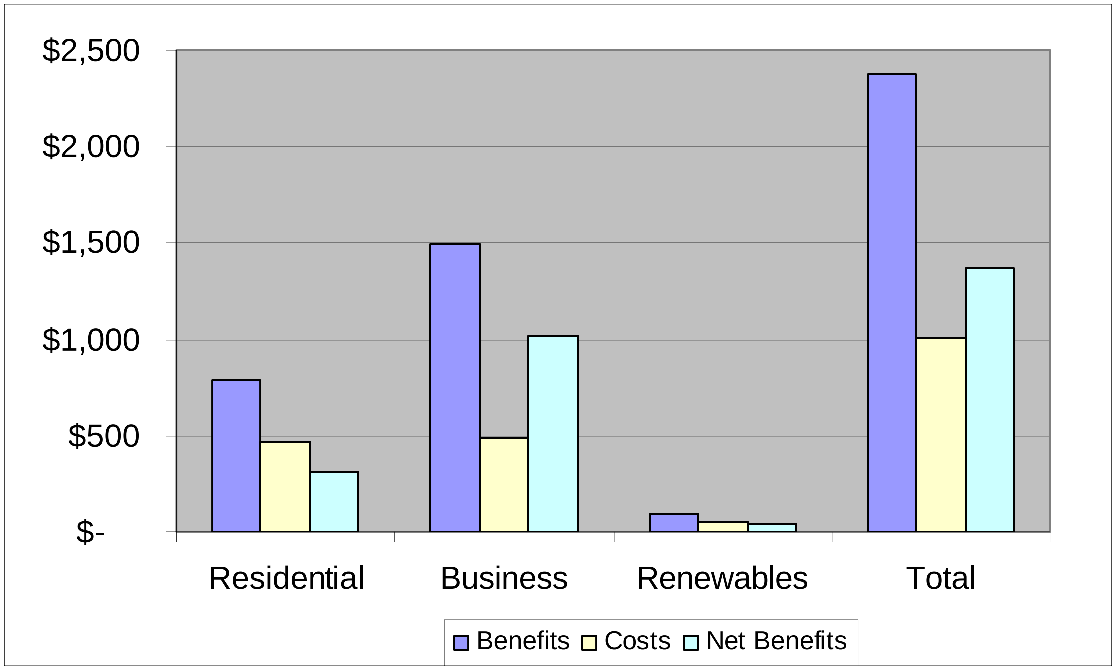

Table 1-1: Benefits and Costs by Program Area
25-Year Net Present Value ($000,000), Simple BC Test, High Funding

Program Area	Benefits	Costs	Net Benefits	BC Ratio
Residential	$785	$469	$316	1.7
Business	$1,499	$483	$1,016	3.1
Renewables	$94	$56	$38	1.7
Total	$2,377	$1,008	$1,369	2.4

Figure 1-2. Benefits and Costs by Program Area
25-Year Net Present Value ($000,000), Expanded BC Test, High Funding

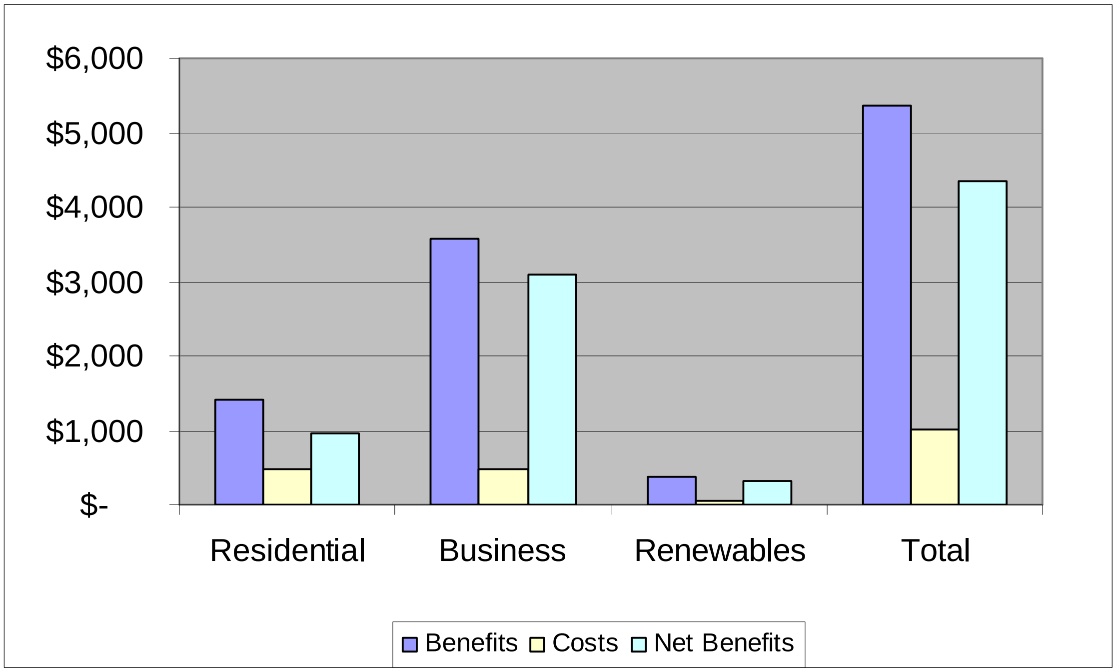

Table 1-2: Benefits and Costs by Program Area
25-Year Net Present Value ($000,000), Expanded BC Test, High Funding

Program Area	Benefits	Costs	Net Benefits	BC Ratio
Residential	$1,418	$469	$950	3.0
Business	$3,577	$483	$3,094	7.4
Renewables	$366	$56	$310	6.5
Total	$5,361	$1,008	$4,353	5.3

1.3.3 Residential Program Area

The Residential Portfolio has projected benefits substantially above the program costs. The net benefit is estimated at $0.3 billion using the simple test and $1 billion with the expanded test. The benefit-cost ratio is 1.7 using the simple test and 3.0 using the expanded test.

A large fraction of the program area achievement comes from compact fluorescent bulbs, both through direct savings tracked by the program and through market effects savings. The ENERGY STAR® Products (ESP) Program, which is dominated by the CFL effort, has the highest simple BC ratio of any of the Residential Programs.

1.3.4 Business Program Area

The Business Program area has net benefits of $1 billion and a benefit-cost ratio of 3.1 under the simple test and $3.1 billion and 7.4 under the expanded test. These BC ratios represent improvements compared to the findings from the Initial BC report. Contributors to this improvement include increased attribution levels based on the most recent impact report, some projected added market effects savings, and, for the expanded BC analysis, the inclusion of non-energy benefits. (The increased attribution stems largely from the change in attribution method for CFLs, applying the same analysis as has been used in the past for the Residential CFLs.)

All four Business Program sectors had benefit-cost ratios above 2.0 even under the simple test. The Industrial sector, which accounts for roughly half of all Business Programs documentable savings, had a simple BC ratio of 3.8.

1.3.5 Renewables Program Area

For the Renewables program, the Low scenario appears to represent a more realistic estimate of the overall BC ratio than does the High scenario. Under this scenario, the BC ratio is 1.2 using the simple test, and 3.9 using the expanded test. Thus, even under the most conservative analysis, the program is cost-effective.

The High scenario for Renewables corresponds to an optimistic assumption that program activity could increase substantially with minimal increase in administrative cost. The effect is some inflation of the BC ratios. Under this High scenario, Renewable Energy Programs have a projected net benefit of $38 million and a benefit-cost ratio of 1.7 using the simple test. Using the expanded BC test, the BC ratio is 6.5 with a net benefit of $0.3 billion.

The increase in BC ratios and net benefits under the expanded BC test compared to the simple test comes primarily from the economic multiplier effects of the program activity. The economic impact of the energy savings and associated NEBs and avoided externality is roughly 2.5 times the direct sum of these benefits.

This economic multiplier is higher than for the other program areas. This greater economic stimulus effect results from two factors:

a. High proportions of benefits go to the commercial and institutional sectors.

b. High proportions of spending for program measures going to Wisconsin businesses, based on information provided by the program administrator. The evaluation has not developed independent estimates of this spending allocation at this time.

1.4 CONTRIBUTORS TO PROGRAM BENEFITS

The value of each of the components that contributes to program benefits is indicated in Figure 1-3 and Table 1-3. The value is shown in terms of the net present value over the 25-year timeframe of the analysis.

Figure 1-3. Focus Benefit-Cost Components
Net Present Value of 25 Years of Benefits ($000,000), Expanded Test, High Funding

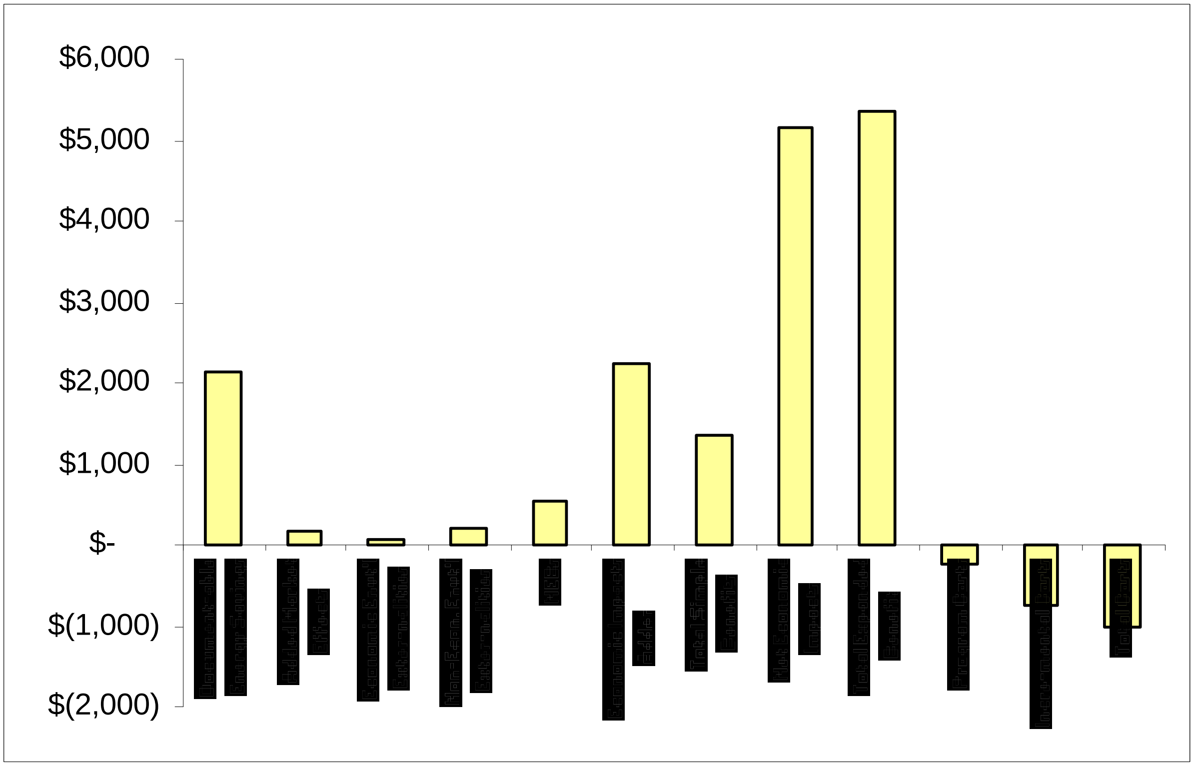

Table 1-3. Focus Benefit-Cost Components
Net Present Value of 25 Years of Benefits and Costs ($000,000), Expanded Test, High Funding

High Funding	Documentable Energy Savings	Added Market Effects	Economic Envt'l Exter-nalities	Non-Econ. Envt'l Exter-nalities	NEBs	Economic Impacts Adder	Total Simple Benefits	Net Economic Impacts	Total Expanded Benefit	Program Costs	Incre-mental Costs	Total Costs
Business	$1,373	$80	$45	$122	$399	$1,557	$1,016	$3,454	$3,577	$145	$338	$483
Residential	$658	$95	$32	$68	$106	$459	$316	$1,350	$1,418	$87	$382	$469
Renewables	$91	$–	$3	$9	$44	$219	$38	$357	$366	$14	$42	$56
Total Focus	$2,122	$175	$80	$199	$549	$2,235	$1,369	$5,162	$5,361	$246	$762	$1,008

1.4.1 Value of Avoided Energy Costs

Documentable energy savings (observed or projected net verified savings based on documented impacts) are the foundation of the Focus benefits.

Added market effects savings (reasonably likely under the higher funding levels planned but not so far demonstrated) represent an adder of about 10 percent over the documentable savings. However, in part because the majority of these savings (and associated additional incremental costs) occur late in the timeframe of this analysis, they have little effect on the overall BC ratios.

1.4.2 Customer Incremental Costs

Customer incremental costs are roughly 35 percent of the value of documentable energy savings. Thus, from the implementer's perspective, the implemented measures pay for themselves nearly three times over the life of the measures. (The simple BC ratio of 2.4 is somewhat lower than this ratio of savings value to incremental cost, because program costs are also counted in this ratio.)

Incremental costs counted in this analysis are those associated with measures attributable to the program. That is, the same kind of attribution or net-to-gross adjustment applied to the gross savings to determine net savings is applied also to the incremental costs associated with the gross savings. Incentive payments are not deducted from these costs.

1.4.3 Environmental Externalities

Externalities increase the value of every unit of documentable energy savings by around 12 percent. The value of avoided externalities has been estimated based on active and planned emissions trading markets.

1.4.4 Non-energy Benefits

Non-energy benefits add about 25 percent to documentable energy savings. Only NEBs that result in monetary flows are counted in this analysis. In contrast to the prior BC analysis, NEBs values are included for all program areas in the present work.

1.4.5 Economic Multiplier

The net economic impact of the program benefits is about 1.6 times as great as the direct sum of these benefits. That is, the economic impact adder is about 60 percent as large as the direct sum. Thus, counting the full economic impact adds substantially to the cost-effectiveness of the programs in the expanded BC test.

1.5 UNCERTAINTIES IN THIS ANALYSIS

This analysis draws on many sources of data, and develops projections for several years into the future in an environment of many unknowns. The results are therefore subject to a variety of uncertainties. Several sources of uncertainty that were present in the previous BC analysis of the Focus programs have been substantially reduced or eliminated in the present work. In particular, the following improvements have been made:

- Savings estimates in the current analysis incorporate attribution analysis that had not been completed at the time of the earlier report.
- Non-energy benefits are incorporated for all sectors in the present analysis, but were available only for the Residential program area in the previous analysis.
- Demand savings are explicitly valued rather than being absorbed in electric energy savings values.
- Explicit values are applied for mercury and carbon.
- Estimates of customer incremental costs are based on somewhat more complete data in the current report
- Market effects savings are explicitly projected for all program areas in the high scenario based on the specific activities in each program area.

Nonetheless, some uncertainties will always remain. This analysis draws on many sources of data, and develops projections for several years into the future in an environment of many unknowns.

The quality of information on end-user incremental costs is one of the most critical limitations of the analysis. Substantial analysis effort goes into determining net (program-attributable) savings for each year. This is the foundation for the determination of the benefits side of the BC tests. The customer cost side of the test is equally critical to the overall result, but does not receive a comparable level of attention, given evaluation priorities. This is an area affecting the quality of the BC results that can benefit from improved tracking and evaluation effort in the future.

2. INTRODUCTION

2.1 PURPOSE OF THIS REPORT

This report provides a benefit-cost analysis of the Wisconsin Focus on Energy Program (Focus). The report is based on evaluation findings from the first five years of program operations. The objective of this study is to provide relevant information to Wisconsin policymakers, regulators, utilities, and other stakeholders on the potential savings to be gained from current and future investments in energy efficiency and renewable energy.

As stated in the draft Vision and Mission statement by the Vision/Missions/Goals Committee:

> The mission of Focus is to develop and operate a range of sustainable energy efficiency and renewable energy programs. In partnerships with consumers, utilities, businesses, non-profit organizations and government at all levels, these programs will:
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> - Reduce the amount of energy used per unit of production in Wisconsin while improving energy reliability.
> - Enhance economic development and make Wisconsin firms more competitive.
> - Reduce the environmental impact of energy use.
> - Expand the ability of markets to deliver energy efficient and renewable goods and services to consumers and businesses.
> - Deliver quantified financial returns on public investments in energy improvements.

The analysis presented here focuses on the value to the state of Wisconsin of energy-efficiency measures implemented as a result of Focus. This value includes savings on energy bills, associated benefits of the measures not related to energy bills, mitigation of environmental externalities, and economic impact.

2.2 RELATIONSHIP TO OTHER FOCUS EVALUATION WORK

This report is similar in structure and intent to a previous benefit-cost analysis completed in 2003. The analysis draws on prior Focus evaluation work to quantify in monetary terms the benefits and costs attributable to Focus. The prior work includes:

- Determination of verified energy and demand savings attributable to the programs
- Assessment of market effects and spillover
- Assessment of non-energy benefits
- Assessment of emissions mitigation associated with energy savings.

Additional steps undertaken for the present analysis include:

- Translation of energy and demand savings into monetary values
- Translation of market effects observations into quantitative energy savings estimates
- Application of emissions factors to estimated savings

- Application of findings from the non-energy benefits work to estimate these benefits for the current programs
- Estimation of customer incremental costs
- Compilation of program spending information
- Projection of the above streams through the duration of the 25-year analysis period
- Specification and estimation of benefit-cost formulas.

In addition, an economic impact analysis is being conducted in parallel with this work using most of the same data streams.[3] A key step in the benefit-cost analysis is to incorporate products of that analysis into a benefit-cost test. The combination of these results provides an overall assessment of program costs and benefits to the state.

2.3 TIMEFRAME AND ASSUMPTIONS

The Focus program includes long-term initiatives that aim to create lasting changes in Wisconsin's energy efficiency markets. The assessment of the Program's cost and benefits, as a result, must take place over a similar timeframe. For this report, the analysis assumes that Focus will fund and manage these programs for 10 years beginning in 2001 (fiscal year 2002, denoted FY02). The total impact of these programs is measured for an additional 15 years after funding ends (FY26).

This sort of temporal analysis of programs requires projections of program spending, direct impacts, market effects of energy savings, and associated customer costs over the analysis period.

Inputs and projections used for this analysis are based as much as possible on specific plans and evaluation findings. Direct energy savings impacts and participation are projected based on spending levels and findings to date. Non-energy benefits are projected in proportion to participation levels or energy savings. Calculation of program market effects, additional energy savings due to actions taken outside Focus programs but as a result of their effect, depend upon the program and the corresponding level of information available. In all cases, the projected effects are considered to be plausible, but are more uncertain than the direct energy savings.

2.4 APPROACHES

This study includes a series of benefit-cost tests designed to calculate not only the direct benefit of Focus programs but also the benefit of programs to the economy as a whole, taking into account indirect benefits.

In all benefit-cost tests, benefits are compared with costs in terms of net benefit (the difference between benefits and costs) and in terms of the benefit-cost ratio. This report presents the results of two approaches, which we have called the "simple" and "expanded" benefit-cost (BC) tests.

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[3] *Draft Economic Development Benefits: FY07 Evaluation Report* (Focus Evaluation Team, 2006).

The “simple” BC test is somewhat conservative. It counts as benefits only the avoided costs of well documented energy savings. This test is comparable to those typically done in other states.

The “expanded” test is intended to be more realistic by including a broader range of effects beyond energy savings. However, including this broader set of effects requires using estimates that have somewhat less empirical certainty and that are not necessarily counted in other jurisdictions.

For both tests, the analysis here considers total benefits of a 10-year program rather than considering a single program year. We also consider a time frame of benefits that extends 15 years beyond the end of the program. The long-term approach is taken because the Focus programs have market transformation as part of their objectives. Lasting changes in markets is not accomplished via single-year efforts. A long-term assessment time frame is needed to balance fairly the costs and benefits of programs that require multiple years to accomplish key objectives. Moreover, analysis based on multiple program years provides more stable results less subject to fluctuation from particular program year circumstances.

Simple BC Test

The simple benefit-cost test is comparable to types of analysis conducted for other programs. The methodology combines elements of a Total Resource Cost (TRC) and Societal Test approach. The analysis calculates the total benefit of the program based on the most basic measures of benefits, the avoided energy costs attributable to the program. These avoided costs include the value of avoided emissions for which active offset markets currently exist. Avoided energy costs are determined at the utility level. Costs are the simple sum of program and customer costs. Market effects or spillover savings are counted in the attributable savings only to the extent these have been well documented by prior Focus impact evaluations.

Expanded BC Test

The expanded BC test expands upon the simple test in several ways.

- Market effects are counted that are considered reasonably likely, but have not been rigorously or precisely quantified in impact analysis to date.
- Non-energy benefits (and costs) are included for all programs.
- Avoided emissions externality costs for expected future emissions offset markets are counted as a benefit.
- Benefits are valued in terms of their total impact on the economy, as determined from the economic impact analysis.

The economic impacts take into account the economic ripple effects on the Wisconsin economy of energy savings and associated non-energy and emissions effects.

Costs

The same costs are counted in the expanded BC test as in the simple test. These costs are the program costs, excluding incentive payments, and the net incremental customer spending attributable to the program. The incremental spending is the cost of efficiency measures above the costs that would have been incurred for the baseline equipment or system. *Net* incremental costs are counted only for measures that are attributed to the program, in the same way that net savings count only these measures.

2.5 SCENARIOS AND LEVELS OF ANALYSIS

Each benefit-cost test was evaluated under two different assumptions as to future spending levels. For each assumed spending level, analysis was conducted both for each program area as a whole and for individual program area components.

2.5.1 Spending Scenarios

The perspective of this report is that a multi-year time frame of program and post-program activity is needed to capture fully the program effects. For this analysis, conducted in the middle of the life of the program, it is necessary to establish meaningful assumptions of the levels and duration of future program spending. These assumptions are central to the projected benefit and cost streams. Two spending scenarios are considered.

- The low-funding version of the analysis assumes that spending levels will be similar to those observed in the first five program years. This version indicates the cost-effectiveness of the program as it has existed to date, but assumes a longer total program life. Under the low-funding scenario, we also count only those market effects that have been rigorously documented in prior impact analysis. Higher spending levels are expected in the coming years based on current legislation. Additional market effects are also likely, but often difficult to quantify accurately. Thus, the low-funding scenario provides a conservative measure of the cost-effectiveness of the programs based on solid empirical evidence thus far. Since future funding levels, allocations of that funding, and additional market effects are all subject to some uncertainty, the low-funding scenario provides a minimum realistic benefit-cost assessment.
- The high-funding version assumes that spending rises based on the currently legislated funding levels for the remaining years. Under this scenario, we also count additional market effects that are reasonably likely but have not been rigorously documented. Thus, the high-funding scenario provides a measure of likely cost-effectiveness of the programs as they could proceed under current funding plans.

The rationale for considering a higher level of market effects under the high-funding scenario is that some of the programs are pursuing market transformation objectives, but have been constrained in this effort by budget limitations. Higher budget levels are likely to allow more dedicated pursuit of market transformation, consistent with Focus's legislative and policy objectives. Higher budget levels are also more likely to allow at least some programs to have direct effects that are large relative to the markets they are targeting – typically a prerequisite for market effects.

2.5.2 Levels of Analysis

The benefit-cost analysis was conducted for the Focus program as a whole and also separately for each program area. Program areas are:

- Business Programs
- Residential Programs

- Renewable Energy.

The expanded BC test was conducted only at these levels. The simple BC test was conducted also for individual programs within each program area.

2.6 ORGANIZATION OF THE REPORT

The cost and benefit components counted in the analysis are described in Section 3. The findings from the analysis are presented in Section 4 by program area. The benefit-cost methodology is described in detail in Section 5.

Appendix A provides details of the development of projected savings and cost streams for each program area.

Appendix B contains a memorandum describing the emissions modeling that is the basis for the externality valuation.

Appendix C provides a comparison between the present results and those from the initial benefit-cost analysis produced in 2003.

Appendix D lists the measure life assumptions used in the analysis.

Appendix E provides an exploration of the effects on the b/c ratios of different assumptions about future program effectiveness under the high scenario.

3. ELEMENTS OF COSTS AND BENEFITS

This section provides an overview of the costs and benefits included in the analysis.

3.1 COSTS

The costs counted in the analysis are:

- All spending by the program administration contractor, except for incentive payments
- Program-attributable customer incremental costs for measure implementation.

Incentive payments are not counted on the cost side; rather, they are considered a transfer payment. If the program induced a customer to implement an energy-efficiency project, this analysis counts the full incremental cost to the customer, including the portion covered by the incentives.

Incremental costs are the added cost of a measure compared to its baseline alternative. The benefit-cost analysis reflects the total customer incremental costs of measures implemented as a result of the program without deducting incentive payments to implementers for the measures.

The measure costs counted are both *net* and *incremental.* Incremental means we count only the cost above the baseline alternative. Net means we count these costs only for the fraction of measures attributable to the program.

Excluded from the cost number are costs incurred by the Department of Administration for overseeing the program. The analysis assumes that similar costs would have been incurred by regulators in the previous environment of utility program operation, so these costs would have not been exclusive to the Focus program.

In principle, non-energy costs associated with the measure implementation are also counted on the cost side. These are costs associated with the effect of the measure other than the direct costs of implementation. Examples of this type of cost include reduced productivity, lower amenity value, or increased operating costs. In practice, non-energy costs have not been identified for these programs. The non-energy benefits analysis did explore costs as well as benefits. However, either non-energy costs were not found, or these negative effects were not separately reported. Instead, the negative and positive non-energy effects were combined into a single value, which is positive for all programs. Thus, to the extent non-energy costs are included in this analysis, they appear as a reduction to the non-energy benefits.

3.2 BENEFITS

Benefits counted in this analysis are the following:

- **Documentable energy savings.** These are the energy savings from energy-efficiency measures attributable to the programs, based on the evaluation verified net savings reported in prior impact evaluations. Documentable energy savings include in-program savings, excluding free-ridership, plus spillover and market effects savings to the extent these effects have been formally documented in past impact evaluations. These energy savings are counted as benefits over the measure lifetime, or the 25 year horizon of the benefit-cost analysis, whichever is shorter. The dollar value assigned is the avoided cost to the Wisconsin utilities per kWh or therm of energy and kW of electricity demand.

- **Added market effects energy savings.** Market effects savings are the energy savings due to additional measures implemented outside of the programs by either participants or nonparticipants that would not have occurred without the program. “Added” market effects energy savings are plausible projections of additional savings that have not been rigorously documented in prior impact studies. These savings are also valued in terms of the avoided cost of the energy to the Wisconsin utilities over the measure lifetime.
- **Avoided externalities.** The avoided externalities considered in this analysis are the avoided air emissions associated with reduced electricity (kWh) and natural gas (therms) consumption. Avoided externalities are divided into two categories:
  - ***“Economic” externalities*** translate into dollar flows in the economy. These are externalities that have been “internalized” via trading markets or emissions caps. These externalities are counted in the simple b/c test as an additional avoided cost per unit of energy saved. They are also included in the economic impact model.
  - ***“Non-economic” externalities*** have values set by regulatory policy or public willingness to pay, but do not translate into flows through the economy. These externalities are not included in the economic impact model. However, they are counted in the expanded b/c test as an additional avoided cost per unit of energy saved.
- **Non-energy benefits.** Non-energy benefits are benefits to the measure implementer or in some cases the utility other than avoided energy costs associated with the measure. For use with the economic impact model, non-energy benefits (and costs) are divided into two categories:
  - ***“Economic” non-energy benefits and costs*** translate into dollar flows in the economy. Examples include reduced sick time and improved productivity. These effects are included in the economic impact model.
  - ***“Non-economic” non-energy benefits and costs*** have perceived value to implementers or other parties, but do not result in monetary flows. Examples include residents’ higher or lower satisfaction with lighting quality. These effects would not be included in the economic impact model. The present analysis does not count any non-economic non-energy effects outside the economic impact model.

The simple BC test counts as benefits only the avoided energy costs and associated avoided economic externalities associated with the energy savings (documentable and added market effects). The expanded test also counts avoided non-energy benefits (NEBs), and non-economic externalities. The total economic value of the avoided energy is determined in the expanded BC test as the output from the economic impact model. We refer to the difference between this total economic benefit and the direct sum of the benefit components as the “economic impact adder.”

3.3 USE OF "NET" VALUES

In this report, the term "net" is used in four essentially distinct ways, arising from standard terminology that applies to different components of the analysis. While these multiple uses of the same term can lead to some confusion, we use "net" in these different senses so that these analysis components will each be understandable in terms of its usual framework. Following is an explanation of the kinds of "netting" that occurs in the analysis.

1. Net as Program-Attributable

Savings valued in this analysis are the *net* savings, meaning savings attributable to the program. Net savings include all savings that are the result of program activity, i.e. that occur because of the program and would not have occurred without the program. These savings account for free ridership, free drivership, spillover, and market effects.

Incremental customer costs counted in this analysis are also net or program-attributable incremental costs in this same sense. These costs are *incremental* in the sense that they represent the difference between the cost for the high-efficiency measure and the cost that would otherwise have been paid for the base case less efficient alternative. The incremental costs counted her are *net* incremental costs meaning that the incremental costs are counted for all the program-attributable savings, and not for measures or savings that would have occurred without the program. Essentially, the same attribution factors applied to gross savings to determine net savings are applied to the (gross) incremental costs to determine the attributable (net) incremental costs used in this analysis. (Incentive payments from the program are *not* subtracted from the customer incremental costs. They are subtracted from the program costs.)

Likewise, the Non-Energy Benefits and avoided emissions valued in this analysis are those that correspond to the attributable savings. We do not apply the term "net" each time we reference these values, but they are net values in the same sense as are the savings and incremental costs.

2. Net Benefits

In the context of a benefit-cost analysis, the "net benefit" is simply the difference between the benefits and the costs counted. This "netting" is distinct from the use of "net-to-gross" or attribution factors in the determination of the benefits and costs.

3. Net Economic Impacts

The economic impacts used as a measure of overall program benefit are "net" economic impacts. That is, these impacts are the effect of the program on the economy over and above the "multiplier" effect that would result if the same money were spent without any direct productive effects.

4. Net Present Value

The value today of a stream of future payments (or costs) based on a particular discount rate is the net present value (NPV). In this analysis, we determine streams of costs and benefits over the timeframe of the analysis, and express these in terms of their net present value. Total benefits and costs are calculated in net present value terms.

In the simple test, we count on a *net* (program-attributable) basis the savings, avoided emissions, incremental costs, and NEBs.

In the expanded test, the total program benefit is the *net* economic impact (i.e. impact beyond the base effect of program spending), plus the value of avoided emissions not captured in the economic model. Inputs to the economic model that determines this impact include the same *net* (program-attributable) values of savings, avoided emissions, incremental costs, and NEBs used in the simple test.

For both tests, each benefit and cost stream over the timeframe of the analysis is translated into its *net present value,* the financial value in 2007$ of the discounted stream. *Net* benefits are the difference between total program benefit and total (societal) cost associated with the program, where both benefits and costs are expressed in NPV terms.

3.4 RELATIONSHIP OF BENEFIT-COST ANALYSIS AND ECONOMIC IMPACT ANALYSIS

This BC analysis is conducted in conjunction with an economic impact analysis, separately reported. The two analyses use the same input streams of program spending and program effects. The expanded BC test uses an output of the economic impact analysis as a measure of program benefits. (Both the simple and expanded BC tests use the same measure of costs, as described under Section 3.1.)

In the simple analysis, documentable and market effects energy savings are counted as benefits. Program costs excluding incentives and customer net (program-attributable) incremental costs are counted as costs. In the expanded analysis, NEBs are added to the list of benefits, and all benefits are valued based on the output of the economic impact model. “Non-economic” externalities are added to this benefit value. Table 3-1 indicates the relationship among these elements.

Table 3-1. Relationship of Elements in Economic Model and Simple and Expanded BC Tests

Analysis Components Included in					BC Tests	
Simple Benefit–Cost	Expanded Benefit-Cost	Economic Impact Analysis	General Category	Element	"Benefit"	"Cost"
Yes	Yes	Yes	**Direct costs and energy savings**	Program operations		+
				Documentable energy savings (avoided cost of energy)	+	
				Added market effects energy savings (avoided cost of energy)	+	
				End-user implementation costs for direct and market effects energy savings		+
				Internalized externalities (NOx, SOx)	+	
No	Yes	Yes	**Other direct effects on the state economy**	Economic non-energy benefits	+	
				Economic non-energy costs	-	
No	Yes	Yes	**Spin-off effects on the state economy**	Business sales	+	
			Dynamic effects on the state economy	Business expansion and attraction	+	
No	Yes	No	**Non-financial changes to WI households and businesses**	CO_2 and Hg emissions reductions	+	
No	No	Yes	**Transfer payment**	Program incentive payments	o	o

\+ Added to the benefit or cost

\- Subtracted from the benefit or cost

o Not included

The simple benefit-cost test incorporates all of Focus' direct energy effects on the Wisconsin economy. This test does not include the spin-off and dynamic effects that are calculated by the economic impact model. These effects, along with economic non-energy benefits and non-economic emissions effects, are included in the more comprehensive expanded benefit-cost test. As indicated, the expanded BC test counts all these effects listed.

The simple test treats incentive payments from the program to end users as a transfer cost. The total incentive amount is subtracted from program spending on the cost side of the benefit-cost test. This incentive total is counted neither as a cost nor as a benefit, since it is simply a transfer from the program to end users. Customer incremental costs are *not* reduced by the incentive amounts. (Customer incremental costs *are* adjusted for program attribution.) In the economic impact analysis, the incentive amounts are taken into account as part of the dollar flows that affect the economy. There are secondary economic effects of these flows, but the incentive amounts themselves are neither an addition to nor a flow out of the state economy.

The benefits components counted in each test and considered in the economic analysis are displayed in condensed form in Table 3-2. The simple analysis counts only the energy savings and direct costs. The expanded test counts these direct effects; other direct effects on the Wisconsin economy; the non-economic changes to state businesses and homes; and the economic "adders" that result from the economic impact model. The economic analysis described in a separate report determines the spin-off and dynamic effects on the economy that translate into economic adders. That analysis does not count the non-economic externalities and non-energy benefits. Transfer payments are not counted in either of the BC tests, but are reflected in the economic analysis.

Table 3-2. Benefits Components Included in the Simple and Expanded Tests, and in the Economic Analysis

<table>
<tr><th>Simple
Benefit-Cost Test</th><th>Expanded
Benefit-Cost Test</th><th>Economic Impact</th></tr>
<tr><td colspan="3">Direct costs and energy savings</td></tr>
<tr><td></td><td colspan="2">Other direct effects on the state economy</td></tr>
<tr><td rowspan="2"></td><td colspan="2">Spin-off effects on the state economy</td></tr>
<tr><td colspan="2">Dynamic effects on the state economy</td></tr>
<tr><td></td><td>Non-financial changes to WI households and businesses</td><td></td></tr>
<tr><td></td><td></td><td>Transfer payment</td></tr>
</table>

These elements, their relationship, and how their values were determined are discussed further in Section 5.

3.5 VALUATION FACTORS

This benefit-cost analysis pulls together information from a number of sources. The projected streams of energy savings and costs were developed based on information provided largely by program-area evaluations. To monetize benefit and cost streams and to develop associated estimates of net present value, the following additional information was required:

- The discount rate
- The energy escalation factor
- The unit avoided cost of energy
- The unit avoided cost of externalities.

The assumptions underlying each of the above valuation factors used in the benefit-cost analysis are discussed below.

Net Present Value Discount Rate: The previous study used a discount rate of 3 percent. For the present work, we use a 5 percent discount rate to calculate the present value of net benefits.

The 3 percent rate was based on the real public cost of capital (i.e., long-term bond rate net of inflation). The public cost of raising money is lower than the private cost because it is subsidized by its special tax free status and it has government backing. However, it brings an opportunity cost of forgone private sector financing. In fact, increasing public fundraising raises the real private cost of capital by further crowding the market. Thus, an argument can be made that public decision-making should be consistent with decisions using the real private cost of capital, which is typically around 5 percent. This is the (real) discount rate used in this study.

The real discount rate reflects the time value of borrowing money that is over-and-above the rate of inflation. In the context of a benefit-cost study, it is an adjustment reflecting the opportunity cost of using money that could have been used for other endeavors. The 5% real discount rate used in this study is a central value within the common range of 3% to 7% seen in studies around the country. US Office of Management and Budget recognizes 3% as the real cost of government borrowing, but recommends going up to 7% as a discount rate for federal agencies evaluating public investments and regulations[4].

The central value of 5% is most commonly used by other state agencies such as Wisconsin DOT in its program spending and prioritization efforts. Wisconsin DOT uses 5% as the real discount rate for highway investment decisions and transit investment decisions.[5] However, rates as low as 3.5% were used for a Wisconsin DOT study of pavement service life, 4% for a study of water pollution in Wisconsin, 5% for a study of landfill gas to energy programs, 5.3% for EPA's study of fuel costs, 6% for studies of forestry policies, 6.1% for EPA evaluation of medium risk investments, and 7% for the Union of Concerned Scientists evaluation of Wisconsin's Renewable Portfolio Standard and a study of revenue-neutral incentives for efficiency and environmental quality.

Energy Escalation—Over the past several years, the cost of energy in Wisconsin has escalated at a rate higher than the rate of inflation. To compensate, the analysis includes an annual energy escalator of 1.0% to account for increases in the cost of all fuels used as inputs for electricity production.

Various forecasts from organizations such as the U.S. Energy Information Administration and the Wisconsin PSC estimate energy cost escalation factors from 0.3% to 1.5% above inflation, depending upon the assumptions used. Additionally, the PSC estimates that coal costs will increase at an average annual rate of 3.05% and natural gas a 3.55%, including inflation. Assuming the rate of inflation is approximately 2.5%, a 1% escalation factor for fuels is therefore warranted.

Avoided Costs—This analysis uses utility avoided cost as the basis for valuing kWh, kW, and therm savings. This approach is a departure from the prior Focus benefit-cost analysis, which valued energy based on customer avoided cost, calculated as average customer spending per kWh and therm delivered. Valuation in terms of avoided utility or supply costs is more consistent with benefit-cost analysis conducted in other jurisdictions. Avoided cost

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[4] OMB Circular A-94, Appendix C, rev January 2007 shows the government long-term cost of borrowing to be 3%. http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html.
OMB Circular A-94, Appendix C, update memo rev January 2007 http://www.whitehouse.gov/omb/memoranda/fy2007/m07-05.pdf, and http://www.whitehouse.gov/omb/circulars/a094/a094.html

[5] The Socio-Economic Benefits of Transit in Wisconsin, Phase 2: Benefit Cost Analysis, May 2006, http://www.dot.wisconsin.gov/library/research/docs/finalreports/05-14tranbenefits-f.pdf

values used here are based on published reports and tariffs and discussions with members of the Wisconsin Public Service Commission.

- **kWh—**An avoided cost of electricity of $.56/kWh is utilized for the benefit-cost analysis. This amount is based on an estimate of $.52/kWh, increased by 8% to account for line loss. This avoided cost figure is based on the electric future market assessment for 12 months as reported in "Platt's Megawatt Daily." For comparison purposes, this amount was validated against the average marginal energy cost of $53.9 per MWh, projected in docket 6680-UR115 by Alliant Energy.

- **kW—**The cost of avoided kW has two components. The first component is the avoided cost of new generation capacity, valued at $60/kW. This calculation is derived based on a PSC buy-back rate of $50.82 plus an 18% reserve margin requirement. The second component is the avoided cost of transmission capacity, valued at $44/kW. This number is estimated by multiplying the per kWh cost of avoided transmission (from the Draft 2006 Wisconsin PSC Strategic Energy Assessment) by total kWh of electricity purchased by WI customers (from EIA State Electricity Profiles, available at http://www.eia.doe.gov/cneaf/electricity/st_profiles/e_profiles_sum.html). The resulting total annual transmission cost is divided by total peak summer demand (kW, as reported in the Draft 2006 Wisconsin PSC Strategic Energy Assessment). The resulting total value of avoided demand is $104/kW.

- **therms—**The avoided cost of natural gas also has two components. The first component is a value of $0.84/therm, an estimate of the average cost of gas per therm delivered to Wisconsin. This value is derived by looking at the costs built into longer term forward gas contracts in 2005, while also accounting for Henry Hub prices prior to Hurricane Katrina and the unusually warm winter of 2006. This amount was then adjusted further to account for differences in costs of transport within Wisconsin across customer segments. To account for transportation costs, the project team used an average of published gas transport tariffs from We Energies and Madison Gas and Electric, determining the basket of prices in accordance with the program under evaluation.

<table>
<tr><th>Sector</th><th>kW</th><th>kWh</th><th>Therms</th></tr>
<tr><td>Schools/Government</td><td rowspan="4">$104.00</td><td rowspan="4">$0.056</td><td>$0.917</td></tr>
<tr><td>Commercial/Agriculture</td><td>$0.987</td></tr>
<tr><td>Industrial</td><td>$0.878</td></tr>
<tr><td>Residential</td><td>$1.061</td></tr>
</table>

Avoided Emissions – Historical avoided emissions from Focus programs were developed from data provided by the Environmental Protection Agency (EPA). Forecast data for avoided emissions were developed based on output from a Multi-Pollutant Optimization model. This model uses yearly plant-level data on fuels, emissions rates, capacity factors, and costs along with the total system hourly load curve to estimate emissions from marginal producers. The model is described further in Emissions Factors and Allowance Prices, included as Appendix B to this report. For the 2006 analysis, factors for NOx, SOx, CO2 and Mercury were included.

- **Generation Emissions Factors**—Emissions factors for electricity generation were estimated using an approach previously developed in 2004 reported in the Focus on Energy publication, *Estimating Seasonal and Peak Environmental Emissions Factors*.

Emissions input data for these factors came from estimates of hourly emissions per hour per MWh of generation in marginal plants in the two NERC regions of Wisconsin in 2006. Marginal plants were plants that had the most change in MWh, increase or decrease, over the previous hour. For additional details, please see Appendix B.

- **Natural Gas On-Site Use Emissions**—Emissions factors for natural gas used in the analysis calculate the effect of energy efficiency on non-electric-related emissions at a customer's site. Values for this type of avoided emissions calculation were taken from the EPA's Technology Transfer Network Clearinghouse for Inventories and Emissions factors. While most factors were uniform, NOx emissions varied by size and configuration of the on-site boiler. Therefore, this type of emission required further delineation by equipment size. For NOx emissions, which are particularly sensitive to equipment size, we used the mid-range emissions factor shown in the table below.
- **Allowance Prices**—Historic and forecast allowance prices were taken from the Multi-Pollutant Optimization Model. The model, designed to evaluate environmental compliance options, explores the emissions costs and benefits of fuel choice, capital investment in pollution control equipment, allowance market purchases, and generating unit operating decisions.

Emissions factors and allowance prices utilized for Years 1, 10, and 25 of the analysis are shown used for the BC analysis are shown in Table 3-3. Resulting avoided emissions values in $/kWh and $/therm are shown in Table 3-4.

Table 3-3. Emissions Factors and Allowance Prices

	Avoided Pollutant	Generation Factors (lbs/MWh)	Natural Gas On-Site Use Factors (lbs/therm)	Year 1 Allowance Price ($/ton)	Year 10 Allowance Price ($/ton)	Year 25 Allowance Price ($/ton)
Economic	NO_x	2.1	0.0000588	915	1468	2168
	SO_x	4.6	0.009804	186	773	2133
Non-Economic	CO_2	1746	11.76	1	7	24
	Mercury	0.0000179	2.55E-08	9,000,000	41,000,000	126,000,000

Table 3-4. Value of Avoided Emissions

	Avoided Pollutant	Year 1		Year 10		Year 25	
		$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm
Economic	NO_x	$0.0010	$0.0000	$0.0015	$0.0000	$0.0023	$0.0001
	SO_x	$0.0004	$0.0009	$0.0018	$0.0038	$0.0049	$0.0105
Non-Economic	CO_2	$0.0009	$0.0059	$0.0061	$0.0412	$0.0210	$0.1411
	Mercury	$0.0001	$0.0001	$0.0004	$0.0005	$0.0011	$0.0016

3.6 COMPARISON WITH PRIOR REPORT

The analysis in this report is similar to that of the Initial Benefit-Cost report (*Initial Benefit-Cost Analysis: Final Report,* March 31, 2003.), but has some important differences. These differences, and their likely effect on the benefit-cost ratios, are detailed in Appendix C. Also presented in Appendix C is a re-calculation of the prior BC ratios using the current formula for a more meaningful comparison with the present work.

The key differences are as follows:

2. For greater consistency with benefit-cost tests conducted for other energy efficiency programs around the country, we count customer incremental costs in the denominator of the ratio rather than subtracting them from benefits in the numerator. Incentive payments are not counted on either side of the ratio. This change does not change the net benefits (total benefit minus total cost). The change also does not move the BC ratio from greater than one to less than one, or vice versa, but will bring all ratios closer to 1. That is, programs that would have BC ratio greater (less) than 1 under the old test will still have BC ratio greater (less) than 1, but not by as much.

3. The discount rate used in the current analysis is 5 percent versus 3 percent in the prior analysis. A higher discount rate tends to lower the benefit-cost ratios.

4. An energy cost escalator of 1% is used. That is, energy costs rise 1% faster than inflation.

5. The current analysis values all energy savings in terms of 2007 avoided costs, while the prior analysis used average energy prices from 2001–2002. In addition, the present analysis explicitly values avoided capacity, in kW demand at system peak hours. In the prior analysis, capacity costs were included in the average price per kWh. The overall effect of these changes is to increase the total value of saved energy, and hence to increase the BC ratios.

6. Non-energy benefits were not available for Business and Renewables Programs in the prior analysis. In the present analysis, NEBs are counted for all programs, but only in the expanded test, and only “economic” NEBs.

7. The value of avoided emissions has been reduced somewhat based on updated analysis using similar methods.

3.7 UNCERTAINTIES IN THIS ANALYSIS

This analysis draws on many sources of data, and develops projections for several years into the future in an environment of many unknowns. The results are therefore subject to a variety of uncertainties. Several sources of uncertainty that were present in the previous BC analysis of the Focus programs have been substantially reduced or eliminated in the present work. In particular, the following improvements have been made:

- Savings estimates in the current analysis incorporate attribution analysis that had not been completed at the time of the earlier report.
- Non-energy Benefits are incorporated for all sectors in the present analysis, but were available only for the Residential program area in the previous analysis.
- Demand savings are explicitly valued rather than being absorbed in electric energy savings values.
- Explicit values are applied for mercury and carbon.
- Estimates of customer incremental costs are based on somewhat more complete data in the current report
- Market effects savings are explicitly projected for all program areas in the high scenario based on the specific activities in each program area.

Nonetheless, some uncertainties will always remain. Key sources of uncertainty are summarized in the table below. Also indicated are steps that might be taken to improve on these areas in future work. The final two columns provide a subjective assessment of how much the uncertainty in this element affects the BC ratio, and how much potential there is to improve on this element in future work.

Table 3-4. Uncertainties in the BC Analysis and Potential for Improvement

Sources of Uncertainty	Issue/Treatment	Potential Improvement	Magnitude of Likely Uncertainty Contributed to BC Ratio	Ability to Improve Estimates
Future funding levels	Not a major factor in benefit–cost comparison, because projected benefits are scaled to projected spending. However, a major change in funding levels could result in added or lost economies of scale.	Modify per any new information.	L	L
Future program efficiency (savings per unit of program spending)	Future assumed similar to historical	Limited concrete information is available as a basis for modifying assumptions	M	L
Future energy savings	Scaled early results or near-term projections to future years based on assumed funding levels.	Modify for any known changes in program emphasis.	M	L
Future incentive payments	Scaled early results or near-term projections to future years based on assumed funding levels and any available information from the program on how it would	Modify for any known changes in program emphasis.	M	L
End-user incremental costs	Often not tracked. Used combination of program tracking data and survey data	Collect and review incremental costs in program tracking and as part of impact evaluations.	H	M
Historic energy savings	Savings values are always subject to estimation error. Used documented values from prior Focus evaluation work.	None	L	L
Market effects	Limited documented effects to date. Used less solidly documented projections for the High Scenario.	Revise as more program history is developed.	M	L
Measure life and decay rate	Measure life by program/technology is based on available literature or DoA assumption. Projections assume exponential decay with the assumed measure life as the average lifetime.	Revise as further information becomes available	M	M
Non-energy benefits	Estimates included for all sectors.	Improve estimates where possible	M	L
Avoided Costs of Energy	Based on recent tariff filings and market data. Electric costs not specific to sector or measures	Develop electric avoided costs that vary according to the time of day of measure	H	M
Externality values	Used trading credits for SOx and NOx and projected market values for CO2 and Hg	Refine market analysis as possible.	M	L

L	Low
M	Medium
H	High

Future funding levels, program efficiency, savings levels, and incentive payments will of course be better known once that time has arrived. The "ability to improve" is rated low because there is relatively little that can be done to improve these estimates at the time they are needed.

Focus has done little work on measure life and decay rates. Since measure survival is likely to be similar in different areas, adopting values from other sources is a reasonable approach, and likely to remain the most cost-effective for most measures in the program. Primary research by Focus evaluation on measure life for components accounting for large fractions of overall savings may be warranted.

Avoided energy costs are a key to determining the value of saved energy. Estimates of these costs may improve as the wholesale market develops. Some of the uncertainties that will remain in the assigned costs will have to do with analytic judgment. Developing measure-specific avoided costs could be an important improvement. These costs would be based on the measure impact shape (the fraction of electric savings that occur at different time periods) together with hourly market prices.

As the table indicates, the quality of information on end-user incremental costs is one of the most critical limitations of the benefit-cost analysis. Tracking data on customer costs are typically of inconsistent quality, and typically indicate only total costs, not incremental cost relative to a baseline. Detailed incremental measure cost data are challenging to obtain in market studies.

Substantial analysis effort goes into determining net (program-attributable) savings for each year. This is the foundation for the determination of the benefits side of the BC tests. The customer cost side of the test is equally critical to the overall benefit-cost result, but does not receive a comparable level of attention. Given the needs and priorities for evaluation resources, it is not necessary that both “sides” of the cost-effectiveness analysis receive equal emphasis. However, improvements to critical elements for this analysis will be considered in future evaluation planning.

4. FINDINGS

4.1 GENERAL

For each Focus on Energy program area, we performed a series of simple and expanded benefit-cost tests. A simple and expanded benefit-cost test was performed for each program area as a whole. In addition, the simple benefit-cost test was performed for individual programs or major components within each program area. These results are described by program area in the following sections.

4.1.1 Program Benefits

For each program and program area, the benefits for all programs are shown for Years 1, 10, and 25. Respectively, these are the first year of the program, (assumed) final year of the program, and the point 15 years after the assumed program close.

The benefits for each year are the total effects of all measures implemented as a result of the program up through that year. Thus, the documentable energy savings for Year 1 would be the annual energy savings due to measures implemented through the programs and attributable to them (first-year net savings). The documentable savings shown for Year 10 are the net (i.e. program-attributable) annual energy savings due to all measures implemented through the program in Years 1 through 10 and persisting until Year 10. The documentable savings shown for Year 25 are the net annual energy savings due to measures implemented in Years 1 through 10, adjusted for persistence over the average measure life of the installed measures. For example, if the average measure life is 20 years, some measures will last longer, so that there are still savings in year 25 from measures installed under the program 15 or more years previously.

Market effects in Year 10 are the total annual savings of all measures implemented due to the program, but outside of it, in Years 1 through 10. Market effects in Year 25 include the total annual savings of all measures implemented due to the program, but outside of it, in Years 1 through 25, adjusted for persistence over the average measure life. As in the case of direct savings, there are still market effects savings in Year 25 from measures installed 15 or more years earlier. Thus, program activity in Years 1 through 10 contributes to market effects savings in Year 25, both through the persistence of market effects implementation that occurred during the program years, and potentially, through lasting market effects that led to implementation in the post-program years.

Under the simple benefit-cost test, only the avoided supply costs of documentable savings impacts and added market effects are counted as benefits. For the expanded benefit-cost test, avoided environmental externalities (in the form of air emissions) that do not directly affect supply costs and NEBs are also counted as benefits. In addition for the expanded test, the total value benefit of energy savings, “economic” avoided emissions, and NEBs is determined as the output of an economic impact model with these streams as inputs.

4.1.2 Program Costs

For each program and program area, the costs for all programs are shown for Years 1, 10, and 25. Respectively, these are the first year of the program, (assumed) final year of the program, and the point 15 years after the assumed program close. For years after the program close, there is no program spending. The only cost in these later years are net (attributable) customer incremental costs associated with measures implemented in those years as a result of continuing market effects. All costs are shown under a low-funding and high-funding scenario, as previously discussed.

The same costs are utilized for both the simple and expanded tests. These include the program costs (excluding incentive payments) as well as the net incremental costs to the customer.

4.2 RESIDENTIAL PROGRAMS

This section discusses the benefit-cost results associated with the Residential Programs. The Residential Program portfolio covers six individual programs:

- ENERGY STAR Products Program (ESP)
- Efficient Heating and Cooling Initiative (EHCI)
- Wisconsin ENERGY STAR Homes Program (WESH)
- Home Performance with ENERGY STAR (HPWES)
- Targeted Home Performance with ENERGY STAR Program (THPWES)
- Apartment and Condominium Efficiency Services Program (ACES).

For the Residential Programs, net savings calculated and reported by evaluators include direct savings tracked by the program, spillover effects, and market effects savings. These components are not separately estimated. The documentable energy savings includes all these components. Added market effects under the low-funding scenario are plausible post-program market effects of CFLs.

Documentable savings for both scenarios are projected by scaling the historical savings levels by the projected future funding levels. Added market effects savings take a middle road between conservative and aggressive estimates.

The small size of the programs relative to the markets they serve and the relative unknowns of the residential market introduce a level of uncertainty to the estimates of savings. Savings estimates were developed on a program-by-program basis based on the project team's general knowledge of program activity, markets in which they operate, and other market intelligence gathered from a variety of industry and national sources.

As of the time the Residential Programs projections were developed, The Programs had done little planning for a situation whereby they would receive increased funding; it was unclear which programs would receive the most benefit from the high-funding scenario. This analysis assumes that extra budget would be used to expand the market reach of relatively small programs that have potential for expansion. As a result, the emphasis of the added infusion of cash is weighted towards programs that are better understood, have been evaluated over a five-year period, and have significant room for expansion. Market considerations for individual programs are presented with the results below. Further details on the development of projected benefits and costs are given in Appendix A.

4.2.1 Simple Test–Portfolio Level Results

On the Portfolio-level simple test, the low- and high-funding scenarios yield similar benefit-cost ratios. As shown in Table 4-1, both programs yield an overall benefit-cost ratio of 1.7. Added market effects are small compared to documentable savings, but are proportionately larger under the high scenario.

The differences in savings and cost levels between the two funding scenarios can be seen by comparing Figure 4-1 and Figure 4-2. The high-funding scenario has somewhat higher documentable savings in the last five program years and much higher added market effects savings in the post-program years compared to the low-funding scenario. There are also higher program and customer incremental costs associated with these higher savings levels. The result is an increase in net benefits for the high scenario compared to the low, with minimal effect on the overall benefit-cost ratio.

Table 4-1. Residential Programs Benefit-Cost Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$2.3	$0.0	$0.0	$8.0	$10.4	$2.3	$18.4		
	10	2011	$50.0	$0.0	$1.8	$5.4	$23.7	$51.8	$29.1		
	25	2026	$22.1	$12.9	$2.0	$0.0	$3.7	$37.0	$3.7		
	NPV Years 1 through 25		$575.7	$60.8	$26.4	$77.3	$319.1	$663.0	$396.5	$266.5	1.7
High	1	2002	$2.3	$0.0	$0.0	$8.0	$10.4	$2.3	$18.4		
	10	2011	$60.7	$0.0	$2.2	$8.5	$37.3	$62.9	$45.8		
	25	2026	$26.5	$20.2	$2.7	$0.0	$5.8	$49.4	$5.8		
	NPV Years 1 through 25		$657.8	$94.9	$32.0	$86.8	$381.8	$784.7	$468.6	$316.1	1.7

*All dollars are in 2007$; Program costs are exclusive of incentives

Figure 4-1. Results of Simple B/C Analysis for Residential Programs (000,000)

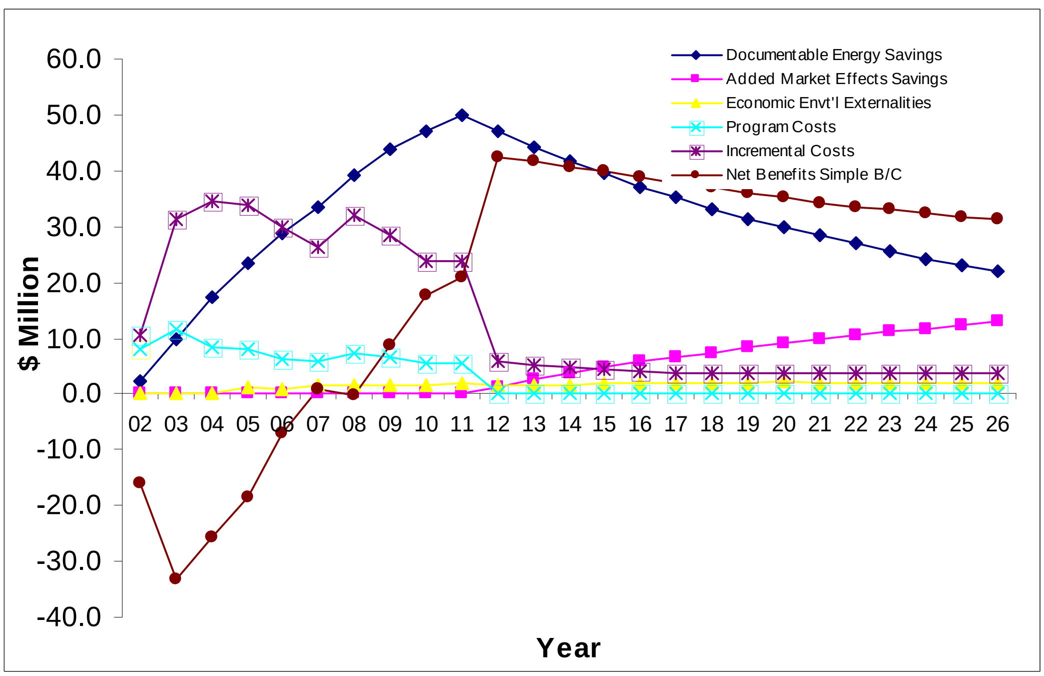
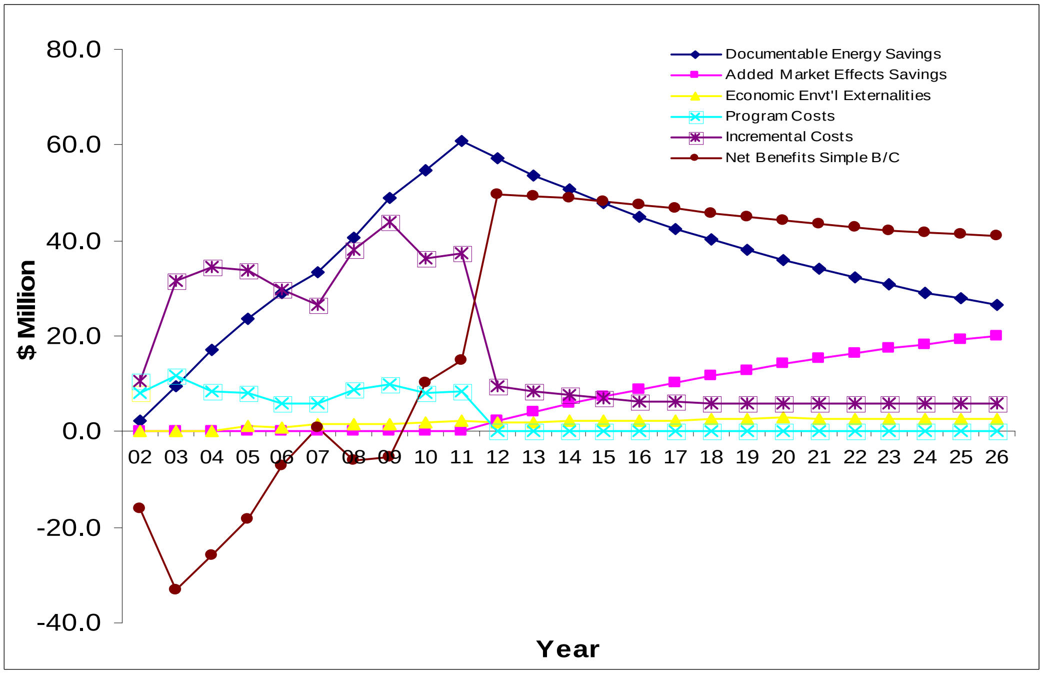


Figure 4-2. Residential Benefit-Cost Components by Year, High Funding, Simple Test



4.2.2 Expanded Benefit-Cost Test–Residential Portfolio

Benefit-cost results for the Residential Program using the expanded benefit-cost test take into account the total effects on the state economy resulting from the Program, as measured by the economic impact analysis.

Table 4-2 shows the inputs to the economic impact model, as well as the results of the economic impact analysis for the Residential Program.

Table 4-2. Residential Programs Benefits and Economic Impact for Expanded Test ($000,000)

			Energy Savings					
Funding Scenario	Year	FY	Documentable	Added Market Effects Savings	Economic Envt'l Externalities	NEBs	Economic Impacts	Economic Impacts Adder
Low	1	2002	$2.3	$0.0	$0.0	$2.2	$6.0	$1.5
	10	2011	$50.0	$0.0	$1.8	$6.6	$81.4	$23.0
	25	2026	$22.1	$12.9	$2.0	$2.2	$81.3	$42.1
	NPV Years 1 through 25		$575.7	$60.8	$26.4	$88.3	$1,148.9	$397.6
High	1	2002	$2.3	$0.0	$0.0	$2.2	$6.0	$1.5
	10	2011	$60.7	$0.0	$2.2	$9.2	$98.5	$26.4
	25	2026	$26.5	$20.2	$2.7	$3.1	$104.6	$52.1
	NPV Years 1 through 25		$657.8	$94.9	$32.0	$106.2	$1,350.1	$459.2

*All dollars are in 2007$

For both the low and high scenarios, the net economic impact of the benefits streams is about 50 percent greater than the direct sum of these benefits. Put another way, the economic impact adder, which is the difference between the total impact and this sum, is about 50 percent as large as the direct sum. The economic multiplier is around 1.5.

Results of the expanded benefit-cost test for the Residential Program are shown in Table 4-3 below. As for the simple test, the BC ratio for the expanded test is similar for the low and high scenarios. However, the ratios are larger in the expanded test, 3.0 in both cases. The majority of this increase compared to the simple test comes from the economic impact adder. A portion also comes from the inclusion of Environmental Externalities and NEBs, which add about 10 percent to the value of the saved energy. The economic impact adder is also increased by the inclusion of these additional benefits.

Table 4-3. Residential Benefit-Cost Components, Low Funding, Expanded Test

Funding Scenario	Year	FY	Benefit Components: Economic Impacts	Benefit Components: Non-Econ. Envt'l Externalities	Cost Components: Program Costs	Cost Components: Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$6.0	$0.0	$8.0	$10.4	$6.0	$18.4		
	10	2011	$81.4	$3.2	$5.4	$23.7	$84.6	$29.1		
	25	2026	$81.3	$7.3	$0.0	$3.7	$88.6	$3.7		
	NPV Years 1 through 25		$1,148.9	$53.4	$77.3	$319.1	$1,202.2	$396.5	$805.8	3.0
High	1	2002	$6.0	$0.0	$8.0	$10.4	$6.0	$18.4		
	10	2011	$98.5	$3.9	$8.5	$37.3	$102.4	$45.8		
	25	2026	$104.6	$9.9	$0.0	$5.8	$114.5	$5.8		
	NPV Years 1 through 25		$1,350.1	$68.3	$86.8	$381.8	$1,418.4	$468.6	$949.8	3.0

*All dollars are in 2007$; Program costs are exclusive of incentives

Figure 4-3 and Figure 4-4 show the annual benefit and cost streams that drive the benefit-cost calculation for the low- and high-funding scenarios, respectively. In the post-program years, the net economic impact is very close to the net benefit level. (As discussed in Section 3.3, “net” is used in two different senses here.) The net benefit is the economic impact plus non-economic avoided externality, minus program spending and attributable customer incremental costs. In the post-program years, program spending is 0 and customer incremental costs are small. The non-economic avoided externality is small compared to total benefits in all years. Non-energy benefits and avoided externalities are multipliers of the sum of documentable and added market effect savings; their shape is similar to that of the documentable savings, but at a smaller level. Other components displayed in the figure are the same as in Figure 4-1 and Figure 4-2 above.

Figure 4-3. Residential Benefit-Cost Components, Low Funding, Expanded Test.

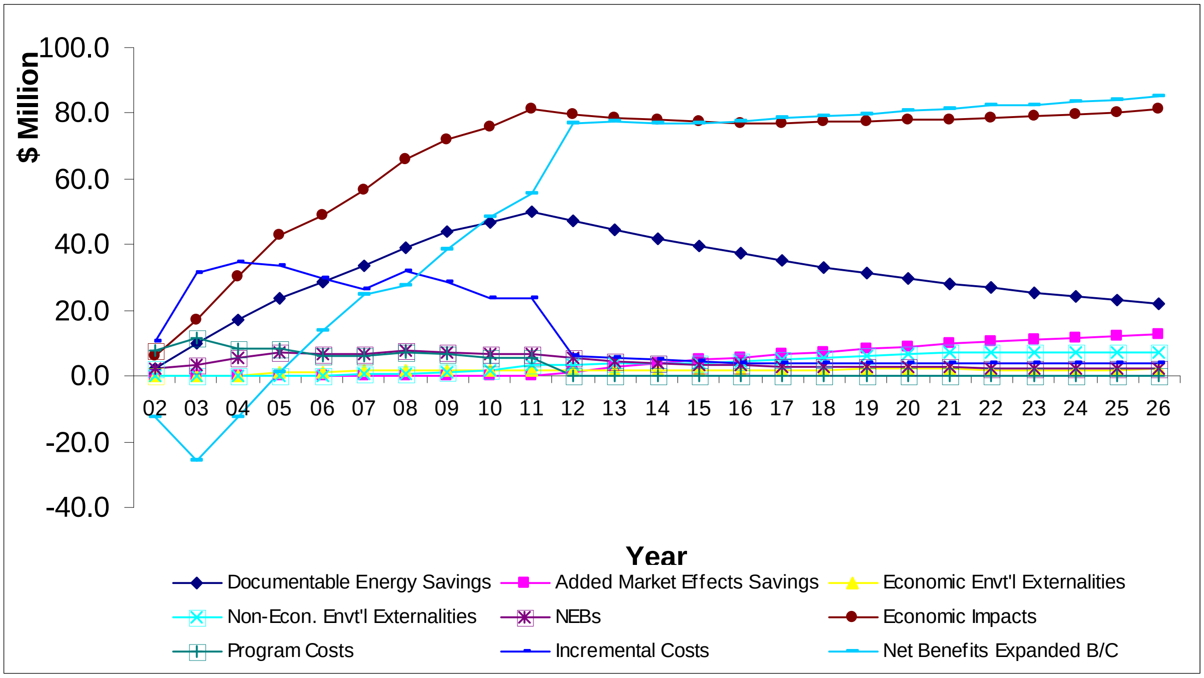
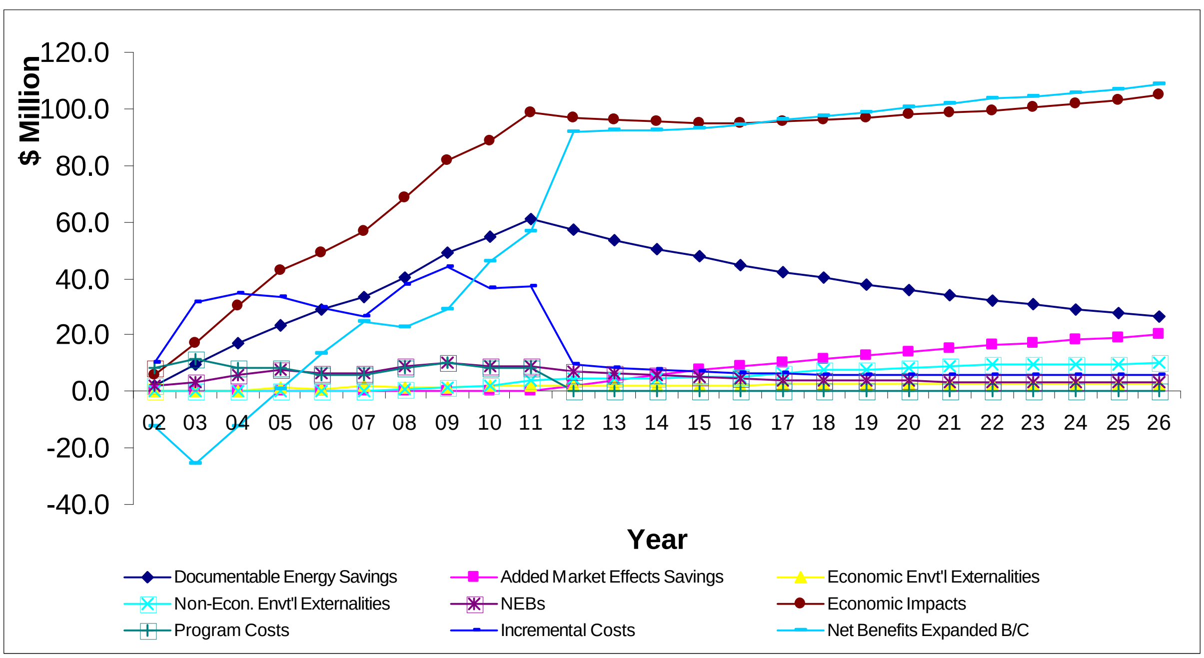


Figure 4-4. Residential Benefit-Cost Components, High Funding, Expanded Test



From the perspective of overall net economic impact, the Residential Program experiences positive net benefits when considered over the 25-year benefit-cost timeframe. Supporting the positive net benefits in both Low and High funding scenarios are documentable energy savings, which are augmented by market effects and economic adders. With higher funding comes greater energy savings, more market effects, more customer incremental costs, and greater ripple effects on the state economy.

4.2.3 Simple Test–Individual Program Results

The results of the simple BC test for individual programs (Table 4-4) show that the ENERGY STAR® Products Program is the greatest contributor to portfolio net benefits and has the highest benefit-cost ratio of the Residential Programs. Benefit-cost ratios are 2.6 and 2.7 for the Low and High Scenarios. The Home Performance with ENERGY STAR Program (HPWES), Efficient Heating and Cooling Initiative (EHCI) and Apartment and Condominium Efficiency Services Program (ACES) also achieve positive net benefits over the 25-year timeframe under consideration, with simple benefit-cost ratios between 1.4 and 1.7.

WESH and THPWES do not achieve positive net benefits in either scenario. Previous evaluation reports have shown no electric savings and low gas savings for the WESH program. The program manager is working on strategies to improve the energy savings. The Targeted Home Performance Program (THPWES) is essentially a low-income program. This type of program is not necessarily expected to have a benefit-cost ratio above 1.0 based on avoided energy and associated emissions costs value alone, as is the basis in the simple test.

Table 4-4. Portfolio Simple Test Results by Program

	Low Funding					
25 Year NPV ($Millions)	**ESP**	**HPWES**	**WESH**	**EHCI**	**ACES**	**THPWES**
Documentable Savings	262.2	99.3	24.8	71.7	102.7	14.9
Market Effects	40.0	6.5	4.2	5.7	4.4	0.0
Externalities	18.5	1.9	0.3	2.5	2.9	0.2
Program Costs	25.7	12.2	19.8	1.7	16.8	1.1
Incremental Costs	95.6	58.7	45.0	56.2	47.5	16.3
Net Benefit	199.5	36.9	-35.5	22.0	45.7	-2.2
Benefit/Cost Ratio	2.6	1.5	0.5	1.4	1.7	0.9

	High Funding					
25 Year NPV ($Millions)	**ESP**	**HPWES**	**WESH**	**EHCI**	**ACES**	**THPWES**
Documentable Savings	302.4	106.2	27.8	89.7	114.7	17.1
Market Effects	62.1	10.3	6.6	9.0	6.9	0.0
Externalities	22.8	2.0	0.4	3.2	3.3	0.3
Program Costs	29.3	13.5	22.0	2.2	18.5	1.3
Incremental Costs	114.9	64.6	56.8	72.8	53.5	19.2
Net Benefit	243.1	40.3	-44.1	27.0	53.0	-3.2
Benefit/Cost Ratio	2.7	1.5	0.4	1.4	1.7	0.8

A. ENERGY STAR PRODUCTS PROGRAM (ESP)

The ESP Program encompasses support for four separate technology categories: compact fluorescent lighting (CFL), clothes washers, other (non-CFL) lighting, and other appliances.

As shown in Table 4-5, the high funding scenario achieves a benefit-cost ratio of 2.7, while the low funding scenario achieves a ratio of 2.6. In the high-funding scenario, the increase in net benefit is driven more by expansions in the market for compact florescent lighting and clothes washers. However, this increase is balanced by higher program costs. While net benefit increases, so do both program and customer incremental costs.

Forecasts for CFL market growth include a prediction that sales are on the cusp of a national growth surge. Driving this assumption is news of partnerships between major manufacturers and retailers, such as the recent agreement between Wal-Mart and General Electric. While Wal-Mart is not currently a Focus partner, an expansion of budget presumes that efforts would be made to include them and other major vendors in future broad-scale initiatives.

ENERGY STAR clothes washers are seen by retailers and manufacturers as a premium product. In addition to rebates, this perception drives their growth in the residential sector and their subsequent energy savings. Their success in the market, by year 10, might be such that retailers will continue to sell ENERGY STAR clothes washers after the program has ended. A limiting factor on benefits achieved through the marketing of ENERGY STAR clothes washers is the possibility that the recent change in energy star standards on January 1, 2007, alters the Wisconsin program's ability to achieve impacts beyond what is being realized in the rest of the US (or a suitable control area). The appeal of an Energy Star model may erode given that other models which save significance amounts of energy (and which used to qualify as ENERGY STAR) are still available.

Table 4-5. ESP Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$1.0	$0.0	$0.0	$2.1	$3.9	$1.0	$6.0		
	10	2011	$24.7	$0.0	$1.3	$2.0	$7.0	$26.0	$9.0		
	25	2026	$7.0	$8.2	$1.4	$0.0	$1.2	$16.6	$1.2		
	NPV Years 1 through 25		$262.2	$40.0	$18.5	$25.7	$95.6	$320.8	$121.3	$199.5	2.6
High	1	2002	$1.0	$0.0	$0.0	$2.1	$3.9	$1.0	$6.0		
	10	2011	$30.6	$0.0	$1.6	$3.2	$11.0	$32.1	$14.2		
	25	2026	$8.6	$12.7	$1.9	$0.0	$1.9	$23.2	$1.9		
	NPV Years 1 through 25		$302.4	$62.1	$22.8	$29.3	$114.9	$387.3	$144.2	$243.1	2.7

*All dollars are in 2007$; Program costs are exclusive of incentives

B. HOME PERFORMANCE WITH ENERGY STAR (HPWES)

The HPWES program provides support for home performance consultants. The program achieves a benefit-cost ratio of 1.5 under both the Low and High As seen in Table 4-6, documentable energy savings drive overall benefit. Greater program budget under the high scenario leads primarily to increases in these savings in addition to an approximately fourfold increase in added market effects. The program achieves a benefit-cost ratio of 1.5 under both scenarios.

In developing the projections there is an understanding that home performance consultants, to some degree, rely upon program advertising to generate leads. Similarly, these consultants rely upon program incentives to subsidize the cost of an inspection and to help them convince customers to take recommended energy-efficiency actions. That noted, however, there are indications that savings attributable to the program will continue beyond the program life. Customers are currently paying about two-thirds of the cost of an inspection, which indicates a willingness to pay for the service. Consultants, additionally, have acquired a valuable skill set, which will carry forward after the program ends. Finally. given., given changes in price and interests in climate change, there is potential for accelerated interests, though as yet uncertain. The program is also looking at additional niches from which to expand, including the DIY market.

Table 4-6. HPWES Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.6	$0.0	$0.0	$1.6	$3.7	$0.6	$5.3		
	10	2011	$6.9	$0.0	$0.1	$0.8	$1.8	$7.0	$2.6		
	25	2026	$5.0	$1.6	$0.2	$0.0	$0.6	$6.7	$0.6		
	NPV Years 1 through 25		$99.3	$6.5	$1.9	$12.2	$58.7	$107.8	$70.9	$36.9	1.5
High	1	2002	$0.6	$0.0	$0.0	$1.6	$3.7	$0.6	$5.3		
	10	2011	$7.7	$0.0	$0.1	$1.2	$2.9	$7.8	$4.1		
	25	2026	$5.5	$2.5	$0.2	$0.0	$0.9	$8.2	$0.9		
	NPV Years 1 through 25		$106.2	$10.3	$2.0	$13.5	$64.6	$118.5	$78.2	$40.3	1.5

*All dollars are in 2007$; Program costs are exclusive of incentives

C. WISCONSIN ENERGY STAR HOMES (WESH)

The Wisconsin ENERGY STAR Homes program encourages the development of ENERGY STAR-certified energy-efficient homes.

In the simple test, as shown in Table 4-7, incremental and program costs exceed the direct energy savings they create in both the high- and low-funding scenarios. A benefit-cost ratio of 0.5 is achieved under the low funding, and a ratio of 0.4 is realized under high funding.

Some market effects are incorporated into projections. By the end of the program period, it is assumed that builders have increasingly begun to accept WESH methods and materials as part of standard building practice. Market effect savings from the program, however, are limited to the amount of knowledge of energy efficient building practices builders will carry with them beyond the end of the program.

Table 4-7. WESH Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.1	$0.0	$0.0	$2.6	$1.4	$0.1	$4.0		
	10	2011	$1.8	$0.0	$0.0	$1.3	$3.2	$1.8	$4.4		
	25	2026	$1.6	$0.9	$0.0	$0.0	$0.9	$2.5	$0.9		
	NPV Years 1 through 25		$24.8	$4.2	$0.3	$19.8	$45.0	$29.3	$64.8	-$35.5	0.5
High	1	2002	$0.1	$0.0	$0.0	$2.6	$1.4	$0.1	$4.0		
	10	2011	$2.1	$0.0	$0.0	$2.0	$5.0	$2.1	$6.9		
	25	2026	$1.9	$1.4	$0.0	$0.0	$1.5	$3.3	$1.5		
	NPV Years 1 through 25		$27.8	$6.6	$0.4	$22.0	$56.8	$34.7	$78.8	-$44.1	0.4

*All dollars are in 2007$; Program costs are exclusive of incentives

D. EFFICIENT HEATING AND COOLING INITIATIVE (EHCI)

EHCI provides funding and assistance to encourage the proliferation of efficient heating and cooling equipment in Wisconsin. The program focuses on two key technologies: central air conditioning and electrically commutated motors (ECM).

Table 4-8 shows the results of the simple benefit-cost test of the program. The program achieves a benefit-cost ratio of 1.4 under both funding scenarios. Added market effects provide roughly 10 percent increase in energy savings compared to the documentable savings. These additional savings are also associated with some added costs. The majority of these gains are assumed to take place in the ECM market, where a portion of Wisconsin contractors would continue to promote the technology certain customers.

Table 4-8. EHCI Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$6.8	$0.0	$0.2	$0.3	$7.4	$6.9	$7.6		
	25	2026	$4.6	$1.4	$0.3	$0.0	$0.7	$6.2	$0.7		
	NPV Years 1 through 25		$71.7	$5.7	$2.5	$1.7	$56.2	$79.9	$57.9	$22.0	1.4
High	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$8.7	$0.0	$0.2	$0.4	$11.6	$8.9	$12.0		
	25	2026	$6.0	$2.1	$0.4	$0.0	$1.2	$8.5	$1.2		
	NPV Years 1 through 25		$89.7	$9.0	$3.2	$2.2	$72.8	$101.9	$75.0	$27.0	1.4

*All dollars are in 2007$; Program costs are exclusive of incentives

E. APARTMENT AND CONDOMINIUM EFFICIENCY SERVICES (ACES)

The ACES program provides energy efficiency information and services for owners and residents of apartments and condominiums. Benefit-cost results for the ACES program are shown in Table 4-9. The program achieves a benefit-cost ratio of 1.7 under both funding scenarios.

The majority of program benefits, as calculated in this test, are derived from documentable program savings. In general, ACES produces limited market effects. While it has been able to affect some change in how apartment and condominium owners see efficient lighting and high-efficiency boilers, the removal of program advertising and incentives are predicted to lead to a significant drop in energy savings benefits.

Table 4-9. ACES Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.6	$0.0	$0.0	$1.7	$1.3	$0.6	$3.0		
	10	2011	$8.6	$0.0	$0.2	$0.9	$2.7	$8.8	$3.6		
	25	2026	$2.9	$0.9	$0.2	$0.0	$0.3	$4.0	$0.3		
	NPV Years 1 through 25		$102.7	$4.4	$2.9	$16.8	$47.5	$110.0	$64.3	$45.7	1.7
High	1	2002	$0.6	$0.0	$0.0	$1.7	$1.3	$0.6	$3.0		
	10	2011	$10.2	$0.0	$0.2	$1.5	$4.2	$10.5	$5.7		
	25	2026	$3.5	$1.5	$0.2	$0.0	$0.4	$5.1	$0.4		
	NPV Years 1 through 25		$114.7	$6.9	$3.3	$18.5	$53.5	$124.9	$72.0	$53.0	1.7

*All dollars are in 2007$; Program costs are exclusive of incentives

F. TARGETED HOME PERFORMANCE WITH ENERGY STAR (THPWES)

The FOCUS Targeted Home Performance with ENERGY STAR Program (THPWES) is a weatherization program similar to the low-income Weatherization Assistance Program (WAP). Results of benefit-cost analysis for THPWES are shown in Table 4-10. There are no market effects or customer incremental costs assumed for this program. The program achieves a benefit-cost ratio of 0.9 and 0.8 for the low- and high-funding scenario, respectively.

Table 4-10. THPWES Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.1		
	10	2011	$1.2	$0.0	$0.0	$0.1	$1.7	$1.2	$1.8		
	25	2026	$0.9	$0.0	$0.0	$0.0	$0.0	$0.9	$0.0		
	NPV Years 1 through 25		$14.9	$0.0	$0.2	$1.1	$16.3	$15.2	$17.4	-$2.2	0.9
High	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.1		
	10	2011	$1.4	$0.0	$0.0	$0.2	$2.7	$1.4	$2.8		
	25	2026	$1.1	$0.0	$0.0	$0.0	$0.0	$1.1	$0.0		
	NPV Years 1 through 25		$17.1	$0.0	$0.3	$1.3	$19.2	$17.3	$20.5	-$3.2	0.8

*All dollars are in 2007$; Program costs are exclusive of incentives

4.3 BUSINESS PROGRAMS

4.3.1 Simple Test – Portfolio Results

The Focus on Energy Business Programs help Wisconsin businesses, industries, farms, schools and local governments identify and install energy and cost-saving efficiency measures. Benefit-cost analysis was performed for each of four business programs: Agriculture; Commercial; Industrial; and Schools and Government. Benefit-cost results for these programs in aggregate are summarized in Table 4-11 below. The various benefit-cost components by year are shown in Figure 4-5 and Figure 4-6 for the low- and high-funding scenarios, respectively.

In the simple test, shown in Table 4-11, both the low- and high-funding scenarios achieve similar positive net benefits by the end of the program period. In the high-funding scenario, overall benefit-cost ratios are similar.

Table 4-11. Business Programs Benefit-Cost Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$2.2	$0.0	$0.0	$6.1	$5.0	$2.2	$11.1		
	10	2011	$109.1	$0.1	$2.8	$18.7	$42.6	$112.0	$61.3		
	25	2026	$59.1	$2.7	$2.6	$0.0	$0.3	$64.5	$0.3		
	NPV Years 1 through 25		$1,172.9	$18.5	$36.1	$121.3	$265.9	$1,227.6	$387.2	$840.4	3.2
High	1	2002	$2.2	$0.0	$0.0	$6.1	$5.0	$2.2	$11.1		
	10	2011	$136.5	$0.9	$3.5	$29.8	$68.1	$140.8	$97.9		
	25	2026	$70.2	$11.5	$3.6	$0.0	$1.1	$85.2	$1.1		
	NPV Years 1 through 25		$1,373.5	$80.3	$44.9	$145.0	$338.2	$1,498.8	$483.3	$1,015.5	3.1

*All dollars are in 2007$; Program costs are exclusive of incentives

Figure 4-5. Business Programs Benefit-Cost Components by Year, Low Funding

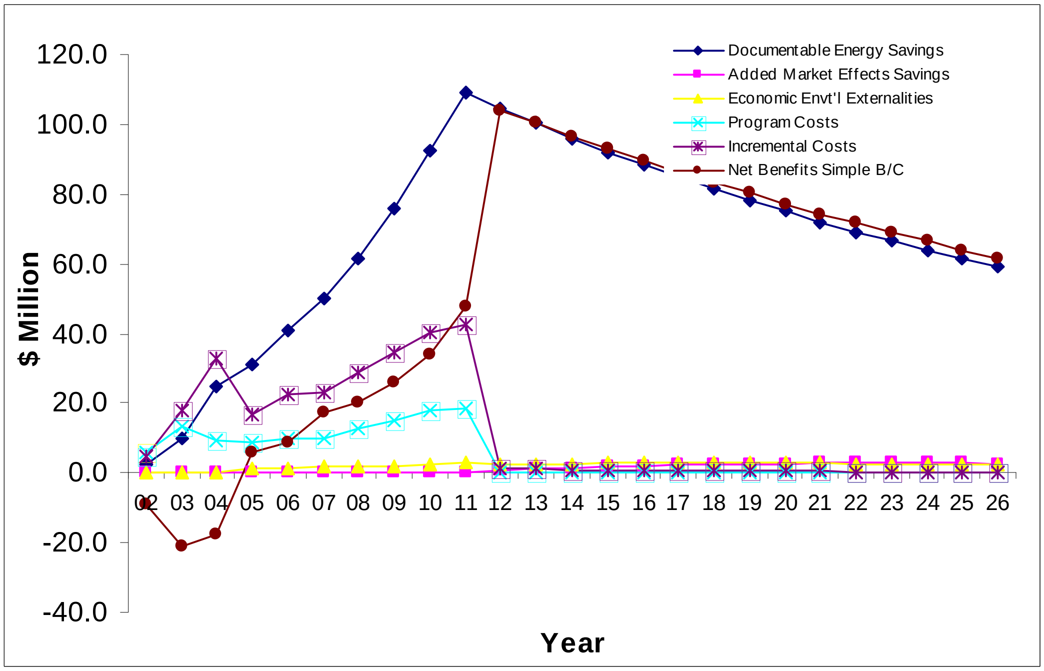
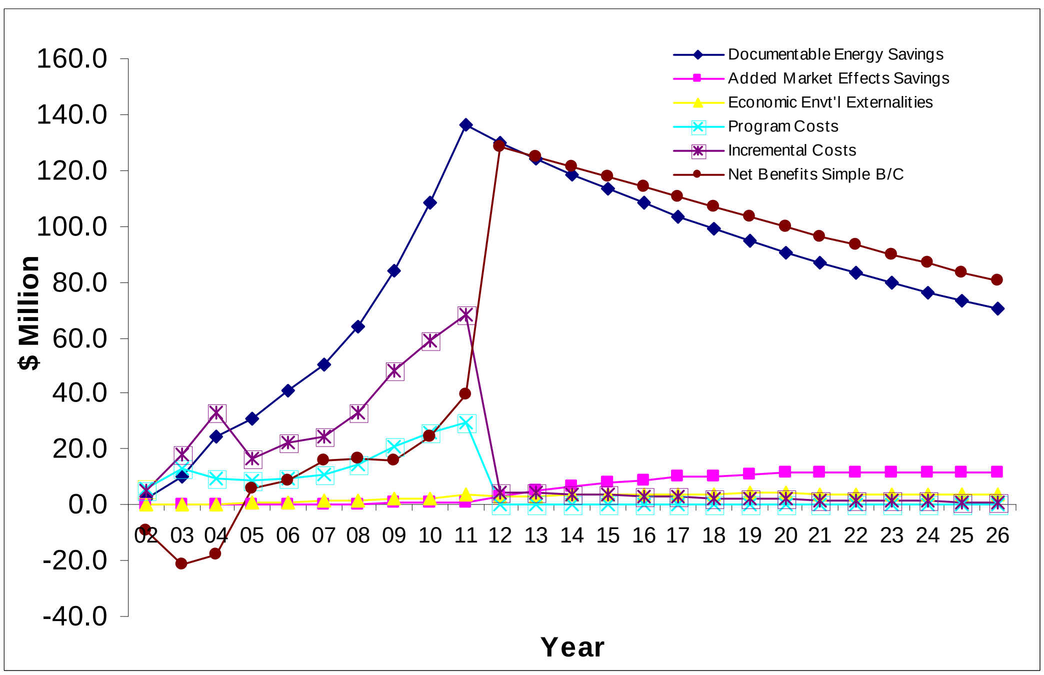


Figure 4-6. Business Programs Benefit-Cost Components by Year, High Funding



4.3.2 Expanded Benefit-Cost Test – Business Programs Portfolio

Results of the expanded benefit-cost test for Business Programs take into account the total effects of program activities on the state economy. In addition to documentable energy savings and market effects, the economic impact analysis incorporates the effects of economic externalities and NEBs. Results of the economic impact analysis are combined with non-economic externalities to arrive at total program benefits under the expanded benefit-cost test. Table 4-12 shows the inputs to the economic impact model as well as the results of the economic impact analysis for the Business Programs.

Table 4-12. Business Programs Benefits and Economic Impact for Expanded Test ($000,000)

Funding Scenario	Year	FY	Energy Savings: Documentable	Energy Savings: Added Market Effects Savings	Economic Envt'l Externalities	NEBs	Economic Impacts	Economic Impacts Adder
Low	1	2002	$2.2	$0.0	$0.0	$0.7	$1.9	-$1.0
	10	2011	$109.1	$0.1	$2.8	$30.6	$203.9	$61.3
	25	2026	$59.1	$2.7	$2.6	$15.1	$228.0	$148.4
	NPV Years 1 through 25		$1,172.9	$18.5	$36.1	$325.9	$2,859.0	$1,305.5
High	1	2002	$2.2	$0.0	$0.0	$0.7	$1.9	-$1.0
	10	2011	$136.5	$0.9	$3.5	$38.5	$238.4	$59.1
	25	2026	$70.2	$11.5	$3.6	$20.4	$295.8	$190.2
	NPV Years 1 through 25		$1,373.5	$80.3	$44.9	$398.7	$3,454.5	$1,557.0

*All dollars are in 2007$

For both the low and high scenarios, the net economic impact of the benefits streams is 80% greater than the direct sum of these benefits, in terms of Net Present Value. That is, the economic multiplier effect is about 1.8.

Results of the expanded benefit-cost test for the Business Program are shown in Table 4-13 below. As for the simple test, The BC ratio for the expanded test is similar for the low and high scenarios. However, the ratios are much larger in the expanded test, 7.6 and 7.4 respectively. The majority of this increase comes from the economic adder, that is, the effect of counting the full value of the benefits in the economy rather than only their direct effects. A portion also comes from the inclusion of NEBs, which add 30 percent to the value of the saved energy. The economic impact adder itself is also increased by the inclusion of these additional benefits.

Figure 4-7 and Figure 4-8 show the annual benefit and cost streams that drive the benefit-cost calculation for the low and high-funding scenarios, respectively. In the post-program years, the economic impact is very close to the net benefit level. The net benefit is the economic impact plus non-economic avoided externality minus program spending and customer incremental costs. In the post-program years, program spending is 0 and customer incremental costs are small. The non-economic avoided externality is small compared to total benefits in all years. Non-energy benefits and avoided externalities are multipliers of the sum of documentable and added market effect savings; their shape is similar to that of the documentable savings, but at a smaller level. Other components displayed in the figure are the same as in Figure 4-1 and Figure 4-2 above.

Table 4-13. Results of Expanded BC Analysis for Business Programs ($000,000)

Funding Scenario	Year	FY	Benefit Components: Economic Impacts	Benefit Components: Non-Econ. Envt'l Externalities	Cost Components: Program Costs	Cost Components: Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$1.9	$0.0	$6.1	$5.0	$1.9	$11.1		
	10	2011	$203.9	$6.0	$18.7	$42.6	$209.9	$61.3		
	25	2026	$228.0	$11.6	$0.0	$0.3	$239.6	$0.3		
	NPV Years 1 through 25		$2,859.0	$94.5	$121.3	$265.9	$2,953.4	$387.2	$2,566.2	7.6
High	1	2002	$1.9	$0.0	$6.1	$5.0	$1.9	$11.1		
	10	2011	$238.4	$7.6	$29.8	$68.1	$246.0	$97.9		
	25	2026	$295.8	$15.5	$0.0	$1.1	$311.2	$1.1		
	NPV Years 1 through 25		$3,454.5	$122.3	$145.0	$338.2	$3,576.8	$483.3	$3,093.5	7.4

*All dollars are in 2007$; Program costs are exclusive of incentives

Figure 4-7. Business Programs Benefit-Cost Components by Year, Low Funding, Expanded Test

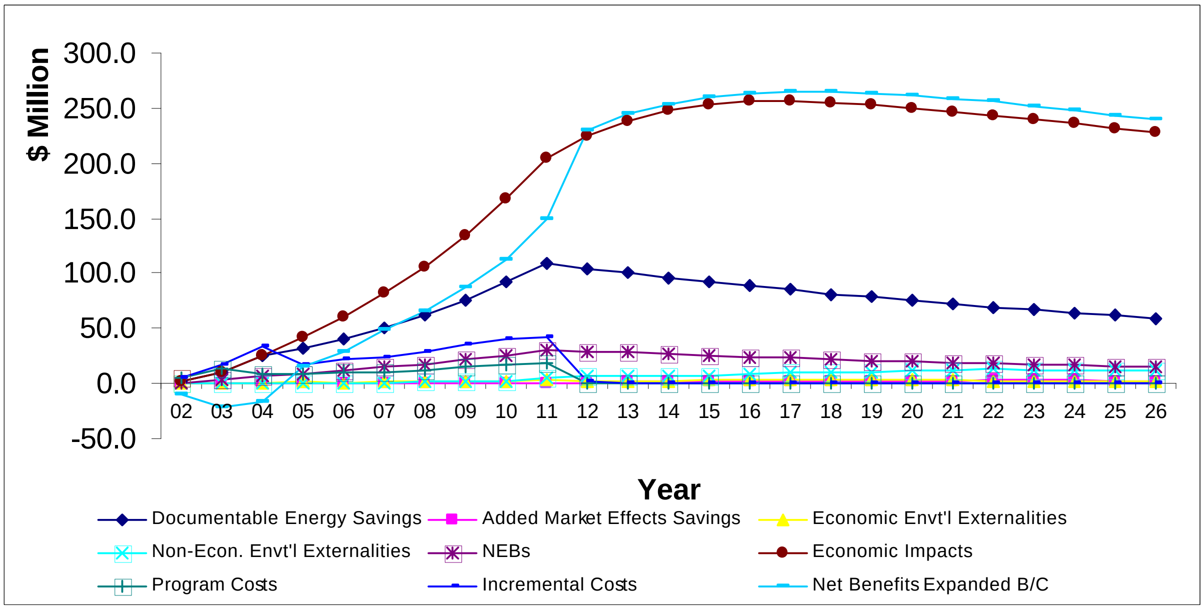
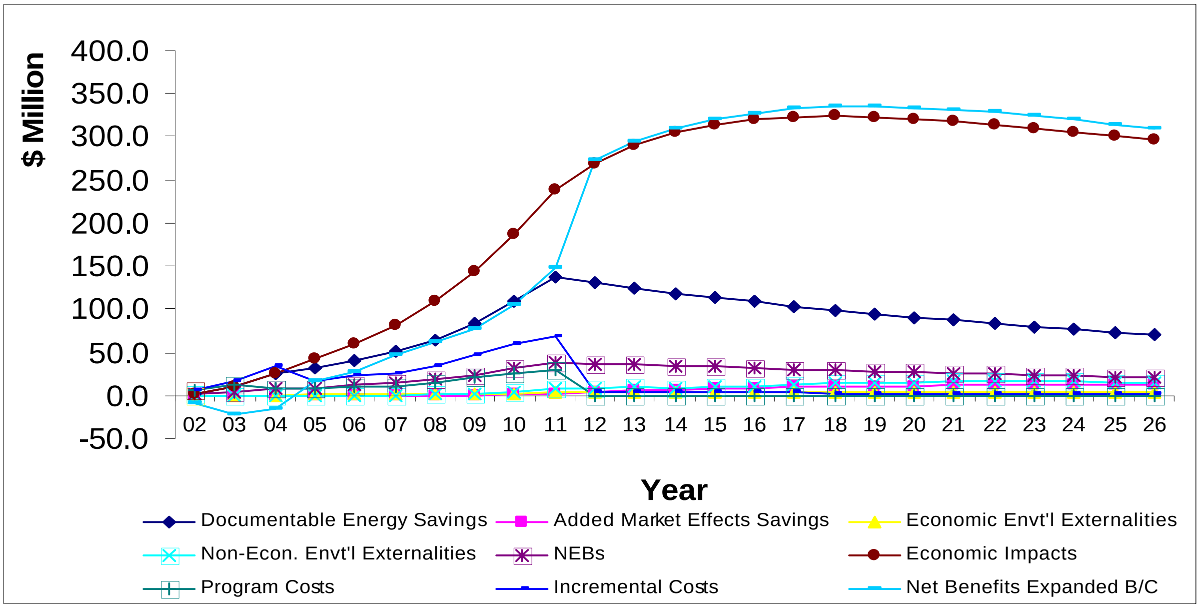


Figure 4-8. Business Programs Benefit-Cost Components by Year, Low Funding, Expanded Test



When the expanded benefit-cost test is applied to the Business Programs, net benefits for the 25-year timeframe are positive, as indicated by the high benefit-cost ratios noted. In the high-funding case, higher funding results in increased energy savings, more market effects, and more ripple effects on the state economy. Compared to the low-funding case, an increase in program funding of approximately $25 million results in $72 million of additional customer spending, with an additional net benefit over $500 million. As for the simple test, the increased proportion of both benefits and costs that occur in later program years results in the slightly lower BC ratio for the high-funding case.

4.3.3 Simple Test—Individual Program Results

The benefit-cost results for each of the individual Business Programs are shown in this section. These results are based on the simple test, which counts only documentable energy savings and added market effects as program benefits.

Table 4-14 provides 25-year NPV for expected benefits and costs achieved by each sector of the Business Programs. As evidenced in the table, the positive overall performance of the portfolio is reflected in the individual program performance. All four sectors have simple BC ratios of at least 2.0, in both the low- and high-funding scenarios. In all cases, the low and high scenarios give very similar ratios.

Table 4-14. NPV of Business Program Benefits and Costs by Sector

	Low Funding			
25 Year NPV ($Millions)	**Agriculture**	**Commercial**	**Industrial**	**Schools and Govt**
Documentable Savings	61.4	268.7	658.0	184.8
Market Effects	3.3	11.4	2.5	1.2
Externalities	3.0	9.8	18.2	5.1
Program Costs	15.6	27.4	49.9	28.3
Incremental Costs	17.0	75.0	126.2	47.8
Net Benefit	35.1	187.6	502.6	115.1
Benefit/Cost Ratio	2.1	2.8	3.9	2.5

	High Funding			
25 Year NPV ($Millions)	**Agriculture**	**Commercial**	**Industrial**	**Schools and Govt**
Documentable Savings	70.2	308.4	775.5	219.4
Market Effects	10.3	34.7	30.1	5.2
Externalities	3.7	12.4	22.5	6.3
Program Costs	18.7	32.8	59.7	33.9
Incremental Costs	23.0	98.6	157.9	58.7
Net Benefit	42.6	224.1	610.6	138.3
Benefit/Cost Ratio	2.0	2.7	3.8	2.5

A. AGRICULTURE

Business Programs activities targeting the Agricultural sector help farmers and agricultural producers to reduce energy, increase profits, and enhance productivity.

As shown in Table 4-15, net benefits for the Agriculture sector over the 25-year timeframe under consideration are positive for both the high- and low-funding scenarios. The energy savings achieved under this scenario contribute to a benefit-cost ratio around 2 under both funding scenarios. Documentable energy savings dominate program costs and participant incremental costs. Market effects have less of an influence, although the impact of market effects, primarily continuing CFL installation, increases in the high-funding scenario.

Table 4-15. Agriculture Program Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.0	$0.0	$0.0	$0.8	$0.1	$0.0	$0.9		
	10	2011	$6.4	$0.0	$0.2	$2.4	$2.8	$6.7	$5.2		
	25	2026	$2.4	$0.5	$0.2	$0.0	$0.1	$3.1	$0.1		
	NPV Years 1 through 25		$61.4	$3.3	$3.0	$15.6	$17.0	$67.7	$32.6	$35.1	2.1
High	1	2002	$0.0	$0.0	$0.0	$0.8	$0.1	$0.0	$0.9		
	10	2011	$8.1	$0.0	$0.3	$3.8	$4.5	$8.4	$8.3		
	25	2026	$2.6	$1.5	$0.3	$0.0	$0.2	$4.3	$0.2		
	NPV Years 1 through 25		$70.2	$10.3	$3.7	$18.7	$23.0	$84.3	$41.7	$42.6	2.0

*All dollars are in 2007$; Program costs are exclusive of incentives

B. COMMERCIAL

The Commercial sector activity supports small and large commercial business owners seeking to improve the energy efficiency of their facilities.

For the Commercial sector, strong documentable energy savings contribute to benefit-cost ratios of 2.8 and 2.7 for the low and high scenarios, respectively. Market effects also contribute, accounting for approximately 5 and 10 percent of the total program benefits in the low- and high-funding scenarios. The added market effects savings in both scenarios are primarily continuing CFL installations.

Table 4-16. Commercial Sector Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.6	$0.0	$0.0	$1.4	$1.5	$0.6	$2.9		
	10	2011	$26.5	$0.0	$0.8	$4.2	$11.9	$27.3	$16.1		
	25	2026	$11.5	$1.7	$0.7	$0.0	$0.2	$13.8	$0.2		
	NPV Years 1 through 25		$268.7	$11.4	$9.8	$27.4	$75.0	$290.0	$102.4	$187.6	2.8
High	1	2002	$0.6	$0.0	$0.0	$1.4	$1.5	$0.6	$2.9		
	10	2011	$33.1	$0.0	$1.0	$6.7	$19.0	$34.1	$25.7		
	25	2026	$12.8	$4.9	$0.9	$0.0	$0.6	$18.7	$0.6		
	NPV Years 1 through 25		$308.4	$34.7	$12.4	$32.8	$98.6	$355.5	$131.4	$224.1	2.7

*All dollars are in 2007$; Program costs are exclusive of incentives

C. INDUSTRIAL

The Industrial program facilitates energy efficiency improvement for owners and managers of industrial facilities of all sizes.

Consistent with other Business Programs, simple benefit-cost test results for the Industrial Program yield positive net benefits over the 25-year timeframe in both the low- and high-funding scenarios. Documentable energy savings of nearly three times program and incremental costs contribute to a benefit-cost ratio of 3.9 and 3.8 for the low- and high-funding scenarios, respectively. Added market effects also play a role. The primary added market effects savings assumed in the high scenario include sustained adoptions of premium efficiency motors, T8 replacements for HID in high-bay applications, and pulp and paper efficiency improvements related to the Focus *Guidebook*.

Table 4-17. Industrial Program Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$1.1	$0.0	$0.0	$2.5	$2.3	$1.2	$4.8		
	10	2011	$59.0	$0.1	$1.3	$7.7	$20.2	$60.4	$27.9		
	25	2026	$36.0	$0.3	$1.4	$0.0	$0.0	$37.8	$0.0		
	NPV Years 1 through 25		$658.0	$2.5	$18.2	$49.9	$126.2	$678.7	$176.1	$502.6	3.9
High	1	2002	$1.1	$0.0	$0.0	$2.5	$2.3	$1.2	$4.8		
	10	2011	$73.7	$0.8	$1.7	$12.3	$32.4	$76.2	$44.7		
	25	2026	$43.5	$4.2	$1.9	$0.0	$0.3	$49.6	$0.3		
	NPV Years 1 through 25		$775.5	$30.1	$22.5	$59.7	$157.9	$828.1	$217.5	$610.6	3.8

*All dollars are in 2007$; Program costs are exclusive of incentives

D. SCHOOLS AND GOVERNMENT

The Schools and Government sector activities help schools and local governments to improve existing buildings and install new energy-efficient lighting, heating, and cooling equipment.

Table 4-18 provides information on the simple benefit-cost impacts of these programs. Under both the low- and high-funding scenario, positive net benefits are observed for the 25-year timeframe under consideration. Both funding scenarios have a benefit-cost ratio of 2.5. Market effects play a limited role relative to documentable energy savings, especially in the low-funding scenario. The market effects added in the high scenario that affect this sector are mainly CFLs and T8 replacements for HID in high-bay applications.

Table 4-18. Schools and Government Program Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.4	$0.0	$0.0	$1.4	$1.1	$0.4	$2.5		
	10	2011	$17.3	$0.0	$0.4	$4.4	$7.7	$17.7	$12.1		
	25	2026	$9.2	$0.2	$0.4	$0.0	$0.0	$9.7	$0.0		
	NPV Years 1 through 25		$184.8	$1.2	$5.1	$28.3	$47.8	$191.2	$76.1	$115.1	2.5
High	1	2002	$0.4	$0.0	$0.0	$1.4	$1.1	$0.4	$2.5		
	10	2011	$21.7	$0.0	$0.5	$7.0	$12.2	$22.2	$19.2		
	25	2026	$11.2	$0.8	$0.5	$0.0	$0.1	$12.6	$0.1		
	NPV Years 1 through 25		$219.4	$5.2	$6.3	$33.9	$58.7	$230.9	$92.6	$138.3	2.5

*All dollars are in 2007$; Program costs are exclusive of incentives

4.4 RENEWABLES PROGRAMS

4.4.1 Simple Test – Portfolio Level Results

Benefit-cost analysis using the simple benefit-cost test was performed at the technology level for each of six technology groups: photovoltaics (PV); wind; solar water heating (SWH); biogas; non-residential wood burning of biosolids (Thermal); and other. Benefit-cost results for these renewable technologies in aggregate are summarized in Table 4-19 below. The various benefit-cost components by year are shown in Figure 4-9 and Figure 4-10 for the low- and high-funding scenarios, respectively.

The net present value (NPV) of Renewables Program benefits and costs for the 25-year timeframe under consideration results in positive net benefits for both the low- and high-funding scenarios. The low- and high-funding scenarios have benefit-cost ratios of 1.2 and 1.7, respectively. Based on the results of the simple benefit-cost test applied here, the current portfolio of renewable energy programs is shown to be cost-effective under both funding scenarios.

These positive results are achieved despite the fact that attribution rates for the Renewables programs have been relatively low to date. One reason for positive benefit-cost ratios despite low attribution is that the measures have long lives. In addition, two aspects of the analysis can be viewed as generous.

One generous aspect of the analysis is that the incentive payments subtracted from the program costs include a category of payments that are not subsidies for measure installation but are support for other activities such as demonstration projects or training. It could arguably be more appropriate to include these costs as part of the program administrative cost. However, even if that change were made the benefit-cost ratio would still exceed 1, even for the Low scenario.

A second generous aspect of the analysis applies to the High scenario only. For this scenario, we accepted the program's projection that almost all increase in spending between the Low and High scenarios would go to incentive payments. The effect of this assumption was to say that program activity in the form of projects supported could increase by nearly 3 times, with only a 3.5 percent increase in administrative costs. Thus, the High funding scenario likely overstates the program effectiveness that would be seen at these funding levels.

Since none of the individual Renewables Programs is expected to yield savings from market effects, the total benefits are attributable to documentable energy savings and avoided emissions benefits only. The positive overall results are driven primarily by a steady stream of energy savings from renewable energy projects in the middle to late years of the 25 year timeframe under consideration. On a net present value basis, these energy savings exceed both program and customer incremental costs over the timeframe of the analysis.

It is worth noting that the positive benefit cost ratio achieved by the renewables technology portfolio is a result of the strong benefit/cost performance of three of the six technologies considered. The thermal, biogas, and other technology categories all achieve positive benefit cost ratios on an individual basis, while the PV, wind, and SWH categories do not. Individual technology performance and effects are explored in subsequent sections.

Table 4-19. Results of Simple B/C Analysis of Renewable Energy Program[6]

Funding Scenario	Year	FY	Select Individual Benefits					Total Benefits	Total Costs	Net Benefits	B/C Ratio
			Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs				
Low	1	2002	$0.0	$0.0	$0.0	$0.9	$0.0	$0.0	$0.9		
	10	2011	$2.8	$0.0	$0.1	$1.4	$2.0	$2.9	$3.4		
	25	2026	$2.0	$0.0	$0.1	$0.0	$0.0	$2.1	$0.0		
	NPV Years 1 through 25		$33.6	$0.0	$1.1	$13.9	$15.4	$34.7	$29.3	$5.3	1.2
High	1	2002	$0.0	$0.0	$0.0	$0.9	$0.0	$0.0	$0.9		
	10	2011	$9.2	$0.0	$0.2	$2.3	$13.0	$9.4	$15.3		
	25	2026	$6.3	$0.0	$0.3	$0.0	$0.0	$6.6	$0.0		
	NPV Years 1 through 25		$90.7	$0.0	$3.1	$14.4	$41.7	$93.8	$56.1	$37.7	1.7

*All dollars are in 2007$; Program costs are exclusive of incentives

[6] Current guidelines call for the Renewables program to be assessed in the future based on gross rather than net (program-attributable) savings. For consistency, the primary benefit-cost analysis are all conducted in terms of net (attributable) savings and associated attributable avoided costs, emissions, NEBs, and attributable incremental costs. A rough estimate of the effect of using gross rather than net savings and corresponding incremental costs for the Renewables Programs is obtained by multiplying total benefits and customer incremental costs each by a factor of 3, with program costs unchanged. This calculation yields a benefit-cost ratio of 1.7 for the Low scenario, and 2.0 for the High scenario.

Figure 4-9. Renewables Simple Benefit-Cost Test Components by Year, Low Funding

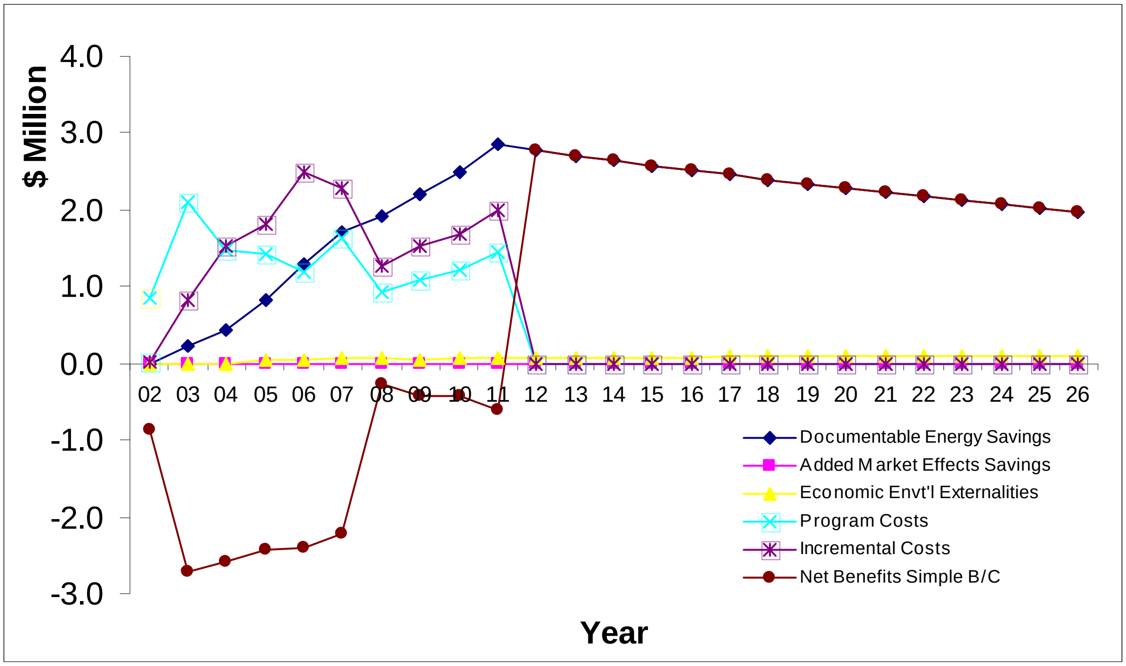
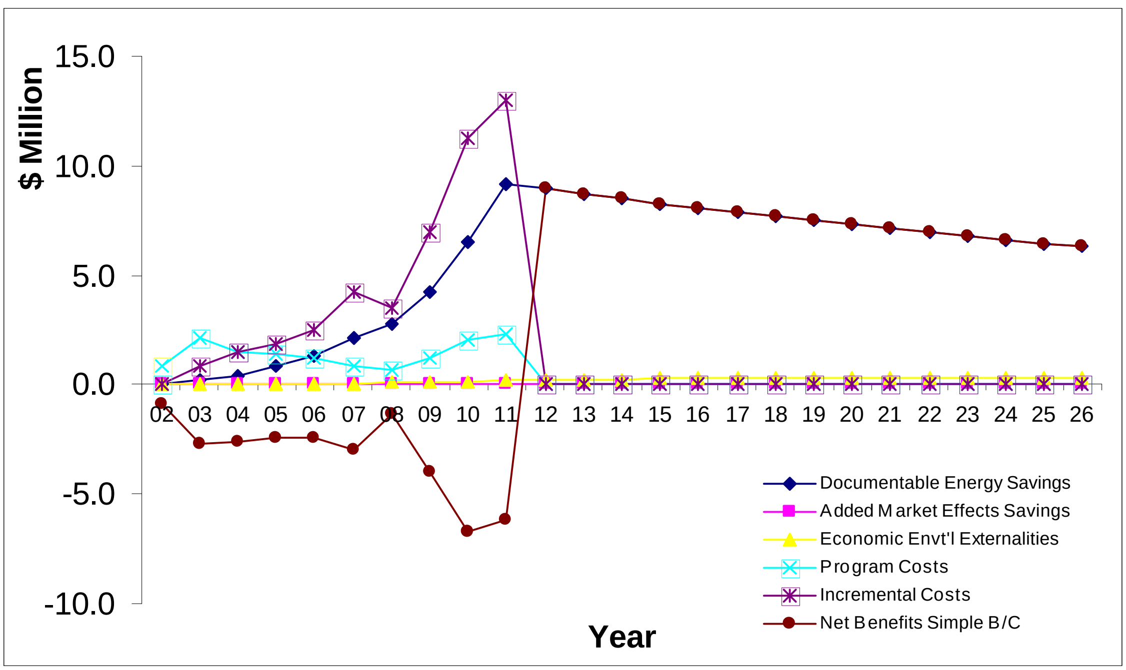


Figure 4-10. Renewables Simple Benefit-Cost Test Components by Year, High Funding



4.4.2 Expanded Benefit-Cost Test—Renewables Portfolio

Benefit-cost results for the Renewables Portfolio using the expanded benefit-cost test take into account the total change to the state economy resulting from the Program, as measured by the economic impact analysis. In addition to energy savings, the economic impact analysis incorporates economic externalities and NEBs along with non-economic externalities. Table 4-20. shows the inputs to the economic impact model, as well as the results of the economic impact analysis for the Renewables Program.

Table 4-20. Renewable Programs Benefits and Economic Impact for Expanded Test ($000,000)

Funding Scenario	Year	FY	Energy Savings: Documentable	Energy Savings: Added Market Effects Savings	Economic Envt'l Externalities	NEBs	Economic Impacts	Economic Impacts Adder
Low	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	10	2011	$2.8	$0.0	$0.1	$1.0	$8.4	$4.5
	25	2026	$2.0	$0.0	$0.1	$0.6	$8.0	$5.3
	NPV Years 1 through 25		$33.6	$0.0	$1.1	$11.0	$110.2	$64.6
High	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	10	2011	$9.2	$0.0	$0.2	$4.8	$32.2	$17.9
	25	2026	$6.3	$0.0	$0.3	$2.9	$30.2	$20.7
	NPV Years 1 through 25		$90.7	$0.0	$3.1	$43.9	$357.0	$219.2

*All dollars are in 2007$

For both the low and high scenarios, the economic impact of the benefits streams is roughly 2.5 times the direct sum of these benefits for the low and high funding scenarios, respectively. Put another way, the economic impact adder, which is the difference between the total impact and this sum, is about 50 percent greater than the direct sum.

The economic multiplier of 2.5 is higher than for the other program areas. This greater economic stimulus effect results from two factors:

a. High proportions of the Renewables program benefits go to the commercial and institutional sectors. These result in greater stimulus effects than would corresponding benefits to the manufacturing sector.

b. High proportions of the spending on program measures go to Wisconsin businesses, based on information provided by the program administrator. The evaluation has not developed independent estimates of this spending allocation at this time.

Results of the expanded benefit-cost test for the Renewables Program are shown in Table 4-21. below. Figure 4-11 and Figure 4-12 show the annual benefit and cost streams that drive the benefit-cost calculation for the low- and high-funding scenarios, respectively.

Table 4-21. Results of Expanded BC Analysis for Renewables Program ($000,000)

Funding Scenario	Year	FY	Benefit Components: Economic Impacts	Benefit Components: Non-Econ. Envt'l Externalities	Cost Components: Program Costs	Cost Components: Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.0	$0.0	$0.9	$0.0	$0.0	$0.9		
	10	2011	$8.4	$0.2	$1.4	$2.0	$8.6	$3.4		
	25	2026	$8.0	$0.4	$0.0	$0.0	$8.4	$0.0		
	NPV Years 1 through 25		$110.2	$2.7	$13.9	$15.4	$112.9	$29.3	$83.6	3.9
High	1	2002	$0.0	$0.0	$0.9	$0.0	$0.0	$0.9		
	10	2011	$32.2	$0.5	$2.3	$13.0	$32.7	$15.3		
	25	2026	$30.2	$1.2	$0.0	$0.0	$31.5	$0.0		
	NPV Years 1 through 25		$357.0	$8.8	$14.4	$41.7	$365.8	$56.1	$309.6	6.5

*All dollars are in 2007$; Program costs are exclusive of incentives

Figure 4-11. Renewable Energy Benefit-Cost Components, Low Funding, Expanded Test

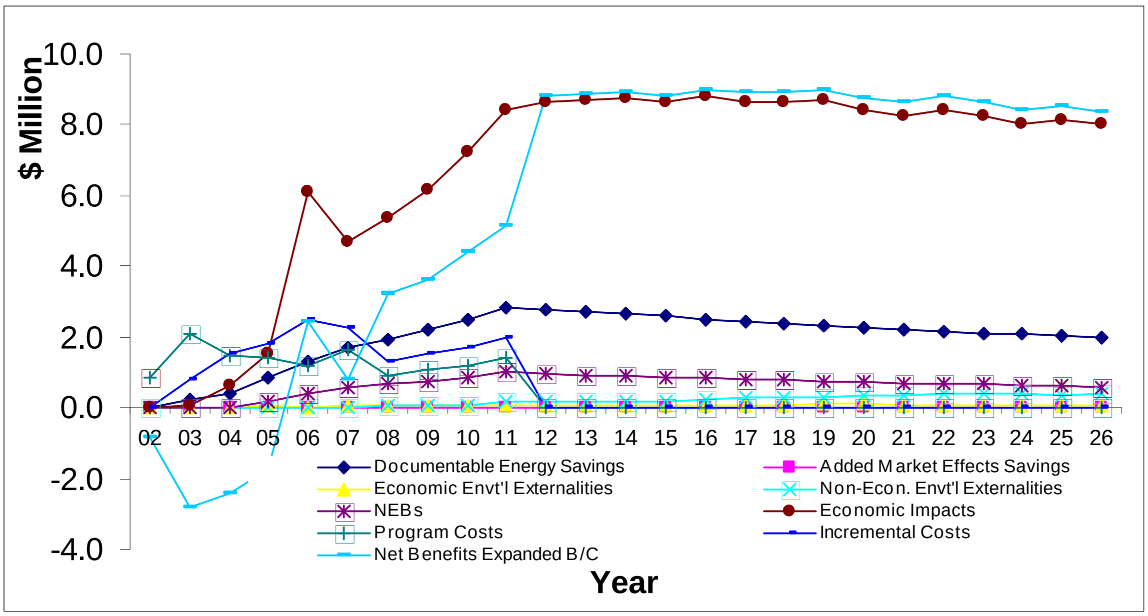
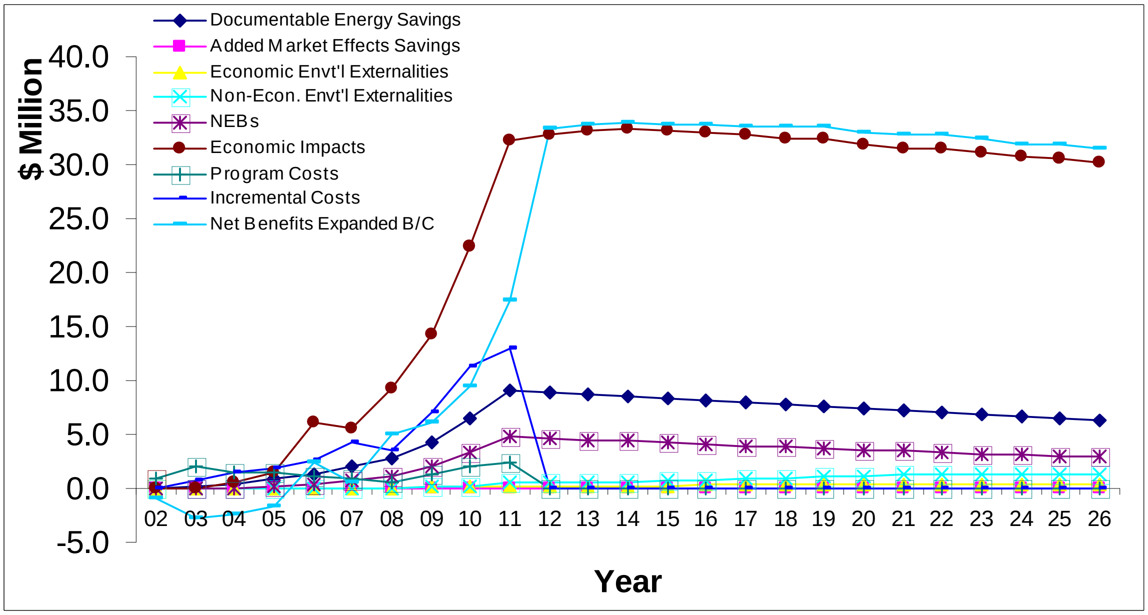


Figure 4-12. Renewable Energy Benefit-Cost Components, High Funding, Expanded Test



As evidenced above, when the expanded benefit-cost test is applied, positive net benefits are observed for the Renewables Program for both the high- and low-funding scenarios, with benefit-cost ratios of 3.9 and 6.5, respectively. Net benefits are also shown to increase with the high-funding scenario. As noted above, the High funding case is probably more generous than is realistic.

NEBs add about 1/3 to the energy savings benefits under the low funding scenario, and about 1/2 to the energy savings benefits under the high funding scenario. The greater increase in benefits compared to the simple test comes from the economic impact adder, which as noted is approximately 1.5 times the energy and non-energy benefits in both the low and high funding scenarios.

4.4.3 Simple Test—Individual Program Results

Benefit-cost results using the simple test are shown for each of the individual renewable technologies in this section. The simple test counts documentable energy savings, added market effects savings, and avoided economic environmental externalities as program benefits.

Table 4-22 provides 25-year NPV for expected benefits and costs achieved by each renewable energy technology group. The results indicate that the PV, Wind, and SWH technology categories each have a benefit-cost ratio below 1.0 in both the low and high funding scenarios. In contrast, the Biogas, Thermal, and Other technology categories are each expected to achieve a simple benefit-cost ratio of greater than one in both funding scenarios. Notably, the benefit-cost performance of the Biogas, Thermal, and Other technology categories are well over 1.0 in both funding scenarios—high enough to elevate the benefit-cost ratio for the entire renewable technology portfolio to above 1.0.

Table 4-22. NPV of Individual Program Benefits and Costs by Technology

	Low Funding					
25 Year NPV ($Millions)	**PV**	**Wind**	**SWH**	**Biogas**	**Thermal**	**Other**
Documentable Energy Savings	$1.3	$1.8	$0.6	$9.2	$12.7	$8.1
Added Market Effects Savings	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Economic Envt'l Externalities	$0.0	$0.1	$0.0	$0.5	$0.1	$0.4
Program Costs	$6.7	$2.6	$0.4	$1.9	$1.3	$1.1
Incremental Costs	$4.9	$1.9	$1.0	$3.3	$2.5	$1.7
Net Benefits	-$10.2	-$2.7	-$0.8	$4.4	$8.9	$5.7
Benefit/Cost Ratio	0.1	0.4	0.4	1.9	3.3	3.0

	High Funding					
25 Year NPV ($Millions)	**PV**	**Wind**	**SWH**	**Biogas**	**Thermal**	**Other**
Documentable Energy Savings	$1.9	$4.6	$3.7	$37.2	$28.4	$14.9
Added Market Effects Savings	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Economic Envt'l Externalities	$0.1	$0.2	$0.0	$1.9	$0.2	$0.8
Program Costs	$5.6	$2.8	$0.9	$2.8	$1.3	$1.1
Incremental Costs	$7.6	$5.1	$6.0	$14.0	$5.8	$3.3
Net Benefits	-$11.2	-$3.1	-$3.1	$22.3	$21.5	$11.4
Benefit/Cost Ratio	0.2	0.6	0.5	2.3	4.0	3.6

*All dollars are in 2007$; Program costs are exclusive of incentives

A. PHOTOVOLTAICS

The Renewables Program supports the development of photovoltaic (PV) installations for residential and business customers. As shown in Table 4-23., net benefits for the PV program over the 25-year timeframe under consideration are negative for both the low- and high-funding scenarios. In both cases, high program costs and incremental costs far exceed documentable energy savings. The result is benefit-cost ratios of 0.1 and 0.2 for both the low high funding scenarios respectively. High customer incremental costs, indicative of the significant upfront capital costs of PV on a per kW basis, are shown to exceed documentable energy savings by more than three times.

Table 4-23. PV Program Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.0	$0.0	$0.0	$0.9	$0.0	$0.0	$0.9		
	10	2011	$0.1	$0.0	$0.0	$0.6	$0.6	$0.1	$1.2		
	25	2026	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1	$0.0		
	NPV Years 1 through 25		$1.3	$0.0	$0.0	$6.7	$4.9	$1.3	$11.5	-$10.2	0.1
High	1	2002	$0.0	$0.0	$0.0	$0.9	$0.0	$0.0	$0.9		
	10	2011	$0.2	$0.0	$0.0	$0.5	$1.7	$0.2	$2.1		
	25	2026	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1	$0.0		
	NPV Years 1 through 25		$1.9	$0.0	$0.1	$5.6	$7.6	$2.0	$13.2	-11.2	0.2

*All dollars are in 2007$; Program costs are exclusive of incentives

B. WIND

The Renewables Program supports the development of wind installations for residential and business customers. For the wind technology group, net benefits are shown to be negative for both funding scenarios. The benefit-cost ratio for the 25-year timeframe is 0.4 for the low funding scenario and 0.6 for the high funding scenario. Both results indicate that the program is not cost-effective based on the simple test. Combined program and incremental costs outpace documentable energy savings over the period under consideration. Of broader interest is that participant incremental costs are just slightly more than documentable energy savings, suggesting that wind technology incremental costs, in the absence of program related costs, border on becoming cost-effective over the life of the measure.

Table 4-24. Wind Program Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits					Total Benefits	Total Costs	Net Benefits	B/C Ratio
			Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs				
Low	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$0.1	$0.0	$0.0	$0.2	$0.2	$0.2	$0.5		
	25	2026	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1	$0.0		
	NPV Years 1 through 25		$1.8	$0.0	$0.1	$2.6	$1.9	$1.8	$4.5	-$2.7	0.4
High	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$0.5	$0.0	$0.0	$0.4	$1.5	$0.5	$2.0		
	25	2026	$0.3	$0.0	$0.0	$0.0	$0.0	$0.3	$0.0		
	NPV Years 1 through 25		$4.6	$0.0	$0.2	$2.8	$5.1	$4.7	$7.8	-3.1	0.6

*All dollars are in 2007$; Program costs are exclusive of incentives

C. SOLAR WATER HEATING

The Renewables Program provides incentives for the installation of solar hot water heating systems. Benefit-cost analysis results shown in Table 4-25 indicate that the SWH program yields negative net benefits for the 25-year period under consideration. The table also indicates that benefit-cost ratios of 0.4 and 0.5 are observed for both the low- and high-funding scenarios respectively for the 25-year time horizon. Customer incremental costs are shown to exceed documentable energy savings by more than 150 percent in both funding scenarios.

Table 4-25. SWH Program Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits					Total Benefits	Total Costs	Net Benefits	B/C Ratio
			Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs				
Low	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$0.1	$0.0	$0.0	$0.1	$0.1	$0.1	$0.2		
	25	2026	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	NPV Years 1 through 25		$0.6	$0.0	$0.0	$0.4	$1.0	$0.6	$1.4	-$0.8	0.4
High	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$0.4	$0.0	$0.0	$0.3	$2.3	$0.4	$2.6		
	25	2026	$0.3	$0.0	$0.0	$0.0	$0.0	$0.3	$0.0		
	NPV Years 1 through 25		$3.7	$0.0	$0.0	$0.9	$6.0	$3.8	$6.9	-3.1	0.5

*All dollars are in 2007$; Program costs are exclusive of incentives

D. BIOGAS

The Renewables Program provides financial assistance for commercial customers who install biogas digester systems. Benefit-cost analysis results shown in Table 4-26. indicate that the biogas program achieves a benefit-cost ratio of greater than 1.0 in both the low and high funding scenarios. Documentable energy savings of more than two and half times incremental costs contribute to benefit-cost ratios of 1.9 for the low funding scenario and 2.3 for the high funding scenario.

Table 4-26. Biogas Program Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$0.8	$0.0	$0.0	$0.3	$0.5	$0.8	$0.8		
	25	2026	$0.6	$0.0	$0.0	$0.0	$0.0	$0.6	$0.0		
	NPV Years 1 through 25		$9.2	$0.0	$0.5	$1.9	$3.3	$9.6	$5.2	$4.4	1.9
High	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$3.9	$0.0	$0.2	$0.8	$5.0	$4.1	$5.8		
	25	2026	$2.7	$0.0	$0.2	$0.0	$0.0	$2.9	$0.0		
	NPV Years 1 through 25		$37.2	$0.0	$1.9	$2.8	$14.0	$39.1	$16.7	22.3	2.3

*All dollars are in 2007$; Program costs are exclusive of incentives

E. THERMAL

The Renewables Program provides incentives for the development and installation of thermal biomass facilities. Benefit-cost analysis results shown in Table 4-27 indicate that the thermal program yields positive net benefits for the 25-year timeframe under consideration for both funding scenarios. The table shows benefit-cost ratios of 3.3 and 4.0 are achieved for the low and high-funding scenarios, respectively. This is the highest benefit-cost ratio among the primary renewable energy technologies covered by the Renewables Program. In both scenarios, documentable energy savings are approximately five times customer incremental costs.

Table 4-27. Thermal Program Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$1.1	$0.0	$0.0	$0.2	$0.4	$1.1	$0.6		
	25	2026	$0.8	$0.0	$0.0	$0.0	$0.0	$0.8	$0.0		
	NPV Years 1 through 25		$12.7	$0.0	$0.1	$1.3	$2.5	$12.7	$3.9	$8.9	3.3
High	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$2.8	$0.0	$0.0	$0.3	$1.7	$2.8	$2.0		
	25	2026	$2.0	$0.0	$0.0	$0.0	$0.0	$2.0	$0.0		
	NPV Years 1 through 25		$28.4	$0.0	$0.2	$1.3	$5.8	$28.5	$7.0	21.5	4.0

*All dollars are in 2007$; Program costs are exclusive of incentives

F. OTHER

Under the Renewables Program, the “Other” technology category refers to projects that fall outside the other five technology groups. Examples include hydroelectric, a geothermal heat pump and solar space heating.

As shown in Table 4-29, the Other technology category is shown to have positive net benefits for the program period under consideration, along with a benefit-cost ratio of 3.0 and 3.6 for the low and high funding scenarios, respectively. Documentable energy savings are more than four times customer incremental costs.

Table 4-28. Other Program Simple Benefit-Cost Test Components ($000,000)

Funding Scenario	Year	FY	Select Individual Benefits: Documentable Energy Savings	Added Market Effects Savings	Economic Envt'l Externalities	Program Costs	Incremental Costs	Total Benefits	Total Costs	Net Benefits	B/C Ratio
Low	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$0.6	$0.0	$0.0	$0.1	$0.2	$0.6	$0.2		
	25	2026	$0.5	$0.0	$0.0	$0.0	$0.0	$0.5	$0.0		
	NPV Years 1 through 25		$8.1	$0.0	$0.4	$1.1	$1.7	$8.5	$2.8	$5.7	3.0
High	1	2002	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0		
	10	2011	$1.3	$0.0	$0.1	$0.1	$0.8	$1.4	$0.9		
	25	2026	$1.0	$0.0	$0.1	$0.0	$0.0	$1.1	$0.0		
	NPV Years 1 through 25		$14.9	$0.0	$0.8	$1.1	$3.3	$15.7	$4.4	11.4	3.6

*All dollars are in 2007$; Program costs are exclusive of incentives

4.5 FOCUS OVERALL

4.5.1 Focus in Total

Focus as a whole is projected to have positive net benefits for the state for all forms of the benefit-cost comparison conducted. For the expanded test, high-funding assumption, the projected net present value of 10 years of program operations over a 25-year horizon is a net benefit of $4.4 billion. The benefit-cost ratio for Focus as a whole is 5.3. Under the more conservative simple test, net benefits are $1.4 billion, with a benefit-cost ratio of 2.4.

4.5.2 Summary Across Program Areas

Figure 4-13 and Figure 4-14 show the total projected benefits and costs of Focus to end users by program area for the simple and expanded tests, respectively, under the High scenario. Tables 4-30 and 4-31 describe the values underlying the two figures. Both benefits and costs are expressed in terms of the net present value of the projected 25-year stream. [7]

[7] Net present value" refers to standard financial terminology. This use is distinct from "net" in the sense of program attribution, net benefits (benefit minus cost), or net economic impacts.

Figure 4-13. Benefits and Costs by Program Area
25-Year Net Present Value ($000,000), Simple BC Test, High Funding

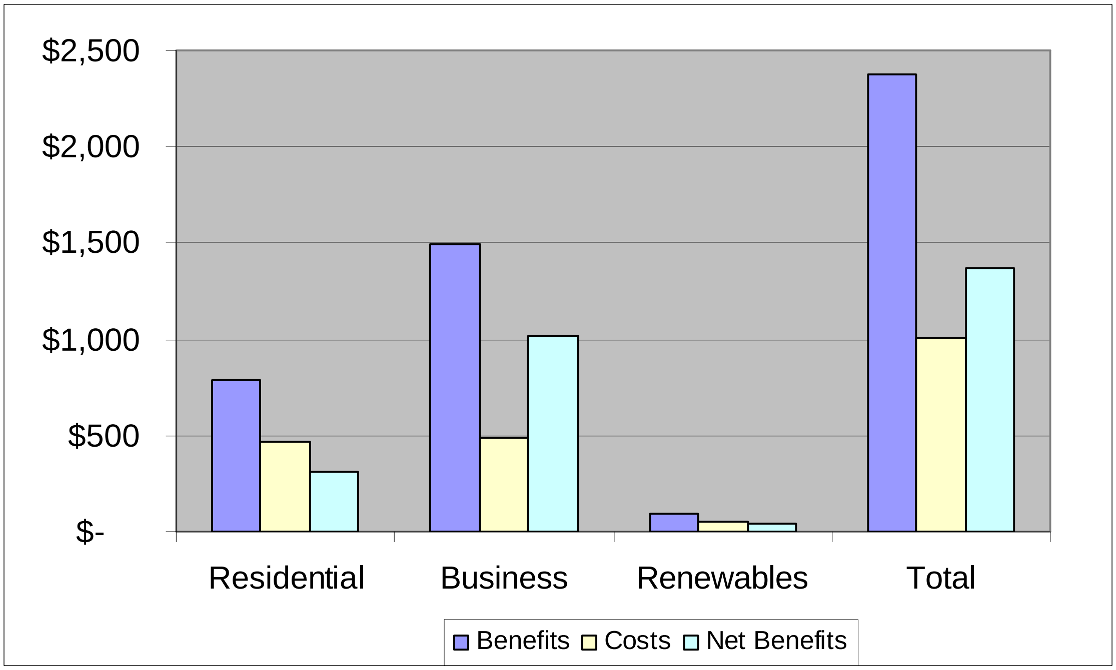


Table 4-30: Benefits and Costs by Program Area
25-Year Net Present Value ($000,000), Simple BC Test, High Funding

Program Area	Benefits	Costs	Net Benefits	BC Ratio
Residential	$785	$469	$316	1.7
Business	$1,499	$483	$1,016	3.1
Renewables	$94	$56	$38	1.7
Total	$2,377	$1,008	$1,369	2.4

Figure 4-14. Benefits and Costs by Program Area
25-Year Net Present Value ($000,000), Expanded BC Test, High Funding

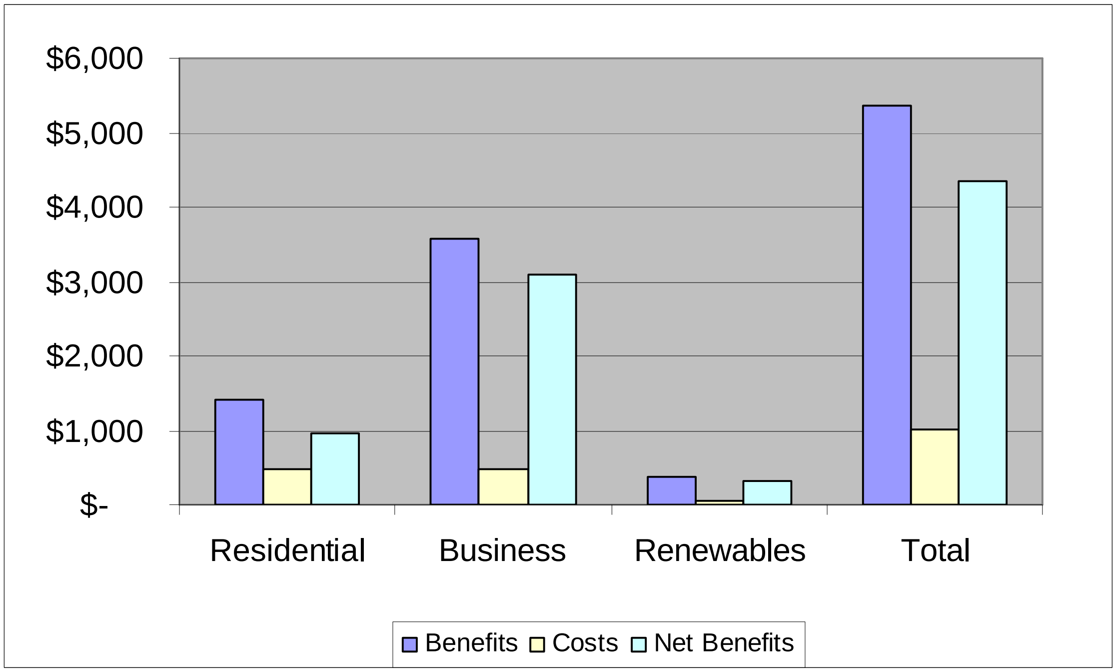


Table 4-31. Benefits and Costs by Program Area
25-Year Net Present Value ($000,000), Expanded BC Test, High Funding

Program Area	Benefits	Costs	Net Benefits	BC Ratio
Residential	$1,418	$469	$950	3.0
Business	$3,577	$483	$3,094	7.4
Renewables	$366	$56	$310	6.5
Total	$5,361	$1,008	$4,353	5.3

4.5.3 Contributors to Focus Benefits and Costs

The value of each of the components that contributes to total Focus benefits and costs are indicated in Figure 4-15 and the table that follows. The value is shown in terms of the net present value over the 25-year timeframe of the analysis.

Figure 4-15. Focus Benefit-Cost Components
Net Present Value of 25 Years of Benefits ($000,000), Expanded Test, High Funding

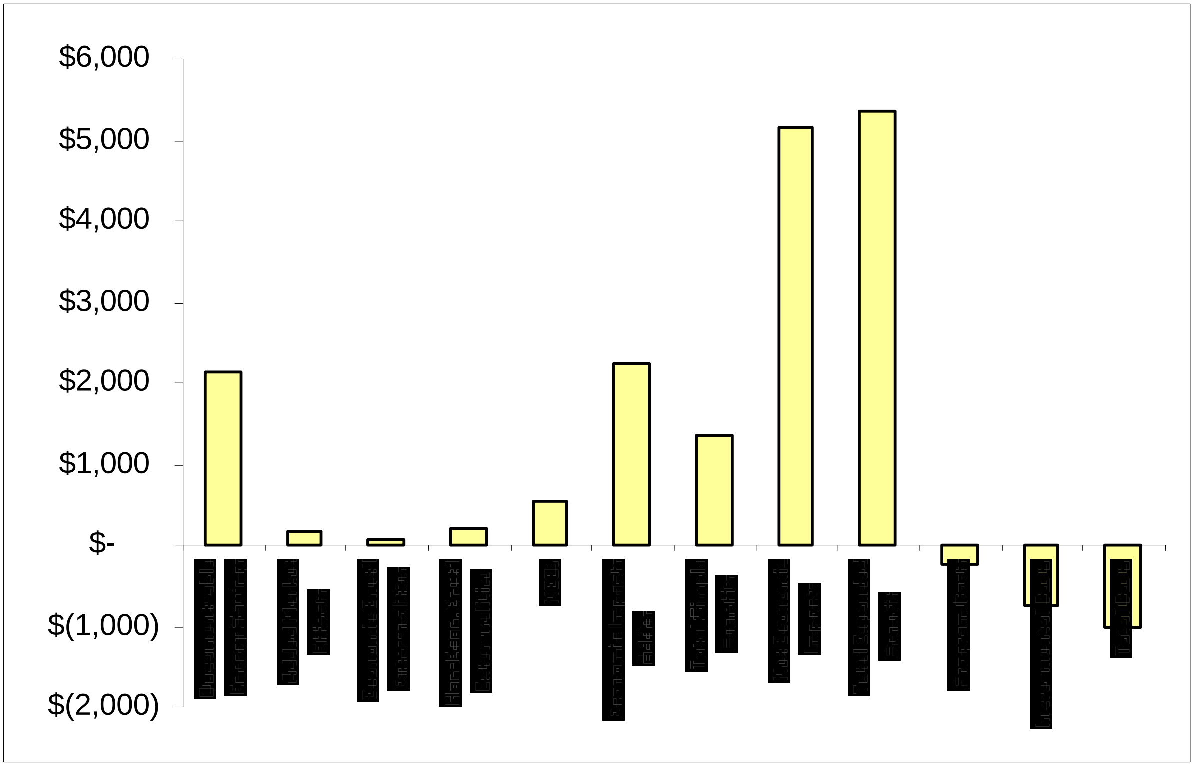


Table 4-32. Focus Benefit-Cost Components
Net Present Value of 25 Years of Benefits and Costs ($000,000), Expanded Test, High Funding Methodology

High Funding	Document-able Energy Savings	Added Market Effects	Economic Envt'l Exter-nalities	Non-Econ. Envt'l Exter-nalities	NEBs	Economic Impacts Adder	Total Simple Benefits	Net Economic Impacts	Total Expanded Benefit	Program Costs	Incre-Mental Costs	Total Costs
Business	$1,373	$80	$45	$122	$399	$1,557	$1,016	$3,454	$3,577	$145	$338	$483
Residential	$658	$95	$32	$68	$106	$459	$316	$1,350	$1,418	$87	$382	$469
Renewables	$91	$-	$3	$9	$44	$219	$38	$357	$366	$14	$42	$56
Total Focus	$2,122	$175	$80	$199	$549	$2,235	$1,369	$5,162	$5,361	$246	$762	$1,008

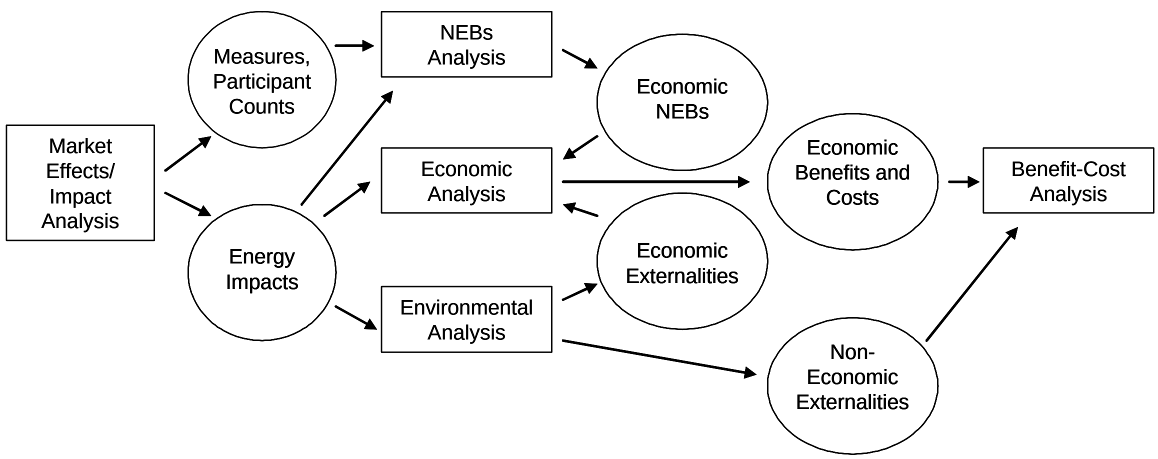
5. METHODOLOGY

This section describes the structure of the benefit-cost analysis. First, an overview of the key elements of the analysis is provided. The source of each of these elements is described in brief. The computation of the simple and economic development benefit-cost measures from these elements is then described.

5.1 ELEMENTS OF COSTS AND BENEFITS

The benefit-cost analysis combines quantified costs and benefits, as determined from a number of evaluation activities. These activities are referred to as “valuation” tasks because they assign values to distinct cost and benefit components. The relationship among the valuation tasks and cost and benefit components is illustrated in Figure 5-1.

Figure 5-1. Overview of Benefit-Cost Components and Valuation Activities



For all components, the results were projected out assuming operation of the programs for a 10-year period, with additional projections made, as warranted for each program, over an additional 15-year timeframe extending beyond the end of the programs. The analysis components and benefit-cost elements provided by each valuation task are described more fully in the table below.

Table 5-1. Analysis Components Contributing to the Benefit-Cost Analysis

Analysis Component	Input to B/C Analysis Provided	Provided by	Extensions Required for B/C	Level of Detail Used
Direct Impacts	Direct energy savings	Program Area Evaluation	Projection for future program years	Program
Market Effects	Market effects energy savings	Program Area Evaluation	Projection for future program years	Program
Non-energy Benefits	Economic non-energy benefits multipliers	NEBs Evaluation	None	Program Area
Economic Impact	Program net impact to state economy	Economic Evaluation	None	Program Area
Environmental Externality	Environmental multipliers	Environmental Evaluation	None	All Programs
Costs	Program spending	Program Area Evaluation	Projection for future program years	Program
	Implementers' incremental project costs	Program Area Evaluation	Projection for future program years	Program

5.1.1 Energy Impacts, Documentable Energy Savings

The impact analysis for each program area determines the documentable energy savings attributed to the program to date. As part of the economic and benefit-cost analysis, energy savings for future years are projected based on the projected spending levels. This analysis also determines avoided costs per kWh, kW, and therm saved, which is used to translate energy savings into dollar values.

In the previous version of the benefit-cost analysis, avoided energy cost was based on the avoided energy bill of the ratepayer. Avoided energy was calculated from average customer spending per kWh and per therm delivered. In the present version of the benefit-cost analysis, utility avoided cost is used to develop energy impact estimates. In addition, whereas the prior benefit-cost analysis considered only kWh and therms in its analysis, the current analysis also includes a separate value for avoided demand (system peak day), or kW. In previous work, the demand cost was embedded in the customer's average cost per kWh.

5.1.2 Market Effects

The most challenging projections to develop are the market effects of a program – the additional energy savings from actions taken outside of Focus but attributable to the Focus programs. The approach taken to projecting market effects varies by program, according to the level of information available at the time of the analysis. In all cases, the projected market effects are considered to be plausible, but are more uncertain than the direct energy savings.

Market effects estimates in the current benefit-cost analysis are improved relative to the initial benefit-cost analysis completed in 2003, based on the first 18 months of program activity. To some extent, the market effect estimates used here incorporate empirical findings on the lasting effects of the programs after approximately five years of documented program activity. Market effects estimates were developed for each of the programs – Business, Residential, and Renewable – based in part on the results of their respective program evaluations. Energy savings were translated into dollar values based on the previously discussed avoided cost factors.

For low-funding scenarios, no additional market effects have been assumed beyond a projected continuation of those that have already been documented in the evaluations. (An exception is made for CFLs. For this technology, a moderate level of sustained effects is considered highly likely, though it has not been rigorously documented in impact evaluations.) For high-funding scenarios, plausible but necessarily less certain projections have been developed based on an understanding of how particular markets are being affected by the programs. Each individual program evaluation team was responsible for the development of these scenarios. These projections are described in Appendix A.

In the previous benefit-cost analysis, the "pro forma" market effects projections for Business Programs were developed using a diffusion modeling approach. Since projected market effects had not been developed for the other programs, the Business Programs estimates were also scaled to produce market effects projections for the Residential and Renewables areas. For the economic and benefit-cost analysis, the evaluation team projected these further out in time.

5.1.3 Non-Energy Benefits

The non-energy benefits (NEBs) analysis provides multipliers in the form of incremental dollar value per unit of energy savings or participation for each of several non-energy benefits. NEBs are separated into "economic" and "non-economic" benefits. "Economic" NEBs result in dollar flows in the economy. These additional benefits are included in the economic input-output model, but not the simple model. "Non-economic" NEBs have value to customers, but do not affect dollar flows. These benefits are sometimes viewed as more subjective and less concrete than the "economic" NEBs. For this reason, non-economic NEBS have not been included in this benefit-cost analysis.

In the previous version of the benefit-cost analysis, we had reasonably well grounded NEBs estimates for the Residential and Low-income Programs. We had no NEBs estimates for the Business or Renewables Programs. Since then, the evaluation team has produced reports on NEBs for the latter two program areas.[8] For the current benefit-cost analysis, economic NEBs have been incorporated for all program areas.

5.1.4 Environmental Benefits (Externalities)

Environmental benefits in the form of avoided emissions are included to varying degrees in the simple and expanded benefit cost tests. In the simple test, we include the well documented value of avoided emissions based on existing cap and trading markets. These values are available for NO_x and SO_x. These prices reflect the costs of mitigating these emissions associated with delivering electricity. For gas, the emissions mitigation cost is not an explicit cost of delivering the fuel. However, we take the trading price as the societal value of the avoided emissions from the gas consumption.

In the expanded test, we also count as benefits avoided carbon (CO_2) and mercury (Hg). These benefits are valued based on projected markets. Because these values are less well defined at this stage, we do not include them in the simple test.

Evaluation's environmental analysis developed emissions factors for electricity and gas saved in terms of pounds of emission per kWh and per therm. As described in Section 3, the emissions model used defined emissions factors for SO_x, NO_x, CO_2, and mercury (Hg) emissions. The analysis also developed dollar values for each of these emissions based on current and projected emissions trading markets. For SO_x and NO_x, current emissions offset markets exist, and present emissions values were forecast for 25 years. For CO_2 and Hg emissions, regulatory markets are not expected to exist until 2009 and 2010, respectively. Projected emissions values for the onset of these markets were both forecast for 25 years to 2026. In addition, to enable valuation of avoided CO_2 and Hg emissions in program years FY02 to FY09, emissions values were developed based on a regression methodology developed expressly for this purpose. It was our intent to capture the value of these emissions in the more comprehensive expanded benefit-cost test irrespective of whether or not they have been prescribed a market value in an existing emissions trading marketplace.

[8] *Non-energy Benefits to Implementing Partners from the Wisconsin Focus on Energy Program,* Final report October 20, 2003.

The previous version of the benefit-cost analysis utilized the avoided bill of the customer to value avoided energy. As a result, the values of avoided SO_x and NO_x emissions were captured by active emissions trading markets, internalized in the customer's bill, and were therefore captured by the economic input-output model. The value of avoided CO_2 emissions was developed by the Wisconsin Public Service Commission and was not valued by a functional emissions trading market. Thus, avoided CO_2 did not translate into dollar flows in the Wisconsin economy. The value of CO_2 emissions was therefore counted in the benefit-cost analysis, but not in the economic input-output analysis. Mercury was not included in the original benefit-cost analysis.

The current version of the benefit-cost analysis uses utility avoided cost. SO_x and NO_x emissions, which are subject to active cap and trade regulations in Wisconsin, are included in the simple benefit-cost test, as well as in the economic input-output analysis. The value of these avoided emissions would be monetized by the PSC and would ultimately be passed onto the customer in the form of reduced rates. Avoided SO_x and NO_x emissions are therefore representative of dollar flows in the economy. In contrast, emissions values for CO_2 and Hg are not currently regulated in Wisconsin and therefore are not captured in the economic input-output analysis. They are, however, included in the expanded benefit-cost tests.

5.1.5 Economic Model

The economic input-output model counts the direct and indirect effects of all dollar flows into the Wisconsin economy resulting from Focus. The model counts the effects of direct energy and demand savings; market effects energy savings; economic NEBs; and any internalized externalities, namely avoided NO_x and SO_x emissions.

5.1.6 Costs

Both the benefit-cost analysis and input-output analysis required development of several cost elements:

- Program spending for each year
- Program incentive payments each year
- Incremental project costs.

Program Spending

Program spending projections were developed in consultation with Department of Administration (DOA) staff and the Focus program administrator. Consistent with the economic impact report, the current benefit-cost analysis assumes operation of the programs for a 10-year period (beginning in FY02) and includes impacts that extend 15 years beyond the end of the programs. Analysis for this timeframe requires projections of program spending, in addition to direct impacts, market effects, and associated customer costs several years forward.

An important feature of the current benefit-cost analysis is that program spending projections over the second five years of the program are modeled according to a low and a high scenario. The low scenario assumes a level of program spending consistent with the average program spending based on the first five years of the program. The high scenario assumes total program spending corresponding to levels set by recent legislation. Thus, the low-funding scenario indicates the long-term cost-effectiveness of the programs as they actually have been funded and operated. The high-funding scenario indicates the overall effectiveness that is likely under the currently expected funding levels.

A rationale for considering the two funding scenarios is that the budget reductions of the last few years have arguably constrained the programs from operating as efficiently as they could under the planned funding levels. At higher spending levels, economies of scale are possible, and the program presence may be large enough to make a noticeable difference in some markets.

On the other hand, it is not clear how and where potential economies of scale would be manifested. Our projections therefore generally use similar relations of savings to program spending as have been observed in the first few actual program years and project only modest added market effects. The result is that benefit-cost ratios are generally similar under the two funding scenarios. However, the total net benefit (benefit minus cost) is greater under the high scenario. (As described in Section 4.4.1, these effects don't apply to the Renewables program.)

It may be expected that higher spending levels would result in economies of scale, meaning that greater savings would be possible per dollar of program spending. We conducted a high-level assessment of the effect of such improvements on the BC tests. This analysis is described in Appendix E.

As it turns out, a plausibly higher level of savings per dollar of program spending has only a small effect on the BC ratios. The reason is that the program spending is small compared to the customer incremental costs. The customer incremental costs increase in proportion to the savings. Hence, the ratio of benefits (proportional to energy savings) to costs (customer incremental costs plus program costs) is dominated by the ratio of savings to incremental costs.

For this reason, rather than speculate on how savings per program dollar might change under higher funding levels, we used the existing experience as the basis for the high funding scenarios. To the extent economies of scale result in higher levels of savings per program dollar, the net benefits would be greater than indicated by this analysis, but the BC ratios would be similar to those provided here.

Program Incentive Payments

Incentive payments are not included in program costs counted in the denominator of the benefit-cost ratio. Incentive payments are also not deducted from the customer incremental costs. These payments are a transfer payment between parties, not a societal cost.

Incremental Project Costs

Incremental project costs are the incremental costs of the higher efficiency measure compared to cost of the baseline measure that would otherwise have been installed. The benefit-cost analysis counts the total incremental cost, not reduced by the amount of any incentive payment the customer may have received. However, the analysis counts only "attributable" incremental costs. These are incremental costs of measures that are attributable to the program. Essentially, the same attribution factor that determines the attributable or net savings from the gross savings is applied to the incremental costs associated with the gross savings to determine attributable incremental costs. For example, if a program has an attribution rate of 80%, the gross savings are multiplied by 80% to determine attributable (or net) savings, and the total incremental costs associated with the gross savings are multiplied by 80% to determine attributable incremental costs.

Incremental cost estimates represent a major source of uncertainty in any energy-efficiency program benefit-cost analysis. Procedures for estimating these costs are further described below for each program type.

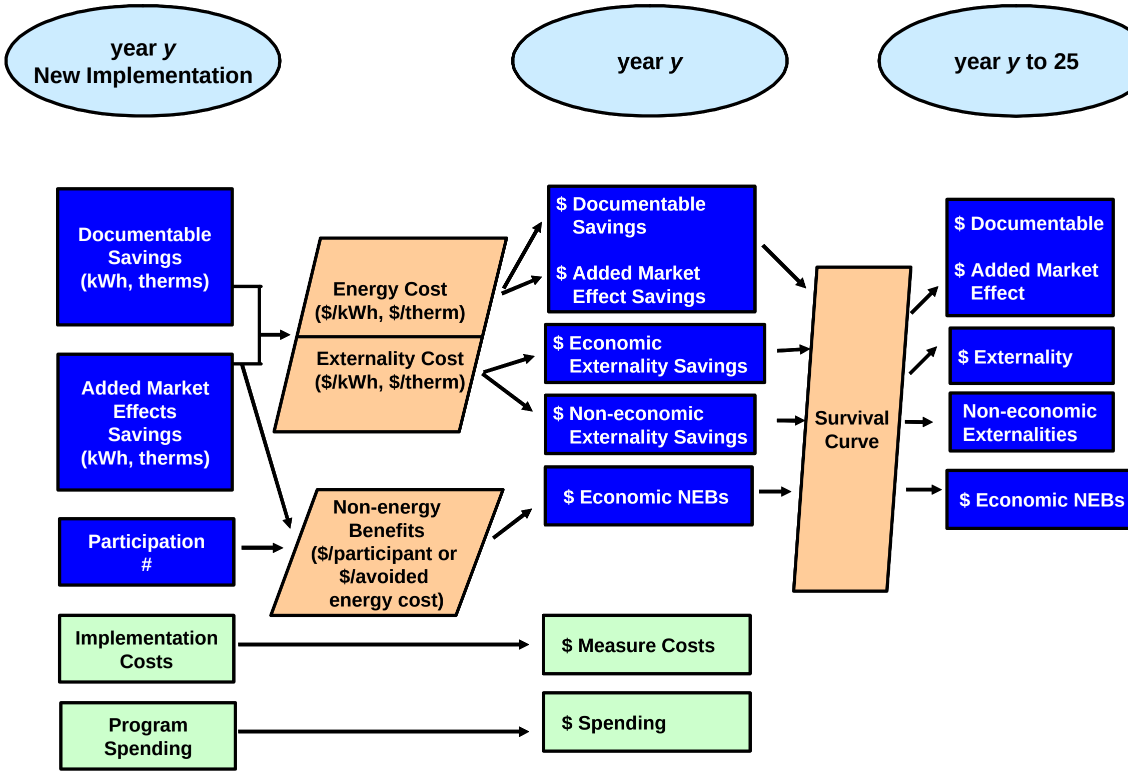
5.1.7 Relationship between the Economic Input-Output Model and the Expanded Benefit-Cost Analysis

The expanded benefit-cost analysis and the economic input-output analysis are closely related. Many of the inputs required for the two analyses are the same. Like the economic input-output model, the expanded benefit-cost analysis counts: direct energy savings; market effects energy savings; economic non-energy benefits; and internalized environmental externalities. The expanded benefit-cost analysis also counts the value of non-internalized externalities. In the expanded benefit-cost analysis, the output of the economic input-output model provides the total value of the elements counted in that model.

5.1.8 Developing the Input Streams

Figure 5-2 shows how the benefit streams for 25 years are developed in the benefit-cost analysis. In each of Years 1 through 25, the projected new implementation of energy efficient measures due to both direct effects (in-program) and market effects are projected. Corresponding estimates of the numbers of program participants and their associated implementation costs are also projected. First-year dollar savings, in terms of avoided energy costs and avoided externalities are calculated from the first-year energy savings. First-year economic NEBs are calculated based on the participant counts. For each year after Year *y*, these benefits are degraded according to an assumed decay curve. The decay curve is an exponential decay, with median lifetime equal to the savings-weighted average measure life for each program area. This decay rate applies to all components of the benefits stream. The calculation and application of the decay curve is described further in Section 5.3.

Figure 5-2. Development of Benefit Streams



5.2 BENEFIT-COST MEASURES

The benefits and costs of a program like Focus can be compared in a variety of ways. This report presents the results of two approaches, which we have called the “simple” and “expanded” benefit-cost tests. The simple benefit-cost test we use is similar to a standard Total Resource Cost (TRC) or Societal Test approach. The expanded benefit-cost test incorporates additional benefits, including economic impacts, avoided air emissions, and non-energy benefits (NEBs). Both tests are based on a long-term time frame, rather than assessing program effectiveness for any single year.

5.2.1 Total Resource Cost Test

The TRC test measures the net costs of a demand-side management program as a resource option based on the total program costs, both to the participants and the utility. The Societal Test, a variant of the Total Resource Cost Test, compares the avoided cost of energy supply with the combined program and participant costs. This framework has its origins in an Integrated Resource Planning process for regulated retail electricity supply. In this framework, investment in energy efficiency is justified if it is cheaper than investing in additional generation/energy supply. The Societal Test also counts avoided externalities among the benefits of energy efficiency and uses a societal discount rate (*California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects,* July 2002.).

The benefits included in the TRC test are the avoided supply costs—the reduction in transmission, distribution, generation, and capacity costs valued at marginal costs for periods when there is a load reduction. Avoided supply costs are calculated using net program savings, or savings net of changes in energy use that would have happened in the absence of the program. The costs included in the TRC test are the program costs paid by both the utility and the participants.

5.2.2 California Public Purpose Test

The California Public Purpose Test is an extension of the Societal Test (CEC, 2001b). The primary differences between the PPT and the Societal Test are that the PPT explicitly allows for counting of non-energy benefits and also allows for consideration of a multi-year timeframe for the analysis of costs and benefits. The PPT counts the following benefits and costs.

A. BENEFITS

- Customer avoided energy costs, based on direct net energy savings. Savings net of free-ridership are valued at the average cost per kWh or therm.
- Customer avoided energy costs, due to market effects energy savings. Market effects energy savings are valued at the same avoided cost as the direct energy savings.
- Customer non-energy benefits value, based on net energy savings. Non-energy benefit multipliers are applied to the net energy savings.
- Avoided externality value, based on net energy savings. Externality multipliers are applied to the net energy savings.

B. COSTS

- Program costs excluding incentive payments. Incentive payments are not counted as either a program benefit or a program cost. The incentives are a transfer payment, and represent a net difference of 0.
- Customer non-energy costs based on net energy savings. The PPT does not explicitly mention non-energy costs. However, consistent with considering non-energy benefits, non-energy costs should also be considered and would be assigned to the cost side of the equation.
- Customer incremental costs, net of free-ridership. The same attribution factor used to adjust energy savings for free-ridership is applied to the in-program customer incremental costs. Only the incremental costs of measures that would not have been implemented in the absence of the program are counted. Incremental costs for market effects implementation are also counted.

5.2.3 Simple Benefit-Cost Test

The simple BC test used in this study is based on the TRC or Societal Test, but with a multi-year time frame. Using this type of approach allows comparison of Focus programs with similar programs around the country. The test counts as benefits net (attributable to the program) energy and demand savings, and documented market effects savings only. The simple test also counts as benefits the avoided value of economic environmental externalities. NEBs, non-economic environmental externalities, and economic multiplier effects are excluded. On the cost side, program costs are included, exclusive of incentives. Net customer incremental costs, including any portion covered by incentives from Focus or anyone else, are also included.

The simple test is carried out for each program portfolio (e.g., Renewable, Residential, etc.), as well for each individual program within the program portfolio. The simple Test is summarized below.

A. BENEFITS

- Customer avoided energy costs based on net (i.e., program-attributable) energy savings
- Avoided energy costs attributable to documented market effects
- Economic environmental externalities for NO_x and SO_x

B. COSTS

- Total program spending, excluding incentive payments
- Net (i.e., program-attributable) customer incremental costs.

C. RATIONALE FOR THE SIMPLE TEST

The simple test is based on direct valuation of energy savings in comparison with the total direct cost of achieving those savings.

5.2.4 Expanded Benefit-Cost Test

The expanded benefit-cost test counts benefits more broadly than the simple test. The expanded test includes NEBs and the full range of environmental benefits in addition to the same benefit elements included in the simple test. In addition, whereas the simple BC test counts the economic benefit by considering only the direct value of the benefit and cost components, the expanded benefit-cost test counts the total change to the state economy resulting from the benefits. This economic impact is calculated by running an economic input-output model for the state of Wisconsin with the expanded list of benefits as inputs.

The same costs are counted in the denominator for both the simple and expanded tests. Thus, the expanded test:

- Counts avoided non-economic externalities and NEBs in addition to the avoided energy benefits and economic externalities
- Values benefits in terms of the total economic impact of the benefits on the state economy
- Uses the same denominator (costs) as in the simple test.

The expanded benefit-cost test is performed at the portfolio level only and not for individual programs within each portfolio.

The total change to the state economy is measured by the economic impact as determined by the economic input-output model. This impact captures the effects of direct and market effects energy savings, as well as those environmental externalities and NEBs that result in dollar flows through the economy.

Benefits that do not result in dollar flows through the economy are not captured by the economic impact model. We refer to these benefits as "non-economic" benefits. These benefits are added to the economic impact calculated from the "economic" benefits to determine the total benefit for this test. In this analysis, NO_x and SO_x costs are internalized via emissions trading markets, and are counted in the economic model. CO_2 and Hg are not internalized and are not counted in the model; these benefits are added to the economic impact of the "economic" benefits to determine the total benefit. This analysis counts only "economic" NEBs.

The primary gains to the economy captured in the economic impact that are not captured by simply summing benefits as in the simple test include:

- Substitution of in-state purchases (such as for locally produced energy-efficiency products and services) for out-of-state purchases (such as for fossil fuel); and
- Increased competitiveness of Wisconsin businesses as a result of increased in-state purchases.

The economic development benefits of interest to the analysis of Focus are:

1. Added worker earnings,
2. Corporate net profits
3. Beneficial changes in the cost of living.

Program savings explicitly benefiting Wisconsin households are best evaluated using the real disposable income impact. This impact captures both the underlying earnings creation as the Wisconsin economy benefits under Focus, and the reduction in the cost of living to households. Thus, the measure of economic impact used to quantify the benefits for the Residential Programs for the expanded BC test is the real disposable income impact.

Program savings explicitly benefiting Wisconsin businesses are best evaluated by examining the value-added impact. This impact captures both additional worker income created in the state and corporate net profits. Thus, for the Business and Renewables Programs, the economic impact used to quantify benefits for the expanded BC test is the value-added impact.

Although the economic impacts are quantified somewhat differently for the different program areas, it is meaningful and appropriate to sum these economic impacts across program areas to obtain the total Focus impact or benefit. The reader will find a consistent treatment of program-specific impacts in the separate report, entitled *Economic Development Benefits: FY07 Evaluation Report* (Focus Evaluation Team, 2006b). Distinct elements of the expanded benefit-cost test are summarized below.

A. BENEFITS

- Economic impacts from the Economic Input-Output Model, where the model inputs are:
  - Avoided energy costs attributable to documented market effects

  - Avoided energy costs attributable to additional, less rigorously measured market effects
  - Economic environmental externalities for NOx and SOx
  - Economic NEBs

- Plus elements not included in the Economic Input-Output Model
  - Environmental externalities for CO2 and Hg, which are not internalized in the Economic Input-Output Model.

B. COSTS

- Total program spending, excluding incentive payments
- Net customer incremental costs.

C. RATIONALE FOR THE EXPANDED TEST

The expanded test is intended to capture the full effects of the program on the state's economy. The test incorporates the flow-through effects of the program spending and savings in the economy. The test also looks at the broader array of benefits resulting from DSM programs, including well documented savings, as well as some effects that not necessarily possible to document as rigorously and/or are less widely accepted as belonging in such analysis.

5.2.5 Comparison of Tests

Table 5-2 compares key components of the standard TRC and Societal tests with those of the simple and expanded tests used here. Also shown are the elements included in the economic impacts. The TRC and Societal Test components are based on the definitions in the *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects,* July 2002.

All the tests considered count the avoided cost of energy supply as a benefit. The Societal Test also counts the value of all avoided emissions associated with the energy savings. The TRC test counts avoided emissions only to the extent that the cost of those emissions has been internalized, for example through mitigation requirements or cap and trade markets.

Effectively, emissions costs for NO_x and SO_x are internalized for electricity generation, but not for most gas consumption. Our simple test counts avoided NO_x and SO_x values for both electricity and gas savings. Our expanded test also counts avoided CO_2 and mercury, which are not currently internalized.

Non-energy Benefits resulting in monetary flows are counted in the Societal Test and in our Expanded BC Test, but not in the TRC or simple test. The Societal Test would also count Non-Energy Benefits that do not result in monetary flows. However, our expanded test considers only the more easily quantifiable monetary NEBs.

Secondary economic benefits related to the stimulus effects of program-related spending and savings are not explicitly identified in the SPM for the Societal Test, but are often counted in the form of "economic multiplier" effects as a form of Non-energy Benefit. Our expanded test includes these secondary economic effects as reflective of the overall impact of the program on the economy.

The TRC Test explicitly counts tax credits as a reduction to customer incremental costs. The Societal Test treats tax credits as a transfer payment and does not recognize a societal value. Both our simple and expanded test treat tax credits as a transfer and do not include their value in the benefits stream. The reason for this treatment is to avoid counting federal tax credits attracted by the program as a benefit to the state economy.

The TRC test uses a non-societal discount rate, such as the utility's. The Societal Test uses a societal discount rate. Both our simple and expanded tests use a discount rate that we think of as a societal rate.

In total, we view both the simple and expanded tests as taking a societal perspective. The expanded test is more comprehensive, and includes some effects that cannot be as rigorously quantified. The expanded test is derived from the economic impact, together with the non-monetized externalities that are not reflected in the economic impact.

Table 5-2. Comparison of Test Components

Analysis Component	TRC	Societal Test	Simple BC Test	Expanded BC Test	Economic Impact
Benefits Counted					
Avoided supply costs of kWh, kW, therm	X	X	X	X	X
Avoided emissions costs included in electric delivery	X	X	X	X	X
Avoided externality value of market-valued emissions costs associated with customer gas use		X	X	X	X
Avoided externality value of projected market value of emissions costs associated with electricity delivery		X		X	
Avoided externality value of projected market value of emissions costs associated with customer gas use		X		X	
Non-energy benefits resulting in monetary flows ("economic")		X		X	X
Non-energy benefits not resulting in monetary flows ("non-economic")		X			
Secondary economic benefits		X		X	X
Tax credits treated as reduction in customer costs	X				
Discount rate	utility	societal	societal	societal	not applicable

5.2.6 Comparing Benefits and Costs

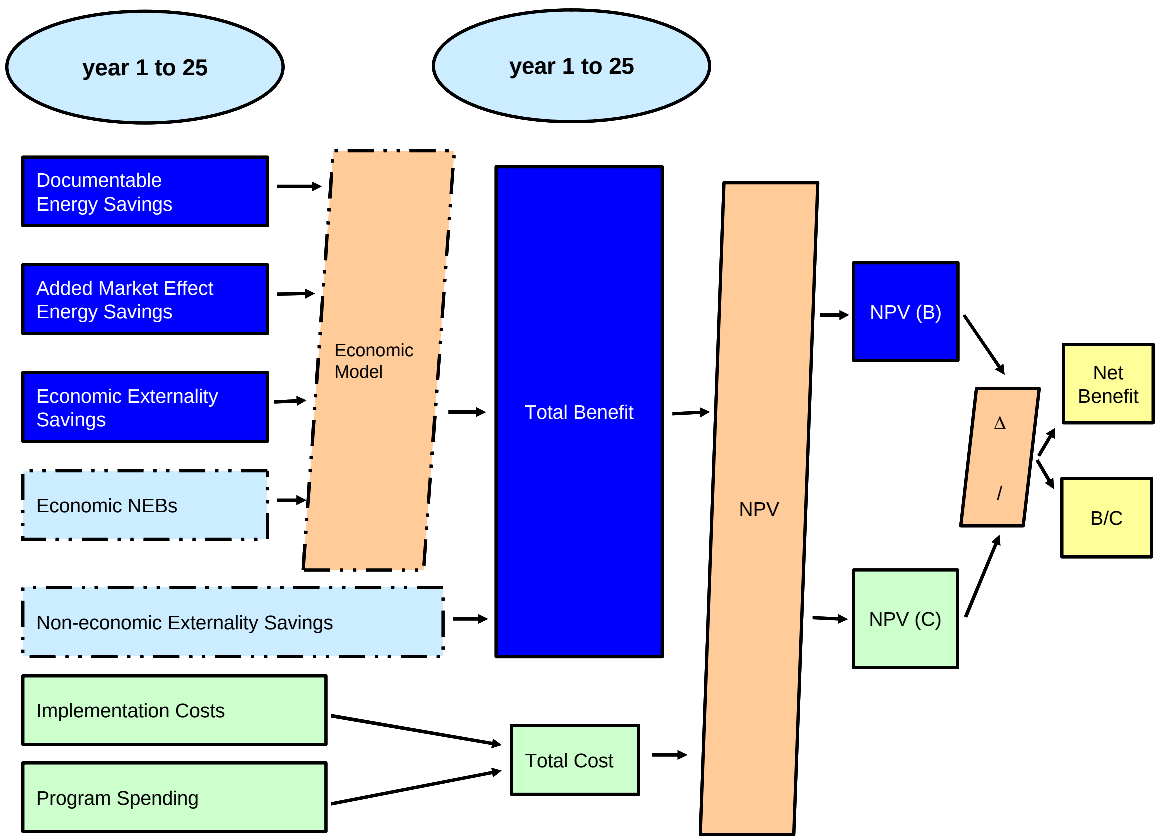
Benefits and costs are compared in this study in terms of the net benefit (total benefits minus total costs) and the benefit-cost ratio. Both the net benefit difference and benefit-cost ratio are calculated based on the net present value of a 25-year stream of costs and benefits. Results are all presented in 2007 dollars. Savings and other projections assume that the programs continue for a period of 10 total years, through FY11. A real discount rate of 5 percent is assumed, as discussed in Section 3.5.

Figure 5-3 illustrates how the benefits and costs are aggregated by the benefit-cost tests applied here. For each year of the analysis, simple or expanded test, the applicable benefits are combined. For the simple benefit-cost test, the combination is simply the sum of program benefits. For the expanded benefit-cost test, the benefit is the output of the economic impact model, using the expanded list of benefits as inputs, plus the non-internalized avoided externalities.

The costs are also combined for each analysis year. In both tests, the same cost elements are counted, and are summed to produce the total cost.

The 25-year net present value (NPV) is calculated for the total benefit and the total costs. The difference between total benefit and total cost yields the net benefit (also in NPV). The ratio is the benefit-cost ratio.

Figure 5-3. Combining the Benefit and Cost Streams



Because programs such as Focus are not likely to achieve meaningful penetration and/or results in a single year, benefit-cost results are calculated for a 25-year horizon. The projections used in the 25-year analysis are grounded in the historical performance of the programs in the early years, FY02 to FY06.

5.3 PROJECTIONS

This analysis required a 25-year stream of all the benefit and cost components. The general approach to developing these projections for each program area is described below. Specific analysis to develop the inputs for each program area is described in Appendix A.

5.3.1 Program Spending

Program spending projections were developed in consultation with Department of Administration (DOA) staff and the program administrator. Allocations to program areas and components were developed based on preliminary proposals from the program administrator at an early stage in the planning process. Consistent with the economic impact report, the current benefit-cost analysis assumes operation of the programs for a 10-year period (beginning in FY02) and includes impacts that extend 15 years beyond the end of the programs.

Program spending projections over the second five years of the program are modeled according to a low- and a high-funding scenario. The low-funding scenario assumes a level of program spending consistent with the average program spending based on the first five years of the program. The high-funding scenario assumes total program spending corresponding to levels set by recent legislation[9].

Other assumptions used to develop the spending projections for the high and low scenarios are as follows:

- FY02–FY06 spending levels are based on actual invoices submitted to DOA;
- FY07 budget numbers were provided by DOA, with spending based on percentage of actual budget spent in FY06;
- Unspent budget in each year is carried over to the following year;
- For the low-funding scenario, FY08–FY11 projections are based on a total budget figure of $48 million, which is tied to actual spending levels in FY02–FY07. For the high-funding scenario, FY08–FY11 projections are based on a total budget figure of $73 million, which represents expected revenues collected from utilities based on current legislation.10

5.3.2 Documentable Savings

Documentable savings for the first few program years are taken from the prior evaluation reports, in particular the most recent year-end report. Break-downs into subcategories needed for the analysis were developed by each program area evaluation team.

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[9] The funding levels under the High scenario are what is currently expected, but are lower than those assumed in the recent Technical Potential study conducted by the Energy Center of Wisconsin.

[10] Total revenues are expected to be approximately $91 million, with the utilities expected to retain $16.5 million to operate their own programs and approximately $1.5 million for DOA/PSC administrative costs.

Projected Savings for future years were based on projected spending levels together with the ratio of savings to spending observed to date. Specific information on future program plans was incorporated to the extent it was available at the time the analysis was conducted.

The low funding scenario is intended to reflect the value of the program as it has existed to date, but assuming a 10-year life. For this scenario, it makes sense to project the future consistent with the past rate of savings. The high funding scenario is intended to reflect a higher potential for the program under higher funding levels. One might conjecture that the larger scale program will provide economies of scale, resulting in greater "program efficiency" in terms of savings achieved per program dollar.

On the other hand, the funding increases are relatively modest. Much of the "low-hanging" fruit has already been harvested. The historic savings levels compared with spending do not indicate consistently increasing program efficiency levels. Further, recent increases in efficiency standards will make it challenging to achieve even the same level of savings per program dollar for some program components. As a result, there is no solid basis for making any specific assumption about changes in the rate of savings per program dollar compared to what has been seen so far. For these reasons, we have mainly assumed the same rates in the high scenario as in the low scenario.

As it turns out, when considering the total cost part of the benefit-cost tests, program spending is relatively small compared to the customer incremental costs. The customer costs in turn scale directly with the savings levels (for a given mix of program measures). As a result, the ratio of benefits (savings) to costs does not change dramatically with modest improvements in program efficiency. (Net benefit, the difference between benefits and costs, do increase with program efficiency.) Appendix E provides some illustrative analysis of this effect.

5.3.3 Measure Life and Decay Rates

Measure life was assessed for each program component by the program area evaluators, primarily based on secondary sources. This measure life is interpreted as the median measure life. Measure lives for all program measures included in this analysis are provided in Appendix D. The savings implemented in each program year is extended into the future with an exponential decay rate, such that half the savings remains after the measure life.

That is, we interpret the measure life identified from the literature as the time until half the units would be expected to have failed or been removed. This interpretation is consistent with the persistence study framework used in California and elsewhere. Under those rules, the "expected useful life" is the median survival time, where "surviving" means remaining in place and operable. *Find cite if possible*

With this interpretation and an assumed exponential decay, the fraction f of savings that survives from one year to the next is given by

$$f = 2^{-(1/L)}$$

where L is the measure life. For example, if the measure life is 15 years, the surviving fraction each year is

$$f = 2^{-1/15} = 95.5\%.$$

The decay rate is

d = 1-f = 4.5%.

Thus, in this example, the surviving savings from the prior year is calculated as 95.5% of the prior year's amount; 4.5% of the prior year's savings is lost. Associated non-energy and environmental benefits decay at the same rate.

The exponential decay formula implies a constant failure rate over time. This assumption is not necessarily realistic for many measures. Experience from numerous persistence studies conducted in California indicates that the failure process is often a mixture of 2 phenomena--in the short term, removal due to defect or dissatisfaction, and In the longer term, more or less steady wear-out patterns. This mixture suggests a "hazard rate" that is high in the early years, then declines, becoming stable (exponential) or eventually rising again in much later years.

The Weibull function is commonly used for survival analysis. This form can give either an increasing or decreasing hazard rate, but not one that starts high, drops, then stabilizes or climbs. For a fixed median measure life, we considered a Weibull with shape parameter 1/2 (decreasing hazard) and one with shape parameter 2 (increasing hazard). The first gives 5-10% lower NPV and the second gives 5-10% higher NPV compared to the exponential. A mixture of the two distributions, representing a combination of the two contributing phenomena, would give NPV somewhere between, or close to that from the exponential itself. Thus, the exponential assumption, which is computationally convenient, appears to yield appropriate end results for purposes of this analysis.

5.3.4 Market Effects Savings

In the low-funding case, we count market effects savings that have been documented by the evaluation and are counted in the program achievement to date. These are projected to later program years similarly to the projection of direct savings. For CFLs, which have had a clear and demonstrable effect on their markets, we also count additional market effects that have not been analyzed in detail but that we believe represent a minimum reasonable lasting effect of the program.

For the high-funding case, we include additional market effects savings that are somewhat less certain, but are still plausible in light of available information on the programs' effects. These added effects are generally modest in magnitude, compared to the documentable savings, to avoid having the high scenario BC results dominated by uncertain effects.

5.3.5 Incentive Payments

Incentive payment amounts were determined from program records.

5.3.6 Incremental Project Costs

Incremental project costs have not been developed and reported by the evaluation team except in the context of the prior benefit-cost analysis. Estimates were developed for the present analysis from a variety of sources.

5.3.7 Non-energy Benefits

Non-energy benefits were estimated based on values provided in the non-energy benefits reports.[11] Each program area evaluator determined how best to apply these findings to the programs as they currently exist.

The residential and low-income NEBs reports identified some NEBs that do not result in dollar flows in the economy, but are based on customer reported value. For purposes of this analysis, only those NEBs that result in economic flows, or “economic” NEBs, are included. While customer perceived value was also used for the business NEBs assessments, the values reported involved financial effects on businesses.

[11] *Low-income Non-energy Benefits for Inclusion in Economic Analysis,* Final report April 3, 2006; *Non-energy Benefits Crosscutting Report Year 1 Efforts*, Final report January 30, 2003; *Non-energy Benefits to Implementing Partners from the Wisconsin Focus on Energy Program,* Final report October 20, 2003; *The Non-energy Benefits of Wisconsin Low-income Weatherization Assistance Program,* Final report November 9, 2005; *Renewable Energy Program: Non-energy Effects,* Final report January 17, 2005.

APPENDIX A: DEVELOPMENT OF PROJECTIONS BY PROGRAM AREA

A.1 BUSINESS PROGRAMS

A.1.1 Structure of Projections

Projections were developed separately for each sector: Agriculture, Commercial, Schools and Government, and Industrial. The first three sectors are broken into seven subcategories:

- Building Shell
- HVAC
- CFL
- Other Lighting
- Motor
- Manufacturing Process
- Other

The Industrial sector has all of the above categories and one additional: Pulp and Paper.

We chose to segregate the BP analysis by sector because each sector runs essentially as a unique unit with its own savings goals and targets. We report impact evaluation results by sector and, therefore, the savings breakdowns are already available at the sector level.

We chose to subcategorize the BP analysis into the five traditional end-use categories used by previous end-use reports: Building Shell, HVAC, Lighting, Manufacturing Process, and Other. In the course of developing the inputs, we split out CFLs, Pulp and Paper, and Motors to allow us to facilitate application of market effects multipliers.

A.1.2 Direct Savings

Direct savings for FY02–FY05 are based on the FY06 Year End Evaluation Report. Savings for FY06 are based on the FY06 impact evaluation report currently under development (*Business Programs Impact Evaluation Report—Fiscal Year 2006,* December 22, 2006). Savings for FY07–FY11 are based on the ratio of savings per program spending dollar in FY06 applied to projected spending dollars in FY07–FY11.

These projections were developed separately by subcategory within each sector. Spending allocations to sectors were based on spending detail provided by the program administrator for FY05–FY06. Savings breakdown by subcategory was assumed to be consistent with the breakdown seen in the programs to date.

A.1.3 Measure Life and Decay Rates

Measure life was determined on the sub-category level from information gathered from the ECW Technical Potential Study and the CA DEER database. Measure life for the Other category was determined by assigning measure life to the different measure types in the Other category and calculating a weighted average based on energy savings.

A.1.4 Market Effects Savings

a. LOW FUNDING

CFLs

Beginning with the BP impact evaluation for FY06 (currently being completed), the impact evaluation is applying the same net-to-gross analysis to BP as has been used for the residential program area. This net-to-gross, which includes spillover and market effects as well as free-rider effects, is included for the documentable savings in both scenarios.

Per the most recent analysis using this method, roughly 15 percent of in-program (tracked) sales are naturally occurring. These are balanced by a roughly equal number outside the program but attributable to it. Thus, the sales outside the program and attributable to it are 15 percent of in-program tracked sales. We assume that these sales would continue after the close of the program, but would decline in the absence of an active program promoting a high level of demand. That is, the added market effects after the program close begins at 15 percent of the FY11 documentable level. These effects are reduced by 10 percent per year.

nonCFLs

The 2005 BP spillover report (*Focus on Energy Statewide Evaluation, Business Programs: Participant Spillover Savings Study*) provides a basis for calculating the nonCFL spillover rate. We calculate this rate as the new savings in the current year per unit of tracked savings in a prior year. This rate represents first-year savings implemented in the current year due to all prior program years. This rate is:

0.08% for kWh

0.11% for kW

0.002% for therms.

These rates are included as part of documentable energy savings. They are calculated at an overall level for each sector, not broken out by subcategory.

b. HIGH FUNDING

The market effects for the high-funding level include all of the spillover described in the previous section and additional market effects resulting from increased program activities. Additional market effects are projected for the CFL, Other Lighting, Motors, and Pulp and Paper subcategories.

In the CFL subcategory, it is assumed that increased activity with large retailers will affect the impact that the program has on the CFL market, resulting in greater post-program spillover. As a result, the added market effects include a higher spillover rate (30 percent) but savings are still allowed to degrade in the absence of an active program.

In the Other Lighting category, we recognized that T8 fixtures that replace T12 fixtures are becoming increasingly standard and not high-efficient equipment. Therefore, assuming that the Commercial and Agricultural Other Lighting savings fall largely into this category, we cannot expect that additional market effects are available for these sectors. However, Industrial and Schools and Government sectors have a greater savings impact in other measures, namely, T8 lamps that replace HID lights. As a result, we applied a 15 percent spillover rate to the portion of the savings that we assumed are not standard T12 to T8 lighting retrofits. We assumed that 2/3 of the Industrial Other Lighting savings and 1/3 of the Schools and Government Other Lighting savings qualify for this spillover.

In the Motors category, we recognized that the Focus program has recently begun a Motors Channel program that addresses high-efficiency motors from a supply (manufacturer/distributor) side and not just a demand (customer) side. As a result, we applied a 15 percent added market effect rate to the high-funding scenario for FY11 through FY26.

In the Pulp and Paper category, we recognized that the program is reaching a number of customers through the Focus Best Practices Guidebook and that a number of projects are being done as a result. Not all of these are being documented through the program tracking database. As a result, we applied an additional 680,000 kWh/year and 100,000 therms/year for FY07 through FY11 and allowed the savings to degrade in the absence of an active program.

A.1.5 Incentive Payments

Historic incentive payments were determined from invoicing and budget records provided by DOA and the program administrators. Future incentive levels were projected for given spending assumptions based on the historic proportions of program spending.

A.1.6 Incremental Project Costs

Incremental cost data have been collected on every Implementing Partner Short-Term Follow-up Survey. These data were merged with reported gross savings data from the tracking databases. Savings values were translated to avoided costs by applying the avoided cost values used in the present report. From this combined database we calculated the ratio of mean incremental cost to mean savings. This ratio can be thought of as the simple payback period.

Multiplying the payback period by the net savings (documentable and market effects) gave the incremental cost. This calculation was done for each combination of sector, end use, and year.

The payback period was calculated separately by end use. The same end-use pay-back periods were used for each sector, since the available data were not sufficient to generate separate estimates by sector and end use combined.

Table A-1 gives the payback periods calculated for each end use. The total payback is divided into equipment and labor costs. These break-outs are used in the economic impact analysis, separately reported.

Table A-1. Business Programs Incremental Cost per Dollar Value of Avoided Energy Cost (Simple Payback)

Category		Total Payback	Equipment Payback	Labor Payback
Overall		2.1	1.4	0.7
Enduse	Lighting	2.2	1.6	0.6
	HVAC	2.5	1.3	1.2
	Building Shell	6.2	4.1	2.1
	Manufacturing Process	1.3	0.9	0.4
	Other	2.9	2.3	0.6

a. SOURCE OF INCREMENTAL COST DATA

The incremental cost data used in the analysis came from the Implementing Partner Short-Term Follow-up Survey conducted as part of each round of impact evaluation. This survey established the purpose of the project for each participant. The response to these questions determined whether the participant was asked about the full cost of the project or the partial increase or decrease as a result of the energy efficiency improvements. In both cases the participant was asked to provide both a total for the costs as well as break out the total for equipment and/or labor. This sequence of questions was asked of participants for each different end use they implemented.

b. PARTICIPANT LEVEL PAYBACK CALCULATION

The incremental cost data from the surveys was combined with energy savings from the tracking data and put in terms of 2006 dollars. Energy savings were transformed into a single avoided cost metric using 2006 energy prices. The incremental cost data from the surveys was inflated to 2006 dollars using the Consumer Price Index. The ratio of the 2006 incremental cost to 2006 avoided energy costs provides a participant level estimate of payback or the number of years it will take to break even on the project.

Incremental cost data is frequently difficult for participants to estimate, particularly when the efficiency measure was implemented in the context of a much larger project. We therefore screened the survey data to remove what appeared to be unreasonable responses. We used the participant level payback estimates to establish whether to include the data in the final estimates of overall payback. We accepted payback ranging from between one-half year and eight years. The median payback was similar with or without this screen.

Final incremental cost estimates were calculated using an unweighted ratio estimator.

$$\text{Payback} = \overline{IC_e} / \overline{AC_e}$$

where:

$\overline{IC_e}$ = mean incremental cost within an end use.

$\overline{AC_e}$ = mean avoided energy cost within an end use.

A.1.7 Non-energy Benefits

Non-energy benefits (NEBs) were calculated by applying a fixed multiplier to the avoided energy costs. To develop this multiplier, we relied on results from the 2003 report on BP NEBs produced for Focus. (*Non-energy Benefits to Implementing Partners from the Wisconsin Focus on Energy Program: Final Report*, October 20, 2003).

The NEBs results produced in the report were reported on a per project basis. However, given the wide range of project sizes in the program, ranging from a few compact fluorescent bulbs to a major industrial plant change-over, it was important to develop a NEBs factor scaled to the project magnitude.

A participant-level ratio of NEBs to avoided energy cost using the original NEBs analysis was not feasible, because the magnitude of savings for the projects included in that study was not reported, and the data identifying the individual respondents are not readily available. Instead, an aggregate avoided cost estimate was calculated using the population from which the NEBs analysis was drawn. That is, we scaled the average NEBs determined in the report by an estimate of average savings per project for the set of participants that served as the starting frame for the NEBs study sample.

To adjust for a possible different mix in project type and complexity between the starting frame and the completed sample, we determined the NEBs per unit avoided cost separately by measure category and weighted the results by the number of sample cases in each measure category. Participants in the NEBs population were assigned to detailed measure categories consistent with those used for the original NEBs analysis. Reported energy savings were transformed to avoided cost using 2006 energy prices and summed within the measure categories. Using the number of completed sample cases in each category as weights, we calculated a weighted average avoided cost for the NEBs population.

This aggregate avoided cost estimate was used to translate the NEBs results from the previous report into a NEBs value per dollar of avoided energy cost.

The original report offered three possible estimates depending on the interpretation of 0 responses and missing values in each NEBs category. We took the most conservative of these estimates. Using data presented in the report, we also constructed a version of that estimate based on median rather than mean values. The NEB value per dollar of avoided costs was found to be 0.22 using the median and 0.34 using the mean. We used a value of 0.3 for the benefit-cost analysis.

A.2 RESIDENTIAL PROGRAMS

A.2.1 Direct Savings

Direct savings for FY02–FY06 are based on the FY06 Year-End Evaluation Report. Savings for FY07–FY11 are based on the ratio of savings per program spending dollar in FY06 applied to projected spending dollars in FY07–FY11.

A.2.2 Market Effects Savings

For each individual residential program included in the benefit-cost analysis, potential market effects have, in some cases, been projected based on an aggressive and conservative view of potential market effects. The midpoint of these estimates is utilized in the benefit-cost analysis. For example, in the ENERGY STAR® Products Program (ESP), the analysis assumes market effects that persist beyond FY11. The rationale behind the approach is the general uncertainty associated with the potential range of savings that may be achieved, and how those savings may be attributable to Focus activities.

An example is provided by two scenarios of projected market effects for compact fluorescent lighting (CFL). Both scenarios encompass a combination of supply-side changes (i.e., continuation of CFL sales among retailers who participated in Focus and those who did not) and demand-side changes (i.e., past program participants continuing to purchase CFLs and past program non-participants beginning to purchase CFLs due to their increased availability). The aggressive scenario assumes that 50 percent of FY11 direct program impacts persist after the program has ended. The conservative scenarios assume that 10 percent of FY11 direct program impacts persist after the program has ended.

Among the six residential programs, only the Targeted Home Performance with ENERGY STAR® Program (THPWES) is assumed to have zero market effects.

A.2.3 Incentive Payments

Incentive payments for each year FY07 through FY11 were included as a line item in the Residential Program budget.

A.2.4 Incremental Project Costs

Per-unit incremental costs were derived based on information provided by WECC. Total incremental costs for FY02–FY06 were calculated based on the number of each measure installed. Incremental costs for FY07–FY11 were determined based on the ratio of incremental cost to savings in FY06 applied to projected savings in FY07–FY11.

A.2.5 Measure Life and Decay Rates

The measure lives for individual measure types were based on estimates from the ECW Potential Study. For each year of the benefit-cost analysis, the life of the measures implemented within each individual Residential Program was calculated as a savings weighted average of the associated measure lives.

Since decay rates are tied to measure life, the decay rates varied by each individual program. Depending on the program, savings were assumed to degrade by between a fixed percent per year for the life of the measure. With this assumed decrease, half the savings remain at the assumed measure life. Thus, each unit of first-year savings was repeated for each year of the analysis, with the given percent decrease each year. The same measure lives and decay rates were applied to documentable and market effects savings. The value of environmental externalities and economic NEBs was also subject to these measure life and decay rates. Further detail on this analysis is included in Section 5. The measure life assumptions are in Appendix D.

A.2.6 Non-energy Benefits

Economic NEBs were derived from estimates presented in the residential NEBs report (*Non-energy Benefits Crosscutting Report Year 1 Efforts*, Final report, January, 30, 2003). For the benefit cost-analysis, forecasts of NEBs estimates are based on projected participant counts for each program year. Participant counts are proportional to the direct savings estimates.

A.2.7 Projection Details

The memo that follows details the assumptions and rationale for developing the savings projections.

Subject	**RATIONALE BEHIND 2006 RESIDENTIAL BENEFIT/COST STUDY INPUTS (REVISED)**
To	Mimi Goldberg, Chris Clark
	Cc Ralph Prahl, Prahl and Associates David Sumi, PA Consulting Group Bryan Ward, PA Consulting Group
From	Tom Talerico and Rick Winch, Glacier Consulting Group, LLC
Date	October 26, 2006

This memorandum is intended to outline the Focus residential evaluator's rationale for the work completed on the benefit/cost (B/C) analysis with respect to market effects and the high/low funding scenarios. The assumptions behind other parameters (e.g., historical energy savings, measure life, incremental costs, non-energy benefits) are discussed in the "source" column within each of the individual program worksheets that accompany this memorandum.

Within this memorandum, we first discuss some general assumptions that apply to virtually all of the residential programs. Then we discuss each of the individual programs separately and, where appropriate, the specific technologies and markets involved. We have attempted to keep the discussion as brief as possible for programs and measures that are only a small component of the overall Focus effort. More discussion and rationale are provided for those programming efforts that have historically accounted for a larger proportion of overall Focus impacts.

General Assumptions—High and Low Funding Scenarios

The residential evaluation team had an opportunity to participate in a WECC sponsored planning retreat on September 18, 2006. As we understand it, the purpose of this retreat was to review past Focus efforts and, to a large extent, brainstorm for program ideas as funding levels ramp up over the next several years. One of the most interesting aspects of the meeting was a presentation by Kathy Kuntz where she contrasted trends over the last 30+ years in residential appliance energy use (energy use of new appliances has gone down significantly) with average residential household energy use (which has gone up). Kathy made the point that the big opportunities to save energy in the residential sector would appear to be gone although there is much that is not understood as to why average residential energy use (per home) continues to rise.

The take away from this meeting is that WECC does not, at this point, have well formulated plans for future programming under a high budget scenario.[12] This, we think, is perfectly understandable. At the same time, we would interject that WECC's current portfolio of programs could be expanded greatly given the overall size of the markets they are trying to impact relative to the budgets they have been operating under. As an example, the CFL effort is rewarding roughly one million CFLs per year but does not work with many major market actors (e.g., Wal-Mart, Sam's Club, Target, K-Mart) who, arguably, have the capacity to sell millions of CFLs.[13] Therefore, we believe that the most appropriate way to model a high funding scenario is to concentrate on current program offerings that: 1) are better understood; 2) have been evaluated over a five year period; and 3) have significant room for expansion. This is what we have done.

General Discussion

Two points need to be understood when reviewing the residential evaluation team's B/C inputs with respect to kWh, KW, and therm savings. First, for most residential programs, the evaluation team has historically used a market-based approach when assessing net program savings. This is especially true for those residential programs, such as the ENERGY STAR Products CFL and clothes washer initiatives, that account for the bulk of to-date residential sector savings. It is important to note that this market-based methodology does not easily lend itself to disaggregating net impacts into their component pieces (e.g., direct program savings, participant spillover, market effects). Rather, through the use of comparison areas or baseline data, the methodology provides a single point estimate of the probable impacts above and beyond what was likely to happen in the absence of such programming efforts. Given this methodology, it is important for the reader to realize that all program-year (FY02 to FY11) net savings numbers (included in the attached spreadsheet) include such phenomena as direct program savings, participant spillover, and market effects.

Second, most of the programs are relatively small compared to the size of the markets they are attempting to impact (this, as discussed above, even applies to the CFL effort which has arguably been the largest and most successful Focus effort to date). And, more importantly, there are many unknowns in most residential markets, making any effort to estimate market effects highly speculative in both the short- and long-term. Nevertheless, we have attempted to project market effects based on our collective knowledge of program activity and the markets in which they operate. The rationale for these market effects, on a program-by-program basis, is the subject of the next sub-heading.

Program by Program Discussion—Market Effects

For each of the programs/products discussed below, we outline an aggressive and conservative view of potential market effects and model the mid-point. We recognize that

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[12] While the Energy Center of Wisconsin's Achievable Potential Study provides some information (for a limited number of markets) on potential program offerings under various funding scenarios it is unclear how program implementers will use that information going forward.

[13] For example, early on, the program worked with Sam's Club. Within a roughly one-month time span, Wisconsin Sam's Clubs sold nearly 200,000 CFLs. Thus, this single nonparticipating retailer would appear to have the capacity to sell several million CFLs per year as part of a Focus sponsored effort.

budget limitations may prevent the modeling of both our aggressive and conservative scenarios, but believe this would be the best way to understand the range of savings that may be achieved.

ENERGY STAR Products Program (ESP)

Compact fluorescent Lighting: For this analysis, we have assumed market effects (for both the low and high funding scenarios) that last beyond the end of program funding in FY11. A key development in this market is that we may be on the cusp of a national surge in the retail promotion of CFLs. This, at least initially, may be a direct result of a partnership between Wal-Mart and General Electric in which Wal-Mart (a Focus nonparticipant) has announced its intention to sell "100 million CFLs in the next year."[14] Three issues have to be considered when determining how this development might impact overall program savings, and subsequent market effects. First, will Wal-Mart actually accomplish their objective? Second, regardless of whether or not Wal-Mart succeeds, can we expect other major retailers (national, regional, local) to follow Wal-Mart's lead? Finally, to what extent should Wisconsin's Focus on Energy be given credit (or partial credit) for any change that does occur?[15]

Admittedly, many assumptions need to be made in order to have this chain of possible future events play into the present B/C analysis. Based on internal evaluation team discussions, we have developed the following two scenarios. Both scenarios encompass a combination of supply-side changes (i.e., continuation of CFL sales among retailers who had participated in the program and those that had not) and demand-side changes (i.e., past program participants continuing to purchase CFLs and past program non-participants beginning to purchase CFLs due to increased availability, etc.). Our aggressive scenario assumes that 50 percent of FY11 direct program impacts persist after the program has ended (i.e., into FY12 and beyond). Our conservative scenario assumes that 10 percent of FY11 direct impacts persist after the program has ended.

Clothes Washers: For this analysis, we have assumed participant market effects (for both the low and high funding scenarios) that last beyond the end of program funding in FY11. Under the aggressive scenario, we assume that 80 percent of ENERGY STAR clothes washers impacts (program induced sales less baseline sales) would continue into FY12. Our rationale

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[14] September 2006 issue of FAST COMPANY magazine entitled "For Years, Compact Fluorescent Bulbs have Promised Dramatic Energy Savings—Yet They Remain a Mere Curiosity. That's About to Change." By Charles Fishman.

[15] This is a difficult question to answer. On the one hand, it is relatively easy to demonstrate that national efforts to promote CFLs have paved the way for the involvement of new retailers (such as Wal-Mart) and the Wisconsin Focus of Energy program has been a part of these collective efforts. This would seem to argue for assigning credit to the Wisconsin program for any changes that take place within Wal-Marts located in the state. On the other hand, on the margin, the influence of Wisconsin Focus on Energy's CFL activities on the national scene would not appear to be the "deciding" factor in a national retailer's (e.g., Wal-Mart) decision to promote CFLs, especially when that retailer has not been involved whatsoever in program efforts. This would seem to argue that the Wisconsin program should not receive credit for changes made within Wal-Marts located in the state. The challenge is to fairly assign credit for the Wal-Mart phenomenon somewhere between these two extremes. Attribution based on Focus's share of collective national efforts (perhaps based on total program expenditures, CFL sales, or number of households) is a possible approach.

for this is the fact that retailers and manufacturers view ENERGY STAR clothes washers as a premium product and will continue to market them heavily when program funding ends. We have also assumed a 20 percent decline in the gap between Wisconsin's achievement and that of a suitable comparison area for each subsequent program year. Thus, in FY13 we assume that 80 percent of the prior years (FY12) impacts will still be realized (and this continues on at the same rate over the years included in the analysis). It is important to point out that this scenario assumes that the change in national ENERGY STAR standards (January 1, 2007) has no impact on the Wisconsin program's ability to create impacts beyond that of a suitable control area. This is quite aggressive when one considers that many models that are currently ENERGY STAR compliant (and save significant amounts of energy compared to other models) will likely continue to be available.

Our conservative view entails a scenario of zero market effects. Under this scenario, which appears to also be plausible, the change in national ENERGY STAR standards dramatically alters the Wisconsin program's ability to achieve impacts beyond what is being realized in the rest of the U.S. (or a suitable control area). As stated above, this would appear to be a possibility due to the fact that the appeal of an ENERGY STAR model may erode given the fact that other models that save significant amounts of energy (and used to qualify as ENERGY STAR) are still available.

Other Lighting: This category includes other (non-CFL) lighting products that have been promoted by the Wisconsin ENERGY STAR Products Program. The most recognizable products in this "other" category include ENEGY STAR compliant fixtures and LED Christmas lighting. We have not projected market effects for this category for three reasons. First, both initiatives, relative to other WECC efforts, have been small. Second, and highly related to the first point, little evaluation effort has been given to these two lighting products. Third, we have little information upon which to base the potential size of any future efforts nor the probable impacts compared to a suitable baseline area.

Other Appliances: This category includes other appliances (e.g., refrigerators, dish washers, dehumidifiers, etc.) that have been promoted by the Wisconsin ENERGY STAR Products Program. We have not projected market effects for these appliances for a couple of important reasons. First, the energy savings realized from these efforts have been minimal. And, more importantly, this can be expected to continue given the fact the ENERGY STAR models are only marginally more energy-efficient than other models available. Second, WECC has stated on a number of occasions that the principle reason for providing incentives for such equipment was to maintain appliance dealer's enthusiasm for the clothes washer effort.

Efficient Heating and Cooling Initiative (EHCI)

Central Air Conditioning: For this analysis, we have assumed participant market effects (for both the low and high funding scenarios) that last beyond the end of program funding in FY11. Under the aggressive scenario, we assume that 20 percent of CAC impacts (program induced sales beyond baseline sales) would continue into FY12 and subsequent years. Our rationale is that HVAC contractors have been reluctant, historically, to promote highly efficient CAC products. In fact, past ECW Baseline efforts[16] indicated that contractors were reluctant

[16] Tracking the *Heating, Ventilation, and Air Conditioning (HVAC)* Market for Energy Efficiency Services. Energy Center of Wisconsin (publication #143-1, 1996).

to sell units above 10 SEER (the federal standard at the time) because of a long payback period, especially for those consumers who do not operate their CAC on a regular basis. Now that the federal standard has moved to 13 SEER, there is little reason to think (and no evaluation evidence to support) the contention that contractors will sell 14+ SEER units (without a subsidy) given relatively low incremental savings and high incremental costs.

Our conservative view entails a scenario of zero market effects. Under this scenario, which appears to also be plausible, the change to a 13 SEER national CAC standard results in a distribution of Wisconsin CAC sales (by efficiency level) that mirrors that of the U.S. (or a suitable control area). As stated above, this would appear to be a possibility because HVAC contractors may not feel the energy savings realized by moving to highly efficient CAC justifies the cost (i.e., the payback is simply not there). And, as a result, they do not market 14+ CAC to their residential customer base.

Electrically Commutated Motors (ECMs): For this analysis, we have assumed participant market effects (for both the low and high funding scenarios) that last beyond the end of program funding in FY11. Under the aggressive scenario, we assume that 20 percent of ECM impacts (program induced sales beyond baseline sales) would continue into FY12 and subsequent years. Our rationale is that a subset of HVAC contractors will continue to promote ECMs to a subset of residential customers (primarily those who operate their furnace fans continually). Under this scenario, Wisconsin contractors' exposure to EHCI results in a higher willingness to promote ECMs (on average) compared to contractors nationally (or in a suitable control area). This would appear to be plausible because Wisconsin contractors are currently having a net impact on this market, despite the fact that EHCI rewards cover a relatively small portion of the increased cost of an ECM furnace (reward of $150 and an incremental cost of nearly $900).

Our conservative view entails a scenario of zero market effects. Under this scenario, Wisconsin contractors show no propensity to sell ECMs (above what other contractors nationally or in a suitable control are do) as a result of the program's termination. This also would appear to be a plausible outcome of program termination.

Wisconsin ENERGY STAR Homes (WESH)

For this analysis, we have assumed participant market effects (for both the low and high funding scenarios) that last beyond the end of program funding in FY11. For this program, we do not present a high and low scenario. Rather, we are more confident that the structure and emphasis of the current program will lead to participant market effects in FY12 and beyond. Our past evaluation work would appear to indicate that a large percentage of current WESH builders could be expected (at least in the near term) to continue to build homes to WESH standards. This is due to the fact that many changes are health, safety, and comfort related (which lead to some energy savings) and, more importantly, involve changing the skill sets of various trades people (e.g., carpenters, HVAC technicians, insulators) involved in the program. Given the acquired skills sets, it would appear to be very plausible that these skill sets (and their application to the job at hand) will carry forward. Furthermore, it seems plausible that over some period of time this acquired knowledge may erode due to attrition in the industry (turnover of skilled trade workers) or simple forgetfulness.

Armed with these assumptions, we have assumed that 80 percent of the number of WESH homes certified in FY11 (the last year of program funding) would be built to WESH standards in FY12. We also assume that this would decline at the rate of 20 percent for each subsequent year, and eventually plateau at 30 percent. The plateau is a result of the evaluation team's assumption that 30 percent of present WESH builders will continue to build to WESH standards over the course of the time period modeled. Vice versa, this implies that over the time period involved in the B/C modeling, 70 percent of WESH builders will regress back to the construction standards adhered to by other (nonparticipating) builders.

Home Performance with ENERGY STAR (HPWES)

For this analysis, we have assumed participant market effects (for both the low and high funding scenarios) that last beyond the end of program funding in FY11. Similar to WESH, we do not present a high and low scenario. Rather, we are more confident that the structure and emphasis of the current program will lead to participant market effects in FY12 and beyond. Our thinking here is that progress in this market will continue to have some degree of dependence upon program advertising and program incentives. Home Performance Consultants, to some degree, rely upon program advertising to generate leads. Similarly, these same consultants, to some degree, rely upon program incentives to subsidize the cost of an inspection and to help them convince customers to take recommended energy-efficiency actions. While the advertising and incentives are important, we recognize that customers are currently paying about two-thirds of the cost[17] of an inspection, which indicates a willingness to pay for the service. We also recognize that consultants have acquired a valuable skill set and it would appear that these skill sets (and their application to the job at hand) will carry forward.

Taking all of the above into consideration, our best estimate is that in FY12 (and for all years beyond that) HPWES impacts will fall to 30 percent of the FY11 level. Essentially, we are saying that removal of program advertising and program incentives will mean that only 30 percent of past (program-induced) activity levels will continue. It will be incumbent upon Home Performance Consultants to 1) generate leads; 2) convince consumers to pay the full cost of their inspection service; and 3) convince customer to take action in absence of an incentive.

Targeted Home Performance with ENERGY STAR (THPWES)

The targeted program operates very similar to Wisconsin's low-income weatherization program. Given the income constraints of participants, it is reasonable to assume that no lasting market effects will be realized through this program. In short, these weatherization jobs simply will not happen in the absence of program subsidies.

Apartment and Condominium Efficiency Services (ACES)

For this analysis, we have assumed participant market effects (for both the low and high funding scenarios) that last beyond the end of program funding in FY11. For this program, we do not present a high and low scenario. Rather, we are more confident (based on a review of past evaluation reports) that parts of the current structure and emphasis of the program will lead to participant market effects in FY12 and beyond. It is important to note that this program, in response to dramatic reductions in program funding, has not been evaluated for

[17] A rating cost approximately $300 and the program provides a subsidy of $75. Therefore, the participating customer out-of-pocket expense is about $225.

the last several years. However, the program has arguably had some long-term impact on the lighting market (a major emphasis of the past program) as well as the high-efficiency boiler market (and continued emphasis in the current version of the program). The lighting efforts were primarily resource acquisition in nature (i.e., direct install program administered by CSG) the high-efficiency boiler effort had a more market-based approach.

Arguably, the present evaluation team has limited knowledge of this program and the market it operates within. As a result, we decided to assume lasting participant impacts that are roughly consistent with what we have done (outlined above) for the mix of other residential programs. Specifically, we have estimated that in FY12 (and for all years beyond that) ACES impacts will fall to 10 percent of the FY11 level. Essentially, we are saying that removal of program advertising and program incentives will mean that only 10 percent of past (program-induced) activity levels will continue. This seems reasonable in light of the fact that past multi-family programs nationally have had a difficult time, absent incentives, getting property owners to take action.

A.3 RENEWABLE PROGRAM BENEFIT/COST INPUTS

This section discusses the evaluation team's Renewable Program benefit-cost model inputs.

The cost-benefit analysis was performed at the technology level, for the following six technology groups:

(1) Photovoltaics (PV)

(2) Wind

(3) Solar Water Heating (SWH)

(4) Biogas

(5) Thermal

(6) Other (this includes hydroelectric, a geothermal heat pump and solar space heating)

This disaggregation—by technology—provides a good basis for the benefit/cost analysis because it allows the analysis to account for:

- Changes in the mix of technologies included in the program. Some technologies have or will increase as a percentage of program activity; others will decline or be phased out.
- Dollars-to-benefits ratios that are technology-specific.

This section includes discussions of the evaluation team's rationale behind the inputs provided for the benefit/cost analysis: funding scenarios (high and low), market effects, incremental costs, non-energy benefits, and measure lives.

A.3.1 Renewable Program FUNDING SCENARIOSSCENARIOS

The benefit/cost analysis includes both low and high funding scenarios, as explained in Section 5.

The evaluation team used its Renewable Program project database assembled over the program life[18] to estimate energy savings. We also used this database in combination with other data[19] to develop:

- The relationship of incentive costs to program costs;
- Technology specific cost-to-savings ratios; and
- Projections for FY07 – FY11.

For both the high and low scenarios projected savings by technology are based on the costs-to-savings ratio (by technology) and the assumption that the ratios will stay constant over the projection period (FY07–FY11). Photovoltaics, wind, and biogas dominate program costs and savings in both scenarios.

The mix of technologies and relative program proportions for the low funding scenario were based on cost and savings averages from 2004 thru 2006. In this scenario we assume that the share of program expenditures across technologies stays at the average 2004–2006 level. This is a business as usual scenario.

The mix of technologies and relative program proportions for FY07 of the high funding scenario was based on cost and savings averages from 2004 thru 2006, but scaled to the FY07 budget. The mix of technologies and relative program proportions for FY08 thru FY11 were assumed to be those planned for FY08[20]. These plans assume that the ratio of fixed costs (administrative and other) to variable costs (incentives) will decline as funding increases.

A.3.2 Market Effects

The Renewable evaluation team did not assign any market effects to the Program. We do not have evidence that the Renewables Program has or will create market effects that go beyond the projects to which it lent direct support in the form of incentives or facilitation. Our interviews with program participants and market research indicate that the Renewable markets in Wisconsin are driven by factors much larger than Focus on Energy. For example, the PV market is limited by the price and demand for silicon worldwide. The US biogas market is driven by greater opportunities in other states due to farm size and types (economies of scale) and better buy-back rates.

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[18] This database is from data extracted from the WECC program -tracking database.

[19] Don Wichert provided historical program costs by program year in four categories: labor, office & and equipment, incentives, and travel.

[20] Provided by Don Wichert on January 11, 2007, in the file “Summary with future program percents by technology.xls”

A.3.3 Incremental Costs

For Renewable Energy projects, the full cost of the project is the incremental cost. This approach .assumes that most renewable projects are in addition to, not instead of, existing infrastructure[21].[22]. Renewable Energy project costs were calculated using the database of projects completed to date.

A.3.4 Non-energy Benefits (Nebs)

Non-energy benefits (NEBs) were calculated for the farm Biogas projects only. We did not find documented NEBs for the other technologies in the Renewables Program.

Biogas NEBs found in literature include:

(1) Reduced bedding costs
(2) Fertilizer savings
(3) Pest control savings (specific references to reduced number of flies)
(4) Reduced need for herbicides
(5) Reduced odor (quality of life, reduced lawsuits and complaints, operational flexibility, locational flexibility)
(6) Reduced nutrient loading which reduces acreage required for land application of manure residuals
(7) Less physical and mechanical handling of solids during composting operations
(8) Reduced operations and maintenance factors for pivot irrigation operations due to use of cleaner water
(9) Pathogen reduction

Based on our biogas installer interviews and our literature review, we were able to quantify (1) bedding cost savings, (2) fertilizer savings, (3) pest control savings, and (4) herbicide savings.

A.3.5 Measure Lives

Measure lives—the maximum number of years that we assume that savings can be expected to occur from the measures[23]—were researched for all technology groups in the Portfolio. This research yielded ranges of estimates for each of them.

For the purposes of the benefit-cost model, point estimates of measure lives—rather than ranges—are necessary. These point estimates were selected by considering the credibility of the sources and the frequency of the estimates. The point estimates used were:

Photovoltaics (PV)	25 years

[21] Notable exceptions are the use of PV systems to avoid utility line costs and thermal biomass projects that replace existing boilers.

[22] Notable exceptions are the use of PV systems to avoid utility line costs and thermal biomass projects that replace existing boilers.

[23] The measure life utilized can be lower than the life expectancy of the components of the measure, due to uncertainty of continued savings.

Wind	20 years
Solar Water Heating (SWH)	20 years
Biogas	20 years
Thermal	20 years
Other	25 years

Subject	**EMISSIONS FACTORS AND ALLOWANCE PRICES - DRAFT**	
To	Mimi Goldberg, KEMA Chris Clark, KEMA Glen Weisbrod, EDRG	Oscar Bloch, WDOA David Sumi
From	Bryan Ward Eric Rambo	
Date	December 4, 2006	

This memo provides current emissions factors based on the Environmental Protection Agency's Office of Air and Radiation "Acid Rain Hourly Emissions Data" from 2005 and actual (2001 – 2006) and forecast (2007-2026) allowance prices for avoided emissions to be used for the Focus on Energy benefit cost and economic impact analysis based on PA Multi-Pollutant Optimization Model (M-POM). This memo will be followed by a report that provides additional discussion around the values, especially regarding the significant reductions in the estimates of the pounds/MWH for NOx and SOx from the previous analysis based on 2000 EPA data.

Generation Emission Factors

Annual emissions factors were estimated from the Environmental Protection Agency's Office of Air and Radiation "Acid Rain Hourly Emissions Data" from 2005, using an approach developed in 2004 using data from the year 2000 and reported in the Focus on Energy publication, *Estimating Seasonal and Peak Environmental Emissions Factors.*

In 2004, emissions factors for NOx. SOx, CO_2 and HG were based on the mass of emissions per hour, per MWh of generation. Emission factors were calculated on marginal plants only, summed over the two NERC regions that supply Wisconsin. A marginal plant was defined as the plant with the most change in MWh, increase or decrease, since the previous hour.

In 2006 we have estimated emissions factors using the same rationale, and in addition have added two refinements. In the table "2005 Annual Emissions Factors," below, we provide three different numbers. In the rows labeled "2006 Report":

1. The row marked "Single Marginal Unit" reproduces the methodology from 2004 exactly, except for some minor cleaning of code that restored data considered missing in 2004.
2. The row marked "Marginal Unit= 99th percentile" redefines as marginal any unit that increases generation from the previous hour by 19% or more of its rated maximum. This represents the 99th percentile of movement over the year.

3. The row marked "Weighted by Region" retains the refinement of the previous row and additionally weights emissions factors by the mix of energy consumed within Wisconsin, with about 82% generated within the state and 18% imported; and of the imports about 47% originates in the MAIN NERC region and 53% originates in the MRO NERC Region.

2005 ANNUAL GENERATION EMISSIONS FACTORS

Source	Year of Data	Type	NOx (Pounds/MWh)	SOx (Pounds/MWh)	CO_2 (Pounds/MWh)	Mercury (Pounds/GWh)
1999 Report	1999	By Marginal Cost	6.4	10.8	2,400	
		By Capacity Factor	5.9	10.0	2,035	
1998 EPA	1998					0.0373
2004 Report	2000	Single Marginal Unit	5.7	12.2	2,216	0.0489
2006 Report	2005	Single Marginal Unit	3.0	4.9	2,419	0.0262
		Marginal Unit = 99^{th} Percentile	2.1	4.3	1,718	0.0198
		Weighted by Region	2.1	4.6	1,746	0.0179

Sources:
1999 Report: *Development of Emissions Factors for Quantification of Environmental Benefits*, June 25, 2001. Focus on Energy Pilot Evaluation Report.
1998 EPA: *EPA's E-Grid 2000 Database* for MAIN and MAPP for 1998.
2004 Report: *Estimating Seasonal and Peak Environmental Emissions Factors*, May 21, 2004. Focus on Energy Public Benefits Evaluation.
2006 Report: This report.

NATURAL GAS ON-SITE USE EMISSIONS FACTORS[24]

The emission factors discussed above are for emissions savings at the electric generator. Other emissions savings occur when energy efficient projects reduce the use of non-electric fuels at the participant's site. The primary site-based fuel (burned at the participant's site rather than at the power generation plant) saved under the Focus program is natural gas. Combustion of natural gas produces a variety of pollutants including CO_2, NO_x, N_2O, SO_x, PM10, VOC, and CO. With the exception of CO_2, these pollutants are emitted in fairly small quantities.

According to the EPA's Technology Transfer Network Clearinghouse for Inventories & Emission Factors, the emission factor for CO_2 is 11.76 pounds of CO_2 per therm. The Clearinghouse provides a single emission rate for SOx and mercury, as it does for CO_2. (Both the SOx and mercury values are quite small, particularly compared to coal, and as a result are often ignored.) The Clearinghouse provides a range of estimates for NO_x that depend on the size and configuration of the boiler. NO_x emissions are particularly sensitive to the size, design, and operating conditions of the boiler. Three representative emission rates for NO_x are presented in the following table.

[24] Taken from *State of Wisconsin Department of Administration Division of Energy Focus on Energy Public Benefits Evaluation Estimating Seasonal and Peak Environmental Emissions Factors—Final Report May 21, 2004.*

NATURAL GAS ON-SITE USE EMISSION FACTORS

Substance	Pounds Per Therm
CO_2	11.76
SO_x	0.0000588
Mercury	0.00000002549
NO_x Lower Bound	0.003137
NO_x Mid-range	0.009804
NO_x Upper Bound	0.027451

Sources: (1) Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area.
(2) EPA Technology Transfer Network Clearinghouse for Inventories and Emission Factors.

ALLOWANCE PRICES

The historic and forecast allowance prices were provided by PA's Multi-Pollutant Optimization Model (M-POM). This model was designed to find optimal market-driven, environmental compliance options, given multi-pollutant compliance requirements. It is designed to explore emission costs and benefits in terms of fuel choice, capital investments in pollution control equipment, allowance market purchases, and generating unit operating decisions.

M-POM is a dynamic, inter-temporal model that simultaneously selects technology (new units and compliance technology) and dispatches units over a 30-year horizon. PA models two seasons and typically six load segments per season. M-POM is set up to operate with 23 US regions.

The table below presents the historic and forecast prices for the relevant emissions allowances for the years 2001–2026.

HISTORICAL/FORECAST ALLOWANCE PRICES

	SO2 Acid Rain/CAIR	NO_x SIP Call	NO_x CAIR - Annual	NO_x CAIR - Ozone	Hg CAMR*	CO_2**
Year	**$/Ton, Nominal**	**$/Ton, Nominal**	**$/Ton, Nominal**	**$/Ton, Nominal**	**$M/Ton, Nominal**	**$/Ton, Nominal**
2001	186	915			2	0
2002	152	778			6	0
2003	176	4,602			9	0
2004	441	2,236			13	1
2005	901	2,760			18	1
2006	790	2,069			22	2
2007	637	1,847			27	3
2008	674	1,693			32	3
2009	713		1,376	393	37	6
2010	773		1,042	426	41	7
2011	844		1,138	465	45	8
2012	918		1,238	506	49	8
2013	995		1,342	548	53	9
2014	1,075		1,450	593	57	10
2015	1,158		1,563	639	61	13
2016	1,261		1,700	695	67	15
2017	1,367		1,844	753	73	16
2018	1,477		1,993	814	78	18
2019	1,570		1,497	884	85	20
2020	1,665		978	957	92	22
2021	1,765		1,000	979	100	22
2022	1,868		1,023	1,002	107	23
2023	1,975		1,047	1,025	115	23
2024	2,085		1,071	1,049	123	24
2025	2,133		1,095	1,073	126	24
2026	2,183		1,121	1,097	129	25

* 2001–2010 based on trend in forecast market based value

** 2001–2009 based on trend in forecast market based value
2010–2014 based on forecast for the RGGI market
2015–2026 based on forecast for a national market

APPENDIX C: COMPARISON WITH PRIOR BC REPORT

C.1 ANALYSIS DIFFERENCES

As described in Section 3, the analysis of this report has several differences from that of the Initial Benefit-Cost Report. These differences, and their effect on the BC ratios compared to those of the initial report are indicated in the table below.

Table C-1. Comparison of Current Analysis Method with Initial BC Analysis

Key Differences in Initial Benefit Cost Analysis and the 2006 Benefit-Cost Analysis			
	Initial Benefit-Cost Analysis	**2006 Benefit-Cost Analysis**	**Effect on BC ratio**
Perspective	Ratepayer	Society	Mixed
Benefits and Costs Counted			
In-program energy savings	Benefit	Benefit	None
Market effects energy savings	Benefit	Benefit	None
Avoided emissions externalities—NO_x and SO_x	Benefit	Benefit	None
Avoided emissions externalities—Hg and CO_2	Benefit	Benefit only in expanded test	Decrease for simple tests
Non-energy effects	Net non-energy benefits and costs counted as benefit, residential only	Net non-energy benefits and costs counted as benefit only in expanded test, all program areas, economic NEBs only	Decrease for residential Increase for business and renewables expanded test
Customer incremental costs	Negative benefit	Cost	Decrease if b/c > 1
Incentive payments	Counted as both benefit and program cost	Not counted, treated as transfer payment	

Table C-1. Comparison of Current Analysis Method with Initial BC Analysis (continued)

Parameters	**Basis**	**Value**	**Basis**	**Value**	**Effect on BC ratio**
Analysis time frame	Assumed program life plus long measure life	25 years	Assumed program life plus long measure life	25 years	None
NPV discount rate	Average yield on 20-year US treasury bond	3%	Public sector cost of borrowing consistent with state of WI valuations	5%	Decrease
Fuel escalator	None	0%	Analysis of historic fuel price increases compared to consumer price index	1%	
Avoided kWh	Calculated from average customer bill	Residential: $.081/kWh Commercial: $.065/kWh Industrial: $.043/kWh	Estimated from forward electricity contract, Alliant Energy Docket 6680-UR115 , with 8% added to adjust for line loss	$0.056/kWh	Increase
Avoided therms	Calculated from average customer bill	Residential: $.671/therm Commercial: $.549/therm Industrial: $.494/therm	Calculated based on long-term Wisconsin forward gas contracts and Utility rate cases	Schools/Govt: $0.917/therm Residential: $1.061/therm Comm/Ag: $0.987/therm Industrial: $0.878/therm	Increase
Avoided demand	Assumed included in average cost per kWh	0	Wisconsin PSC avoided generation figures, adjusted for avoided transmission using EIA data.	$104/kW	Increase
SO_x, NO_x valuation	Estimated from emissions market model	SOx: $0.0009/kWh NOx: $0.0008/kWh	Estimated from emissions market model, initial value	SOx: $0.0004/kWh NOx: $0.0010/kWh	Decrease
CO_2, Hg valuation	Not counted	0	Estimated from emissions market model, initial value	CO2: $0.0009/kWh Hg: $0.0001/kWh	Increase

C.2 COMPARISON OF RESULTS USING CONSISTENT FORMULA

Re-calculating the Initial BC ratios with all the current assumptions is beyond the scope of this analysis. However, it is straightforward to apply the simple BC formula of the present report to the benefit and cost elements developed in the prior work. That is, we retain the net present values of the benefits and cost streams developed in the earlier work, using the valuation factors and discount rates of that study. We apply the simple BC formula of the current work. Results are shown in Table C-2. Corresponding results from the present work are shown for comparison in Table C-3.

Table C-2. Simple BC Test Results from Initial BC Analysis Using Current Formula

Initial BC Results	Benefits			Costs		BC Results	
Program Area	Direct Savings	Added Market Effects Savings	Economic Environmental Externalities	Program Costs (Excluding Incentives)	Incremental Costs	Net Benefits	Simple BC
Residential	669.6	231.7	237.5	122.8	289.3	726.7	2.8
Business	289.8	106.0	148.1	188.4	140.0	215.4	1.7
Renewables	45.5	13.1	5.5	14.3	101.0	-51.2	0.6
All Focus	1004.9	350.9	391.0	325.6	530.3	890.9	2.0

Table C-3. Simple BC Test Results from Present Analysis

Current BC Results		Benefits			Costs		B-C Results	
Program Area		Documentable Savings	Added Market Effects Savings	Economic Environmental Externaliteis	Program Costs (Excluding Incentives)	Incremental Costs	Net Benefits	Simple B/C
Residential	**Low**	576	61	26	77	319	266	1.7
	High	658	95	32	87	382	316	1.7
Business	**Low**	1173	19	36	121	266	840	3.2
	High	1373	80	45	145	338	1016	3.1
Renewables	**Low**	34	0	1	14	15	5	1.2
	High	91	0	3	14	42	38	1.7
All Focus	**Low**	1782	79	64	213	600	1112	2.4
	High	2122	175	80	246	762	1369	2.4

For the Residential Programs, the simple BC ratio is smaller than the comparable ratio from the prior work. One reason is that the attribution or net-to-gross factors currently determined for major components of this program area are lower than those used for the earlier analysis. This change is reflected in lower documentable savings under the Low scenario compared to that for the prior work. At the same time, the incremental cost estimates are somewhat higher in the current work. Together, these factors result in a lower overall BC ratio.

For the Business Programs, by contrast, the current ratio is higher than the comparable one from the prior work. One reason for the difference is likely to be the value of avoided demand included in the current analysis. This value tends to add substantially to the value of avoided on-peak kWh. BP has more demand savings relative to kWh savings than does the Residential Program area.

For the Renewables Program, the current BC ratio is also higher than the comparable value from the prior work. Projected savings levels are roughly similar for the current Low (business-as-usual) scenario as in the prior work. However, incremental costs in the current analysis are much smaller, resulting in a better overall BC ratio. The incremental cost values in the present work are based on program documentation that was not available for the earlier study.

APPENDIX D: MEASURE LIVES

Measure lives for all program measures considered in the benefit cost-analysis are listed below by program portfolio and individual program.

Residential Programs

ESP		HPWES		WESH		EHCI		ACES		TARGETED	
Measure	*Measure Life in Years*	*Measure*	*Measure Life in Years*	*Measure*	*Measure Life in Years*	*Measure*	*Measure Life in Years*	*Measure*	*Measure Life in Years*	*Measure*	*Measure Life in Years*
CFL	6	Air Sealing	25	Home Certification	50	CAC - 12 SEER	20	ACES Measures	8.5	Targeted Measures	25
Clothes Washers	12	Attic Insulation	25	CAC - 12 SEER	20	CAC - 13 SEER	20				
Other Lighting	25	Sidewall Insulation	25	CAC - 13 SEER	20	CAC - 14+ SEER	20				
Other Appliances	12	CAC - 12 SEER	20	CAC - 14+ SEER	20	ECM Furnace	13				
		CAC - 13 SEER	20	ECM Furnace	23	Other Measures	20				
		CAC - 14+ SEER	20	Other Measures	12						
		ECM Furnace	23								
		Other Measures	25								

Business Programs

Agriculture		**Commercial**		**Industrial**		**Schools & Government**	
Measure	*Measure Life in Years*	*Measure*	*Measure Life in Years*	*Measure*	*Measure Life in Years*	*Measure*	*Measure Life in Years*
Building Shell	10	Building Shell	10	Building Shell	10	Building Shell	10
HVAC	15	HVAC	15	HVAC	15	HVAC	15
CFL	6	CFL	6	CFL	6	Other Lighting	15
Other Lighting	15	Other Lighting	15	Other Lighting	15	CFL	6
Motor	16	Motor	16	Motor	16	Motor	16
Manufacturing Processes	12	Manufacturing Processes	12	Manufacturing Process	12	Manufacturing	12
Other	17	Other	19	Other	28	Other	10
				Paper and Pulp	12		

Renewable Programs

Measure	**Measure Life in Years**
PV	25
Wind	20
SWH	20
Biogas	20
Thermal	20
Other	25

APPENDIX E: EFFECT OF INCREASES IN PROGRAM EFFICIENCY

As described in Section 5.3, in developing the projections to future years, we considered whether increases in savings per program dollar should be assumed under the High Funding scenario. To explore the possible effect of an increase in overall efficiency, we conducted the following analysis.

We began with the NPV of savings, cost components, and incentive levels assumed in the Low and High scenarios presented in this report. We then assumed:

1. Program spending *excluding* incentives would be the same under a modified High scenario as it was in the Low scenario. Effectively, all increased spending in the High scenario compared to the Low scenario would go to incentives, with no additional administrative cost.

2. Total savings per program dollar increase by 25 percent over the life of the program. While this efficiency increase may seem slight, it is an average over the entire life of the program, including the first 5 years, which are now fixed. It is also greater than the average increase in funding projected over the next 5 years.

Under these assumptions, we re-calculated the benefit-cost ratios. Results are indicated in Table E-1. The analysis was not conducted for the Renewables program, because High projections there were based on program planning scenarios that already assumed minimal increase in administrative costs.

Table E-1. Illustration of Effect of Increased Program Efficiency on Benefit/Cost Ratios

Business Programs	**Low**	**High**	**Modified High**
NPV ($1,000,000)			
Total Benefits	1,228	1,499	1,874
Program Spending excl Incentives	121	145	145
Customer Incremental Costs	266	338	423
Total Cost	387	483	568
Benefit/Cost	3.17	3.10	3.30
Program Admin/Total Cost	31%	30%	26%
Residential Programs	**Low**	**High**	**Modified High**
NPV ($1,000,000)			
Total Benefits	663	785	981
Program Spending excl Incentives	77	87	87
Customer Incremental Costs	319	382	478
Total Cost	396	469	565
Benefit/Cost	1.67	1.67	1.74
Program Admin/Total Cost	19%	19%	15%