DEMAND-SIDE PLANNING PROGRAM EVALUATION: Wisconsin Power and Light's Experience

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ABSTRACT

On October 15, 1987, Wisconsin Power and Light Company (WPL) filed its first integrated resource plan with the Public Service Commission of Wisconsin. Included in that integrated plan was 171 MWs of savings due to customer demand-side management programs. The greatest contribution to overall demand-side management impacts was 82 MW's of savings from a commercial/industrial shared savings program. Also, 1.2 MWs of demand-side management impacts were included from an agricultural shared savings program.

Bright Ideas for Business is WPL's commercial/industrial shared savings program. The Milkhouse Heat Exchanger Guaranteed Savings Plan is WPL's shared savings program in the agricultural sector. During the past year, these energy services were piloted in WPL's service territory. The purpose of the pilot programs was to determine the acceptance and effectiveness of the shared savings concept prior to companywide implementation.

An evaluation of both the process and impact of the programs has been completed. The design and results of the impact evaluation, in particular, the economic analysis, will be reported in this paper. Results indicate these programs are cost-effective. Also, this paper will compare program results to date with planning assumptions used in WPL's integrated planning process.

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INTRODUCTION

In 1987 Wisconsin Power and Light Company (WPL) implemented two pilot energy efficiency shared savings services; Bright Ideas for Business (BIB) in the commercial/industrial sector and the Milkhouse Heat Exchanger Guaranteed Savings Plan (MHEGSP) in the agricultural sector. Both energy services (or programs) are part of WPL's Integrated Plan, which identified 171 MWs of program induced demand savings by the year 2006 (BIB is forecasted to contribute 82 MWs and MHEGSP 1.2 MWs). As part of the state legislated Advance Plan process, this twenty-year plan was filed with the Public Service Commission of Wisconsin on October 15, 1987.

Evaluations of demand-side management programs are important not only for near-term program planning and implementation needs but increasingly so for long-term integrated planning needs. Process and impact evaluations have been completed for both programs. The design and results of the economic analysis will be reported in this paper. Results to date indicate that these programs are cost effective. Comparisons of program results with planning assumptions used in WPL's integrated planning process will be made.

PROGRAM DESCRIPTION

The overall goal of both programs is to motivate customers to implement cost-effective energy efficient technologies through a shared savings financial mechanism. Objectives of the pilot programs, which ran from April - December 1987, were to identify what needed to be modified in the programs prior to companywide expansion, to determine the future market potential for energy efficiency services in the commercial/industrial and agricultural sectors and to determine the appropriate timing to introduce additional energy efficient technologies through this or other marketing mechanisms. Additionally, to determine impacts of these programs and to determine if they are cost-effective.

Bright Ideas for Business

The Bright Ideas for Business (BIB) program is a complete energy service program designed to identify, coordinate, and finance energy efficiency projects in the commercial and industrial sectors. Through the program WPL will plan, finance and oversee the installation of energy efficiency improvements in WPL's customers facilities. As of December 31, 1987, nine customers had signed Bright Ideas for Business contracts. The program was piloted in 3 of WPL's 14 districts. In March 1988 the program was expanded companywide. Initially, the program offered shared savings financing for energy efficient lighting and motor technologies. As the program developed, additional technologies where added. Participating customers receive an energy analysis that determines the energy and demand savings for energy efficiency options appropriate to their business, the capital and labor costs of installing the efficient equipment and the maximum amount that WPL can cost-effectively invest in the project while meeting a three, four or five year payback criteria for the customer.

A WPL representative reviews the result of the energy analysis with the customer. If the customer chooses to participate, WPL arranges for the installation of the equipment through local contractors and suppliers. WPL pays all upfront costs, with the customer repaying these costs plus an administrative fee over a three, four, or five year contract period. The current shared savings fee is the prime interest rate plus 2 percent for those customers that have less than \$35 million annually in product sales and the project costs less than \$500,000. For customers larger than this the shared savings fee is 16.19%.

Milkhouse Heat Exchanger Guaranteed Savings Plan

The Milkhouse Heat Exchanger Guaranteed Savings Plan (MHEGSP) is an energy service program designed to encourage energy efficiency in the agricultural sector through the installation of heat recovery systems. Through the program, qualifying WPL dairy farm customers will be able to purchase a heat exchanger with no money down and pay for the purchased equipment with a portion of the resulting energy savings over a four or five year period. As of December 31, 1987, 81 customers had installed milkhouse heat exchangers through the pilot program. This program was piloted in 6 of WPL's 14 districts. In March 1988 the program was expanded companywide.

An objective of this energy service program is to enhance relations with trade allies in addition to encouraging efficient use of electricity on the farm. In the future, WPL plans to include additional energy efficient farm technologies in the program.

The milkhouse heat exchanger technology was chosen for the pilot program because this technology has been field tested, showing a reduction of 60 to 80% in water heating costs. In the pilot phase of the program, through premetering a customer's water heater, the trade ally (farm equipment dealer) determines energy currently used in water heating. Using this information plus milk production data, WPL is able to determine if the installation of a heat exchanger will meet a four or five year payback criteria.

EVALUATION GOALS AND OBJECTIVES

WPL's pilot evaluations are designed to obtain information needed for the anticipated expansion of the pilot programs to full-scale, companywide programs. The primary goals of these evaluation projects are to assess the potential impacts of a program (impact evaluation), and to identify ways to improve a program's design and implementation (formative evaluation). Specific evaluation objectives are:

- 1. Determine the energy savings, participation rate and cost-effectiveness of the program.
- 2. Determine the customer decision making processes with regard to participation in and satisfaction with the energy service program.
- 3. Analyze the program's acceptance among field staff and trade ally groups.
- 4. Evaluate the potential for expanding the program systemwide, and to other technologies.

STUDY DESIGN

By December 31, 1987, nine Bright Ideas for Business customers and 81 Milkhouse Heat Exchanger Guaranteed Savings Plan customers had signed contracts. This difference in sample size affected the evaluation design.

To evaluate the cost-effectiveness of the BIB program and MHEGSP, two approaches were followed. For the MHEGSP, the analysis was done on a program basis; and, for BIB program, the analysis was done on a case-by-case basis. With only one technology, the number of participants (81) in the MHEGSP was larger than the BIB program.

The case by case analysis was done on the BIB program for two main reasons:

- The number of customers who had actually signed a Bright Ideas for Business contract as of December 31, 1987 was relatively small compared to the original projections of program participation. (The original projection was 50 to 80 customers).
- 2. The projects which were completed, although most addressed the lighting end-use, were specific to a customer's business and operating procedures.

Data were collected from several sources for the BIB economic analysis. WPL maintains a separate file for each BIB customer. In that file is information pertinent to the economic analysis: customer historical energy and demand usage patterns, engineering estimates of the energy and demand savings and hardware lives, project capital costs, and engineering consulting fees for the customer's energy analysis. Program administrative costs were developed from a number of sources including WPL's accounting system and field staff estimates of time spent on specific projects.

For the MHEGSP, WPL's accounting system was used to make projections for administrative costs. Energy savings were an average of the actual estimates made from metering the installation before and after installation of the heat exchanger. Dealers and manufacturers provided information on expected hardware lives. Sales slips, collected as part of the program's administrative process, were used to determine the average cost of a heat exchanger. Qualitative Choice Analysis was used to determine the free-rider component (8%).

FRAMEWORK FOR ECONOMIC ANALYSIS AT WPL

The definitions, viewpoints and procedures used in this economic analysis are those which WPL has developed through its integrated planning effort. WPL developed this framework in conjunction with the other Eastern Wisconsin Utilities (EWU). The EWU is made up of Madison Gas & Electric Company, Wisconsin Electric Power Company, Wisconsin Power and Light Company and Wisconsin Public Service Corporation.

This economic framework identifies the benefits and costs of a program from several different viewpoints. WPL uses the following viewpoint definitions in its integrated planning analysis:

 Participant -- A customer who participates in a demand-side management program.
Non-participant -- Utility customers not involved in demand-side management programs.
Utility Revenue Requirement -- Traditional calculation of the utility revenue required to support a utility project.
Total Cost -- The total costs and benefits of a project or program to all customers a utility serves.

For each viewpoint there are different benefit and cost components (refer to table I). In addition to the alternative viewpoints, several economic tests can be calculated to summarize the benefits and show the relationship of the benefits to the costs. The various viewpoints and associated economic tests are illustrated below.

Viewpoint	Economic Test	Threshold
Participant	Simple payback	Less than 10 yrs
Non-participant	Benefit/Cost ratio	None
Utility Revenue Requirement	Benefit/Cost ratio	Greater than or equal to 1.0
Total Cost	Benefit/Cost ratio	Greater than or equal to 1.0

WPL staff from Supply Planning and Analysis and from Electric Marketing and Customer Service have developed a model and set of procedures for screening energy efficiency projects/programs. The model employed for recording input assumptions and calculating tests for each viewpoint is called the Integrated Planning Evaluation Program (IPEP). The IPEP model was used to perform the economic tests of the Bright Ideas for Business pilot program.

The determination of a program's and/or a project's cost effectiveness is done from the Total Cost and the Utility Revenue Requirements viewpoints using the benefit/cost ratio test. Options that have a benefit/cost ratio of one or greater for both the Total Cost and the Utility Revenue Requirements viewpoints are considered to be cost-effective demand-side management options.

ANALYSIS AND RESULTS

Utility Revenue Requirements Viewpoint

The Utility Revenue Requirement viewpoint is the traditional calculation of the utility revenue required to support a project. This viewpoint considers the direct costs and benefits of a project to WPL. Utility costs include utility capital and O&M as well as any rebates or incentives paid. For the BIB and MHEGSP programs, costs include the capital carrying cost associated with the investment in the customers facility as well as administrative costs such as WPL representative incentives, engineering consulting fees, general office support, etc. Utility benefits include fuel savings, plant investment savings (generation, transmission and distribution capacity credits) and shared savings receipts.

The Utility Revenue Requirement benefit/cost ratio indicates whether or not the utilities total revenue requirements will increase or decrease because of a program. This calculation is simply the net present value of the benefits received by the utility divided by the net present value of the costs incurred by the utility. If the Utility Revenue Requirement benefit/cost ratio is greater than one (less than one) the total utility revenue requirements will decrease (increase) as a result of the project. All of the projects in the BIB program and the MHEGSP have a Utility Revenue Requirement benefit/cost ratio greater than one and therefore result in a decrease in total utility revenue requirements (refer to tables II and III).

Total Cost Viewpoint

The Total Cost viewpoint includes the total costs and benefits of a project or program to all customers a utility serves; in effect, the Total Cost viewpoint is the sum of the participant and non-participant viewpoints. Cost components include the direct costs and benefits of a project to participants and non-participants. Participant costs include the direct costs incurred by the participant as a result of the project. Examples of the costs to participants include shared savings payments, increased O&M expenses, etc. Non-participant costs include the costs incurred by the utility (see Utility Revenue Requirements viewpoint above) including the revenue impact of the project.

Benefit components in the Total Cost viewpoint include the direct benefits of a project to participants and non-participants. Participant benefits include the electric bill reduction a participant realizes because of a project as well as any other fuel savings. Non-participant benefits are synonymous with the benefits received by the utility (see Utility Revenue Requirements viewpoint above).

The Total Cost benefit/cost ratio indicates whether or not a program or project undertaken by the utility is cost-effective from the viewpoint of all WPL customers. This calculation is simply the net present value of the benefits received by participants and non-participants divided by the net present value of the costs incurred by participants and non-participants. If the Total Cost benefit/cost ratio is greater than one (less than one) the project or program is cost-effective (not cost-effective) from the viewpoint of all WPL customers.

All the BIB projects, which had signed contracts as of December 31, 1987, had a Total Cost benefit/cost ratio greater than or equal to one. The nine BIB projects, and their corresponding Total Cost and Utility Revenue Requirements benefit/cost ratios, are illustrated in Table II. For the MHEGSP, the Total Cost benefit/cost ratio was less than 1.00 (refer to table III). This result was due to a relatively low market potential of approximately 1,300 installations over a 5 year period. Also, the 8% free-rider component, determined through Qualitative Choice Analysis, serves to decrease the benefits of the program. However, despite both of these limitations the Total Cost benefit/cost ratio was close enough to 1.00 to warrant the expansion of the program company wide.

Program Results vs. Planning Assumptions

Another component of the evaluation process is to compare program results to planning assumptions. Given the participation rate, this can be done only for the MHEGSP at this time. Table 3 compares program results to planning assumptions. Overall, the comparison of planning assumptions to program results are similar. Individual assumptions differ most for administrative costs and hardware life of the equipment. Administrative costs were under forecast in the planning process and the hardware life of the equipment was over stated. Administrative costs were calculated from WPL's project/activity accounting system and the hardware life was changed from 15 to 10 years based on trade ally feedback. These economic results have been incorporated into the planning process.

A similar comparison of program results to planning assumptions will be performed on the BIB program when a adequate sample size is available.

IMPLICATIONS FOR FUTURE EVALUATIONS

Both programs have been modified to incorporate findings in the formative and impact evaluations. These modifications, combined with the effect of spreading fixed program costs over more participating customers, should help to ensure the continued cost-effectiveness of the programs as they are offered on a companywide basis.

Two evaluation plans that started with similar designs for economic analysis had to be modified due to sample size. For a complicated program, such as BIB, where sample sizes are small in the early months, a case-by-case analysis is appropriate and provides important information to program staff. A program analysis, such as the MHEGSP, will be completed on the BIB program at a future date when the sample size is appropriate.



Table I. Viewpoint Definitions

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Bright Ideas Customer	Total Cost benefit/cost	Utility Rev. Req. <u>benefit/cost</u>
A	1.11	2.19
В	1.24	2.90
C	1.48	5.48
D	1.19	2.63
Е	1.34	4.03
F	1.16	2.93
G	1.00	2.10
Н	1.18	2.91
I	1.39	1.02

Table II. Project benefit/cost ratiosBright Ideas for Business

Table III. Program benefit/cost ratios Milkhouse Heat Exchanger Guaranteed Savings Plan

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	Utility	
Total Cost	Rev. Req.	
<u>benefit/cost</u>	benefit/cost	
0.93	1.77	

	Planning Assumptions	Program <u>Results</u>
Administrative Costs one-time annual	\$50,000 \$50,000	\$36,000 \$119,000
Program Life	3 yrs	5 yrs
Possible Installations	500 *	1313 #
Hardware Life	15 yrs	10 yrs
kWh savings per installation	7,700/yr	9,000/yr
Utility Capital Cost per installation	\$1,500	\$1,425

Table IV. Program Results vs. Planning Assumptions Milkhouse Heat Exchanger Guaranteed Savings Plan

- estimated by Agricultural staff working group

** - estimated through Qualitative Choice Modeling 65.7% participation with program 8.0% participation without program