

An Evaluation of Boston Edison's WattBusters Program

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A process, marketing and outcome evaluation was undertaken of Boston Edison's WattBusters program. This program is aimed at fostering water heating, lighting and other types of electric energy efficiency among residential customers.

The approach and data collection methods used to conduct the evaluation were multifaceted including: participant and nonparticipant surveys, on-site inspections of households, and billing analysis.

The findings indicated that the program was successful in a number of ways: it reached a broad range of the target market, most measures targeted for the program were installed and are still in place in good working order, participants are satisfied and believe the program has saved them energy, and, corroborating participant's beliefs, statistically reliable evidence of the program's energy impact exists based on independent analysis of utility billing records.

Nonetheless, important lessons can be learned for future program design delivery and measurement of program impact:

- Any program must be carefully designed and integrated with other current, past and future utility programs in mind to avoid duplicative programs and participants misdirection into a less than optimal program.
- Original engineering estimates for program impact are likely to overestimate actual program impact, as was true of WattBusters, and should be appropriately discounted based on prior experience from similar programs.
- Utility programs need time to mature and planners should not be hesitant to make changes based on early experiences.
- Given inevitable changes in programs over time, evaluators should plan timing of their studies carefully and do repeated measurements over time as is feasible.
- Participant/nonparticipants comparisons are vital to an accurate assessment of true program impact, yet will require careful and often time consuming analysis.

Introduction

Evaluation Goals and Objectives

The overall goal of the evaluation was to conduct a thorough review of the WattBusters program including process, marketing, and impact evaluations.

The objectives of the process evaluation, specifically, were concentrated in understanding:

- Program goals, design and the consequences of any changes in these over time

- Effectiveness of program delivery mechanisms

- An assessment of program administration and implementation issues (e.g., cost and quality control procedures, adequacy of program staffing, etc.)

The focus of the marketing evaluation was to understand three key elements: How successfully the program penetrated the targeted market, how well specific marketing strategies worked relative to others, and the level of

customers' satisfaction with the program. Specific objectives of the marketing evaluation were to understand:

- The relative differences and similarities between participants and nonparticipants: demographically, attitudinally and behaviorally - to understand if the program had broad market appeal rather than being limited to only certain customer segments
- Satisfaction of program participants (overall, with measures, with installation, as well as measures originally accepted, still retained)
- Optimal positioning of the program, appropriateness of various marketing communications, what message was received, etc.

The primary objectives of the outcome evaluation were:

- To provide a quality assurance audit on contractor installations
- To assess comprehensiveness and persistence of measure installation
- To determine the energy savings associated with Program participation

Overview of the WattBusters Program

The WattBusters program began in the early part of 1989 and was concluded at the end of 1990, with approximately 18,000 participants enrolled over the program's existence. As originally designed, the major thrust of the WattBusters program was the promotion of energy savings for electric water heating and specifically the installation of water heater wraps. The focus evolved over time, however, to include a lighting efficiency focus as well as other measures, while excluding electric heating.

The original focus of the program included installation of a tank wrap and pipe insulation, low flow shower head, faucet aerators and delivery of (although not actually installation of) halogen bulbs. In the second year of the program the following measures were added: tank temperature turn down, AC filter change, installation of fluorescent bulbs, drop off of a refrigerator coil brush and energy conservation educational materials.

The motivations for the change in the program were to:

- Make the program as comprehensive (measure-wise) as possible for the appropriate target customers (i.e., electric water heating customers) - hence the inclusion

of additional measures over the course of the program's evolution.

- Ensure that targeted customers were the most appropriate for the major thrust of the program (i.e., water heating) and to thus minimize the lost energy saving opportunities - hence the eventual focus on water heating only customers as opposed to both *space* and water heating customers as was part of the original program design. A separate program for space heating customers was underway.

Methodology

The approach to the process and marketing evaluation assessment included the following data collection efforts:

- One-on-one, in-depth personal interviews with:
 - BECO staff involved in the program design, cost-benefit analysis, and implementation including:
 - BECO program manager(s) - original and final
 - Final program staff (marketing, database, etc.)
 - Members of the Demand Planning Division (responsible for program design)
 - DSM Contractor interviews (managers and staff) (responsible for installation and database)
- Telephone interviews with both program participants and nonparticipants with sample size targets as specified below:

	<u>Sample Size</u>
• Program participants	249
• Program nonparticipants	289

Nonparticipants were further broken down into the following two groups:

• Customers known to have been contacted by the program but ultimately declined	126
• Random sample of electric water heating customers	163

The sources of information and approaches used for the outcome evaluation of the WattBusters program were as follows:

- *On-site inspections of 250 WattBusters participating households* by an experienced quality assurance sub-contractor. The inspections and a short survey conducted during the time of the inspection addressed the following issues:
 - Agreement between what work was billed to BECO work order information and that actually documented by the on-site inspection.
 - Evaluation of the quality and effectiveness of installations
 - Evidence of any measure removal/modification
 - Reasons for any discrepancies/changes
 - Participants satisfaction with the program and the installation process
- *Analysis of household energy use information* for 210 program participants and 253 nonparticipants based on Boston Edison billing records. The purpose of the energy use analysis was to understand what changes in usage occurred and could be objectively measured as a result of program participation.

Evaluation Findings

Findings of Process and Marketing Evaluation

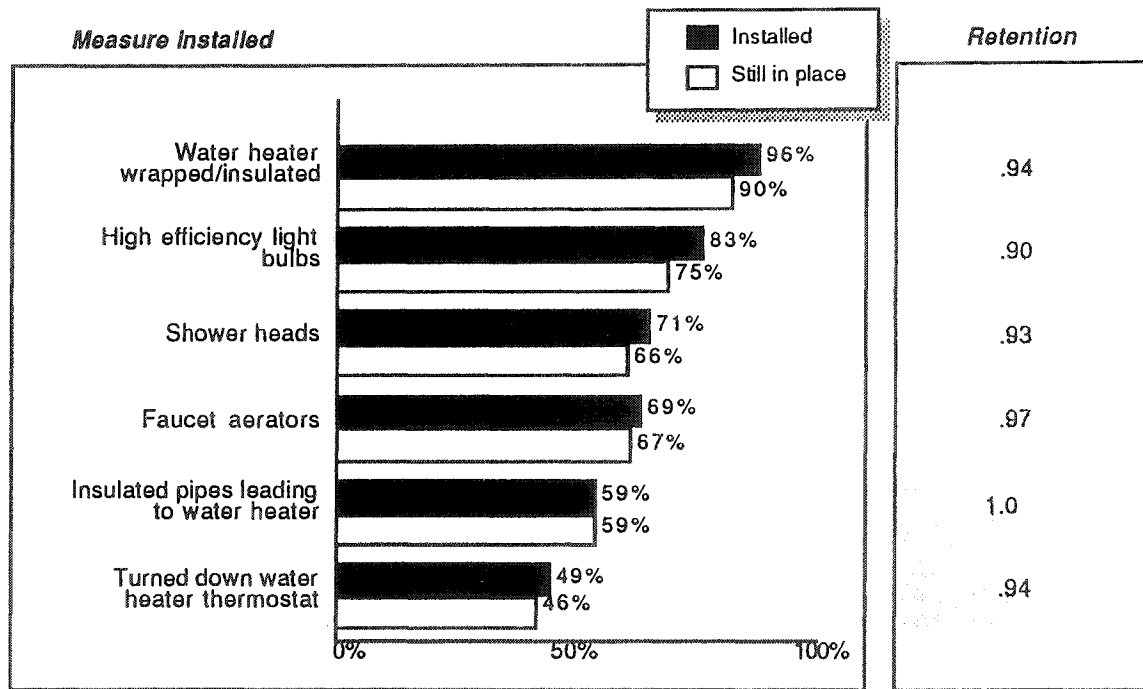
From a process and marketing evaluation perspective, the WattBusters program was successful in a number of important ways, notably:

- Program participants appear very highly satisfied, generating significant goodwill toward Boston Edison. As shown in Exhibit 1, over 90% of participants were satisfied with the program overall and 80% or more were satisfied with each of the individual specific aspects of the program.
- Most measures targeted under the program are reported by participants to have been installed by the contractor and to still be in place and functional. All retention figures were over 90% as shown in Exhibit 2.
- The majority of participants believe the conservation measures have saved them energy and decreased their electric costs. (Exhibit 3)
- Also, the program reached a broad cross-section of the BECO customer base as evidenced by a broad demographic, attitudinal analysis (income, age and education).

Exhibit 1
Satisfaction with WattBusters Program
 (Mean rating on a 1 to 5 scale where 5 = "very satisfied")
 (Satisfied = % of respondents rating attribute 4 or 5 on same scale)

<i>Measure</i>	<i>Participants (n=249)</i>	
	Mean	Satisfied %
Overall program rating	4.7	93
Ease of signing up	4.9	95
Elapsed time from interest to installation	4.4	82
Types of measures installed	4.6	86

Exhibit 2
Comprehensiveness of WattBusters Installations
 - Self-Reported -
 Participants (n=249)



Despite WattBusters success, however, room for improvement exists. First, the high level of water heating conservation activity evident among program nonparticipants (as shown in Exhibit 4) suggests the likelihood of significant free-rider incidence among participants (i.e., the percentage of program participants who might have taken the conservation initiative as many nonparticipants did - without the program).

Second, important enhancements could have been made in the process by which the WattBusters program was planned and executed.

Specific areas in need of improvement were:

- Initial WattBusters program planning appeared lacking on a number of levels, specifically:
 - No clear or sustained marketing strategy existed
 - System(s) for program monitoring/contractor evaluation were inadequate

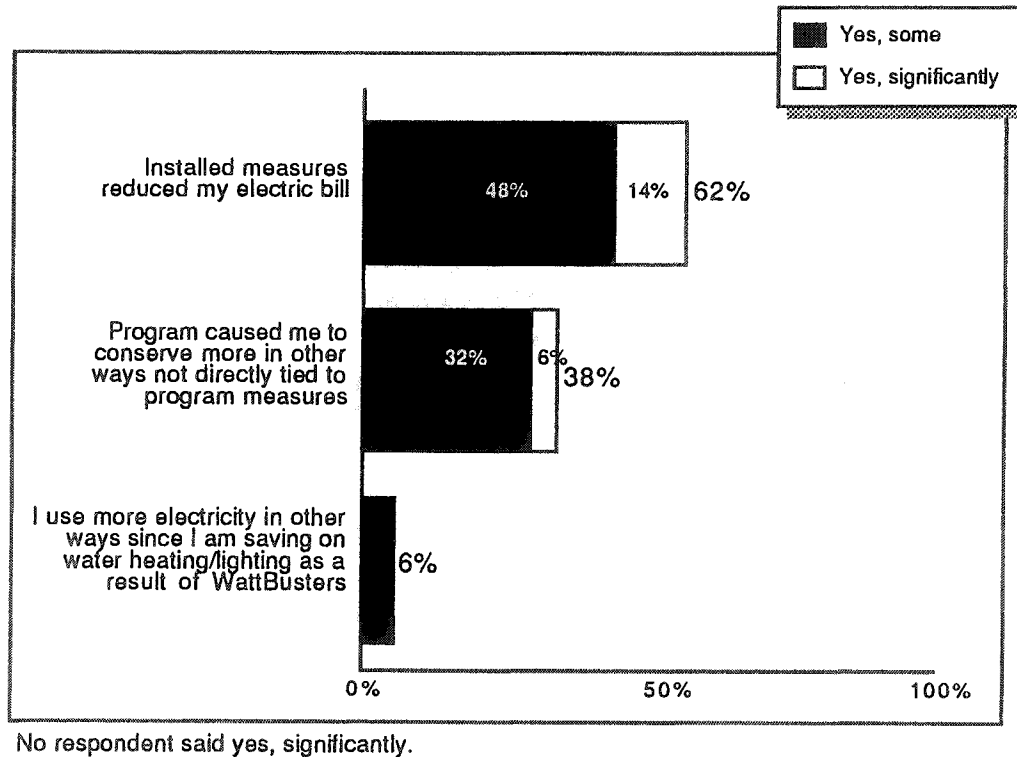
- Overall program staffing requirements were underestimated (e.g., lack of field monitor, need marketing support)
- WattBusters design and marketing could have been better integrated with that of other residential conservation programs. Better integration would have resulted in successfully channeling customers into the most suitable program for him/her, thus maximizing the savings achieved from each household.

Findings of the Outcome Evaluation

Overall the results of the outcome evaluation were positive although savings were less than originally anticipated. There were two components of the outcome analysis: on-site inspections and a billing analysis. The findings of each are described in the following sections.

Findings of Site Inspections. The major finding of the household site inspections were:

Exhibit 3
Perceived Outcomes of WattBusters Program
 Participants (n=249)
 Percent Agree with Statement



- With nominal discrepancies, the work billed to Boston Edison was documented to have been installed. For most measures, in over 90% of households, the site visit confirmed the information in the work order. It is also important to note that participants' self-reported measure retention data was highly similar to that of the site inspections as shown in Exhibit 5.
- Virtually all measures were properly installed with good workmanship (upwards of 95% for most measures).
- Most measures were still found to be in place and in good working order (upwards of 95% for most measures). The exception was light bulbs, where in about 20% of households there were fewer bulbs currently retained than indicated on the work order.

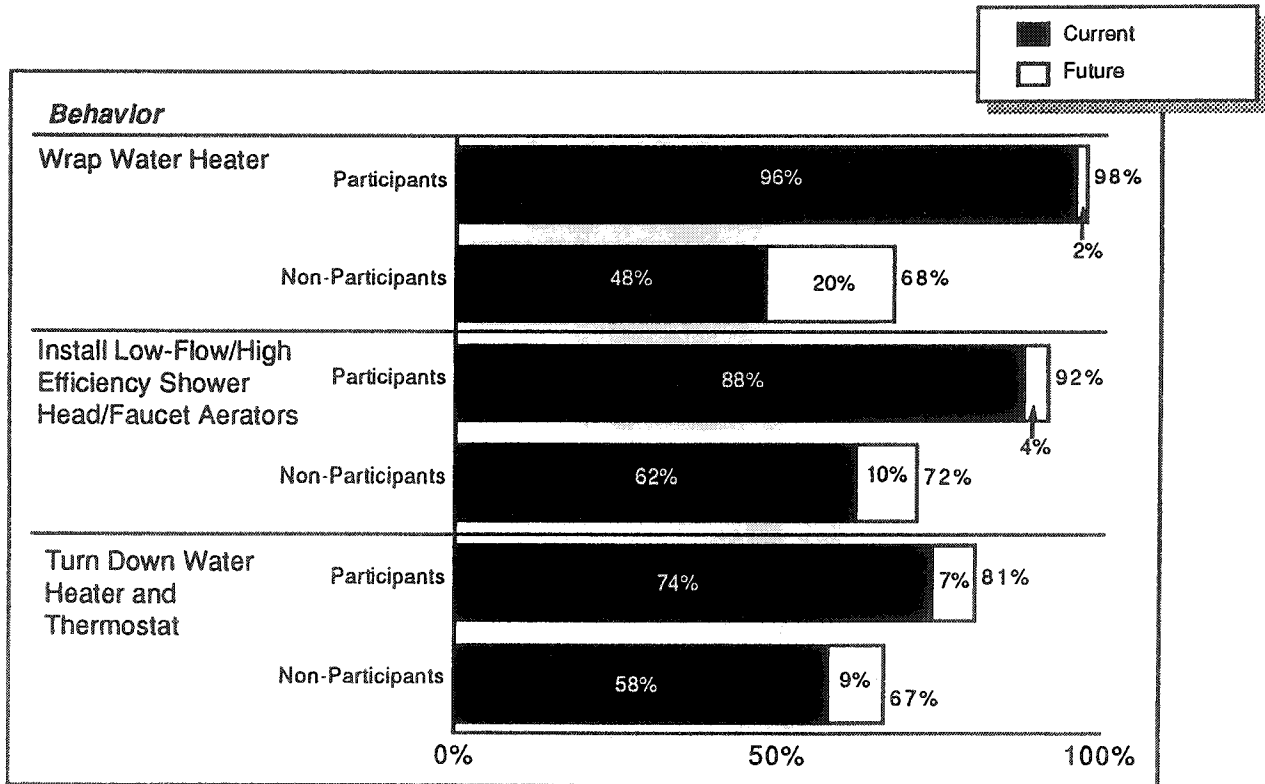
Findings of Energy Analysis.

Energy Impact Estimating Technique. The primary method used to estimate the energy impact of the program was to compare the difference in energy usage for participants in pre and post installation periods with that of a comparable group of nonparticipants for the same time period. This approach controls for the effects of such factors as weather, energy prices, and general economic trends which might be correlated with the pre/post time period of the program and hence, if uncontrolled for, would bias the estimate of program impact.

Since the definition of the pre/post program time period is different or moves for each participant, the approach adopted was to select affixed time period which is known to be either pre or post program for a given group of

Exhibit 4
Hot Water Conservation Behavior and Future Intentions
Participants (n=249) Versus Non-Participants (n= 289)

(Current = % of respondents installed measure in past 2 years; Future = likely installations in next 2 years)



participants so that energy usage can be compared for this same time period for nonparticipants. The pre/post time periods used for the evaluation were defined as follows:

	Pre Program Phase Defined As:	Post Program Phase Defined As:
For 1989 Program Participants	Jan.-Dec. 1988	Jan.-Dec. 1990
For 1990 Program Participants	Jan.-Dec. 1989	Jan.-Dec. 1991

It is important to note that the analysis focused only on analyzing *relative differences* as opposed to absolute differences in usage for participants and nonparticipants for the defined pre and post time period. The relative differences were measured as essentially the percentage change in usage for the defined time periods. Relative as opposed to absolute differences were analyzed to adjust for any differences in the level of overall energy use (either higher or lower) between the participants and

nonparticipant control group which could bias the estimate of program impact.

The key end result of the energy billing analysis was a calculation of the following:

Avg. Net Energy Savings (due to the program) =

$$Avg. kWh_{pre-part.} \times \left(\frac{Avg. kWh_{post-nonpart.}}{Avg. kWh_{pre-nonpart.}} - \frac{Avg. kWh_{post-part.}}{Avg. kWh_{pre-part.}} \right) \quad (1)$$

Where $Avg. kWh_{pre-nonpart.}$ is defined as the mean energy usage for nonparticipants in the pre program phase.

$Avg. kWh_{post-nonpart.}$ is defined as the mean energy usage for nonparticipants in the post program phase,

Exhibit 5
Comparison of Self-Reported and Inspection Data on Measures Retained
(n = 250)

	Self-Reported Percent Retained	Site Inspection Percent Retention
■ Water Heater Wrap	94	95
■ High Efficiency Bulbs	90	81 (of households where all bulbs billed are still present) 91 (of bulbs billed are still present)
■ Shower Heads	93	91
■ Aerators	97	93
■ Pipe Insulatin	100	99
■ Temperature Turndown	94	92

Avg. kWh_{pre-part.} is defined as the mean energy usage for participants in the pre program phase.

Avg. kWh_{post-part.} is defined as the mean energy usage for participants in the post program phase.

Estimated Saving. Based on the primary pre/post participant/nonparticipant method of analysis:

- The aggregate net savings estimated for the WattBusters Program weighted across the two years of program operation was:
 - 409.3 kWh per participant annually or
 - A total of 7,531,120 kWh annually when multiplied by all program participants for the two years of the program's operation
- These estimated net savings figures were 57 percent and 85 percent of the original engineering estimates for the 1989 and 1990 program years respectively. These percentages were derived by dividing the billing estimate by the original engineering estimate for 1989 (274.8 kWh + 480 kWh) and 1990 (628.8 kWh + 740 kWh).
- Differences in estimated program impact were observed for customers with and without electric space heat.

Thus, despite the expedited and sometimes resource constrained process by which WattBusters was planned and implemented (e.g., moved unusually quickly into field implementation from original proposal, lack of adequate marketing support at some stages), the program appears relatively successful from an end-result or outcome perspective.

However, future programs may benefit from some insights gained from this outcome evaluation:

- Original engineering estimates are likely to be significantly larger than actual savings in practice and, in the future, some consideration should be given to discounting original engineering estimates based on experience gained through previous outcome evaluations such as WattBusters.

Given that WattBusters appears to be far more successful in its second year of operation (as opposed to the first), program planners should take heed to allow programs to mature over time and allow for this in the time frame planned for the program.

The following exhibits display the difference in energy use, pre and post program, for participants and a comparable time period for nonparticipants (Exhibit 6) as well as the net energy savings estimates (Exhibit 7).

Exhibit 6
Differences In Energy Use Pre and Post Program
 (based on average monthly k Wh)

	Pre Program k Wh Use	Absolute Differences in Use (Post-Pre k Wh)	Relative % Difference in Use $\frac{\text{Post-Pre}}{\text{Pre}} \times 100$
For the 1990 Program Year (pre program phase = Jan-Dec '89; post = Jan-Dec '91)			
■ Customers without electric space heat			
- Program participants (n=91)	578	-84	-14.5
- Program non-participants (n=188)	676	-17	-2.5
		net % difference = -12.0	
		t= -3.9 (for differences in use)	
■ Customers with electric space heat			
- Program participants (n=35)	1214	-141	-11.6
- Program non-participants (n=63)	1341	-146	-10.9
		net % difference = -.7	
		t= .11 (for differences in use)	
For the 1989 Program Year (pre program phase = Jan-Dec '88; post = Jan-Dec '90)			
■ Customers without electric space heat			
- Program participants (n=51)	741	-82	-11.1
- Program non-participants (n=184)	729	-51	-7.0
		net % difference = -4.1	
		t= -1.17 (for differences in use)	
■ Customers with electric space heat			
- Program participants (n=33)	1019	-71	-7.0
- Program non-participants (n=67)	1394	-82	-5.9
		net % difference = -1.1	
		t= .05 (for differences in use)	

Lessons Learned for Future Evaluations

Number of important lessons were teamed for future evaluations:

- Changes in the program can and will occur over time and will require evaluating program process impact at various points in a program's lifecycle.
- Inherent problems arise in analyzing billing data. As such, significant time and effort should be planned to clean the data, to do manual matching of participants and billing records, etc. In some cases, inherent limitations exist and are out of the control of the evaluator.
- When multiple measures are offered in essentially a packaged program offering, as was true of WattBusters, it became practically impossible to unbundle statistically the impact of individual program components (as was attempted in the WattBusters evaluation, although not shown here).
- The WattBusters evaluation demonstrated that customers' self reported data, in terms of what measures were installed under the program and are still in place, were very close to the data resulting from actual site inspection. This findings suggests the appropriateness of using customers' self reported data instead of more costly site inspections for some purposes.

Exhibit 7

Net Energy Savings Estimates

	<u>Net Savings (k Wh)</u>	
	<u>Monthly</u>	<u>Annually</u>
<u>1990 Program Participants</u>		
■ Customers without electric space heat	69.4	832.3
■ Customers with electric space heat	8.5	102.0
■ Combined customers (weighted estimate across customers with and without electric space heat)	50.1	601.2
<u>1989 Program Participants</u>		
■ Customers without electric space heat	30.4	364.8
■ Customers with electric space heat	11.2	134.4
■ Combined customers (weighted estimate across customers with and without electric space heat)	20.9	250.8
<u>Combined 1990 and 1989 Program Participants</u>		
<i>(weighted by number of program participants in each year)</i>	34.1	409.3

• Contamination of participant and nonparticipant sample can occur as a result of other utility programs having been offered at or before the time of the specific program being evaluated. As such, differences observed from participant and nonparticipant's com-

parisons may be obscured and unfairly discounted in terms of program impact on the basis of what is essentially utility induced conservation behavior among nonparticipants. How to adjust evaluation results for this phenomenon is an important issue for further consideration.