

THE ELMHURST RESIDENTIAL REBATE PROGRAM:  
ISSUES IN THE CONDUCT OF A COMPREHENSIVE EVALUATION

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ABSTRACT

This paper discusses three evaluation issues in a process and outcomes evaluation of an experimental residential weatherization program. Two programs were run simultaneously in a small utility in suburban Tacoma, Washington. Households requesting energy services were randomly assigned to the experimental or conventional weatherization program. Three evaluation issues were examined which arose during the course of this program: (1) the role of the evaluator in situations where program management responsibilities are in transition; (2) the effect of major program changes on the evaluation; and (3) the impact of supplementing data on the analysis results.

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INTRODUCTION

In 1978, a few utilities in the Pacific Northwest began offering their customers low (or zero) interest loans to help finance home weatherization. This initiative was followed by the startup of the Residential Conservation Service portion of the National Energy Conservation Policy Act. Both programs had two distinct features: (1) direct utility staff-consumer interaction; and (2) a mathematical calculation of the potential energy savings from weatherization. In addition, the common practice for utilities was to do "heat loss" calculations when advising designers, builders and consumers on the size of electric heating systems in new homes. The Bonneville Power Administration's Weatherization Pilot Program followed these models when it began in 1980.

The BPA Regionwide Weatherization Program, offered to all Pacific Northwest utilities in 1981, was true to form. Direct utility involvement and sophisticated heat loss calculations were seen as necessities for this new program. Unlike prior low-interest loan programs, the new effort featured substantial cash payments to "buy back" energy savings. This considerable investment meant the cost-effectiveness of each weatherization job assumed importance -- the involvement of the utility and detailed calculations served as checks and balances on job prices and quality.

The Regionwide Weatherization Program was implemented by over 100 regional utilities. As with many decentralized implementations of centrally planned programs, certain utilities -- particularly the smaller ones -- encountered some difficulty in adhering to program requirements.

For example, some utilities were finding consumer contact both time consuming and non-productive -- utility staff members were too busy taking measurements and making calculations to establish good rapport. Heat-loss calculations seemed to produce more paper than accuracy; thus, "How accurate can we be?" became the prime question. Those with a real interest in getting the home weatherized, the installers, were not in the picture until the homeowner knew what measures were to be installed and how much the work should cost.

As the primary designer and financial backer of the Weatherization Program, BPA needed to find solutions to these operational problems. Inefficient operations could hurt morale, waste time and cost money.

The Elmhurst Pilot Program, implemented by Elmhurst Mutual Power & Light Co. (Pierce County, Washington), allowed BPA to test a number of alternative solutions to local problems. This approach was designed to reduce utility

costs through lower staff involvement and fewer wasted consumer contacts (i.e. those that did not result in completed jobs). Also, Elmhurst tested the marketing effectiveness and quality control implications of having installers contact interested consumers directly.

BPA's interest in the Elmhurst Pilot Program included the following:

1. Reducing administrative costs. The Weatherization Program currently incurs administrative costs of about 13%. If utility involvement could be reduced, perhaps administrative and total program costs would fall. These costs might be shifted to installers, but since they generally make home visits to prepare bids on weatherization work, only limited additional costs were likely. Increased efficiencies would permit better use of utility staff and reduce administrative payments from BPA. Better operations "up front" could also result in higher quality work by installers and inspectors.
2. Creating a cost control mechanism. The energy savings calculation provides a method of setting what the BPA/utility contribution is for each weatherization job. With installers making the only pre-weatherization home visit, a way to establish reasonable job costs was needed. Elmhurst provided a new tool. The time and effort to create the cost control mechanism (the "price list") and the process used to gain installer acceptance would be valuable real-world experience for use with other utilities.
3. Calculating energy savings. The considerable weatherization investment by the region through BPA makes energy savings crucial. Removal of utility staff and the savings estimate as program elements brought into question the reliability of projected savings. Elmhurst continued to use utility inspections of completed work. But would that be enough to insure against cost creep-up and savings slide-down? Elmhurst broke the old mold in an environment that provided careful, thorough evaluation of program costs and savings.
4. Marketing weatherization. The Elmhurst project resulted in an interesting test of marketing techniques. Generally, Pacific Northwest utilities had found strong consumer demand for weatherization. However, by late 1983 Elmhurst found itself in a situation of sluggish consumer interest. As the more interested consumers have their homes weatherized, lower demand in the remaining market will become more common. Stimulating consumer interest and then being able to manage the new workload was an unexpected benefit of the Elmhurst Pilot Program.

BPA engaged International Energy Associates Limited (IEAL) to undertake a comprehensive evaluation of the Elmhurst Pilot Program. The evaluation was composed of two separate but interrelated parts: a process evaluation focusing on implementation issues, and an outcomes evaluation focusing on energy savings and cost effectiveness.

The evaluation generally covered the time period from January to December 1984. During that time, Elmhurst operated two residential weatherization programs: the conventional BPA Regionwide Weatherization Program ("Buy-Back Program") and the Elmhurst Pilot Program ("Rebate Program"). During 1984, 122 single family residences were weatherized under the Buy-Back Program and 239 were weatherized under the Rebate Program.

Several major innovations were included in the evaluation plan for the Elmhurst project. First, enough resources were made available for IEAL to conduct systematic and frequent site visits for the process evaluation. As a result, IEAL visited the utility and observed their process and procedures at least once a month for more than a year.

Second, the utility agreed to assign households randomly to the Buy-Back and Rebate Programs from a waiting-list backlog of over 600 requests for energy services. Thus, we would be assured of pre-weatherized group equivalence for the energy savings (outcomes) analysis.

The results of the process and outcomes evaluations are presented elsewhere (Bronfman and Lerman 1985, Bronfman and Horowitz 1986), and will not be reiterated in this paper. Instead, we summarize here the major evaluation issues we encountered and how they were resolved. The final section will discuss our conclusions and their implications for future residential weatherization evaluations.

## EVALUATION ISSUES

We discuss below the major evaluation issues which were raised during the implementation of the Elmhurst Pilot Program. These issues cut across both the process and the outcomes evaluations, and are presented as examples of issues that can arise in any evaluation situation.

### The Evaluator as Project Manager

Process evaluation serves many purposes. In addition to examining implementation issues, a process evaluation serves as an alternative line of communication to project management. As shown elsewhere (Lerman and Bronfman 1984a, 1984b), process evaluations have been used effectively by project management to identify problems and modify program requirements.

However, management and support staff at BPA saw significant personnel turnover during the Elmhurst program period. Between October 1983 and July 1984, there were five project managers and two evaluation task managers at BPA headquarters. At the local BPA Area Office assigned to Elmhurst, there were three different staff representatives. The Technical Support staff at BPA had several individuals available to address technical questions, and different staff members were assigned to deal with issues as they arose. The result was

that no single individual was really "in charge" of managing the BPA-Elmhurst contract.

We are not ready to propose an overall solution to this problem. Beyond making a forceful argument to the sponsoring agency on the importance of consistent program guidance (an issue they know quite well) evaluators can establish a more systematic written account of management issues on a periodic basis (for example, quarterly), rather than relying on discussions or informal correspondence. Second, to avoid being co-opted by the utility staff, the evaluator should rely more on periodic structured discussions (interviews) with utility staff, rather than becoming a participant observer. Finally, the evaluation plan should specify that all relevant staff meet on a periodic basis to discuss program progress, issues and solutions. For the Elmhurst project, quarterly meetings composed of a utility representative, an evaluation contractor staff member and BPA Program, Evaluation and Area Office staff members would have substantially improved program communication.

As regular visitors IEAL staff members were asked for advice and requested to pass along ideas by the Elmhurst staff. Without a regular day-to-day contact person at BPA, the utility used the evaluators as a "sounding board" for solutions we were expected to review critically in the evaluation. Specifically, advice was requested about changing the reimbursement on heating duct insulation, requesting additional funds to cover "start-up" program costs, random assignment procedures, reporting requirements and program progress.

#### Program Changes: Direct Marketing

By July 1984 it became clear that, even though the utility had a backlog of 600 requests for audits, the number of completed jobs was lagging far behind acceptable rates. It had been decided that a sample size of 200 weatherized residences in each program (Rebate and Buy-Back) would be acceptable for statistical analysis, and 150 in each group would be the minimum required.

Table I shows the monthly completion rates for each program. By the end of July, 73 Buy-Back residences had been weatherized but only 50 Rebate homes were completed. (Note that residences were randomly assigned to receive invitations. The acceptance rate or completion rates for weatherization could not be prescribed.) BPA decided to implement an intense direct marketing effort for the Rebate Program. Under the new effort, the installers (weatherization contractors) were encouraged to contact households directly and were supplied with a list of households drawn from the utility's backlog of weatherization service requests. Installers were supplied with training and materials to provide assistance in this effort (Keane 1986).

The Rebate Program response rate clearly developed a significant turnaround. In all, 189 Rebate homes were weatherized through the direct marketing effort.

Table I. Number of residences weatherized by month and program.

Month (1984)	Buy-Back	Rebate
January	5	0
February	12	2
March	10	8
April	12	4
May	11	6
June	14	20
July	9	10
August	10	21
September	11	14
October	11	80
November	5	44
December	11	30
	121	239

The direct marketing effort raised two issues for the evaluation. First, the direct marketing applied only to the Rebate Program; the Buy-Back Program continued with little change. As a result, we were challenged to estimate whether any bias was introduced into the samples because of this program difference.

Second, direct marketing changed the nature of the intervention in the middle of the program period, making a comparison of the administrative costs moot.

To examine the impact of program changes, we compared costs of weatherization jobs by program and measure costs by program, as well as "early" (pre-direct marketing) vs. "late" jobs. No statistically significant differences were found for any of these comparisons. We concluded that the two program samples were equivalent for evaluation purposes and that the direct marketing effort had not introduced any bias into our program samples.

### Supplementary Samples

A major concern arose when we realized that there would not be enough Buy-Back homes weatherized in Elmhurst for our outcomes (energy savings) analysis. For this analysis, we selected residences which were weatherized between April and October 1984. Using PRISM (Princeton Scorekeeping Method, Fels 1984) we planned to weather-adjust energy use and create Normalized Annual Consumption (NAC) estimates for the 12 month pre- and post-weatherization periods.

The number of Rebate homes in the April-October period was 163. However, only 88 Buy-Back homes were weatherized during the same time. To supplement the latter sample, we randomly selected 101 weatherized homes from a neighboring utility. This utility -- Parkland -- was also a participant in the BPA Regionwide Weatherization Program ("Buy-Back"). Both Elmhurst and Parkland are located in the homogeneous suburban area southeast of Tacoma. Additionally, Parkland shared similar characteristics with Elmhurst regarding housing stock, climate zone, weatherization history and demographics.

Table II shows a comparison of weatherization costs among the samples in the evaluation. As can be seen, no differences in the costs were shown between the Parkland and Elmhurst Buy-Back samples. We concluded that incorporation of the Parkland homes to supplement the Elmhurst Buy-Back sample would be acceptable.

After the samples were selected, IEAL conducted a mail survey of Buy-Back and Rebate participants to examine the residential and demographic characteristics of the samples. Table III shows a comparison of selected variables from the survey. Several of these -- age of home, age of respondent and percentage heating with wood -- showed significant statistical differences.

Our analysis of energy savings also showed differences between the Buy-Back and Rebate groups. However, as can be seen in Table IV, the differences were almost exclusively a function of having included Parkland in the Buy-Back sample.

Clearly, the introduction of Parkland to supplement the Elmhurst Buy-Back sample had an effect on our analysis. However, the dimensions of this effect could not be ascertained until the outcomes analysis was virtually complete.

As noted above, our "first look" at the Parkland sample indicated that the samples would be compatible. (Later analyses, including a "Chow" test, showed no structural differences across samples in the behavioral model.)

In the end, however, the inclusion of Parkland raised more questions than the addition of more cases contributed to the analysis. Most importantly, inclusion of these residences lowered mean pre-program energy use of the Buy-Back sample from 26,100 kWh/year to 25,200 kWh/year. By themselves, the Parkland residences shared similarity in pre-program energy use not with the participant groups, but with the non-participant sample.

Table II. Costs of weatherization jobs by program and sample.

	ELMHURST REBATE		ELMHURST BUYBACK		PARKLAND BUYBACK
	Process Sample	Outcomes Sample	Process Sample	Outcomes Sample	Outcomes Sample
	(N=239)	(N=163)	(N=121)	(N=88)	(N=101)
Total Cost	\$1,714.96	\$1,798.34	\$1,668.11	\$1,671.08	\$1,660.64
Utility Contribution	1,277.40	1,339.02	1,286.55	1,268.01	1,288.50
Customer Contribution	437.56	459.32	381.55	403.07	372.14
% Customer Contribution	25.5%	25.5%	22.9%	24.1%	22.4%

Since the evaluation results fed directly into the BPA decision-making process, the credibility of the analysis was somewhat diminished by the fact that the "random assignment" appeared to have created the two participant groups with different starting points. We conclude that supplemental samples developed solely for the sake of increasing sample sizes should be avoided if possible.

Table III. Residential and demographic characteristics of sample groups.

	Buy-Back	Rebate
Thermostat Setting: Home	68 <sup>0</sup>	68 <sup>0</sup>
Thermostat Setting: Asleep	58 <sup>0</sup>	58 <sup>0</sup>
Thermostat Setting: Away	52 <sup>0</sup>	55 <sup>0</sup>
Percent Owning Home	95%	96%
Age of Home*	24 years	20 years
Length of Residence	13 years	11 years
Age of Respondent*	49	46
Income	\$27,500	\$29,500
Percent Heating with Wood*	39%	55%
Number of Household Members	3.5	4.3

\* T-test for difference of means significant at the .05 level.

Table IV. Program energy savings ( $\bar{X}$ ).

$R^2 \geq .25$					
	Rebate	Buy-Back	Control	BUY-BACK SAMPLES	
				Elmhurst	Parkland
ENERGY USE (kWh/year)					
1983-84	26,600	25,200	24,800	26,100	24,500
1984-85	23,500	21,900	24,200	23,200	20,800
Total Savings	3,000 <sup>a</sup>	3,300	600	2,900	3,600
Reduction (%)	10% <sup>b</sup>	12%	1%	9%	14%
MODEL $R^2$					
1983-84	.87	.88	.88	.85	.91
1984-85	.83	.86	.88	.85	.87
REFERENCE TEMPERATURE ( $^{\circ}$ F)					
1983-84	61	60	59	60	59
1984-85	60	59	61	60	58
SAMPLE SIZE					
	149	154	91	70	84

<sup>a</sup> Total savings does not equal the difference between energy use estimates due to rounding.

<sup>b</sup> Percentage reported is the average percentage savings across households.

## SUMMARY AND CONCLUSIONS

The evaluation of the Elmhurst Residential Weatherization Rebate Program involved both a process evaluation and an outcomes evaluation.

A feature of the process evaluation was that the evaluator became, in the eyes of the utility, a proxy for the project sponsor's management. It was very difficult for the evaluators to maintain objectivity in examining program implementation issues. Further, close involvement in program activities by the evaluator resulted in an "information overload" on implementation issues. This made the task of abstracting major issues a more difficult and resource-consuming activity.

IEAL's more usual model of conducting a process evaluation is a periodic structured site visit approach (Lerman and Bronfman 1985, Bronfman and Lerman 1986). We recommend that evaluators follow this method to avoid becoming too involved in project implementation. A more structured and less interactive approach would have forced the utility to pursue other ways of increasing and systematizing communication with BPA program staff.

A second notable factor in this evaluation was the initiation of a marketing effort in the middle of the project. This effort could have introduced significant bias into the project, but was undertaken in response to evaluation-related concerns regarding sample sizes for analysis. Evaluators have tools at their disposal to examine the effect of significant program changes, and even simple ones such as comparison of mean costs can readily be employed.

In the Elmhurst project, some of this mid-stream correction could have been avoided simply by specifying a contractual minimum rate of weatherization in the contract between the sponsoring agency and the utility. Clearly, however, better communication with BPA staff and quicker action for program changes would have been preferable.

Finally, extreme care must be taken in supplementing samples for analysis. Certainly, monitoring of variations within groups should be undertaken in all phases of the evaluation. As we have seen, some basic differences may not be manifest until the late stages of the evaluation process.

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