Assessment of Non-Energy Benefits of Low-Income Programs: The Indiana REACH Program

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ABSTRACT

This paper reports on the method planned for the evaluation of the Indiana Residential Energy Assistance Challenge (REACH) program. Program participants receive support services, health benefits, skill development, financial advice, energy assistance, weatherization services, and energy education. The objective of the program is to help needy families achieve financial, environmental, social, and economic stability. Program evaluation is to include an assessment of energy and non-energy benefits accruing to the participants and other parties.[1]

Introduction

The State of Indiana has received funds from the U. S. Department of Health and Human Services Administration for Children and Families to implement the REACH (Residential Energy Assistance Challenge) program. The program's goal is to assist Energy Assistance Program participants that have lost within the last year, or will lose within one year, Temporary Assistance to Needy Families (TANF). Eligibility to receive REACH services is dependent upon:

- Participation in job training, an active search for work, or current employment
- Have a history of high energy costs, overdue bills or rent, or frequent moves
- Have income ≤ 150% Federal Poverty Level

Program participants receive support services, health benefits, skill development, financial advice, energy assistance, weatherization services, and energy education. Appliance or structural repairs are included as needed.

The program was designed to achieve various goals including financial stability, environmental/social stability, and housing/energy stability. In our evaluation plan, we have mapped program goals to specific metrics. Our metrics include, among others, changes in arrearage levels, changes in energy bills, changes in level of other financial assistance, changes in mobility (voluntary and forced), changes in ability to pay bills, changes in income, changes in school attendance, and changes in home ownership. We have also mapped the metrics to specific data collection tools.

A major part of the program is the completion of a Family Development Plan (FDP). The FDP process entails the completion of a questionnaire, a family matrix that computes various indices, and a family action plan. Data will be collected quarterly, and the family matrix will be used to track changes in key metrics.

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[1] Due to delays in designing and delivering questionnaires to the family consultants, at the time of writing this paper, no data had been collected. The family development consultants are now in the process of collecting data. By the time of the presentation at the conference, we will have some preliminary results. Any of the authors can be contacted for program results after August 1999.

Requirements

Qualification is determined by the Community Action Agencies (CAA) through Program Coordination Committees (PCC). Coordination of Services/benefits is conducted by Family Development Consultants (FDC) following a holistic case management approach. These consultants need to complete a Family Development Plan (FDP) to include the following:

- Family Development Questionnaire (FDQ)
- Family Development Matrix (FDM)
- Family Action Plan (FAP)

The FDM is specifically designed to measure and track changes in key program indices.

Program Goals

The TANF participants are in need of help in climbing the self-sufficiency ladder. The program's main goal is to offer assistance towards achieving the following objectives:

- Housing and energy stability
- Environmental stability
- Economic stability
- Social stability

The Indiana program is designed as a pilot to test the delivery mechanism using 240 families (60 per CAA). Assistance is offered in various forms including support services, health benefits, skill development, energy benefits, housing benefits, and weatherization service.

Program Evaluation

The primary goals of the evaluation were to provide: (1) an assessment of the overall design and delivery, (2) estimates of the impacts (including energy and non-energy benefits), and (3) an assessment of the cost-effectiveness of the offerings.

We divided the program benefits into those accruing to the participants and those accruing to other parties. Program impacts can be further divided into energy and nonenergy benefits. Our evaluation intends to examine all program impacts. The focus of this paper is the nonenergy benefits.

Some of the program intended nonenergy benefits (e.g., reduction in domestic violence) being evaluated cannot be reasonably attributed to either weatherization or energy education. We present them here as part of the overall evaluation since they are stated explicitly as part of the program goals.

Table 1 displays the energy and nonenergy benefits that have traditionally been attributed to weatherization and energy education programs. The following discussion elaborates on the various benefits.

Table 1. Summary of Energy and Nonenergy Benefits

Affected Party	Benefit		
	Energy	Nonenergy	
Participants	Lower Bills	• Water Savings • Reduced Mobility • Lower Arrears • Better Health	• Increased Safety • Increased Housing Value • Increased Comfort • Lower Use of Alternative Fuels (e.g., wood)
Utility	Lower Generation/ T&D Costs	• Lower Arrears • Lower shutoff/ Service/collection Costs	• Fewer Emergency Costs • Lower Need for Working Capital
Societal	More Efficient Use of Resources	• Water Savings • Economic/Employment Benefits	• Environmental Benefits

Attribution of impact to programs has always been a serious challenge to evaluation research. Quasi-experimental design requires the use of a control group to "remove" the impact of non-programmatic factors. This usually requires that the control group is similar to the treated group in all aspects except the actual participation. These groups are usually difficult to find in voluntary programs. In the case of low-income programs, identifying such a group is even more complex.

In conducting this evaluation, we will attempt two approaches. Whenever possible, the changes in comparable indices among nonparticipants will be used to measure net program impacts. For example, changes in arrears among the participants and the general population of low-income customers will be compared. The difficulty with this approach is that we are dealing with over 20 different utilities in this program. We are currently monitoring individual participants on quarterly basis. Any exogenous changes will be noted. and their impact will be included in our evaluation both qualitatively and quantitatively. We plan on building a time series model utilizing the various indices. These models will incorporate some quantitative assessment of the effects of non-programmatic variables.

Participants

Energy Impacts

This portion of the analysis involves traditional simple comparison of pre and post weather-normalized energy consumption. Weather normalization will be performed using the Princeton Scorekeeping Method (PRISM). Since this type of experimental design has been used by literally thousands of Demand Side Programs, we will not elaborate on this issue any further.[2]

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[2] PRISM was selected as the energy impact assessment tool in the program design phase. The reason for the choice was to standardize the method across the various REACH programs. Once the weather-normalized values are estimated (in cases where that is possible, i.e., no significant secondary heating source), additional regression models will be estimated taking into account exogenous variables (e.g., new baby). All necessary variables will be tracked quarterly for each family in the program.

Water Savings

Many of the energy-saving measures also save water. These measures include showerheads and faucet aerators. The total savings value of this varies by location and family size. Skumatz and Dickerson (1997) estimate the "average" value to be approximately $36/household annually with a range of $8 to $111. Khawaja and Reichmuth (1997 & 1998) estimated total water savings of 5,336 gallons (approximately $12) per year for PacifiCorp Shower Head Program.

We intend on using results from previous programs to extrapolate the savings to the population of the REACH participants receiving water saving measures. Demographic and geographic adjustments will be made as needed. For example, in the Khawaja and Reichmuth (1997 and 1998) studies, regression models were developed explaining energy and water savings as a function of number of occupants, difference in water temperature (inlet versus outlet), and changes in water flow. The savings will be estimated in terms of energy and water saved per household.

Non-Energy Impacts

After evaluating over a dozen different low-income programs nationwide, we strongly believe that such undertakings cannot be justified solely as resource acquisitions. However, we also strongly believe that the nonenergy may exceed the energy benefits and that, in combination, these benefits may make most low-income programs cost-effective. Brown et al (1993) estimated "conservatively" that net present value of nonenergy benefits of weatherization assistance programs to be $976 per participant in 1989 dollars.[3]

As mentioned above, one of the major goals of this evaluation is the assessment of the program impacts on the participants' economic well being and general welfare. This includes housing, family environment, economic, and social stability.

Economic Stability. Economic stability benefits are to be measured in terms of changes in the following variables: the family's ability to pay bills, arrearages, family net income, the quality of the dwellings, employment status, weeks of full-time equivalent employment, overall level of debt, and the level of other forms of public assistance. Most of the data required for assessment of the impact of the program on economic stability will be collected using surveys designed by quantec. Data are currently being collected by the family development consultants. Other data sources include billing records from utilities and telephone service providers.

Family Environmental Stability. These benefits will be assessed in terms of changes in forced moves, changes in mobility, a comparison of whether the family was in danger of homelessness before and after the program, the number of times clients change jobs, and changes in the incidence of both automobile and telephone ownership. Health, comfort, and even safety are other potential nonenergy benefits of the program. In a recent evaluation of Cinergy's low income program, 81% of the participants stated that their homes were more comfortable, 60% thought that members of their household got sick less often, 64% thought that they had better control over their finances, and 75%

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3   The estimate is "conservative" due to the fact that the assessment did not include estimates for "thermal comfort improvements, indoor air quality, benefits of increased nonenergy expenditures, and savings associated with fewer residential moves." The $976 estimate included $126 of the present value (PV) of enhanced property value and extended lifetime of the dwellings, $32 of PV of reduced arrears, $55 PV of federal taxation generated from increased employment, $506 PV of income generated from indirect employment, $82 PV of avoided cost of unemployment benefit, and $172 PV of environmental externalities.

thought that the program increased the value of their homes. (Khawaja and Miller, 1999) All data needed for this portion of the evaluation are being collected by the family consultants using **quantec** surveys.

Social Stability. These benefits are measured in terms of level of education, the extent of forced mobility and the impact this has had on children's schooling (measured in terms of number of times children change schools as well as the frequency with which children are absent from school), as well as the incidence of volunteerism. Low-income customers move for a variety of reasons. However, there is ample research indicating that bad debt and service shutoffs are highly correlated with the high level of mobility. The 1984 National Science and Law Center study in Pennsylvania found that low-income households were three times as likely to move as non-low-income households, low-income movers were more likely to be recipients of public assistance, and movers were more likely to have poor utility bill payment history. Furthermore, frequent movers have high school drop-out rates that are four times the average. The National Consumer Law Center conducted a study for Maine Public Utilities Commission and found that 60% of low-income movers had some payment history troubles. (Colton, 1994 and 1996) Estimates of the impact of the weatherization alone on the reduction of turnover among low-income customers ranges between 2% and 7.5%. (Skumatz and Dickerson, 1997)

Family Development Matrix

As mentioned above, qualification for the program is determined following a holistic case management approach. In the process, a Family Development Plan (FDP) is completed to include the Family Development Questionnaire (FDQ), Family Development Matrix (FDM), and Family Action Plan (FAP). The FDM has been designed by FSSA administrators in order to quantify the progress agencies make in their work with families. **quantec**'s evaluation of the REACH program will include an index that tracks the progress of REACH participants along the family development matrix. The FDM will be implemented across the various REACH program, thus assuring standardized evaluations.[4]

The FDM creates subjective metrics for various indicators including energy, housing, income, adult education, child development and education, family relations/domestic violence, employment, transportation, support systems, health, nutrition, and substance use. As mentioned above, most of these benefits cannot be realistically attributed to weatherization or energy education. We present the model here for illustrative purposes of a method of estimating the impacts of a program on difficult-to-quantify indices.

Individual FDMs are constructed by the family consultant. The consultant fills in the index values based on a set of questions related to each category. For example, for the indicator "Family Relations/Domestic Violence," the consultant will assign a score value of 10 if he/she feels that there is:

> no threat of abuse/violence; strong positive sense of family identity; stable family makeup; conflicts negotiated successfully; rules/expectations consistently followed; open respectful communication; appropriate guidance and support in family.

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[4] We realize that the subjective nature of the FDM maybe a little problematic to some evaluators. We share that feeling to some degree. We do also realize that subjective assessment is often the only way to conduct an evaluation. The family consultants do, however, receive training in completing the FDM, thus helping reduce the subjectivity or at least assure consistency.

The other extreme:

> current violence/abuse; out of home placement may have occurred; minimal family identity; family make-up may change often; unrealistic nonexistent rules/expectations; barriers to communications/respect; little/no guidance/support given; high conflict rate

receives a score of 0. All other indices are assigned a score in a similar fashion. Once the values of the various indices have been determined, an overall value is computed by simply summing across the indices. All indices are assessed every three months. Values are tracked across time for measurement of program impact (see Table 2).

Table 2. Family Development Matrix Score Sheet

Index	Initial Score	Score at 3 Months	. . .	. . .	Score at 24 Months
Energy					
Housing					
Income					
Adult Education					
Child Development & Education					
Family Relations & Domestic Violence					
Employment					
Transportation					
Support Services					
Health					
Nutrition					
Substance Use					
Total All Indices					

Matrix Score Key: All Indices

97-120 Points: Thriving

73-96 Points: Self-sufficient

49-72 Points: Stable

25-48 Points: Vulnerable

0-24 Points: In-crisis

It is not possible in this paper to go through all indices.[5] Table 3 shows a complete example of FDM scoring for the energy indicator.[6]

Table 3. Family Development Matrix: Energy Index

Matrix Score	Indicators and Criteria
Thriving 9,10	Family members actively apply energy conservation techniques; exposure to energy education; home is wx'd; utility bills are paid consistently and in a timely manner; no late notices; no subsidized benefits.
Self-sufficient 8	Energy conservation techniques applied sporadically; exposure to energy education; home is weatherized; utility bills are paid consistently and in a timely manner; no disconnect notices; no subsidized benefits.
Self-sufficient 7	Applies minimal energy conservation techniques; exposure to energy education; home is weatherized; utility bills are paid consistently and in a timely manner; no disconnect notices; no subsidized benefits.
Stable 6	Does not apply energy conservation techniques; exposure to energy education; home is weatherized; utility bills are paid consistently and in a timely manner; no disconnect notices; receives subsidized benefits.
Stable 5	Does not apply energy conservation techniques; exposure to energy education; home is weatherized; arrangement to pay bills on a budget plan; no disconnect notices; receives subsidized benefits.
Vulnerable 4	Does not apply energy conservation techniques; no exposure to energy education; home is weatherized; utility bills are usually paid to avoid disconnection; some disconnect notices; receives subsidized benefit.
Vulnerable 3	Does not apply energy conservation techniques; no exposure to energy education; home is not wx'd; energy bills are paid sporadically; often presented with late notices or actual disconnection; receives subsidized benefits.
In crisis 2	Does not apply energy conservation techniques; no exposure to energy education; home is not weatherized; family is unable to pay costs of energy use; constant threat of disconnect; receives subsidized benefits.
In crisis 1	Does not apply energy conservation techniques; no exposure to energy education; home is not weatherized; family is unable to pay costs of energy use; utilities disconnected; may receive subsidized benefits.
In crisis 0	Does not apply energy conservation techniques; no exposure to energy education; home is not weatherized; family is unable to pay costs of energy; utilities disconnected; no subsidized benefits.

All families are asked to complete the FDM questionnaire to determine family strengths and basis for future growth. The FDM is reviewed and revised every three months.

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[5] Interested readers may get copies of the FDM from the authors.

[6] Several questions are asked during the interview to help the consultant decide on the score to choose. These include: Are your utilities on? Is your home weatherized? Have you ever attended a class or workshop about energy use? Do you pay your utility bills in full every month? Have you ever received utility assistance (EAP)? Have you ever been or tried to be on a budget plan? Do you receive disconnect notices every month? Do you pay your utility bills on time every month? Do you do things around your house to cut your utility bills?

Other Benefits

All energy-conservation programs create environmental benefits due to the reduction in need to generate energy and reduce the need for capacity expansion. In addition energy conservation programs often lead to a reduction in arrears, which also has a direct economic benefit to the utility. As arrears decrease, utilities experience savings due to the following:
- Reduction in bad debt
- Reduction in collection/shutoff/reconnect costs
- Increase in earning due to time value of money/reduction in carrying charge[7]
- Reduction in regulatory costs

It was estimated that in the State of Washington alone, the total cost of bad debt has exceeded $9.5 million in 1985. Added to the rate base, these costs have caused a 0.1 to 0.4 mill increase per kWh. (Quaid, M. and S. Pigg 1991)

In a study of PG&E's Venture Partners Pilot Program, Skumatz and Dickerson (1997) found that the total value (to PG&E) of reduced arrears, reduced shutoff costs, and fewer gas emergency call, was nearly $35/participant annually. When these non-energy benefits were included, the program payback to PG&E was reduced from 7 to 3.8 years. PacifiCorp low income program reduced median arrears for low income participants in Oregon from $11.84 to $3.14. During the same time period nonparticipant arrears remained virtually unchanged.(Khawaja, et al. 1992)

Summary

Table 4 summarizes the various indices to be used along with their data source. Each of the following indices is constructed by comparing pre-program behavior to post-program behavior. Whenever possible, the changes in comparable indices among nonparticipants will be used to measure net program impacts.

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[7] The actual benefits that accrue from the program will be in terms of reduced carrying charges on the unpaid balance for the participants. In this approach, we will first calculate the carrying charges for each participant before and after participation in the program. For each period, the total transaction costs will be calculated as:

$$CH_i = \sum [(BD_{it} - PD_{it}) * r]$$

where CH_i is the total carrying charge for participant i over a prespecified period (for example, one year) before or after participation in the program; BD_{it} is the date that a bill was issued and PD_{it} is the date of payment of that bill; and r is the daily interest rate. The change in carrying charges for each participant will then be calculated as the difference in CH for the same length of time before and after participation in the program.

Table 4. Indicators and Data Sources

	Data Source
Economic Impact Indices	
Change in monthly employment income	**quantec** questionnaires
Change in the number of weeks employed per quarter	**quantec** questionnaires
Change in the family's level of debt	**quantec** questionnaires
Change in federal/state assistance benefits as a proportion of total income	**quantec** questionnaires
Change in arrearages of utilities, rent and other bills	Data from Utilities and other
Change in occurrence of late payments	Data from Utilities
Environmental/Social Impact Indices	
Change in the frequency of moves over 2 years	**quantec** questionnaires
Change in number of school absences for children per month	**quantec** questionnaires
Change in number of school/work absences for client per month	**quantec** questionnaires
Change in willingness to participate in volunteer work	**quantec** questionnaires
Change in the incidence of automobile ownership	**quantec** questionnaires
Change in the incidence of telephone ownership	**quantec** questionnaires
Change in the incidence of volunteerism	**quantec** questionnaires
Change in the average level of education of sample.	**quantec** questionnaires
Energy Conservation Impact Index	
Change in kilowatt hours of electricity used	Data from Electric Providers/DFC
Change in natural gas use	Data from Gas Provider
REACH Family Development Index	REACH Family Development Matrices

Once these indices have been constructed, standard quantitative analyses will be conducted in order to summarize the effects of the program and also to determine if there has been a *significant* impact on the variables of interest. The effects of the program are summarized by descriptive statistics, including frequency distributions, measures of central tendency (mean, median, and mode), and measures of dispersion (standard deviation and variance). Statistical tests of significance will include t-tests between groups on variables of interest and chi-square tests on the frequency distributions.

The type of data collected here often do not lend themselves to standard statistical testing (parameteric statistics). We often use nonparameteric (distribution free) methods. These typically require less restrictive assumptions concerning the form of the probability distribution associated with the data under analysis. For example, the Mann-Whitney-Wilcoxon test is used to test the means of two populations when they are not normally distributed and do not have equal variances.

The various indices will also be analyzed collectively as a *Seemingly Unrelated Regression Model*. This approach is used occasionally in business and economics to model variables as a group because they bear a close conceptual relationship to each other. The system of equations model will take the following form:

$$Index_{ijt} = f(FamilyCharacteristics_{jt}, Time)$$

where index i (energy, environment, etc.) of family j in time period t (initial, three months into program, six months into program, etc.) is a function of family j characteristics at time t and progress into the program.

Conclusion

Since no data collection has taken place yet, no conclusion to the validity of the experimental design can be made.

It is our experience, however, that low-income programs do not represent viable cost-effective resource acquisition. In other words, energy benefits alone will usually not justify the program expenditures. However, other studies have shown that the nonenergy benefits may be quite significant and can change the cost-effectiveness picture considerably. We have developed, we believe, a robust framework for estimating the impact of the REACH program on various nonenergy metrics.

References

Brown, M., Berry, L., Balzer, R., and F. Faby, "National Impacts of the Weatherization Assistance Program in Single-Family and Small Multi-Family Dwellings." ORNL/CON-326. May 1993.

Colton, Roger, "Identifying Savings Arising from Low-Income Programs," Fisher, Sheehan & Colton: Public Finance and General Economics. July 1994.

Colton, Roger, "Low-Income Program and Their Impacts on Reducing Utility Working Capital Allowances," Fisher, Sheehan & Colton: Public Finance and General Economics. July 1994.

Colton, Roger, "Road Oft Taken: Unaffordable Home Energy Bills, Forced Mobility and Childhood Education in Missouri," Sheehan & Colton: Public Finance and General Economics. 1996.

Khawaja, M. Sami and Elaine Miller. "Low-Income Conservation and Energy Education ProgramThe Oregon Singly Family Shower Head Program: Impact Evaluation." Quantec 9806, Portland, OR., February 1998.

Khawaja, M. Sami and Howard Reichmuth. "The Oregon Singly Family Shower Head Program: Impact Evaluation." Quantec 9806, Portland, OR., February 1998.

Khawaja, M. Sami and Howard Reichmuth. "Impact Evaluation of the PaciCorp/EBCONS Multifamily Program." Barakat & Chamberlin, 960091, Portland, OR., December 1997.

Khawaja, M. S., Ballou, D., and Karen Schoch. "Effect of Weatherization Programs on Low-Income Customer Arrearage." *Proceedings of the 1992 ACEEE Summer Study on Energy Efficiency in Buildings*. Washington, D.C.: American Council for an Energy Efficient Economy, August 1992.

Peach, H.G., Williams, W., Woodside, L., Gagorik, S., and West, A., "Low-Income Program Evaluation for Competitive Era," 1997 International Energy Program Evaluation Conference. Chicago, IL., August 1997.

Pindyck, Robert and Daniel Rubinfeld, Econometric Models & Economic Forecasts, 3rd Ed. McGraw Hill. 1991.

Quaid, M. and Scott Pigg, "Measuring the Effects of Low-Income Energy Services on Utility Customer Paymens." International Energy Program Evaluation Conference. Chicago, IL., August 1991.

Skumatz, Lisa, and Chris Ann Dickerson, "Recognizing All Program Benefits: Estimating the Non-Energy Benefits of PG&E's Venture Partners Pilot Program (VPP)," 1997 International Energy Program Evaluation Conference. Chicago, IL., August 1997.