

# SURVIVORS: EFFECTIVE LOW-INCOME PROGRAMS

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## Introduction

Utilities and regulators across the US seek the most effective means to create and preserve energy conservation programs for the low-income market. For utilities, low-income programs have the benefits of reducing bill arrearages, demonstrating commitment to the community, and satisfying regulatory requirements. The social benefits are numerous, including reducing health risk for children and elderly, increasing the ability of low-income families to manage finances, enhancing comfort levels, and providing education.

This paper compares and contrasts the designs and results of ten low-income programs at four utilities in the South, Southwest, Midwest, and Northeast. The focus is on honing program delivery vehicles and measure offerings to enhance customer benefit as well as cost effectiveness. In this light, the paper presents results on savings by measure type, the saturation rates of alternative marketing and delivery mechanisms, and customer satisfaction.

## Approach

In the six evaluations conducted, program results were evaluated through comprehensive techniques, including in-person interviews with program staff, vendors and customers, site visits, telephone surveys, simulation modeling and billing analysis. The approach taken in this analysis is to report the most effective elements to be gleaned from the various program designs, and to integrate results on the behavioral, satisfaction, and savings impacts of these design elements.

The analysis will focus on the elements of these programs that have proven impacts on energy consumption and/or customer comfort and financial control. The key challenges to be addressed are: 1) what mechanisms are effective in achieving participation goals, 2) what measures are most effective and which do not have proven savings, 3) what methods are effective in achieving savings due to behavioral changes, and 4) what aspects of programs are most appealing to customers and collaborating agencies. These issues will be addressed through a comparative analysis of the various data sources and programs evaluated by the researchers.

## The Programs

The six evaluations encompass ten programs at four utilities. For discussion purposes, the programs are numbered 1 through 10. The programs are:

1. Northeastern Public Housing Program

2. Consumers Power Electric Blitz Program
3. Consumers Power Gas Blitz Program
4. Consumers Power DSS Electric High Use Program
5. Consumers Power Gas DSS Program
6. Texas Utilities Piggyback Program
7. Texas Utilities Public Housing Program
8. Texas Utilities Neighborhood Blitz Program
9. Southwestern Piggyback Program
10. Michigan Collaborative Low Income Weatherization

Programs 2 through 5 were offered by a Michigan, dual-fuel utility. For this utility, programs 2 and 4 (Version I) were focused on the electric heat market, while programs 3 and 5 (Version II) were focused on the gas heat market. All other programs were offered by electric-only utilities. Program 10 did not receive a full evaluation, and is discussed in selected areas of the paper dealing with program process evaluation.

## Savings

Table 1 describes the estimated gas and/or electric savings for each of the programs. For programs 1, 4, 5, and 9, savings are based on pre/post billing analysis with a control group. In all other cases, savings were based on engineering estimation and/or on-site visits. In the table, Program 4 is divided into two components. Program 4a was a single visit direct install component, while 4b involved a second contractor visit to install more costly, complex measures.

Table 1 offers a picture of the range of savings one can realistically expect from a low-income program offering. The electrical energy savings ranged from a low of 75 kWh for a blitz program focused on a gas heat market, and a high of 2,429 kWh for a direct install program offering major measures to the high use electric heat market in Michigan. The gas energy savings for the dual fuel programs ranged from a low of 4.1 MCF for a blitz program focused on the electric heat market, to a high of 25.1 MCF for the same direct install program that had the highest kWh savings.

In comparing savings, clearly it is important to consider the region and the space conditioning fuel that was the focus of the programs evaluated. Program 4, the most effective program in terms of magnitude of electrical energy savings, was focused on high use electric heat customers in Michigan. A counterintuitive result is that the single visit component of the same program yielded the highest gas savings, with higher savings than the program directed to the gas heat market. Based on these results, it is

clear that the distinction between the markets for the two programs was blurred and that, due to the dominance of gas heat in Michigan, the electric heat program included gas heat customer base. The high gas savings for the single visit component of the electric heat program can be explained by the fact that the customers that only received one visit did not qualify for more expensive measures focused on electric heat. These customers had mainly gas heat homes, with high savings based on air sealing as well as water heating saving measures.

Program Type	MCF Svgs	kWh Svgs
<i>Northeast</i>		
1. Public Housing		637
<i>Midwest</i>		
2. Blitz I	4.1	171
3. Blitz II	24.3	75
4a. Direct Install I	25.1	1,903
4b. Direct Install I+	18.3	2,429
5. Direct Install II	18.1	138
<i>South</i>		
6. Piggyback		1,273
7. Public Housing		1,109
8. Blitz		637
<i>Southwest</i>		
9. Piggyback		1,183

**Table 1: Savings per Participant**

### Delivery Mechanisms

The programs had varied delivery mechanisms. The main program types were as follows:

1. Piggyback implementation by community weatherization agency,
2. Public Housing Authority implementation,
3. Blitz with direct install of low cost measures, and
4. Direct install of major measures in scheduled visits.

A fifth program type not covered in this paper is a performance contracting or bidding program. For a comparison of two programs of this type in the Northwest, see Bell and Meek (1996).

The Piggyback mechanisms have the advantages of reducing costs by adding measures to weatherization visits already taking place through government funded programs. However, they have the disadvantage of focusing on customers already receiving assistance, potentially leaving other customer groups unattended.

Analogous to Piggyback Programs, the Public Housing approach allows the majority of funds to be allocated to measure installation, as administrative costs and travel time are reduced. This program approach is the best vehicle for targeting this market, although other avenues must be explored to reach a larger customer base.

Piggyback programs, while more cost-effective than other delivery mechanisms, can be more challenging than expected. Several factors contribute to potential difficulties, including strict requirements of the utility to meet cost-effectiveness screens, differences in objectives between the community action agencies and the utility, tight utility funding cycles relative to agency client flow, and conflicting eligibility requirements between utility programs and federal or state funded programs.

Similar problems may arise with Public Housing Authorities, where Authority guidelines or principles conflict with desired utility program procedures. While the tendency might be for a utility to develop program procedures on their own and install them without agency input, under the logic that they are providing the funding, this approach has led to program problems that prevent participation or other goals from being met.

In its Piggyback and Public Housing Authority Programs, Texas Utilities expended considerable time and effort to collaborate in developing programs that met the needs of all parties to some degree. This helped to prevent the development of guidelines which were unpalatable to agency or Authority staff, in addition to giving all parties an understanding of potential challenges and differences in organizational objectives.

A Blitz program allows a large and diverse market to be delivered relatively low cost measures through a widespread marketing format. This program type often involves the determination of low-income neighborhoods using census data or other sources, and telemarketing with subsequent canvassing of these neighborhoods, allowing households without phones to be reached. The program is best fitted to goals of reaching a broader pool of low-income customers, i.e., including the working poor, rather than goals directed at strictly defined low-income households, e.g., 125% of poverty. As seen in Table 1, the blitz approach tends to lead to lower savings per participant. Therefore, the costs per participant must be carefully controlled to ensure that cost-benefit ratios remain within reasonable.

The final approach considered here--the direct install program type--allows targeting of specific customer groups as well as the installation of major measures directed at high savings per participant. Direct install programs are often offered in two stages. The first stage involves an audit to install low-cost measures, such as faucet aerators, and to identify more major measures, such as furnace replacement. The two-stage approach is needed to manage program costs, allowing appropriate contractors to be sent out only to those homes needing their services. The two-stage approach also allows for competitive bidding of jobs to control costs for costly measures such as insulation. This approach has the highest cost per participant, but also the greatest potential for savings.

All of the delivery mechanisms discussed have their place and time. Choice of program vehicle will depend on both the program goals and the budget. For organizations with a broad set of objectives, the best approach will be that taken by Consumers Power and Texas Utilities. These

utilities applied a complement of approaches to meet their diverse set of program goals.

## Measure Offerings

In addition to the delivery mechanism, the measures installed are an obvious key component of savings. Table 2 describes the electric measures installed in each program, while Table 3 describes the gas measures. The top rows of the table show the program number, the region of the country, the type of program, and the number of participants. These tables show both the savings in magnitude and, where available, the savings as a percent of use. The savings as a percent of use gives an indication of the effectiveness of the program at achieving comprehensive potential savings in each home. For both electric and gas savings, the highest performance programs in terms of magnitude of savings also achieved the largest percent savings.

The bottom rows of the table describe the percent of installs by measure. The measures are grouped by end-use and then roughly by magnitude of expected savings, with major measures listed first. Based on the data available, there are some inconsistencies in the representation of measure distribution by program. For program 1, the distribution represents the percent of tracking savings for each measure. For programs 2, 4, 6, 7, and 8, the percents represent the quantity of the measure divided by the number of customers. For example, an average of 1.5 compact fluorescent lamps were installed in each program 2 household. The exception for these programs is insulation, for which an "X" is used to represent installation as the quantity was expressed in square feet. For programs 3, 5 and 9, the percent represents the proportion of customers receiving the measure.

In considering measure installations, it is clearly necessary to consider the space conditioning requirements and fuel of the main participant base. Looking at the space conditioning section of Table 2, one notes that electric space conditioning measures are limited for programs 1 through 5 in colder climates, as the homes are mainly heated by other fuels. This situation obviously limits the level and percent of savings that can be achieved. Program 4a, targeted at high use electric heat, is the exception, explaining the high savings.

In the warmer climates served by programs 6 to 9, space cooling requirements are typically the most demanding load and, for residential applications, are almost always electrically served. In fact, for cost/benefit reasons, program 9 required that air conditioning be in place and in use, although the requirement was not always met in practice. In these climates, an electric-only program is well-positioned to achieve the majority of potential savings in the home.

For the southwestern program (9), the key space conditioning measure was duct sealing, providing 35% of the program savings. This measure was not installed in any of the other programs, underscoring the need for sensitivity to climate when building from other organizations' program designs.

In the southern programs (6-8), space conditioning measures were limited to the Piggyback program. For this program, the measures included weatherstripping of doors and windows and attic insulation. The extent of installation and savings beyond federally funded measures has not been estimated at this time, as the data is housed by each individual community action agency. However, participant survey results indicate that weatherstripping and attic insulation are being installed in 78% of the residences visited. There may be a lost opportunity here, however, as duct sealing was not one of the weatherization measures offered. This measure proved highly effective and was responsible for most of the infiltration savings in the southwestern program.

In examining the overall electric measure mix, it is again interesting to compare the highest and lowest savings programs. The higher savings programs (4 and 9) also had a much higher saturation of water heating measures. This is again likely driven by the higher incidence of electric water heating. The highest saving program was the most aggressive in water heating measures, installing new, 90% or better efficient furnaces in 54% of participating households.

Programs 6 and 7 also came in at the top of the savings categories. These savings were driven mainly by refrigerator replacement, representing approximately 60% of savings in both programs. For this region, the measure was very effective, replacing refrigerators of 1,675 kWh or more with units consuming 500 kWh.

With water heating and space heating measures differentiating the programs in terms of level of savings, lighting was common across all. Compact fluorescents were the most common measure. Fixtures and incandescent timers, a less common measure, were installed in two of the programs.

On the gas side, the majority of customers in all programs had both gas space and water heat. The level of measure installation within these end-uses then becomes the differentiating feature. However, in this case it is not as easy to see the basis for savings. For space conditioning, the program with the fourth highest savings had the highest

Program Number	1	2	3	4a	4b	5	6	7	8	9
Region	NE	MW	MW	MW	MW	MW	S	S	S	SW
Program Type	PHA	Blitz I	Blitz II	DI I	DI I+	DI II	Piggybk	PHA	Blitz	Piggybk
Participation	50	21,031	26,873	1,021	1,227	1,884	516	373	1,299	49
Average Use (kWh)	--	10,082	10,082	17,332	17,332	10,000	--	--	--	--
Savings (kWh)	637	171	75	1,903	2,429	138	1,273	1,109	637	1,183
Percent Savings	--	2%	1%	11.0%	14.0%	1.4%	--	--	--	--
<b>SPACE CONDITIONING</b>										
Attic/Ceiling Insulation					X					24%
Wall/Other Insulation					X					
Air/Duct Sealing	1%	1%		3%	X					82%
Evaporative Motor										4%
AC Replacement								1%		
Vent					18%					
Storms/Windows	1%	2%		1%	7%					
Thermostat	1%	4%								8%
Pipe Insulation					41%					
Outlet Insulators		3%								
General	15%									
<b>WATER HEATING</b>										
Water Heater					54%					
Water Heater Wrap		7%		14%	19%		18%			20%
H/W Timer/Setback				12%	24%					20%
Low Flow Showerhead		8%		30%	37%		58%	70%	94%	20%
Faucet Aerators		16%		55%	75%		144%	184%	195%	
H/W Pipe Insulation		7%		21%	35%					
<b>LIGHTING</b>										
CF		150%	54%	196%	197%	49%	393%	329%	507%	
Fixtures	81%									
Incandescent Timer			21%	21%						
<b>REFRIGERATOR</b>										
Refrig Coil Cleaning			43%							
Refrig Replacement						18%	60%	58%		0%

**Table 2: Distribution of Electric Measures**

installation of major measures, such as new furnaces and insulation, in addition to somewhat similar installation of more minor measures, such as outlet insulators.

For water heating, the program with the second highest savings dominated. This program had the highest percentages for all categories, with the exception of water heater replacements. While it is difficult to draw strong conclusions from the data, it is clear that a full complement of water heating measures can yield effective savings, even without a strong set of space conditioning measures. In addition, it seems that the lowest savings program, the Blitz program (2), had a fairly low measure saturation. In addition to the low measure saturation, the numbers indicate, the air sealing and thermostat measure (thermostat turndown, in this case) were less intensive for this program than the analogous measures in the other programs. The low savings results of this program designed to target very

large groups of customers underscore the risks of administering a blitz program.

### **Education and Behavior**

From a social perspective, customer education and behavioral impacts are a key part of programs for the low income market. To reap the full benefit of the financial investment in conservation programs, it is important that customers become aware of the measures installed and additional measures that might be implemented to increase their comfort, reduce any of their debt to utilities and increase their ability to have control over future bills.

Program Number	2	3	4a	4b	5
Region	MW	MW	MW	MW	MW
Program Type	Blitz I	Blitz II	DI I	DI I+	DI II
Participation	20,276	26,873	1020	1259	1,884
Avg. MCF Use	138	-	160	-	137
MCF Savings	4.1	24.3	25.1	18.3	15.4
Percent Savings	3%	-	15.6%	-	11%
SPACE CONDITIONING					
Boiler or furnace				3%	19%
Attic Insulation				X	21%
Wall insulation				X	23%
Joist/Floor Insul.					19%
Air Sealing	21%	50%	47%	52%	33%
Pipe Insulation				100%	
Thermostat	25%		30%	15%	
Vent				83%	
Storm Windows	67%	39%	119%	126%	52%
Outlet Insulators	65%		93%	90%	64%
WATER HEATING					
Water Heater				10%	
Tank Wrap	33%	50%	24%	11%	30%
Timer/Setback		45%			
Low Flow Shwr.	34%	57%	20%	13%	34%
Faucet Aerators	70%	81%	50%	28%	66%
Pipe Insulation	39%	75%	31%	17%	50%

**Table 3: Distribution of Gas Measures**

In 1995, Consumers Power, Detroit Edison, the Department of Social Services, and a number of community action agencies joined forces. While this program was never fully evaluated, Consumers Power and RLW Analytics conducted a series of interviews in a preliminary assessment of the program. The goal of the program was to add utility funds to allow more comprehensive treatment as well as customer education for homes already being weatherized by Community Action Agencies using state and federal funds.

This program had an aggressive education component. A contractor specializing in energy conservation educational training conducted two site visits for each participant. In the first visit, the auditor reviewed the customer's bill with them, showed them an estimated disaggregated bill, reviewed a comprehensive set of ways through which the customer could reduce their energy costs. The contractor and the customer worked together to make one or more of these low to no cost improvements, such as cleaning refrigerator coils, reducing the water heater temperature setpoint, or installing caulking around a window. The contractor then left materials for the customer to install one or more additional improvements on their own.

On the second visit, the contractor would check the customer's progress on their own improvement, test the customer's remembrance of the full set of concepts reviewed in the first visit, and refresh the customer's memory on any items not recalled. The interviews of contractor

staff indicated that customer's recall of energy conservation techniques was good, their acceptance of the training in particular, the auditors noted that many customers were surprised and appreciative of the amount of attention devoted to them and the program, and were eager to learn.

While the process evaluation interviews suggested that the program is satisfying customers and improving their knowledge and energy conserving behavior to some degree, the cost/benefit of these visits was difficult to assess, as no impact evaluation or customer surveys were conducted for the pilot. However, an evaluation of a case study of 13 homes implemented prior to this pilot indicated that the educational component was effective in increasing energy savings. In terms of customer knowledge, pre and post participation survey results indicated notable increases in customer knowledge of energy saving behavior, including: turning down the thermostat (increase of 69%), using less water (+46%), turning on the energy saver on the refrigerator (+45%), and dressing in warm clothes (+17%). The impact evaluation found that this increased awareness was responsible for 6% of the kWh savings for the program. This represents a 2% reduction in overall consumption for the average participant, based on the educational component. One potential improvement was noted in the case study evaluation. While education improved overall knowledge, knowledge of the use of some measures, e.g., thermostats, was not sufficient. Educational efforts should be sure to address key measures installed through the program.

The Blitz II (3) and Direct Install II (5) program evaluations also indicated successful educational components. In Blitz II, the auditor developed an audit checklist while at the home, explained the measures installed and the components of the customer's bill, and reviewed the recommendations with the customers in detail. Auditors interviewed as part of the process evaluation indicated that they found the customer education to be the "strongest component of the program." The evaluation survey results indicated that participants were much more active in conservation behavior than non-participants. Of survey respondents, 83% of participants as compared to 55% of unexposed non-participants reported that they had made conservation improvements.

The educational component is similar in the Direct Install II (5) program. Additionally, customers received and were trained in the installation and storage of plastic storm windows. In the evaluation survey, an impressive 94% of participants stated that the program had improved their understanding of how to save energy. More importantly, 46% reported taking some conservation action since participation. These actions included lowering daytime thermostat settings (30%), lowering nighttime thermostat settings (20%), reducing lighting levels (10%), using less water or reducing water temperature (10%), and/or making window improvements (10%).

In other programs, customers had limited recall of any educational materials or training and reported limited additional conservation action. In the Blitz I program (2), the educational component was much more limited than in the collaborative pilot (10). In Blitz I, the auditor collected characteristics and behavioral information on energy use

while at the home, returned to the office to compile an energy profile which graphed the energy use per appliance and listed ways to save energy, and forwarded this profile to the customer by mail. This approach seemed to have no effect on behaviors. While 88% of survey respondents said they recalled receiving the profile and 84% stated they found the information in the report useful, there was no significant difference between participants and non-participants in conservation actions taken to date. The results of this evaluation provided motivation to offer the improved educational component described for Blitz II (3).

Other evaluation results indicated that customers did not take actions and did not recall materials. At the southwestern program (9), each customer was supposed to receive education on energy conservation as part of the weatherization visit. However, process evaluation on-site interviews indicated that only 20% of participants recalled any educational materials or training, and that only 13% recalled materials and felt they learned something. In this case, the results may have been due to the fact that 68% of respondents were Spanish speaking, and the education materials left were in English. In addition, the documentation review suggested that the package left behind was not visually appealing, and not enticing to read.

### **Program Participation and Barriers**

Once the program is structured and eligible measures selected, the next key step is determining how to define and reach the market. For Piggyback and Public Housing programs, the ease of eliciting participation is the key advantage. For Blitz programs, the challenge is to target neighborhoods with a high saturation of eligible customers, and to develop an approach to effectively elicit participation through cold-calling. Process evaluation results for the Blitz 1 program (2) indicated that canvassing without telemarketing yielded participation from only 8% of homes canvassed. In addition, half of surveyed non-participants indicated that door-knocking would not be the preferred approach for program contact, primarily for security reasons. The high participation numbers seen for the program were supported by telemarketing combined with the canvassing approach.

Tables 2 and 3 display the participation rates for each program and fuel type. Seven of the programs had healthy participation rates and were able to meet or exceed their participation objectives. In fact, non-participant survey results for the Midwest Blitz II program (3) indicated that a main reason non-participants that were aware of the program did not participate is that they contacted the program but were not called back (28% of aware respondents). Many others just didn't get around to it (32%). These two findings indicate general receptiveness to program participation, as do the exceptionally high participation rates for the program.

The lowest participation rates were seen for the Public Housing Authority (PHA) program in the Northeast and the Piggyback program in the southwest. The northeast program was in its mature years, and had already saturated much of the existing market. The 50 participants

satisfied the program's objectives. In contrast, the program in the southwest was a pilot in its first year, and the first year participation of 50 was well below the program target of 300 homes. In addition, the Piggyback program collaboratively offered by a number of Michigan entities (program 9) falls far short of measure installation goals.

To avoid pitfalls in generating adequate participation rates, it is important to consider what went wrong for these two piggyback programs. For the southwestern program, the key difficulty reported in process evaluation interviews was locating customers who required measures meeting the program's cost-effectiveness requirements. The program requirements which caused the most difficulty were the exclusion of multi-family and manufactured housing, and the requirement that the home have air conditioning or electric heat. An estimated 75% of the homes in the region for the program were estimated to have evaporative cooling rather than air conditioning, making cost-effective homes difficult for the agencies to locate.

For program 10 in the midwest, the program had similar undertones, with added complications. Here, there was some concern over the limited measure offerings, particularly in areas that covered electric measures only. A perhaps more significant problem was the tight time frame for the program. As the program cycle was only six months, some of the agencies found themselves without significant government funding to do the core weatherization for homes. These agencies were limited to homes that had already been weatherized or to new homes in which they could not install the full set of measures. Therefore, in each visit they were installing a fairly limited set of measures designed to complement federal programs. Under these constraints, it became difficult for the agencies to utilize the budgets allocated to providing additional energy efficiency assistance.

The difficulties faced in these two programs highlight the challenges that can arise in collaborative programs that must meet the needs of multiple organizations and stakeholders. It is also important to note, however, that the majority of process evaluation interviewees still felt that the Piggyback concept was the most logical means for the utility to provide funding for low income conservation programs. With some effort, the potential savings in labor and administrative costs can certainly outweigh the cost of careful collaborative program planning and design.

### **Customer Satisfaction and Comfort Levels**

Added program benefits include increased customer well-being and comfort. Unfortunately, the evaluations did not focus on these customer benefits, per se. Customer satisfaction can be used as one gauge of the overall customer-perceived value of the program. Satisfaction was addressed in seven of the ten evaluations. Overall, satisfaction was very high, ranging from a low of 87% to a high of 100% for the case study of 13 customers conducted in preparation for the Program 10 pilot.

Program Type	% Satisfied
2. Blitz I	96%
3. Blitz II	89%
5. Direct Install II	91%
6. Piggyback	87%
8. Blitz	87%
9. Piggyback	95%
10. Piggyback	100%

**Table 4: Customer Satisfaction**

Customer comfort levels were directly addressed in three of the ten evaluations. For the southwestern piggyback program (9), an impressive 90% of the respondents stated that the program measures made their home more comfortable. In the evaluation of the case study of 13 homes conducted as a precursor to the program 10 Piggyback pilot, most of the respondents reported increased comfort levels when asked what they liked most about the program. Lastly, in the Direct Install II Program (5), 62% of respondents reported increases in comfort levels due to the program.

### Program Delivery Pitfalls and Peaks

Once program participation is elicited, program procedures must ensure that measures are installed properly to achieve savings and improve comfort levels, and that measures are installed in a comprehensive fashion in order to avoid lost opportunities. This final section describes the highs and lows experienced in the ten programs evaluated.

#### Pitfalls

Examining the challenges experienced in other programs can assist in initial program design and planning as well as in troubleshooting once program delivery is underway.

*Program 2: Midwestern Blitz I.* Due to limited saturations of low saving measures, this program achieved the lowest gas savings per participant, and was not cost-effective. In addition, the educational component had no proven effect on customer conservation behavior.

*Program 9: Southwestern Piggyback.* As discussed above, the major challenge faced in this program was participation. An additional minor issue was the low level of installation for certain measures. Evaluation on-sites revealed that sun screens and shade trees shown to be cost-effective were frequently not installed by agency personnel. Process evaluation interviews further revealed that agency personnel did not find these measures significant, although they tested cost-effective under the utility's guidelines and have been shown to enhance comfort levels in the home. This evaluation finding again underscores the need for strong communication between the utility and the implementing organization so that program measures and their benefits are clearly understood.

*Program 10: Midwest Piggyback.* In a related vein, the process interviews for this program indicated a burdensome paperwork requirement for community action agency

auditors. Some auditors reported spending as much as half of their time completing paperwork. Organizations considering a piggyback approach should be sensitive to the diversity of funding sources and the related burdensome reporting requirements that many of these agencies face, and attempt to limit the additional burden to the extent possible.

#### Peaks

Equally important to the pitfalls are the program highlights, which can make the difference between meeting and failing to meet program goals.

*Programs 3, 5, and 10.* The Blitz II, Direct Install II, and Collaborative Piggyback Programs all offered strong educational components with proven effects on customer conservation behavior and program impacts. The Blitz II program was a notable improvement over less effective education offered by the same utility in the Blitz I Program.

*Program 5.* The Direct Install II evaluation included a sophisticated analysis to address the impacts on arrearages. A cross-sectional, time series analysis of billing history data was used to analyze (1) the change in the proportion of bills in arrears, the change in the number of days it took participants to pay their bills, and (3) the change in the carrying charges associated with outstanding bills.

While the analysis showed only modest improvements in payment behavior and reductions in carrying charges (0.5%), it demonstrated an effective and innovative approach for the analysis of arrearage impacts.

*Programs 6 and 8.* The TU Piggyback and Blitz programs included an effective refrigerator replacement measure, responsible for approximately 60% of savings. The cost-effectiveness and savings of the measure were ensured through pre-replacement metering of the existing refrigerator to ensure usage of greater than 1,675 kWh.

*Programs 6 and 7.* The TU Piggyback and PHA programs included a very unique feature to enhance measure cost-effectiveness. Lighting, AC replacement, and refrigerator replacement components included a low monthly lease feature to enhance program and improve measure persistence, particularly for lighting, by increasing the customer's stake in the measure. While it is too early in the program process to assess the effects on measure persistence, the great majority of customers in the Piggyback and PHA programs have met their commitment to low monthly lease fees. In the case of the Public Housing Authorities, these organizations chose to pay the lease fees up-front, due to the level of transience in tenant units.

*Program 9: Southwestern Blitz.* This program assisted in the purchase of blower door testing as well as training for the agencies. The impact evaluation revealed that the blower door tests led to highly effective duct sealing. The process evaluation interviews supported the effectiveness of the technique for the homes treated, with agency personnel stating that the new approach enabled them to achieve significantly higher savings as well as comfort levels in all of the client homes they now treat.

*Programs 6 and 10: TU and Midwest Piggyback.* Each of these programs included a refrigerator replacement component. In addition, both programs required re-

frigerator monitoring prior to replacement to ensure that the measure would meet cost-effectiveness criteria. This pre-program monitoring prevented mis-application of a measure which has a large up-front cost.

## Conclusion

Many utilities designed DSM programs targeted at the low-income market-based on negotiations with regulators, cost-effectiveness testing and social benefits. As these early to mid-1990's generation of these programs are being evaluated, the five utilities seek to measure the effectiveness of their program designs, and improve them. This comparative analysis was conducted to assist utilities and other agencies in developing effective low-income programs to meet the goals of their respective organizations.

Some conclusions and lessons learned in this analysis include:

- The delivery mechanism and measures should be selected based on the space conditioning requirements and the space and water heating fuels of typical customers. The potential savings available from these measures and the desired participant base will further inform the most desirable choice.
- Where a diversity of participant groups are in the target market, a combination of delivery mechanisms should be employed.
- The low-income programs evaluated here demonstrated proven energy savings, with electrical energy savings ranging from 75 to 2,429 kWh per household, and gas energy savings ranging from 4.1 to 25.1 MCF per household.
- Other benefits observed in the ten programs increased customer comfort and feeling of control over bills, some reduction in bill arrearages, and were additional savings due to changes in behavior based on education.

The impacts and delivery highs and lows discussed here can be used to inform program design as well as to troubleshoot and enhance programs already underway.

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