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ENERGY EFFICIENCY PROGRAMS FOR LOW-INCOME HOUSEHOLDS: SUCCESSFUL APPROACHES FOR A COMPETITIVE ENVIRONMENT

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EXECUTIVE SUMMARY

The nation's low-income population bears an inordinate energy burden, paying, on average, three to seven times more on energy than the median-income household pays as a percentage of income. Utilities have made some good progress toward ameliorating this burden by providing energy efficiency programs for their low-income customers. Many of these programs have been implemented by utilities in response to regulatory mandates and were not expected to be cost effective. Certain utilities, however, have proven that these programs can operate cost effectively. Despite the fact that regulatory changes are creating an uncertain future, this does not indicate a necessary death of energy efficiency. It is most likely that some sort of funding will be required to continue energy efficiency programs for low-income households. This period of transition presents opportunities to pursue new, innovative approaches to achieving energy efficiency goals for customers in general and low-income customers in particular.

As utilities deregulate and become more focused on the "bottom line," they will change the way they do business. If low-income programs are mandated, utilities will want to operate them as cost effectively as possible. The recommendations detailed in this paper speak to this goal. This paper also discusses the business advantages — from a utility perspective—of providing energy efficiency services to their low-income customers:

- Energy efficiency programs for low-income customers *can* be operated cost effectively.

- The low-income sector, because of its generally older, draftier, substandard housing, presents greater opportunities for energy savings than the average customer.

- Many deaths occur each year due to inadequate heating and cooling or termination of utility service. Energy efficiency programs for low-income customers can reduce the incidence of such deaths and create good public relations, which utilities will value more as they become more competitive.

- Energy efficiency is good for the local economy because saving money on energy (money that usually goes *outside* the local area) increases discretionary dollars, which tend to be spent locally. Energy savings also tend to have a positive net effect on providing jobs. A strong local economy is good for the utility's business.

- Reducing the low-income energy burden has non-energy benefits for the utility, including reducing arrearages, disconnect/reconnect costs, working capital needs, and customer goodwill.

This report draws on the research and experience of some of the country's leaders in providing energy efficiency services to low-income households. In addition, several of the more successful and progressive energy efficiency programs for low-income customers are profiled. The case studies,

experience, and research compiled in this report provide many ideas regarding how energy efficiency services can be provided to low-income customers most effectively, from both a cost-of-service perspective and a benefit-to-customer perspective. Recommendations fall into six categories: forming partnerships, targeting high-use customers, education, energy efficiency measure selection, marketing, and avoiding lost opportunities.

Utilities may form *partnerships* with other utilities (e.g., water, alternate fuel), government programs (WAP and LIHEAP), or local community agencies. Potential synergies also exist with affordable-housing developers, banks, first-time home ownership programs, local housing financing agencies, state and local land trusts, and community development financial institutions. These partnerships can provide effective cost controls by making possible such activities as bulk purchasing; centralized participant recruitment; large, more competitive subcontracting; increased energy savings through increased comprehensiveness; sharing of trained energy efficiency professionals; and development of joint delivery. The result of sharing expertise and resources is to provide more comprehensive energy efficiency services to more people more efficiently and more cost effectively. In some cases, partnerships allow the utility to enable someone else to operate energy efficiency programs, without having a substantial day-to-day role itself.

Most of the programs profiled indicate the importance of *targeting customers with high-energy use*. These customers tend to use energy the most inefficiently and therefore have the highest potential to save energy both through efficiency measures and by becoming more aware and involved in conserving energy. Targeting these customers helps make a program more cost effective because savings are maximized while effort is minimized. High-use low-income customers also tend to have higher arrears, so by targeting them, the utility increases its opportunity to reduce bad debt and the administrative cost of credit and collections. Although many utilities do not yet quantify these non-energy savings, as utilities become more streamlined under competitive pressures, the savings in this area will get increased attention.

Education has proven to be a valuable component of energy efficiency programs, not just education of the customer, but also education of the service providers and program sponsors. Experience has shown that energy efficiency programs increase energy savings and enhance the persistence of savings by providing customer education, and providing training to maintenance staff. Education helps the customer feel more committed to the program and gives the customer some control over their energy usage and savings.

Measure selection directly affects the energy savings of a program. Many criteria will affect which measures will provide the greatest, most cost-effective energy savings in any one home for any specific utility in a particular climate. For example, because electric heating is less common than gas heating, electric utilities will probably find the greatest energy savings resulting from replacement of electric appliances. Gas utilities, on the other hand, get the most energy savings from measures that reduce the energy needed to heat the home (e.g., attic

and wall insulation, replacing inefficient heating systems, and increasing attention to heating system distribution systems). Ideally, electric and gas utilities will work together so that a comprehensive set of measures can be provided cost effectively through one customer contact.

Marketing is an important facet of any energy efficiency program. In order for a program to be successful, customers must be interested in participating. The utility must understand and identify the low-income market segment, and market the program in a way that will minimize barriers and maximize participation. An important component of this marketing strategy is that customers be contacted by someone they trust.

In the case of energy efficiency, *lost opportunities* occur when we miss an occasion to install energy-efficient measures at minimal incremental cost. In order to avoid lost opportunities, it is important that a program is *comprehensive*, maximizing the savings in each home. This can be achieved by analyzing all end uses and technologies that *may* be cost effective, and installing as many types and numbers of measures as is cost effective in as few visits to the home as possible. This approach increases program costs in the short term, but increases program benefits, reducing costs in the long term.

These approaches have proven to be valuable to many utilities, allowing them to provide energy efficiency programs to their low-income population more cost effectively. These programs fulfill some very important social needs, but also have value that stretches beyond social benefits. Serving the low-income customer sector can be good for society, good for the economy, and good for business.

INTRODUCTION

Utility energy efficiency programs have made progress over the past twenty years, saving 1.6 percent of total U.S. energy sales annually as of 1994 (EIA 1995b). In recent years, many utilities have been cutting back on demand-side management (DSM) expenditures in order to reduce their operating costs in anticipation of increased competition. This does not indicate the death of energy efficiency. Rather, this period of transition presents opportunities to pursue new, innovative approaches to achieving energy efficiency goals for customers in general and low-income customers in particular, at lower costs to the utility than in the past.

The low-income customer segment needs assistance to pay their energy bills, and utilities can provide a customer service to this segment that benefits not only the individual customer but also the community in general. From a financial standpoint, energy efficiency programs for low-income customers support economic development by creating jobs, and increasing discretionary income that can be spent locally to enhance the regional economy. These programs also have economic advantages for the utility beyond the typical energy and demand savings associated with energy efficiency programs in general. In particular, when energy efficiency programs lower energy bills for low-income customers, the utility reduces arrearages, credit and collection costs, and working capital needs. In addition, because of the generally poor condition of low-income housing,[1] low-income households can be inefficient users of energy, and thus present a greater opportunity for significant savings from energy efficiency measures.

The low-income customer also presents unique opportunities for the utility to explore innovative approaches to providing cost-effective energy efficiency services to this market segment. One such opportunity is to leverage its investment in low-income energy efficiency by forming partnerships with federal, state and local agencies that specialize in assisting the nation's poor. Joint ventures are also possible with low-income housing developers and banks that provide financing for affordable housing development. Such opportunities to collaborate can allow utilities to get a much higher return on dollars spent on energy efficiency for low-income customers, and benefit from synergies with partners and economies of scale.

This report draws on the research and experience of some of the country's leaders in providing energy efficiency services to low-income households. In addition, several of the more successful energy efficiency programs for low-income customers are profiled. Recommendations are offered to help energy efficiency programs for low-income customers maximize their cost-effectiveness and energy savings.

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[1] For example, 31 percent of households eligible for federal assistance are poorly insulated, as compared to 18 percent of median-income households (EIA 1995a).

TRADITIONAL LOW-INCOME ENERGY SERVICES

Over the past 20 years, federal programs have provided significant energy assistance to low-income households. The Weatherization Assistance Program (WAP) was established in 1974 as part of the Community Services Act (NCLC 1996a). Now run by the Department of Energy (DOE), WAP is the largest residential energy conservation program in the country. Its objective is to reduce the cost of heating and cooling for low-income households, especially for the elderly, physically challenged, and children, by improving the energy efficiency of their homes and ensuring their health and safety. DOE provides funding to State agencies that administer the program and fund local agencies to perform the weatherization work (Brown et al. 1994).

The second major federal energy-assistance program is the Low-Income Home Energy Assistance Program (LIHEAP). Originally called the Home Energy Assistance Program, LIHEAP was created in 1980. LIHEAP funds are intended to reduce eligible households' energy burden and thus enhance their health and safety and avoid service termination from nonpayment. LIHEAP funds come from federal appropriations, which are then distributed to the states through the U.S. Department of Health and Human Services. Households with incomes below 150 percent of federal poverty guidelines or below 60 percent of State median income qualify for both WAP and LIHEAP (BCI 1992; EIA 1995a).

In the 1970s, utilities became involved in providing conservation services to customers, including low-income customers. Utilities have taken varied approaches and have had different reasons for providing energy efficiency programs to their low-income customers. Oak Ridge National Laboratory studied this in a survey that identified 132 low-income programs operated by 95 utilities in 33 states in 1992. According to the study, the most common goal of low-income energy efficiency programs was to make energy services more affordable to low-income customers. The second most common goal of low-income programs was to provide a cost-effective energy resource; this reason was offered as a secondary goal for many programs. Seventy-eight percent of the utility expenditures on low-income programs in this survey occurred under regulatory mandate, and programs were concentrated in California, the Pacific Northwest, the Upper Midwest, and the Northeast. In 1992, most utility programs included an education or information component, and the most common measure installed was compact fluorescent lighting (CFL) (61 percent of participants), followed by water-heating measures (low-flow showerheads and water-heater tank wraps) (59 percent of programs). Only 24 percent of utility-program participants received any type of insulation, as compared to 62 percent of participants in the federally funded weatherization program. Gas utility programs tended to involve more space-heating measures and health and safety measures, whereas electric utility programs involved more lighting and appliance measures (Brown et al. 1994).

Because LIHEAP and WAP funding is declining and utilities are looking for ways to cut costs, forming partnerships with related public- and private-sector programs offers opportunities to stretch the effectiveness of limited funding. In 1992, 69 percent of the utility low-income energy efficiency programs in Oak Ridge's survey (Brown et al. 1994) used the DOE local agency network to deliver

some or all of their weatherization services. Collaborative efforts between utilities and government programs will most likely become more valuable as budgets become tighter on all fronts.

RATIONALE FOR PROVIDING ENERGY EFFICIENCY SERVICES TO LOW-INCOME HOUSEHOLDS

Many important reasons—some more obvious than others—exist for providing energy efficiency programs for low-income customers. This section quantifies the low-income population's energy situation, environmental benefits, and non-energy economic benefits, and discusses the comfort, health, and safety benefits from energy efficiency programs for low-income households.

Social Benefits

The low-income population suffers financially from a high energy burden (high cost of energy relative to a low income), a constant threat of termination of utility service, and a higher incidence of illness and death due to inadequate heating and cooling. Energy efficiency programs can ameliorate the low-income population's energy crisis. A National Consumer Law Center (NCLC) state-by-state study of the energy crisis facing low-income Americans confirms the continuing burden that energy costs place on low-income households (NCLC 1995d). For example,

> On average, low-income households pay between 12 percent (minimum wage households) and 26 percent (Aid to Families with Dependent Children [AFDC] households) of their income for energy—three to seven times the percentage that the median-income household pays (3.8 percent). The average AFDC income remaining after energy costs was less than $300 per month.
>
> Only 21.5 percent of families eligible for LIHEAP received this assistance. In addition, LIHEAP benefits have not kept up with the Consumer Price Index (CPI); between 1988 and 1992, LIHEAP payments grew 6.1 percent as compared to the CPI, which grew 18.6 percent.

Federal and state budget cuts continue to threaten LIHEAP funding. Major cuts in LIHEAP funding began in 1986, with particularly heavy cuts in 1987-89: from $1.8 billion in 1987 to $1.4 billion in 1989—a 24 percent cut over two years. Cuts have continued in recent years, with 1996 funding ($900 million) at half of 1987 levels[2] (NCLC 1996b). Terminations of utility service in 1990/91 were almost double that of 1987/88, which corresponds to the onset of major cuts in LIHEAP. High energy burdens as well as LIHEAP budget cuts are two major factors in the increasing number of utility-service disconnects for low-income households (NCLC 1995c).

[2] These figures do not account for inflation, so the decline in constant dollars is even greater.

Recent research in Philadelphia has found that utility-service terminations are "clearly a precipitating factor in housing abandonment." Over a five year period, an average of 32 percent of the homes of residential electric customers in that city were abandoned within one year following termination. Twenty-two percent of households whose gas service was terminated were abandoned. The study also found a clear relationship between disconnects and homelessness (ECA/IPPS 1991). Forced mobility of low-income customers (twice the mobility as the general population) impacts not only the uprooted family but also adversely affects the stability of the community (Brockway 1993). For example, a study in Missouri shows that frequent mobility creates problems for mobile students and for the teachers and schools that educate these students (Colton 1995b).

All of these social benefits have economic ramifications for utilities. For example, if customers cannot pay their energy bills, the utility accumulates bad debt. To the extent that utilities can lower the energy burden for low-income customers, utilities are helping themselves by reducing their bad debt. To the extent that lessening the energy burden reduces housing abandonment and forced mobility, the utility helps strengthen the local community and economy, which, in turn strengthens their own business. Helping low-income customers will also enhance the image of utilities as they work to establish themselves as a good corporate citizen.

Enhanced Comfort, Health, and Safety

In addition to lowering financial burdens, energy efficiency programs often raise the health, safety and comfort levels of occupants, as well as increase the value of their homes. In a national weatherization evaluation conducted by Oak Ridge National Laboratory, occupants' perceptions of their homes were much improved following weatherization. Occupants of weatherized and control-group homes were asked to rate comfort, draftiness, safety, and heating expenses of their home. They were also asked to rate their own health (e.g., colds, flu, allergies, headaches, nausea, arthritis). The control group, as might be expected, reported no change in perception in any of these areas. Occupants of weatherized homes, on the other hand, reported improved levels of satisfaction in all areas: increased comfort, decreased draftiness, improved health and safety, and decreased heating expenses (Brown, Berry, and Kinney 1994).

Inadequate heating and cooling problems can also be a life-or-death issue. Deaths from inadequate heating and cooling is a continuing tragedy. For example, the five-day heat wave in 1995 resulted in 500 deaths in Chicago alone, with most victims being elderly and without adequate cooling systems (NCLC 1995b). Deaths attributable to hot weather, however, are not limited to dramatic heat waves. A study based on an 11-year average found that more than 1,150 deaths were attributable to hot weather in 15 large cities in an *average* summer (Colton 1994a).

Environmental Benefits

Because of the generally poor condition of low-income housing, great opportunities exist for reducing pollution by improving energy efficiency in these homes. Based on a study of homes weatherized in

1989, weatherizing a household that heats primarily with natural gas reduces carbon emissions by 0.25 metric tons per year. Weatherized households heating with electricity reduce carbon emissions by 0.48 metric tons per year,[3] and those heating with fuel oil reduce carbon emissions by 0.45 metric tons per year. These carbon emissions estimates translate into CO_2 emissions 3.67 times higher due to the additional weight of the oxygen (Brown, Berry, and Kinney 1994).

To the extent that utilities can lower their emissions by helping customers use energy more efficiently, utilities lower their investment in emission-control equipment.

Non-Energy Economic Benefits

Energy efficiency has economic impacts that reach beyond the obvious economic advantages of saving energy. Energy efficiency programs directly support jobs for agency staff and contractors, and support businesses that supply materials used in the programs. Money saved on energy bills creates a ripple effect through economy, providing more money to spend on other items (most of which are purchased locally, thus supporting the local economy). Reduced energy usage by clients reduces business for utilities and deliverable fuel industries, but these industries tend not to be labor intensive and are dominated by commodities that are imported from out of state. Utility funds come from ratepayers, so this reduces their disposable income slightly. However, based on a study done in Iowa, each million dollars of program spending directly supports 34 jobs and provides about $685,000 of additional value added to the local economy. Approximately $240,000 of these benefits are indirect benefits that arise from spending the saved money locally rather than on imported fuels (Pigg, Dalhoff, and Gregory 1995). Reducing energy bills also provides more discretionary income that can be used to improve the participant's standard of living and increase their self sufficiency (Brockway 1993).

These economic benefits have been found to help in particular the low-income communities in which they arise because low-income households tend to shop for goods and services locally and local businesses in low-income neighborhoods tend to use local suppliers far more than other businesses (Colton 1995c). As a result, the money saved on energy bills tends to stay in the low-income community, benefitting the residents, local businesses, and local utility.

A 1994 Oak Ridge study (Brown, Berry, and Kinney 1994) estimates that $976 in non-energy benefits result from weatherizing one single-family or small-multifamily dwelling. Those savings break out as shown in Table 1.

Table 1 quantifies not only non-energy benefits to the customer and to the economy in general, it also quantifies a non-energy benefit that goes directly to the utility—reduced arrearages. This is just one of many non-energy economic benefits that a utility can reap from providing energy efficiency serv-

[3] Emissions from electricity generation are based on coal-fired combustion.

Table 1. Non-Energy Financial Impacts from Weatherization Programs

Type of non-energy impact	Value of impact per dwelling
Increased property value	$126
Reduced incidence of fire	$3
Reduced arrearages	$32
Federal taxes generated from direct employment	$55
Income generated from indirect employment	$506
Avoided costs of unemployment benefits	$82
Environmental externalities	$172
Total	$976

ices to low-income customers. Other benefits include reducing working capital, credit and collection expenses, and disconnect/reconnect costs. Although utilities in general have not yet focused on quantifying these non-energy benefits, as competition grows, they will pay more attention to the costs and benefits of all their decisions.

Several studies have estimated the cost to the utility of disconnecting (because of nonpayment) and subsequent reconnecting of service (reconnection usually happens shortly after disconnect). In a study at Columbia Gas, Colton (1993) estimated disconnect/reconnects to cost between $67 and $84 per incident, depending on whether the customer was contacted by telephone or in person. RPM Systems Inc., an energy efficiency consulting firm, estimates the 1993 marginal cost associated with each termination of service to be $117 per termination. This figure takes into account the assumption that the customer will pay for part of the reconnection costs (RPM 1995). Disconnecting, and subsequently reconnecting customer service, however, does not make a customer more able to pay the utility bill, it just increases the balance due (assuming the customer will be billed for the reconnect), exacerbating the arrearage problem.

JOINT VENTURES IN LOW-INCOME ENERGY EFFICIENCY

The advantages of leveraging energy efficiency investments have become more obvious with the anticipation of competition. By pooling resources with a partner or partners, utilities can offer more cost-effective, comprehensive weatherization services to their low-income customers. This section discusses several types of coordinated programs that are becoming more popular, along with their strengths and weaknesses. In addition, suggestions are offered for different types of partners that utilities may not have considered. Some of these partnerships allow the utility to have someone else to do the energy efficiency work, without having a substantial day-to-day role themselves.

Partnerships in energy efficiency programs exist in many forms. Three types of low-income programs coordinated with government programs are:

Parallel Programs - The local weatherization agency operates two parallel programs: one funded by the government and the other funded by utilities. The utility uses the agency as a subcontractor to deliver energy efficiency services to low-income households. Some of the agency's staff and equipment are used by both programs, but households usually participate in only one of the programs.

Supplemental Programs - Utility funds supplement the agency's government-funded weatherization program, with no changes to the operation of that program. This approach allows for the weatherization of more homes and/or more comprehensive weatherization.

Coupled Programs - Utility and government funds are combined to deliver enhanced weatherization services as part of an integrated program that is distinct from the agency's preexisting government-funded program. This approach takes advantage of the unique capabilities of utilities and government sponsors, giving it the greatest potential of the three types of coordinated programs (Brown and Hill 1994).

In a 1994 Oak Ridge study (Brown and Hill 1994) of six coordinated programs, utilities and agencies agreed that the strengths associated with coordinating programs far outweighed any weaknesses. Common strengths and weaknesses of coordinated low-income programs include:

Strengths:

- lower costs due to the centralization of participant recruitment and income qualification, as well as bulk purchasing and large, competitive subcontracts;
- more comprehensive weatherization and greater energy savings due to greater expenditures per home serviced;
- access to sophisticated equipment and trained weatherization professionals, especially when the local agency conducts the work;
- less duplication of agency and utility efforts;
- ease of recruitment due to community's trust of local nonprofit agencies;
- ability to weatherize homes that require repair; and
- higher quality due to multiple inspections. .

Weaknesses:

- confusion by participants and eligible households over roles and responsibilities of the agency, utility, and subcontractor, especially if the utility is running a separate low-income program;

- bureaucratic process adds to costs and tends to slow down weatherization work unless the utility and public utilities commission (PUC) can agree in advance on general rules by which the agency can determine how much the utility will contribute;
- the agency must spend more time searching for utility customers and ensuring that the heating fuels meet the utility's criteria; and
- multiple inspections may be redundant and expensive.

One way to minimize the weaknesses of a partnership is to understand the differing perspectives of your partner. Vermont Energy Investment Corporation (VEIC) summarizes the differing perspectives between a weatherization program and a utility program (VEIC 1994):

Table 2. Differing Perspectives Between Weatherization and Utility Programs

Weatherization Program	Utility Program
customer economics	utility avoided costs
yardstick: annual energy savings	load shape of savings must be considered
may choose some benefits for the many over comprehensiveness for the few (focus on immediate needs of the clients)	choosing comprehensiveness (rather than serving more customers with fewer measures) avoids creating lost opportunities
can spend money on energy-related home repair, health, and safety	single focus: energy and demand impacts
may choose immediate benefits over persistence	persistence of impacts is very important
ceilings on investment per job	investment depends on cost-effectiveness
tracking largely for accounting	high-level tracking for many purposes
social-service approach to client interaction	customer-service approach; utility often wants customer contact

A utility can also leverage energy efficiency investments by forming partnerships with other utilities, such as water utilities or alternate-fuel utilities (e.g., electric utilities forming partnerships with gas utilities). This collaboration allows for joint delivery, and increased cost-effectiveness and comprehensiveness (VEIC 1993).

Colton (1995a) offers many innovative possibilities for partners and approaches for utility low-income energy efficiency programs:

To prevent lost opportunities, a utility can look into potential synergies with:

- affordable-housing developers (e.g., the federal Home Investments Partnership Program (HOME), Housing and Urban Development (HUD), the Resolution Trust Corporation (RTC), and the federal Low-Income Housing Tax Credit program);
- state Community Reinvestment Act (CRA) programs by banks;
- first-time home ownership programs (e.g., through Mortgage Revenue Bonds);
- energy service companies (ESCos) serving the residential market;
- working through state and local Housing Finance Agencies;
- working through state and local Land Trusts; and
- financing through Community Development Financial Institutions.

Another alternative institutional arrangement suggested by Colton involves linked-deposit programs, which allow for discretionary funds to be deposited in such a way as to support programs of particular public benefit. Utilities make long-term deposits with community-based lenders with the stipulation that such deposits be used to finance low-interest loans for energy efficiency improvements performed by developers of low-income housing. Linked deposit programs are available in ten cities and 17 states. This is an example of the utility enabling someone else to do the energy efficiency work, without taking a substantial role themselves (Colton 1994b).

Collaboration can also happen with partners other than government agencies. For example, working with property managers can be advantageous when serving multi-family dwellings. The multi-family market has different characteristics than the single-family market, particularly because the person investing in equipment and appliances (property owner/manager) is usually different from the person who pays the energy bills (the tenant). A property owner prioritizes many other issues—filling vacancies, collecting rent, making repairs—over pursuing energy efficiency. This characteristic usually requires a separate approach to serve the multi-family market. Serving this market is further complicated by the numerous types of multi-family housing owners: public, publicly assisted, nonprofit, private, individual, partnership, corporate, and institutional. Different types of owners have different concerns, time horizons, and priorities (Morgan 1995).

Approximately 25 percent of low-income (LIHEAP-eligible) households are in multi-family dwellings (five or more units per building). Although this is a significant and important population to consider, this report does not attempt to address the complexities of servicing the multi-family sector, because this topic is covered thoroughly in *Improving Energy Efficiency in Apartment Buildings* (DeCicco et al. 1995).

CASE STUDIES

Several utilities have developed successful energy efficiency programs for their low-income customers. The case studies that follow profile several such programs that exhibit various approaches to achieving cost-effective energy efficiency goals.

Duquesne Light's Smart Comfort Program

In 1992, Duquesne Light Company (Duquesne) developed an end-use pilot program designed to reduce electric bills for low-income, payment-troubled, electric-baseload (non-space heating) customers. This approach, which has since become a full-scale program, represented a shift from Duquesne's traditional approach of offering space heating efficiency measures and services (e.g., heating, windows, and insulation) to customers with electric heat. Fewer than five percent of Duquesne's customers heat with electricity, so the utility took this new approach believing that a usage-reduction program that focused on baseload customers would offer more cost-effective, electric-reduction opportunities than approaches that primarily address space heating (Gregory 1994).

Smart Comfort team members look at how electricity is used by low-income, non-electric-heating customers with monthly bills exceeding $70. Duquesne has trained three energy managers in energy usage analysis, usage reduction analysis, and conservation measure installation. An energy manager visits qualified customers' homes, and walks through the home with the customer, looking at how electricity is used, identifying efficiency opportunities from each customer's unique perspective, and educating the customer on energy-saving habits. Energy managers use diagnostic tools that provide on-site, accurate readings. For example, energy managers install a meter on customers' refrigerators while conducting the audit (approximately two hours) and if energy use is greater than six kWh per day, a new efficient refrigerator is provided. After reviewing all the data, the energy manager identifies electric usage reduction opportunities, helps the customer make better choices on energy use, and installs appropriate energy efficiency measures, as needed (Duquesne 1995). The evaluation indicated that the primary technical sources of savings were lighting, refrigerator replacement and replacement of water beds with conventional bedding. Originally, Duquesne approached homes with a preconceived notion of its energy savings potential; they later found that entering customers' homes with an open mind, customizing end-use solutions, and providing comprehensive energy efficiency services is a more successful approach (IRT 1996).

There is a significant follow-up process for one year following installations. Participants are supposed to phone the energy manager every month after receiving their electric bill to track post-installation consumption. This call allows customers to ask questions and allows the energy manager to see if customers are following through with behavioral and technical modifications. The energy manager also calls participants quarterly following the in-home visit to discuss changes in energy bills to ensure expected savings. Site visits were made on a sample of 20 percent of participants to check if installed measures (e.g., CFLs) were still in place and to meter the consumption of replacement refrigerators. After a year, the energy manager conducts a survey to identify reasons for differences in energy

consumption pre/post program. Unfortunately, during the early years of the program, only 20 percent of participants actually made their monthly calls to the utility and energy managers frequently missed their quarterly calls. This lack of follow up has been identified as a program weakness and plans to focus more on follow up should improve persistence, awareness, and savings (IRT 1996).

Duquesne's Smart Comfort has experienced great success, achieving a mean reduction in electricity use of 35.5 percent from baseline in 1993, and is projected to be 40 percent in 1994. These savings are based on the weather-adjusted comparison of pre- and post-program electricity bills for a sample of participants. The average utility program cost in 1994 was approximately $1,100 per household, which resulted in an estimated annual bill reduction of $356 per household. The levelized cost of saved energy to the utility is approximately $0.03/kWh of saved energy (IRT 1996).

Mitigating bill arrearages is an attractive benefit to the utility. By including customer's income level and payment history as eligibility criteria, the program has been successful in enabling payment-troubled customers to pay their bills and even repay some past arrearages. For 1992 (pilot year) participants had paid an average of 78 percent of their total billing prior to participation in the program. After participating in the program, the average payment was 106 percent, indicating that customers were paying off past debt. Another benefit (not yet quantified) identified by the utility is emissions mitigation (IRT 1996).

In addition to *targeting customized end-use savings*, Smart Comfort's success is attributed to several other design attributes.

- An evaluation performed by the Pennsylvania Public Utilities Commission (PPUC) identified Duquesne's *targeting of high-use customers* as the primary reason for success.

- The PPUC also identified the *high quality of energy-managers* as a key to the program's success. Energy managers were selected not only for their technical qualifications, but also for strong communication skills and the ability to make decisions. Their training was designed to enable them to perform their responsibilities. Giving energy managers the autonomy to maximize savings while minimizing costs has also proven to be more cost effective than setting spending guidelines or prescribing eligible measures. Although counterintuitive, the *absence of a spending limit* on each installation has controlled program costs. In addition, the attention paid to the selection and training of staff, along with the freedom they are given to manage their own time, have all contributed to *low turnover of staff*, which also strengthens the program. Energy managers also recognize the value of continuing professional development on advanced technologies and techniques for efficiency.

- This program's success is also heightened by its *comprehensiveness*, addressing the entirety of the customer's using habits and thus avoiding "lost opportunities."

- *Education*, which results in behavioral changes, also plays an important role, which was demonstrated by an evaluation that documented energy savings *prior* to appliance replacements (IRT 1996).

- The utility works in *partnership with participants* to deliver a range of services and products designed to reduce total electric consumption. According to the program coordinator, the partnership aspect—finding steps that both the utility and the customer can take—is an important component to the program's success. Creating a partnership involves listening to the customer's needs and observing their usage patterns. Customers participate by learning how to effectively practice energy conservation and agreeing to monitor their monthly consumption (Duquesne 1995). The difficulty of forming partnerships with customers in gang-controlled neighborhoods (15 percent of Smart Comfort participants) was overcome by employing a gang liaison to determine when and where it was appropriate to visit these customers. In cases where customers showed no interest or concern in decreasing energy usage, energy managers recognized that it made no sense to invest in added measures and time, although in certain instances, these customers received basic no- and low-cost installations required through Pennsylvania's Low-Income Usage-Reduction Program (LIURP) (IRT 1996).

Smart Comfort's impact has gone beyond saving energy in Duquesne's service territory; it also influenced Pennsylvania's PUC to include baseload-usage reduction when revising their Low-Income Usage-Reduction Program. The program won the governor's energy award in 1993 and DOE's National Energy Award in Utility Technology in 1994. The Smart Comfort team has also begun to explore ways to coordinate its approach with gas utility low-income programs; pilots are underway at Columbia Gas Company of Pennsylvania and Equitable Gas Company (Duquesne 1995).

As a result of Duquesne's success with this program, New England Electric System (NEES) is running a pilot similar to Smart Comfort. NEES's Appliance Management pilot, which started April 1, 1996, targets Massachusetts Electric's low-income population, and assesses electric end-use information (Legg 1996).

Iowa's Low-Income Weatherization Collaborative

Since 1992, the state of Iowa and Iowa's major investor-owned utilities (IOUs) have collaborated on energy efficiency programs for low-income households in Iowa. In order to meet cost-effectiveness guidelines issued by the PUC, Iowa's major IOUs centralized their contracting through the Division of Community Action Agencies (DCAA), and combined their efforts with the Department of Human Rights, the Iowa Office of Consumer Advocates, and the Department of Energy's Kansas City regional office. This collaborative approach extends the reach of the program and makes the program more cost effective (Dalhoff 1996b; Pigg, Dalhoff, and Gregory 1995).

The utilities and Community Action Agencies (CAAs) have streamlined the program and saved money as a result of the collaborative allowing them to:

- establish common eligibility criteria;
- establish the same procedures for pricing of services;
- purchase standardized conservation measures in bulk;
- contract through a central party (DCAA);
- develop a common format for collecting and reporting data; and
- share evaluation costs (e.g., development of measure-specific energy and demand algorithms, surveys, economic impact assessment) (Dalhoff 1996b).

The collaborative approach has also enhanced the quality of the program by creating uniformity, working with agencies that are knowledgeable about low-income households and weatherization, and maximizing cost-effectiveness by providing the greatest amount of services with minimum intrusion to customers. Several utilities reported in a survey that it would have been difficult to operate this program without the advantages of coordinating with the state. Because the weatherization agencies are already in the customer's house and have already invested in the trip, combining efforts saves time, administration costs, and duplication of services (WECC 1995).

The collaborative funds ceiling and attic insulation, low-flow showerheads, faucet aerators, pipe wrap, water heater wrap, CFLs, halogen bulbs, and water bed mattress pads. The collaboration has extended the Iowa Weatherization Program to small, electrically heated homes that had been a low priority previously. Because the utilities fund energy efficiency measures, the state is able to shift some funding to heating system replacements, and health and safety measures (Dalhoff 1996b). Over the years, the program has become more effective at targeting high-use customers; 1992 clients used almost 50 percent more gas than did 1987 customers (WECC 1994).

Weatherization efforts in Iowa are funded by utility, state, and federal funds, including funding earmarked for weatherization from LIHEAP. In 1994, program spending, exclusive of administration, was $2,135 per household (WECC 1995). Between 1992 and 1994, the utilities provided approximately 13 percent ($2.85 million) of total program funding, however, their expenditures account for a disproportionately large fraction of energy and demand savings: 56 percent of electricity savings, 37 percent of electricity demand savings, 28 percent of annual therm savings, and 25 percent of peak day therm savings (Dalhoff 1996b). As a result of this concentration of energy savings from utility spending, from a utility perspective (IES Utilities, Inc., in particular), the program is cost effective, with a benefit/cost ratio of 1.4 for electricity and 1.25 for gas (Reuter 1996).[4]

[4] Energy savings are based on statistically adjusted engineering algorithms (for each measure installed) derived from a study of 500 households treated in 1992 and adjusted based on a billing data analysis conducted in 1994 (Pigg, Dalhoff, and Gregory 1995).

From a customer perspective, client energy cost savings averaged $152 per treated household as a result of measures installed in 1994. These savings represent an increase of about 18 percent over the prior year; much of the increase in savings is attributed to increased penetration of water heating measures (WECC 1995). Overall, customers seemed very satisfied with the measures installed. In an evaluation of measure retention, results were quite favorable, with site visits indicating a 94 percent satisfaction rate with CFLs, and approximately 70 percent satisfaction with low-flow showerheads and faucet aerators. Surveys and site visits also indicate a minimal amount of take-back (e.g., increased thermostat settings) (Pigg, Dalhoff, and Gregory 1995).

From an economic development standpoint, the program has had a very favorable impact. An economic input-output analysis showed that for every million dollars spent through the program, total industry output (similar to Gross National Product for Iowa) increased by $1.82 million and by 43 job years as a result of direct and indirect ("ripple effect") impacts (Dalhoff 1996a). Thus, the $21.75 million spent on the program between 1992 and 1994 increased the state's industry output by almost $40 million and by 935 job years.

Although the program has done a good job transitioning to the state-of-the-art in low-income weatherization, the program has not been without its challenges. For example, agencies have had some problems installing measures that customers don't want, such as low-flow shower heads and faucet aerators, resulting in lower installation rates. Limited product selection has reduced the opportunities for installation, and the agencies' lack of understanding about measure benefits has made it difficult for them to overcome issues of product limitations and installation problems, and convince skeptical customers of measure benefits. These issues may contribute to differences in costs among CAAs (WECC 1995).

Another challenge facing this collaborative is CAA's recognition of their role in a market-based delivery system. Historically, CAAs have been the agents of service for government programs, where funding is systematically provided and the CAA's role has been to meet the low-income client's needs. Through the collaborative they have had to recognize the additional role of providing a service for the utilities, who must achieve their target number of installations and spend money on cost-effective measures in a timely manner (WECC 1995; Dalhoff 1996a).

The evaluation of this program has been performed by the Statewide Low-Income Collaborative Evaluation (SLICE) committee, a collaborative of state and utility representatives. Based on their evaluation of the program in 1994, SLICE offers several recommendations, many of which would benefit collaborative programs in general:

- create a customer feedback mechanism that passes information from the customer to the CAA to the utility;
- prepare two sets of fact sheets (for CAAs and customers) to clarify benefits and installation criteria for energy efficiency measures;

- develop a process that will educate agency staff regarding benefits of measures and communication of benefits to customers; and
- expand the selection of lighting measures as well as the necessary specialized training required, in an effort to increase the penetration of energy-efficient lighting.

The synergies and economies of scale with this collaborative state-wide approach to energy efficiency should be particularly appealing to utilities in a competitive environment because this approach minimizes the time, effort, staffing, and investment required by the utility to provide energy efficiency services to low-income customers.

Wisconsin Weatherization Bureau and Northern States Power

Mandated by state statute since 1982, all nine Wisconsin utilities, as well as the state Weatherization Bureau, operate programs for low-income households. Many utilities contract the same agencies used by the Weatherization Bureau to deliver services. Although many of these programs have been successful, there still exists a duplication of certain efforts, such as audits, and administration, which contributes to driving up the cost of providing energy efficiency services to low-income households (Newman 1996).

In an effort to deliver energy efficiency services to low-income households more effectively, Northern States Power (NSP) now coordinates efforts and channels funding through the Weatherization Bureau. The Weatherization Bureau contracts with 22 independent non-profit organizations, municipalities, and CAP agencies to provide services state wide, and six of these contractors operate in NSP service territory. NSP funding is allocated to these six contractors based on the number of low-income households and heating-degree days in each area. The cost of certain measures (e.g., insulation and lighting upgrades) is shared by both sources. Other measures are funded by *either* the weatherization bureau *or* the utility. For example, the state program allows more repair work to be done, while only NSP funds water/water heater measures, air conditioning maintenance, water bed mattress pads, and removal of second refrigerators and freezers. NSP provides fuel consumption data by customer to sub-grantees, who input these data into an energy audit system that calculates the benefit/cost ratios of measures (Newman 1996).

Coordinating efforts in this way provides numerous benefits:

- eliminates problems of finding competitive contractors;
- gives customers access to consistent services while allowing for regional housing stock differences;
- creates economies of scale through bulk purchasing and elimination of duplicated services and administration;
- retains a trained work force that may have been displaced as a result of funding cuts; and
- controls quality through the state program's monitoring staff.

The result of this partnership between NSP and the Weatherization Bureau is a program that reduces energy usage by an average of approximately 26 percent. These savings are based on a pre- and post-participation billing analysis (Newman 1996). The partnership also creates a very cost-effective program, with levelized total utility costs of $0.019 per kWh saved (Clemmer 1996).

Public Service Company of Colorado's Energy $aving Partners Program

In April 1993 Public Service Company of Colorado (PSCo), a combined electric/gas utility, and the State of Colorado's Residential Energy Conservation Assistance Program (RECAP) formed a partnership to provide energy efficiency services to low-income customers. This Energy $aving Partners (E$P) program is funded by the utility and, as of April 1, 1996, the governor's Office of Energy Conservation. (Prior to this date, state funding came through the State's Division of Housing). Local agencies provide energy efficiency services to low-income residential customers in PSCo's service territory. Utility funding allowed the previously existing RECAP to extend services to more low-income households. PSCo's funding is limited to providing energy efficiency measures, while RECAP funding can also be used for maintenance, health and safety repairs (PSCo 1995).

E$P measures include attic, wall, and floor insulation, infiltration reduction (e.g., air leakage testing and attic and duct sealing), storm windows, furnace-efficiency improvements, CFLs, conversion of electric water heaters to gas, and water-heater efficiency improvements (e.g., low-flow devices and insulation blankets). The program also makes health and safety improvements to gas appliances, however, this measure is funded by RECAP, not PSCo. Insulation measures account for 65 percent of gas savings. Electric savings are not a significant part of total electric consumption or total savings.

In 1995, over 3,700 households were serviced by the 13 RECAP agencies within PSCo's service territory. Many weatherization contractors have outperformed set goals. PSCo's average cost to provide energy efficiency services to an E$P participant is $744, totaling almost $2.8 million spent by the utility on this program in 1995. ACEEE calculated the present value of net benefits to be $850 per customer, resulting in a benefit/cost ratio of 1.14. Consistent with ACEEE's method of calculating the present value of benefits, figures reflect the full life of each measure, with benefits discounted at 5 percent.[5] The benefit figures also include non-energy benefits for one year. PSCo was convinced that the program in the first two years achieved its primary objectives by assisting low-income customers with their energy efficiency needs and obtaining significant energy savings for

[5] PSCo used a different method to calculate the present value of benefits. They looked at several scenarios involving different fuel-price-increase assumptions (ACEEE made no price- increase assumptions), and discounted benefits at a higher discount rate (9.38 percent). Using this approach, PSCo estimated the benefit/cost ratio to range from 0.95-1.2 (a range within which ACEEE's calculation falls).

them. Gas savings were estimated based on pre- and post-participation billing data. Engineering models were used to calculate electricity savings because they were minimal.

United Illuminating's Homeworks Program

United Illuminating (UI) ran a very successful program in some of Connecticut's most economically depressed communities from 1990 through 1995. The program was modeled after the Energy Fitness program administered by New England Power Service. The program was discontinued in 1996 because it was so successful, it had saturated its target market (Unger 1995). Homeworks was a direct-installation program that achieved a high participation rate by employing the "neighborhood blitz approach"—making an intensive pass through a low-income, densely populated neighborhood, installing as many measures for as many customers as possible. To deliver program measures, UI used a primary contractor and several non-profit agencies, as well as hiring and training youths from the communities serviced. This not only created jobs in the community, but also provided a means for the utility to get into hard-to-reach areas (IRT 1992).

The "blitz" approach involved UI sending out a direct mail piece explaining the program to a targeted neighborhood, approximately seven to ten days prior to the time when they expected to be in the neighborhood. A few days before canvassing the neighborhood, door hangers announcing the program were distributed. The neighborhood was then canvassed, making appointments for installation of services either the same day or the next day. The performance of services took approximately one hour per household. If, after several attempts, no contact was made with a resident, a "sorry we missed you" door hanger (with the installer's phone number) was left (IRT 1992).

The program provided energy efficiency measures for not only UI (electricity), but also for Southern Connecticut Gas Company and three local water utilities (Dyballa and Connelly 1992), thus achieving certain economies of scale by joining forces. The program focused primarily on lighting but also included water heater wraps, pipe insulation, water temperature set back, low-flow showerheads, and faucet aerators. Customer education was also provided for measures installed as well as for other energy efficiency opportunities for the customer (IRT 1992).

As of mid-1993, Homeworks had installed measures that saved approximately 15 GWh annually, based on an impact evaluation using billing analysis. For larger service territories, UI achieved one of the highest participation rates, having serviced 27 percent of the 100,000 eligible customers in the first three years of the program. The combination of the "blitz" approach and partnering with other utilities drove the program costs down to a levelized utility cost of approximately $0.032/kWh saved (Nadel, Pye, and Jordan 1994).

EXPERIMENTAL PROGRAMS UNDERWAY

In addition to the well-evaluated programs discussed above, several promising programs that have recently begun are too new to be evaluated. Two of these programs are discussed in this section.

The Center for Energy and Environment and Minnegasco's Low-Income Weatherization Programs

The Center for Energy and the Environment (CEE), a private, nonprofit organization, has been providing energy efficiency services to public agencies and electric and gas utilities across the country since 1980. CEE used its many years of expertise to develop a streamlined low-income weatherization program for Minnegasco, a gas utility in Minnesota, which was implemented in 1995.

This program prioritizes customers according to their energy savings potential, which is based not only on energy use, but also on customer motivation, which is demonstrated by responding to and completing a pre-weatherization survey. Minnegasco has a data base that identifies income-qualified customers who are high-energy users. This information is combined with assessor's data on floor area to identify customers with high-energy use per square foot of living space. Phone interviews determine the condition of the home and its insulation (e.g., customers are asked if previous insulation work has been performed), as well as further assessing customer motivation level. All of this information is used to determine households with the greatest potential for cost-effective weatherization. Pre-selecting motivated customers also maximizes the productivity of the auditor's time.

Audits focus on which measures can be installed cost effectively. The household audit includes: a visual walk through, a mechanical safety test of the water heater and furnace, an indoor-air-quality assessment, a wall- and attic-insulation assessment, and, if warranted, advanced pressure diagnostics (e.g., blower door and infrared tests). The auditor concludes the audit by explaining recommendations to the customer, identifying the insulation contractor, and reviewing and leaving information from Minnegasco. The product of the audit is a work plan that provides guidelines for contractors installing measures.

Contractor selection, capabilities, and training are very important as the private-sector contractors are allowed discretion to make minor modifications to the plan as needed, as long as only cost-effective measures are installed. The median turn-around time from application to insulation is 33 days. This quick turn-around time ensures administrative efficiency, as does their automated, simplified paperwork (six pieces of paper per customer file). A post-installation inspection involves visual inspection of installed measures and a blower door test. Infrared inspections are use as needed. Educating customers about energy use is an equally important component of the post installation inspection, during which customers sign an action form agreeing to three conservation behaviors.

CEE believes that quick feedback is crucial to enable timely program refinements. Along with the State of Minnesota, CEE has designed software that quickly and reliably evaluates energy savings using mechanical system run-time loggers. Although it is still too early to have results from this new streamlined program, some spot checking has verified a 23 percent projection in gas savings. An average of $1,650 is spent per single-family house, including the cost of measures, audits, inspections and administration. Currently this program is being implemented in Minnesota, where housing stock generally is sound and savings are somewhat difficult to achieve. An average seven-year payback is expected (CEE 1996).

Wisconsin Power & Light's Weatherization Services Program

The Wisconsin Power & Light (WP&L) Low-Income Weatherization Services program began in 1983. In 1995, WP&L contracted Wisconsin Energy Conservation Corporation (WECC) to enhance its weatherization program by maximizing cost-effective energy savings for low-income customers, reducing their utility bills, and reducing arrears of program participants. In addition, the enhanced program focuses on combining gas and electric efficiency measures with intensive energy education that involves a commitment by both program providers and participants. Various organizations are responsible for different aspects of the program. WECC is responsible for daily oversight and management of the project, the Center for Energy and Environment (CEE) is responsible for developing the energy education program and project evaluation, and nine Weatherization agencies deliver the services to the customer and report data to WECC (WP&L 1995).

To identify and prioritize potential participants, WECC compiled a database of customers, looking at their consumption histories, arrears, LIHEAP eligibility, and previous weatherization history, if any. Customers meeting the specified energy-intensity thresholds are eligible to receive full weatherization (up to $3,000 per building), including insulation, necessary appliance/equipment replacement, energy education, high-efficiency lighting, and low-cost water-heating devices. Measures must have a benefit/cost ratio of 1.35 or greater to merit installation (the 35 percent add-on is to cover administrative costs). Customers whose energy intensity is below the threshold can receive energy education, high-efficiency lighting, low-cost water-heating-saving devices, and warranted electric appliance/equipment replacement if eligibility criteria and a 1.35 benefit/cost ratio are met. Major weatherization measures for these customers are referred to WAP (WP&L 1995).

In terms of the energy education component of the program, WP&L believes that customers' actions can be just as important as the weatherization measures installed in homes so the utility has developed an approach that integrates energy education into each contact with the customer. WP&L promotes a partnership between the customer and the weatherization agency to address the customers' energy concerns and motivate them to be actively involved in the process and take action on recommendations made by the weatherization agency. Three strategies to successful education include:

- designing information to capture customers' attention and motivate them;
- making the process simple, providing goals and giving the customer a sense of control; and
- following up and giving feedback—rewarded behavior is repeated behavior.

What is most impressive about this program is the WP&L training manual, which provides extensive tips, guidelines and sample scripts for involving customers in the process and getting them to commit to energy action steps. The training manual also defines procedures to be used when providing services, including allowable weatherization measures, installation and material standards, and audit fees for site-built and mobile homes based on heating fuel type, measure benefit/cost ratio, and energy intensity levels. The manual also details procedures for making referrals to WAP for emergency appliance and equipment replacement services. Customer feedback is provided through a survey given to the customer by the weatherization agency and forwarded to WECC for data compilation.

Because implementation of this enhanced weatherization program began in June 1995, it is still too early to quantify its track record. However, WP&L and WECC already are realizing one of their program goals, which is to motivate customers to pay a portion of their utility bill during the disconnect moratorium in the winter (customers had gotten into the habit of not paying utility bills during the period that they knew their service would not be disconnected). Management believes their approach will be successful due to good program design and support from the partners involved in the program (Ramamurthy 1996).

CASE STUDY SUMMARY

The profiled programs for which results are available have all proven to be successful in terms of providing benefits to low-income customers using cost-effective approaches. As shown in Table 3, available cost data indicate that each program either has a benefit/cost ration greater than one or has a reasonable levelized utility cost of approximately $0.03 per kWh saved. Thus, the common impression that energy efficiency programs for low-income customers cannot be cost effective is not valid; approaches exist that allow these programs to at least pay for themselves, if not save the utility money.

Savings per average household (for the programs for which these data were available) ranged from 19 percent to 37 percent. This high level of savings per household reflects many factors, including: most of the utilities targeted their high-use customers; low-income customers tend to be in situations where they use energy inefficiently (e.g., poorly insulated homes with inefficient appliances); and most programs emphasized providing a comprehensive list of services.

In many cases, the utilities leveraged their investments by forming partnerships with WAP, LIHEAP, other utilities, or community agencies. These partnerships not only allowed the utilities to run more cost-effective programs, but also allowed the programs to be more comprehensive and customized,

Table 3. Energy Efficiency Programs for Low-Income Households: Data Summary

Program	Data Period	Utility Annual Cost	# Customers Served/year	Energy Savings	% Energy Saved per HH	Levelized Cost of Savings	Benefit/ Cost Ratio	Partners
Duquesne Light's Smart Comfort	1993	$674,000	625	1,900 MWh	36%	$0.03/kWh		Pursuing partnerships with gas utilities, local weatherization agencies
Iowa's State-Wide Collaborative	1994	$1,258,000	4,400	4,100 kWh 1,870,000 therms	19%		1.4 - electric* 1.25 - gas*	State of Iowa and all major IOUs in state
Wisconsin Weatherization Bureau/NSP	1994	$283,000	269 - elec. 230 - gas	581 MWh 72,000 therms	26%	$0.019/kWh $0.217/therm		State weatherization bureau
PSCO's Energy $aving Partners	1995	$2,760,000	3,700	569,000 therms	~15%		1.14	State of Colorado (WAP and LIHEAP)
UI's Homeworks	1995**	$534,550	~3,100	2,100 MWh		$.03/kWh		Non-profit local agencies, So. Connecticut Gas Co., and local water utilities

* for IES Utilities Inc.

** Annualized based on 1/95-11/95 figures

Note: All savings have been calculated using either billing analysis or a combination of billing analysis and engineering estimates.

and reach more low-income customers. The importance of partnership also extends to developing a partnership with the customer, which increases their commitment to success. Other utilities (e.g., Duquesne Light) achieved success by targeting electric end-use efficiency.

The programs profiled have also been successful because they made a concerted effort to know their low-income market and understand how to minimize the barriers that exist in reaching them and gaining their confidence (e.g., UI's Homeworks). Most of the programs profiled also included an education component, which enhances the sustainability of energy savings and helps the customer buy into the program, its goals, and its importance to the customer. Another important component of success is the quality of the staff. A program may be expertly designed, but if staff is not committed and well-trained, success will be difficult.

These programs exhibit some successful approaches to providing cost-effective energy efficiency services to low-income customers. They are by no means an exhaustive list of successful low-income programs, nor will all approaches be attractive to all utilities—that is, each utility must consider its own characteristics (e.g., gas versus electric) and the needs of its particular customer base (e.g., urban versus rural).

RECOMMENDATIONS

The case studies, experience, and research compiled in this report provide many ideas regarding how energy efficiency services can be provided to low-income customers most effectively, from both a cost-of-service perspective and a benefit-to-customer perspective. Recommendations fall into six categories: forming partnerships, targeting high-use customers, education, energy efficiency measure selection, marketing, and avoiding lost opportunities.

Forming Partnerships

Many utilities are realizing the value of forming partnerships as they approach a competitive environment. For example, both utilities and the federal government are finding the formation of partnerships with industrial customers and trade allies to be fruitful (Elliott, Pye, and Nadel 1996). It is, therefore, not surprising that partnerships can also be valuable in providing energy efficiency services to other sectors, including the low-income population. Forming partnerships is not a new concept, but it is becoming more important as federal budgets shrink and utilities face competitive cost-cutting pressures.

In providing services to low-income customers, joint ventures can provide effective cost controls, such as bulk purchasing; centralized participant recruitment; large, competitive subcontracting; increased energy savings through increased comprehensiveness; sharing of trained energy efficiency professionals; and development of joint delivery. These partnerships may be with other utilities (e.g., water, alternate fuel), government programs (WAP and LIHEAP), or local community agencies.

Potential synergies also exist with affordable-housing developers, banks, first-time home ownership programs, local housing financing agencies, state and local land trusts, and community development financial institutions (Colton 1995a). The result of sharing expertise and resources can be to provide more comprehensive energy efficiency services to more people
more efficiently and more cost effectively. In some cases, partnerships allow the utility to enable someone else to do energy efficiency work, without having a substantial day-to-day role itself.

Forming a partnership with the *customer* is also an important method of achieving greater success in a program. By forming a relationship with the customer, the utility gets the customer to feel more committed to making the effort a success. Utilities have used different approaches to create this feeling of partnership with its customers. Some utilities (e.g., Minnegasco) have customers sign a contract indicating their commitment to the program. Most develop a relationship through the process of educating the customer, giving the customer a sense of control over their level of savings. A partnership with the customer can be strengthened by continuity among utility staff—in other words, having the same staff member work with the customer throughout the entire process, which requires a low turnover among staff. The partnership with the customer can also be strengthened by diligent follow-up with customers (e.g., having the customers call in and/or having the representative call on the participants).

Targeting High-Use Customers

Most of the programs profiled indicate the importance of targeting those customers with the highest energy use. These customers tend to use energy the most inefficiently and therefore have the highest potential to save energy both through efficiency measures and by becoming more aware and involved in conserving energy. Targeting these customers helps make a program more cost effective because savings are maximized for the same level of effort.

High-use low-income customers also tend to have higher arrears. So by targeting them, the utility increases its opportunity to reduce bad debt and the administrative costs of credit, collections, and disconnects/reconnects. Although many utilities do not yet quantify these non-energy savings, as utilities become more streamlined under competitive pressures, the savings in this area will get increased attention.

Education

Education has proven to be a valuable component of energy efficiency programs, not just education of the customer, but also education of the service providers and program sponsors. Experience has shown that energy efficiency programs enhance the persistence of savings by including a customer-education component, and providing training to maintenance staff (VEIC 1993; VEIC 1992). A well-trained staff is better equipped to design an effective program and educate participants. Education teaches participants how to conserve energy and how to use and maintain efficiency measures properly.

The Alliance to Save Energy (the Alliance) found that adding an educational component to a weatherization program significantly increases energy savings and the persistence of energy savings as measured three years later. The Alliance studied a group of Niagara Mohawk customers who had received several weatherization measures, as well as a setback thermostat, instruction on its use, and several energy efficiency education visits. Customers who received an educational component along with efficiency services showed savings in excess of 25 percent in the first year, as compared to customers who received services-only (no education), who saved around 16 percent. After three years, families who received energy efficiency education were saving over 20 percent of gas use, whereas families who received only weatherization measures achieved savings of less than 13 percent. One strategy suggested was for utilities to do periodic "educational tune-ups," just as they do furnace tune-ups. Harrigan and Gregory (1994) suggest that personal visits, preferably by the same person who made the first visit, are most effective. Some utilities have already expanded the role of the auditor from that of a technician to an educator who focuses on customer needs such as comfort and financial security. This personalized, value-added service could also help the utility by promoting brand differentiation that will give a utility a competitive edge (Harrigan and Gregory 1994).

The value of an educational component in low-income programs was verified in programs conducted in Pennsylvania, Ohio, Michigan, and Washington that were designed to isolate and measure the impacts of energy education on energy savings. Despite many differences between the programs, additional savings in both gas and electric space heating produced by client education were fairly consistent, ranging between four and eight percent, when corrected for weather (Quaid 1990).

Massachusetts Representative Edward Markey has sponsored an amendment to LIHEAP that requires that education be included in all Residential Energy Assistance Challenge (REACh) programs, which are designed to help LIHEAP clients achieve long-term self sufficiency through empowerment. The amendment requires that national quality standards be set for energy efficiency education and that additional funding be provided to states whose REACh programs meet those quality standards (Smithers 1996).

Wisconsin Power & Light offers three strategies to achieve successful education:

- designing information to get people's attention and motivate them;
- making the process simple, providing goals and giving the customer a sense of control; and
- following up and giving feedback—rewarded behavior is repeated behavior (WP&L 1995).

It is important to the success of an energy efficiency program that those who deliver the services and those who design the programs are educated and are given the tools they need to educate their customers. Fact sheets prepared specifically to educate the consumer should be available to reinforce the education that the service deliverer imparts directly to the participant. In order for those who deliver services to be most effective, they themselves need to be educated regarding benefits of

measures and communication of benefits to customers. This process can be facilitated by preparing more detailed fact sheets for energy efficiency measures to clarify benefits and installation criteria. EUA Citizens Conservation Services encourages energy educators to be as knowledgeable as possible by giving them bonuses based on savings achieved in households in which they worked (Morgan 1996).

It is also important to create a customer feedback mechanism that passes information from the customer to the delivery agency to the utility (WECC 1995). This feedback mechanism allows the program designers and implementers to make improvements to the program based on experience as the program progresses.

Energy Efficiency Measure Selection

Many criteria will affect which measures will provide the greatest, most cost-effective energy savings in any one home for any specific utility in a particular climate. Some utilities (e.g., Duquesne) have found success through selecting measures based on savings-to-investment ratios produced by individual audits rather than by prescriptive methods. Other utilities (e.g., Minnegasco) have found that their customer base's housing stock is homogeneous enough that after performing some preliminary auditing and savings-to-benefit calculations, they know to a great extent what measures will be cost effective for their customers in general. Audit equipment is becoming more refined, giving energy efficiency providers a tool with which they can determine the cost-effectiveness of potential measures.

The type of energy efficiency measures that garner the greatest energy savings can be specific to the type of utility. Because electric heating is less common than gas heating, electric utilities will probably find the greatest energy savings resulting from replacement of electric appliances (e.g., refrigerators, lamps, and electric water heaters as in Duquesne Light's Smart Comfort program). Gas utilities, on the other hand, get the most energy savings from measures that reduce the energy needed to heat the home (e.g., attic and wall insulation), from replacing inefficient heating systems, and from increasing attention to heating system distribution systems. Ideally, electric and gas utilities will work together so that a comprehensive set of measures can be provided cost effectively through one customer contact (Brown, Berry, and Kinney 1994).

Based on a 1995 survey conducted by Cleveland State's Center for Neighborhood Technology for Cleveland Electric Illuminating Company, the National Consumer Law Center's (NCLC) Low-Income DSM Project found that because 75 percent of households in the survey reported using electric heaters to supplement their heating systems, great potential exists to reduce the use of this inefficient heat source by pursuing measures that reduce heating needs and improve the efficiency of gas heating systems. These steps would also allow reduction in thermostat settings by making the home more comfortable and easier to keep warm (NCLC 1995a). Electric resistance space heat can often save energy under the circumstance that only one or a few rooms in the house are heated and the others

are not heated (sometimes labeled the "warm room" concept), otherwise, it is generally an expensive source of heat (Nadel 1996).

The Cleveland study also found that refrigerators are a major potential source of electricity savings. NCLC suggests that low-income households' old refrigerators could be replaced (and destroyed with freon collection) with energy-efficient models, using a lease/fee arrangement in order to involve the customer in the decision and reduce the cost to the utility or other funder (NCLC 1995a). Super-efficient apartment-sized refrigerators are being developed by Maytag and are expected to be available in 1997. These refrigerators are being developed in response to a market transformation effort in which New York Power Authority (NYPA), EUA Citizens Conservation Services, and New York City Housing Authority (NYCHA) demonstrated to manufacturers the substantial demand for super-efficient apartment-sized refrigerators (NYCHA alone purchases 10,000 refrigerators every year). These refrigerators are 30 percent more efficient than DOE's 1993 standard (Nolden and Morgan 1996).

NCLC also noted the potential of installing energy-efficient lighting. A study by Wisconsin Energy Conservation Corp. emphasized that expanding the selection of lighting measures as well as the necessary specialized training required would increase the penetration of energy-efficient lighting (WECC 1995).

Duquesne Light found that some of its greatest savings have come from replacing water bed mattresses with 12-inch thick foam mattresses. Although water beds are significantly cheaper to purchase than traditional bedding, heating a water bed can cost up to $30 per month. Replacing water beds with traditional mattresses results in a significant and immediate reduction in usage that encourages customers to continue their own commitment to reduce energy use. The Duquesne Light energy managers have also begun focusing on the importance of proper venting of clothes dryers to prevent moisture from remaining in the laundry, which lengthens drying time (Duquesne 1995).

In an Oak Ridge study, households that received duct leakage control measures and distribution system diagnostics achieved above-average savings in a study of single-family weatherized homes. Duct problems can negate the benefits of other weatherization measures. In addition to saving energy, sealing and balancing, duct systems can raise furnace-system efficiency, decrease overall air infiltration, solve moisture problems, improve comfort, and enhance indoor air quality (Brown, Berry, and Kinney 1994).

Marketing

In order for any program to be successful, customers must be interested in participating. The utility must understand and identify the low-income market segment, and market the program in a way that will minimize barriers and maximize participation. Vermont Energy Investment Corp. offers several recommendations to achieve these goals, based on their extensive experience in providing energy efficiency services to low-income customers (VEIC 1993; VEIC 1992).

1. Understand the low-income market:
   - be aware of diversity in low-income population;
   - talk directly to low-income customers about needs and barriers;
   - collect data on population to be served; and
   - consider the pride factor (especially for elderly), emphasize the opportunity for them to take control over their lives and help the environment.

2. Identify the market segment:
   - differentiate lost opportunity from discretionary (retrofit) resources;
   - segment markets and design programs around new purchase, replacement and retrofit opportunities;
   - reach decision makers at the point at which they are making decisions;
   - segment retrofit services by energy-consumption level, offering more services to households with greater consumption; and
   - identify market transformation opportunities.

3. Maximize customer participation by overcoming barriers:
   - use familiar, trusted delivery contractors, such as local community groups;
   - work with community leaders;
   - require no co-payment from low-income customers;
   - use community outreach networks to promote program; and
   - use printed materials appropriate to all potential participants (e.g., have foreign-language materials available for neighborhoods with a substantial non-English-speaking population).

4. Marketing the program:
   - utilize existing networks;
   - develop new outreach methods;
   - use bill stuffers with a clear message;
   - advertise in welfare checks, food stamps, school flyers;
   - keep the message simple, link it to tangible benefits, use examples to describe the program;
   - minimize lag time between offer of services and delivery of services; and
   - dispel the myth that conservation means deprivation.

Minimizing Lost Opportunities

Minimizing lost opportunities is basic to most businesses and certainly to energy efficiency in general. In the case of energy efficiency, lost opportunities occur when we miss an occasion to install energy-efficient measures *at minimal incremental cost* (e.g., during construction or routine renovations or equipment replacement). The consideration of lost opportunities arises as a component of designing a program, selecting energy-efficient measures and marketing the program. In order to avoid lost

opportunities, it is important that a program is comprehensive, maximizing the savings in each home. This can be achieved by analyzing all end uses and technologies, and installing as many types and numbers of measures as is cost effective in as few visits to the home as possible. This approach increases program costs in the short term, but will increase program benefits, reducing costs in the long term.

CONCLUSION

Low-income households face an inordinate energy burden. Utilities have made some good progress towards ameliorating this burden by providing energy efficiency programs for their low-income customers. Many of these programs have been implemented by utilities in response to regulatory mandates and were not expected to be cost effective. Certain utilities, however, have proven that these programs can operate cost effectively. Despite the fact that regulatory changes are creating an uncertain future, it is likely that many utilities will maintain energy efficiency programs for low-income customers either at their own initiation or because of regulatory requirements. Regardless of what form this funding takes, utilities will want to maximize the benefits achieved.

The experience compiled in this study indicates that energy efficiency programs for low-income customers *can* be cost effective. Some utilities, such as Duquesne Light, have achieved cost-effectiveness by targeting measures that will save their utility the most (e.g., electric appliances for electric utilities, and gas heating and insulation for gas utilities). Other utilities have maximized the return on investment by forming partnerships. All of the programs profiled in this report involve some sort of partnership or plan to integrate partnership into their low-income program. These partnerships can exist with state and federal agencies—most often WAP and LIHEAP—or with other utilities or community agencies. Forming partnerships allows dollars to be spent more effectively, providing more services to more customers at a lower cost. This is done by sharing expertise, labor, and equipment, and taking advantage of economies of scale. Opportunities to leverage funding also exist through synergies with banks and affordable-housing developers.

As utilities deregulate and become more focused on the "bottom line," they will change the way they do business. If low-income programs are mandated, utilities will want to operate them as cost effectively as possible. If utilities are not mandated to operate energy efficiency programs for low-income customers, some utilities may be tempted to cut them completely. In an idealistic world, free-market enterprise would be rewarded (profit-wise) for performing valuable social services. But since the real world mandates free-market enterprise to maximize shareholder value, utilities may want to consider the following business advantages to providing energy efficiency services to low-income customers:

- Energy efficiency programs for low-income customers *can* be operated cost effectively.

- The low-income sector, because of its generally substandard housing, presents opportunities for greater energy savings than the average customer.

- Many deaths occur each year due to inadequate heating and cooling or termination of utility service. Energy efficiency programs for low-income customers can reduce the incidence of such deaths and enhance goodwill, which utilities will value more as they become more competitive.

- As utilities begin to compete with each other for customers, some consumers may be more inclined to select an energy provider who exhibits a legitimate social consciousness by assisting lower-income households.

- Energy efficiency is good for the local economy because saving money on energy (money that usually goes *outside* the local area) increases discretionary dollars, which tend to be spent locally. Energy savings also tend to have a positive net effect on providing jobs. A strong local economy is good for the utility's business.

- Reducing the low-income energy burden has a variety of benefits for the utility, including reducing arrearages, disconnect/reconnect costs, and working capital needs.

Providing energy efficiency programs to the low-income population has benefits that stretch beyond social advantages. Serving the low-income customer sector is good for society, good for the economy, and good for business.

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