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CASE STUDY

Energy Fitness: Canvassing Urban Neighborhoods

by Stephen Cowell, Steve Gag, and Jackie Kelly

How can utilities serve the poor, non-English speaking, and elderly people DSM programs find so hard to reach? Energy fitness programs are designed to target exactly those customers. Here's how one contractor does it.

For the past two years, Conservation Services Group has been operating energy fitness programs in Massachusetts. In 1991, we delivered the programs to over 19,000 customers in low- and moderate-income communities. Having encountered many challenges in implementing such large-scale door-to-door programs in low-income urban neighborhoods, we have learned in the field what makes a successful energy fitness program.

The primary objective of an energy fitness program is to achieve measurable energy savings for both the customer and the utility company through the installation of lighting, water, and appliance efficiency measures in customers' homes. A second objective is to refer residents to other utility demand-side management (DSM) and low-income programs. Customers' acceptance of product installation and their understanding of the purpose and use of these measures ensures maximum retention of measures and the persistence of savings over the full life of the measure. Achieving the highest level of customer awareness and satisfaction with the products and service is extremely important to these programs.

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Paula Lerner, courtesy of Conservation Services Group

An installer walks to his next appointment, bringing energy-saving measures into homes at the neighborhood level.

Our energy fitness programs were designed to solve several of the most difficult challenges of any DSM plan. The first challenge is to deliver services to customers who are low users of electricity (the general use customer). These customers use electricity for lighting and refrigeration in all cases and occasionally for hot water, air conditioning or high-use appliances on a random basis. The delivery costs for bringing services to the home are often considered too high to justify serving these low-use customers with a direct program.

The second challenge is to serve the hard-to-reach populations in a service territory. These customers include low- and moderate-income households, renters, non-English speaking people, the elderly, or others specific to a geographic area. Unfortunately for DSM planning the two challenges of low-use and hard-to-serve customers often happen simultaneously. The inability to serve a large and important segment of the utility customer base can significantly weaken public support for DSM programs and ultimately lead to a backlash against DSM based on equity concerns.

The energy-fitness or DSM-canvass strategy is designed to solve these problems by providing a high-profile, comprehensive and, most importantly, cost-effective program for low- and moderate-income urban neighborhoods. These are predominantly general service customers. The program is based on the concepts pioneered in the Santa Monica energy audit program delivered in 1983–1985 (see

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box, "Origin of a Species") and applied to DSM strategies in the collaborative programs negotiated in New England by Conservation Services Group.

How Energy Fitness Works

To maximize customer participation during the door-to-door canvassing, neighborhoods are prepared in advance. Elderly, low-income, and non-English speaking customers need to be the target of special outreach efforts to increase their participation.

Initial planning and outreach steps are completed well in advance of the canvass. For each neighborhood these steps include assessing:

- housing stock (how many units are single-family, 2–4 unit multifamily, or 5+ unit multifamily?),
- security buzzer and safety problems,
- language barriers, and
- ownership patterns.

A high-quality map facilitates block-by-block organization and planning based on the number of units on the street and the neighorhoods' demographics. This demographic "game plan" provides the template for timing and logistics involved with each neighborhood sweep.

A short, easy-to-understand mailer (either a postcard or fold-over brochure), written in one or more languages (depending upon the neighborhood), provides the customers an introduction to the program. The mailer includes a local phone number to call to make appointments.

Origin of a Species: The Evolution of Energy Fitness Programs

Energy fitness programs germinated in Santa Monica, Calif., in the early '80s from the seed of the U.S. Department of Energy's (DOE) Residential Conservation Service (RCS) program.

Frustrated by the potential energy savings missed by RCS programs, Peggy Curran (then Peggy Gardels) and Heather Ball wanted to develop a program that would use the basic premise of RCS (namely on-site home inspection and conservation recommendations) and add implementation of various no-cost/low-cost, high-payback conservation measures. The "token" measures taken by utilities for RCS ended up costing about $200 per home audit, and were not visibly successful since participation rates were low and no retrofits were installed, only recommended. Curran, then working with Western Sun (DOE's renewable energy agency, since disbanded by the Reagan Administration) and Ball, who worked with an energy policy firm, projected that their program would cut the per-house cost of audits while providing immediate energy savings from the installation of such measures as water-heater jackets, hot-water-pipe insulation, and low-flow showerheads.

Curran and Ball took their idea to the City of Santa Monica, which agreed to sponsor the program, provided that they could get utility cooperation. Even while aided by Leonard Grimes, then president of the California Public Utilities Commission (who was convinced that the plan for "direct service" audits would increase overall energy savings), it took nearly as long to recruit utility support as it did to implement the program.

When the utilities did agree to try the program, Curran hired Ken Egel to implement it. Egel designed contracts and hired contractors to cover the audit design, publicity (Egel came up with the name "energy fitness"), and evaluation. The resulting program succeeded in boosting participation from a nationwide average for RCS programs from 2–5% to 33–35%. This number is especially impressive for an urban area where approximately 75% of the residents are renters—a group traditionally difficult to serve through RCS. Also, the door-to-door canvassing approach generated interest from a population that is often less energy-conscious than that served by RCS. (RCS required consumer initiative to schedule audits.)

At a per-audit cost of $87, the savings generated by the Santa Monica Energy Fitness Program from May 1984 through May 1985 included a 5.4% average savings in gas, and 16% savings in water per home (see *HE*, Nov/Dec '86, p. 6). The program also earned awards on both the state and local levels. Despite the genuine success of Santa Monica's program, it was not replicated elsewhere until 1988, when Martin Kushler and Patti Witte of the Michigan Public Service Commission contacted Ken Egel for advice in designing a pilot energy fitness program for Michigan, intended to replace RCS when its federal legislation expired. Michigan's Energy Fitness pilot program (slightly modified to include a few more measures) was well-received, generating 49% participation across five different communities targeted in the pilot program. (The details of the Michigan study, including measured savings data, were presented at the 1989 National Evaluation Conference.[1]) The program was subsequently adopted by all the major electric and gas utilities in Michigan.

From Michigan, energy fitness programs spread to New England, with programs in Massachusetts and Connecticut garnering good response rates as well. As the program spread, it maintained the basic principle of high-visibility, low-cost energy savings, with some improvements added along the way. Bob Kemper, for instance, managed to bring electric, gas, and water utilities into one energy fitness-type program in the "Homeworks" neighborhood project he designed for United Illuminating (a Connecticut utility) in 1989. This synthesis reduced overhead administrative costs, and allowed auditors to install a wide range of energy-saving measures. A computer inventory allowed auditors to keep records of each device, and to later generate invoices for each utility according to the number and variety of measures installed.

With utility conservation budgets on the rise, and utilities increasingly seeking areas with high public visibility and energy payback, energy fitness programs are sure to continue to expand. While limited to areas with high-density housing (due to per-house audit costs), the programs can be adapted to target neighborhoods with high energy use at peak times. Steve Morgan of Citizens Conservation Corp. says that energy fitness programs can still grow substantially, especially in program referral services and behavioral energy education.

—Lesley Mandros Bell

Endnote

1. Kushler, M., P. Witte, and S. Ehlke, "Are High-Participation Residential Conservation Programs Still Feasible? The Santa Monica RCS Model Revisited." *Energy Program Evaluation: Conservation and Resource Management; Proceedings of the Fourth International Conference on Energy Program Evaluation*, pp. 365–371. Chicago: Argonne National Laboratory, 1989.

Through our experience in the field we learned that using a complex marketing piece does not work. Our first piece was written at a college reading level, was text heavy, and booklet length. To simplify the piece, we limited it to one page, wrote in simpler language, and used more graphics.

Next, crews distribute brochures throughout the neighborhood informing customers the fitness program will be in their neighborhood until a given date. The brochure duplicates the format and message of the mailer and repeats the phone number for making appointments. Crews slip the brochure under the customer's door or hang it from the doorknob 1–2 days after the mailer arrives.

The canvasser then knocks on doors and makes appointments in the targeted area the day after the brochure has been distributed. In order to reduce the number of "no-shows," the canvasser makes the majority of appointments for that day or the next whenever possible. The appointments are transmitted via radio to the crew chief who assigns and dispatches an installer to the appropriate address.

Targeted marketing is used to involve difficult-to-reach populations. The program uses the services of neighborhood centers for outreach support, brochure and poster displays, interpreters, and to understand the markets better. In Massachusetts, local organizations helped to prepare educational materials in over 15 different languages. In addition, the energy fitness crew found that placing a free-standing sign next to the energy fitness van generated walk-up customers. These types of appointments are important for replacing no-show appointments.

The Energy Fitness Team

The crew consists of a crew chief, a canvasser, and five installers. The installers respond to appointments made in advance by the canvasser. The crew works out of a van and each installer carries supplies for two households. Two-way radios aid with replacing no-show appointments, requesting additional supplies, and reporting addresses of other interested customers. Most of the staff is bilingual; where needed and possible, we hire interpreters from community groups in particular neighborhoods.

Teamwork is stressed in an environment that encourages high-quality installations and education. The aim is to leave customers with positive feelings about their role in reducing the need for new power sources in their community.

Safety Concerns

Teamwork is also important for the safety of the installers. Recently, a homeowner with a scheduled appointment physically threatened one of our installers. The installer radioed a canvasser working in a nearby apartment building for help. The canvasser distracted the homeowner while the police were called. Both the installer and canvasser left without incident and the individual was apprehended by the police.

The crew takes safety precautions prior to arriving in a neighborhood, too. First, when we meet with community leaders to gather marketing information, we invite a community police officer. We inform the officer and community leaders about the energy fitness program. We ask them to alert us to issues unique to their community (demographic make-up, language barriers, safety concerns). Their help is then enlisted in identifying where, if any, safety problems exist in their community.

Training

Proper and thorough training of field staff is essential to the success of a labor-intensive program like the energy fitness program. Two days of training are necessary to cover all the different aspects of the program. A third day is set aside several weeks later for additional training, focusing on lessons learned in the field. Training should involve:

1. At the outset of the training program, the fitness program must be placed in the overall context of the utility's conservation and load-management strategy.

2. The importance of educating and motivating the customer should also be addressed early in the training curriculum. In addition to being armed with good educational materials, field staff must understand the importance of their roles as educators and motivators.

3. Training in each energy-saving measure should be standardized. The format should include the following:

- a general description of the end use;
- a discussion of how to assess opportunities for savings;
- training in the installation of measures;
- customer education, operation and maintenance instructions, application information;
- referral to the utility's other programs, if appropriate; and
- criteria for inspection and quality assurance.

Paula Lerner, courtesy of Conservation Services Group

Trained in customer education, installers disperse information about energy use that can save consumers as much as the energy-efficient measures they install.

4. One half-day of classroom training is allocated for training on lighting. This is followed up with one half-day of field training and regular refresher training. The electricity savings captured in the overwhelming majority of households served will be derived from the lighting installations.

Customer Education

Most of the installer's time is spent talking with the customer. The first discussion usually centers around explaining why a utility would want to install the bulbs at no charge. Most customers are incredulous and need some convincing, especially when they discover how much the bulbs cost. "Why would the utility want to give me bulbs for free that use less electricity?" is a constant refrain. Installers must be trained to overcome this initial customer skepticism; without a satisfactory explanation, a significant percentage of potential participants will refuse the service. The best explanation is a simple one: "Saving energy is less expensive than building new power plants. By helping you save electricity, the utility gains as well."

Once the installer is in the door, most of the conversation centers around the use and best location for lighting products. Customers learn about lumen output, cost savings, electronic versus magnetic ballasts, and many other lighting issues. In addition, the installer educates the customer about various other conservation measures that the customer can employ to save even more money.

Some examples of customer education that reap energy savings include:

- Wash a full load of clothes instead of a partial load.
- Unplug or dispose of seldom used refrigerators.
- Dry clothes outside whenever possible.
- Turn off lights when leaving a room.
- Clean refrigerator coils. When this conservation tip is combined with a free refrigerator brush and a cleaning demonstration by an installer, the customer participation is impressive. Through field installations in the Northeast Utilities' Western Massachusetts Electric Company Spectrum Neighborhood Program, we cleaned 83% of all refrigerator coils. Our quality control analysis indicates that most customers have already cleaned or intended to clean their coils in the future. We estimate the savings from maintaining clean coils at 3 kWh per month or 36 kWh per year. (See box, "Assumptions.")

Paula Lerner, courtesy of Conservation Services Group

Energy fitness installers instruct customers how to clean refrigerator coils.

Assumptions for Savings Estimates

The savings from low-cost/no-cost measures are very difficult to measure from utility bills. So until submetering data comes in, we've had to go by engineering estimates of these measures. Here is how we calculated them:

Refrigerator Coils

A savings of 3 kWh/mo or 36 kWh/yr is based on the following assumptions:

- The average refrigerator uses 100 kWh/mo.
- A dirty coil reduces the overall efficiency of the refrigerator by 3% or 3 kWh/mo.
- After receiving a demonstration of how to clean the coil by a program installer, customers clean their refrigerators 2–3 times each year using the free brush distributed through the program.

The average measure life for customers cleaning their refrigerator coil is three years.

Air Conditioner Filters

A savings of 75 kWh per year is based on the following assumptions:

- The average window air conditioner uses 250 kWh/mo. for three months a year.
- A dirty filter reduces the overall efficiency of the air conditioner by 10%.
- After receiving a demonstration of how to clean or replace a filter by an installer, the customer cleans the filter once a month during the cooling months.

Faucet Aerators:

A savings of 187 kWh per year in homes using electricity to heat water is based on the following assumptions:

- The average house/apartment kitchen sink uses 10 gallons of hot water each day while a bathroom basin uses 2 gallons per day.
- Half this usage can be impacted by a water conservation device (an aerator has no impact if a customer is filling a sink to wash dishes) and an aerator can reduce flow rates from 3 gallons per minute to 1.5 gpm. Therefore, the savings potential will be 2.5 gallons/day for the kitchen sink and 0.5 gal/day for a bathroom sink.
- Replacement of kitchen sink aerator:

$$1\ ^{Btu}/_{lb/°F} \times 2.5\ ^{gal}/_{day} \times 70°F \times 8.3\ ^{lbs}/_{gal} = 1{,}450\ ^{Btu}/_{day}$$

$$\frac{1{,}450\ ^{Btu}/_{day} \times 365\ ^{days}/_{yr}}{3{,}412\ ^{Btu}/_{kWh}} = 155\ ^{kWh}/_{yr}\ \text{savings}$$

- Replacement of bathroom basin aerator:

$$1\ ^{Btu}/_{lb/°F} \times 0.5\ ^{gal}/_{day} \times 70°F \times 8.3\ ^{lbs}/_{gal} = 290\ ^{Btu}/_{day}$$

$$\frac{290\ ^{Btu}/_{day} \times 365\ ^{days}/_{yr}}{3{,}412\ ^{Btu}/_{kWh}} = 31\ ^{kWh}/_{yr}\ \text{savings}$$

- Clean or replace air conditioner filter. In the same Northeast Utilities program mentioned above, 35% of customers with air conditioning received this service and were given a demonstration by an installer. We estimate the savings per household for maintaining a clean filter at 75 kWh per year.

The energy savings from these measures, however, are not nearly as large for the customer as lighting measures. Customer education encourages consumers to think about conservation more often in their daily lives. This leads to greater customer satisfaction and receptivity to other energy conservation programs. Education is also a cost-effective way to counter the "take-back effect" often associated with retrofit programs. (See "Taking Back the Take-Back Effect," May/June '90, p. 19.)

Lighting Products: Which, Where, and How

The major savings captured by the Spectrum Neighborhood Program come from installing efficient lights. The program also addresses hot water measures, but only where customers have electric hot water. (Energy savings from hot water measures are significant but the saturation rate is low. Because of its older, urban housing stock, very few homes in New England heat water with electricity—generally about 5%. This explains the relatively small average savings per household.) Some savings accrue from customer education and the cleaning of refrigerator coils and changing of air conditioning filters, too. But as much as 80% of the savings come from lighting installations. To achieve these savings, the lighting products selected must cover as many potential applications as possible. The program costs associated with getting into customers' homes are considerable, so installers need to make sure savings opportunities are not lost in any of the homes served.

Using a wide variety of bulb configurations is essential to the program. Installers need to be trained in the applications of a wide variety of compact fluorescent lamps and adaptive hardware, and stock many types to make sure conversions are optimal. (See "Of Sockets, Housecalls, and Hardware," *HE*, Nov/Dec '91, p. 22.)

The compact fluorescents must be truly compact. Although twin tubes are less expensive than quad lamps, they have far fewer applications in the residential sector because of their height. As the number of utilities using compact fluorescents has grown, certain products have been unavailable periodically (and unpredictably). Carrying an array of wattages and styles will allow for greater flexibility in the field and also will help avoid dependence on the availability of one or two products.

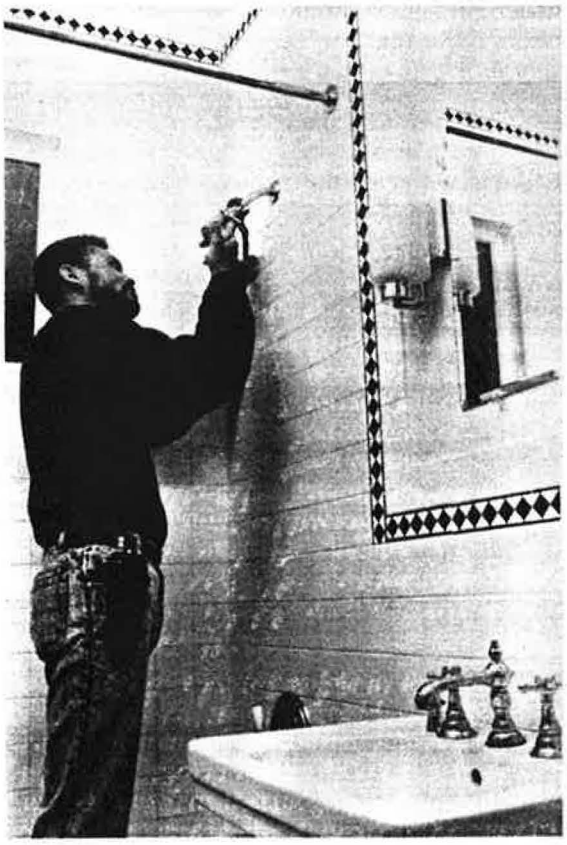
In addition, the installation rate of bulbs is increased by using accessories (adaptive hardware), such as 10 in. and 12 in. replacement harps, harp adaptors, and socket extenders. We've often found as many as 12–15 opportunities to install compact fluorescents per home and have easily installed an average of six bulbs in high-use sockets in low- to moderate-income housing stock. The following bulbs are used in the Boston Edison Energy Fitness Program: 9-watt quad, 13-watt quad, 15-watt integral, two types of 18-watt quad, 20-watt quad, 22-watt quad, and 27-watt quad. (See Table 1.)

Table 1. Average Installation Rates per Bulb Type for an Edison Energy Fitness Program using 2-hr Minimum Burn Time.

Bulb Type	Ballast	Manufacturer	Average per Household
9W Quad	Magnetic	Enertron Ballast OSRAM Tube	0.06
13W Quad	Magnetic	Enertron Ballast OSRAM Tube	1.0
15W Integral	Magnetic	Panasonic	1.2
18W Integral	Electronic	Philips	1.1
18W Integral	Electronic	Sylvania	1.9
20W Integral	Electronic	OSRAM	0.1
22W Quad	Magnetic	Enertron Ballast Panasonic Tube	0.24
27W Integral	Electronic	Panasonic	0.9
	Total per Household		**6.5**

Minimum Burn-Time

Minimum burn-time, established by the utility, is the minimum amount of time a compact fluorescent light



Paula Lerner, courtesy of Conservation Services Group

Removing an old showerhead, an installer prepares the way for a new low-flow model, one of several water conservation measures offered as a part of the program.

should be used in order for it to be cost-effective. By asking the customer how many hours a day each light fixture is used, the installer determines the location and number of compact fluorescent lamps to install.

Establishing a daily "minimum burn-time" is important from the utility, customer, and vendor's points of view. Installers need clear criteria to determine which bulbs to replace in order to maintain consistency throughout the program. Customers often compare notes with each other about how many bulbs they received and where they were installed. Consistency in installations helps alleviate the possible problems that can result. The minimum burn-time means bulbs will be installed in high-use areas, which helps convey a message to the customer about program cost-effectiveness. The minimum burn-time enables the utility to make rough estimates of energy savings; these estimates can be used as benchmarks to evaluate the effectiveness of program delivery through detailed field and phone surveys during the course of the program.

Some utilities choose a lower minimum burn-time, which allows more replacements per household. This tends to make the delivery of the program more expensive but the measure life is longer because rarely used bulbs last longer. A two-hour minimum burn-time leads to an average of 6.5 installed bulbs per household and a four-hour minimum averages 4.9 bulbs.

Installer guidelines should also include the maximum number of bulbs that may be installed per household. A small percentage of customers are interested in as many free products as possible and are not interested in cost-effectiveness. Establishing a ceiling (eight is a reasonable maximum) for bulb installations prevents the installer from being the "bad guy" with a forceful customer.

Staying Out of Hot Water and 'Piggy-backing'

In homes that have electric hot water, all appropriate water conservation measures are installed, including low-flow showerheads and faucet aerators and water-heater wrap and hot water pipe insulation. Homes needing in-depth electric heat and hot water measures are referred to the utility's other electric DSM programs as well.

Conservation Services Group encourages "piggy-backing" as many services as possible from a number of utilities when performing energy fitness-type programs. Installing gas as well as electric domestic hot water measures is an ideal use of the program in terms of cost-effectiveness and customer satisfaction.

Tallying up the Dollars and Sense

In order to be effective, the lighting products installed must remain in the locations where they are installed. For the Spectrum Neighborhood Program, Conservation Services Group compiled field data on measures installed and projected energy savings. Our data show that retention rates are between 92% and 98%. The average number of lighting products installed was 4.78 per

Table 2. Savings and Saturation Analysis for Electric Customers Only, Spectrum Neighborhood Program.

Measure	Estimated Savings	Confidence Factor	Adjusted Estimate	Saturation	Weighted Savings	Measure Life	Cost	Weighted Cost
LIGHTING								
Bulbs	349	0.92	321	1.00	321	14	$76.07	$76.07
Exit Signs	272	0.80	217	0.05	11	20	$19.10	$0.96
Fixture Replacement	296	0.90	266	0.10	27	20	$90.00	$9.00
WATER								
Aerator	187	0.80	149	0.14	21	7	$1.75	$0.25
Showerhead	746	0.40	298	0.06	18	5	$5.75	$0.35
Tank Wrap/ Pipe Insulation	674	0.70	472	0.06	28	10	$16.30	$0.98
Temperature Setback	635	0.40	254	0.03	8	5	$2.50	$0.08
APPLIANCES								
Room A/C Filter	75	0.70	53	0.30	16	3	$2.50	$0.75
Refrigerator	36	0.70	25	0.84	21	3	$4.40	$3.70
TOTAL						471		$92.14

ASSUMPTIONS

LIGHTING		
Compact Fluorescents	Average bulbs installed	4.78
	Average watts displaced	50
	Average annual usage (hrs)	1,460
Exit Signs	Average watts displaced	31
	Average annual usage (hrs)	6,570
Fixture Replacement	Average watts displaced	45
	Average annual usage (hrs)	6,570

WATER MEASURES	
Savings per aerator (kWh)	186
Savings per showerhead (kWh)	746
Savings per tank wrap (kWh)	674
Savings per setback (kWh)	635
APPLIANCES	
Savings per A/C filter	76
Savings per coil cleaned	36

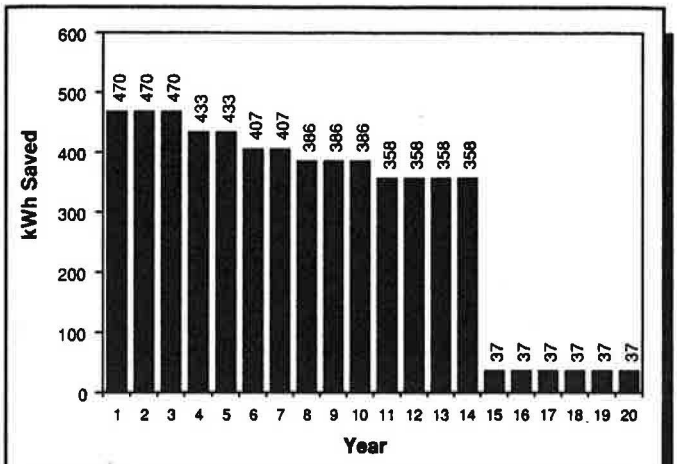


Figure 1. Fitness Program Energy Savings Over Time. Spectrum Neighborhood Program estimates the annual savings each year for 20 years.

household. The average household energy savings calculated for these lighting installations was conservatively estimated at 321 kWh annually or 4,494 kWh average lifetime savings.

Table 2 details the estimated savings and the weighted direct labor and materials cost per average installation. This analysis includes installation of a small number of exit sign retrofit kits and the replacement of a small number of common area fixtures with compact fluorescent fixtures. The analysis assumes that 8,500 installations are completed within a 12-month time-frame. The average number of bulbs installed, 4.78, is conservative. The measure lifetime of a component ballast is 28 years, while the lifetime of bulbs is seven years. This is based on a 4 hr/day usage. For this reason, the average lifetime of efficient lighting products installed is projected at 14 years for all compact fluorescent products. Also, we expect market transformation and customer satisfaction with the efficient technologies will result in the replacement of burned-out efficient bulbs with similar products. Ongoing program designs will assist with the market transformation process and encourage the replacement of one efficient technology with another.

If the savings, charted over time in Figure 1, are assumed to be $0.10 per kWh and are discounted at 11%, the present value of the savings is $295 per installation. This is considerably more than the labor, materials, program delivery, and administration costs, so the benefit/cost ratio is greater than one.

So energy fitness is a cost-effective way to conserve energy when the program is well-executed by a highly trained and motivated crew and if a full complement of lighting, water, appliance, and education measures is utilized. It can help properly serve hard-to-reach customers and provide all customers with a share of the benefits of DSM. ■

Editor's note

Northeast Utilities had an independent evaluation done of the Spectrum Neighborhood Program, but the results were still proprietary at press time. Please note that all savings and cost-effectiveness estimates are based on engineering estimates, rather than measured data at this point in time.