Short-Term Market Intervention: The Key to Long-Term Benefits

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The discussion includes a description of the tripartite strategy which has been designed to facilitate a transformation of the residential lighting market from one where incandescent use predominates to one using compact fluorescent technologies. Predicated on the premise that the retail market for these products is extremely limited, electric utility company intervention is proposed to accomplish the transformation.

Beginning with direct installation, compact fluorescents are provided to customers coincident with the delivery of other conservation services. The second phase of the strategy consists of a mail order catalog which offers a selection of compact fluorescent bulbs and high efficiency fixtures at discounted prices. Together, the first two phases have been implemented to generate consumer awareness of and demand for the products.

That accomplished, the third phase of the strategy, a retail rebate component has been instituted. Under this scenario, the utility, working with lighting manufacturers, wholesalers, and distributors, has obtained shelf placement in retail outlets and offers rebates for the purchase of eligible products.

This paper chronicles the utility's experience from program design through implementation and evaluation stages. The results of these analyses may be of use to others that may be considering a similarly intended DSM initiative.

Introduction

The installation of compact fluorescent (CF) and other highly efficient lighting products present electric utilities and their customers with mutually beneficial opportunities for the conservation of energy and dollars.

Lighting usage accounts for about 20 percent of all of the electricity consumed in the United States costing customers from $29 billion to $47 billion each year (Lovins and Sardinsky 1988). Certainly, compact fluorescent technology is new. Product development and adoption were accelerated in keeping with the pervasiveness of conservation efforts mounted in response to the oil embargoes of 1973 and 1979 (Gilleskie 1991). To date, the majority of utility conservation and load management (C&LM) programs have targeted participation of commercial and industrial customers through a combination of incentives and rebate activities. The magnitude of the efforts is characterized by Northeast Utilities Energy-Saver Lighting Rebate program which has, over the course of six years, achieved an estimated load reduction of 107 MW with expenditures of $42.2 million (Northeast Utilities 1992).

However, attempts to introduce compact fluorescent products to residential markets have been confounded by a number of factors. Technological innovations easily accomplished for commercial and industrial applications have been slow in adaptation for residential applications. Compact fluorescent bulbs are heavier and larger than their incandescent counterparts. Their use is often constrained by their physical dimensions. Customers, unfamiliar with the appearance of the products have been reluctant consumers, a fact exacerbated by the historical lack of retail availability and the seemingly exorbitant shelf prices.

If the conservation potential of residential lighting was to be realized, a significant number of hurdles needed to be overcome. Utility company intervention was deemed necessary to surmount the barriers and facilitate transformation of the residential lighting market. Precedent for such activity can be traced to the origin of the electric industry itself when new-fangled electric lights were pitted against those fueled by gas. In a similar fashion, electric (and gas) utilities are credited with giving rise to the appliance industry. Whether acting for the sake of load building or conservation, utilities have played a major role in shaping society.

Intervention Tactics

Phase One - Direct Installation

Northeast Utilities began installing energy conservation materials in the homes of requesting customers in 1981. This early demand-side management effort offered the installation of water heater insulation blankets and low-flow shower heads at a nominal charge of $5.00 and $10.00, respectively.

Over time, the services offered by the program were expanded to include caulking and weather stripping of windows and doors, as well as other infiltration reducing and domestic hot water conserving measures. The program was known as Operation Wrap-Up/Seal-Up, and it quickly became the centerpiece of NU's residential conservation efforts. In addition to reaching over 230,000 customers with services in a seven-year run, it became a proving ground for testing newly developed or alternative energy conservation techniques and technologies. For example, the activities of Operation Wrap-Up/Seal-Up were used as the baseline for comparative analysis of blower door testing/air sealing versus traditional weatherization treatments. This early work fostered the development of the company's current SPECTRUM™ Conservation Services Program which features the use of blower doors and interior air sealing for electrically-heated homes. Another innovation that can be attributed to the early conservation work was the installation of compact fluorescent light bulbs simultaneous with the delivery of other conservation services.

Northeast Utilities had been seeking opportunities to work with its residential customers-in-need to assist them more effectively in managing their electricity usage and bills. Contracts were established with community action agencies throughout NU's service territory whereby the agencies became an additional weatherization resource serving their clients, our customers. While conservation services for electric heating and electric water heating customers were well-defined and available, there were no electricity-conserving measures offered for general service customers.

This need was quantified in 1987 coincident with the entry of the first generation of compact fluorescents to the market. NU performed cost-benefit analyses of these new products, the results of which indicated that the company could afford to purchase the products and fund an installation fee if customers were to use them for four or more hours a day (Jacobson 1987).

A supply of the bulbs were purchased and provided to the community action agencies for installation. There was only one type provided that was readily available in the quantities required, a 15 W magnetically ballasted globe-type device.

The response was mixed. The agencies reported that the bulbs were fragile and difficult to transport. They were big. Installers reported difficulty in finding lamps or fixtures suitable for application of the products. They made certain table and other free-standing lamps top-heavy given their weight.

Some customers would not allow the bulbs to be installed or removed them shortly after the installers left. They were unusual looking. They provided a quality of light similar to that found in stores and not at all like that from incandescent bulbs. They flickered when the switch was turned on and took a few minutes to reach full brightness, and even then they were not bright enough for some people's needs.

But other recipients liked them. In keeping with the conservation ethic that was in force during those times, some customers embraced the technology. The bulbs lasted far longer than the incandescents that they replaced, which made them especially attractive for use in hard-to-reach places. More than 10,000 of these bulbs were installed in the initial installation effort, but the bulbs were installed wherever they would fit rather than where the customers would use them most often.

Drawing upon the experience gained, NU began to investigate the practicality of expanding the installation of compact fluorescents to nonlow-income customer program participants. In order to overcome the myriad of objections that had been voiced in the initial phase of installation effort, it was apparent that opportunities for improvement existed along both technological and delivery dimensions.

With regard to the hardware, the introduction of harp adapters and socket extenders served to increase the number of locations where the bulbs could be installed. The addition of electronically-ballasted products with improved color rendition was yet another innovation that augured well for customer acceptance. These program enhancements were implemented and offered to nonlow-income customers in late 1987.

The direct installation tactic was further modified and expanded in 1990. The variety of compact fluorescent products manufactured grew as did the applications.

During the design phases of the second generation of Northeast Utilities' C&LM programs, the company entered into a collaborative program design process. The collaborators, impressed as they were with NU's achievements with compact fluorescents, provided the impetus for an increase in scope of the company's overall C&LM efforts.

The collaborators stressed the importance of customer education as an integral feature of program delivery. The point was well taken because the savings forecasted by the company were predicated on the bulbs remaining installed for the duration of their useful lives. As part of this process, guidelines for installation were developed and product lines were expanded. Rather than installing the bulbs on the basis of where they fit, contractors were instructed to match CF lamps with existing incandescent lumen outputs.

The expanded product offerings and the educational enhancements are now a cornerstone technology of NU's residential C&LM retrofit programs. Whether a customer participates in the residential energy audit, domestic hot water, neighborhood, single-family electric heat, multi-family, or public housing programs, the customer is certain to benefit from the installation of compact fluorescent lighting products.

The company had expected that direct installation would garner consumer acceptance for the products and create demand. While that may have occurred, the lack of retail availability continued to hinder market acceptance. The stage was set for the next phase of the intervention.

Phase Two - Catalog Sales

The catalog sales component was conceptualized through the collaborative process in early 1990. As filed with the Connecticut Department of Public Utility Control (DPUC), the catalog was designed to further consumer acceptance for highly efficient lighting products by providing consumers with access to the technologies. In addition to providing customers who participated in the retrofit components with a means of ordering replacement or supplemental products, the catalog would reach many more customers than the retrofit programs could.

The first element of program design to be finalized was the decision to contract with a fulfillment house which, in addition to performing the customer service function of the program, would purchase and supply the products specified by Northeast Utilities for inclusion in the catalog. Even though the retail market for these products was extremely limited, this policy has served to stave off restraint of trade criticism. Manufacturers, wholesalers, distributors, and even certain retailers who voice concern with the company's program are invited to bid on the supply of catalog products, a feature that has proven to be useful to locate supplies sufficient to meet customer demand.

Catalog Product Selection. Three general criteria were used in the selection of products for the catalog: quality, quantity, and applicability. The direct installation tactic had provided NU with experience in all three areas. Our objective was to offer an assortment of quality products that would meet with a majority of residential application opportunities and, to that end, a listing of candidate products was assembled.

The products were grouped by category: modular compact fluorescent lamps, integral compact fluorescents, indoor fixtures, outdoor fixtures, a motion control switch, harp adapters, and socket extender hardware, as well as replacement bulbs for the appropriate products. Both electronic and magnetically ballasted compact fluorescents were included as well as fixtures which were evaluated based on their suitability for installation in residential settings.

The subject of product availability proved to be a difficult area to project. Spot shortages of certain products began to occur with the residential retrofit program and such shortages grew more acute as additional electric utilities began to implement similar programs and competition for the finite production resources grew.

NU commissioned Arthur D. Little & Co. to study the lighting market for compact fluorescent lamps and electronic ballasts. Published in 1991, the report indicated that a market imbalance existed, whereby demand for compact fluorescents would likely outstrip supply for a period of at least two years. Shortages of production machinery and the long lead time necessary to add capacity were cited as the primary cause of the imbalance. To further complicate the issue, a great deal of uncertainty regarding future demand was identified (A. D. Little 1991). Together, these factors suggested that shortages of certain products had the potential to undermine the energy savings and/or customer service effectiveness of the proposed catalog program.

The final selection of products for the catalog was based on inspection of product samples and evaluation performance coupled with the manufacturers' and suppliers' most current estimates of availability. Of course, not having had any previous catalog sales experience, NU's projection of catalog sales activity was, at best, uncertain.

Establishing Pricing. Once the products had been selected and anticipated volumes projected, analyses of program energy savings were conducted as the basis for establishing catalog prices. The objective of this exercise was to offset the price to the customer by the degree of savings from the use of the catalog products when compared to their incandescent counterparts.

Nominal prices were set for compact fluorescents where the savings approached or exceeded the cost of the products as a means of controlling demand. For the most part, CFs were priced at $4.00 each. In a similar manner, pricing for fixtures was established to preclude the perception of the program as a giveaway, resulting in catalog prices of about one-half the suggested retail prices.

Concurrent with the aforementioned activities, NU developed the catalog itself and the attendant marketing plan. It was clear that in addition to being a showcase of the products offered, the catalog ought to serve as a guide for customers to select the most suitable product for their application. The catalog had to serve both as the salesperson and the showroom. Acceptance of the compact fluorescent products requires a shift in the consumers' perception of lighting. This paradigm transition is facilitated in the catalog by copy points that, for example, encourage customers to think of lighting in terms of lumens instead of watts. This is accomplished by differentiating between task and general lighting applications. Product recommendations are grouped according to the customer's need for a particular purpose, i.e., reading vs. ambient lighting.

Catalog Advertising. The catalog was finalized and released in September 1990. A print advertisement campaign was instituted with placements limited to the major Sunday newspapers in NU's service territory. The plan was to have customers call a toll-free telephone number or visit one of the company's offices to obtain a copy of the catalog as opposed to mailing copies to all residential customers. The postage costs for mailing catalogs to all 1.2 million customers exceeded the program's entire annual advertising budget.

Customer response to the offer exceeded company projections. Four incoming telephone lines for customer inquiries were soon expanded to eight. Nevertheless, customers were calling our service centers to report that the 800 catalog line was invariably busy. An hourly phone line use study provided by ATT confirmed the customer reports. For example, nearly 24,000 unsuccessful attempts to connect with one of the eight incoming lines were made between 8:00 and 9:00 a.m. on Monday, October 22, 1990 (ATT 1990). As a result of this study, NU began to stagger the days of the week in which the print ad was placed and rotated the placement among the newspapers.

Customer demand for the catalog outstripped expectations; the initial 100,000-copy supply that was expected to last for 12 months was depleted within 6 months. Customers also ordered more products than were anticipated. After 3 months of operation, the average order was for 11 products at a customer cost of $55.00, figures that have remained relatively constant as the program entered its second year of operation (NU 1992).

Early on, the Company experienced a flurry of complaint activity from participants where they objected not to the products ordered, but to the foam packaging material in which the bulbs were shipped. Switching to a paper-based dunnage system that used recycled and recyclable materials eliminated the complaints and enhanced the beneficial environmental aspects of the program without increasing the frequency of breakage.

Customer Response. Survey work to assess customer reactions to the catalog was undertaken during 1991. Three groups of customers were surveyed: those customers who had ordered products from the catalog, those who had received the catalog and not made any purchases, and those customers who were unaware of the program. A total of 1,494 telephone surveys and 30 on-site interviews were conducted.

When asked for reaction to the catalog itself, 88 percent of purchasers and nonpurchasers reported that they liked it. Aspects reported as favorable included the discounted prices and the informative nature as to how the products could be used. The same groups reported similar reasons for requesting the catalog. In ranked order, they are: energy conservation, long-term saving money on electricity, curiosity about new products, and availability of longer lasting bulbs at discount prices. This ranking is statistically equivalent to when purchasers were probed for their motivation in ordering products.

With regard to product installation and usage, 82 percent from the purchaser group reported that they had installed all or most of the products that were ordered. Further, this same group reported an average usage of just over 6 hours per day for the products that were installed. Fully 90 percent of the purchaser group were satisfied with the products ordered from the catalog, while 6 percent were mostly or very dissatisfied and 4 percent offered no opinion.

Customers that received the catalog but had not yet purchased products reported that their decisions were

influenced more by procrastination rather than perceived drawbacks in the catalog or its products. Eighty-seven percent (87%) of the nonpurchaser group reported their plan to buy something from the catalog in the next 6 to 12 months. Less than 3 percent of this group mentioned bulb shape, limited varieties, bulb brightness, or other reasons for not participating in the program (Bourget 1991).

Displays containing a sampling of the most-often ordered products from the catalog were built and placed in 15 of the company's district offices. In this manner, customers who wanted to see the products could visit a nearby office and see them firsthand. A couple of portable displays were also built and made available for trade shows and fairs.

Through January 1992, about 310,000 products had been shipped to just over 28,900 customers. The return rate for products has been just under 3 percent, the majority of which were returned as the result of being faulty or damaged in transit and not because of customer dissatisfaction.

The catalog has proven to be an effective method of familiarizing customers with highly efficient lighting technologies and distributing products as a means of preparing the market for the third phase of the strategy--the residential rebate component.

Phase Three - Residential Rebates

Two options were considered by NU as the company prepared for the implementation of the third phase of its lighting market intervention--a coupon redemption program and a mail-in rebate program. Each option offered a combination of drawbacks and benefits that were considered in the design of the program regarding how to achieve maximum results and meet the company's goals of transferring the responsibility for product offering to the retail markets.

The first option considered would allow customers to purchase compact fluorescents at retail outlets and tender a coupon at the cashier to receive immediate discounts on the purchase price. This mechanism presented the fewest obstacles for customer participation which would assist in the attainment of the highest levels of participation.

However, drawbacks to this approach were identified during the design process which precluded its adoption. The issue of potential abuse of the coupons was identified as an issue, as misuse is a multimillion dollar industry in the United States even when the face value for the vast majority of the coupons was less than $1.00 (Giges and Alter 1983). Rates for coupon misredemption are estimated to be as high as 30 percent for all coupons redeemed. The value proposed by NU for the lighting coupon was $10.00 per product which may have increased the likelihood for misuse. Another related issue was the report that certain retailers would be reluctant to redeem coupons worth $10.00 as retail cash flows could be effected as they waited for redemption house reimbursement for the coupons. If multiple products were purchased and rebated during each transaction, the retailer's exposure grew.

The coupon concept was further complicated due to the fragmented nature of the Western Massachusetts Electric Company (WMECO) service territory, the locale in which the retail component was proposed to be introduced. By exercising the coupon option, NU could not ensure that the individual redeeming the coupon was a customer of record. The responsibility for such verification was deemed too extensive to rely on cashiers in participating stores. Therefore, the decision was made to utilize a through-the-mail rebate mechanism, trading off the sheer numbers of participants expected through the coupon option for a more measured and controllable approach.

One of the first activities was to establish a contract for the fulfillment of customer rebate requests. This was accomplished through a request for proposal competitive bidding process. The contract was priced on a per transaction basis with NU providing the funds for the rebates. An additional feature of this contract was the contractor consultation service which proved invaluable in the design and production of the rebate instruments and the mechanisms for their processing.

The means by which stores could be encouraged to stock products and participate in the program were identified. Recognizing the constraint of limited personnel and financial resources with which to call on stores to enlist their participation in the program, NU established a noncontractual relationship with a company that already had shelf space for lighting products in the majority of retail outlets in our service territory. In the parlance of retail trade, such vendors are known as "rack jobbers." Through various financial arrangements, they have established store shelf space into which products are placed on a consignment basis. The rack jobber representative visits the stores on a regular basis to replenish inventories and perform routine maintenance of the displays. When approached regarding NU's proposed rebate program, the rack jobber became an enthusiastic participant and supporter of the initiative.

This contractor, a wholesale distributor, had access to almost every compact fluorescent manufacturer's product line. One of the principles of the program design was to offer a selection of products that performed well so as not to alienate consumers from continued used of the technology. This exercise was similar to that undertaken during the product selection phase of the Lighting Catalog except, with more data available for analysis, we expanded our selection criteria to include the electrical performance characteristics of products.

Laboratory tests of compact fluorescents from the catalog revealed that use of the products resulted in undesirable load characteristics. Low power factors in the 40 to 60 percent lagging range for magnetically ballasted units were cited as causing the need for increased volt-amperes to supply the real power (watts) for one bulb. Increased harmonic current generation was another source of concern to NU. Nonlinear loads as replacements for linear loads can decrease the efficiency and reliability of the overall power system (Bowes and Lorusso 1991).

In consideration of these findings, product eligibility criteria were developed using a 90 percent power factor as the minimum performance threshold for magnetically ballasted units and providing for compliance with to-be-developed total harmonic distortion (THD) levels. The criteria, intentionally vague at the outset was established to alert manufacturers that NU was concerned about the poor performance characteristics of many compact fluorescents and signal that utility support for such products would cease. Over time, it is expected that the criteria will be expanded to include other characteristics such as lumen equivalencies and product lifetimes.

A consumer marketing campaign was developed to support the residential lighting rebate program. The research conducted for the Lighting Catalog component suggested that there were several key reasons for customer participation (Bourget 1991). In ranked order, they are:

- Saving money on electricity by using new, efficient bulbs.
- Helping conserve energy.
- Getting the same amount of light for less electricity usage.
- The bulbs last longer than regular bulbs.
- The bulb prices are discounted.

These concepts were translated into copy points for the point-of-purchase support materials; graphics for the displays in which the products would be placed, an informational brochure, the rebate certificate, and window banners. The theme of the effort became "The Light Fantastic."

The network of retailers serviced by the rack jobber were designated as the initial participants in the program, with the expectation that the dealer recognition advertising campaign would elicit the interest of other stores in the area. Kits describing the program's operation were prepared to respond to these inquiries. NU's plan is to decrease the promotion of the catalog and heighten the promotion of the rebate program and eventually eliminate the catalog in favor of the retail rebate component. In the long term, it is expected that increased production of CFs will result in lower retail prices and the need for utility intervention will be obviated once consumer demand has been established.

Results

The results of NU's market intervention thus far have been encouraging with regard to customer acceptance of CF technologies. The degree of market transformation achieved was evident in the survey of Lighting Catalog purchasers, 84 percent of whom had not previously purchased energy-efficient lighting products. Of this group, 93 percent reported that they had not even considered making such purchases prior to receiving the catalog (Bourget 1991). In a subsequent survey, nearly half (45 percent) of the customers who had purchased products said that they planned to make additional purchases of energy-efficient lighting products within the next year (Bourget 1992A).

Results from the direct installation component are similarly favorable. Participants in NU's Neighborhood program were surveyed to determine which CF products installed remained in use, the wattages of the lighting products replaced, and hours of use per day, comparing the new products with the old. Ninety-one percent (91%) said they are still using all of the bulbs that were installed by the program. Of the remaining 9 percent, 6 percent reported the removal of one bulb, 2 percent said two bulbs, and under 1 percent said three or more products. In terms of magnitude, about 2 percent of the total number of CFs installed were removed from service by customers.

Average wattages of replaced bulbs ranged from 67.1 to 79.3 watts with a 13 W CF replacing the 67.1 W unit, the 18 W CF replacing 69.7 W, the 20 W CF for a 73.2 W, and a 22 W for 79.3. Hours of customer average usage were nearly identical when CFs were compared to the

bulbs that were replaced; 5.7 hours for the former vs. 5.6 hours for the latter (Bourget 1992B).

Data to support the evaluation of the rebate portion is in the process of being collected for future analysis. However, the agreement of 30 retailers to stock CFs is indicative of their expectation of consumer demand and participation.

Benefit-to-cost ratios for the two stand-alone lighting interventions, the catalog and the rebate components have been established. Total net benefits on a cumulative present value basis have been calculated over a 20-year planning horizon for each component. The Lighting Catalog benefit-to-cost ratio from the revenue requirements perspective is 2.33. From the societal perspective, the benefit-to-cost ratio is 2.29. The revenue requirements benefit-to-cost ratio for the rebate program is 1.61 and 1.80 from using the societal criteria (NU 1992).

The combined lighting efforts have also resulted in favorable media coverage for NU. Local television stations have featured the products through interviews in the homes of customers who had participated in the program. Newspapers have also given coverage to the program through stores that promote the adoption of CF technologies. One newspaper, *The Hartford Courant*, supported the Lighting Catalog effort with a positive review of the program on their editorial page and, in a break with tradition, listed the 800 customer inquiry number (*The Hartford Courant* 1990). In addition, NU has received numerous letters from customers thanking the utility for sponsoring the program.

By the middle of February 1992, about 240,000 compact fluorescents had been installed through the retrofit programs and over 300,000 products had been distributed through the catalog (NU 1992).

Over time, NU will continue to monitor the customer acceptance of CF technologies and effect improvements in program delivery and product application techniques to ensure that benefits continue to accrue to the company and our customers.

References

Lovins, A. B. and Sardinsky, R. 1988. *The State of the Art Lighting,* Competitek, Rocky Mountain Institute, Snowmass, CO.

Rackie, D. 1992. *Energy-Saver Lighting Rebate Tracking System Report,* Northeast Utilities, Berlin, CT.

Gilleskie, R. J. 1991. *A Summary of Findings On the Electrical Characteristics of Compact Fluorescent Lamps,* San Diego Gas & Electric Company.

Jacobson, B. 1987. Internal Memorandum to Bruce L. Roth, Northeast Utilities, Berlin, CT.

Northeast Utilities 1992. *Conservation and Load Management Department Tracking System,* Rocky Hill, CT.

Arthur D. Little 1991. *Supply and Demand of Compact Fluorescent Lamps and Electronic Ballasts,* Cambridge, MA.

American Telephone and Telegraph 1990. *Blockage Report for 800-622-3133,* Farmington, CT.

Northeast Utilities 1992. *SPECTRUM Lighting Catalog Tracking System,* Rocky Hill, CT.

Bourget Research 1991. *Results of the Energy-Saving Lighting Catalog Survey,* Farmington, CT.

Bowes, K. B. and Lorusso, A. 1991. *Compact Fluorescent Lighting Test,* Northeast Utilities Service Company, Berlin, CT.

Bourget Research Group, Inc. 1992A. *SPECTRUM Conservation Services Neighborhood Program, Neighborhood Program Telephone, and On-Site Survey Final Report,* West Hartford, CT.

Bourget Research Group, Inc. 1992B. *SPECTRUM Conservation Services Lighting Catalog Program Telephone and On-Site Survey Final Report,* West Hartford, CT.

Giges, N. and Alter, J. 1983. "Bill Making Coupon Fraud A Crime Being Proposed," *Advertising Age,* June 6, pg. 2.

Northeast Utilities 1992. The Commonwealth of Massachusetts Department of Public Utilities Application of Western Massachusetts Electric Company for Preapproval of Conservation and Load Management Programs, Berlin, CT.

The Hartford Courant 1990. Editorial, December 17, pg. 32.