The Elements of Sustainability

David C. Hewitt, Northeast Energy Efficiency Partnerships, Inc.

ABSTRACT

What are the elements that turn market effects into market transformation? How are the short-term gains of utility-funded market transformation efforts turned into lasting market impacts? While securing the passage of codes and standards represents a "tried and true" mechanism to secure energy savings over the long-term, what other mechanisms are available, and should be included in market transformation plans, to increase the likelihood of developing sustainable savings?

This paper reviews six long-term and diverse case histories of market transformation efforts, specifically to extract the key elements that aided sustainability of the market changes. The case studies are: manufactured housing in the Northwest, residential gas furnaces in Wisconsin, the impact of the National Fenestration Rating Council in support of residential windows, the Super-Efficient Refrigerator Program, resource-efficient clothes washers, and electronic ballast and T-8 lamps. The paper also discusses how the sustainable strategy elements found in these cases can influence current market transformation initiatives.

Introduction

The six case studies presented in this paper represent a variety of methods to assure that the energy savings achieved through changes to technologies or markets are sustainable over the long-term, and after the withdrawal of all or most of the original program funding. Some of these case studies were designed from their inception with market transformation goals in mind (e.g., the Super-Efficient Refrigerator Program), while others were programs operated under a utility conservation resource acquisition plan that ultimately proved to have staying power (e.g., the Wisconsin gas furnace program). In either situation, the resulting long-term benefits are worthy of review to determine what lessons might be transferable to the current generation of market transformation programs.

The case studies included below track both the program and market results of the individual initiatives. Each case study is presented in a similar format, starting with market issues related to efficiency, then a description of the short and long-term program and market results, followed by an analysis of the key lessons from a sustainability perspective. Common themes are explored in the conclusions section.

Manufactured Housing in the Northwest – 1988 to 2000

Initial Market and Efficiency Issues

Manufactured housing is not required to meet state or local building codes, but instead is regulated nationally by HUD. The HUD standard for energy efficiency was very lax, especially for northern climates. Manufacturers built housing to the lowest allowable levels of efficiency in order to reduce first costs and compete for customers who, typically,

could not afford site-built housing. Manufacturers could readily build to higher efficiency levels by adding additional insulation, specifying better windows and doors, and changing some details of assembly to improve air sealing, but there was not a ready market for the improved product due to the higher costs.

Key Program Strategy Elements

The Bonneville Power Administration worked with other parties to develop a specification to define efficient manufactured housing. The specification included an overall efficiency level for the house shell, quality control measures, third-party certification of efficiency, and additional attention to moisture and air quality issues. The program used a trademarked name from their site-built new construction program, Super GOOD CENTS® (SGC). The initial program strategy was to offer customer incentives covering the costs of the efficiency upgrades. The program included substantial training for the infrastructure and marketing to consumers.

After several years of paying customer incentives, BPA and other utilities offered to pay an incentive directly to manufacturers if they would build all manufactured housing to the SGC level. All manufacturers agreed to the new incentive structure within two months, and customer incentives were replaced with a less expensive one (per unit) paid directly to the manufacturer.

Short-Term Program Results

Using the consumer incentive, and with a substantial marketing effort, after several years SGC achieved a market penetration rate of 22%. The switch to a manufacturer incentive increased the market penetration rate to nearly 100%.

Short-Term Market Results

The program created both a significant increase in the quality of manufactured housing and a significant increase in manufactured housing's market share relative to site-built housing. Quality increased because of the use of better materials (e.g., 2x6 studs rather than 2x3, and vinyl windows rather than aluminum). Sales increased because the manufactured homes could more effectively compete with site-built housing and because some manufacturers used the incentive to help customers with the down payment, thereby increasing affordability. Manufacturers were very pleased with the program results and were enthusiastic supporters of the program. Consumers preferred the SGC housing because of improved comfort, lower energy bills, and overall improved quality. To protect their fuel share, the gas utilities developed a similar program for gas-heated manufactured housing that had the same specifications and was cooperatively marketed.

Longer-Term Program and Market Results

Because of the success and benefits of the initial program, the Northwest was able to get HUD to modify their national standards for manufactured housing efficiency, over the strenuous objections of housing manufacturers from other areas of the country. While the new standards were substantially lower than the SGC specifications, they permanently raised

the floor for manufactured housing. This enabled the utility funders of the program to lower the incentive amount paid per house.

There were several unanticipated results of the success of the program. Most importantly, the high take-up by manufacturers and consumers significantly escalated the costs of the program beyond initial expectations. With the unknown impact of electric industry restructuring in sight, one major utility exercised their option to cease financial support of the program, and all utilities eliminated support within six months.

There was not an "exit" or "transition" strategy in place at the time funding was stopped. However, there have been efforts by some utilities to revert to consumer rebates, and several more coordinated efforts to continue to market the program. Manufacturers agreed to pay a modest ($30) incentive per home to cover quality control and certification costs of the SGC homes, and the infrastructure to assure quality remains in place. However, the market penetration of SGC homes has declined steadily, and is now below 50%

Sustainability of the Market Changes

There are several elements to the sustainability of the changes to the manufactured housing market in the Northwest:

- The HUD code for energy efficiency was increased, resulting in essentially permanent and continuing savings in the Northwest and other areas of the country.
- While the HUD code supercedes state and local building codes, within municipal jurisdictions in many locations (including all municipalities on Oregon) SGC or its equivalent is required by zoning codes in order to site manufactured housing on urban lots. This impacts about 20% of all manufactured home sales in the Northwest.
- Some manufacturers continue to promote and manufacture SGC houses routinely. However, the market share of SGC manufactured housing has eroded substantially over the past four years, since the end of the program. This erosion is occurring despite a project funded by the Northwest Energy Efficiency Alliance (NW Alliance) to coordinate and enhance marketing efforts.
- Nearly all manufacturers now build a "sort of SGC" home (as an upgrade to their base efficiency house) that includes many key energy efficiency features. The presence of SGC in the market forces manufacturers to build houses with competitive features.
- Manufacturers in the Northwest routinely include levels of energy efficiency, even in their lowest-cost houses, that are better than HUD standards would require.

While some savings generated by the SGC program are clearly sustainable due to standards at the federal and local level, savings from market-based (consumer demand) elements are still susceptible to erosion caused by the intense focus of this industry on low first costs as a competitive strategy. Benefits to the broader industry (e.g., increased sales versus site-built housing, or increased profit margin per house) may not be sufficient to maintain the SGC market over time, although efforts to bolster manufacturer support of the SGC program continue.[1] Whether or not this latest effort to promote SGC homes succeeds,

[1] The NW Alliance has recently provided three years of matching marketing funds to an industry-led coalition interested in continuing to support SGC. Manufacturers have agreed to raise per house fees to $100 to provide the administrative and marketing funds needed to continue operation of the SGC program.

manufacturer-developed energy efficiency packages should be sustainable due to their lower costs and the need to compete on features with the products of other manufacturers.

Ratings in Support of High-Efficiency Windows – 1989 to 2000

Initial Market and Efficiency Issues

Windows represented a major lost opportunity in both the construction of new homes and in the replacement market. Significant advances in window technologies had been developed, but higher costs and limited availability were issues. Many utilities were interested in and supported these improved technologies, often within the context of a new construction program. However, the marketplace was very confusing for consumers and building contractors, as the definition of what constituted an efficient window varied and manufacturers made conflicting and sometimes-outrageous claims for energy efficiency. Manufacturers who had invested in upgrading the efficiency of their products (i.e., by using low-emittance coatings or inert gas fills between glazing layers) wanted to take credit for and be able to fairly market their improved products.

Key Program Strategy Elements

In order to ensure that utility programs and consumers could identify and purchase efficient windows when desired, utilities, researchers, government, and larger window manufacturers agreed to develop a single protocol for testing and rating windows for key energy-efficiency related features. The National Fenestration Rating Council (NFRC) was formed in 1989 to develop rating procedures and testing protocols, and began publishing window ratings as they became available (beginning in 1994). Utilities started to require NFRC-rated windows in their programs to qualify for incentives or loans. Some state building codes also required NFRC ratings to replace several earlier and inconsistent rating systems that had little to do with efficiency.

Short-Term Program Results

Requirements were placed in utility programs with sufficient lead-time to allow manufacturers to prepare for the changes. A review of the windows market in Massachusetts resulted in a recommendation to change the Massachusetts Residential Building Code to require NFRC-rated windows (of a specified U-value for replacement windows), a process that resulted in a complete overhaul of the code, resulting in significant energy savings through windows and other energy features.

Short-Term Market Results

Because major manufacturers were involved in the development of the NFRC specifications and understood the benefits of rating and labeling, they readily adopted the protocols and began testing and labeling their windows. Utilities sometimes helped smaller manufacturers fund the rigorous testing protocols. The number of windows tested increased dramatically over a two-year period. Virtually all nationally-distributed window manufacturers, and those with commitments to improved window technologies, supported

the program. However, regional/local manufacturers often were not aware of the NFRC system if there were no code or utility program requirements in their area. Some types of window manufactures, notably those of metal frame windows, were competitively disadvantaged because their products could not compete on the consistent rating scale due to heat loss through the frame. Many aluminum-frame window manufacturers switched to the production of vinyl windows to improve thermal efficiency. Other manufacturers made smaller changes that were low cost but had some impact on ratings (i.e., such as the use of "warm-edge" spacers to separate glazing layers and reduce heat loss at the edges of the glazing, or improved weather-stripping).

Longer-Term Program and Market Results

While the NFRC rating system had some immediate payoffs, the label was technical in nature, and therefore not friendly to consumers and builders. Any window could have an NFRC label, as the label simply coveys testing results. Several parallel efforts are now underway to improve the marketing appeal. Windows are now covered with an ENERGY STAR® label. The transition to ENERGY STAR® is very straightforward to manufacturers who participate in NFRC rating and labeling, as ENERGY STAR® relies on the rating to determine which products meet a given efficiency threshold. The threshold values are climate specific, with separate thresholds for cooling-dominated climates, heating-dominated climates, and combined heating/cooling climates. In addition, the manufacturers who started NFRC are working with the Alliance to Save Energy to provide more detailed training and support to builders and window vendors in selecting the appropriate, climate-specific windows for their applications.

Sustainability of the Market Changes

- NFRC has been adopted by the vast majority of window manufacturers as the standard energy-related certification method. The rating system is well integrated into the industry.
- Leadership by major manufacturers brought the entire industry along; manufacturers wanted to recover R&D expenses and to profit from their leadership.
- NFRC ratings were specifically developed with an eye to building codes, and indeed have been incorporated in many code upgrades.
- Consistent ratings also supported changes in manufacturing to further incorporate energy efficiency, including minor changes such as glazing spacer technology, and major changes such as vinyl rather than metal-framed windows.
- Other projects are aimed at improving the marketing of efficient windows, but rely on the NFRC ratings as an underlying methodology for determining efficiency.

Resource Efficient Clothes Washers – 1989 to 2000

Initial Market and Efficiency Issues

European clothes washers used substantially less energy and water than U.S.-made equipment and washed clothes at least as well. However, the European machines were smaller, loaded from the front, and were substantially more expensive than U.S.-made

washers. Sales of resource-efficient clothes washers were flat (at about 1% of the market), and U.S. manufacturers had little interest in redesigning their products when consumers were satisfied with their current clothes washers.

Key Program Strategy Elements

In 1989, DOE noted that Federal Appliance Standards for clothes washers might be based on the horizontal-axis technology found in the European-made models. Utilities worked together through the Consortium for Energy Efficiency (CEE) to support resource-efficient clothes washers (RECWs) through the development of consensus technical specifications and model program designs, which were broadly circulated in 1993. Various utilities across the country, most notably in California, began to offer customer rebates for the purchase of clothes washers that exceeded the technical specifications.

Short-Term Program Results

Sales of RECWs did not meet program expectations, despite the provision of substantial rebates. Most consumers did not want to purchase the higher-priced and smaller European clothes washers, which were the only models available in the first years of the program.

Short-Term Market Results

The availability of rebates and the threat of possible federal standards encouraged manufacturers to develop and test-market new models of RECWs. Product developments were closely guarded information; several manufacturers were in the race to develop RECWs that would meet the expectations of the U.S. market.

Longer-Term Program and Market Results

Two broader-scale rebate, marketing, and retailer support programs were developed – first in the Northwest in 1997, then in the Northeast in 1998. These programs began operation shortly after the availability of RECWs from two U.S. manufacturers. While these new models were significantly more expensive than standard washers and loaded from the front, their size, features, brand names and availability, combined with support from utility programs, lead to a dramatic increase in sales. Sales in areas with program support from utilities rapidly went above 10% market share. Sales in other areas of the country also increased several-fold. Manufacturers began expanding production capacity and adding new models to their lines.

The receptivity of consumers to the U.S.-made RECWs, supported by strong data on resource savings and favorable customer attitudes, has increased the opportunity to develop a strong Federal Appliance Standard for clothes washers in the near future. Standards could be in place as early as 2004.

Sustainability of the Market Changes

There are several aspects to the sustainability of RECWs in the market:

- Sales of RECWs, even at current high prices, are sufficiently strong to demonstrate that these products have created a profitable niche market less than two years after product introduction.
- RECWs have substantial non-energy benefits that have helped drive sales and customer satisfaction. Benefits include water savings, detergent savings, ability to handle bulky items, large total capacity, improved cleaning ability, and improved gentleness on clothes. The two U.S. models were top- ranked in a recent *Consumer Reports* test.
- Manufacture of RECWs, at least for horizontal-axis machines, is a substantially different process. Large investments were made by manufacturers to change their product lines. These changes are not readily reversible.
- There is a very realistic opportunity to create a strong National Appliance Standard to ensure that all clothes washers sold are energy efficient. In May 2000, the appliance manufacturing industry and energy efficiency advocates agreed to a "negotiated standard" which will likely be adopted as the new Appliance Standard by DOE.

Residential Gas Furnaces in Wisconsin – 1982 to 1996

Initial Market and Efficiency Issues

High-efficiency gas furnaces were available in the Wisconsin market, but sales were uncommon due to high cost, concerns about reliability, and differences in installation practices compared to standard-efficiency furnaces. Cooling the flue gases to extract more heat meant that potentially corrosive gases would condense on the heat exchangers, causing premature failure of a critical, and safety related, component. The sales and service industry was concerned about call backs, liability, and warranty issues, and was reluctant to sell high-efficiency equipment, even to customers who wanted to reduce energy bills.

Key Program Strategy Elements

Utility and government programs to promote high-efficiency furnaces began in 1982. Many initial installations were in utility-funded, low-income weatherization programs; utilities offered rebates for other customers. As part of the requirements for inclusion in their programs, utilities required manufacturers to provide adequate warranties, especially on the vulnerable heat exchangers. Utilities also provided training and quality control inspections to ensure that contractors installed the new equipment properly.

Short-Term Program Results

Over 16,000 high-efficiency furnaces were installed through low-income programs. Consumer rebates began increasing market share in the general market. By 1989, the last year utility rebates were offered, high-efficiency gas furnaces had a 70% market share of gas furnace sales.

Short-Term Market Results

All manufacturers began to offer longer warranties so that they could participate in the utility programs. The longer warranties removed a critical risk from the sales and

services infrastructure. An infrastructure gradually developed that believed in the equipment and knew how to install it properly. Increased competition among vendors led to reduced prices.

Longer-Term Program and Market Results

Even six or more years after the conclusion of the program, prices for high-efficiency gas furnaces were lower in Wisconsin than in other northern climates in the U.S. Sales continued after the rebates ended in 1989, moving from about 70% market share in 1989 to about 90% market share in 1995. There has been some erosion of market share in recent years, due to price competition in the southeast corner of the state.

Sustainability of the Market Changes

- The incremental costs of high-efficiency equipment have been reduced in Wisconsin (from about $1,000 to $465) due to familiarity with the equipment and installation practices, and to competition with other suppliers for similar equipment. (In other cold climates, high-efficiency equipment has a greater price premium, perhaps because it is positioned as a premium product competing with standard efficiency equipment.)
- The attitudes and behavior of contractors regarding high-efficiency equipment have changed significantly. Most would now consider it a disservice to their customer to install anything but high-efficiency heating equipment. However, a few contractors and some homebuilders are promoting standard-efficiency heating equipment as a way of reducing first cost by a few hundred dollars. There are concerns that this trend might continue.
- Savings are not locked in. That is, there are no requirements that only high-efficiency equipment be sold, although a law governing the resale of rental properties requires energy upgrades at the time of sale, with high-efficiency heating equipment listed as an optional measure.
- The market share of high-efficiency gas furnaces continued to grow after the end of program rebates, and continues at a very high level, about 85%.

Super-Efficient Refrigerator Program (SERP) – 1992 to 1998

Initial Market and Efficiency Issues

Research completed by the U.S. DOE, EPA, and others indicated that refrigerators could be developed that used 25% less energy than the 1993 federal minimum efficiency standards. However, consumer interest in more efficient refrigerators was limited, and the cost to develop and produce such a unit was estimated to be tens of millions of dollars. Manufacturer risks appeared to be greater than potential manufacturer rewards.

Key Program Strategy Elements

Multiple utilities from across the country pooled incentive dollars and issued a request for proposals, with the winning manufacturer to receive all $30 million. The

manufacturer who could deliver the most energy savings, with reasonable assurances of success, would receive the contract.

Short-Term Program Results

Whirlpool was selected as the winner of the contract, and developed a side-by-side refrigerator that met the program guidelines. The winning models were supposed to be sold (at a reduced cost) in the service territories of utilities that supported the program. There were a variety of administrative and tracking problems, and some utilities were not satisfied that their customers received the benefits that the utilities had paid for. Many supporters did not consider that a side-by-side refrigerator could win the contract, and particularly in older housing stock found in the Northeast, the refrigerator did not meet customer's requirements to fit in smaller kitchens.

Short-Term Market Results

The manufacturer produced the required number of units, but had difficulty in selling the refrigerator developed through the program in areas of the country where rebates were not available to lower the price. The manufacturing changes were incremental to an existing product and readily reversible. The model was eventually discontinued and production ceased.

Longer-Term Program and Market Results

The efficiency gains of the SERP refrigerator set the stage for an updating of the Federal Appliance Standards covering refrigerators because it indicated that obtaining these higher efficiency levels was possible using existing, cost-effective technology. Although there were substantial delays caused by wrangling over the future of appliance standards, ultimately a consensus standard was developed that increases the efficiency of all refrigerators by 25% to 30%. It will go into effect in 2001.

There is also evidence that other manufacturers offered high-efficiency refrigerator models in response to the SERP contest because the Whirlpool unit demonstrated that off-the-shelf components could be used to make significant efficiency gains.

Sustainability of the Market Changes

- The SERP award was successful in attracting competitors and funding a mechanism to overcome the costs of developing new prototypes for efficient refrigerators.
- While SERP effort could have been judged a failure based on the initial program and market results, the development of a stringent Federal Appliance Standard was at least partly based on the technical achievements represented by the SERP refrigerator. (Federal standards were increased by 25% to 30% for most types of refrigerators, effective 2001.) Additionally, other (none winning) manufacturers developed more energy efficient models to ensure that they could compete.
- Project supporters recognized the value of national collaboratives among utilities, and developed the Consortium for Energy Efficiency to continue coordination and development of multi-utility efforts.

Electronic Ballasts and T-8 Lamps – 1986 to 2000

Initial Market and Program Issues

Commercial lighting is the largest single end-use of electricity in the U.S., so even small changes in the efficiency of technologies translate into large energy and demand savings. Reduced lighting loads also mean reductions in cooling loads for larger buildings. While the use of electronic ballasts and T-8 lamps could easily be accommodated in many existing lighting design layouts, higher prices and initial performance issues with electronic ballasts slowed their adoption.

Key Program Strategy Elements

Lighting rebate programs were a large part of the resource acquisition programs of utilities. Typically, payments were based on estimated savings using standard protocols.

Short-Term Program Results

Programs were often fully subscribed, or even over-subscribed, as firms competed to utilize the utility rebates. Much of the activity was for retrofits. The total volume of qualifying installations was very large; by some estimates, more than half of utility DSM expenditures in the C&I sector have been to support electronic ballasts and T-8 lamps.

Short-Term Market Results

Most end-users, and many other market actors, became aware of electronic ballasts and T-8 lamps through interaction with utility programs. Sales increased very strongly to meet demand. Distributors and contractors became proactive in promoting energy-efficient lighting because of the potential profits to their businesses. Utility efforts drove improvements in product quality for electronic ballasts.

Longer-Term Program and Market Results

The utility strategy pursued energy savings as resource acquisition, not as market transformation. However, it became clear that the programs were creating "spillover," that is energy savings beyond that directly purchased by the utilities. As prices were reduced, the market began to install electronic ballasts and T-8 lamps in projects that were beyond the scope of utility funding. Utilities were able to reduce rebates and/or adjust target markets because many aspects of the market were adopting these higher-efficiency lighting technologies.

Expansion in demand for electronic ballasts and T-8 lamps intensified competition between manufacturers, leading to enhancements in reliability, the addition of product features, increased promotion, and reduced prices.

Sustainability of the Market Changes

- Prices have dropped substantially for both electronic ballasts and T-8 lamps. For example, from 1992 to 1996, the incremental prices were reduced by about 50% for both

products. At current prices, use of electronic ballasts and T-8 lamps falls within the financial parameters of most end-users.

- According to California data, the market share of electronic ballasts is now over 50% of all ballast shipments in areas where utility programs operated. T-8s show similar effects.
- In the Northeast, the market share of electronic ballast and T-8s appears to be even higher; both products are standard practice in new construction and retrofits in New England. Many specifiers believe that the efficient products are superior to standard products, and routinely include them in projects.
- DOE has recently issued a rule regarding ballast efficiency, and electronic ballasts will be required in the future. Manufacturers had already largely made the investment in new facilities or manufacturing lines.
- New market actors entered the lighting field to provide services in utility programs.
- Broad adoption of these technologies has set the stage for decreased lighting power densities in state building codes.

Conclusions

While the case studies were selected to illustrate a variety of points, there are some common lessons that can be drawn from them.

- All market transformation initiatives should consider the potential role for codes and standards. Codes and standards can be used to "raise the bar" for efficiency (SERP), to backstop gains already made in the market (SGC), or as a way to force the industry to adopt common specifications or ratings (NFRC). Program developers should look beyond the obvious roles of codes and standards and consider any possible linkages that could develop over time. There may be local zoning ordinances or opportunities for adoption as a specification by a national trade association that could have similar impacts.
- Several programs were successful in changing the market within a state or region (for example SGC and the Wisconsin furnace experience), but these efforts did not necessarily translate into national market changes of the same level. These markets may be good candidates for future action by other states, or a coordinated national effort.
- While the initial costs of advanced, energy-efficient technologies may be high, prices drop significantly once there is full competition between energy efficient products (as opposed to positioning energy efficiency as a "premium" product, which frequently happens initially). These price reductions are predictable as the technology and the market mature, and can dramatically influence the cost-effectiveness of the effort.
- Several initiatives have used market dominance as a way to create long-lasting changes – commercial lighting, SGC, the Wisconsin gas furnace example. These three initiatives were not focused originally as market transformation efforts. A challenge to current and future initiatives will be how to get these types of long-term changes without the amount of time and financial investments required by these earlier efforts.

In general, each market transformation initiative will need to chart a specific path to success. However, part of charting that path should be consideration of specific changes to the market that will help "lock-in" savings, and recognition that these changes need a separate course of action from program activities designed to increase sales or awareness. Charting a path to a transformed market is likely to require actions beyond simply supporting

market growth, and these actions require separate attention in the planning, implementation, and evaluation stages.

References

Carmody, J., S. Selkowitz, and L. Heschong. 1996. *Residential Windows: A Guide to New Technologies and Energy Performance.* New York, N.Y.: W.W. Norton and Co.

Hewitt, D., J. Pratt, and M. Quaid. 1995. *Windows of Opportunity: Residential Window Efficiency and Opportunities for Market Transformation in Massachusetts.* Boston, Mass.: Boston Edison DSM Settlement Board.

Hewitt, D., J. Pratt, and G. Smith. 1998. *The Super GOOD CENTS® Manufactured Housing Venture: Baseline Market Assessment and Market Characterization.* Portland, Oreg.: Northwest Energy Efficiency Alliance.

Hewitt, D., J. Pratt, and G. Smith. 1999. *WashWise/ENERGY STAR® Resource-Efficient Clothes Washer Program: Market Progress Evaluation Report #3.* Portland, Oreg.: The Northwest Energy Efficiency Alliance.

Nadel, S. 1994. *Using Utility Demand-Side Management Programs to Spur the Development of More Efficient Appliances.* Washington D.C.: American Council for an Energy-Efficient Economy.

Nadel, S. and L. Latham. 1998. *The Role of Market Transformation Strategies In Achieving a More Sustainable Energy Future.* Washington, D.C.: American Council for an Energy Efficient Economy.

Pacific Energy Associates, Inc. 1998. *Coming Clean About Clothes Washers: An Initial WashWise Program and Market Progress Report.* Portland, Oreg.: The Northwest Energy Efficiency Alliance.

Rosenberg, M., M. Rufo, A.Besa, and M. O'Drain. 1998. "The Market Effects of SDG&E's and PG&E's Commercial Lighting Programs." *In Proceedings of the ACEEE 1998 Summer Study on Energy Efficiency in Buildings.* Washington D.C.: American Council for an Energy-Efficient Economy.

Schlegel, J. 1996. *Evaluating Market Transformation Initiatives: Issues, Challenges, and Experience to Date.* Paper presented at the NARUC-EPA Workshop, Tampa Fl., 1996.

Suozzo, M. and S. Nadel, 1996. *Learning the Lessons of Market Transformation Programs.* Washington D.C.: American Council for an Energy-Efficient Economy.

Vorsatz, D. et al. 1997. *Lighting Market Sourcebook for the U.S.* LBNL 39102. Berkeley, Calif.: Lawrence Berkeley National Laboratory.