

**SUPER-EFFICIENT REFRIGERATOR
PROGRAM (SERP) EVALUATION
VOLUME 2: PRELIMINARY IMPACT AND
MARKET TRANSFORMATION ASSESSMENT**

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FOREWORD

This report is one of a two-volume set providing results from Pacific Northwest National Laboratory's evaluation of the Super Efficient Refrigerator Program. The reports were prepared for the U.S. Department of Energy.

The first volume presents the process evaluation of the Program. The second volume presents the results from the preliminary impact evaluation and the market transformation assessment.

Either report can be obtained by contacting James Brodrick, U.S. Department of Energy, at 202-586-5253. The reports can also be obtained by contacting the lead authors. Volume one is available from Linda Sandahl at 503-417-7554. Volume two is available from Allen Lee at 503--417-7556.

ABSTRACT

The Super Efficient Refrigerator Program (SERP) is a collaborative utility program intended to transform the market for energy-efficient and environmentally friendly refrigerators. It is one of the first examples of a large-scale "market transformation" energy efficiency program. This report documents the preliminary impact and market transformation evaluation of SERP ("the Program"). Pacific Northwest National Laboratory (PNNL) conducted this evaluation for the U.S. Department of Energy.

This study focuses on the preliminary impact evaluation and market transformation assessment, but also presents limited process evaluation information. It is based on interviews with refrigerator dealers and manufacturers, interviews with utility participants, industry data, and information from the Program administrators. Results from this study complement those from the prior process evaluation also conducted by PNNL.

SUMMARY

The Super Efficient Refrigerator Program (SERP) is a collaborative utility program intended to transform the market for energy-efficient and environmentally friendly refrigerators. It is one of the first examples of a large-scale "market transformation" energy efficiency program. This report documents the evaluation of SERP ("the Program") across all 24 participating utility service areas. Pacific Northwest National Laboratory (PNNL) conducted this evaluation for the U.S. Department of Energy at the request of SERP, Incorporated.

This study includes the preliminary impact evaluation and market transformation assessment. It also presents process information on SERP from a prior study and data collected for the current study. It is based on refrigerator dealer site visits and interviews, manufacturer interviews, industry data, and SERP, Inc., information.

SERP, Inc. was created in 1991 to conduct a competition to select a manufacturer to design, produce, and sell SERP refrigerators. Whirlpool Corporation won the SERP competition to produce a chlorofluorocarbon-free (CFC-free), super high efficiency refrigerator. In mid-1994, the first units were sold. The Program is scheduled to last until mid-1997. The winning refrigerators are large, side-by-side units. Through SERP, Inc., utilities provide an incentive payment to Whirlpool for SERP units sold.

SERP'S OBJECTIVES

One major Program objective was to promote the production and widespread marketing of a super-efficient refrigerator that did not use CFC refrigerants. Whirlpool's SERP models clearly met these requirements. In addition, numerous models of other high-efficiency, CFC-free refrigerators have become available since SERP began.

The second major objective of the Program was to support the planned 1998 DOE efficiency standards upgrade. Successful construction of a SERP unit demonstrated that achieving higher standards with a CFC-free refrigerator was technically feasible, at least in the side-by-side style. The economic viability issues have not been completely resolved, however, because the SERP incentive payment has partly offset SERP's price impacts.

PROGRAM IMPLEMENTATION

Although Whirlpool has conducted a systematic training process, dealer interviews revealed that only about one-third of salespeople indicated that they had been trained adequately about SERP.

Promotion was important to stimulate and maintain consumer interest in SERP. The Program received extensive media coverage at its beginning. Media advertising, SERP floor models, in-store promotional materials, and utility promotions have been key ingredients to promote SERP sales.

Despite Program planners' intentions, SERP retail prices were higher in many stores than the prices of comparable units. This has diminished SERP sales, which appeared to be very sensitive to price.

Information flow and communication problems have been one source of difficulties encountered in Program implementation. Inadequate dealer and salesperson understanding of the sales tracking requirements have contributed to diminished SERP sales and documentation. Some utility activities helped improve dealers' understanding.

Sales tracking has turned out to be very complex and difficult to implement. Dealer sales information flow to Whirlpool has been slow or non-existent for some dealers. The automated tracking system of some large dealers, however, has worked very well. Tracking began to show signs of improvement in early 1996 and Whirlpool moved towards an automated tracking system for larger independent dealers..

Sales tracking has been complicated by the "cross-border" issue that arises when SERP units sold by a SERP dealer are sited in the territory of another SERP or non-SERP utility. Difficulties generating accurate lists of utility zip codes in SERP areas initially aggravated the tracking problem and created considerable difficulties for Whirlpool.

The geographic dispersion of the SERP utilities has increased the tracking problems. It's also increased the probability of misclassifying dealers.

PROGRAM IMPACTS

Estimating Program impacts was hindered by the lack of key data and the fact that this evaluation was conducted relatively early in the Program. We developed several findings about preliminary Program impacts, but caution the reader, however, that these findings are incomplete and need to be enhanced with more complete data and additional analysis.

When this report was prepared, SERP unit shipments were reported to be about 64% of projected levels and incentive payments were only about 37% of the original sales projections, in part because of delays in the reporting system. Sales rates varied substantially across utilities; it appeared that higher sales were generally correlated with higher electricity rates.

The energy savings associated with SERP were difficult to estimate and were complicated by the market transformation characteristics of the Program. The free driver effects had to be assessed because of their potentially large impacts.

The energy efficiency of side-by-side units improved for all brands between 1993 and 1996. In 1996, Whirlpool's average consumption was about 25% less than the maximum allowable amount and other brands averaged 7.5% below the maximum allowable level. SERP appeared to be responsible for much of Whirlpool's increase and contributed to a modest increase in the efficiency levels of other brands.

We estimated that each SERP refrigerator saved about 331 kWh/year, averaged over all the SERP models. This estimate took into account a general 5% reduction in consumption that probably would have occurred without SERP.

Several categories of free driver effects existed, with the most significant probably being energy savings from future sales of higher efficiency refrigerators after SERP ends. Free rider effects appeared to be minimal.

We estimated that total utility costs average about \$124 per SERP unit receiving an incentive payment. Despite Program planners' original expectations, dealers on the average were charging consumers about \$80 more for SERP models than for comparable units.

We conducted a preliminary benefit-cost analysis using the total resource cost (TRC) perspective. The baseline TRC benefit-cost ratio for the Program would be about 2.7 (i.e., participating utilities would reduce energy costs \$2.7 for each dollar they spent on the Program). The results should be considered preliminary and are subject to the following constraints and assumptions: 1) Program costs include only the average utility cost, 2) the average electricity avoided cost is 8.41¢/kWh (reflecting the assumptions of the Energy Guide Label), 3) electricity prices are constant in the future, 4) the real discount rate is 5%, and 5) there are no free driver or free rider effects.

If, however, both consumers paid more for a SERP unit (as we found for some dealers) and Whirlpool received an incentive payment for the unit, the benefit-cost ratio could be reduced substantially. If the average incremental cost to consumers were included, the benefit-cost ratio would decline about 39% to 1.7.

Of the free driver effects, future sales of efficient units could have the most impact, increasing the benefit-cost ratio to 6.7??, more than double the baseline value.

The TRC perspective did not include two potentially large Program impacts that should be credited to SERP. One was the benefits of more efficient refrigerators in all those utility areas that were not SERP participants. The second was externalities associated with energy savings. A societal test would include these benefits.

MARKET TRANSFORMATION

All demand-side management (DSM) programs produce some degree of market transformation and there is no point at which a standard DSM program suddenly becomes a market transformation program. Because SERP accomplished some market transformation, the issue addressed here was in what ways and to what degree SERP transformed the market. We answered this question by assessing SERP's accomplishments against a checklist of effects indicative of market transformation.

SERP was intended from the beginning to lead to the design, production, and sale of a super-efficient, CFC-free refrigerator and it succeeded. Although sales have been below original projections, the SERP refrigerator was successfully marketed and captured about 14% of its market segment overall.

SERP prompted some behavioral changes by manufacturers. The changes tended to be competitive responses to the presence of SERP refrigerators in the market, rather than sweeping, institutional changes. Manufacturer changes induced by SERP were constrained by characteristics of the refrigerator market. SERP accelerated the conversion to CFC-free refrigerants, but the effect was modest. SERP was partially responsible for manufacturers increasing their efficiency levels. In mid-1993 no models were available that exceeded the 1993 standards by 25%; by January 1996, there were more than 75 models that consumed at least 25% less than the maximum permitted by the standards.

Dealers played a critical role in SERP. Their awareness, attitudes, and actions could affect consumer purchases significantly. Although dealers generally provided information to consumers about SERP refrigerators, there was little evidence of dealers actively promoting SERP units. Most SERP dealers displayed information about SERP on the refrigerators and some set up special displays that were very effective at generating consumer interest in SERP. Small dealers often had no SERP models on display and this led to fewer sales. SERP dealers were more likely than non-SERP dealers to promote energy efficiency and CFC-free refrigerants in general.

We did not collect consumer information directly so our conclusions about consumer attitudes and behavior were limited. About 40% of SERP dealers said that over half their customers asked about energy efficiency. Consumer interest in energy efficiency was slightly higher in the SERP areas than in the non-SERP areas, and also appeared to be correlated with local electricity prices. Early media promotions stimulated a high level of consumer awareness about and interest in SERP, but consumer awareness and interest fell substantially when publicity declined.

Where utilities had taken an active role in promoting SERP or had conducted energy-efficient appliance programs, their actions usually had a very significant positive influence on consumer and dealer attitudes and responses. Effective activities included providing rebates, establishing an "energy store," and sending out "bill stuffer" information.

Market transformation implies that effects extend beyond direct program participants. We have concluded from the available evidence that SERP was partially responsible for significant efficiency increases in numerous Whirlpool refrigerators and a modest increase in the average efficiency of other brands. There was some evidence that consumer awareness about energy efficiency increased because of SERP, leading buyers to purchase more efficient units, even if not SERP models.

Successful market transformation produces persistent changes in the market. There was little evidence that consumer or dealer attitudes and behavior had been modified sufficiently by SERP to persist after the Program ended. It appeared, however, that SERP induced technology changes and efficiency improvements that would last after the Program ended. As anticipated by Program planners, SERP's most significant lasting impact could be its effect on the next generation of refrigerator efficiency standards. SERP demonstrated that efficiency improvements of as much as 41% over the 1993 standards could be accomplished without the use of CFCs or exotic technologies.

The possibilities of SERP succeeding as a market transformation effort were limited by the context in which the Program occurred. The CFC phaseout schedule, for example, and the success of previous refrigerator efficiency standards limited the market transformation impacts that SERP could achieve. Many dealers noted that they emphasized energy efficiency to their customers by comparing the consumption of an old refrigerator with any new refrigerator because all refrigerators were now required to meet the 1993 standards. This meant that the additional energy savings of SERP refrigerators were at the margin, and hard to justify, if the consumer had to pay any additional amount or preferred styles or features not offered in the SERP units. Because of these limitations, it should not be surprising that few observers would attribute major market changes to the Program.

Although external factors limited the market transformation impacts of SERP, there were actions that could be taken to improve the Program and future market transformation programs. This report presents several key recommendations.

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1.0 INTRODUCTION AND OVERVIEW

The Super-Efficient Refrigerator Program (SERP) is a collaborative utility program intended to transform the market for energy-efficient and environmentally friendly refrigerators. It is one of the first examples of a large-scale "market transformation" energy efficiency program. This report documents the preliminary impact and market transformation evaluation of SERP ("the Program") across the utility regions in which the Program is being conducted. Pacific Northwest National Laboratory (PNNL) conducted this evaluation for the U.S. Department of Energy (DOE).

This report presents the process evaluation, preliminary impact evaluation, and market transformation assessment. Chapter 7 summarizes our evaluation findings and presents recommendations to improve the Program, conduct future analysis, and design future market transformation programs.

PNNL previously completed a process evaluation of the Program (see Sandahl et al. 1996). We also have conducted an overall evaluation of the Program (Lee and Conger 1996) for one of the participating utilities, the Bonneville Power Administration (Bonneville). Bonneville is participating in SERP on behalf of its public utility customers in the Pacific Northwest.

This chapter presents an overview of SERP and its market transformation characteristics. It also presents an overview of the evaluation approach.

1.1 SUPER-EFFICIENT REFRIGERATOR PROGRAM

Nationally, refrigerators represent a significant share, about 14%, of total residential electricity use. For years, utilities have been conducting demand-side management (DSM) programs to improve the efficiency of refrigerators.

In 1987, 150 nations, including the United States, signed the Montreal Protocol. The protocol prohibits, after January 1, 1996, the use of chlorofluorocarbons (CFCs) to manufacture foam insulation and serve as refrigerants. Research suggested that non-CFC refrigerants would reduce cooling efficiency, thus making it harder to achieve refrigerator efficiency improvements.

SERP arose out of utility and environmental group concerns that refrigerator efficiency improvements were likely to slow dramatically when these limitations on the use of CFC refrigerants went into effect. In the past, experts anticipated that non-CFC refrigerants would incur a 15% efficiency penalty.^(a)

In 1991, the SERP non-profit corporation was formed. Twenty-four utilities created SERP to advance the technology of super-efficient refrigerators and bring them to consumers years ahead of when the market was expected to provide them. The Natural Resources Defense Council, American Council for an Energy-Efficient Economy, Washington State Energy Office, and U.S. Environmental Protection Agency joined the utilities in developing the program.

The member utilities committed over \$30 million for a process through which refrigerator manufacturers would be invited to compete to design, construct, and sell SERP refrigerators. SERP developed the Golden Carrot award to be presented to the single winning manufacturer selected through a competitive procurement process. In July 1992 the request for proposals (RFP) was issued to the industry and 14 manufacturers responded with proposals.

To win the Program competition, a manufacturer had to develop a refrigerator that was at least 25% more efficient than the 1993 U.S. Department of Energy standards. The manufacturer had to commit to pricing the refrigerator at no more than the wholesale price of similar models using CFCs. The interior capacity had to be between 14.5 and 26.7 cubic feet and any type of refrigerator configuration (e.g., side-by-side, top freezer, etc.) was eligible. The selection criteria were designed to favor manufacturers who could prove that they had the capability to mass-produce and distribute the SERP models. In addition, all SERP units had to be delivered by June 30, 1997.

On June 29, 1993, Whirlpool Corporation was selected as the Golden Carrot award winner and was authorized to produce SERP refrigerators. Whirlpool committed to produce and distribute 250,000 SERP refrigerators for sale in the SERP utility service areas. The winning refrigerator design was a side-by-side unit. Whirlpool proposed delivering initially a unit with an internal volume of 22 cubic feet with a rated efficiency 29.7% better than the level required by the 1993 standards. Whirlpool also committed to producing more efficient units in three sizes after the initial phase of SERP.

(a) Recent research has shown that the penalty is more like 5% (IRT 1995).

One requirement of the Program is detailed tracking of the sales of SERP refrigerators. Whirlpool receives payments for SERP refrigerators sold in member utility service territories and the affected utility pays the incentive payment that goes to Whirlpool. Through Whirlpool's ExacTrak mechanism, dealers return information to Whirlpool on the location of purchasing customers.^(a) Whirlpool charges dealers slightly more for SERP refrigerators, and when the dealer returns the tracking data Whirlpool reimburses the dealer if Whirlpool's conditions are met.^(b) Whirlpool, in turn, submits the customer information to SERP, Inc., and receives its payment if the SERP contract terms are met. Whirlpool and SERP, Inc., believed that this system would permit very accurate tracking of SERP refrigerator sales. The SERP contract required that at least 75% of the sales be tracked.

Whirlpool has the primary responsibility for marketing SERP refrigerators. SERP refrigerators are sold under the Whirlpool and Kitchen Aid brand names, and by Sears under the Kenmore name. The Program and SERP refrigerators initially received considerable national publicity through extensive media coverage. Whirlpool produced press releases and a brochure about SERP refrigerators. The bulk of the marketing effort, however, has been left to Whirlpool to coordinate through its regional sales personnel and dealers.

The SERP staff, under the direction of the SERP Board of Trustees, administers the Program. With external assistance, SERP drew up the RFP that solicited proposals from manufacturers and then enlisted an independent team of experts to evaluate the proposals. Based on the team's evaluation, Frigidaire and Whirlpool were selected as finalists. Since then, Program on-going administrative requirements have been handled by about two full-time staff equivalents (FTEs) (reduced from original forecasts of about 5 FTEs).^(c)

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- (a) Two of the largest national dealers use their own tracking system.
 - (b) To encourage dealer sales reports, Whirlpool has provided an additional \$10 incentive, recently increased to \$20, when dealers submit their sales information. A Whirlpool spokesman also noted that his company recently began implementing in New York and Northern California SERP wholesale net pricing, in which SERP units cost the dealers no more than their less efficient counterparts, in an effort to boost sales.
 - (c) Personal communication with Ray Farhang, SERP, Inc. and Southern California Edison, May 28, 1996.

Each SERP utility member pays annual membership dues to cover administration and operation expenses. The membership dues are proportional to the utility's total financial commitment to SERP, but are no less than \$5,000 per year. The utilities accrue votes in proportion to their financial contribution to SERP. SERP's administrative and operations functions include making payments to Whirlpool, performing quality assurance checks to determine the number of SERP refrigerators received in each utility member's service territory, and determining cross-border sales and charges.^(a)

The SERP member utilities are scattered across the country, with most in California, the Midwest, and the Northeast. The member utilities include investor-owned utilities (IOUs) and public utilities. Bonneville represents all of its wholesale, Pacific Northwest public utility customers in the Program.

1.2 MARKET TRANSFORMATION

SERP is one of the first large-scale energy-efficiency market transformation programs. Market transformation is a recent strategy, developed primarily by utilities, for enhancing energy efficiency. It represents an evolution in approaches to increase energy efficiency and is based on the strategy of stimulating market forces to promote the development, introduction, and adoption of energy-efficiency technologies and practices. Market transformation can affect the actions of consumers, trade allies (such as component suppliers or retailers), and product manufacturers.

In contrast to traditional DSM resource acquisition approaches, market transformation aims to induce substantial effects beyond the immediate program participants. Most acquisition programs provide financial incentives to participants (usually energy end users) to encourage them to employ energy-efficient measures or technologies. Although market transformation programs may provide financial incentives, the incentives usually are not directed at the end user. Market transformation programs often are based on the assumption that it is possible to leverage program investments by providing incentives to product manufacturers or retailers, rather than consumers. In

(a) "Cross-border" refers to situations in which dealers are located in areas served by one SERP and at least one other SERP or non-SERP utility or the customer is in such an area. The SERP contract specifies a series of such possible situations and how they affect the payment to Whirlpool. A cross-border account has been established to handle funds for paying the incentive in these situations.

theory, at least, a dollar used to offset increased manufacturing costs should be multiplied by the markups that occur throughout the wholesale and retail chain and, as a consequence, should reduce consumer cost by more than a dollar. Additionally, the program's largest effect may be beyond the direct program participants. One benefit sought by utilities participating in market transformation programs is to leverage the dollars invested to achieve energy savings across a wide range of energy users who are not program participants. This so-called "free driver" effect could include, for example, non-participating manufacturers who make their product more efficient and consumers who are influenced by the program to buy a more efficient product even if not a program model. These free drivers may be future purchasers as well as current ones.

Market transformation programs are expected to yield greater energy savings than standard programs, but at the price of being harder to control, predict, and measure (Pahl and Schlegel 1994). They typically require increased emphases on education, moral suasion, and structural changes in the marketplace. In addition, market transformation programs usually require fundamental changes in evaluation and resource planning practices.

SERP embodied several of the characteristics of market transformation programs. Its creators expected it to partially transform the energy-efficient refrigerator market by leading to the production of a non-CFC, super-efficient refrigerator. SERP's creators expected market pressures to push other manufacturers to produce products that would compete with the Golden Carrot winner. Unlike most previous refrigerator efficiency programs, SERP provided an incentive to the manufacturer, rather than the buyer, with the intention of leveraging the utility investment. As anticipated with market transformation programs, SERP has been harder for individual utilities to control, and the SERP organization was designed to provide some centralized oversight. The Program was designed to use market forces and widespread publicity in the popular and industry media to create awareness. As with other market transformation programs, the unique characteristics of SERP posed special challenges for evaluating the impacts of the Program and for integrating the Program into utility resource planning.

1.3 EVALUATION OVERVIEW

The purpose of this evaluation was to assess the overall impacts or outcomes associated with the Program, including its market transformation effects. We considered this assessment a preliminary impact evaluation for a number of reasons. First, SERP

was only about half way through its planned lifetime when this analysis was conducted. Second, Program impacts were harder to identify and measure than in typical energy efficiency acquisition programs. Third, the institutional features of the Program made it difficult to obtain impact data. Fourth, the budget for this study was very limited, but the Program covered a wide geographic area and assessing its impacts entailed several complexities.

This evaluation was guided by the Program objectives. The primary objective of SERP was to encourage the production of an automatic defrost, CFC-free refrigerator that would be at least 25% more efficient than the DOE 1993 standards. This level of improvement was chosen because it was high enough to induce production of a substantially more efficient unit, yet was low enough to encourage manufacturer participation. SERP believed that if one major manufacturer developed a significantly more efficient unit sooner due to the incentive, competitors would follow in order to protect their market share, thus accelerating the introduction of energy-efficient refrigerator technology into the marketplace (L'Ecuyer et al. 1992).

Another Program objective was to have manufacturers produce this efficient unit without CFCs. As noted earlier, this objective was intertwined with the objective to increase efficiency.

SERP also identified another key objective for this market transformation program: supporting the planned 1998 DOE efficiency standards upgrade. Successful construction and marketing of a SERP unit would demonstrate that achieving higher standards with a CFC-free refrigerator was feasible.

Because of SERP's focus on market transformation, this report discusses the concept of market transformation in detail. Chapter 2 reviews the market transformation literature. This information sets the stage for the discussion of the research approach and data collection activities in Chapter 3. Chapter 4 presents some program process findings to supplement the prior process evaluation (Sandahl et al. 1996). Chapter 5 discusses the preliminary impact evaluation. Chapter 6 focuses on market transformation findings and Chapter 7 presents overall findings and recommendations.

2.0 MARKET TRANSFORMATION

Evaluating SERP posed special challenges because SERP was one of the first market transformation programs. This chapter presents background information drawn from the literature on the concepts and principles underlying energy-efficiency market transformation and the evaluation of market transformation programs. It then discusses SERP in the market transformation context. Finally, it discusses the measures that were sought for assessing SERP's impacts and their influence on data collection and analysis.

2.1 THE MARKET TRANSFORMATION APPROACH

This section discusses what is meant by market transformation. It then presents some of the implications for measuring the effects of market transformation programs.

2.1.1 What Is Market Transformation?

Market transformation as a means to increase energy efficiency originated at least as early as 1987 when the Natural Resources Defense Council (NRDC) proposed a more balanced approach between the incentive "carrot" and regulatory "stick" (Goldstein 1994). The NRDC argued that the approach be aimed at the introduction of new technologies through transformation of the market.

Several factors motivated efforts to develop this alternative approach to traditional DSM programs. On-going tensions between efficiency proponents and equipment manufacturers motivated a search for an approach that would take more advantage of market forces. Political shifts created pressures to seek market-oriented, rather than incentivized, ways to improve efficiencies. Concerns about program costs and cost-effectiveness prompted utilities and others to search for less expensive and less open-ended alternatives to standard DSM programs. Energy efficiency supporters also perceived a failure of the market and DSM programs to deliver significantly higher efficiency products that would become economical to produce if manufactured in large quantities. Finally, many observers were concerned about the apparent lack of long-term market effects of many DSM programs.

Market transformation was the approach that emerged. Exactly what market transformation is, however, remains imprecisely defined. Prah and Schlegel (1993) suggest that there is at least consensus that the approach relies on two premises: 1) the

market systems for energy efficiency measures are in constant evolution and 2) DSM programs have the potential to change fundamentally the course of that evolution. The second premise is the basis for applying the term "market transformation." While the focus of traditional DSM programs is the direct acquisition of energy savings, the focus of market transformation programs is broader and at a more fundamental level.

Technology diffusion analogies are used by some analysts to describe market transformation. Nilsson (1992) describes market transformation in terms of the "S-shaped" technology diffusion curve as shown in Figure 2.1.

The two curves illustrate possible market transformation effects. The lower curve shows how the cumulative adoption of a specific technology would vary over time, *in the absence of a market transformation program*. The upper curve illustrates three possible effects of a market transformation program. A market transformation program can 1) speed up when a new, efficient product is introduced, 2) accelerate how quickly it penetrates the market, and 3) increase the final market penetration for the product. These three possible effects are important for describing the influences of market transformation, but they are too limited.

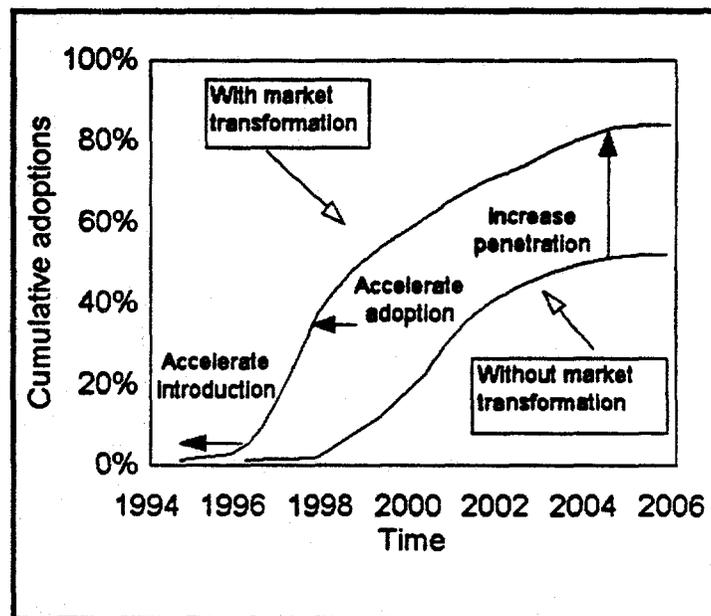


FIGURE 2.1 Market Transformation Effects

One difficulty with viewing market transformation in terms of market adoptions of a given technology is that a market transformation program may have large impacts on market choices related to efficiencies, but may not necessarily affect a specific technology. For example, the Pacific Northwest's Manufactured Housing Acquisition Program (MAP) dramatically transformed the market for energy-efficient manufactured homes, but it was not targeted at a specific technology (Lee et al. 1995); manufacturers were free to meet the program's performance specifications with any technology they chose. For this reason and others discussed below, market transformation programs are probably best illustrated overall in terms of changes in efficiency levels, rather than just through the adoption rate for a specific technology.

McMenamin, Monforte, and Rohmund (1994) identify other complexities that must be reckoned with in market transformation programs. The upper curve in Figure 2.1 does not show explicitly what happens when the market transformation program ends. It is likely that the market share of efficiency measures declines from its level during the program; how much it changes is critically important in determining program effectiveness. These authors and others also have pointed out the need to assess free riders - those program participants who would have adopted the program's energy-efficient measures without the program. These can be interpreted in Figure 2.1 to be the consumers under the "without-market-transformation" curve at any given point in time.

Another extension that generally must be made to the view of market transformation represented by Figure 2.1 is to capture other efficiency changes associated with the program, rather than just adoption rates of specific technologies. This arises because programs can induce consumers to purchase efficient products other than a specific one targeted by a program. For example, a consumer might purchase a more efficient light bulb than he would have without the program, but the purchased light bulb might not be the one targeted by the program. Similarly, a consumer might buy an efficient dishwasher, although not one covered by a program, because she saw ads for the efficient refrigerator covered by the program. Violette and Rosenberg (1995) call this effect "spillover."

The intent of market transformation is to take a broad view of the market and introduce fundamental changes to it. Market transformation can modify the actions of three key groups in the market: consumers, trade allies, and manufacturers. Traditional DSM programs typically focus on the consumer and they direct program mechanisms at him or her. Rebates, incentives, and marketing campaigns directed at consumers are common components of DSM programs. Market transformation often expands actions to include influence on trade allies and manufacturers as well. Many market transformation programs emphasize mechanisms directed at manufacturers. The Pacific Northwest manufactured housing program mentioned earlier, for example, relied on a contract between utilities and manufactured home producers. To offset the additional costs of increasing energy efficiency, it provided a payment to manufacturers for each program home produced. Program planners anticipated that the payment would eliminate most of the wholesale and retail markups associated with the energy-efficiency measures. The objective of this approach was to leverage the utility payment to have a larger economic effect at the consumer level than a consumer rebate would have (Lee et al. 1995).

Market transformation seeks to cause one or more of three types of market changes (Feldman 1994). The nature or members of the three market groups - consumers, trade allies, and manufacturers - may be modified. For example, the size of the consumer group interested in energy efficiency may be increased. Second, the mix of goods and services exchanged may be altered. Figure 2.1 shows one change in the mix of goods: accelerated introduction of a specific technology. Third, the rules of exchange in the market may be reconstructed. Customers might begin asking dealers about the energy efficiency of their products and sellers might start promoting energy efficiency as an attribute.

Another feature that most analysts and planners associate with market transformation is that market changes are long lasting. The term "transformation" implies that the market is changed broadly in fundamental ways, suggesting that the market does not simply revert to its previous state when a program's market intervention ends. Experts have different opinions about what constitutes "long lasting" but the key distinction is that a market transformation program, unlike a standard DSM acquisition program, is intended to leave an imprint on the market that lasts after the intervention ends. Violette and Rosenberg (1995) caution, however, that short-term spillover effects should not be overlooked and that there is no consensus on what long lasting means. They note that, "From this perspective, Market Transformation is still a term of art subject to interpretation" (Violette and Rosenberg 1995, p. 9).

2.1.2 Implications for Assessing Market Transformation Programs

Because of the differences between market transformation and standard DSM programs, the focus of DSM evaluation on estimating the sales and associated energy savings of energy efficiency measures has less utility in assessing market transformation program impacts. Feldman (1995b) highlights difficulties with trying to use sales data to measure program impacts, including the expense of obtaining the data, contamination of sales data by exogenous factors, and reluctance of manufacturers and dealers to provide sales statistics. Feldman argues further that sales data are not a particularly useful metric of program impacts because they are a *lagging indicator* - they come at the end of a long chain of market processes. He believes that this fact and their sensitivity to external influences make sales data fairly poor and ineffectual measures of program impacts.

Feldman in a series of papers (1994, 1995a, and 1995b) and other authors have argued that other indicators of market effects may be more practical and effective measures of market transformation impacts. Feldman (1995b) suggests using *leading indicators* -

those closer in time to the program intervention and earlier in the marketing cycle - to provide more useful information about market transformation programs. He sees two advantages of such indicators. First, they increase confidence in causal attribution because there are likely to be fewer confounding factors that obscure the program's effects. Second, they are more likely to provide actionable information, i.e., better insights into how well things are working and if and how they should be changed.

For insights on such proximate indicators of market transformation, we refer back to the expected effects of market transformation discussed in Section 2.1.1: modifying the nature or members of market groups, altering the mix of goods and services exchanged, and revising the rules of exchange in the market. Although the ultimate desired effect is a reduction in energy consumption for specific end uses, tracking indicators associated with these three market characteristics may be a more effective and useful means for assessing market transformation program effectiveness.

The number of dealers selling efficient equipment, the number of market segments with the option to purchase energy-efficient options, and new manufacturers offering energy-efficient equipment are possible indicators of changes in the market groups. The amount of advertising and promotion, shelf and floor space devoted to efficient equipment, and the number of dealers stocking efficient equipment may serve as indicators of the availability of energy-efficient equipment in the mix of goods (Marks and Golemboski 1995). Declining prices for efficient equipment, the upgrading of efficiency standards, and changes in consumer requests for energy efficiency information can be indicators of changes in the market rules of exchange.

We add another component to the discussion of market transformation effects: permanence of the changes. As noted earlier, if the market reverts back to its pre-program conditions when the program intervention ends, then little market transformation has occurred. Prospectively assessing the persistence of market changes necessitates the use of leading indicators, consistent with the approach discussed earlier. For consumers, such indicators may be changed attitudes or values related to energy efficiency. For manufacturers, indicators may include organizational changes implemented to develop and market energy-efficient products.

Determining which of these indicators can and should be used to assess a specific market transformation program is a matter of judgment, subject to the constraints of the assessment and the program itself. Feldman (1995a) suggests applying the following criteria to judge various indicators:

- meaningfulness
- ease of application
- reliability
- usefulness for informing program changes
- verifiability.
- theoretical defensibility
- expense
- sensitivity

Evaluations of market transformation programs also must address the impact of free riders and free drivers. Because market transformation programs have the objective of fostering efficiency improvements throughout the market, they are expected to have significant free driver effects. If these effects are not properly accounted for, major program impacts may be neglected. For example, MAP has changed the manufactured housing market in the Pacific Northwest so much that observers believe that a majority of manufactured homes are being built to MAP specifications well after the program has ended. These homes are being built without any cost to the utilities (thus they are free drivers) and the inclusion of a conservative estimate of their energy savings in the cost-effectiveness calculations reduces program levelized costs by about 50% (Lee et al. 1995).

The assessment of free riders - program participants who would have adopted the program's energy-efficient measures without the program - has some unique characteristics in market transformation programs. In many cases, market transformation leads to production of a product that did not exist before. Pure free riders cannot exist in this case because the consumer could not have purchased the product without the program. Often, some program participants who would purchase the product eventually purchase it sooner because of the program; these participants are termed "deferred free riders" (Nelson 1993). Another category is those participants who were already going to purchase an improved efficiency level, but not all the way up to the level under the program. These participants are called "incremental free riders" (Nelson 1993).

One particularly problematic issue with market transformation programs is the possibility of misidentifying free drivers as free riders (Saxonis 1992). In energy savings estimates, if a decrease is seen in the energy consumption of a comparison (non-program) group, the change is often attributed to non-programmatic factors and netted out from the energy savings observed in the program participant group. In market transformation programs, however, any energy consumption reduction in a comparison group is

probably due in part to the program because of intended spillover effects. These savings are free driver effects *that should be added to program savings rather than deducted from estimated savings* for program participants. Deducting these savings is a form of double-discounting that can greatly reduce estimated program impacts.

2.2 MARKET TRANSFORMATION AND SERP

This section discusses SERP in the market transformation context described in Section 2.1. It then discusses implications for the program evaluation.

2.2.1 SERP's Market Transformation Characteristics

SERP emerged out of the NRDC proposal to develop programs that balanced the "carrot" and "stick" to promote energy efficiency. Years of negotiations among appliance manufacturers, environmental groups, and government agencies led to the implementation of national efficiency standards for refrigerators and other residential appliances under the National Appliance Energy Conservation Act (NAECA) of 1987. The law set a period of every five years for modifying the standards. The potential conflict between future efficiency improvements and the Montreal Protocol's requirement for phasing out CFCs increased the likelihood of differences between the objectives of energy-efficiency advocates and manufacturers.

Utility staff frustration with the costs of implementing efficient appliance programs and the apparent lack of lasting effects also prompted interest in a new approach. Existing DSM programs usually relied on the best available efficiency levels readily available, rather than prompting significant efficiency increases. Utility efforts, notably those of Southern California Edison, Pacific Gas and Electric and others, spurred the search for a better way to promote appliance efficiency improvements.

In response to these factors, SERP was designed to be a market transformation program. Referring to the framework illustrated by Figure 2.1, SERP sought to accelerate the introduction of a CFC-free, super-efficient refrigerator well before the market was likely to produce one, thus shifting the market adoption curve forward in time. Program planners probably also anticipated that the adoption rate would be higher as a result of SERP. By influencing other manufacturers to produce more efficient, CFC-free refrigerators, SERP could increase the availability of such refrigerators and accelerate the rate of adoption in the market.

SERP might produce some indirect benefits by inducing consumers to make efficiency improvements they would not have made otherwise. Purchase of a more efficient refrigerator, although not a SERP unit, is one likely effect of this type. For example, a buyer might prefer a non-SERP brand but, because of SERP, choose a more efficient one than she would have in the absence of the Program. This spillover would benefit the participating utility and at no cost.

Another feature of SERP that was typical of market transformation programs was its focus on the manufacturer. The incentive for each refrigerator went to Whirlpool and the SERP retail price was determined by the market. Planners expected, however, that the manufacturer payment would have a larger monetary effect on the retail price because of the leveraging phenomenon noted earlier.

In terms of the three market groups upon which market transformation usually acts, SERP attempted to influence the manufacturers directly, and retailers and consumers indirectly. It was designed to change the mix of goods offered by engendering production of a new product. Because the Program had very little direct involvement with dealers and consumers, however, the market changes at the sales level (at the time of this study) depended almost totally upon the actions implemented by Whirlpool and its dealers.

Finally, SERP aimed to produce long-term effects on the market. One possible effect was continued production of SERP refrigerators (or other refrigerators influenced by SERP) by Whirlpool after the Program ended. If market demand persisted, future purchasers of these refrigerators would be free drivers for whom the utilities would have to make no incentive payment.

2.2.2 Implications for the SERP Impact Evaluation

In this study we sought to determine and assess SERP's impacts. The approach used reflected many of the insights about evaluating market transformation programs presented in Section 2.1.2.

Consistent with the recommendations of Feldman (1995b), our data collection focused on identifying leading indicators of SERP's market transformation effects and collecting data relevant to those indicators. Rather than emphasizing quantification of sales data, we concentrated on proximate indicators of market transformation farther up the market chain, principally at the dealer level.

All dealers selling Whirlpool, Kitchen Aid, and Kenmore refrigerators in the areas served by SERP utilities were eligible to sell SERP models. Information from the dealers on their promotion of SERP refrigerators, the number of SERP models on the floor, in-store displays, and sales techniques could indicate how well the program was working. Dealer information on customer awareness of SERP, SERP refrigerator prices, and approximate sales percentages also could provide information about the Program's effectiveness. Dealer information on training and education received from the manufacturer or distributor could indicate how committed the producer was to the Program and how effective its efforts were. Dealers also could provide insights about the response of other manufacturers to SERP.

Information from participating and non-participating dealers could be compared to identify Program impacts. SERP offered the potential of two comparison groups: 1) dealers outside the SERP areas and 2) dealers within the SERP areas who did not carry any of the three brands covered by the Program.

Evidence of institutionalized changes in the refrigerator industry could be indicative of the effects of SERP. For example, significant organizational changes at Whirlpool or other manufacturers in response to SERP would suggest that the companies had made a commitment to change and that the effects might be long-lasting.

As noted earlier, SERP and other market transformation programs associated with entirely new products are likely to have only limited or no free ridership. Deferred free riders were possible in SERP, however, because the Program could make it possible for consumers who would eventually purchase a super-efficient refrigerator to buy it now because the Program made it available sooner. Some buyers were likely to be incremental free riders because they would have bought a relatively efficient refrigerator now without the Program. The scope of our study, however, did not permit us to conduct buyer interviews and a thorough analysis of these issues.

Free drivers should be a critically important component of SERP's impacts. Various categories of potential free drivers existed. One category was current buyers in participating utilities' service territories who purchased a more efficient refrigerator, or even other appliances, because of SERP, but for whom the participating utility made no payment to Whirlpool. These transactions could be for more efficient versions of brands not included in SERP, more efficient versions of different models of SERP brands, or appliances, such as dishwashers and clothes washers, that were not included in SERP. Probably most significant to participating utilities would be free drivers who purchase

SERP refrigerators after the Program is over and the utility payments stop.^(a) These future free drivers are likely to be the core of the market transformation effect of the Program. Their existence and quantity are, of course, impossible to measure until the Program ends. The extent to which the market changes to ensure that production and sales continue after SERP ends would be an indication of the Program's market transformation impact.

Finally, current sales of some high efficiency refrigerators outside the SERP utility areas would be an additional free driver effect. The participating utilities would not benefit from these sales and, in fact, they would be problematic if the participating utilities paid Whirlpool an incentive for these refrigerators. These sales were one element of the "cross-border" issue, which necessitated careful tracking of the location of SERP refrigerator purchasers.

One source of information on the market impacts of SERP were statements from the industry. Manufacturers' testimony on refrigerator appliance standards and the elimination of CFCs could be compared across manufacturers and before and after SERP to identify potential effects of the Program. The Program's twin goal of efficiency improvements and CFC elimination was met by the winning Whirlpool model. Testimony before the Program on the feasibility of accomplishing these goals and any changes in industry perceptions after SERP started would be informative about the Program's impacts.

SERP utilities were a primary source of process information on the Program. They provided insights into how well the Program was designed and implemented and potential areas for improvement.

Notwithstanding the difficulties in tracking them and their questionable usefulness as leading indicators of market transformation, sales data and trends could be helpful measures of Program impacts. The number of SERP units sold, particularly in comparison with projections, would be an indicator of Program effectiveness. Information on incentives paid (through December 1995) was available from the SERP organization and this provided a measure of unit sales. Changes in market shares of the SERP brands, within and outside SERP areas, also could be examined to determine if any significant effect from the Program can be observed. Independent market survey

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- (a) No information was available at this point regarding what the SERP organization intends to do after the current SERP implementation is over. It was unknown, for example, whether the SERP label would still be applied to complying refrigerators.

statistics could provide this type of information. Ultimately, data on individual refrigerator sales gathered through consumer surveys could reveal specific efficiency buying patterns inside and outside of the SERP areas.

Data on the energy efficiency of new refrigerators could provide a view of market trends that might be impacted by SERP. The average, minimum, and maximum consumption levels of the models available each period could reveal informative trends in the market. Without detailed sales data, however, it would be difficult to estimate average consumption levels accurately.

Finally, because SERP also had the objective of facilitating the switch from CFCs, data on the production of units that did not use CFCs could give insights into the effects of SERP.

We used multiple data sources in this evaluation to assess SERP's impacts based on several of the indicators suggested above. Chapter 3 discusses the data sources, data collection, and methodologies used.

3.0 RESEARCH APPROACH

This chapter discusses the research issues addressed, information sources, data collection approaches, and our analysis methods, including what issues each analysis addressed.

3.1 RESEARCH ISSUES

This evaluation focused on preliminary estimates of Program impacts and an assessment of market transformation effects. It also provided some information on the processes associated with SERP and an assessment of their effectiveness.

Sandahl et al. (1996) presented the SERP process evaluation, relying primarily on information provided by manufacturers and utilities. This study supplements that report with more recent information and information from the retail end of the Program. Specific process issues addressed here (in Chapter 4) include dealer training, promotion of SERP units, cross-border accounting, and Program information flow.

Key Program impacts (discussed in Chapter 5) include the number of SERP units sold, how the quantity varied over time, how sales compared with projections, energy savings associated with these units, and Program costs. Energy savings estimates would be dependent on what baseline consumption was assumed.

Our study of market transformation effects raised several research questions:

- Did the Program succeed in demonstrating that the production of super-efficient, CFC-free refrigerators could be accelerated?
- Have significant changes occurred in the refrigerator market as a result of SERP?
- Did SERP induce the non-winning manufacturers to increase their efficiencies and use of non-CFC refrigerants?
- Are there any spillover effects from the Program?
- Are there lasting changes in the refrigerator market as a result of SERP?

Our data collection and analysis approaches were designed to respond to these research issues and questions. The following sections discuss the information sources that we accessed and some that we were unable to use due to various constraints.

3.2 BACKGROUND INFORMATION

Several studies on SERP and similar programs have been conducted and extensive information about the Program was available in the literature. We reviewed this information to provide background on the Program and help in the selection of specific analytic approaches.

IRT (1995) provided a comprehensive overview of the Program. In addition to background information, it summarizes the financial contributions of the participating utilities, energy savings estimates, and assessment findings.

Eckert (1995) provided an overview of the Program and discussed in detail how the Program was developed.

A study by Sampson (1993) provided an evaluation of an efficient refrigerator program using incentives to consumers and salespersons. It contains useful information on refrigerator efficiencies and trends.

Another useful information source was the user's guide for a computer program designed to analyze alternative refrigerator efficiency program designs (Battelle 1991). The user's guide provides historical and projected refrigerator statistics. The software permitted analysis of early replacement, early retirement, efficiency rebates, and Golden Carrot programs.

Other information sources included newspaper articles based on Whirlpool's press releases. We reviewed some of the several hundred newspaper and magazine articles about the Program and the SERP refrigerator (IRT 1995).

3.3 INFORMATION FROM PROCESS EVALUATION

Sandahl et al. (1996) reported findings from their process evaluation of SERP. The report relied on interviews with utility and manufacturer representatives to document Program implementation. It provided extensive information on the characteristics of

SERP, perspectives on Program design, opinions about the effect of SERP on the market, and findings on how well the Program was performing.

We used information from the process evaluation in this study where it was relevant. The information from that report reflected the situation in the early phases of the Program. In some cases, we updated that information with subsequent utility and manufacturer staff interview data.

3.4 DEALER INTERVIEWS

The focus of our assessment was appliance dealerships. Refrigerator promotional information displayed or offered to consumers by dealers can have a significant effect on appliance sales. The types and numbers of refrigerators on the floor are indicative of what units a dealer is promoting. Salespeople are familiar with how knowledgeable consumers are about energy efficiency and SERP and where they obtain information. They can also provide estimates of SERP market penetration. In addition, salespeople can provide insights into how well the Program is working and what changes are desirable. For these reasons, dealer interviews were one of our main sources of data.

3.4.1 Sample Selection and Data Collection

As noted earlier, three categories of dealers existed: dealers eligible to sell SERP refrigerators, dealers within the SERP utility areas who do not carry SERP brands, and dealers outside the SERP territories. From available information about where SERP was in effect, we developed lists of dealers in each of these categories and obtained telephone numbers from electronic versions of telephone books and other sources.

We developed interview instruments for each of these dealer groups. The interview instruments included questions about sales volume, customer preferences, dealer promotion of energy efficiency, customers' interest in energy efficiency and refrigerants, and the existence of rebates for energy-efficient refrigerators. The interview instrument for SERP dealers also included specific questions about SERP such as customer awareness about the Program, additional cost of SERP units, and recommendations for improving SERP.

We randomly selected dealers from each of these groups and attempted to contact them by phone. Taking into account budget limitations, we targeted data collection from a sample of about 5% of the SERP dealers (to provide approximately 100 interviews).

When we began calling dealers, we discovered that many telephone numbers were disconnected, the store no longer sold refrigerators, or other situations occurred that prevented data collection. As a result, each completion required about 45 minutes, or about twice the time anticipated. Nevertheless, we were able to complete 101 interviews with SERP dealers.^(a)

For comparison information, we interviewed 34 non-SERP dealers.^(b) Thirteen were in SERP utility areas and 21 dealers were outside of SERP areas.

3.4.2 Data Analysis

The dealer interviews provided both qualitative and quantitative information. The qualitative data included issues such as customer level of interest in energy efficiency, changes in customer interests, amount of dealer promotion of energy efficiency and environmental impacts, types and amount of dealer promotion of SERP, degree of consumer awareness, and suggestions for Program improvements. These data were summarized and tallied. Most of the qualitative data were relevant to process issues and market transformation.

The quantitative data included dealer sales volume, importance scores for different refrigerator features, percentage of customers inquiring about energy efficiency, sales percentages for SERP refrigerators, and incremental cost of SERP units. Some of these data were useful for categorizing dealers. Other data were analyzed statistically. Most were instrumental in analyzing market transformation and, to a lesser degree, Program impacts.

Some of the data collected from dealers were useful for categorizing the responses and exploring the relationships between different factors. For example, the results could be reported for dealers with different sales volumes. Data, such as electricity rates, from other sources were used to examine their influence on Program outcomes.

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- (a) In addition to telephone interviews with dealers throughout the United States, we also conducted site visits to 22 dealerships in the Pacific Northwest and obtained additional showroom floor information.
 - (b) The interviews included 11 site visits in the Pacific Northwest.

3.5 UTILITY STAFF INTERVIEWS

About half the utilities participating in the Program were interviewed for the process evaluation reported in Sandahl et al. (1996). These interviews occurred early in the Program, so we updated some of that information by follow-up interviews. These interviews also addressed impact and market transformation issues that were not covered before.

The utility staff interviews provided process, impact, and market transformation information. We obtained utility representatives' views on the effectiveness of the Program and its administration, information flow, cross-border issues, unit sales, and market changes.

3.6 REFRIGERATOR MANUFACTURER REPRESENTATIVE INTERVIEWS

Representatives of most major manufacturers were interviewed for the process evaluation (Sandahl et al. 1996). We updated some of the information from those interviews and also explored impact and market transformation issues in our manufacturer interviews.

The manufacturer staff interviews were intended to answer questions about how the manufacturers have been influenced by SERP. In particular, we addressed whether manufacturers, including Whirlpool, had made any organizational changes that could be attributed, in part, to SERP and whether these changes were likely to be long lasting. We also tried to determine whether manufacturers attached value to the SERP label and perceived marketing benefits associated with such labels.

3.7 EFFICIENCY AND REFRIGERANT DATA

We used two energy-efficiency data sources. The Association of Home Appliance Manufacturers (AHAM) publishes the *Directory of Certified Refrigerators and Freezers* semi-annually. It documents the style, size, and tested energy consumption for certified refrigerators. We used the directories published in January for 1988 through 1995 to provide energy consumption data (AHAM 1988 - 1995).

The California Energy Commission (CEC) provides a comparable electronic database. The *California Appliance Database* is updated on a regular basis and, in addition to

energy consumption data, indicates whether a specific refrigerator model is CFC-free. We used a version with data through early-October 1995 and one with data through mid-January 1996 as data sources (CEC 1995 and 1996).

These data helped compare refrigerator energy consumption levels. We used them to track the energy consumption levels of refrigerators similar to the SERP model over time. For any manufacturer, these data permitted analyzing trends in the highest and lowest efficiencies. Without sales data, however, it was impossible to calculate an accurate sales-weighted average consumption level.^(a)

The CEC data allowed analysis of the introduction of CFC-free models. We used the certification dates in the database to analyze how many models each manufacturer had introduced over time.

These data helped us to see efficiency trends and investigate whether SERP had affected the trends. They also provided some indications about how the industry had progressed in introducing CFC-free models. This information was useful for assessing Program impacts and market transformation effects.

3.8 ADVERTISEMENTS

We reviewed advertisements in the *Los Angeles Times* for 1994, 1995, and 1996. We also reviewed ads in the *Seattle Times* during 1996. Newspaper advertisements were reviewed to determine when and how often energy efficiency, CFC-free refrigerants, and SERP were mentioned to provide some indication of the effects of SERP.

3.9 TESTIMONY ON APPLIANCE STANDARDS AND RELATED STATEMENTS

Testimony presented on appliance standards prior to the Program gave an indication of what kind of technology enhancements appliance manufacturers were planning. It indicated what efficiency advancements were anticipated and expected difficulties in converting to non-CFC refrigerants.

(a) The sources of sales data that we investigated are discussed later. It would have been prohibitively expensive, if not impossible, to obtain accurate sales data for all brands of 22 cu. ft., side-by-side refrigerators over the historical period analyzed.

We reviewed available testimony, public comments by appliance manufacturer representatives, and related information to determine how the technology was expected to change in the absence of SERP. This information provided a baseline of expectations against which the achievements of SERP could be compared.

3.10 OTHER INFORMATION SOURCES

To provide a quantified measure of SERP's effects on the market, we explored several possible sources of sales and market shares data. We were able to obtain access to incentive payment summary data from the SERP organization through December 1995. These data included the total quantity of full incentive payments (for sales in zip codes that were not shared with another utility) and partial incentive payments (for sales in zip codes that were shared with another utility or utilities), the total number of units receiving incentives, and the total dollar amount paid. These data provided the basis for partial quantification of SERP sales and examination of variations across utilities.

We contacted the Electric Power Research Institute (EPRI) because of their reported efforts to develop appliance databases. We were informed that they had not yet developed a database for refrigerators. We also contacted the Lawrence Berkeley National Laboratory because they have assembled data on refrigerators.^(a) They relied on data purchased from a national consumer convenience sample survey. We were unable to obtain their sales data during the period of our study. We also identified and investigated sources of panel survey data. The most promising source was Industrial Marketing Research (IMR), which developed market shares data for the major appliance manufacturers.^(b) They used data from multiple panels that provided information on up to one million households. Although we could have obtained estimated market shares data in both SERP and non-SERP areas and tracked market shares over time, the cost of obtaining these data was beyond our budget. This data source would be promising to pursue in future studies.

Another data source that would have been useful was customer interviews. Customer interviews could have provided insights into customer shopping, information received by customers, and awareness of SERP. We obtained preliminary agreement from some

(a) Lorna Greening, Lawrence Berkeley National Laboratory, Berkeley, California, personal communications October 5 and 17, 1995, and January 29, 1996.

(b) Personal communications with Bill Hayes, IMR Research, Clarendon Hills, Illinois between November 1995 and February 1996.

dealers to contact customers who had purchased SERP refrigerators. Schedule and budget limitations, however, prevented us from contacting any customers during this preliminary impact evaluation. Such interviews should be conducted in a comprehensive impact evaluation.

4.0 PROCESS FINDINGS

This chapter discusses specific process issues associated with SERP. These issues include dealer training, promotion of SERP units, cross-border accounting and sales tracking, and information flow.

4.1 DEALER TRAINING AND AWARENESS

A Whirlpool representative informed us that Whirlpool had conducted a series of training activities to support the Program. The first step was utility training to increase awareness about Whirlpool's response to the Program. The 3-hour session was completed with 90% of the utilities.

The second step was internal training targeted at Whirlpool's 400 salespeople, about 150 of whom were involved in SERP. Whirlpool conducted four such initial regional training sessions. An eight-page training manual was developed by Whirlpool for this initial training. Whirlpool's regional sales staff, in turn, trained salespeople at dealerships. Whirlpool stated that 80% of the salespeople at local dealerships received training through the regional representatives, although only 30% of all salespeople participated in actual formal training. According to a Whirlpool spokesman, the rest received informal training from their owner or manager, or from visiting Whirlpool representatives. Training materials were revised to include the new SERP models when they came out.

The third step was training Whirlpool's consumer assistance personnel who answer toll-free telephone calls. Whirlpool conducted this training in 1994 and 1995.

Based on our dealer interviews, about half the salespeople were aware of special training on SERP models, but only about one-third said they had received any type of training on SERP. Most salespeople indicated that the training was part of standard training provided by Whirlpool.

Most dealers that we interviewed were knowledgeable about the SERP models and the Program. Awareness varied considerably among dealers, however, with the smaller dealers tending to be the least knowledgeable. Much of the knowledge appeared to come from routine product familiarity, rather than specific training. Salespeople generally were able to consult product literature to answer specific product questions.

About half the utility representatives interviewed said that they were conducting or had conducted evaluations of SERP for their territories. The main action was informal surveys of the dealers, and these had shown that there was little awareness of SERP by the dealers and that the level of knowledge varied greatly from store to store.

4.2 PROMOTION

The Program was accompanied by widespread publicity when it started. Whirlpool produced about a half dozen press releases and SERP, Inc., hired a contractor to promote the Program leading to about 1,500 magazine and newspaper articles.^(a) Since then Whirlpool has handled most of the promotion and advertising, primarily through regional sales offices.

Most on-going promotion of SERP refrigerators has occurred in the store. About 70% of SERP dealers that we contacted had special stickers on SERP models, provided customers with brochures or fact sheets, or had displays on the refrigerators. Labels appeared on the units indicating that they were the "Super Efficient Refrigerator Program SERP winner--in partnership with your local power company." Another label usually found on the unit indicated that it had a CFC-free sealed refrigeration system. These materials were provided by Whirlpool. A few dealers had special materials such as articles from *Popular Mechanics* about SERP.

In addition to print materials, salespeople said that they often brought up information about SERP during their sales pitch, particularly if customers appeared interested. One store set up an innovative display in late 1995 that they called the "pig and panther" display. The store had an older refrigerator (the pig) and a SERP unit (the panther) running side-by-side; each was equipped with a meter showing energy consumption. This display generated consumer interest and boosted sales of SERP units in an area with very low electricity rates. A few other dealers mentioned that they emphasized the efficiency improvement of all new units, including SERP models, compared with older refrigerators. To emphasize the general increase in efficiency, one major chain put stickers on every refrigerator stating "Energy Saver." Most dealers put information on models to identify those that were "CFC-free."

(a) Personal communication, Ray Farhang, Southern California Edison, May 28, 1996.

About 20% of dealers indicated that they provided neither printed materials nor special information to customers about SERP units. Some noted that more information was available from Whirlpool when the Program started and they had run out of special materials. A few noted that there was growing interest in CFC-free refrigerants and buyers brought up that issue more often than energy efficiency or SERP. Some also believed that the efficiency of other units now compared favorably with SERP units so they were less motivated to promote SERP.

Only about 10% indicated that they had promoted SERP models through print ads, but many dealers said that they did not do any print advertising anyway. One noted that the local utility (Central Maine Power) provided an information telephone line about SERP that helped promote the Program. Another dealer noted it would advertise SERP in its print ads if Whirlpool provided some co-operative advertising funding.

We reviewed the *Los Angeles Times* from 1994, 1995, and 1996 to determine what print advertisements for SERP and other energy-efficient refrigerators had appeared.^(a) We found that most ads were for the two largest retailers, Circuit City and Sears. Table 4.1 shows that no SERP ads appeared until mid-1995. SERP ads were most common in the last quarter of 1995. A Whirlpool representative informed us that Whirlpool conducted intensive newspaper advertising in Los Angeles, San Francisco, and New York to promote SERP models during the last part of 1995 and this was apparent from our review. Overall, advertisements about refrigerator energy efficiency were far more common in 1995 than in 1994. Comparing the April through December periods, the total number of ads mentioning energy efficiency doubled between 1994 and 1995. Much of the increase was due to SERP ads directly, but there may have been some indirect effect on other energy efficiency advertising as well. Energy efficiency advertisements appeared frequently during the first three months of 1996.

Whirlpool indicated that, in April 1996, they were going to begin an aggressive marketing push for SERP refrigerators and other similar units. They planned to include expanded consumer financing, dealer incentives, cash back offers, and other mechanisms.^(b) A Whirlpool spokesman noted that they were also having discussions with the SERP organization about what steps might be taken in future promotion and training activities.

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- (a) We also examined the *Seattle Times*, but were able to obtain information for only 1996 and this period was inadequate for our analysis.
- (b) This promotion was based in part on a recent consumer magazine's favorable rating of the 22 and 27 cu. ft. SERP models.

TABLE 4.1. Print Ad Information on SERP and Energy Efficiency, Los Angeles Times

Year	Period	Number of Energy-efficiency Ads			Sample Information
		SERP	Other	Total	
1996	Jan - Mar	1	8	9	- White Westinghouse: "Energy saver switch" - GE: "GE Profile 22 cu. ft. side-by-side; Super energy efficient compressor model" - Whirlpool: "Energy saver refrigerator;" SERP model
	Oct - Dec	8	7	15	- Whirlpool: "Energy efficient refrigerator;" "SERP model;" "Energy saver" - Kenmore: "Energy saver;" "SERP model"
	Jul - Sep	0	4	4	- Frigidaire: Energy saver refrigerator;" "20% more efficient than the DOE standards" - Hotpoint: "Energy saver refrigerator" - Southern California Edison (utility): [advertising new efficient models to customers] "Comparing new models \$128 annual cost v \$251 annual cost for old models" - Circuit City: Big ad for SERP models and their higher efficiency "S.E.R.P. Super Efficient Refrigerator Program. Now Super Energy-Efficient refrigerators cost a lot less to operate." - Sears: Big ad for SERP refrigerators: "Revolutionary technology; Unprecedented energy efficiency - 38-41% above federal energy standards; all 3 brands (Whirlpool, Kenmore, Kitchen Aid) available in 22, 25, and 27 cu. ft. sizes"
1994	Apr - Jun	4	8	12	- GE: "Energy efficient 21 cu. ft. refrigerator" - Whirlpool: "SERP refrigerator;" "Whirlpool 22 cu. ft. designer style refrigerator" - Kitchen Aid: "Energy saving refrigerator"
	Jan - Mar	0	3	3	- Kenmore: "Energy saver refrigerator" - GE: "Energy saver refrigerator"
	Oct - Dec	0	2	2	- Frigidaire: "Energy efficient refrigerator" - Hotpoint: "Energy saver switch"
1994	Jul - Sep	0	9	9	- Frigidaire: "Energy saver" - Kenmore: "Energy saver" refrigerator - Whirlpool: "Energy efficient refrigerator;" "18 cu. ft. energy efficient refrigerator"
	Apr - Jun	0	5	5	- Frigidaire: "Energy efficient refrigerator" - GE: "Energy efficient 21 cu. ft. refrigerator" - Kitchen Aid: "Kitchen Aid deluxe Energy saving 18 cu. ft. refrigerator"

Displaying SERP models on the showroom floor appeared to be a key ingredient to successful promotion. Approximately 65% of dealers that we interviewed had one or more SERP units on the floor. Our dealer visits showed that floor models usually had SERP labels on them and dealers stated that the labels stimulated consumer questions that promoted discussion of SERP with the salesperson. Smaller dealerships often did not have SERP models on display so their chances of selling SERP refrigerators were reduced.^(a)

Utility promotional activities appeared to be one of the most effective mechanisms for increasing consumer interest in SERP models. Because this activity was not planned as an integral part of SERP, the discussion is deferred until Chapter 6.

We also asked SERP dealers about obstacles that they encountered in selling SERP models. Nearly 50% indicated that there were no obstacles to selling SERP units. A few offered that they were easier to sell because they gave the salesperson more to talk about.

About 50%, however, identified several obstacles that they had to overcome to sell SERP refrigerators. The most common obstacle, mentioned by about 30% of dealers, was a higher price; however, about 30% of all the dealers said that the SERP units did not cost more than a comparable model. It was hard for dealers and consumers to compare prices because the SERP models were loaded with features that could make comparisons difficult. The dealers who mentioned that price was an obstacle said they sold the SERP unit for about \$50 to \$400 more than a comparable model (the price difference varied for the different models as well as across dealers). For dealers who said that price was not an obstacle, about 40% said that the SERP model was no more expensive than a comparable unit. The remaining dealers who said that price was not an obstacle typically said that SERP units were between \$20 and \$180 more expensive than comparable models. Averaged across all dealers, the sales-weighted mean added price was \$80 (with a standard error of \$20).^(b)

Only about 8% of dealers mentioned that some buyers were concerned initially about the non-CFC refrigerant and potential problems with it. About 10% mentioned that having

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- (a) A Whirlpool spokesman suggested that smaller dealerships typically displayed other Whirlpool side-by-side units that were relatively energy efficient.
 - (b) The estimated added price was weighted by reported dealer sales.

SERP units available in only the side-by-side model or larger sizes was a problem. One mentioned that the freezer door could not be opened as far as other units.^(a)

Dealer data collection also provided feedback about the Energy Guide Labels.^(b) Comments by dealers were generally positive on the value of the labels. About 70% of SERP dealers mentioned the labels as an effective source of information for consumers. About half the non-SERP dealers also mentioned Energy Guide Labels as an information source. Consumers generally used the labels for comparisons among refrigerators, although energy consumption was not an overriding decision factor. Most dealers in the Pacific Northwest told consumers that the values on the labels were calculated using electricity prices considerably higher than the Pacific Northwest levels, so any differences among units would be less than suggested by the labels. Two different salespeople mentioned problems with the labels. First, some buyers mistakenly thought that the values on the labels were the monthly payment for purchasing the refrigerator. Second, some of the efficient units showed annual electricity costs that were less than the minimum amount shown on the Energy Guide Label range and this created confusion.

4.3 CROSS-BORDER ACCOUNTING, SALES TRACKING, AND INFORMATION FLOW

There was evidence that information flow among SERP planners and participants worked effectively during Program development and start-up. Manufacturers and utilities provided input on the Program approach, and SERP fostered unprecedented cooperation among industry, utilities, government, and environmental and consumer groups (Eckert 1995).

IRT (1995), however, raised some cautions about the flow of information once the Program went into the implementation stage. The report noted discomfort expressed by some participating utilities about communication delays between the SERP organization and utilities. Consistent with our findings, the report also noted that confusion existed

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- (a) This problem apparently existed in the first production units and was later corrected (personal communication, Ray Farhang, May 28 1996).
 - (b) The label presents estimated annual energy costs based on the Federal Trade Commission procedure (16 CFR Part 305) and is a requirement independent of SERP.

among dealers about SERP unit pricing policies. This confusion stemmed from uncertainties about the incentive payment and tracking system.

Sandahl et al. (1996) reported some early utility problems or concerns about the sales tracking and cross-border accounting system. In follow-up interviews, we asked utility representatives about specific experiences with the tracking system and cross-border account.

Staff at all of the utilities that we interviewed reported having problems getting the sales tracking data on a timely basis. They reported that although the quality and timeliness of the reports had been getting better, there was plenty of room for improvement. A number of them mentioned that they were unsure where the breakdown was in the communications - the dealer reporting to Whirlpool, Whirlpool reporting to SERP, or SERP reporting to the utilities. Regardless, they were all concerned about improving the timeliness of communications. In general, the last data the utilities had received (as of March 1996) was from September 1995, and there was a high volume of sales reported at that time. Utilities were unsure whether sales really increased substantially in September or if the sales had been stored up and reported all at once. Another concern several of the utilities mentioned was that they knew through their own information collection system of sales in their areas that did not appear on the SERP reports. One utility reported that it had confirmation of about 600 SERP units sold that had not been documented in the SERP reports. Although this might have been only a problem of timing, it caused the utility to be concerned about the accuracy of the tracking data.

The utility representatives interviewed differed in their attitudes and concerns about the cross-border accounting system. One-third reported that they were not concerned with cross-border sales or tracking them because they were insignificant compared with their other sales, or it simply was not worth their time to track them. Other utilities were very concerned about the cross-border sales because they were supposed to be no more than 15% of sales, but had been reported by some utilities to be about 30% to 40% of sales. This was a concern because they felt that they were paying for electricity savings in another utility's territory (a non-SERP utility). One utility reported that if all the nearby utilities were participating in the Program, the cross-border sales would probably be a wash and, therefore, not worth tracking. Three of the utilities indicated that the problems could be minimized by improving the data collection at the dealers' site, clarifying actual siting address versus billing address, and accounting for inventory transfers of stock from one area to another.

For several utilities, problems with the tracking system translated into increased workloads. Several said that they were spending unplanned time to digest the information or that they were not trying to process it because of the time it would take.

To assess the effectiveness of information flow to dealers, we questioned SERP dealers about their knowledge of the rebate and tracking system. About 45% had a reasonable understanding of either the tracking system or the manufacturer's rebate.^(a) About half had no knowledge of the rebate at all. The remainder were aware that a rebate existed, but they had an incorrect understanding of it. For example, some salespeople thought that the rebate was arranged through the utility. Several believed that the customer received it. Salespeople also had very little knowledge of the tracking system. Less than 5% had any knowledge of the ExacTrak forms used to track SERP refrigerators. A few understood that tracking was linked to the rebate, but none could explain how it worked. The awareness varied considerably among the geographic areas. The highest awareness (based on small samples in most states) was in Minnesota and Massachusetts. The lowest awareness was in New Jersey and the Pacific Northwest.

We examined information from dealers and utilities to determine what factors might have explained why awareness varied by location. Comparing dealers who reported that they had received some training with those who didn't, we could not find a statistically significant difference in their awareness: dealers who had received training were not measurably more likely to have a better understanding of the rebate or tracking system.^(b) The one factor that appeared to be correlated with dealer awareness was the level of involvement of the local utility. Our sample was too small in individual utility areas to provide definitive results, but dealer awareness tended to be higher where the utility had taken more steps to publicize the Program and interact with dealers.

Some salesperson uncertainty about the rebate and tracking was understandable given that these functions might have been handled by someone else at the dealership. A Whirlpool representative noted that the store owner or manager was likely to know about the rebate and tracking system even if salespeople didn't. When we asked questions to probe this issue with salespeople, however, the responses suggested that personnel in

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- (a) We excluded salespeople at Sears and Circuit City from this tally because they handled the tracking electronically and salespeople had no direct involvement.
 - (b) We used the data for dealers who had and had not received training and their knowledge about the rebate and tracking system. Although salespeople who had received training were more aware, the chi-square test showed that the difference was not significant at even the 0.1 level.

many stores were completely unaware of the tracking and rebate system. Consequently, sales by many stores were unlikely to be reported back to Whirlpool, SERP, and participating utilities.^(a) This finding was consistent with utility reports of a gap between sales that they knew about and the sales reported by SERP. One troubling finding was that a number of salespeople were misleading consumers about the rebate, suggesting that *the consumer* would receive it.

Many of the process difficulties encountered in this Program were related to the geographic dispersion of the SERP utility areas. First, it was difficult to market SERP refrigerators effectively because SERP dealer locations did not coincide with any conventional boundaries such as city, county, or state lines, radio markets, or newspaper territories. Second, tracking and cross-border accounting were complicated by the high probability in some areas that SERP units might be sold to consumers outside the utility's service territory, or that the dealer could be in an area served by the SERP utility and a non-SERP utility. Third, the probability was increased that miscommunication occurred about which dealers were qualified to be in the Program. The probability of misclassifying dealers was high because the "frontier" between SERP and non-SERP areas was larger with the dispersion of member utilities than it would have been if all member utilities were in a contiguous area. Two non-SERP dealers that we interviewed, in fact, were angry about being told initially that they qualified as SERP dealers and then later told that they were not qualified.^(b)

4.4 PROCESS IMPROVEMENTS

This section presents process improvements that were recommended by dealers, utilities, and manufacturers.

4.4.1 Program Design

During the Program process evaluation, manufacturers expressed concerns about the Program's "winner-take-all" feature. Our interviews with manufacturers reiterated this concern. The manufacturers' discomfort was partially based on self-interest (only one manufacturer would benefit from a "winner-take-all" approach) and partially reflected a

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- (a) Interviews with Whirlpool supported the finding that there was a gap between Whirlpool's shipment data and dealer reported sales of SERP units.
 - (b) These dealers were quite knowledgeable about SERP and had submitted their requests for rebates, which they said were later rejected by Whirlpool.

concern for the success of the Program. The latter concern was based on the higher risk of relying on a single manufacturer and the lack of product diversity.

A few of the manufacturer and utility representatives suggested that the Program should have included a wider range of sizes and styles. One utility spokesperson stated that "Pushing the side-by-sides with all their features as energy-efficient was embarrassing, when a simple top-mount refrigerator was much more energy-efficient." One manufacturer suggested that a "stepped" approach should have been used that would have provided incentives to manufacturers who produced units in different sizes and with *different efficiency levels*.

A broader theme emerged from the manufacturers' comments. Several commented that there was an apparent lack of understanding of the appliance market by the SERP planners. This type of comment suggested that manufacturers felt more needed to be done to develop a common understanding of the market by utilities, manufacturers, and Program designers.

One utility representative that we interviewed made a comparable recommendation. He commented that AHAM had convened a meeting a few years ago at which the appliance manufacturers described their research and development process and utilities discussed the regulatory environment in which they operate. He suggested that similar meetings involving the two industries be held as the basis for designing future programs.

One of the utilities indicated that better coordination with Whirlpool was important, both for the tracking and the promotion of the units. Another suggested that developing a better contract or negotiating position with Whirlpool would allow SERP to ensure that communications with Whirlpool were more timely, consistent, and reliable.

4.4.2 Training and Awareness

Although about two-thirds of the salespeople we interviewed said that they had not received training on SERP, only about 5% suggested that training or information provided to dealers be improved to make the Program function better. Although not many salespeople expressed a need for more training, several felt that they should be better prepared to promote SERP models and needed the tools and information at hand to do so. As one dealer stated: "The key to selling is value. People buy the most value for the money and we need something to explain to consumers what the value is of energy efficiency."

Utilities had few specific recommendations about improving dealer awareness or training. One utility noted that it had decided to hire its own contractor to supplement Whirlpool's dealer training, thus suggesting that it felt this to be an important need.

4.4.3 Promotion and Consumer Education

The most common dealer suggestion for improving the Program was increased advertising, promotion, and consumer education. Half the dealers we interviewed recommended either better promotion of the SERP models or better education of consumers to increase their awareness of energy efficiency and environmental benefits. The recommendations were about evenly split between simply advertising SERP models more on TV, in magazines, and in newspapers, and educating the consumer more generally about energy efficiency and environmental effects. Dealers recommended that the manufacturer, utilities, and the SERP organization play a larger role in promoting the Program.

About 10% of the dealers mentioned that SERP unit prices should be reduced to make the refrigerators more competitive. Similar to recommendations to reduce prices, about 3% recommended consumer rebates for SERP units. Consumer rebates appeared to be a very effective way to respond to perceptions of higher prices for SERP models. In one utility area, a rebate ranging from \$60 to \$120 was available to buyers of efficient refrigerators. SERP units qualified for a rebate of \$120 and this was a great sales stimulant. All qualifying units had a green sticker on them indicating the amount of the rebate. Salespeople said that consumers were very aware of the rebate and the dealers used the rebate as a selling tool. It appeared that even a modest consumer rebate could stimulate sales and offset concerns about cost.

About 19% recommended that the Program include other sizes, styles, or brands. One dealer recommended that the manufacturer provide financial incentives or other inducements to the salespeople to sell SERP models.

The majority of the utilities indicated that marketing of the SERP units needed to be improved to make the program successful. Views differed as to who should be responsible for that effort. Nearly all agreed that Whirlpool had a responsibility; however, recommendations on the amount of effort that should be devoted by the utilities and SERP differed across the utilities. Some felt that marketing should be a joint effort among the partners, while others indicated that it was Whirlpool's responsibility under the contract it had with SERP. The utilities' marketing recommendations were focused in primarily two areas. The first was increasing general consumer awareness of the SERP

units to create more of a market "pull." The second was educating the sales force and encouraging them to "push" the SERP model.

4.4.3 Cross-Border Accounting, Sales Tracking, and Information Flow

The main suggestion made by a number of the utilities was to capture the sales data electronically at the dealers' site and transfer it electronically to Whirlpool, SERP, and finally to the utility. Utilities felt that this would speed up the information flow and improve the reliability of the data. One utility staff person indicated that an electronic database system was scheduled to be available in February 1996, but that the status was unknown. Two of the large appliance chains were already using an electronic tracking system and this appeared to improve and increase the transfer of data to Whirlpool and SERP.^(a) However, it was unclear whether this improved the eventual transfer to the utilities.

Some utility representatives also suggested that SERP report back to the utilities when corrections were made so that they would know an issue had been resolved. One mentioned that they would prefer receiving the raw data from Whirlpool again as they had early in the Program. They commented that even though it was difficult to review, the information was timely.

One utility representative suggested that the process could be improved by having the purchase information reported back by the buyer instead of the dealer. This suggestion arose primarily to eliminate problems with refrigerators being installed in residences that were outside the utility service area (such as vacation homes).

Overall, utility representatives had few suggestions on ways to improve Program tracking and information flow because they had too little information and understanding of the process to make constructive suggestions.

(a) Whirlpool also pushed the installation of an automated system at larger independent dealers in 1996.

5.0 PRELIMINARY IMPACT FINDINGS

Key Program impacts included the number of SERP units sold, how the quantity varied over time, how sales compared with projections, and the energy savings associated with these units. Free-drivers and free-riders were also essential considerations in assessing impacts. Program costs were another important impact component and were required to assess cost-effectiveness. This chapter discusses the information that we had available for this preliminary impact evaluation.

5.1 SALES OF SERP UNITS

The initial projections of SERP unit sales were 25,000 in 1994, 90,000 in 1995, 90,000 in 1996, and 45,000 in 1997. Total projected sales through the scheduled end of the Program on June 30, 1997, were 250,000 units (IRT 1995). Through 1995, therefore, the projected sales were 115,000.

As of early 1995, Whirlpool indicated that sales were meeting their expectations. According to data from SERP, Inc., however, the number of incentive payments reported through December 1995, was only about 42,000, or about 37% of the forecast sales (SERP 1996), but in mid-1996 a Whirlpool spokesman noted that shipments were about 64% of original projections. We did not have access to sales data that would allow us to investigate the difference between projections and actual sales figures; however, several factors emerged during our study that might contribute to differences between forecast sales and the quantity of incentive payments and actual sales.

First, SERP sales might have failed to meet projections independent of any other market changes. Several dealers reported that SERP units had sold well initially, but sales had declined in the past year; many dealers attributed the initial surge to early publicity about the Program. Second, there was some anecdotal evidence that overall refrigerator sales had fallen during 1995 and SERP sales probably declined with them. Third, a substantial number of SERP sales might not have been reported to SERP because of the failure of dealers to return tracking information. According to a Whirlpool spokesman, Whirlpool was receiving sales information on about 70% of the SERP units, so about 30% could have been unreported to SERP. Finally, the data on incentive payments lagged behind sales so that, at a given point in time, the number of incentive payments documented would be less than actual sales.

According to a Whirlpool spokesman, there were other events that probably influenced SERP sales. Two lawsuits were filed challenging the CFC-free and non-ozone depleting claims for refrigerators that used HCFCs (hydrochlorofluorocarbons), including the SERP models. Refrigerator manufacturers, including Whirlpool, withdrew promotional literature as a result of these lawsuits and this negatively impacted SERP unit sales. Another factor that affected sales in California was PG&E's initial exclusion of SERP from its rebate program. Both these events probably reduced SERP sales during specific time periods.

For all these reasons, SERP sales were less than the projected quantities, but we were unable to document directly how much less. Utility representatives confirmed that sales reported in their areas were below projections; several said that they were from 30% to 50% of the projected quantity. As noted above, a Whirlpool spokesman stated that their data showed that shipments were about 64% of projections in mid-1996. Although we lacked primary data to quantify unit sales accurately, it was clear that sales had been below original projections.

We examined the incentive payment data as a measure of sales to examine how sales compared across utilities. Table 5.1 presents the percent of total units receiving incentives that were in each utility area, the percent of total dollars committed at the beginning of the Program by each utility, and the ratio of these two numbers. This ratio was computed to give an indication of how utilities compared in terms of SERP sales relative to original expectations.

Utilities with a value greater than 1.0 in the rightmost column had paid incentives for more units than would have been expected based on their original dollar commitment, suggesting that sales were higher in their region relative to other utilities. This ratio varied greatly across utilities. At the low end, Northern States Power Company, Wisconsin, had paid incentives representing only about 10% of its expected share. Arizona Public Service, on the other hand, had paid almost five times its expected share of incentives. We examined the dealer and utility interview data to determine what might have explained these differences. There was no dealer or utility information that consistently explained the difference. The one possible explanation that emerged was differences in electricity rates. We found that the average electricity rate for utilities with a higher-than-expected share of incentive payments was 2.4¢/kWh higher than the average rate for utilities with lower-than-expected sales. The difference was statistically significant at the 0.05 level. This result suggested that utilities with lower electric rates might need to implement steps to increase SERP sales.

TABLE 5.1. Comparison of Utility Incentive Payments and Resource Commitment

Member Name	Units Receiving Incentive Payments (% of total)	Dollars Committed (% of total)	(% of Units Receiving Incentive Payments) / (% Dollars)
Arizona Public Service	3.75%	0.80%	4.70
Wisconsin Electric Power Co.	2.25%	0.62%	3.65
Northern States Power Co. - Minnesota	3.52%	1.30%	2.70
Central Maine Power	1.43%	0.98%	1.47
Long Island Lighting	8.22%	6.34%	1.30
Jersey Central Power	4.02%	3.16%	1.27
Southern California Edison Co.	22.13%	19.07%	1.16
Baltimore Gas & Electric Company	5.34%	4.65%	1.15
Pacific Gas & Electric	24.36%	21.52%	1.13
Wisconsin Power & Light	0.90%	0.93%	0.97
Atlantic City Electric	1.50%	1.63%	0.92
Sacramento Municipal Utility District	2.17%	2.45%	0.89
PacifiCorp	2.54%	3.26%	0.78
Wisconsin Public Service	0.86%	1.13%	0.76
Northern California Power Agency	0.31%	0.42%	0.75
Bonneville Power Administration	4.59%	6.85%	0.67
Public Service Electric & Gas	5.89%	9.78%	0.60
Los Angeles Department of Water & Power	3.30%	6.52%	0.51
Madison Gas & Electric	0.20%	0.44%	0.46
Western Massachusetts Electric	0.43%	1.04%	0.42
New England Power (Mass. Electric & Narraganset)	1.89%	4.89%	0.39
Commonwealth Electric/Cambridge	0.33%	1.63%	0.21
Northern States Power Co. - Wisconsin	0.06%	0.60%	0.10

5.2 ENERGY SAVINGS

This section discusses factors that affected the estimation of energy savings associated with the Program. In Section 5.4 this information is used to develop preliminary savings estimates.

Energy savings attributable to SERP refrigerators depended on the baseline unit used for comparison. SERP units could be compared with the maximum allowable usage under the 1993 appliance standards. IRT (1995) used this approach and estimated that the original 22 cu. ft. SERP model (produced in 1994) saved 285 kWh per year and the new 22, 25, and 27 cu. ft. models saved 388, 399, and 403 kWh/year, respectively. Using the maximum consumption allowed by the standards, however, could overstate savings. The appropriate baseline would be the consumption of refrigerators that would have been installed without SERP.^(a) If SERP did not affect the buyer's decision to replace an existing unit or the brand and type chosen, then the proper comparison would be with the Whirlpool unit that would have been available without SERP. Of course, the efficiency level without the Program could not be known, but we developed an approach to produce a reasonable estimate.

Section 6.2.1 presents information useful for estimating baseline energy use. It shows that 1) major manufacturers other than Whirlpool produced large, side-by-side units by January 1995 that were 1.7% more efficient, on the average, than required by the standards; 2) these same manufacturers achieved an average efficiency 7.5% better than the standards by January 1996; and 3) Whirlpool's average efficiency for side-by-side units was 22.7% and 25.2% better than required by the standards in 1995 and 1996, respectively.^(b) Based on our analysis, we believed that SERP was largely responsible for Whirlpool's side-by-side units being more efficient than other manufacturers' units.

This conclusion about Whirlpool's efficiency levels implied two consequences. First, the energy savings of SERP units should be estimated with respect to a less-efficient baseline unit than Whirlpool's current non-SERP units. Second, SERP should be credited with some of the energy savings of all Whirlpool's non-SERP, side-by-side units because their higher efficiency was due, in part, to SERP. This second issue was a free driver effect of SERP. Other free driver effects also need to be considered.

Probably the most significant free driver impact of SERP would be associated with purchasers who buy SERP or other high-efficiency refrigerators after the Program ends.

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- (a) Whirlpool expected SERP refrigerators to substitute for sales of comparable Whirlpool models (Sandahl et al. 1996, p. 6.2).
 - (b) Because we lacked sales data, the average percentage difference in consumption levels was calculated as the simple average across all models.

A Whirlpool representative, however, indicated that his company probably would not continue to produce SERP units after the Program ended. Whether this will occur, of course, is unknown because the Program is still underway. Even if Whirlpool did discontinue the SERP models, it seems very likely that Whirlpool will continue offering numerous higher efficiency units after the Program ends because many of the efficiency improvements had been integrated into its product lines. The savings of these units would accrue in SERP and other utility areas.

In addition to these free rider effects, the SERP utilities also benefitted from SERP units sited in their areas for which the utilities did not pay an incentive. These occurrences resulted from incomplete reporting of SERP installations. Either Whirlpool, dealers, or consumers have absorbed their added costs.^(a)

The efficiency increases of other manufacturers' models noted earlier were caused, in part, by SERP, thus adding to Program benefits.^(b) Chapter 6 presents information supporting this assertion. As discussed in Section 2.1.2, such other efficiency increases induced by SERP should be credited to SERP, and they should be deducted from changes in the baseline to account properly for SERP unit savings.

Because SERP led to production of an entirely new product, there was likely to be only limited or no free ridership. Deferred free riders were possible in SERP, however, because the Program could make it possible for consumers who would purchase a comparable refrigerator in the future to buy it now because the Program made it available sooner. Also, some buyers were likely to be incremental free riders because they would have bought an efficient, but not as efficient as SERP, refrigerator now without the Program. The scope of our study, however, did not permit conducting buyer interviews and a thorough analysis of these issues.

An additional free ridership type of effect occurred in this Program: cross-border sales of SERP units into non-SERP areas for which the SERP utilities paid Whirlpool an incentive.^(c) SERP utilities incurred the incentive cost of these units, but non-SERP utilities benefitted from their energy savings. We had no definitive data available on the number of these cross-border sales. Although they were probably relatively small overall, some utilities stated that these cross-border sales were much larger than anticipated.

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- (a) A company spokesman indicated that Whirlpool usually absorbed this cost.
 - (b) A Whirlpool spokesman suggested that part of the industry efficiency increase could be attributed to utility rebate programs, particularly those in California.
 - (c) This situation met the requirements of the dealer-based incentive payment system agreed to by Whirlpool and SERP, Inc.

5.3 COSTS

We estimated the probable direct utility costs based on Program planning information. The estimates are based on current dollars rather than constant dollars. The total estimated incentive and cross-border account costs are \$27.5 million (IRT 1995). SERP, Inc., administrative costs were estimated to be 10.2% of total Program direct costs, thus bringing initially estimated total costs to about \$30.6 million. As noted earlier, however, administrative staff requirements have been closer to about 2 FTE than the original estimate of 5 FTE. Using this figure instead, total costs will be about \$28.7 million. Spread over the planned 250,000 SERP units, the total direct Program costs will be about \$115 per unit.

In addition, each utility dedicated some effort to processing the data, assessing the Program, and other internal activities. We asked the utility representatives that we interviewed what level of resources they were devoting to SERP. The responses ranged from 0.1 FTE to about 1 FTE. Most said that they were dedicating about ~~0.5~~ FTE to the Program. Many of the utilities had invested in activities such as information dissemination through bill stuffers, employees' newsletters, and press releases. A few of the utilities had sponsored open houses and participated in home shows where a SERP unit was highlighted. Many of these activities were done early in the program and had since been discontinued based on the understanding and expectation that Whirlpool would be the main promoter of the unit. However, one utility had recently focused some effort on encouraging SERP sales by hiring a consulting company to act as an additional "sales force." The consultant had dedicated approximately 2 to 3 FTEs to work with the regional Whirlpool sales representatives to promote SERP to the dealers and to develop point-of-purchase displays. Half the utilities that we interviewed either had conducted or were planning to conduct evaluations of SERP. They ranged from modest "mystery shopper" activities to find out how dealers were promoting SERP units to complete evaluations. No cost figures on these studies were obtained. Based on our limited data, we estimated that utilities were spending, on the average, about \$30,000 per year to cover internal Program support activities. Over the course of the Program, this would amount to about \$100,000, on the average, or about \$2.4 million across all the utilities. Averaged over the expected 250,000 refrigerators, the cost would be about \$9.60 per unit.^(a)

Combining these two sets of costs, the estimated total direct and indirect Program costs incurred by participating utilities are about \$124 per SERP refrigerator.

When SERP was designed, utility planners wanted the SERP refrigerators to be sold at a price no greater than that of comparable models without the SERP energy-efficiency and

(a) If lower-than-expected sales continue, the per-unit cost would probably increase.

CFC-free features (Sandahl et al. 1996). The appliance industry noted that it was not legal for them to control retail prices, but the expectation was that the SERP incentive and Whirlpool's dealer rebate would reduce substantially any incremental cost to consumers. Our dealer interview data suggested, however, that SERP refrigerators were priced about \$80 more than comparable models, *on the average*, although the major chains stated that they charged consumers no additional price. To assess Program costs and benefits, these additional consumer costs needed to be addressed.

5.4 BENEFIT-COST ASSESSMENT

Table 5.2 summarizes the savings categories that should be included in a cost-benefit analysis of SERP. At this stage of the Program, and because of study limitations, it was impossible to quantify several categories. The energy savings associated with free drivers should be added to savings from direct SERP sales. The benefits should be reduced by free rider energy savings, but the treatment of free rider costs would depend on the perspective from which costs and benefits were calculated. As noted in Section 2.1.2, the efficiency changes induced in non-SERP areas should not be included in the baseline when estimating Program energy savings.

The cost-benefit analysis could be conducted from a number of different perspectives including the utility, total resource cost, and societal perspectives. How costs and benefits were accounted for would vary with the different perspectives. Because only limited data and resources were available, we considered just the total resource cost (TRC) perspective here for illustrative purposes.

The simplified expression for the net benefits, NB, of an efficiency program using the TRC test is as follows:

$$NB = \text{program benefits} - \text{program costs} = AC - (UC + DC) \quad (5.1)$$

where AC is the avoided electricity supply cost, UC is the program cost incurred by the utilities, and DC is the direct added cost borne by consumers (Goldman et al. 1993). This simple relationship is very incomplete for a market transformation program such as SERP but it is a useful place to start.

TABLE 5.2. Savings Categories

	Incentive payment sales	Free Drivers			Free Riders		
		Non-incentive payment SERP sales	More efficient, non-SERP units, all manufacturers	Future efficient unit sales	Deferred	Incremental	Cross-border (non-SERP areas)
Number	41,819 (12/95)	Unknown; small number	Unknown; large number	Unknown; large number	Unknown; small number	Unknown; small number	Data unavailable; small % of SERP sales
Who pays?	SERP utilities	Whirlpool, dealer, or consumer	Consumer	Consumer	SERP utilities	SERP utilities	SERP utilities
Utilities affected?	SERP, cross-border non-SERP	SERP	All	All	SERP	SERP	Cross-border non-SERP

SERP utility costs included administrative, tracking, incentive, and cross-border costs. Although no added consumer costs were expected, our data suggested that consumers did pay about \$80 more for a SERP unit, on the average. We noted, however, that dealers who charged substantially more for SERP units probably were not aware of the rebate and tracking system and were less likely to claim a rebate from Whirlpool. Whirlpool, in turn, would not submit a claim to SERP, Inc., for these units and, therefore, it was unlikely that the utility would have to make a payment to Whirlpool for them.^(a) To simplify our baseline analysis and account for the fact that it was fairly unlikely that the dealer charged substantially more and Whirlpool claimed an incentive for the unit, we included only the higher of the two costs, the utility cost, in our base case analysis. We looked at the combined utility and average consumer costs as a sensitivity case.

Avoided supply costs would be the stream of costs avoided over the life of a SERP refrigerator because of its reduced electricity consumption. They would include the energy and generation capacity costs associated with electricity resources. These costs would vary by utility area and over time. For this simplified analysis, we approximated

(a) The amended SERP contract allowed for Whirlpool to claim the rebate from SERP, Inc., in cases where dealers did not track the customer, but Whirlpool credited the dealer for the sale. The proportion of sales falling into this category could be as high as 25%, but SERP, Inc., considered this high a percentage to be an unlikely outcome.

the avoided electricity cost with the rate assumed to calculate the refrigerator FTC Annual Energy Cost (AHAM 1995), 8.41¢/kWh. For simplicity, we assumed no electricity price escalation over the estimated refrigerator lifetime of 19 years (IRT 1995). We calculated the present discounted value of the energy savings using two real discount rates: 5% and 10% per year.

The introduction of new SERP models midway through the Program, the lack of actual sales data, and uncertainties about what would happen when the scheduled Program termination date was reached complicated the estimation of energy savings. To derive a weighted average energy savings we assumed that 1) the original projection of SERP sales was met, 2) the proportion of units produced during any time period did not differ from original projections, 3) production of the original 22 cu. ft. model ended in April 1995, and 4) sales of the new models were evenly divided among the 22, 25, and 27 cu. ft. units. Based on the information in Section 5.2, we assumed that, without SERP, Whirlpool's initial 22 cu. ft. units would have been 1.7% more efficient than required by the standards (the average observed across the five major manufacturers in 1995) and the subsequent models would have been 5% more efficient than required by the standards.^(a) Starting with the estimated savings in IRT (1995), we estimated savings of 331 kWh/year averaged over all the SERP units.

Using these assumptions, the baseline TRC benefit-cost ratio for each SERP unit would be 2.73 (\$338/\$124) and 1.87 (\$233/\$124) at discount rates of 5% and 10%, respectively. In both cases the benefit-cost ratio exceeds 1.0. The discount rate has a significant effect on the ratio; however, even under the conservative assumption of a 10% real discount rate, the ratio exceeds 1.0. As noted, however, this analysis was very much simplified and incomplete.

To examine the effect of two key inputs, we separately considered a lower electricity resource cost and additional consumer costs. At 5¢/kWh avoided resource cost, the benefit-cost ratio would be reduced to 1.63 and 1.11 at discount rates of 5% and 10%, respectively. Both values exceed 1.0, but the ratio is clearly very sensitive to the avoided cost assumption.

If consumers did incur the average added cost and the utility paid an incentive, then the baseline benefit-cost ratio would decline by about 39% to 1.66 (\$338/\$204) and 1.14 (\$233/\$204) at discount rates of 5% and 10%, respectively. The economic impacts of the Program are very sensitive to the additional amount, if any, that consumers have to pay for a SERP unit. The possibility that dealers might charge substantially more for

(a) This number was based on the fact that non-SERP brands improved by 7.5% in 1996 and we assumed that SERP induced an average improvement of 2.5%.

units for which Whirlpool, in turn, received an incentive could be a major determinant of SERP's cost-effectiveness.

In addition to these economic variables, several other benefit and cost components shown in Table 5.2 could affect SERP's economic impacts significantly. Table 5.3 presents our estimates of the potential magnitude of these components from the TRC perspective. The estimates take into account only potential impacts on side-by-side models. The impacts are presented in terms of adjustments to the benefits and costs presented earlier assuming avoided costs of 8.41¢/kWh and a 5% real discount rate.

TABLE 5.3. Potential Free Driver and Free Rider Impacts, TRC Perspective

	Free Drivers			Free Riders		
	(1) SERP sales without incentive payment ^(a)	(2) More efficient, non-SERP units, all manufacturers ^(b)	(3) Future efficient unit sales ^(c)	(4) Deferred ^(d)	(5) Incremental ^(e)	(6) Cross-border (non-SERP areas) ^(f)
Effect on TRC Benefits	Increase SERP utility energy savings	Increase SERP utility energy savings from non-SERP units	Increase SERP utility savings in future	Deduct from future savings	Deduct from savings	Deduct from SERP utility savings
Potential Benefits (averaged over SERP units)	+\$17	+\$80	+\$493	-\$17	-\$17	-\$34
Effect on TRC Costs	Include added cost to consumer	No added cost to utility or consumers	No added cost to utility or consumers	Deduct associated costs	Deduct associated costs	Costs are accounted for already
Potential Costs (averaged over SERP units)	+\$5	\$0	\$0	-\$10	-\$10	\$0

Note: A real discount rate of 5% is assumed in all calculations.
 (a) Assumes that in addition to SERP sales for which an incentive is paid, 5% more units are sold without a payment.
 (b) Assumes that SERP induced a 20% improvement in Whirlpool's non-SERP units and 2.5% improvement in other brands at no added consumer cost.
 (c) Assumes that SERP-induced changes persist for five years after Program ends.
 (d) Assumes effect is 5% of savings and costs. Savings effects would occur in year that consumer would have bought a SERP-equivalent unit.
 (e) Assumes effect is 5% of savings and costs.
 (f) Assumes effect is 10% of SERP incentive payment sales. Savings accrue to non-SERP utilities.

Non-incentivized SERP sales would save the utility energy at no added utility cost, but with an additional cost to consumers. More efficient, non-SERP units produced by all manufacturers would save the utilities energy for all refrigerator purchasers, but

competition would probably keep consumer cost increases to a minimum. Future savings would be attributable to any efficiency increases in all brands that were induced by SERP. We assumed that these savings would accrue for five years after SERP ended and that new efficiency standards would then go into effect.

The effect of these free driver effects could be very significant. Efficiency improvements in non-SERP refrigerators during the life of the Program (Table 5.3, column 2) could increase the benefit-cost ratio by nearly 25%. The largest free driver effect would be benefits from efficiency increases in the future (column 3). This simplified analysis suggested that accounting for these benefits could more than double the benefit-cost ratio.

The results for free riders shown in columns 4, 5, and 6 of Table 5.3 are based on reasonable simplifying assumptions. The effects appeared to be relatively minor, particularly compared with the free driver effects.

Combining all the free driver and free rider effects in Table 5.3 with the baseline benefits and costs, the overall benefit-cost ratio would increase to 7.89 using a 5% real discount rate. This was nearly three times the baseline estimate, 2.73, which did not account for any of these additional effects. This significant change in the benefit-cost ratio demonstrated the importance of including these effects, particularly any future benefits attributable to the Program.

Several major potential impacts were not included in this analysis. The first was the effect of SERP on the next efficiency standards. Current proposals are for a 30% energy use reduction. Given industry comments that 20% would be the maximum economically feasible improvement, if 30% were adopted, one-third of that increase might be attributable to SERP. If this benefit were attributed to SERP, across all refrigerator models and far into the future, the impacts would be substantial. The second impact not included was energy savings in non-SERP utility areas. Unless allowed by regulators, these benefits would not accrue to SERP utilities and, from the TRC perspective, would not be included. Because SERP utilities contain only about 21% of all U.S. households, the benefits attributable to SERP in non-SERP areas could be four times the benefits in SERP areas alone. Finally, the externalities associated with reduced energy use were not included in the TRC test. The societal test would incorporate these benefits and the Program would receive the additional credits of reducing environmental damages associated with electricity generation.

6.0 MARKET TRANSFORMATION ASSESSMENT

We used several types of data and information to investigate SERP's market transformation effects. Assessing market transformation effects raised several research questions:

- Did the Program succeed in demonstrating that the production of super-efficient, CFC-free refrigerators could be accelerated?
- Have significant changes occurred in the refrigerator market as a result of SERP?
- Did SERP induce the non-winning manufacturers to increase their efficiencies and use of non-CFC refrigerants?
- Are there any spillover effects from the Program?
- Are there lasting changes in the refrigerator market as a result of SERP?

These research questions framed the following discussion of SERP's market transformation effects.

6.1 ACCELERATION OF TECHNOLOGY INTRODUCTION AND MARKET PENETRATION

This section discusses market transformation effects of SERP in terms of accelerating the introduction of a new technology and its market penetration.

6.1.1 Technology Introduction

Available information and testimony on federal appliance efficiency standards prior to SERP suggested that the goals of energy efficiency and CFC elimination conflicted with each other. As noted earlier, SERP arose out of utility and environmental group concerns that refrigerator efficiency improvements were likely to slow dramatically when limitations on the use of CFC refrigerants went into effect. Initially, experts anticipated that non-CFC refrigerants would incur a 15% efficiency penalty (IRT 1995) and,

consequently, there was concern that it would be more difficult to increase refrigerator efficiency standards.^(a)

Several years before SERP, manufacturers were working with DOE through the Appliance Industry-Government CFC Replacement Research Consortium, Inc., to explore ways to eliminate CFCs and meet strict efficiency requirements (Remich 1991). The group investigated thermal conductivity, dimensional stability, compatibility with cabinet liners, and other properties of alternative insulating materials. The consortium also investigated vacuum panels for insulation. The group also explored alternative refrigerants, examining performance and compatibility with lubricants and other materials. In late 1991, the group proposed a set of research projects including vacuum panel life testing, alternative foam compatibilities, component improvements, and refrigerant testing.

Whirlpool was able to accelerate the introduction of several new technologies, overcoming some of the issues addressed by the consortium, as a result of SERP. Whirlpool overcame compatibility problems with the R134a refrigerant and eliminated CFC refrigerants as early as any other manufacturer. They switched to a non-CFC blowing agent for the foam insulation. They installed fuzzy-logic electronics to optimize the defrost cycle, improved the condenser and evaporator fan motors, and modified other components to achieve the highest efficiency levels in the industry (Langreth 1994). In 1995, they introduced evacuated panels and other refinements to reduce consumption another 16%.

Vince Anderson, of Whirlpool, noted in 1994 that many of the technologies incorporated in the SERP model were already under development, but the Program spurred the company into production much earlier than planned (Langreth 1994, p. 67). Comments from Frigidaire, the other finalist, suggested that the Program cut in half the normal 18-month product development process (Schiller 1993, p. 81).

The fact that Whirlpool was able to design, produce, and market a refrigerator meeting the SERP requirements showed that the twin goals of energy efficiency and CFC elimination could be met. Technical issues of designing and producing a qualifying side-by-side refrigerator were overcome. SERP clearly succeeded in demonstrating that super-efficient, CFC-free refrigerators could be produced, over 18 months ahead of the mandatory phaseout of CFCs. In the absence of SERP, it seems unlikely that Whirlpool,

(a) Recent information from a discussion with a manufacturer's representative suggested that the penalty was closer to 3% or 4%.

or any other manufacturer, would have introduced a super-efficient, CFC-free refrigerator as early as Whirlpool did in response to the Program. Based on this evidence, we have concluded that SERP did accelerate the introduction of a new technology before the market would have otherwise.

6.1.2 Market Penetration

The second issue in technology introduction was how rapidly the technology penetrated the market. Our study budget constraints and industry concerns about proprietary data prevented us from analyzing very accurately the market penetration effects of SERP. The dealer interviews, however, provided some information on sales of SERP units and this helped us assess market penetration.

When asked what share SERP units constituted of side-by-side refrigerators sold, dealer responses ranged from 0% to 100%. Nearly 60% of dealers responded in the range of 0% to 5%; about 30% said that SERP sales were between 5% and 50%; and about 10% said that SERP comprised over 50% of these sales. Some noted that sales had fallen after the first year, in part because of reduced publicity and consumer awareness.

To understand what affected SERP sales, we examined the relationship between the share of SERP units sold and other factors. The SERP share did not appear to be correlated with a dealer's total sales volume. There was some correlation with utility area, although within many utility areas the SERP sales share covered a large range across dealers. There were a few utility service areas where the reported sales percentages were either uniformly high or uniformly low.

Three factors emerged that appeared to be correlated with sales: promotion, having models available in the showroom, and incremental cost (if any) of the SERP models. It was difficult to compare dealer promotion levels, but dealers who mentioned more promotional activities, including mentioning energy efficiency in print and radio ads, tended to sell a larger share of SERP units. Dealers who did not stock SERP units consistently said that they sold an almost negligible amount. Although not surprising, this finding confirmed the importance of having a SERP model on the floor for consumers to see, touch, and ask about.

The additional cost of SERP units was negatively correlated with the SERP sales percentage (the correlation coefficient was statistically significant at the 0.01 level). A simple regression analysis suggested that at no added cost, SERP units would comprise

about 30% of sales and that each \$100 of added cost lowered the SERP share by about 10 percentage points.^(a)

From dealer supplied estimates, we estimated that the volume-weighted average SERP sales were about 14% of all units sold by SERP dealers in that size and style category.^(b) Our estimate was about 56% of Whirlpool's estimated 25% overall refrigerator market share in 1993 (Treece 1993, p. 79).

As noted in Chapter 5, SERP sales did not increase as fast as originally projected. The analysis in Chapter 4 showed that SERP units, on the average, sold for about \$80 more than comparable refrigerators. It was likely that this additional cost, despite Program intentions, diminished SERP's market penetration.

6.2 CHANGES IN THE REFRIGERATOR MARKET

To assess SERP's market transformation effects, we investigated indications of market changes at the manufacturer, dealer, and consumer level. This section discusses our findings regarding some key indicators of market changes.

6.2.1 Manufacturer Behavior

The first issue that we addressed was what effects SERP had on the production and marketing decisions of manufacturers. Ray Farhang, SERP chairman, noted in 1994 that the SERP refrigerator would "transform the very nature of the market by encouraging all manufacturers to develop and deliver appliances that are as efficient and without CFCs" (PR Newswire, Inc., 1994). We obtained information from manufacturers and utilities to document opinions about SERP's effect on manufacturers' production and marketing decisions, but recognized that the opinions held by both manufacturers and utilities on this issue were likely to be colored by their perspectives.

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- (a) This analysis was conducted excluding areas where dealers indicated that utilities provided consumer rebates for efficient refrigerators. If included in the analysis, a consumer rebate would offset the price effect partially.
 - (b) There are several sources of uncertainties in this value including inaccuracies in market share and sales volume estimates provided by salespeople. We believe, however, that this is a reasonably accurate estimate of the overall average.

From our manufacturer interviews, a useful picture of the industry started to emerge that could explain how the industry responded to SERP and might respond to future programs. Only the largest manufacturers have the capability to produce most of their components. As one of the smaller top five manufacturers noted, "We focus on cabinet design changes because we have to obtain our mechanical components from other suppliers." Consequently, substantial efficiency increases requiring mechanical system enhancements were not very likely for any but the largest manufacturers.

Several manufacturers described their research and development (R&D) approach as a "portfolio" or "deck" strategy, in which they had a range of technologies under investigation at any one time. The decision to commercialize a specific technology was motivated primarily by cost reductions that resulted from R&D. Because the SERP incentive offset the added costs, Whirlpool was able to take the necessary research and product development steps to integrate several technologies into the SERP model. This was, in fact, one of the intended effects of the Program.

On the other hand, our information from manufacturers suggested that industry characteristics and the SERP criteria might have limited the number of manufacturers that realistically could compete for the SERP award. This reality probably limited how widespread market transformation was at the manufacturer level.

Sandahl et al. (1996) noted that utility observers and manufacturers were divided, early in the Program, on whether SERP would affect the manufacturers' phaseout of CFCs. Two-thirds of utility respondents believed that SERP had sped up the phaseout. Utilities argued that SERP likely influenced the speed of the phaseout in multiple ways. First, manufacturers had to address the CFC-free requirement in their SERP bids. Second, the presence of the CFC-free SERP refrigerator in the marketplace was likely to prompt other manufacturers to offer their own CFC-free units to compete with SERP refrigerators. Most importantly, SERP showed that an energy-efficient, CFC-free refrigerator could be produced.

Eight of nine manufacturer representatives interviewed by Sandahl et al. (1996), on the other hand, reported that they felt that SERP would have no impact on CFC phaseout. Most said that they were already working on replacing CFC compounds prior to SERP; therefore, they did not believe that SERP had any influence. In our recent interviews with refrigerator manufacturers, however, they acknowledged at least a minor effect of SERP on the phaseout. Although Whirlpool had already established a schedule for beginning and completing the CFC phaseout, a Whirlpool spokesman said that SERP led the company to increase the rate of conversion. According to GE representatives, it was

encouraged by the competition of the SERP refrigerator to introduce a large, side-by-side, CFC-free unit in 1994. The other major manufacturers, however, indicated that SERP didn't cause them to modify their plans to introduce CFC-free units.

Although they could not provide definitive answers, refrigerator model data shed some light on manufacturers' responses to SERP. We used the data in CEC (1995, 1996) to determine how many CFC-free models were introduced

by manufacturers over time. Figure 6.1 shows that over 300 CFC-free refrigerator and freezer models were available more than one year prior to January 1996, when CFC production was required to end. Whirlpool (WH) led the introduction of CFC-free models (under various brand names) with about half its introductions occurring prior to December 1994. Amana (AMF) introduced over half of its models before March 1995 and GE introduced a large majority of its models in the first quarter of 1995. Frigidaire (FCF) introduced all of its CFC-free models in mid-1995.^(a) All other manufacturers introduced most of their models late in 1995.

Figure 6.1 shows that Whirlpool led the rest of the industry by 3 to 6 months in introducing CFC-free refrigerators. The fact that SERP accelerated Whirlpool's introduction of a CFC-free model probably influenced the introduction pace for other CFC-free units.

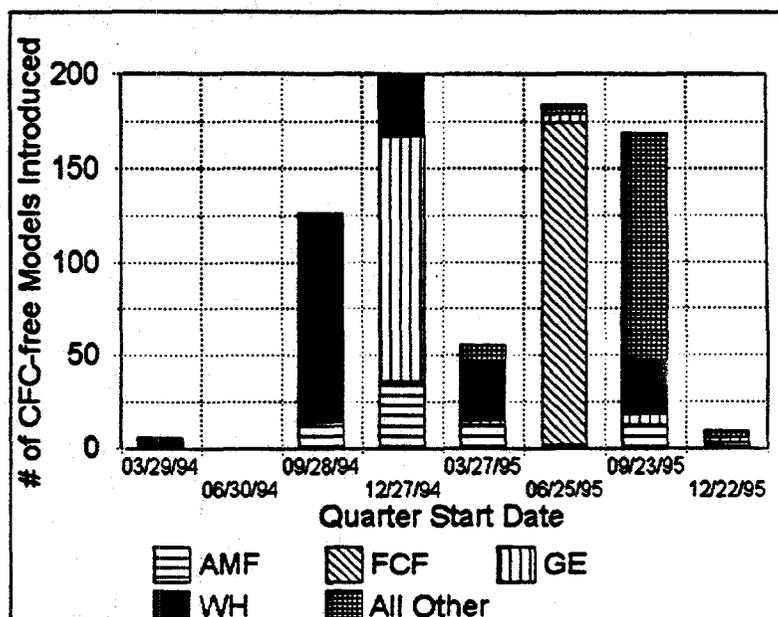


FIGURE 6.1 Introduction of CFC-Free Models

- (a) Given that Frigidaire was the other SERP finalist, its late introduction of CFC-free units is somewhat surprising because its prototype had to demonstrate CFC-free technology. This was not consistent with early expectations that the SERP technology would appear in Frigidaire models even if the company lost the SERP competition (Schiller 1993). A Frigidaire spokesman indicated recently, however, that the company chose not to market its SERP model because it was not economical to sell it without the SERP incentive.

The data in CEC (1995, 1996) showed that several manufacturers met both the efficiency and CFC-free requirements of SERP and that the goals were met in various sizes and styles.^(a) Over one year before the CFC phaseout, Amana and Whirlpool were producing more than 40 models of high efficiency refrigerators that were also CFC-free. They included all styles and sizes ranging from approximately 20 to 25 cu. ft. By about the same time, GE had introduced five top-freezer models meeting the SERP requirements. In addition to its SERP models, Whirlpool introduced a comparably efficient "Energy Wise" model outside the SERP utility areas.^(b) When the CFC phaseout went into effect, over 75 of the CFC-free models from different manufacturers were at least 25% more efficient than the standards. Although most were side-by-side units, many top and bottom freezer models also were available.

In summary, it appeared that SERP affected manufacturers' behavior by accelerating their introduction of CFC-free, high efficiency units. Although an Amana representative did not confirm this, it appeared from the refrigerator statistics presented here that Amana responded to the SERP model by producing energy efficient, CFC-free models. Amana and Whirlpool, followed by GE, expanded the availability of such units beyond the single style produced under SERP.

To examine possible effects of SERP on efficiency alone, we analyzed the data from AHAM (1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995) and CEC (1995, 1996). We considered only side-by-side units in the 21 to 23 cu. ft. size range.

We plotted the energy efficiency of the least efficient and most efficient models certified by each manufacturer under its own brand for 1988 through 1996. Both the maximum and minimum efficiencies of all brands improved substantially over this period.

Figure 6.2 presents Frigidaire data

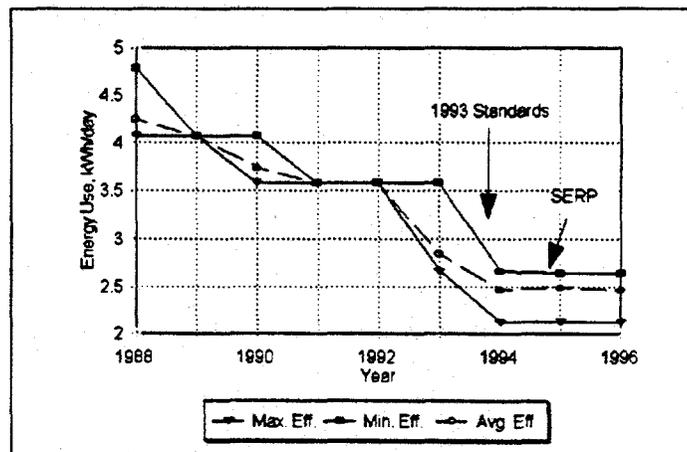


FIGURE 6.2 Frigidaire 21-23 Cu. Ft. Side-by-Side Consumption

- (a) The units all exceeded the efficiency requirements of the standards by at least 25%.
- (b) These units were sold without any rebate. A Whirlpool spokesman indicated that sales were discontinued, however, due to inadequate consumer response.

as one example.^(a) The energy consumption of both Frigidaire's least and most efficient models declined about 48% over this period. (The average efficiency curve in this and subsequent figures was calculated as just the simple average across certified models because sales data were unavailable.) The figure illustrates the significant effect of the 1993 appliance standards: the annual energy consumption of Frigidaire's least efficient model in this category decreased by almost 300 kWh. Neither the maximum nor minimum efficiency levels, however, showed any effect of SERP.

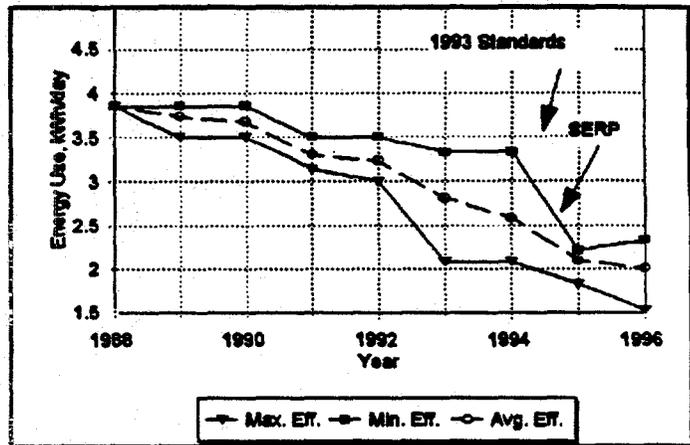


FIGURE 6.3 Whirlpool 21-23 Cu. Ft. Side-by-Side Consumption

Figure 6.3 displays the same data for models produced by Whirlpool.

These data showed that the efficiency of Whirlpool's most efficient units improved sharply about a year before Frigidaire's. The plot also shows the effects of SERP: efficiencies of the most efficient models continued to improve through early 1996.

Although the Frigidaire data exhibited no effect of SERP, other brands appeared to. Amana improved the efficiency of its most efficient units in both 1995 and 1996. Data for the two other major brands, GE and Maytag, showed a different pattern. The efficiency of both brands' least efficient units increased substantially in 1996, significantly reducing the difference between their most and least efficient units.^(b)

Figure 6.4 presents one other view of energy-efficiency trends. This figure shows the average consumption for all brands in the SERP size range and style. It shows that average consumption declined 45% from 1988 to 1996. The biggest impact resulted from the 1993 standards; just under half of the improvement occurred as the standards went into effect. Comparing the pre-standards period and the period after the

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- (a) Note that the consumption data plotted are for units certified as of January each year so the effects of the standards and SERP are not likely to show up until the following year.
 - (b) A Whirlpool representative has noted that some of the industry efficiency improvements probably were due to utility refrigerator efficiency programs. This seems likely, but we were unable to assess this issue during our study.

standards, the annual percentage increase in efficiency was comparable at about 5% per year. These results might be interpreted to demonstrate that SERP had a negligible effect on the overall efficiency of side-by-side units in this size range.

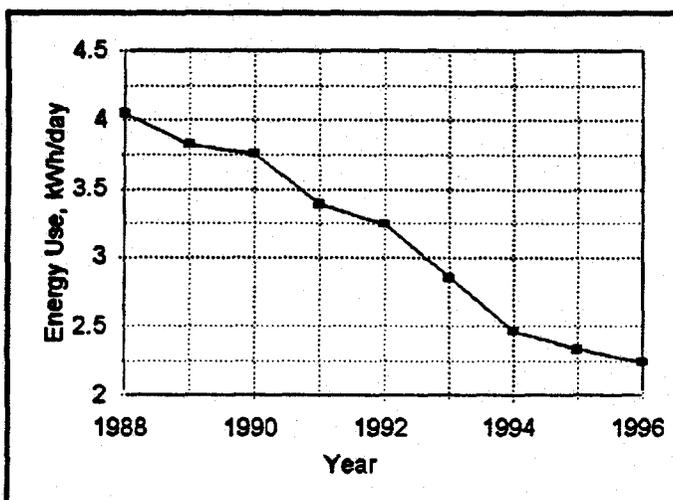


FIGURE 6.4 Average Consumption, All 21 - 23 Cu. Ft. Side-by-Side Models

As noted earlier, however, the data for individual brands suggested that SERP had an effect on the efficiencies of some products. In mid-1993, no major manufacturers were producing refrigerators in any style and size that had consumption levels 25% less than the 1993 standards, i.e., the minimum SERP requirement (CEC 1993). By January 1996, however, over 75 units were available that consumed at least 25% less than the energy level set by the 1993 standards and were CFC-free.

The open question was whether these units would have been produced without SERP. Although there was no way to answer this question definitively, manufacturer comments were informative.

In 1994 testimony on the development of a proposed 1998 efficiency standards, several manufacturers questioned the benefits of increased efficiency and the risks attached to the required technology advances. They questioned the ability of the industry to meet tighter standards cost-effectively (see, for example, Whirlpool 1994 and Frigidaire 1994) and one manufacturer argued that anything more than a 20% improvement could not be justified economically (GE 1994).^(a) In our interviews, several manufacturer representatives made similar arguments. Although manufacturers said that they would make the changes necessary to comply with new standards, most representatives specifically said that they expected minimal efficiency increases without tighter standards or effective market transformation. Several expressed the opinion that it would require consumer demand for the industry to make significant efficiency improvements, and both manufacturers and dealers indicated that there was little evidence that consumers were willing to pay for higher efficiencies.

(a) The proposed standard would require a 30% efficiency improvement.

Despite the industry's comments, as we noted earlier, several models were being produced by 1996 that consumed at least 25% less than the 1993 standards threshold.

From a simple cost analysis and dealer comments, we have concluded that SERP, at least partially, motivated manufacturers to produce such high efficiency units. With an energy consumption about 41% less than the 1993 standards requirement, the newest SERP 22 cu. ft. model had an estimated annual energy cost of about \$47, or a \$33 savings per year compared with a model having the minimum required efficiency. Based on our dealer interviews, this difference would be adequate to get the attention of buyers. Compared with a model that was 25% more efficient than the standards, however, the SERP refrigerator would save only about \$13 per year. Many dealers told us that this small a difference did not matter to most consumers. It appeared, therefore, that some manufacturers responded to SERP by producing units that were around 25% more efficient than required by the standards and that, without the Program, these units probably would not have been produced.

We examined one additional set of data to shed light on the effect SERP had on energy efficiency. We determined the average efficiency of all certified large (greater than 23 cu. ft.), side-by-side units produced by the major manufacturers from 1994 through early 1996 (AHAM 1994, 1995; CEC 1996). Table 6.1 shows how much less the average consumption was than required by the efficiency standards during this time period.^(a) Combining the data for manufacturers except Whirlpool, the average efficiency improved a modest amount over the period and the average consumption for these manufacturers in 1996 was 7.5% less than required by the 1993 standards. The average efficiency for Whirlpool models increased sharply in 1995, with none of the certified models using more than 80% of the threshold set by the standards.

These data showed that all manufacturers improved the efficiency of their side-by-side models. The non-Whirlpool brands exhibited improvements, but of lesser magnitude than Whirlpool. Some of the improvement in the other brands probably occurred in response to SERP, but it would be impossible to determine accurately how much. If SERP were responsible for one-third of the improvement, the effect on average consumption would be a 2.5% reduction. Whirlpool clearly made significant efficiency improvements in its largest side-by-side units, as well as the 22 cu. ft. models. Based on these data, we believed that SERP influenced the efficiency levels of all Whirlpool's side-

(a) These numbers were calculated as the simple average of percentage savings for all models produced under the indicated brand name. They were not weighted by sales data because these data were not available.

by-side models, possibly reducing the consumption of all its side-by-side models an additional 15% to 20% beyond the reductions of other manufacturers.

TABLE 6.1. Efficiency Comparisons for Large, Side-by-Side Units

Brand	1994	1995	1996
Amana	9.5%	11.1%	10.6%
Frigidaire	5.2%	6.7%	8.0%
General Electric	-9.9%	-8.5%	4.9%
Maytag	5.2%	5.2%	9.6%
Average of Four Brands Above	-1.3%	1.7%	7.5%
Whirlpool	0.8%	22.7%	25.2%
Average of All Five Major Brands	-0.9%	3.3%	9.8%
Note: Percentages indicate average consumption reduction relative to 1993 standards. Negative numbers indicate consumption higher than the standards.			

Observations during visits in early 1996 to dealer showrooms in the Pacific Northwest tended to corroborate the perception from the detailed efficiency data for 22 cu. ft. models that at least Amana and GE were competing on the same ground as the SERP models. The more energy-efficient GE refrigerators had labels saying that they were "Energy Smart" and some Amana models had stickers saying that they were "Energy Efficient." Some Amana units had stickers saying that they were "CFC-Free" and some GE models had stickers saying "CFC-Free Sealed System." Special labeling for energy-efficient and CFC-free models of other brands, however, was minimal.

About 70% of dealers that we interviewed felt that SERP had not had a direct effect on non-winning manufacturers. Many noted, however, that efficiencies of all brands had been improving and that CFCs were no longer being used. Dealers usually attributed these changes to regulations, rather than SERP. About 30% of dealers did feel that SERP had influenced other manufacturers. Several commented that Amana had increased the efficiency of its units, and one noted that both GE and Amana were mentioning energy efficiency in print ads. A few suggested that Amana had lowered

prices, partially in response to SERP, making the payback longer from purchasing a SERP unit.

In summary, there was circumstantial evidence that SERP caused Whirlpool and other manufacturers to modify their products and marketing. The introduction of CFC-free models was accelerated by SERP. Also, SERP probably prompted the production of CFC-free, highly-efficient refrigerators in a range of styles and sizes.

6.2.2 Marketing Activities and Consumer Awareness

Other key market transformation effects were expected at the dealer and consumer level. This section discusses marketing activities related to SERP and energy efficiency in general. It also presents information about consumer awareness and preferences.

Marketing Activities and Dealer Awareness

Overall, SERP experienced a major splash of publicity in the beginning and diminishing ripples of local promotion since. The prevalence of articles in the popular and technical press about SERP was a unique first step in transforming the refrigerator market. Residential appliances rarely have received such extensive attention in the media.

We found little evidence that dealers were promoting SERP units very intensively. Salespeople usually were familiar with the SERP models, but it appeared that many salespeople lacked adequate training and information to promote SERP models effectively. Less than a third said they had received training on SERP, and that usually came as part of general training by Whirlpool's sales representatives. Several mentioned that training had occurred at the beginning of the Program, but not recently. Almost no dealers were aware of the changes that had been made to improve the efficiency of the new SERP models. We saw little evidence that Whirlpool had publicized the significant technological advances in its new models as it had those in the original SERP unit.^(a)

About 60% of SERP dealers that we interviewed indicated that they had done some promotion of SERP models. Most promotion, however, was limited to having SERP stickers on the refrigerators. Dealers also typically had SERP brochures available for customers. Most of the information was from Whirlpool. The media publicity about the Program played a role because some dealers said that they showed consumers articles

(a) These observations are based on what we were told by dealers and the data that we collected. A Whirlpool spokesman indicated that he did not concur with them.

from the popular press about SERP. Only about 20% of those who promoted SERP units did so in print ads.

There was some indication that SERP had increased the promotion of high efficiency refrigerators and CFC-free refrigerants in general. About 70% of the SERP dealers said that they or their store emphasized energy efficiency in their sales pitch, through in-store displays, or in print or radio ads. A few noted that they stressed the efficiency improvement of new units compared with old refrigerators and this was a useful tool for encouraging a consumer to buy a new unit. One major chain that was in SERP areas put stickers on every refrigerator stating "Energy Saver." Most dealers put information on models to identify those that were "CFC-free." As noted earlier, one store mentioned an innovative "pig and panther" display that had been set up in late 1995 to compare the energy use of a SERP unit and an older refrigerator. About 10% of SERP dealers said that they put energy efficiency information in their print or radio ads. Surprisingly, there was no statistically significant relationship between local electricity rates and the likelihood that dealers promoted efficiency to consumers.

Only about 50% of non-SERP dealers emphasized energy efficiency through their sales pitch, ads, or in-store displays. Non-SERP dealer showroom visits produced few cases where refrigerators had any labeling related to energy efficiency, other than the Energy Guide Label. Newspaper ads of non-SERP dealers also rarely contained information on energy efficiency. One non-SERP dealer mentioned that the local utility let customers borrow a meter that they could use to measure the consumption of their old refrigerator and then compare it with the Energy Guide Label; this usually sold them on the new unit.

As noted earlier, the key for SERP dealers to generate consumer interest once buyers were in the store was having SERP models on display. The SERP stickers distinguished the units from others and stimulated consumer questions. From dealer interviews and site visits, it appeared that small stores were unlikely to have SERP units on the showroom floor. The stores that had intermediate sales volumes (20 to 75 units per month) were likely to have the 22 cu. ft. model on the floor. The largest stores were likely to have more than one SERP unit on the floor in different sizes. The smaller stores had less flexibility to display a range of models and apparently chose to display other Whirlpool side-by-side units. As pointed out earlier, these models may have been relatively efficient, but less efficient than the SERP models. Consequently, the smaller stores were the least likely to generate consumer interest in SERP.

It was impossible to determine how much effect SERP promotion had on buyers who chose to buy a non-SERP unit, but SERP units and materials often stimulated consumer

questions about efficiency and refrigerant types. It was likely that some of these buyers were motivated to buy more efficient, CFC-free units because of SERP, even if they didn't purchase a SERP model.^(a)

Consumer Awareness and Preferences

In our dealer interviews, dealers rated the importance of energy efficiency and refrigerant type to consumers as relatively low.^(b) Averaging across SERP dealers, they believed that their customers rated the importance of features and characteristics in the following order: price, size, style, shelf type and arrangement, water/ice dispenser, energy efficiency, and refrigerant type. The order of importance indicated by non-SERP dealers was similar, but energy efficiency was rated as more important than the water/ice dispenser. The variances in the ratings were highest for the energy efficiency and refrigerant type, indicating that their importance was more sensitive to consumer differences and external factors (such as electricity rates). Although these dealer ratings were informative, the information could be improved by collecting information from consumers directly since other studies have suggested that disparities sometimes exist between what salespeople believe and what consumers say directly.

Analysis of the scores that SERP dealers gave for the importance of energy efficiency to buyers indicated that a weak, but statistically significant (at the 0.001 level), correlation existed between the perceived importance of energy efficiency and electricity rates.^(c) This result suggested that although several factors were probably responsible for the perceived importance of energy efficiency to consumers, electricity prices were a key one.

Almost 80% of SERP dealers indicated that some consumers asked about energy efficiency. About 40% said that over half the consumers asked about efficiency. The Energy Guide Labels appeared to be a broadly used tool for comparing energy efficiency.

Non-SERP dealers reported almost the same frequency of consumer inquiries about energy efficiency and about 30% said that over half the buyers inquired about efficiency.

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- (a) These buyers would then be classified as free drivers.
 - (b) Dealers were asked to estimate a score from 1 (not important at all) to 5 (very important) for a set of features and characteristics.
 - (c) This finding was consistent with the finding in Chapter 5 that SERP sales seemed to be influenced by electricity rates.

Surprisingly, about 70% of SERP dealers said that consumers asked about the refrigerant. Non-SERP dealers reported that consumers asked about the refrigerant only about half as frequently as SERP dealers did. The difference may have been due to more CFC-free displays at SERP dealerships. Consumer interest in refrigerants was about evenly split between concerns over environmental impacts of CFC refrigerants and disposal problems, and potential reliability problems with non-CFC refrigerants. Only a few dealers indicated that they felt there were reliability and performance problems with CFC-free refrigerants; they tended to be those who didn't carry CFC-free models.

According to dealers, consumer awareness of energy efficiency resulted largely from information in the print and electronic media. Concerns about CFC refrigerants usually came from media information about ozone depletion. Concerns about performance problems with CFC-free refrigerants came from word-of-mouth and media stories about problems with new refrigerants, for example, in automobile refrigerant systems. Consumer awareness also came from dealer information. Several dealers indicated that they or other dealers had warned consumers about reliability problems with non-CFC refrigerants. Almost all SERP dealers said that consumer interest in energy efficiency and refrigerants had increased in the last few years. One dealer mentioned that SERP had caused a blip in the interest level in efficiency and refrigerant type. A few dealers mentioned that the electric utility had been instrumental in educating consumers about these issues through information and rebate programs.

Several of the manufacturer representatives that we interviewed observed that consumer interest in energy efficiency was critical if the industry were to make additional efficiency improvements. Manufacturers typically felt that consumers were not demanding higher efficiencies and that, at best, efficiency was only a tie-breaker; i.e, if two refrigerators were equivalent to a consumer, based on style, size, and features, then the consumer would favor the more efficient one. Manufacturer representatives generally felt that SERP had done little to affect consumer perceptions or interest in energy efficiency, particularly after the first few months of the Program. One noted that the refrigerator market changed fast and SERP was already "old hat." One manufacturer (and a few dealers) mentioned that added labels on refrigerators were a sales hindrance because they created a cluttered appearance.

Another factor that affected consumer awareness was local culture. There were striking differences between consumer attitudes in two Pacific Northwest communities. Even though electricity rates were comparable, dealers indicated in one town that almost no one asked about energy efficiency but, in the other town, dealers said that one-third or

more of their shoppers were concerned about efficiency. In the latter community, dealers reported that there was a large group of environmentally conscious (or as one non-SERP dealer said "environmentally radical") consumers who asked for the most efficient, environmentally friendly appliances. The community predisposition and the local utility's active efficiency program appeared to increase interest in energy efficiency, despite very low electricity rates, resulting in consumer awareness comparable to communities with higher electricity rates.

Most SERP dealers indicated that some consumer awareness of SERP existed before buyers came into the store. About 70% of dealers said that some customers, typically 5% to 10%, were aware of SERP. Many dealers noted that awareness was much higher at the start of the Program and inquiries had dropped off dramatically in the past few months. Awareness appeared to be triggered by several actions. Consumer awareness was higher for the small share of dealers that mentioned SERP in their ads. Some consumers, especially early in the Program, were specifically looking for CFC-free models and knew that SERP units were CFC-free.

One of the most effective ways to increase consumer awareness were steps taken by utilities, although they were not very common. The Eugene Water and Electric Board (EWEB), for example, opened an "energy store" where efficient appliances, including SERP refrigerators, were displayed. This increased consumer interest substantially. Other dealers noted that utility mail-outs that mentioned SERP had increased awareness. Probably the most directed activity taken by any utility was the promotional effort, mentioned earlier, that was launched recently by the New England Power Service Company. It hired a consulting company to act as an additional "sales force" that supports the Program. The consultant works with the regional Whirlpool sales representatives to promote SERP to dealers and to develop point-of-purchase displays. This utility discovered that the Whirlpool representatives in its territory were spread too thin to adequately promote SERP and the Whirlpool sales representatives in the area welcomed the additional help. It was too early in this effort and there was no dealer information on the effort to permit us to assess its effectiveness. Nevertheless, this approach was likely to be productive because it addressed problems identified in our study.

About 10% of non-SERP dealers said that consumers occasionally asked about SERP models. Some had heard of SERP in the media and some had seen SERP models at other dealers.

6.3 SPILLOVER EFFECTS AND CROSS-BORDER SALES

The earlier discussion of product changes possibly influenced by SERP suggested that there were effects of the Program beyond sales of Whirlpool's SERP models. Some dealers noted that Whirlpool had improved the efficiency of several models and other manufacturers had improved the efficiency of a range of products. These changes have benefitted utilities and consumers in SERP areas.

The dealer interviews suggested that Program publicity, SERP models on the floor, and SERP materials stimulated consumer inquiries about energy efficiency. Some non-SERP dealers in the SERP areas indicated that consumers occasionally asked whether the dealer had SERP units and how they compared with the units that the dealer did carry. Although no quantifiable data were available, it appeared that the Program increased consumer awareness about energy efficiency, leading to consumers being more likely to buy an efficient refrigerator, even if not the SERP unit.

Probable benefits of SERP have extended beyond the borders of SERP utilities.^(a) Whirlpool introduced its "Energy Wise" model for sale in non-SERP areas and efficient refrigerators produced by other manufacturers were available in non-SERP areas (as well as SERP areas). These effects could be classified as free drivers for which the SERP utilities incurred no costs, but for which they also received no direct energy savings benefits.

Another type of market transformation impact that occurred involved cross-border sales, in particular sales of SERP refrigerators to consumers who lived outside of SERP utility areas. If these customers bought from a dealer located in a SERP area, the SERP payment system would use the cross-border account to pay Whirlpool the incentive, yet SERP utilities would not receive the energy savings benefits. Although these sales represented energy-efficiency impacts of the Program, to the participating utilities they were a leakage of Program benefits for which the utilities incurred costs.^(b)

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- (a) As noted before, these effects outside the SERP territories should be attributed to the Program, rather than included in the baseline trend, when estimating impacts.
 - (b) As discussed in Chapter 5, it would be necessary, in assessing energy savings impacts, to properly attribute these efficiency changes in non-participant areas to the Program.

6.4 LASTING CHANGES

SERP might have caused several types of lasting changes. We looked for evidence of different types of long-term changes.

Institutionalized organizational and product line changes at Whirlpool and other manufacturers were one area that we investigated. Most of the manufacturers assembled a special cross-cutting team to respond to the SERP RFP. After the award, the only manufacturer that maintained organizational changes was Whirlpool, which established a team to get the SERP unit into production. Once production was smoothly underway, this team disbanded and the SERP refrigerator was integrated into Whirlpool's regular production process.^(a) None of the manufacturers indicated that SERP led to any lasting organizational changes to focus better on energy efficiency or CFC phaseout.

Most manufacturers commented that SERP had little, if any, long-term effect on their product lines. Even the Whirlpool spokesman noted that SERP had little effect on its other products. Despite the fact that Frigidaire did not market its SERP unit, it did use some of the cost-effective technologies from its SERP model in other products, according to a Frigidaire representative. One manufacturer representative noted that the winning SERP model was in such a small market niche that his company did not feel they needed to compete with it and it did not influence their products.

Overall, manufacturers generally shared the sentiment that SERP had not induced significant long-lasting market changes. The Whirlpool spokesman articulated this view as follows: "I assume that market transformation means long-lasting change so that consumer preferences are shifted, manufacturing infrastructure is altered, and undoing these changes is not feasible. Since refrigerators are a collection of components, we can take out the SERP components easily after the Program ends. [Furthermore] the efficient technologies [need to have] consumer benefits that will convince buyers to not go back." Generally, manufacturers felt that the efficiency improvements in refrigerators offered consumers few of the other benefits that would create a lasting shift in consumer demand.

(a) The fact that Whirlpool was able to integrate the SERP unit into its existing processes exemplified that some market transformation occurred because the technology did not continue to be treated as unique.

Although manufacturers expressed doubts that SERP had induced any long-lasting market changes, it seemed unlikely that the efficiency gains in Whirlpool's non-SERP models and other manufacturers' products would not remain when SERP ended. To the extent that these gains were related to SERP, SERP would have lasting effects on efficiency levels in the future.

There was less evidence that long-lasting changes had been made in dealer behavior or consumer preferences. Although there was evidence of such changes during the Program, it appeared that they were modest enough that they were unlikely to last long after SERP ended.

The most significant lasting change resulting from SERP could be its effects, if any, on the next generation of appliance efficiency standards. Sandahl et al. (1996) noted that perceptions were mixed about SERP's effect on tightening the standards. Nine of 11 SERP utility representatives interviewed for the study felt that SERP would have at least some positive impact on tightening refrigerator standards. Only about half the representatives of refrigerator manufacturers interviewed, on the other hand, believed that SERP would have some effect on tightening the standards. The study authors quoted one participant in the negotiations for the new standards who said that "It is likely that SERP had at least some effect on the proposed 1998 NAECA standards. While the technical aspects of the SERP model reportedly were not discussed in the negotiations, the SERP model was referenced as evidence that an energy-efficient CFC-free refrigerator could be produced cost effectively."^(a)

(a) From personal communication with Howard Geller, American Council for an Energy-Efficient Economy.

7.0 OVERALL FINDINGS AND RECOMMENDATIONS

This chapter summarizes Program findings and presents recommendations for improving SERP and other potential market transformation programs. It also presents recommendations for analyses that would be relevant to a final Program evaluation.

7.1 MAJOR FINDINGS

This section presents major findings from our evaluation and prior studies.

7.1.2 Did SERP Meet Its Objectives?

The first major objective of the Program was to promote the production and widespread marketing of a super-efficient refrigerator that did not use CFC refrigerants. The Whirlpool SERP models clearly met these requirements and our data indicated that numerous models of high efficiency (using less than 75% of the energy allowed by the 1993 standards), CFC-free refrigerators have become available since SERP began.

Although the SERP units sold represented a small market share, the wide range of styles and sizes of high efficiency, CFC-free units that have since become available have demonstrated that SERP met its first major objective. SERP also helped accelerate the conversion to CFC-free refrigerants by demonstrating that high efficiency could be achieved even with CFC removal.

The second major objective of the Program was to support the planned 1998 DOE efficiency standards upgrade. Successful construction of a SERP unit demonstrated that achieving higher standards with a CFC-free refrigerator was technically feasible, at least side-by-side units. Although a range of high-efficiency units in other styles and sizes have entered the market, questions still remain about achieving efficiency improvements of 30% or more across the board. The economic viability issues have not been completely resolved either because the SERP incentive has partly offset the price impacts of SERP models.

SERP succeeded partially in answering questions of the technical feasibility of 30% efficiency improvements proposed for the next standards, but some questions of economic feasibility remained.

7.1.2 How Well Has the Program Worked?

Whirlpool has conducted a systematic training process for its personnel and regional representatives. Our dealer interviews, however, revealed that only about one-third of salespeople had been trained adequately about SERP. This was consistent with information reported by utilities.

Although personnel at the beginning of the marketing chain have been trained adequately, a large proportion of dealer salespeople had received little or no training on SERP.

Promotion was important to stimulate and maintain consumer interest in SERP. The Program received extensive media coverage at its beginning, but since then has relied primarily on limited dealer promotions. The number of consumers knowing about SERP has declined and in-store promotions have become more pivotal in promoting consumer interest.

Media advertising, SERP floor models, in-store promotional materials, and utility promotions have been key ingredients to promote SERP sales. Their occurrence has declined in recent months, contributing to diminished sales.

Despite Program planners' intentions, SERP retail prices were higher in many stores than the prices of comparable units. To improve sales tracking, Whirlpool has used a unique approach of charging more for SERP units and then giving dealers a rebate when they return sales information. To try to make this approach more effective, Whirlpool gave dealers an extra incentive of \$10 (which was increased recently to \$20) to encourage their response.^(a) Unfortunately, this approach appears to have not worked as anticipated in all cases (at least in early phases) and has contributed to higher retail prices for SERP units. Dealers indicated that, on the average, they charged about \$80 more for a SERP refrigerator.

Whirlpool's strategy of increasing the wholesale price of SERP refrigerators and then providing a rebate to dealers when sales information is returned has not worked uniformly. Due to misunderstandings about this approach

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- (a) Also in an effort to boost sales in Northern California and New York, Whirlpool has begun implementing a net pricing strategy in which dealers are charged no more initially for SERP units.

and other factors, many dealers have priced SERP refrigerators higher than competitive models and this has diminished SERP sales, which appeared to be very sensitive to price.

Information flow and communication problems were one source of difficulties encountered in implementing the Program.

Inadequate dealer and salesperson understanding of the rebate and sales tracking requirements have contributed to diminished SERP sales and sales documentation. Some salespeople communicated incorrect information to consumers about the rebate. Some utility activities helped improve dealers' understanding.

Sales tracking has turned out to be very complex and difficult to implement. Dealer sales information flow to Whirlpool has been slow or non-existent for a subset of dealers. The automated tracking system of some large dealers, however, has worked very well and Whirlpool has moved to implement an automated system at larger independent dealers. The manual system of compiling and distributing the information to SERP utilities has lagged several months behind sales, but has begun to show signs of improvement in early 1996.

The cross-border tracking process has proven to be very complex and hard to maintain accurately. Difficulties generating accurate lists of utility zip codes have aggravated this problem, creating considerable difficulties for Whirlpool and straining the working relationships among all parties.

The geographic dispersion of the SERP utilities has increased the tracking problems, increased the probability of misclassifying dealers, and complicated marketing.

7.1.3 What Impacts Has SERP Had?

Estimating Program impacts was hindered by the lack of key data and the fact that this evaluation was conducted relatively early in the Program. Based on the information available, we determined several preliminary Program impact findings. We caution the reader, however, that these findings are incomplete and need to be enhanced with more complete data and additional analysis.

All observers agreed that sales of SERP units had been below original projections. We did not have access to the manufacturer's sales data for comparison with incentive data, so questions remained about how many SERP units were produced but unaccounted for in the incentive reports. Lags in the reporting system decreased the ratio between reported and projected sales; unfortunately, we were unable to estimate the magnitude of this effect. Despite these data limitations, several findings emerged.

As of mid-1996, Whirlpool reported that SERP shipments had reached about 64% of original projections. Program implementation problems and external factors both reduced sales. Reported incentives were only about 37% of sales projections. These data highlighted the lag between shipments and incentive payments, and showed that SERP sales were falling below original projections.

When compared with the proportions of SERP sales projected for each utility, actual sales have varied substantially across the utilities. The only factor that we could correlate with the variation was differences in electricity prices, with higher sales occurring where rates were higher.

The energy savings associated with SERP were difficult to estimate and were complicated by the market transformation characteristics of the Program. The existence of four different SERP models, introduced over time, also complicated the energy savings estimation. We used available reports of energy consumption data to estimate savings. The baseline consumption used for comparison purposes had to be selected and available industry data helped develop a reasonable baseline consumption level. The free rider and free driver effects also had to be assessed because of their potentially large effect in such a program.

Efficiency data showed that side-by-side unit efficiencies of all brands improved between 1993 and 1996. We estimated that, in 1996, the average consumption of brands other than Whirlpool was about 7.5% below the maximum level allowable under the 1993 standards. The average for Whirlpool, on the other hand, was about 25% less than the maximum allowable amount.

SERP appeared to be responsible for much of the increase in the overall efficiency levels of Whirlpool's side-by-side units. It also appeared to have induced a modest increase in the efficiency levels of other brands.

We estimated that SERP refrigerators saved about 331 kWh/year, averaged over all the SERP models. This estimate took into account a general 5% reduction in consumption that probably would have occurred without SERP.

Probable free rider effects of the Program included 1) increases in the efficiency of Whirlpool's non-SERP models, 2) SERP units sold for which SERP utilities did not pay an incentive, 3) increases in the efficiency of other brands that were prompted by SERP, and 4) energy savings from sales of higher efficiency refrigerators after SERP ends.

Free rider effects appeared to be minimal because the SERP refrigerator would not have existed, at least in the near future, without SERP. Some free ridership occurred, however, because some SERP buyers would have purchased a higher-than-average efficiency refrigerator without the Program and some would have purchased the SERP unit in the future without the Program.^(a)

The costs expended by utilities were estimated based on utility and SERP data. Consumer costs were estimated from the dealer interview data.

Including direct incentive payments, Program administrative costs, and utility internal expenditures, we estimated that utility costs are about \$124 per SERP unit receiving an incentive.

Despite original expectations, many dealers indicated that they were charging consumers more for SERP models than for comparable units. The sales-weighted average amount reported was \$80. However, it appeared likely that Whirlpool infrequently requested an incentive for units sold by dealers where consumers paid a substantially higher amount for SERP units.

We used these data and information collected during this study to conduct a preliminary benefit-cost analysis using the total resource cost (TRC) perspective. The results reported here should be considered preliminary and subject to the constraints and assumptions noted.

(a) The consequences of the first free rider effect, however, were eliminated largely because we used an average efficiency level as the baseline.

Assuming that consumers paid no more for SERP units than comparable, less-efficient units and assuming an average electricity avoided cost of 8.41¢/kWh, no price escalation, a real discount rate of 5%, and accounting for no free driver or free rider effects, the baseline TRC benefit-cost ratio for the Program would be about 2.7. Assuming an avoided cost of 5¢/kWh, the benefit-cost ratio would be about 1.6.

If both buyers paid more for a SERP refrigerator and Whirlpool, in turn, received an incentive for it, the benefit-cost ratio would decline significantly. Using the baseline assumptions, if consumers paid the average additional amount estimated by dealers and Whirlpool received an incentive, the baseline benefit-cost ratio would decline about 39%, to 1.7.

Of the free driver effects, future sales of efficient units could have the most dramatic effect on the benefit-cost ratio. Adding these benefits under the baseline assumptions, the benefit-cost ratio would increase to 6.7. Adding in just the benefits of increases in non-SERP refrigerator efficiencies due to the Program could increase the baseline benefit-cost ratio to 3.4.

The only free rider effect likely to have much impact on the benefit-cost ratio was the location of incentivized SERP refrigerators in non-SERP utility areas. We estimated that, at 10% of total SERP incentives, this effect would reduce the baseline benefit-cost ratio to 2.5.

The TRC perspective does not include two potentially large Program impacts that should be credited to SERP. One is the benefits of more efficient refrigerators in all those utility areas that are not SERP participants. To the extent that they occurred, society, as a whole, reaped these benefits, but the TRC test did not include them. They are probably substantial because nearly 80% of U.S. households are outside SERP areas. Second, the environmental benefits, or externalities, associated with energy savings are not included in the TRC analysis. A societal test would include both these benefits.

7.1.4 Did SERP Transform the Market?

All DSM programs produce some degree of market transformation and there is no point at which a standard DSM program suddenly becomes a market transformation program. Because SERP accomplished some market transformation, the issue addressed here

was in what ways and to what degree SERP transformed the market. We answered this question by assessing SERP's accomplishments in a checklist of effects indicative of market transformation. The checklist included these items: acceleration of the introduction of a new technology and the extent of market penetration; changes in the behavior of market members including manufacturers, dealers, consumers, and utilities; extent of free driver and other spillover effects; and the degree to which changes were long-lasting.

Technology Introduction and Penetration

SERP was intended from the beginning to lead to the design, production, and sales of a refrigerator with characteristics unavailable in the market.

SERP succeeded in promoting the design, production, and sale of a super-efficient, CFC-free refrigerator. Although sales have been below original projections, the SERP refrigerator was successfully marketed and captured about 14% of its market segment.

Changes in the Market and Market Actor Behavior

SERP prompted some behavioral changes by manufacturers. The changes tended to be competitive responses to the presence of SERP refrigerators in the market, rather than sweeping institutional changes.

Manufacturer changes induced by SERP were constrained by characteristics of the refrigerator market, including domination by a few, large producers and R&D strategies oriented toward cost reduction.

Manufacturers made essentially no fundamental organizational changes to respond to SERP.

SERP accelerated the conversion to CFC-free refrigerants, but the effect was modest. The deadline for CFC elimination was the main driver. SERP did demonstrate that high efficiency could be coupled with CFC-free technologies, and manufacturers have responded with a wide array of efficient, CFC-free units.

SERP was partially responsible for manufacturers increasing their efficiency levels. In mid-1993 no models were available that exceeded the

1993 standards by 25%; by January 1996, there were more than 75 models on the market that consumed at least 25% less energy than the level permitted by the standards.

Dealers played a critical role in SERP. Their awareness, attitudes, and actions could affect consumer purchases significantly.

Although dealers generally were knowledgeable about SERP refrigerators, many questioned why they should promote them or the merits of their added energy savings.

Dealers generally had information available about SERP refrigerators and provided it to consumers when they felt it was appropriate, but there was little evidence of dealers promoting SERP units actively.

Most SERP dealers displayed information about SERP on the refrigerators and some set up special displays that were very effective at generating consumer interest in SERP. Small dealers often had no SERP models on display and this led to fewer sales.

Dealers who participated in SERP were more likely to promote energy efficiency and CFC-free refrigerants in general.

We did not collect consumer information directly so our conclusions about consumer attitudes and behavior were limited. Several interviewees noted that the viability of long-term changes in refrigerator efficiencies were extremely dependent on consumer attitudes and perceptions.

About one-third of all dealers said that over half their customers asked about energy efficiency. Consumers' views on the importance of energy efficiency were correlated with local electricity prices.

SERP dealers indicated that consumers inquired about the refrigerant type twice as often as non-SERP dealers. This was probably a result of more displays about refrigerants at SERP dealerships, thus indicating the impact of in-store displays.

Early media promotions stimulated a high level of consumer awareness about and interest in SERP. Consumer awareness and interest fell substantially when publicity declined.

Utility responses to the Program varied widely. Many dealers commented on the role of electric utilities in SERP and energy-efficiency programs in general.

Where utilities had taken an active role in promoting SERP or had conducted energy-efficient appliance programs, their actions usually had a very significant positive influence on consumer and dealer attitudes and responses. Utility activities included providing meters to consumers to measure refrigerator energy use, setting up energy stores to display efficient appliances, providing rebates, and sending "bill stuffer" information on SERP to customers.

Free Driver and Spillover Effects

Market transformation implies that effects extend beyond direct program participants. SERP had the potential to affect the efficiency of non-SERP refrigerators available during the Program and in the future.

The efficiency of Whirlpool's non-SERP refrigerators increased substantially after SERP started. Other manufacturers increased the efficiency of their models, but to a lesser degree. We have concluded from the available evidence that SERP was partially responsible for these improvements and they should be counted as free driver effects.

There was some evidence that consumer awareness about energy efficiency increased because of SERP, leading buyers to purchase more efficient units as a result, even if not SERP models.

Long-Lasting Changes

Successful market transformation produces persistent changes in the market. Such changes could be at the consumer, dealer, or manufacturer level.

There was little evidence that consumer or dealer attitudes and behavior had been modified sufficiently by SERP to persist after the Program ended.

It appeared that Whirlpool had made substantial efficiency improvements in its non-SERP models and other manufacturers had made lesser changes that were prompted in part by SERP. Since it appeared that the market had adjusted to any cost impacts of these changes, it seemed unlikely that these changes would be reversed after SERP ended. Therefore, SERP appeared to have induced some technology changes that, in our view, will last after the Program ends.

SERP's most significant lasting impact could be its effect on the next generation of refrigerator efficiency standards. SERP demonstrated that efficiency improvements of as much as 41% over the 1993 standards could be accomplished without the use of CFCs. Although as much improvement might not be technically and economically feasible in other models, SERP has demonstrated new technologies that might be used in various models and has shown what can be achieved without using exotic, uneconomical technologies.

Summary Observations

The possibilities of SERP succeeding as a market transformation effort were limited by the context in which the Program occurred. The CFC phaseout schedule, for example, minimized the impact of the CFC-free feature of SERP refrigerators. To control production disruptions and meet the January 1996 deadline, most refrigerator manufacturers began phasing out CFCs in their products just a few months after SERP began. Therefore, the uniqueness of SERP units as CFC-free products was relatively short-lived. Ironically, the success of previous refrigerator efficiency standards also limited the market impacts of SERP. Many dealers noted that they emphasized energy efficiency to their customers by comparing the consumption of an old refrigerator with **any** new refrigerator because all refrigerators were now required to meet the 1993 standards. This meant that the additional energy savings of SERP refrigerators were at the margin and hard to justify if the consumer had to pay any additional amount or preferred styles or features were not offered in the SERP units. Because of these limitations, it should not be surprising that few observers would attribute major market changes to the Program.

SERP did succeed in transforming the energy-efficient refrigerator market from the technology perspective. It led to the design, production, and sale of an entirely new refrigerator that has achieved efficiency levels unmatched by comparable units. It appeared that the SERP unit provided a foundation for Whirlpool to improve the

efficiency of all its side-by-side units substantially, although not as much as the SERP models. SERP demonstrated that major efficiency gains could be made, even with the elimination of CFC refrigerants, and provided a basis for future production of Whirlpool's other efficient models and development of the next efficiency standards.

Major changes across the entire refrigerator manufacturing industry, however, were not apparent. A few efficiency improvements by other manufacturers did occur in direct response to SERP, but the average effect across all brands was relatively modest. The impact of even modest changes, however, could affect the overall Program benefits significantly.

There was little evidence that SERP caused fundamental changes in the retailer and consumer segments of the market. Nevertheless, there was evidence that the initial Program publicity created extensive buyer and dealer interest and this showed that the market could be responsive to effective promotion.

Although external factors limited the market transformation impacts of SERP, there were actions that could be taken to improve Program implementation and increase SERP's effectiveness. The next section presents several key recommendations.

7.2 RECOMMENDATIONS

This section presents our recommendations based on this study. It presents three groups of observations and recommendations: ways to improve the Program, analytical steps that should be taken in a final SERP evaluation, and observations about ways to improve future market transformation programs.

7.2.1 Program Recommendations

The previous process evaluation (Sandahl 1996) highlighted several areas where problems or concerns had arisen in the design and implementation of SERP. Our evaluation identified additional problems or potential problems that could limit the success of SERP. The following recommendations address changes that could be made to remedy these problems and improve the program in key areas:

Whirlpool, SERP, and individual utilities should take actions to improve the understanding that dealers and salespeople have of the Program. This need is especially important at smaller and individual dealerships. Sales-

people should be better informed about the rebate and tracking system so that higher sales reporting rates are achieved. Dealers should be made fully aware of the Whirlpool rebate so that SERP retail prices are not unnecessarily high.

The retail pricing of SERP units and its connection to the retailer rebate system employed by Whirlpool should be examined to determine if the process can be improved to reduce the premium that is being charged by many retailers for SERP refrigerators.

Whirlpool should implement its planned promotions and should target areas where SERP sales have been less than expected. Whirlpool's regional representatives should ensure that dealers have adequate supplies of promotional materials.

Whirlpool should investigate innovative ways to increase floor displays of SERP models, particularly for small dealers with limited floorspace. Alternative, low-cost ways to capture the attention of consumers should be explored. Information on effective steps taken by some dealers (such as the "pig and panther" display) should be documented and shared with all dealers.

Utilities should increase steps that would make consumers more aware, in general, about energy efficiency and specifically about SERP. Inexpensive steps, such as sending out bill stuffers, and more costly actions, such as opening an "energy store," should be considered and implemented as appropriate. Ways to draw consumer attention to efficient refrigerators, possibly including small consumer rebates, should be considered by utilities. Utilities should investigate possible co-op advertising opportunities and implement appropriate ones with Whirlpool and dealers.

Utilities in areas with relatively low electricity rates should investigate how much low rates attenuate SERP sales and develop cost-effective ways to stimulate consumer interest, if appropriate.

SERP, Inc., utilities, and Whirlpool should increase their efforts to develop and implement joint actions for improving the Program, particularly promotion and dealer training. Such actions may need to be designed at the local level to reflect local conditions.

The sales tracking process should be automated as much as possible to reduce lags in information flow. Ways to improve the dealer's data collection process should be investigated and implemented where appropriate.

7.2.2 Recommendations for Comprehensive Evaluation

This study was the first overall evaluation of SERP. The study scope limited our ability to quantify Program impacts, conduct in-depth comparisons across different utility areas, and acquire information directly from consumers. We recommend that a more complete evaluation be conducted when the Program is nearer its end. The following steps should be incorporated in a final evaluation:

- Information should be obtained to clarify what the actual combined utility and consumer costs are under SERP. Uncertainties in the total cost greatly affect the benefit-cost calculations for the Program and need to be resolved before a final assessment can be made.
- Consumer research should be conducted to get information directly from consumers on their response to the Program and energy efficiency in general. This information would expand the understanding developed in the current evaluation and would help validate and clarify existing data.

More complete data should be obtained from SERP, Inc., to document SERP refrigerator sales and where the units are sited to determine the magnitude of cross-border sales.

Sales data should be obtained from a source that can provide information on the sales of SERP and non-SERP refrigerators in both the SERP and non-SERP utility areas.

Free driver effects of SERP should be explored further to better quantify their magnitude. From the limited information for the current study, these effects appeared to be significant and could dominate overall benefit-cost analyses of the Program.

Additional benefit-cost tests should be performed once more complete and better quality data are available. The participant, non-participant, utility, societal, and possibly other tests should be applied.

The evaluations conducted by individual utilities should be compiled and synthesized in a consistent framework to supplement the information in this study.

7.2.3 General Market Transformation Program Observations and Recommendations

A conflict in market transformation programs is almost inevitable between advancing the technological state of the art and widespread adoption of new technology. SERP was designed to strike a balance between these competing objectives by leading to production of a new technology, but not one so advanced that it would take years to be widely adopted, if ever. SERP was crafted carefully to provide competitors enough financial incentive to make significant advances, but without performance requirements so strict that only exotic, untested technologies could meet them. To a large extent, SERP succeeded in achieving these ends and this characteristic of the Program should serve as a model for other programs.

Many manufacturers, however, have questioned the "winner-take-all" approach of SERP, which was partially responsible for the Program's ability to satisfy these two competing ends. Manufacturer concerns, of course, represented their self interest, but also pointed out a potential risk of such approaches: the higher danger inherent in relying on a single producer. It would probably be advisable in future market transformation programs to permit more winners by setting a qualifying performance level at which any product could be certified as a "winner." How far the technology could be pushed in such an approach, however, remains an open question.

Although a great deal of preparation went into the design of SERP and both manufacturers and utilities were involved in the design, some manufacturers felt that the Program reflected a lack of understanding by utilities of the appliance industry and market. Some utility representatives echoed this theme, and both utility and manufacturer representatives suggested that a more solid base of mutual understanding be built as the foundation for future programs.

Tracking the actual siting of appliances is a problem that may never be fully resolved. In a program such as SERP, where utilities expend funds for appliances that might be sited outside their service territory, tracking is critical. Technological solutions, such as bar coding and improved automation, may overcome this problem eventually. In the meantime, simple agreements between adjoining participant utilities may be preferable to complex accounting systems. However, widespread geographical dispersion, which results in extensive mixing of participating and non-participating utilities, amplifies the problem. The lesson for future programs may be to emphasize the participation of adjoining utilities across entire geographic regions.

Most SERP participants saw little future value in the "SERP" label because it was unique to this program. One utility representative, however, strongly supported the Golden Carrot concept and label. Because labeling and consistency are very important in developing consumer awareness, planners should give thorough consideration to using the Golden Carrot, or some other generic term, as a label for future sets of similar market transformation programs.

One of the major lessons from SERP that should be considered in future market transformation efforts is the importance of addressing consumer preferences and economics. SERP sales generally were highest where electricity prices were high or consumers had a clear predilection for energy-efficient, environmentally friendly products. In the first case, economics affected consumer demand. In the second case, inherent values drove preferences and buying behavior. Dealers and refrigerator manufacturer representatives frequently mentioned the necessity of educating consumers about the benefits of energy-efficient appliances and being able to express the characteristics of such appliances in a way that met consumer needs. In many cases, benefits such as improved performance, reduced environmental damage, and quieter operation, were felt to be more important selling points than reduced utility bills. To address the basic economics, consumers need understandable information about monetary impacts today and into the future; similarly, dealers need to have economic information readily accessible. To address preferences, non-monetary benefits need to be identified and communicated to consumers. The key implications for future market transformation efforts are that 1) consumer economics and preferences must be an integral, major consideration during program design and 2) activities must be included in the program to ensure that relevant economics and preferences are identified and analyzed and necessary information is then communicated effectively to consumers.

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