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**EVALUATION OF THE SUPER EFFICIENT
REFRIGERATOR PROGRAM (SERP) IN THE BONNEVILLE
POWER ADMINISTRATION SERVICE TERRITORY**

A. D. Lee
R. L. Conger

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Prepared for Pamela Brandis,
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Pacific Northwest National Laboratory
Richland, Washington 99352

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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 evaluation of SERP ("the Program") in the Bonneville Power Administration's (Bonneville's) service territory. Pacific Northwest National Laboratory (PNNL) conducted this evaluation for Bonneville.

This study includes the process evaluation, preliminary impact evaluation, and market transformation assessment. It is based on site visits and interviews with refrigerator dealers and manufacturers, industry data, and Bonneville information. Results from this study are compared with those from a parallel study that examines the Program across the 24 participating utilities.

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") in the Bonneville Power Administration's (Bonneville's) service territory. Pacific Northwest National Laboratory (PNNL) conducted this evaluation for Bonneville.

This study includes the process evaluation, preliminary impact evaluation, and market transformation assessment. It is based on site visits and interviews with refrigerator dealers and manufacturers, industry data, and Bonneville information. Results from this study are compared with those from a parallel study that examines the Program across the 24 participating utilities.

SERP, Incorporated, was created in 1991 to conduct a competition to select a manufacturer to design, construct, 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 and 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. The Whirlpool's SERP models clearly met this requirement. 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 20% of salespeople in the Bonneville area, and one-third in all SERP areas, 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. On average, dealers indicated that they charged about \$84 more in the Bonneville area (\$101 across all SERP areas) for SERP 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. Some non-Bonneville utility representatives felt that tracking was beginning to show signs of improvement in early 1996.

Sales tracking has been complicated by "cross-border" sales in which SERP refrigerators sold in a SERP utility area are sited in homes located in another SERP utility area or non-SERP area. Difficulties generating accurate lists of utility zip codes in all SERP areas have aggravated this problem. This problem has been complicated in Bonneville's area by the fact that Bonneville does not serve end-use customers.

The interspersion of Bonneville customer utilities and private utilities has aggravated these problems.

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.

As of the end of 1995, reported incentive payments were only about 24% of their originally projected levels for that date in for the Bonneville area. The comparable figure was 37% across all SERP utilities. The only factor that we could correlate with variations was differences in electricity prices, with lower sales occurring where rates were lower.

The energy savings associated with SERP were difficult to estimate and complicated by the market transformation characteristics of the Program. The energy efficiency of all side-by-side units improved 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 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.

The free rider and free driver effects had to be assessed because of their potentially large effects. Several categories of free drivers existed, with the most significant probably being energy savings from sales of higher efficiency refrigerators after SERP ends. Free rider effects appeared to be minimal.

We estimated that Bonneville's Program costs have averaged about \$128 per SERP unit reported. Despite planners' original expectations, many dealers indicated that they were charging consumers about \$101 more, on the average, for SERP models than for comparable units.

We conducted a preliminary benefit-cost analysis using the total resource cost (TRC) perspective in the Bonneville area. The baseline TRC benefit-cost ratio for the Program was about 1.57. This estimate should be considered preliminary and is subject to the following constraints and assumptions: 1) costs included only the

average utility cost, 2) an average electricity avoided cost of 5¢/kWh for the Bonneville area, 3) no price escalation, 4) a real discount rate of 5%, and 5) no free driver or free rider effects are included.

If consumers paid more for a SERP unit and Whirlpool received an incentive payment for the unit, the benefit-cost ratio could be reduced substantially. If the average incremental cost to consumers of \$101 were included, the benefit-cost ratio would decline nearly 50% to 0.88.

Including free-driver effects could improve the benefit-cost ratio substantially. Including all free-driver effects could increase the benefit-cost ratio to 4.28.

The TRC perspective did not include two potentially large Program impacts that should be credited to SERP. One was energy savings attributable to SERP from more efficient refrigerators in utility areas that were not SERP participants. The second was externalities associated with energy savings. A societal benefit-cost 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 17% of its market segment in the Bonneville area (compared with 13% in all other SERP areas).

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. 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 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 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. Dealers in the Pacific Northwest promoted energy efficiency less than dealers in other areas, presumably because of the relatively low electric rates in the Pacific Northwest.

We did not collect consumer information directly so our conclusions about consumer attitudes and behavior are limited. About 10% of all dealers in the Bonneville service area said that over half their customers asked about energy efficiency. This proportion was about one-fourth the value in other SERP areas, again probably because of the lower electric rates in the Pacific Northwest. 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.

Because of Bonneville's role as a power wholesaler, it had no direct involvement in the Program at the customer end. Since Bonneville's utility customers were not direct participants in SERP, most took few actions to support the Program. Nevertheless, some local utilities took steps that affected the success of the Program. In Bonneville's area and throughout all SERP areas, where utilities took an active role in promoting SERP or conducted energy-efficient appliance programs, their actions usually had a very significant positive influence on consumer and dealer attitudes and responses. Eugene Water and Electric Board's (EWEB's) consumer rebate program for efficient refrigerators and energy store, for example, generated positive feedback from dealers.

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 as a result, 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 evaluation of SERP ("the Program") in the Bonneville Power Administration's service territory (Bonneville's area). Pacific Northwest National Laboratory (PNNL) conducted this evaluation for Bonneville.

This report presents the process evaluation, preliminary impact information and evaluation, and market transformation assessment. Chapter 8 summarizes our evaluation findings and presents recommendations to improve the Program, conduct future analysis, and design future market transformation programs.

This chapter presents an overview of SERP and its market transformation characteristics. It also presents an overview of the evaluation approach. Much of the material presented in this chapter is based on IRT (1995) and Sandahl et al. (1996).

1.1 THE NATIONAL SUPER EFFICIENT REFRIGERATOR PROGRAM

Nationally, refrigerators represent 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 the production of chlorofluorocarbons (CFCs) after January 1, 1996, which are used to manufacture foam insulation and serve as a refrigerant. Research had 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 1991, the SERP non-profit corporation (SERP, Inc.) was formed by 24 utilities. It was created to advance the technology of super-efficient refrigerators and to bring the units 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, Inc., 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 distributed 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 to households 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.

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 its 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. Whirlpool, in turn, submits the customer information to SERP, Inc., and receives its payment if the SERP contract

(a) Two of the largest national dealers use their own tracking system.

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 primary responsibility for marketing SERP refrigerators. SERP refrigerators are sold under the Whirlpool and Kitchen Aid brand names, and Sears sells them 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 coordinated through its regional sales personnel and dealers.

The SERP, Inc., staff, under the direction of the SERP Board of Trustees, administers the Program. With external assistance, SERP, Inc., 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).

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. Bonneville represents all of its wholesale public utility customers in the Program. PacifiCorp is the only other SERP member in the Pacific Northwest.

(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.

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 dealers), and product manufacturers.

In contrast to traditional DSM resource acquisition approaches, market transformation programs aim 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 to consumers. In 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 could 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 (Prahl and Schlegel 1994). They typically require increased emphases on education, persuasion, 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 is to focus on the effects of SERP in Bonneville's service territory. It includes an emphasis on the market transformation effects of the Program, retailer activities, and preliminary estimates of regional energy savings effects.

PNNL also has conducted a national evaluation of SERP for the U.S. Department of Energy (DOE) (Lee and Conger 1996). Conducting these two evaluations in parallel permitted the development of a national context for comparison to this effort and allowed for the sharing of information and research efforts between the two evaluations. This evaluation of the Program in the Pacific Northwest allowed us to examine in more detail what was happening at the retail level where the contact occurred between salespeople and shoppers.

Bonneville is unique among the SERP utilities because of its role on behalf of the public utilities in the Pacific Northwest. All other SERP utilities directly represent themselves in SERP. Bonneville, however, is primarily a wholesale utility without retail end-use customers; it provides power to public utilities and government agencies who, in turn, sell power to retail customers. For this reason, Bonneville has little information on the residential customers who actually purchase refrigerators. The actual public utilities who serve these customers, however, are not directly involved in SERP. In addition, the territory in which power from Bonneville is sold at retail is intermingled

with the service territories of numerous private, investor-owned utilities (IOUs), only one of which is a SERP participant. This situation complicates the implementation of the Program and the evaluation discussed here.

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 low enough to not discourage manufacturer participation. SERP planners 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 planners 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 in Chapter 2. Chapter 3 discusses the research approach used in this study, including data collection. Chapter 4 presents process evaluation information. In this chapter and subsequent ones, the results for the Bonneville area are compared with those from the national study of SERP. Chapter 5 discusses the impact evaluation data and analysis. The market transformation assessment is discussed in Chapter 6. Chapter 7 presents an overview of major findings and recommendations.

2.0 MARKET TRANSFORMATION

Evaluating SERP poses special challenges because methods for evaluating market transformation programs are still evolving and many key pieces of data about the Program are lacking. 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 is the approach that emerged. Exactly what market transformation is, however, remains imprecisely defined. Prahl 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 the cumulative adoptions of a specific technology 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.

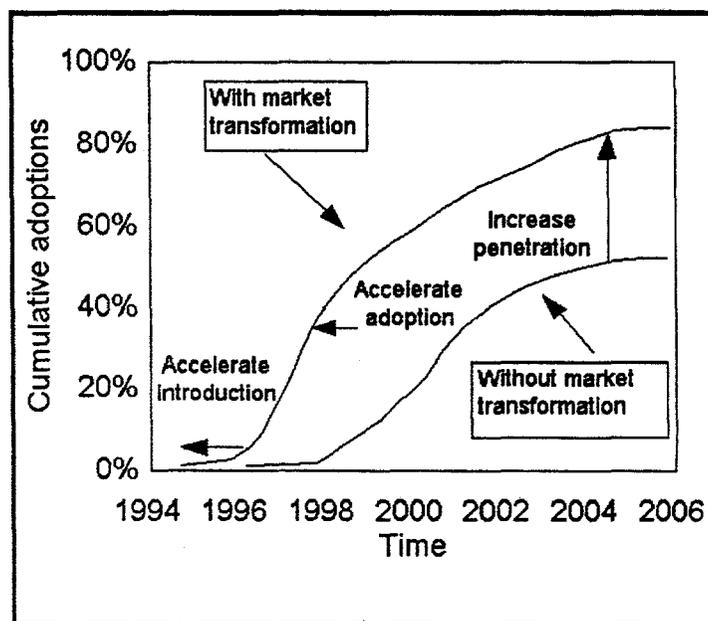


FIGURE 2.1 Market Transformation Effects

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 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. For example, the manufactured home program described above 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 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 (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 may begin asking dealers about the energy efficiency of their products and sellers may 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 (1994, 1995a, and 1995b) and others argue that different 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.

Leading indicators of market transformation, can be identified by considering 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
- theoretical defensibility

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

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 planners and evaluators 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 could reduce 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 balance 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, rather than prompting significant efficiency increases. Utility efforts, notably those of Southern California Edison and 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 encouraging 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 Evaluating SERP in Bonneville's Service Territory

In this study we sought to assess the implementation of SERP and its impacts. The approach used reflects many of the insights about evaluating market transformation programs presented in Section 2.1.2. This section outlines the steps that we anticipated pursuing to assess SERP in this region. Chapter 3 discusses details of the actual methodology employed.

Similar to the approach recommended by 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, which were difficult to obtain, 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 Bonneville and other SERP utilities were eligible to sell SERP models.

Information from dealers on their promotion of SERP refrigerators, the number of SERP models on the floor, in-store displays, and sales techniques were sought to provide an indication of how well the program was working. Dealer information on customer awareness of SERP, SERP refrigerator prices, and approximate sales percentages was pursued to provide information about the Program's effectiveness. Dealer information on training and education received from the manufacturer or distributor suggested how committed the producer was to the Program and how effective the producer's efforts were. Dealers also provided insights about the response of other manufacturers and brands to SERP.

A comparison of information from participating and non-participating dealers provided partial information about 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.

We attempted to find evidence of institutionalized changes in the refrigerator industry as indicators of SERP's effects. 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 the effects could be long-lasting.

As noted in Section 2.1.2, 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 eventually would purchase a comparable refrigerator to buy it now because the Program made it available sooner. Some buyers would 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.

Market transformation aims to produce a significant number of free drivers; thus, free drivers should be a critically important component of SERP's impacts. Various categories of potential free drivers exist. One category is current buyers in Bonneville's service territory who purchased a more efficient refrigerator, or 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 refrigerators not manufactured by Whirlpool, more efficient versions of other units produced by Whirlpool, or other more efficient appliances, such as dishwashers and clothes washers. Probably most significant to participating utilities are free drivers who

purchase SERP refrigerators after the Program ends and 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 a solid indication of the Program's market transformation impact.

Finally, sales outside the SERP utility areas of refrigerators that are more efficient as a result of SERP are an additional free driver effect. Bonneville's utility customers would not benefit from these sales; in fact, if the units were SERP refrigerators for which Bonneville paid Whirlpool an incentive, then they would increase Bonneville's costs. These sales are one element of the "cross-border" issue, which necessitated careful tracking of the location of SERP refrigerator purchasers.

One source of information on SERP's market impacts was public 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 started to identify potential effects of the Program. Testimony before SERP on the feasibility of accomplishing the Program's twin goals of efficiency improvements and CFC elimination, and any changes in industry perceptions after SERP started, would be informative about the Program's impacts.

Bonneville and other utility participants were a primary source of process information on the Program. They provided insights into how well the Program was functioning and potential areas for improvement and allowed comparisons between the experiences of Bonneville and other utilities.

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, could be an indicator of Program effectiveness. SERP, Inc., has tracked the number of units for which Whirlpool received an incentive

(a) The first SERP units were delivered under the overall Program to the market at the end of February 1994. No data were available on when the first units were delivered in the Bonneville area. The overall Program is currently scheduled to end on June 30, 1997. No information was available to us about 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.

payment. Changes in market shares of the SERP brands, within and outside Bonneville's area, also could be examined to determine if any significant effect from the Program could be observed. Independent market survey 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 Bonneville's area.

Data on the energy efficiency of new refrigerators were collected to 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. Because of the lack of detailed sales data, however, it was 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 were sought to 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 METHODOLOGY

This chapter discusses the research issues we addressed, information sources, data collection approaches, and our analysis methods, including what issues each analysis addressed. The research approach for this study paralleled the method used in the multi-region SERP evaluation for DOE. This chapter highlights methodological differences between the studies.

3.1 RESEARCH OVERVIEW

This evaluation addressed process, preliminary impacts, and market transformation effects of SERP. The corresponding DOE preliminary impact evaluation focused primarily on providing preliminary impact estimates and assessing market transformation effects.

This study relied in part on information from Sandahl et al. (1996), which provided process information for the Program as a whole. That study also was conducted by PNNL for DOE. The current study supplements the information from Sandahl et al. (1996) with more recent information and information from the retail end of the Program in Bonneville's territory. Specific process issues addressed here include dealer training, promotion of SERP units, cross-border accounting, and Program information flow.

Key Program impacts include the number of SERP units sold in the Pacific Northwest, how the quantity has varied over time, how sales compare with projections, energy savings associated with SERP units, and Program costs. Energy savings estimates were dependent on what baseline consumption was assumed as discussed in Chapter 5.

Our evaluation 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 in the Pacific Northwest as a result of SERP?

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

3.2 BACKGROUND INFORMATION SOURCES

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

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

Eckert (1995) also provides an overview of the entire Program. It discusses in detail how the Program was developed.

A study by Sampson (1993) provides 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 is 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 covers the entire country and provides historical and projected data for the Northwest. The software permits analysis of early replacement, early retirement, efficiency rebates, and Golden Carrot programs.

Other information sources include newspaper articles based on Whirlpool's press releases. We have reviewed some of 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 provides 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. Many of the findings from that study were relevant to the process evaluation here. Because the information from that report reflected the situation in the early phases of the Program, we updated that information with subsequent manufacturer interview data and interview data from the Pacific Northwest.

3.4 DEALER INTERVIEWS

Appliance dealerships were one of our primary data sources. Refrigerator promotional information displayed or offered to consumers by dealers affects appliance sales. The types and numbers of refrigerators on the floor indicate what units a dealer is promoting. Salespeople are familiar with how knowledgeable consumers are about energy efficiency and SERP and where they obtain information. Salespeople also can provide information about market penetration. In addition, salespeople can provide insights into how well the Program is working and what changes would be desirable.

3.4.1 Sample Selection and Data Collection

As noted earlier, three categories of dealers exist: dealers eligible to sell SERP refrigerators, dealers within Bonneville's area who did not carry SERP brands, and dealers outside the SERP territory. We developed lists of dealers in each of these categories and obtained their telephone numbers and addresses.

We prepared site-visit interview instruments and forms to document refrigerator stock and display information for each of these dealer groups. We selected dealers from the three groups and contacted them by telephone to confirm their status.^(a) We then

(a) The dealers selected for site visits were chosen in conjunction with Bonneville to represent a diverse range of locations, utility characteristics, and dealer types in the Pacific Northwest. Once basic locations were selected, the sample was largely a convenience sample based on the concentration of dealers in certain areas. We always selected a large dealer (typically Sears) in a location, if one was present, because it typically represented half the sales or more in that

conducted site visits to interview salespeople and document what models they had on the floor and promotional information. We conducted 22 interviews with salespeople at SERP dealers in the Pacific Northwest (about 6% of all known SERP dealers in the region). For comparison information, we interviewed eight non-SERP dealers in SERP utility areas and three dealers outside of SERP areas.

In addition to the site visits, we conducted 102 telephone interviews of SERP and non-SERP dealers throughout the United States for the DOE evaluation. Information from these interviews was compared with information from the Bonneville area site visits.

3.4.2 Data Analysis

The dealer site visits provided both qualitative and quantitative information. The qualitative data included information on the customer level of interest in energy efficiency, changes in their 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, the types and quantity of different refrigerators on the floor, importance scores for different refrigerator features, percentage of customers inquiring about energy efficiency, sales percentages for SERP refrigerators, and the incremental cost of SERP units. Descriptive statistics were developed for some of these data. Most were instrumental in analyzing market transformation and, to a lesser degree, Program impacts.

Generally, the Bonneville sample was too small provide valid statistics for the population. When possible, these data were compared with and analyzed in the context of the SERP-wide data collected for the DOE study.

3.4 UTILITY INTERVIEWS

About half the utilities participating in the Program were interviewed for the process evaluation reported in Sandahl et al. (1996) and that information was available for this study. These interviews occurred early in the Program, so we updated some of that

location. In some smaller towns, our sample was essentially a census because we interviewed nearly all dealers.

information for the parallel DOE study through follow-up interviews. We interviewed Bonneville's SERP project manager to get specific data for this region.

The utility 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.

3.5 REFRIGERATOR MANUFACTURER REPRESENTATIVE INTERVIEWS

We used the manufacturer information obtained from the DOE process and program evaluations. For the DOE process evaluation, representatives of most major manufacturers were interviewed (Sandahl et al. 1996). For the DOE preliminary impact evaluation, we updated some of the information from those interviews and also explored impact and market transformation issues in manufacturer interviews.

The manufacturer staff interviews were intended to answer questions about how the non-winning manufacturers had 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.

3.6 EFFICIENCY AND REFRIGERANT DATA

For the parallel DOE evaluation, we used two energy efficiency data sources. The Association of Home Appliance Manufacturers (AHAM) publishes the *Directory of Certified Refrigerators and Freezers* semi-annually. We used AHAM data for eight years (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 consulted the database for data through 1995 and 1996 (CEC 1995 and 1996).

Lee and Conger (1996) described how this information was used in the DOE evaluation. No specific data for the Northwest were available so the national information is presented here, as needed, to discuss efficiency trends and the introduction of CFC-free refrigerants.

3.7 ADVERTISEMENTS

We reviewed appliance store ads in the *Seattle Times* during 1996. For the DOE study, we reviewed ads in the *Los Angeles Times* for 1994, 1995, and 1996. The 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.

3.8 TESTIMONY ON APPLIANCE STANDARDS AND RELATED STATEMENTS

Testimony presented at public hearings 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.

For the DOE evaluation, we reviewed available testimony, public comments by appliance manufacturers representatives, and related information to determine how refrigerator technology was expected to change in the absence of SERP. This information was available for the current evaluation and provided a baseline of expectations against which the achievements of SERP could be compared.

3.9 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 data from SERP, Inc., 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 for which incentive payments were made, and the total dollar amount paid. These data provided the basis for partial quantification of SERP sales and comparison of Bonneville with other utilities.

We tried to obtain national refrigerator sales data from a number of other sources, but were unsuccessful (see Lee and Conger 1996). Obtaining data for the Bonneville area only would have been even more problematic.

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 dealers to contact customers who had purchased SERP refrigerators. Schedule and budget limitations, however, prevented us from contacting any customers during this evaluation.

4.0 PROCESS EVALUATION

This chapter discusses specific process issues associated with SERP. These issues included dealer training, promotion of SERP units, cross-border accounting and sales tracking, and information flow. Differences are noted if any occurred between results in the Bonneville area and other SERP utility areas. This chapter also summarizes information from the Program process evaluation conducted for DOE (Sandahl et al. 1996).

4.1 PROGRAM PROCESS EVALUATION FINDINGS

Sandahl et al. (1996) reported on their findings from a process evaluation of the overall Program. Information from that report is summarized here as background to the process findings from the current study.

The process evaluation documented the SERP formation and implementation process and identified preliminary administration and implementation issues. It was based on interviews with staff from 12 of the 24 participating utilities, information on 12 non-participating utilities, and interviews with manufacturers that bid and did not bid on the Program. The initial interview information was collected in March and April 1995. Information from SERP planners was collected in the summer of 1994.

Utilities viewed the Program as desirable because funding the commercialization of one unit could potentially lead to the availability of several highly energy-efficient models. Additionally, utilities found the broad geographic scope of SERP appealing because it allowed funds to be pooled to influence the national market for refrigerators and generate enough SERP refrigerator sales to lead to high volume production. Utilities could not hope individually to influence a national market.

Respondents interviewed for this evaluation reported that positive publicity, associated either with participating in the program (utilities) or potentially winning the competition (manufacturers), was a primary reason for becoming involved in the program. Non-participating utilities interviewed did not want to be involved in or expand DSM programs or did not expect the program to be cost effective. Non-participating manufacturers interviewed typically did not submit a bid because they did not believe that their bid would be competitive or because they could not meet some requirement of the RFP, such as the production or distribution requirement.

SERP utilities and manufacturers interviewed agreed with most of the SERP requirements specified in the RFP. The only requirement that utilities were divided on was the size requirement (14.5 to 26.7 cu. ft.); half agreed with the requirement and half said that the allowable size range should not have included refrigerators as large as 26.7 cubic feet. Some utilities and manufacturers also reported that the side-by-side model should have been disallowed given its limited market share.

Manufacturers would have preferred a program that rewarded every manufacturer who achieved a certain level of energy efficiency instead of SERP's "winner-take-all" approach. Most SERP utilities reported that the "winner-take-all" approach was necessary to take maximum advantage of market forces.

Generally, utilities believed that the program would transform the market, lead to more stringent refrigerator standards, and accelerate the phasing out of CFCs in refrigerators. Most manufacturers, however, felt that SERP would have little or no impact in these areas.

One of the objectives of the process evaluation was to identify any early implementation or administrative issues associated with SERP. When the evaluation was conducted, early in the Program, Whirlpool reported that SERP unit sales were meeting its expectations. Whirlpool identified administrative challenges that needed to be resolved, including a cash flow problem and the lack of accurate zip code data for SERP utility service territories. Whirlpool expressed frustration that the first payment for verified SERP unit sales was not received until April 1995, even though Whirlpool stated that it had submitted customer and sales data in a timely manner consistent with the SERP tracking requirements. SERP, Inc., reported that some incentive payments to Whirlpool had not been made because adequate tracking information was not received. Whirlpool and SERP, Inc., had different views about whether the information provided to SERP met the contractual obligations.

The majority of SERP utilities reported frustration about not receiving any information on SERP unit purchases in their service territory at the time the process evaluation interviews were conducted. They expected this information much sooner. Many of these utilities reported that SERP management had not been responsive to their concerns about the lack of tracking information.

One of the goals of SERP was to make SERP units available to consumers at a price comparable to similar non-SERP units. Both Whirlpool and utilities were questioned during the process evaluation about SERP pricing. Whirlpool reported that, based on its records, 90% of the SERP units were priced at a level similar to comparable, non-

SERP models. The majority of utilities, however, reported that they believed SERP units sold in their service territory were priced higher than comparable units.

4.2 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 believed 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 Whirlpool the rest received less formal 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.

About half the dealer salespeople we interviewed in the Bonneville territory were aware of training provided on SERP. Only about 20%, however, said that they personally had received SERP training. Two salespeople indicated that they had participated in SERP training as part of overall training provided by Whirlpool and one said that Whirlpool was starting to provide dealerships with training materials on compact disks that included information on SERP and the CFC-free refrigerants. For those people who had taken the training, they felt that it was useful, but provided only an overview.

Findings on the training in the Bonneville area differed in part from the results in other areas. In non-Bonneville SERP areas, dealer awareness about training was essentially the same as in the Bonneville area: about one-half were aware of SERP training. However, the percentage of salespeople in non-Bonneville areas who said that they had received some training on SERP (35%) was almost double the percentage in the Bonneville area. Bonneville's Program representative confirmed this lower level of

training based on anecdotal information. We were not aware of any factor that could have caused this difference, but it should be investigated.

Salespeople at essentially all of the SERP dealerships in the Northwest were knowledgeable about the SERP models. Much of the knowledge appeared to come from routine product familiarity, rather than special training. Salespeople generally could consult product literature to answer specific product questions. There was considerably less knowledge about the Program itself, particularly at smaller dealers.

4.3 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. During dealer site visits, we observed that when SERP models were on the floor they usually had a sticker on them indicating that they were a SERP unit. Some had as many as three stickers or displays on the SERP models. Sears, the largest seller, typically had information on SERP models stating that they were "CFC-free" and an "Energy saver." The Sears store displays usually also stated that the units were 38% or 41% more efficient than required by standards. Most dealers had brochures or other materials to describe the SERP models. Promotional materials were typically provided by Whirlpool. One dealer in this region commented that the available materials had declined since the Program started. About 15% of the dealers stated that they really did nothing to promote SERP models.

One store in Eugene mentioned an innovative "pig and panther" display that they had set up in late 1995. The store had an older refrigerator (the pig) and a SERP unit (the panther) running, side-by-side and had equipped both with meters showing energy consumption. This generated consumer interest and boosted sales of SERP units in an area with very low electricity rates.

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

Only about 15% of Bonneville-area dealers said that they had mentioned SERP in print ads. To assess the use of print ads, we intended to review the Seattle daily newspaper, but found that back issues of the newspaper were not readily available. For the parallel overall Program evaluation, we reviewed advertisements in the *Los Angeles Times* in 1994, 1995, and 1996. We found that most refrigerator ads were for the two largest retailers, Circuit City and Sears. 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.^(a) Overall, refrigerator advertisements about energy efficiency were far more common in 1995. 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 units in that style and size class. They planned to include expanded consumer financing, dealer incentives, cash back offers, and other promotional mechanisms.^(b) A Whirlpool spokesman noted that they were also having discussions with SERP, Inc., about what steps might be taken in future promotion and training activities.

Displaying SERP models on the showroom floor appeared to be a key ingredient to successful promotion. Approximately half the SERP dealers that we visited in Bonneville's area had SERP units on the floor. Floor models usually had SERP labels on them and the labels stimulated consumer questions that led to a discussion of SERP with the salesperson. SERP models were often not displayed at smaller dealerships so the chances of selling SERP refrigerators were reduced.

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- (a) A similar advertising campaign was not conducted in the Bonneville area. This was because, in part, the publication of electricity rates in such ads, as proposed by Whirlpool, would have not been possible because Bonneville does not determine the rates of its customer utilities that actually serve residential customers.
- (b) This promotion was based in part on a recent consumer magazine's favorable rating of the 22 and 27 cu. ft. SERP models.

Utility promotional activities to supplement Whirlpool's promotion appeared to be an effective mechanism for increasing consumer interest in SERP models. Because such activities were not planned as an integral part of SERP, they are discussed in Chapter 6.

Experiences promoting SERP refrigerators across the other SERP utility areas appeared to be very similar to those in the Pacific Northwest. Chains, such as Sears, tended to have similar approaches in all their stores. One exception was the unique promotional efforts (including the "pig and panther" display) of a Sears in Eugene. This was motivated, in part, by the active role taken by the local utility. Because of the higher electricity rates in other parts of the country, dealers in those areas typically used the Energy Guide Label more often and more effectively to explain the energy efficiency of different models.

Dealers in the Bonneville area mentioned a limited number of problems associated with promoting and selling SERP models. The most common problem was a higher price; one-third of Bonneville area dealers mentioned this. This was not always perceived to be an issue associated with the higher efficiency of SERP models: the SERP units were felt to be packed with features that were beyond the needs of some consumers. Dealers that reported price was a sales deterrent indicated that SERP units cost between \$100 and \$300 more than a comparable unit. Dealers who did not report that price was a problem reported that the units sold for no more to \$175 more than a comparable unit. Most of these dealers said that SERP models were no more expensive than a comparable unit.^(a) Based on the dealer data for the Bonneville area we estimated that the average incremental consumer cost was \$84 (with a standard error of \$25).^(b) Based on dealer data for all SERP areas, we estimated that SERP refrigerators sold for about \$101 (with a standard error of \$13) more than a comparable unit. Using a t-test to compare these values, we concluded that the value for the Bonneville area was not different at a statistically significant level from the overall value.

Only one Bonneville area dealer that we interviewed reported that the CFC-free refrigerant was an obstacle to selling SERP units. With all refrigerators converting to

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- (a) Sears salespeople reported that SERP units cost no more than a comparable model and they sold more units than any other retailer.
 - (b) The estimated added price was not weighted by dealer sales. The weighted mean probably would be less because Sears dealers reported no additional price, and represented the largest sales of any retailer.

CFC-free refrigerants, this should no longer be an issue. One dealer said that thicker doors were a sales deterrent.^(a)

Nearly half the Bonneville area dealers said that there was no problem selling SERP refrigerators. A few even said that they were easier to sell because there were more features to talk about with the consumer.

In the other SERP utility areas, sales and promotion problems were similar. About 30% of the dealers said that a higher price was an obstacle. For this group, the added cost ranged from about \$50 to \$400. 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, and the remainder said that SERP units were between \$20 and \$180 more than comparable models.

Only about 8% of dealers in the other SERP areas indicated that the CFC-free refrigerant was a potential concern to some buyers. Unlike in the Pacific Northwest, where none of the dealers we interviewed mentioned it, about 10% of dealers in other areas mentioned the limited style and sizes as selling impediments.^(b) A small number of dealers in other areas mentioned the thicker door as a problem. Similar to the Pacific Northwest, nearly half the dealers said that there were no problems selling SERP units.

Dealer interviews also provided feedback about the Energy Guide Labels.^(c) About 70% of Pacific Northwest SERP and 50% of non-SERP dealers that we visited mentioned the labels as an effective source of information for consumers. Dealers said that consumers generally used the labels for comparisons among refrigerators, although energy consumption was not an overriding decision factor. Most dealers in this region told consumers that the electricity costs 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 people mistakenly

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- (a) This same dealer remarked that Whirlpool also had problems supplying parts for all its models, not just SERP units, in 1995 and this was a general problem in promoting Whirlpool products. It was unclear what caused this perceived problem.
 - (b) This may be attributable, in part, to a higher penetration of side-by-side units in the Northwest market (Battelle 1991).
 - (c) The label presents estimated annual energy costs based on the Federal Trade Commission procedure (16 CFR Part 305).

thought that the values on the labels were the monthly payment for purchasing the refrigerator. Second, buyers were confused because some of the efficient units showed annual electricity costs that were less than the minimum amount shown on the Energy Guide Label range.

4.4 SALES TRACKING AND INFORMATION FLOW

There was evidence that during Program development and start-up, information flow among SERP planners and participants worked effectively. 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 SERP, Inc., and utilities. Consistent with our findings, the report also noted that confusion existed 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, including Bonneville, reported having problems getting the sales tracking data on a timely basis. Comments common to the Bonneville area and others included that they were uncertain where the communications breakdown was occurring and they could not tell when sales in a specific report actually occurred. Although Bonneville did not make this point, some utilities reported 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. All of the utility representatives we spoke to were concerned about improving the timeliness of communications.

For several utilities, including Bonneville, 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 processing it because of the time it would take.

The Program was affected by one additional complication in the Bonneville area: Bonneville's role as a wholesale electricity supplier, not a retail provider. Bonneville lacked information on the residential customers of its over 100 utility customers; this information was available to other SERP participants. Bonneville had no direct information on retail customers. Bonneville's wholesale utility customers, who did have end-use customer information, were not directly involved in SERP and did not receive firsthand information on the Program.

To assess the effectiveness of information flow to dealers, we questioned dealers about their knowledge of the incentive payment and tracking system. Less than 20% of the salespeople we spoke with had any awareness of the incentive payment system. Knowledge of the incentive payment was uncorrelated with whether the salesperson had received training. Comments by some salespeople suggested that their lack of knowledge might be because someone else at the dealership might handle the paperwork for the incentive payments.

None of the salespeople we interviewed was aware of the Whirlpool tracking system for SERP refrigerators. Most said that they did not collect any special information on buyers of SERP models. None had heard of the ExacTrak form. As noted for the incentive payment, it might be that some salespeople were not directly involved in tracking so they would not be cognizant of the process.

Salespeople in the Pacific Northwest appeared to be less informed than those in other SERP areas. In the other utility areas, the salespeople we interviewed were about twice as likely to have a reasonably good understanding of the incentive payment process. As in the Bonneville area, however, salespeople in other SERP utility areas were almost totally unaware of the tracking system. 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.

Across all SERP, we found that salespeople in many stores were completely unaware of the tracking and incentive payment system. Consequently, SERP sales in many stores were unlikely to be reported back to Whirlpool, SERP, Inc., and participating

utilities.^(a) This finding was consistent with utility reports of a gap between sales they knew about and the sales reported by SERP, Inc. One troubling finding was that a number of salespeople were misleading consumers about the incentive payment, suggesting that *the consumer* would receive it.

Many of the 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 both the SERP utility and a non-SERP utility.^(b) Third, the probability was increased that miscommunication occurred about which dealers were qualified to be in the Program (i.e., located in a SERP utility service territory). 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 in the Pacific Northwest that we interviewed, in fact, were angry about being told initially that they qualified as SERP dealers and then later being told they were not qualified.^(c) These problems were aggravated in the Pacific Northwest because of the extensive mixing of public and private SERP and non-SERP utility areas.

4.5 PROCESS IMPROVEMENTS

This section discusses process improvements that were suggested by dealers, utilities, and manufacturers.

4.5.1 Program Design

During the Program process evaluation for DOE, 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-

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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) Both these situations are related to the cross-border sales issue.
 - (c) These dealers were quite knowledgeable about SERP and had submitted their requests for rebates, which were later rejected by Whirlpool.

interest (only one manufacturer could benefit from a "winner-take-all" approach) and partially reflected a 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.

Although not mentioned in the Bonneville utility interview, a few of the manufacturer and other utility representatives suggested that the Program should have included a wider range of sizes and styles. 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 that more needed to be done to develop a common understanding of the market by utilities, manufacturers, and Program designers.

One non-Bonneville 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 operated. He suggested that similar meetings involving the two industries be held as the basis for designing future programs.

4.5.2 Training and Awareness

Nearly 25% of salespeople interviewed in the Bonneville area suggested that added dealer training and information would improve the Program. This was much higher than the 2% who made this recommendation in the other SERP areas. This difference was consistent with the lower incidence of training noted by salespeople in the Pacific Northwest.

Several salespeople felt that the dealership should have been provided with the tools and information to be better prepared to promote SERP models. As one regional 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 in another SERP area indicated that it had decided to hire a

contractor to supplement Whirlpool's SERP dealer training, thus suggesting that they felt this to be an important need. The Bonneville Program representative did not point out specific recommendations about dealer training and awareness, but did suggest that improved awareness was needed.

4.5.3 Promotion and Consumer Education

The most common dealer suggestion for improving the Program was increased advertising, promotion, and consumer education. One-third of the dealers we interviewed in the Bonneville area recommended either better promotion of the SERP models or better education of consumers to increase their awareness of energy efficiency and environmental benefits. Most salespeople recommended increased advertising. Dealers recommended that the manufacturer, utilities, and SERP, Inc., play a larger role in promoting the Program. Similar recommendations came from dealers in other SERP areas.

Only one (of 22) dealers mentioned that SERP unit prices should be reduced to make the refrigerators more competitive. This suggestion occurred more than twice as often in the other SERP areas.

No dealers mentioned the need for rebates, but several noted that their local utility (the Eugene Water and Electric Board, EWEB) offered a consumer rebate that was a significant factor in promoting sales of SERP models. 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 rebate could stimulate sales and offset concerns about cost.

Two dealers mentioned that SERP should be expanded to other refrigerator models to promote sales. The frequency of this recommendation was similar in other SERP areas.

The majority of the utility representatives, including Bonneville's, recommended improved SERP promotion and advertising to make the Program more successful. Bonneville's representative noted that some print ads had been placed early in the Program, but no promotion was evident in recent months and nothing had occurred yet to promote the new SERP models introduced in mid-1995. Views differed across the utilities as to who should be responsible for additional promotion. Nearly all agreed that Whirlpool had a responsibility; however, recommendations on the amount of effort that should be devoted by the utilities and SERP, Inc., varied 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, Inc. The utilities' marketing recommendations were focussed 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.

4.5.3 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, Inc., and finally to the utility. Utilities felt that this would speed up the information flow and improve the reliability of the data. The Bonneville Program representative did not feel that this would make as much difference in the Bonneville area because of Bonneville's unique situation. A stumbling block was Bonneville's lack of data on end-use customers and this problem would remain even with an electronic tracking system.

Some utility representatives also suggested that SERP, Inc., 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.

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

5.0 IMPACT EVALUATION

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

Assuming that the expected SERP unit sales were proportional to Bonneville's share of the total SERP utility funding commitment, expected sales in the Bonneville area were about 1,700 in 1994; 6,200 in 1995, 6,200 in 1996; and 3,100 in 1997. Using these assumptions, total projected sales through the scheduled end of the Program on June 30, 1997, would be about 17,100 units based on total Program sales of 250,000 units (IRT 1995). Through 1995, therefore, the projected sales were about 7,900 units in the Bonneville area, and 115,000 for all SERP areas.

As of early 1995, Whirlpool indicated that sales were meeting its expectations. According to data from SERP, Inc., however, the number of incentive payments reported through December 1995, was only 1,906 in the Bonneville area (42,000 in all areas), or about 24% (37% across all areas) of the forecast amount (SERP 1996). It appeared from these data that SERP sales had sagged substantially in 1995. We did not have data available on sales trends that would allow us to check this; however, several factors could have accounted for the apparent decline in SERP sales.

First, SERP sales might have fallen below projections independent of any other market changes. Some dealers in the Bonneville area reported that many customers had come into showrooms early in the Program aware of SERP because of the initial publicity; SERP units had sold well in the beginning, but sales had declined in the past year. Second, overall refrigerator sales might have fallen during 1995 and SERP sales declined with them. There was some anecdotal evidence to support this. Third, incentive payment reports lagged behind SERP sales so there were probably more sales in the pipeline than accounted for by the 1995 incentive payment report. Finally, a substantial number of sales might not have been reported to SERP because of the failure of dealers to return tracking information. According to a Whirlpool spokesman, they were receiving sales information on about 70% of the SERP units, so about 30%

could have been unreported to SERP, Inc. We did not obtain shipment data from Whirlpool, so it was impossible to quantify any discrepancy between shipments and incentive payments reported.

For all these reasons, SERP sales were less than the projected quantities, but we were unable to verify 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. Although it was impossible to quantify accurately the status of unit sales, it was clear that sales were considerably below initial projections.

We examined the incentive payment data to determine how the reported sales compared across utilities. Table 5.1 presents the percent of total units receiving an incentive payment 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 provide more unit incentive payments 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. In the Bonneville area, SERP incentive payments were only about two-thirds of its expected share. At the low end, Northern States Power Company, Wisconsin, had provided incentive payments for only about 10% of its expected share. Arizona Public Service, on the other hand, had made almost five times its expected share of incentive payments.

We examined the dealer and utility interview data to determine what might explained these variations across utilities. 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. This explanation might have accounted for the smaller sales share in the Bonneville area. The rates of Bonneville's customer utilities were about 5¢/kWh less than the average rate for those utilities where SERP sales had exceeded their expected share.

TABLE 5.1. Comparison of Utility Incentive Payments and Resource Commitment

Member Name	Units Receiving Incentive Payments (% of total)	Dollars Committed (% of total)	(% 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. Section 5.4 uses this information 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 as the baseline, 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 absent 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 on large side-by-side units that is useful for estimating baseline energy use. It shows that 1) 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 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

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- (a) Whirlpool expected SERP refrigerators to substitute for sales of similar style and size 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 certified models.

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 needed 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. A Whirlpool representative, however, indicated that his company probably would not continue to produce SERP units after the Program ends. 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 would continue offering higher efficiency units after the Program ended because many of the efficiency improvements have been integrated into its product lines. The savings of these units would accrue in all utility areas, not just SERP areas.

In addition to these free driver effects, the SERP utilities also benefitted from SERP units sited in their area 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 the added costs of these units.

The efficiency increase of other manufacturers' models noted earlier were caused, in part, by SERP, thus adding to Program benefits. 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. Some buyers also 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. 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.

5.3 COSTS

The direct utility costs of the Program were fairly easy to document. Bonneville originally committed about \$2.105 million to the Program incentive payment, cross-border account, and administrative costs (compared with about \$30 million committed by all SERP utilities) (IRT 1995). Administrative costs were estimated originally to be about 10.2% of total costs, but SERP, Inc., indicated in 1995 that they expected them to be more like 6% of total costs (IRT 1995); this change would reduce Bonneville's expenditure to \$2.016 million over the life of the Program. Based on these figures, the combined direct incentive payment, cross-border account, and administrative costs for Bonneville would be about \$118 per SERP unit.

In addition, Bonneville dedicated some effort to processing the data, assessing the Program, and other internal activities. We asked utility representatives that we interviewed what level of resources they were devoting to SERP. The Bonneville representative indicated that Bonneville had dedicated about one-half FTE since the Program started, but the effort had declined in recent months. Responses across all SERP utilities ranged from 0.1 FTE to about 1 FTE. Like Bonneville, most utilities were dedicating about one-half FTE to the Program. We did not obtain actual utility costs for these activities. Based on our limited data, we estimated that Bonneville and other 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 for Bonneville, or about \$2.4 million across all the utilities. Averaged over the expected 250,000 refrigerators for the entire Program, the cost would be about \$9.60 per unit.

Combining these two sets of costs resulted in an estimated cost to Bonneville of about \$128 per SERP refrigerator for which an incentive was paid.^(a)

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 CFC-free features (Sandahl et al. 1996). The appliance industry noted that they could not control retail prices, but the expectation was that the SERP incentive payment and Whirlpool's dealer rebate would reduce substantially any incremental

(a) This analysis assumes that all costs are proportional to the number of units for which an incentive is paid to Whirlpool. Administrative costs may be relatively fixed so if lower-than-expected sales continue, the per-unit cost would probably increase.

cost to consumers. Our dealer interview data suggested, however, that SERP refrigerators were priced about \$101 more than comparable models, *on the average*, although the major chains stated that they charged consumers no additional price.^(a) To assess Program costs and benefits, these additional consumer costs are addressed.

5.4 BENEFIT-COST ASSESSMENT

Table 5.2 summarizes the savings categories that should be included in a benefit-cost 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

TABLE 5.2. Savings Categories

	Incentive payment sales in Bonneville area	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	1,906 (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

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

(a) We have used the estimate from Lee and Conger (1996) for all SERP utilities, rather than just Bonneville, here because it was a more precise and accurate estimate.

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 benefit-cost 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:

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

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.

For SERP, utility costs included administrative, tracking, incentive payment, and cross-border costs. Although no added consumer costs were expected, our data suggested that consumers did pay about \$101 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 incentive payment 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 payment for the unit, we included only the higher of the two costs, the utility cost. 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

(a) The SERP contract was amended early in the Program to allow 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 25%, but SERP, Inc., considered this high a percentage to be an unlikely outcome.

costs would vary by utility area and over time. For this simplified analysis in the Bonneville area, we approximated the avoided electricity cost with a representative regional average retail rate of 5¢/kWh.^(a) 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 a real discount rate of 5%.^(b)

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, absent 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.^(c) 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 1.57 (\$201/\$128). As noted, however, this analysis was very much simplified and incomplete.

To examine the effect of three key inputs, we separately considered a higher electricity resource cost, higher discount rate, and added consumer costs. At 8.41¢/kWh avoided resource cost, the benefit-cost ratio would be increased to 2.64 (\$338/\$128). With a 10% real discount rate, the baseline benefit-cost ratio would decline to 1.09 (\$139/\$128). The ratio was clearly very sensitive to the avoided cost and discount rate assumptions.

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- (a) In the overall SERP evaluation we used the rate assumed to calculate the refrigerator FTC Annual Energy Cost (AHAM 1995), 8.41¢/kWh, in our base case analysis. We used that rate here also for sensitivity analysis purposes.
 - (b) We also used a 10% real discount rate in sensitivity analyses.
 - (c) 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%.

If consumers did incur the average added cost and the utility paid an incentive, then the baseline benefit-cost ratio would decline by about 50% to 0.88 (\$201/\$229). The economic impacts of the Program were very sensitive to the additional amount, if any, that consumers had to pay for a SERP unit. The possibility that dealers might charge substantially more for 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 5.0¢/kWh and a 5% real discount rate.

SERP sales without incentive payments 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 22%. 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 appear 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 4.67. This is nearly three times the baseline estimate, 1.57, which does not account for any of these additional effects. This significant change in the benefit-cost ratio demonstrates the importance of including these effects, particularly any future benefits attributable to the Program.

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)	+\$10	+\$44	+\$293	-\$10	-\$10	-\$20
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

(a) Assumes 5% more units are sold than those refunded and utility pays no incentive.
 (b) Assumes that SERP induced a 20% improvement in Whirlpool's non-SERP units and a 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.

For the SERP areas as a whole, we used the FTC Annual Energy Cost of 8.41¢/kWh as the avoided cost for calculating benefits. Because of the higher cost, the benefits estimated were about 70% higher (assuming a 5% discount rate) than those estimated for the Bonneville area.

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's influence. 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 accounted for 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 national 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. Because the refrigerator market is a national one, our market transformation study addresses large-scale market changes as well as ones identified in the Bonneville service territory. 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.

This chapter focuses on market transformation in Bonneville's area. Many of the market transformation issues, however, such as the responses of non-SERP manufacturers, are general in scope, so we relied on information compiled from our parallel evaluation for DOE (Lee and Conger 1996).

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. The fact that Whirlpool was able to design, produce, and market a CFC-free refrigerator meeting the SERP efficiency requirements showed that these twin goals could be met. SERP clearly succeeded in demonstrating that super-efficient, CFC-free refrigerators could be designed and produced over 18 months ahead of the mandatory production phaseout of CFCs. 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). A spokesman for Frigidaire, the other finalist, said it cut its normal 18-month product development process time in half in its effort to win the competition (Schiller 1993, p. 81). In the absence of the Program, it seems unlikely that Whirlpool, or any other manufacturer, would have introduced a super-efficient, CFC-free refrigerator as early as Whirlpool did in response to the Program.

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 conducting a very thorough analysis of 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 we asked dealers in the Bonneville area what share SERP units constituted of side-by-side refrigerators sold, the dealer responses varied from 0% to 80%. Forty percent said 5% or less; about half said they were between 5% and 50% of sales; and about 15% said they were over 50% of sales. From these responses, we estimated that SERP units represented about 17% of SERP dealers' volume-weighted average sales of side-by-side units in the Bonneville area.

The number of dealers visited was too small to draw many conclusions about what affected the market penetration of SERP units. The two most significant factors related to higher penetration were the presence of SERP units on the floor and the availability of a utility rebate. Dealers who had no SERP units on the floor typically said that SERP sales were less than 5% of their side-by-side sales, with many stating that they sold no SERP units. The dealers who had multiple SERP models on the floor typically said that SERP models comprised 15% or more of side-by-side sales. Dealers in the service area of the one local utility that offered a rebate to buyers of SERP (and other high efficiency) refrigerators stressed that the rebate was very important. Across three dealerships in this area, the SERP market share was about 21% of units in the SERP category.

The kind of SERP promotion used by dealers did not vary much and this prohibited us from assessing any relationship between promotions and SERP sales. There was no correlation with the dealer's overall sales volume.

We also examined the possible effect of any added cost of SERP units on SERP market shares. There was a statistically insignificant negative correlation between the amount, if any, of the added cost of SERP units and their sales percentages. We performed a simple linear regression of SERP shares on added cost and found a negative, but not statistically significant, relationship between added cost and SERP shares. Because of the potential effects of a utility rebate, we next eliminated the data for the one area where the utility provided a consumer rebate: the coefficient on price then was significant at the 0.1 level. This limited analysis demonstrated that price did affect sales and the presence of a rebate could offset the effect of a higher price. Both results were consistent with expectations, but the demonstration of these effects with such a small sample was surprising.

The SERP market share findings in other utility areas were similar to those for the Bonneville area. From the dealer data, we estimated that the weighted average SERP sales were about 13% in non-Bonneville SERP areas.^(a) Having SERP units on the floor was correlated with high market penetration. In the few areas where utilities offered a rebate for efficient refrigerators, the SERP market share appeared to be considerably higher than the average in other areas. It was difficult to compare the level of promotion across dealers, but those that listed more promotional activities, including mentioning energy efficiency in print and radio ads, tended to sell a larger share of SERP units.

The relationship between additional cost of SERP units and the SERP sales percentage was clearer in other SERP areas (the Pearson correlation coefficient was statistically significant at the 0.01 level). A simple regression analysis suggested that

(a) Uncertainties in this value could come from several sources. The SERP sales share was an estimate from salespeople who probably didn't have access to accurate data. The sales volume was also a rough estimate. Finally, the shares reported by each dealer were weighted by the total estimated sales volume, not the volume of side-by-side units in the SERP size range. Any systematic correlation between sales volume and the proportion of side-by-side units sold would bias these estimates. We believed, however, that this was a reasonably accurate estimate of the overall average. Our estimate was about 56% of Whirlpool's estimate of their overall market share in 1993 (Treece 1993, p. 79).

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)

As noted earlier, SERP sales did not increase as fast as originally projected. The analysis in Chapter 4 showed that SERP units, on the average, sold for 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, Inc., 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.

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 own 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 from any but the largest manufacturers.

(a) This analysis was conducted excluding areas where dealers indicated that utilities provided rebates for efficient refrigerators. If included in the analysis, a rebate would offset the price effect partially.

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 resulting from that technology. Because the SERP incentive payment offset the added R&D 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 (such as reliance on other vendors for major components) and the SERP criteria (such as the winner-take-all condition) might have limited the number of manufacturers that realistically could compete for the SERP award. These factors probably limited how widespread manufacturer market transformation could be.

Utility observers and manufacturers were divided early in the Program on whether SERP would affect manufacturers' phaseout of CFCs (Sandahl et al. 1996). Two-thirds of SERP utility respondents interviewed early in the Program believed that SERP had sped up the phaseout in multiple ways. First, manufacturers had to address the CFC-free requirement in their SERP bid. 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.

Representatives of nearly all the manufacturers (8 of 9) interviewed by Sandahl et al. (1996), on the other hand, reported 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. Our recent interviews with refrigerator manufacturers, however, indicated that there was 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 representative said that SERP led Whirlpool to increase the rate of conversion. GE was encouraged by the competition of the SERP refrigerator to introduce a large, side-by-side, CFC-free unit in 1994 according to company representatives. 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 of its introductions occurring prior to December 1994. Amana (AMF) introduced over half of its CFC-free models before March 1995 and GE introduced a large majority of their its in the first quarter of 1995. Frigidaire (FCF) introduced all of its CFC-free models in mid-1995. All other manufacturers introduced most of their models late in 1995.

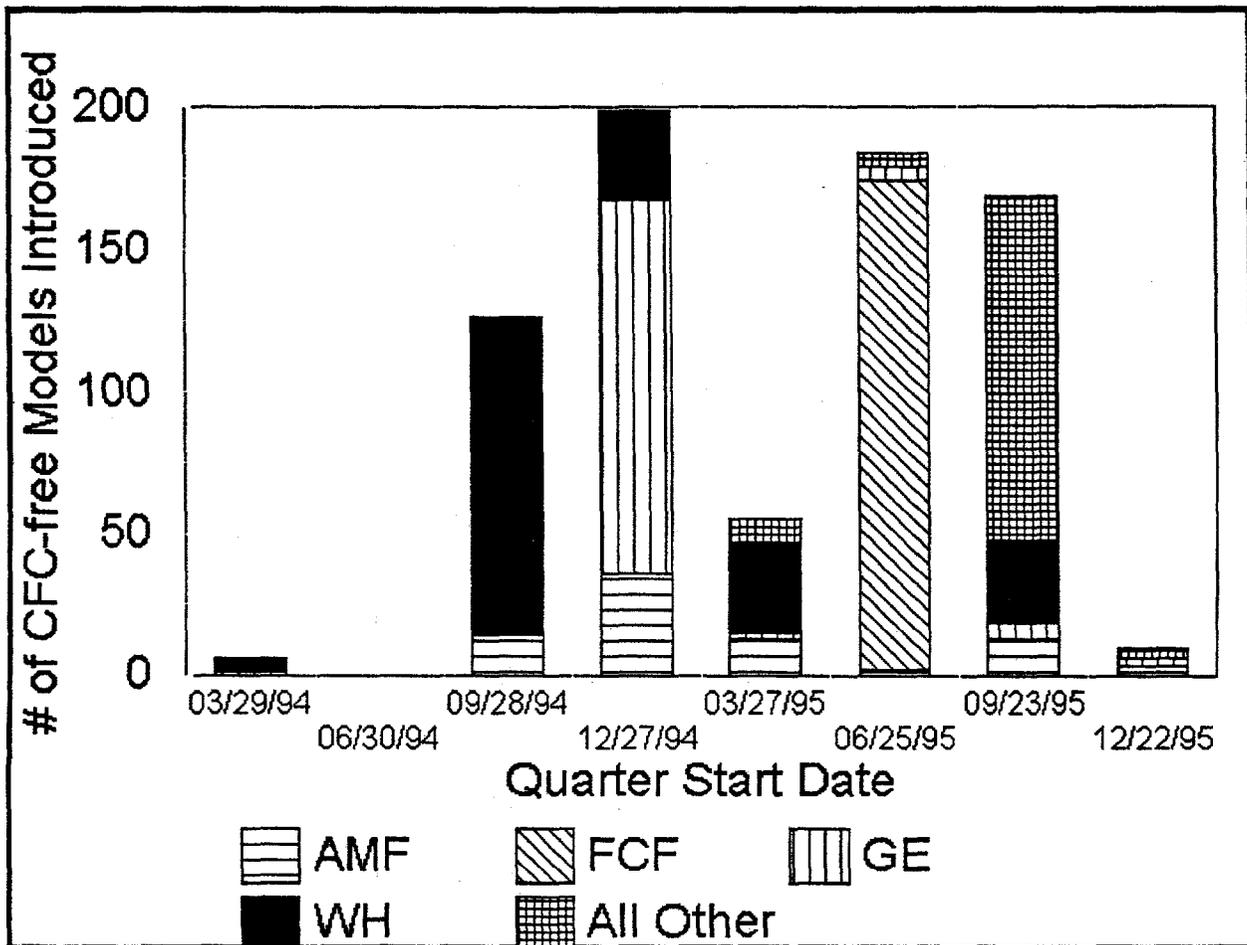


FIGURE 6.1 Introduction of CFC-Free Models

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 other manufacturers' introduction pace.

The data in CEC (1995, 1996) showed that several manufacturers have met the SERP efficiency and CFC-free requirements and that the goals have been met in other sizes and styles.^(a) Over one year before the CFC production phaseout, Amana and Whirlpool were producing over 40 models of high efficiency refrigerators, in different styles and sizes, that were also CFC-free. 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 production phaseout went into effect, over 75 CFC-free models were available from different manufacturers that were at least 25% more efficient than the standards.

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 refrigerator statistics 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 for side-by-side units in the 21 to 23 cu. ft. size range from AHAM (1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995) and CEC (1995, 1996). We plotted the energy efficiency of the least efficient and most efficient models certified by each manufacturer under its own brand from 1988 through 1996. Both the maximum and minimum efficiencies of all brands improved substantially. For example, the energy consumption of both Frigidaire's least and most efficient models declined about 48% over this period, largely in response to the 1993 efficiency standards, but neither the maximum nor minimum efficiency levels for Frigidaire refrigerators showed any effect of SERP.

Although the Frigidaire data exhibited no apparent effect of SERP, data for other brands did. For Whirlpool, efficiencies of the most efficient models continued to improve into 1996. Amana appeared to respond to SERP by improving the efficiency

(a) The units all exceeded the efficiency requirements of the standards by at least 25%.

(b) These units were sold without any rebate. According to a Whirlpool spokesman, sales were discontinued, however, due to inadequate consumer response.

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.

Figure 6.2 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 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.

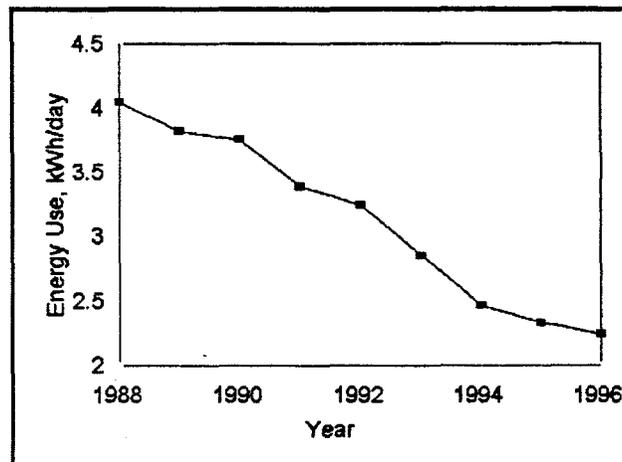


FIGURE 6.2 Average Consumption, All 21 - 23 Cu. Ft. Side-by-Side Models

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, more than 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 unless there were 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.

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 of 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 AHAM-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.^(b) Combining the data for manufacturers except Whirlpool, the

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

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%
<p>Note: Percentages indicate average consumption reduction relative to 1993 standards. Negative numbers indicate consumption higher than the standards.</p>			

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-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.

Pacific Northwest dealer visits in early 1996 tended to corroborate the perception, discussed earlier, 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 was minimal.

Of dealers we interviewed in the Bonneville area, only about 10% felt that SERP had a direct effect on non-winning manufacturers. One dealer stated that Amana appeared to have responded by introducing efficient models when the SERP unit came out. Several noted that the CFC production phaseout occurred shortly after SERP started so it was hard to identify any effect of SERP on CFC-free refrigerant use. Others noted that the energy standards had led to efficiency improvements in all brands. One dealer commented "I haven't noticed [any effect from SERP], but I wish they would respond because I'd like to have more SERP units available." One salesperson noted that other brands were putting more energy efficiency stickers on their units.

In non-Bonneville SERP areas, the proportion of dealers who believed that SERP had affected other brands was higher, about 30%. Several mentioned that Amana appeared to have increased its efficiencies in response to SERP. Some commented that price reductions in other brands appeared to be one response.

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.

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 has experienced a major splash of publicity in the beginning and has seen 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, however, in the Bonneville area and elsewhere that dealers were promoting SERP models very intensively. Principal responsibility for promoting SERP models rested with Whirlpool, primarily through its regional distributors. Several dealers felt that promotion of the Program had slacked off in the months since it started.

Although salespeople usually were familiar with the SERP models, it appeared that many salespeople lacked adequate training and information to promote SERP models effectively. Only about 20% had received training on SERP, and that usually came as part of general training by Whirlpool's sales representatives. This percentage was very similar to the results for non-Bonneville areas.

Over half the Bonneville-area SERP dealers that we interviewed indicated that some promotion of SERP models occurred. Most promotion, however, was usually limited to having SERP stickers on the refrigerators. Dealers also typically had brochures available on SERP. Most of the information was from Whirlpool. These results were very comparable with data for the non-Bonneville SERP dealers.

About 40% of Bonneville-area SERP dealers said that they promoted energy efficiency in general. This was substantially lower than the proportion in non-Bonneville SERP areas. The main cause for the lower percentage appeared to be the relatively low electricity prices in the Pacific Northwest.^(a) Several dealers commented that the rates were about half the value used to calculate the Energy Guide Labels and, as noted earlier, they pointed this out to consumers.

Despite the low electricity rates, some of the most proactive promotion occurred in one Pacific Northwest utility area. In the EWEB territory every dealer mentioned the "energy store" where the utility displayed energy-efficient appliances in conjunction with retailers. EWEB also provided rebates for efficient refrigerators (including SERP units). Dealers noted that the EWEB activities were very effective in prompting consumer interest in SERP and other efficient units. As mentioned earlier, one store had conducted an innovative "pig and panther" display in late 1995, in part because of EWEB's actions, to compare the energy use of a SERP unit and an older refrigerator.

(a) We did not find a statistically significant relationship, however, between electricity rates and energy efficiency promotion across the entire set of SERP utilities.

Non-SERP dealer interviews suggested that they promoted energy efficiency about as often as SERP dealers in the Bonneville area. A few noted that they believed the low electricity rates made efficiency differences insignificant to the consumers.

As noted earlier, the key for SERP dealers to generate consumer interest once buyers were in the store was having SERP models on display. SERP stickers distinguished SERP models from other units and stimulated consumer questions. About one-third of Bonneville-area SERP dealers had SERP units on the floor. The smallest stores were unlikely to have SERP units on the floor. Consequently, they were the least likely to generate consumer interest in SERP. This observation applied to the non-Bonneville areas as well.

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

About two-thirds of Bonneville-area SERP dealers, compared with more than 80% in other areas, indicated that buyers inquired about energy efficiency. Only about 10% said that half or more of their consumers asked about efficiency. This was considerably less than the proportion in non-Bonneville areas. The Energy Guide Labels appeared to be a broadly used tool for comparing energy efficiency. Bonneville-area non-SERP dealers reported a similar level of interest in energy efficiency. The lower level of consumer interest in energy efficiency in the Bonneville area appeared to be related to the lower electricity prices in the region.^(b) It was notable that in the Eugene area consumer interest in energy efficiency was consistently higher, due in large part to EWEB energy-efficiency promotions.

Surprisingly, about 50% of SERP dealers in the Bonneville area said that consumers asked about the refrigerant (compared with over 70% in the non-Bonneville areas). Consumer interest in refrigerants was about evenly split between concerns over environmental impacts of CFC refrigerants and disposal problems, and potential reliability problems of non-CFC refrigerants. Only a few dealers indicated that they felt

(a) These buyers would then be classified as free drivers.

(b) This finding was consistent with the finding in Chapter 5 that SERP sales seemed to be influenced by electricity rates.

there were reliability and performance problems with CFC-free refrigerants; they tended to be those who didn't carry CFC-free models.

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. Some dealers indicated that they or other dealers had warned consumers about reliability problems with non-CFC refrigerants. 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." Most felt that the SERP label did little to promote interest in efficiency, except for an occasional customer who inquired about the label.^(a) 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 Eugene area dealers said that one-third or more were concerned about efficiency. In this area, 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 EWEB'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 prices.

(a) Some dealers also mentioned that this occurred.

Half the Bonneville-area SERP dealers indicated that some consumer awareness of SERP existed before buyers came into the store. Several 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. The most effective ways to increase consumer awareness were steps taken by utilities. In particular, EWEB's activities increased consumer interest substantially.^(a)

About half the Pacific Northwest 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. This proportion was much higher than in areas outside of the Pacific Northwest. This was due primarily to the proximity of non-SERP and SERP areas in the Pacific Northwest and some active utility promotions of the Program.

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. Our data suggested 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 Bonneville-area utilities and their consumers.

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 Bonneville and other SERP areas indicated that consumers occasionally asked whether the dealer had SERP units, and how they compared with the ones that the dealer did carry. Although no data were available directly from consumers, it appeared that the Program increased consumer awareness about

(a) Probably the most directed activity taken by any utility was the promotional effort launched recently by the New England Power Service Company. It hired a consulting company to act as an additional "sales force" to support the Program. 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.

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 Bonneville's utility customers too.^(a) Whirlpool introduced its "Energy Wise" model for sale in non-SERP areas and efficient refrigerators produced by other manufacturers have become available in non-SERP areas (as well as SERP areas). These effects could be classified as free drivers for which Bonneville incurred no costs, but for which its customers 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 customers outside of Bonneville's area. Because of the payment system, Bonneville paid the incentive payment for some of these units yet did not receive the energy savings benefits. Although these sales represented energy-efficiency impacts of the Program, to Bonneville they were a leakage of Program benefits for which Bonneville incurred costs.^(b)

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.^(c) None of the manufacturers indicated

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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.
 - (c) 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.

that SERP led to any lasting organizational changes to focus better on energy efficiency or CFC phaseout.

Most manufacturers also 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. Frigidaire, the other SERP finalist, used some of the cost-effective technologies from its SERP model in other products, although it did not market a production version of its SERP unit, according to a company spokesman. 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.

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 that would be relevant to future evaluations of SERP.

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 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. Although a range of high-efficiency units in other styles and sizes have entered the market, questions still remained about achieving efficiency improvements of 30% or more across the board. The economic viability issues have also not been completely resolved because the SERP incentive payment 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 20% of salespeople in the Bonneville area, and one-third in all SERP areas, had been trained adequately about SERP. This was consistent with information reported by utilities.

Although personnel at the beginning of the marketing chain probably have been trained adequately, a large proportion of dealer salespeople have 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. Unfortunately, this approach appears to have not worked as anticipated in all cases and has contributed to higher retail prices for SERP units. Dealers indicated that, on the average, they charged about \$84 more in the Bonneville area (\$101 across all SERP areas) 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 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 incentive payment and sales tracking requirements have contributed to diminished SERP sales and sales documentation. Some salespeople communicated incorrect information to consumers about the incentive payment. 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. The manual system of compiling and distributing the information to SERP utilities has lagged several months behind sales, but began 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 in all SERP areas have aggravated this problem. This problem has been complicated in Bonneville's area by the fact that Bonneville does not serve end-use customers.

The interspersions of Bonneville customer utilities and IOUs has increased the tracking problems, increased the probability of misclassifying dealers, and complicated marketing. This problem is similar to the overall geographic dispersion problems faced by the SERP utilities as a whole.

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 midway through the Program. Based on the information available, we determined several preliminary findings about preliminary Program impacts. We caution the reader, however, that these findings are incomplete and need to be enhanced with more complete data and additional analysis.

Utilities, SERP, Inc., and Whirlpool all 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 payment data, so questions remained about how many SERP units were produced but unaccounted for in the incentive payment 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 the end of 1995, reported incentive payments were only about 24% of the original sales projections for the Bonneville area. Over all SERP utilities the comparable figure was 37%. There was evidence that sales had fallen during 1995 from their initial levels due to several possible causes.

SERP sales for which Whirlpool received an incentive in Bonneville's area were below Bonneville's share of funds committed. The shares varied substantially across the SERP 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 driver effects of the Program included 1) increases in the efficiency of Whirlpool's non-SERP models, 2) SERP units sold for which Bonneville and other 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 Bonneville's costs were averaging about \$128 per SERP unit for which an incentive was paid.

Despite original expectations, many dealers indicated that they were charging consumers more for SERP models than for comparable units. Based on data across all SERP areas, the average amount reported was \$101. 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 in the Bonneville area. The results reported here should be considered preliminary and subject to the constraints and assumptions noted.

For the Bonneville area, assuming that consumers paid no more for SERP units than comparable, less-efficient units and assuming an average electricity avoided cost of 5.0¢/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 1.57. At an avoided cost of 8.43¢/kWh, the benefit-cost ratio would increase to 2.65.

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

If buyers paid more for a SERP refrigerator and Whirlpool, in turn, received an incentive for it, the benefit-cost ratio could decline significantly. Using the baseline assumptions, if consumers paid the average additional amount estimated by dealers and Whirlpool received an incentive, the benefit-cost ratio would decline about 50%, to 0.88.

Of the free driver effects, future sales of efficient units could have the most dramatic effect on the benefit-cost ratio. Adding all the free-driver benefits under the baseline assumptions, the benefit-cost ratio would increase to 4.28. Adding in just the benefits of increases in non-SERP refrigerator efficiencies due to the Program could increase the baseline benefit-cost ratio to 1.94.

Across all the SERP utility areas, we assumed higher average avoided costs than in the Bonneville area alone. Under the assumed conditions, the baseline benefit-cost ratio was about 70% higher than in the Bonneville area.

The only free rider effect likely to have much impact on the benefit-cost ratio was locating SERP refrigerators for which incentives were received in non-SERP utility areas. We estimated that, assuming they amounted to 10% of total SERP incentive payments, this effect would reduce the baseline benefit-cost ratio to 1.41.

The TRC perspective did not include two potentially large Program impacts that should be credited to SERP. One was the benefit of more efficient refrigerators in all those utility areas that were not SERP participants. To the extent that it occurred, society, as a whole, reaped these benefits, but the TRC test did not include them. They were probably substantial because nearly 80% of U.S. households were outside SERP areas. Second, the environmental benefits, or externalities, associated with energy savings were not included in this analysis. A societal test would include 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; the 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 17% of its market segment in the Bonneville area (compared with 13% in all other SERP areas).

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 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.

In the Bonneville area, there was little difference between how much SERP and non-SERP dealers promoted energy efficiency and CFC-free refrigerants in general. Dealers in the Pacific Northwest promoted energy efficiency less than dealers in other areas, presumably because of the relatively low electric rates in the Pacific Northwest.

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 10% of all dealers in the Bonneville area said that over half their customers asked about energy efficiency. This proportion was about one-fourth the value in other SERP areas. The most likely cause of the lower proportion was the relatively low electric rates in the Pacific Northwest.

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

Because of Bonneville's role as a power wholesaler, it played no direct role in the Program at the customer end. Since Bonneville's utility customers were not direct participants in SERP, most took few actions to support the Program. Nevertheless, some local utilities took steps that affected the success of the Program. Several dealers commented on the role of electric utilities in SERP and energy efficiency programs in general.

In Bonneville's area and throughout all SERP areas, 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. EWEB's rebate program and energy store generated positive feedback from dealers. Utility activities outside the region included providing meters to consumers to measure refrigerator energy use 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 technology changes that would last after the Program ended.

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 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. Nevertheless, the impact of even modest changes 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 et al. 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, Inc., Bonneville and other SERP 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. Salespeople should be better informed about the incentive payment 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.

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.

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 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, including Bonneville's customers, 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. Utilities should investigate possible co-op advertising opportunities and implement appropriate ones with Whirlpool and dealers.

Utilities in areas with relatively low electricity rates, such as those in the Pacific Northwest, 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 Full-Scale Evaluation

This study was one of the first utility evaluations of SERP and was conducted in conjunction with the first SERP-wide evaluation for DOE. In both studies, the scope limited our ability to quantify Program impacts, conduct in-depth comparisons across different utility areas, and acquire information directly from consumers. We have recommended to DOE that a more complete evaluation be conducted when the Program is nearer its end (Lee and Conger 1996) and recommend here that a full-scale, final impact evaluation be conducted in the Bonneville area as well. Because of Bonneville's unique situation as an electricity wholesaler and the extensive mix of public and private utilities in the Pacific Northwest, a separate, full-scale evaluation for the Bonneville is warranted. The following steps should be incorporated in a final evaluation for Bonneville:

- 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 from SERP, Inc., should be obtained 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 quantify their magnitude better. 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 effect of the Program in different Bonneville utility customer areas should be explored in more depth and the impacts of different factors, such as utility rebates and promotions, should be studied more fully.

To lay the groundwork for the evaluation, we recommend that an on-going data collection approach be instituted as soon as possible.

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 (Sandahl et al. 1996). 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 an 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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