Super Efficient Refrigerators: The Golden Carrot® from Concept to Reality

John W. Feist, Super Efficient Refrigerator Program, Inc.
Ray Farhang, Southern California Edison Company
Janis Erickson, Sacramento Municipal Utility District
Elias Stergakos, Long Island Lighting Company
Paul Brodie, Pacific Gas and Electric Company
Paul Liepe, Atlantic City Electric Company

In 1993 a national coalition of utilities awarded an incentive contract to Whirlpool Corporation for the market introduction of super efficient refrigerators. Formed in 1991, the coalition developed several key goals. The super efficient refrigerator would achieve energy savings which exceed 1993 federal standards by 25% to 50%, or more, and would be free of CFC materials. The program would employ a window of opportunity between 1994 and 1997, and would assure market acceptability in function, style and price. The program would stimulate competition among manufacturers for efficiency improvements. Finally, the program would move the market toward these goals beyond the $30 million in program commitments. The program's turnkey design, market transformation potential and benefit/cost parameters attracted membership commitments totalling $30 million from 24 utilities across America. Dubbed "Golden Carrot," the embodiment of these key goals in a structured program produced tight competition for the contract which will produce aggregate energy savings of over 1 billion kWh over a 15 year life cycle of the approximately quarter million units planned for the market.

This super efficient refrigerator program adds significantly to the DSM landscape and advances national energy and environmental policies. This paper describes the program from various perspectives, including the participating utilities, the refrigerator manufacturer, the Environmental Protection Agency, and the Department of Energy. The paper concludes by identifying those aspects of the program which form a foundation for other national program opportunities, whether similar or dissimilar in program specifics.

Introduction

The Setting for Change

Three factors were at play in 1991 that could shape future efficiency levels in America's refrigerators: (1) the need for the industry to convert to non-CFC insulation and refrigerant compounds to comply with Montreal Protocol timelines; (2) the U.S. Department of Energy 1993 efficiency standards, and the anticipation of 1998 successor standards; and (3) weak demand for refrigerator super-efficiency due to low consumer interest and widely diverse utility rebate programs throughout the nation.

CFC Substitution

In 1991 there was concern that refrigerator manufacturers' CFC conversion by the end of 1995 would penalize efficiency. CFC substitutes appeared to be less efficient. Although manufacturers had researched many technologies capable of greatly improved efficiency levels, the market lacked an effective incentive for commercialization of these technologies. Individual utility rebate programs, which tend to focus on products already on the market, neither encouraged risk taking by manufacturers nor advanced the baseline for the 1998 standards.

The Concept of Golden Carrot

Responding to these factors, a group of individuals representing utilities, the Environmental Protection Agency (EPA), state energy offices, and environmental interests began in 1991 to examine the possibility of a national incentive program to accelerate the market introduction of super efficient refrigerators during the critical 1994-1997 timeframe. The utilities had determined that a market transformation project was needed that went beyond individual rebate programs. The group embraced the "golden carrot" concept to draw efficiency technology out of experimental stages by buying down a portion of the costs, and thus bring technology to the market. ("Stalking the Golden Carrot" ACEEE 1992 Summer Study Proceedings). "Golden Carrot" means market introduction of energy efficient products through public/private partnership efforts. The concept is key to the mission of Super Efficient Refrigerator Program, Inc. (SERP).

Building the Program

Following its incorporation in 1991, SERP assembled commitments totalling $30 million from 24 utilities. It designed a competitive solicitation for proposals to produce refrigerators which would be 25%-50% more efficient than 1993 Department of Energy (DOE) standards, would be CFC free, would be competitive with less efficient models in terms of style, features, look and price, and could be tracked to the utilities' service areas. SERP evaluated the two most promising proposals and prototype models, submitted by Whirlpool and Frigidaire, and awarded the contract to Whirlpool on June 29, 1993.

Industry Wide Support

The following utilities are active members of SERP: Arizona Public Service; Atlantic City Electric; Baltimore Gas & Electric Co.; Bonneville Power Administration; Central Maine Power; Commonwealth Electric; Jersey Central Power and Light; Long Island Lighting Company; Los Angeles Department of Water & Power; Madison Gas & Electric; New England Electric System; Northern States Power Company-WI; Northern States Power Company—MN; Northern California Power Agency; Pacific Gas & Electric Company; PacifiCorp; Public Service Electric & Gas; Sacramento Municipal Utility District; Southern California Edison Company; Superior Water, Light and Power; Western Massachusetts Electric Co.; Wisconsin Electric Power Company; Wisconsin Power & Light; and Wisconsin Public Service Corporation.

Public Endorsement

The following organizations have endorsed, supported, or advised SERP: American Council for an Energy Efficient Economy; California Manufacturers Association; Consortium For Energy Efficiency, Inc.; Electric Power Research Institute; National Association of Regulatory Utility Commissioners; Natural Resources Defense Council; U.S. Environmental Protection Agency; U.S. Department of Energy; Washington State Energy Office; Western Area Power Administration; and Wisconsin Center for Demand Side Research. Each of these organizations has provided important communication among utilities, conservation groups, public officials, and manufacturers in the development of the Super Efficient Refrigerator Program.

Status

Production of SERP models commenced in February, 1994 and sales commenced in April, 1994. By the third quarter of 1994 over 17,000 SERP models will have been produced and shipped to retailers. In total about 250,000 units are to be tendered for sale at retail outlets in the SERP member service areas during the program.

Demand Side Management and Refrigerators

Impact of Refrigerators Upon Energy Consumption

SERP identified that a unique opportunity exists for effectively applying a long-term DSM strategy for refrigerators. Refrigerators constitute a significant residential end-use of electricity (up to 22% of the annual residential load), so that efforts to promote efficiency in this end-use are worthwhile. Environmental Protection Agency, *Multiple Pathways Toward Super Efficient Refrigerators,* 1993 (herein *"Pathways").* Second, research and development efforts on emerging, super-efficient technologies have demonstrated the potential of significant, cost-effective energy efficiency well beyond the National Appliance Energy Conservation Act (NAECA) 1993 standards *(Pathways).*

Potential Adverse Impact of CFC Conversion Upon R/F Energy Efficiency

The phaseout of chlorofluorocarbons (CFC's) by the end of the decade will necessitate technological change as

substitute refrigerants and insulation systems are introduced. Certain utilities, federal and state agencies, and environmental groups were concerned that the manufacturers' preoccupation with CFC phaseout without simultaneously adopting super-efficient technologies during the next redesign and retooling phase could result in a significant lost opportunity for advances in energy efficiency. If this opportunity were lost, progress of NAECA refrigerator standards beyond 1993 would also be impeded. Therefore, SERP program designers seized upon this window of opportunity for refrigerator efficiency.

Evolution of Traditional Programs to SERP'S Collective Program

The Need for a National Program

Utilities have individually engaged in a variety of energy efficiency programs. These programs are fragmented, often inconsistent, and impact very small portions of the market for refrigerators. Consumer rebates, designed for the short-term promotion of appliances already on the market, have not provided sufficient inducement for manufacturers to shift toward super efficient technologies. SERP's program seeks a market transformation to induce manufacturers to develop and introduce new product lines to the market.

Customer Rebates; Limited Impact

SERP determined that manufacturers of refrigerators would not introduce to the market a super efficient refrigerator without a third party incentive to bring the price offered to the public to a level competitive with the less efficient models. SERP decided that to achieve the ambitious technological advances of the SERP model, customer rebates would have to be so high as to be beyond the cost/benefit limits of many utilities. Moreover, refrigerators are sold in a *national* market. To combine cost effectiveness and national market impact, SERP designed the program to provide the rebate *directly* to the manufacturer.

Manufacturer Rebate; Higher Impact

Providing the rebate incentive directly to the manufacturers produces a significantly greater cost reduction to the general public than through a direct to the consumer rebate program. Georgetown Economic Services Study, 1991, commissioned by SERP *("Study").* To make the SERP refrigerator equal in price to existing refrigerators, a direct to customer rebate from an individual utility would have to be approximately 82% higher than the direct-to-manufacturer rebate program of SERP *(Study).* A direct-to-manufacturer incentive provides a greater opportunity for the public to acquire the super efficient refrigerator, thus achieving overall movement toward energy efficiency both during and after the program's term.

The SERP Program

The Goal: Market Transformation

Although "market transformation" has been the topic of great discussion, the SERP program is the first national attempt to stimulate an energy efficiency market transforming impact. A new refrigerator product option has been created for consumers because of the program. Supporters in the utility industry of SERP's goals look for market transforming DSM programs to make fundamental changes in customer attitudes toward energy efficiency, thereby causing changes in purchasing behavior that long outlast the direct impact of the programs themselves.

Some benefits of market transformation have already manifested themselves. Some refrigerator manufacturers have publicly stated that some of the efficiency technology contained in their SERP bids will be incorporated in standard commercial models commencing in 1994. Whirlpool has stated it plans to offer the SERP model in non-SERP markets later in the program, noting that the company believes that a portion of consumers believe that environmental aspects and energy savings are sufficiently important to motivate purchases of the SERP model even in areas where the SERP incentive does not apply.

Gathering Commitments for Incentive Payments

SERP obtained financial commitments of $30 million from 24 utilities across the count to cover manufacturer incentive payments and administrative costs to support the RFP and contract performance phases of the program. Of this amount, over $27 million was designated for payment of the per-unit manufacturer rebate—the so-called "bid pool" of the program. Each utility decided for itself the appropriate level of investment. The level suggested by program designers was that which would satisfy at least 5% of total refrigerator sales in each service territory over the life of the program.

SERP established certain benefit/cost parameters in order to attract a broad spectrum of utility participation. The unit incentive level was to be determined through the competition. The full "bid pool" would be available if the proposed unit incentive did not exceed $.375 incentive per first-year kWh savings. A reduced "bid pool" would be available if the proposal was above that figure but not

higher than $.50 per first-year kWh savings. The RFP award procedure was designed so that there was a scoring benefit associated with minimizing the unit incentive. Whirlpool met the parameter to earn the entire "bid pool. " The incentive will be paid on a per-unit basis as refrigerators are sold in stores in SERP member service territories.

Solicitation of Super Efficient Refrigerator Proposals

SERP designed an RFP, invited industry comment on it, and solicited refrigerator manufacturers to submit proposals on super efficient refrigerator designs. SERP's program defined "super efficient" as a refrigerator that: (a) meets or exceeds Trial Standards Level 5 as developed by DOE for refrigerators under NAECA, and (b) consumes, at a minimum, 25% less energy than a similar unit at the 1993 NAECA standard. SERP required that the refrigerators have an automatic defrosting capability and an interior capacity of between 15 and 26 cubic feet.

Fourteen (14) offerors submitted proposals in October, 1992. Whirlpool and Frigidaire, the two offerors with the best proposals, were selected for the second phase of the program, in which they were required to submit prototypes of their proposed SERP model for evaluation. SERP awarded Whirlpool the contract after analyzing the prototypes and evaluating final offers. The offerors were required to propose the number of refrigerators to be produced, the unit incentive, a marketing and tracking plan, and a delivery schedule to retail stores. The winning proposal reflected the most improvement in energy efficiency relative to 1993 DOE standards, a favorable delivery schedule, and reliable data tracking the SERP model to households in the SERP service areas.

Evaluation of Proposals

SERP selected an RFP framework for the incentive contract because it provides competition and a predictable process for disbursing funds in return for a product specified well in advance of its market introduction.

The proposals received by SERP were judged by an independent team of experts according to:

- The proposer's manufacturing capability;
- The proposer's ability to distribute the product nationwide;
- The proposer's marketing, tracking and monitoring plan;
- Corporate reliability and capital resources to pursue the program;
- The ability to meet the minimum standards for energy efficiency; and
- Price per kWh saved.

Whirlpool will introduce a minimum number of refrigerators for sale in the service territory of each member utility. This minimum number relates to the utility's program commitment, the unit incentive proposed by Whirlpool, and Whirlpool's assessment of the refrigerator market.

Primary Emphasis in SERP Program: Energy Savings

Energy savings had top priority in the evaluation of proposals. The evaluation scoring system in the RFP assigned to energy savings the greatest weight in the mix of evaluation factors. The proposals of the two finalists presented the best energy efficiency for the least cost and the earliest delivery schedules. Both finalists proposed refrigerator units of a size in which the greatest energy savings could be achieved, i.e. units 22 cubic feet and larger. SERP was told that SERP's minimum requirements and DOE trial level 5 standards could not be achieved in smaller units in SERP's timeframe. SERP recognized that the advanced technology associated with super efficiency was not cost effective for manufacturers to include in smaller units during their first production runs, and that, like air bags in automobiles, new technology typically enters into the higher end market first and then becomes standard in other models.

Energy Savings and Specifications of the SERP Refrigerator

In 1994 Whirlpool will introduce to the market a 22 cubic foot, side-by-side refrigerator/freezer which is 29.7% more efficient than the 1993 federal standards. Whirlpool plans to introduce in 1995 more efficient models utilizing vacuum panel technology. Until these models are put in stores—presently scheduled for first quarter 1995–Whirlpool requires SERP to treat as confidential all information about those models, including size, features, quantities, and energy savings.

The information in Table 1 relates to the SERP model available in 1994.

Table 1. Description of the 1994 SERP Refrigerator

1.	UEC (kWh/yr)	670
2.	Model Type	Side-by-Side A-D w/TTD
3.	Total Refrigerator Volume	21.63
3a.	Fresh Food	14.48
3b.	Freezer	7.15
4.	Outside Dimensions	33"W X 66" H
5.	STD UEC	953
6.	kWh Savings	283
7.	Refrigerant(s)	HFC134a
8.	Foam Blowing Agent(s)	HCFC141b
9.	Refrigeration Cycle Desc	Vapor Compression
10.	Cabinet Insulation	
10a.	Type	Foam
10b.	Thickness (FC/RC)(2)	2.1"/1.8"
10c.	"K" Factor (Btu-in/hr-ft2-F)	0.125
11.	Door Insulation	
11a.	Type	Foam
11b.	Thickness	2.75"
11c.	"K" Factor (Btu-in/hr-ft2-F)	0.125
12.	Design Schematic Provided:	No
13.	Control Schematic Provided:	No
14.	HCFC Free Insulation:	No
15.	HCFC Free Refrigerant:	Yes
16.	Separate Air Flow:	No

FC stands for Freezer Compartment, RC stands for Refrigerator Compartment

Benefits

Broad Range of Technology Advances

Whirlpool has included the following key technological features in meeting SERP's standards:

- HCFC14lb blowing agent used for foam insulation replacing CFC12.
- HFC134a refrigerant replacing CFC12.
- Modification of compressors to achieve greater efficiency and also handle the new CFC-free refrigerant fluids which are more corrosive to refrigerator components than conventional refrigerant fluids.
- Fuzzy-logic microprocessor to constantly monitor conditions inside the cabinet, adjust defrost cycle accordingly, and defrost less often if, for example, the door is opened infrequently.
- Freezer compartment insulated with vacuum panels, which are three times as effective as foam; due in 1995,
- Formed-in-place insulation which fills the nooks and crannies of the previously hollow interior door molding; due in 1995.
- Permanent Split Capacitor (PSC) condenser fan motor.
- Thick doors containing an extra inch of foam insulation.
- High Efficiency Shaded Pole evaporator fan motor.
- Compressor valves, lubrication system, and motor revamped; due in 1995.
- Drain pipe modified to eliminate return of hot air.

Price Considerations

The SERP RFP required the offeror to tender the new products to distributors and retailers at a wholesale price that is no higher than the price of an existing, comparable model that it sells. The manufacturer's price cap provision is intended to promote sales of the new refrigerator on a competitive basis with less efficient refrigerators, although neither SERP nor the manufacturer controls retail prices.

The manufacturers competing for the SERP award needed to solve technological challenges, *and* modify production lines, *and* generate market interest in the new product within the foregoing price cap. The manufacturers were competitively constrained to "sharpen the pencil" when figuring the amount of incentives to be paid by SERP. Each offeror made its own decision as to the extent to which the incentive it requested in its proposal would reduce incremental costs.

Energy Conservation Benefits and Savings

Whirlpool estimates that annual cost of operating the 1994 SERP unit will be about $55.00, assuming $0.08 per kWh. Residential energy bills may be reduced by over $1 billion over 15 years. This savings does not take into account the full range of benefits from market transformation. (See Figures 1 and 2.)

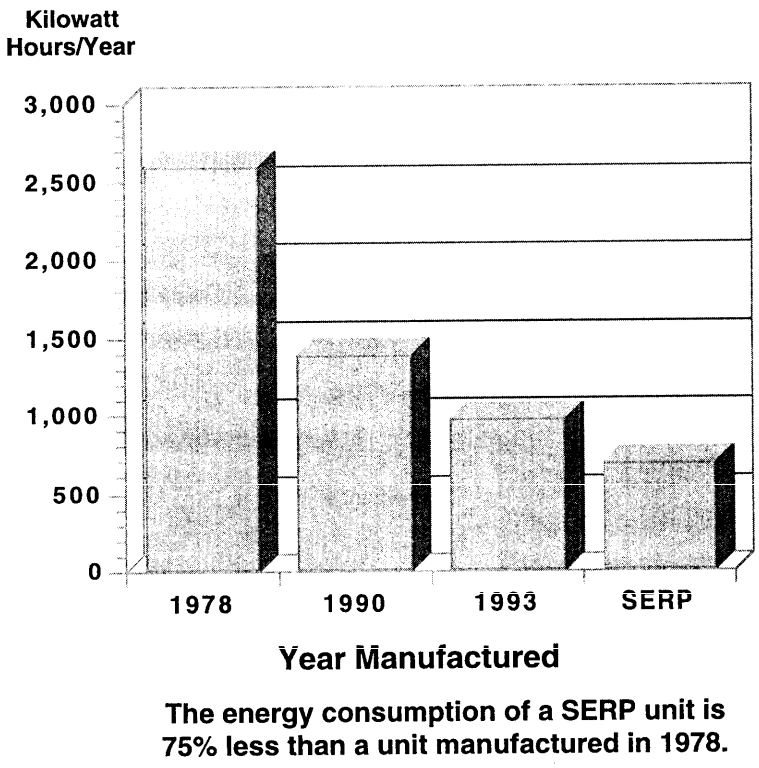

Figure 1. Refrigerator Annual Energy Consumption

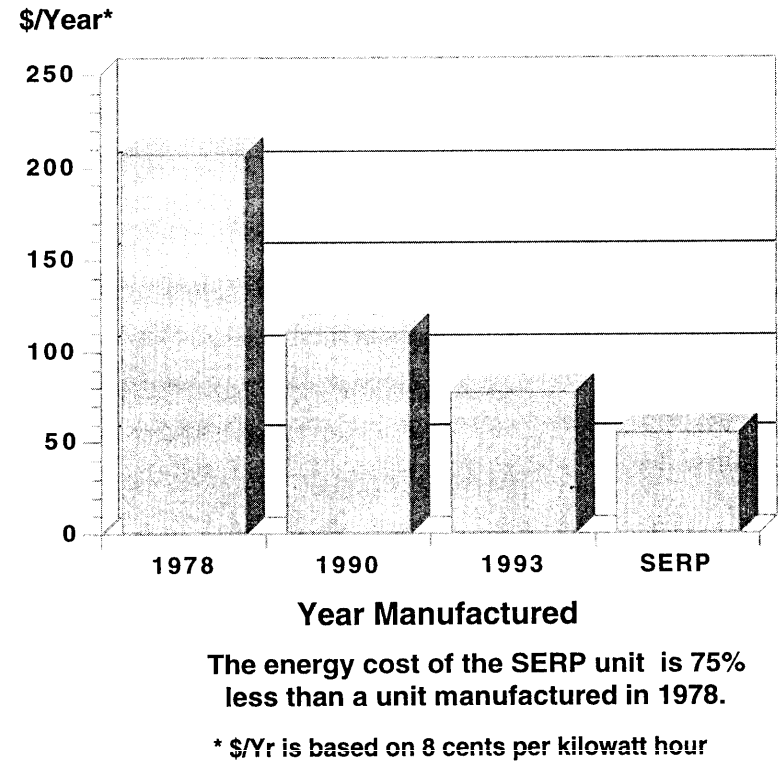

Figure 2. Annual Cost of Refrigerator Operation

Caution must be used in attempting to quantify savings produced by refrigerator DSM programs, including the SERP program, since energy consumption varies under climatic conditions and individual usage. Furthermore, the savings are presented relative to the applicable 1993 federal standards.

National Policy Benefits

The driving force behind its members' support for the SERP program is the commitment of each member to achieve national energy policy goals through innovative programs to conserve energy as an alternative to new power generation facilities. The Administration's Climate Change Action Plan announced in October, 1993 strongly endorses market-pull strategies and points to the SERP refrigerator program as a case study—see attached, page 14 of the Action Plan.

Advances in Tracking

An important example of the benefits of this competitive process is that Whirlpool proposes a system of tracking sales of refrigerators to the utility customer in a high percentage of cases. SERP established as its initial criterion that the manufacturer provide data for tracking at least 25% of the units produced and shipped. In the run-off between the two finalists, SERP improved this criterion to 75%. Whirlpool included in its proposal a method of tracking which indicated to SERP the likelihood of achieving even higher levels of tracking information.

Lessons

General

At the date of this paper, only a small number of refrigerators have been sold in the SERP service areas. Therefore many of the lessons of the program with respect to overall advancement of energy efficiency goals, permanent transfer of technology from R & D to commercial application, and consumer willingness to value energy efficiency and environmental goals in making purchasing decisions are still to be revealed. However, over the three years of SERP's experience in working through structural, governance, marketing and tracking problems, certain lessons for future national incentive programs may be drawn.

Coalition Forming

A very important first lesson is the process of coalition forming. Widely diverse groups have been major supporters and designers of various aspects of the SERP program. SERP recognized at an early stage the need for a collaborative and collegial environment in which the views of investor owned utilities, federal power authorities, municipal utilities, federal and state regulatory agencies, and environmental groups could be synthesized in carefully defined objectives. Then, through SERP's RFP and contract negotiation process, the manufacturers responded with their best ideas and expertise to translate these objectives to the realities of the market.

Program Structure

From the outset it was recognized that the national program would require a structure with clearly identified principles of governance. A nonprofit corporation was formed to establish independence and to distinguish the national program from other programs conducted by individual utilities, including other refrigerator programs. SERP's structure is an organization which advances a public benefit, is worthy of public acclaim, has attracted capital from sponsoring utilities, and maintains fiscal controls and accountability.

Market Forces

The SERP program confirms the lesson that for a national, market-transforming program to achieve success it must be shaped by market forces. The SERP program designers attempted to define energy efficiency and environmental criteria, but looked to manufacturers and others in the marketplace to devise ways and means of achieving SERP's objectives.

Antitrust Issues

Substantial attention was given to antitrust aspects of designing and implementing the refrigerator program. The first level of concern dealt with the coalition so that competing or potentially competing utilities not engage in anti-competitive conduct. Accordingly, the SERP Board, its advisory process, and all committee activities have been conducted in compliance with antitrust guidelines adopted as the policy of the Board of Trustees at its first meeting. The second concern relates to the interaction between SERP and its members with manufacturers, distributors, dealers and others involved in the refrigerator industry. All aspects of the SERP program were designed and developed with advice of counsel. SERP then sought and obtained a Business Review Clearance from the Antitrust Division of the Department of Justice which enhanced the comfort level of interested parties in the program and helped establish a precedent for future national DSM programs.

RFP Solicitation Process

SERP also recognized that manufacturers would not come forward with serious proposals in response to SERP's program unless safeguards were established to achieve a fair solicitation process including the protection of confidential information during the bid and pre-production phases. Representatives of manufacturers do not sit on the Board of Trustees, did not attend SERP's advisory committee sessions, and did not participate in the initial program design. In February, 1992 a draft of the RFP was widely circulated to all known, interested manufacturers and was advertised in the Wall Street Journal. There followed a process in which individual manufacturers provided confidential input to SERP in separate, individual meetings and in confidential written submissions. SERP took care that input and submissions of manufacturers were not disclosed to their competitors or to the public during the process. These procedures were developed by SERP to encourage manufacturers to be forthcoming with technological, marketing and tracking ideas.

The winner-take-all approach to the RFP was the subject of substantial internal discussion. The SERP Board decided that the winner-take-all process would produce a highly competitive environment so as to achieve cost effectiveness. These benefits have been confirmed in the SERP program. The principal lesson for future programs is that a competitive environment must be created to draw out manufacturers' technologies, whether such competitive environment takes the form of a winner-take-all approach or some other structure.

Measurement and Evaluation

It is important that SERP utilities demonstrate the market transforming effects of the SERP program. The tracking requirements relating to sales in SERP member service areas will provide critical data to identify regional markets, identify behavior in those markets, and identify sales in a particular time frame in which to study market behavior. SERP members must also be able to demonstrate to their rate regulating authorities that there is a benefit to the ratepayers they serve. DOE and EPA have indicated a willingness to conduct a comprehensive study of the market transforming effects of the SERP program.

Future Opportunities

Climate Change Action Plan

Currently the Department of Energy is formulating definitive provisions of segments of the Administration's Climate Change Action Plan. Portions of the Action Plan stress strategies to select markets and technologies for market-driven advances in energy efficiency. The Action Plan emphasizes the desirability of forming "Golden Carrot" voluntary market-pull partnerships. The Super Efficient Refrigerator Program is an exemplar of the market-pull strategy, and is thus a central part of a new national policy to encourage market forces to develop gains in energy efficiency above and beyond the levels achieved through government regulation. The SERP program also confirms that the services and guidance of federal agencies (at little cost), in partnership with the private sector, can leverage substantial public benefits.

New Opportunities

New opportunities for national DSM initiatives are being investigated by Consortium For Energy Efficiency, Inc. (CEE) which was formed at the same time as SERP. CEE has been a close ally and supporter of the SERP initiative. CEE is examining the potential for applying a market-pull approach to achieving energy efficiency in numerous other fields.

Future Market Transformation Programs

Future national market transformation programs may, but need not, follow the winner-take-all structure of SERP. The SERP model appears to be cost-effective and to produce good results. Other competitive market-pull approaches may be appropriate for other technologies. The emphasis on turnkey program design of SERP and CEE allows utilities to avail themselves of market transformation, technology transfer opportunities without diverting or creating special resources within their organizations to do so.

The pioneering SERP refrigerator program demonstrates the value of public/private partnerships. Federal and state agency personnel provided SERP vital guidance, expertise and encouragement. This helped channel the interest and funding of utilities in a cost effective manner. Refrigerator manufacturers could then recognize a clear market for their efficiency technology advances. As a result of the SERP "Golden Carrot" partnership of all these interests, a quarter-million new refrigerators will be offered which are at least 30% more energy efficient than mandated by 1993 federal regulation, are free of ozone-harming CFCs, and will cut annual carbon dioxide emissions from power plants by an estimated 600,000 metric tons.

Attachment

Action #l3

Establish *Golden Carrot* Programs for Industrial Air Compressors, Pumps, Fans and Drives

DESCRIPTION: DOE will work with business to create industrial *Golden Carrot* programs for air compressors, fans and pumps, as well as other types of industrial process equipment. *Golden Carrots* pool utility rebates or a group of organizations' purchasing power to promote commercialization of advanced efficiency measures. The original *Golden Carrot* -- the Super Efficient Refrigerator Program -- pooled $30 million in utility rebate money for the manufacturer who could commercialize the most energy-efficient, CFC-free refrigerator. The greatest potential for improved industrial energy efficiency is found in pulp and paper, textiles, chemicals, petrochemical, and food processing industries, which use more than 50% of the process energy consumed by this sector.

IMPLEMENTATION: This initiative will accelerate the commercialization of high efficiency air compressors, pumps, fans and drives through the following activities:

- DOE-sponsored study that quantifies the potential efficiency gains from advanced high efficiency air compressors, pumps and fans, and identifies other types of process equipment with potential for cost-effective efficiency gains.
- A joint effort between utilities, industrial firms, the government, energy users, and non-profits to establish common utility specifications and financial incentives to promote the commercialization of advanced high efficiency equipment. This effort will ensure that utilities develop uniform specifications for high efficiency equipment purchases and provide monetary incentives for their use.
- A utility-led effort to develop contests similar to the first *Golden Carrot* to commercialize advanced technologies.
- A private sector pooled purchasing project to enable industrial energy users to make large purchases of high efficiency industrial equipment, at a lower price than individual purchases.

No additional authorization is required. The Administration is proposing to obligate $2 million in FY 1995 for this action and $14 million through 2000.

MARKET IMPACT: This action, together with the action to accelerate adoption of energy-efficient technologies (see table), stimulates about $600 million in private sector investment for the period 1994-2000 (undiscounted 1991 dollars). This investment yields energy savings worth $1.3 billion through 2000, and continues to pay off over the next decade, for an additional savings worth $7.8 billion over the period 2001-2010 (undiscounted 1991 dollars).

EMISSION EDUCTION: The emissions impact of this action was analyzed in combination with the action to accelerate adoption of energy-efficient technologies. Together, these actions reduce greenhouse gas emissions from projected 2000 levels by 2.9 MMT of carbon equivalent.