Market Transformations to Super Efficient Products: The Emergence of Partnership Approaches

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Market transformation programs were developed to overcome barriers that prevent the commercialization of new energy efficiency technologies. These programs focus on creating widespread commercial availability of new technologies that did not previously exist or were only minimally available. Since the late 1980s, an increasing array of market transformation programs have been developed via partnerships between utilities, public interest organizations, and government. This paper describes some of the theoretical issues behind market transformation programs, and traces the development of major partnership organizations in the United States. It also discusses the results of some programs for which data on market success are now available. Market transformation raises new issues concerning program measurement and evaluation and the regulatory treatment of utility-sponsored market transformation programs, which are reviewed briefly.

Introduction

What is Market Transformation?

Market transformation programs are developed as a response to the difficulty of introducing new efficiency technologies in the marketplace. Numerous studies have established that cost-effective technologies to increase energy efficiency do not sell in large numbers in the marketplace. Commonly, efficiency measures with simple payback periods longer than two or three years are not accepted at all.

Confronted with such an environment, a rational equipment producer will completely ignore energy efficiency research and development, as well as product development and marketing efforts, for technologies with payback periods in excess of two to three years. Such products, therefore, will seldom be available to the ultimate consumer, whether that consumer is in the residential, commercial, industrial, or agricultural sector.

Market transformation attempts to bridge this gap by encouraging the development of new technologies and by establishing incentives or conditions under which they will succeed in the marketplace.

No widely accepted definition of market transformation programs has yet been proposed. This paper discusses two complementary approaches to the definition of market transformation.

The first approach is simply to categorize market transformation programs as programs which encourage widespread adoption of advanced energy efficiency technologies that were either not available, or were so narrowly distributed as to be practically unavailable, prior to the program. This definition is similar to the definition of "technology procurement" proposed by the Swedish National Board for Industrial and Technical Development, which has implemented some successful market transformation programs.

Conventional incentive programs, such as utility demand-side management (DSM) programs for most end uses, focus on the consumer as the decisionmaker: the program looks at the efficiency choices from the consumer's point of view, and provides incentives whose goal is to induce the consumer to make different decisions.

Market transformation programs, in contrast, focus on the producer of energy using equipment rather than the consumer. (Eckman et al., "Acquiring Energy Efficiently" 1993) The utility may still design incentives that encourage consumers to purchase efficiency in the marketplace, but that effort is made only to the extent that it is necessary to induce technology changes at the producer level. For example, the Super Efficient Refrigerator Program (L'Ecuyer et al. 1992) provides incentives at the manufacturer level only.

Through organizing or creating the conditions for purchases on the regional, national, or international scale, market transformations can bring forth technology that would not otherwise be available.

A second approach to defining market transformation involves the development of quantitative indicators of market transformation. Such indicators would recognize the fact that market transformation is not a quantum variable, in the sense that programs either are or are not market transformation programs, but rather a continuous variable measuring the extent of transformation induced in a market.

A key feature of the success of a market transformation program is the extent to which the technologies being incentivized are eventually purchased by non-participants in the program, as well as by participants. This phenomenon of consumers who purchase the energy efficiency technology that is being promoted by an incentive pro-. gram without receiving any direct incentive from the program is referred to as "free drivership." Obviously, the greater the extent of free drivership in a program, the lower the cost for incentives and administration. Thus, one possible market transformation index might be defined as follows:

$$\textit{Market transformation index} = \sum_{(i=1)}^{N} \frac{(FD)(i) - (FR)(i)}{(GPS)(i)} \qquad (1)$$

where:

N = the number of years from the initiation of the program until some time sufficiently far in the future where savings are either zero or considered irrelevant;

(FD)(i) = free driver savings in year i: savings from non-participants in the program who purchase the device being incentivized;

(FS)(i) = free rider savings in year i: savings from participants in the program who would have purchased the new technology without the program; and

(GPS)(i) = gross participant savings in year i: savings recorded by the participants without consideration of what non-participant behavior was .

This index is negative and much less than one for most DSM programs, and positive and much greater than one for market transformation programs. For example, for a conventional DSM program with 30% free ridership, the market transformation index would be -0.3. For a hypothetical market transformation program that eventually produces two units of non-participant savings for one unit of participant savings, the market transformation index would be 2.

This index, added to the number 1, is essentially a multiplier that allows one to calculate net savings from the program compared to gross savings. Using this index, any program that had a positive index could be considered to have some aspects of market transformation.

Some analysts have suggested that market transformation programs be defined by their ability to change the markets for energy-using equipment in a permanent way: that the market must "stay transformed" even after the incentive program terminates.

This criterion of permanence is implicitly incorporated into the market transformation index suggested above: programs that induce continuing market transformation will continue to record free drivership savings during the years after the program has terminated. Thus, permanence can be considered as one aspect that increases the degree of market transformation that a program has achieved.

Scope of This Paper

Market transformation programs can be developed by a wide range of actors, from individual large utilities to consortia of utilities, from government agencies to private businesses. With the increasing focus worldwide on demand-side efficiency improvements, a number of programs have been developed that could be reasonably classified as market transformation activities. This paper does not attempt to be comprehensive, but focuses on activities affecting energy use in buildings that are being developed by the utility and government sectors. Theoretical issues are discussed first. Next we trace the development of U.S. organizations established to promote market transformation, and attempt to survey the results of programs where there are enough data to draw firm or tentative conclusions concerning program effectiveness. The paper concludes with a discussion of the institutional issues of measurement and evaluation of utility-based market transformation programs, and regulatory treatment of their costs.

Theory of Market Transformation

Defining the Problem

Analyzing market transformations requires a thorough reexamination of the "efficient markets" paradigm with respect to energy efficiency improvement. According to this conventional economic paradigm, increased research and development that produces new technologies for energy efficiency will lead to their introduction in the marketplace when they can be mass-produced in a cost-effective fashion. Market barriers may prevent some, or even most, consumers from purchasing such products, for reasons that are well known (such as split incentives, lack of information, etc.); but some consumers will behave "rationally" and purchase the more efficient products..

The goal of market-based incentive programs such as utility DSM would then be to increase the market share of these products by focusing on solving the problems on the consumer side of the purchase transaction. Market transformations would accelerate the introduction of new products or move their market penetration curve forward a few years. This is discussed in Schlegel et al. 1993.

But in many cases, even this weak form of the efficient markets hypothesis fails to account for real world behavior. Higher efficiency technologies may simply be unavailable to the consumer, either directly in that they are not being produced at all, or indirectly in the sense that the production volumes are too small. Indirect unavailability occurs when a technology fails to be cost-effective to most consumers, not because the technology itself is too expensive, but because the low production volumes lead to poor returns to scale: the efficient products are essentially handmade and thus inappropriately costly .

The theoretical problem encountered is that the conventional premise of macroeconomics—that consumer A's behavior does not affect consumer B—is violated. For most mass-produced products, consumer A will face a price determined by whether or not the collective of consumers B are perceived by the manufacturer as being willing to buy the product. If they are, the product will be mass-produced and A has the choice of buying it; if not, the product will either not be produced or not be mass-produced, and thus will be unavailable at a reasonable price to consumer A, regardless of his or her own preferences.

As summarized by NUTEK's Hans Nilsson: "The market's best products to date are not sufficiently good. Generally, improvements in performance can be effected if demand is sufficient to insure adequately large volumes to cover the costs." (emphasis added) (NUTEK, 1993)

If mass production is necessary to develop a new energy efficiency technology, and the market conditions to support mass sales do not exist, the new technology may never be introduced without market transformation programs. Such programs can then be described as introducing technology that simply would not have been available without the program, rather than merely accelerating the introduction of something that would be produced anyway. Eight years of utter stagnation in the fuel economy of new automobiles, despite widespread evidence that technological improvements could substantially improve fuel economy in a cost-effective way, support this hypothesis about the importance of market transformation programs.

Once a market transformation program has induced mass production, it is possible that the program can be withdrawn. However, actually withdrawing the program could place too much risk on the validity of the hypothesis of functional markets in energy efficiency to be a rational choice without specific market data on the continued acceptance of the new technology.

Practical Solutions

Solutions to the conundrum of efficient products not being brought to market because of a lack of a sufficient volume of demand focus on a pragmatic view of the functioning of marketplaces, and a commitment by some governmental or non-governmental entity to intervene in the market to mediate the needs of purchasers and producers. This entity can involve utilities, government, or private purchasers. In practice, many of the successful market transformation programs involve collaborations of a variety of different sectors and parties to provide the linkage between manufacturers and users that is missing from real markets. This linkage can be provided by changing incentive structures to manufacturers, distributors, retailers, or end-use customers; it can involve changing financial incentives or providing additional information, or it may be accomplished through changes in attitudes by participants. (Schlegel et al. 1993)

Various options for program design have been applied successfully in the United States and Sweden. Some of these are discussed in the Sections on "Institutions to promote market transformation" and "Results" below.

Institutions to Promote Market Transformation

Utility-Based Consortia

Complementarity of Standards and DSM: the Carrot as Well as the Stick. When utility DSM programs first developed in the U.S. in the late 1970s and early 1980s, they were instituted in an environment in which mandatory efficiency standards were not as important a factor as they became by the 1990s. At that time, there were no federal standards for buildings or appliances at all, and by the crest of the first DSM wave, in the 1980s, the few state standards that did exist had become outdated.

An increasing emphasis on mandatory standards during the rnid-1980s, which culminated in the adoption of the National Appliance Energy Conservation Act of 1987, revealed sharp disagreements between efficiency advocates and equipment manufacturers that threatened to persist indefinitely. Total reliance on the "stick" of mandatory standards might produce significant energy savings, but it came at the cost of strong divisions and controversies. The Natural Resources Defense Council (NRDC) suggested in 1987 that a more balanced approach between the "carrot" of incentives and the "stick" of regulation could produce greater consensus and perhaps stronger progress towards energy efficiency. The new incentive, NRDC argued, would have to be explicitly directed at new technologies: at market transformation.

Effective incentives would work complementarily with standards by using the existing standards as a base, both for calculating efficiency and for comparing products with different attributes, for example, side-freezer refrigerators with ice service compared to top-freezer refrigerators. But a different design of "carrot" would be necessary to induce new products into the market that were not currently being produced at all. It became clear that the scale of such programs would have to be larger than the utility-by-utility scale of existing DSM.

The Consortium for Energy Efficiency and the Super Efficient Refrigerator Program. Several agencies, both in the United States and Sweden, were pursuing thoughts along the same lines. Pacific Gas & Electric, which began rapid expansion of its DSM efforts in 1990-1, recognized its need to command a larger market share for success in its appliance programs. The U.S. Environmental Protection Agency (EPA), which was implementing the successful "Green Lights" program to increase the penetration of already available commercial lighting technologies, was looking for methods to bring new technologies to market. Similar processes were being put forward by the Washington State Energy Office and the American Council for an Energy Efficient Economy.

Following a meeting in late 1990, these organizations agreed to work together to develop the first large-scale market transformation effort in the U. S.: the Super Efficient Refrigerator Program (SERP). (L'Ecuyer et al. 1992) This program has yielded successful results: Whirlpool's winning bid provides CFC-free refrigerators that use 29.5% less energy than the 1993 Department of Energy standards in 1994, and appears poised to increase savings to over 40% in 1995.

The discussions about organizing SERP, which began with a narrow focus on a program design for residential refrigerators, quickly expanded into a forum for designing programs for a wide variety of utility end uses, and spanning a wide range of investor-owned and publicly owned utilities, state and federal government agencies, non-profit organizations, and, later, gas and water utilities. In 1991, these organizations established the non-profit Consortium for Energy Efficiency, Inc., (CEE) whose mission is to develop model DSM programs that can accelerate the development and availability of energy efficiency technologies. By including active participation of the Electric Power Research Institute and the Gas Research Institute, the U.S. Department of Energy, and more recently, a broader array of electric and gas utilities and state energy offices, CEE has positioned itself as an organization that can help move new technologies from the successful completion of research and development to commercialization and widespread acceptance.

The Consortium for Energy Efficiency is developing a variety of program designs to address specific needs of particular market sectors: to act as a "visible hand" (L'Ecuyer et al. 1992) to make market forces work effectively. Two programs adopted in 1993—for residential clothes washers and commercial packaged air conditioners—set uniform specifications for qualification for different tiers of rebates from the participating utilities.

The Consortium for Energy Efficiency's first two programs act by setting specifications or model program eligibility levels that utilities can adopt at their option. Other potential program designs include competitive awards of manufacturer cost credits based on competitions held on a utility-by-utility basis, or manufacturer cost credits for the sale of products that meet the program's efficiency standards. CEE may also develop programs similar to SERP, in which a single organization conducts one or more competitions for the most appropriate new technology.

The Western Utilities Consortium and Northwest Residential Efficient Appliance and Lighting Group. While CEE was getting started, two different informal coalitions of U.S. West Coast utilities organized themselves in about 1990 to develop regional model specifications for DSM programs in particular areas. The Western Utilities Consortium (WUC), which began as a California-based organization but expanded to include Northwest utilities, began specifying standards for residential refrigerator programs, and later expanded to include programs for clothes washers. This program was eventually co-sponsored by CEE because of its usefulness on a national scale.

The Northwest Residential Efficient Appliance and Lighting Group (REAL Group) set common standards for efficiency of electric water heaters, and then followed with standards for showerheads and model programs for compact fluorescent lighting.

The REAL Group also provided leadership in developing the residential clothes washer program that was eventually co-sponsored by WUC and CEE.

The results of some of these programs are discussed in the "Results" Section below.

Energy Star Computers

The Energy Star Computer Program was developed by the U.S. Environmental Protection Agency as a voluntary program to encourage manufacturers to improve the energy efficiency of personal computers. Technology developed for battery-powered computers reduces energy consumption dramatically; the EPA program asked manufacturers to make automatic shut-off or power-down technologies available on desktop computers as well.

The Energy Star Program is unique among market transformation programs in that it is based entirely on persuasion, rather than on the use of financial incentives. The Environmental Protection Agency established, working with industry groups, a specification for the minimum energy efficiency needed to meet the program's requirements. It then worked with manufacturers to encourage them to comply with the program's requirements. One reason this program did not require financial incentives was the very low cost of the technologies employed.

Manufactured Housing Acquisition program (MAP) in the Pacific Northwest

At about the same time, the Northwest Power Planning Council (NPPC) worked actively with Bonneville Power Administration (BPA) and the Washington State Energy Office. (WSEO) to develop an acquisition program in which energy efficient manufactured homes were acquired directly from the 18 manufacturers in the Northwest to meet a common specification that included a package of all regionally cost-effective energy efficiency measures. The program was intended to reduce space heating energy consumption by more than 50% compared to pre-existing practice. The approximate cost of the program was $2,500 per unit. (Eckman 1993 and Eckman et al. 1992)

The Programs of NUTEK

Simultaneously with the activities culminating in the development of SERP in the United States, NUTEK was developing a similar competition for super efficient refrigerators in Sweden. This program was based on contest that would award an order for at least 500 energy efficient and environmentally friendly refrigerators.

The competition produced a refrigerator with 30% lower electricity use than the most efficient unit previously on the Swedish market, as well as reduced consumption of CFC's. The winner of the contest, Electrolux, has subsequently introduced entirely CFC-free units at comparable energy efficiency. The level of efficiency achieved is about 20% below the U.S. Department of Energy 1993 standard-generally comparable to Whirlpool's SERP winning unit, considering the earlier introduction of the Electrolux unit into the marketplace. Since then, NUTEK has developed programs for residential clothes washers, windows, and commercial lighting.

Results

Residential Refrigerators: A Success Story of the Western Utilities Consortium

Most of the market transformation programs described in this paper are relatively new, so there are insufficient data to evaluate thoroughly their effect. But one program has been in operation for sufficient time to demonstrate its accomplishments: the residential refrigerator programs of the Western Utilities Consortium. The results of this program are illustrated in Figure 1.

Following the efficiency improvements provoked by the 1987 California efficiency standards, the range of efficiencies available on the market was low. Most products just met the standards. 1988 data suggested that a prospective program seeking a 10% energy savings beyond the slightly more stringent 1990 federal standards would be difficult to implement because (depending on size and features) less than 15% of the models on the market met a 10% threshold that was considered the lowest reasonable threshold for a rebate qualification. Only a handful of models—5% or less—were 15% lower in energy use than the standards. As a result, one utility that studied these data decided not to run a program.

But Pacific Gas and Electric did offer rebates in 1989, producing the results illustrated in Figure 1: significant numbers of rebates were issued on 10% improved units, and a non-trivial number of rebates were paid for the units with 15% savings. For 1990, California utilities attempted a common approach: meetings were scheduled well in advance of the operation of the programs to establish uniform statewide specifications for qualification for rebates. By announcing these specifications sufficiently in advance to influence manufacturers, the same thresholds

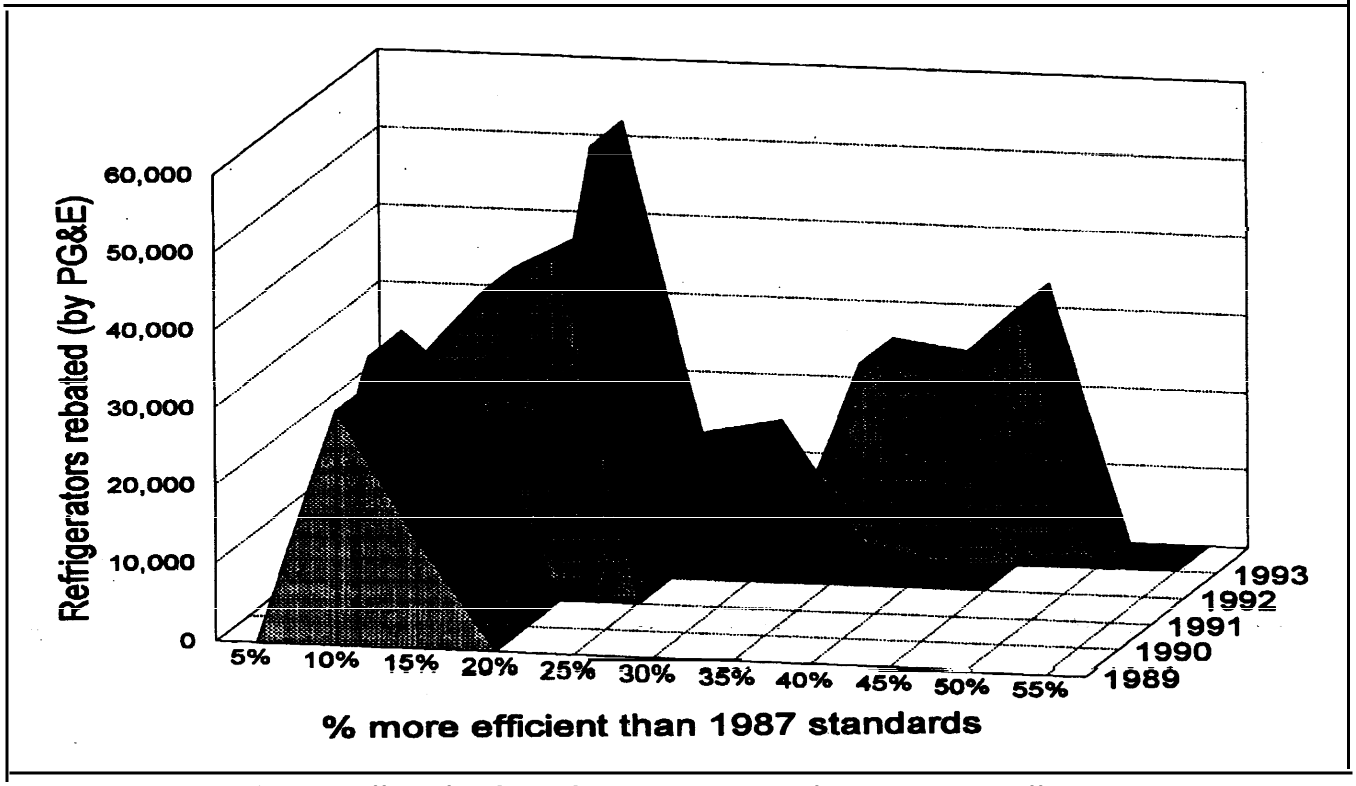

Figure 1. Effect of Utility Rebate Programs on Refrigerator Energy Efficiency

of 10% and 15% produced the higher prominence of the 15% models for 1990 shown in the figure.

As a result of this success, the utilities agreed on a 1991 program that added a 20% improvement category. As seen in the figure, this category was the most popular one for 1991, despite the fact that such products did not exist at all eighteen months earlier.

The 1992 Western Utilities Consortium program anticipated the attempt by manufacturers to comply with federal standards, which were almost 30% below 1987 standards, by dropping incentives for the 10% and 15% savings levels and adding tiers at 25%, 30%, and for some utilities, 35% and 40%. Manufacturers responded to these higher' levels by producing a large number of models at the 30% and 35% levels. This is significant because these levels exceeded the minimum required to meet the 1993 federal standards.

Following the implementation of these standards, the Western Utilities Consortium keyed its rebate program to the new standards, setting qualification levels at 10%, 15%, and 20% greater efficiency than the new 1993 standards (corresponding to the 35%, 40%, and 45% bins on Figure 1). Contrary to the results in previous years, when not a single model exceeded the less stringent 1990 standards by 20%, in 1993, more Western Utilities Consortium program participants qualified at the 20% level than at either of the lower levels. In fact, the existence of mass-produced refrigerators 20% better than a standard, introduced within the first year of standards compliance, is a remarkable result, that is hard to see as anything other than a direct effect of the incentive program. Also, as noted on the figure, some models achieved 50% reductions in energy use compared to the 1987 standards by 1993.

Pacific Northwest Manufactured Housing Acquisition Program (MAP)

Before the Northwest's Manufactured Housing Acquisition Program began, levels of thermal integrity comparable to those demanded by the program were essentially absent from the Northwest market. A 1987 study of mobile home construction in the Northwest showed average overall thermal conductance of a mobile home at the MAP level was more than three standard deviations lower than the sample mean. (Harkreader et al. 1987) That is, the performance level demanded by MAP was essentially unavailable.

The first step in incorporating manufactured housing into Northwest DSM programs was their inclusion in the "Super Good Cents™" program, which primarily was aimed at site-built housing. After about one and one-half years of eligibility, market penetrations reached about 20%. But after the negotiation of the MAP contracts with manufactured housing producers, saturations reached essentially 100% after less than six months. In addition, the cost per home went down somewhat.

The level of energy savings projected from the MAP program is greater than 50% of the pre-existing space heating usage. The fiscal year 1993 program incentivized 15,000 homes, for a savings of eleven average megawatts.

The Northwest REAL Group Water Heater Program

The Northwest REAL Group standard for efficient electric water heaters was established in 1990-91, based on the highest efficiencies that were at all available in the marketplace. However, units this efficient were virtually unavailable at retail level in the Northwest at the time. Northwest utilities worked closely with water heater manufacturers to inform them about the program and to encourage them to ship only high efficiency units into their service territories.

While no formal results have been published, Bonneville Power Administration data show market penetration among electric water heaters at the 22% level for October 1992- September 1993. Anecdotal information suggests a substantial reduction in the incremental cost of the more efficient products.

Special Issues Regarding Market Transformations

Measurement and Evaluation

Market transformation programs, particularly those promoted on a national or international scale, provide a challenge with respect to measurement and evaluation (Kitchin, 1993), particularly when considered in the context of standard protocols for the evaluation of DSM programs such as those adopted by California. (California Public Utilities Commission, 1993) This paper suggests the skeleton of some methods for such evaluation.

Market transformation programs should do extremely well in evaluations. Almost by definition, if market transformations cause new products to come into the marketplace, free ridership will be zero: no one would have bought the product if the program weren't there.

Protocols such as those adopted by the California Public Utilities Commission for measurement of conventional DSM programs are based on a comparison of the energy savings of participants in the program compared to those that don't participate. The California protocols state that spillover effects such as free drivership caused by market transformation programs, can, in theory, be taken into account, but no methodology is provided for doing so.

This is a fundamental problem for successful market transformation programs. The point of a market transformation program is to introduce new technology to the marketplace that would not have occurred otherwise. But the measurement protocols do not provide guidance on estimating, and it is impossible to imagine even in theory how one could measure, what would have occurred without the program.

The most successful market transformation programs will induce some non-participant consumers to buy the newly available product, even in the short run. In the long run, other market mechanisms, including possible standards, are likely to encourage an increasing fraction of the population to purchase the new technology. How can one then measure the behavior of a control group unaffected by the program?

For small scale programs, such as the California-based WUC refrigerator program, it may be possible to use out-of-state areas that do not run DSM programs as a control group. This also is somewhat problematic, in that a manufacturer who introduces a model meeting, for example, the 10% savings thresholds in the 1993 WUC program, may find that it is more cost-effective to sell that unit nationwide than to produce separate units for the WUC utilities and for everyone else. This is a systematic bias, underestimating the savings of the DSM program. Note that the underestimate, when considered nationwide, is especially large because the savings incurred by the control group should be added to, not subtracted from, the savings of the experiment group. But for nationwide programs, even this approach is not possible.

One possible solution to this conundrum is to take the resource planning perspective and look at what utilities, their regulators, and state energy offices were predicting without the DSM program, and assuming that that prediction is the base case. For example, if a utility or state energy regulator is unwilling to cancel or defer power plants based on the expectation that efficiencies will improve beyond a certain level, then that is the level that should be assumed as the base case in evaluating the effect of the DSM program. Whether or not that prediction was correct, it was the one on which investment decisions on power plants were made. Therefore, it is one reasonable basis on which to evaluate investments in DSM.

One difficulty with the resource planning perspective approach for defining the base case is that once it is known that market transformation programs will be evaluated compared to this base, there will be an incentive for utilities to "game" the base case forecast. That is, if utilities predict essentially no improvement in efficiencies as the base case, they would be able to claim credit for all of the efficiency improvements that actually occur when they are running a market transformation program, whether or not some of those improvements might have occurred anyway. The difficulty of gaming is a serious problem because there is no obvious bench mark for an "objective" base case: different forecasts vary substantially even when there is no incentive to reach a particular conclusion.

Another approach that has been suggested for defining a base case is to interview key players in the market in an attempt to estimate what they were planning to do without the market transformation program. These interviews would best be conducted before the market transformation program was being developed to avoid contaminating opinions about "what would have happened" with knowledge of "what did happen." Unfortunately, this approach also produces incentives for respondents to "game" the answers.

A second related problem concerns the award of shared savings incentives for market transformation DSM. For conventional programs, utilities in many states are paid shared savings incentives based on a fraction of the societal value of saved energy. (See Schlegel 1993 for discussion.) On what savings should market transformation programs be evaluated? Should the savings be limited to those that can be directly attributed in the year of the DSM program to the program? Or should they include some spillover effects such as non-participating customers in the utility service area, who, in later years, make use of the technology? To what extent, if any, should utilities receive payments for savings incurred when the technology in question is adopted as a standard?

The "conservative" answer of assigning only those savings that can be unambiguously and uniquely attributed to the DSM program could provide perverse incentives for utilities to focus on less ambitious but more risk-free programs compared to the more desirable market transformation DSM programs.

This "conservative" approach also presents definitional problems with respect to measurements such as the market transformation index propose in the section above entitled "What is Market Transformation?". That index defines free drivership as savings from those customers who purchase the energy efficiency technology without participating in the program. But conventional measurement and evaluation practice allows utilities to take credit only for non-participants whose purchase can be directly linked to the program. What if the technology is purchased because a government has set standards that require it? What if it is purchased in a given utility's service territory because a larger neighboring utility is continuing to run incentive programs for the product and the distribution channels overlap?

For the market transformation index suggested in this paper or other alternative approaches to be meaningful in projecting future levels of energy use, they must measure overall free drivership without concern about the issue of attribution to a particular utility or program operator. This approach works effectively in projecting reduced resource needs from market transformation programs, but is it also a rational basis on which to pay utilities shared savings incentives? An approach that paid utilities for the entire recorded change in the marketplace might be flawed in two ways: first, it would be overly generous to utility shareholders; and, second, it would reward a utility based on the actions of another entity, such as the Department of Energy, in establishing standards. Rewarding one entity for the actions of another seems inherently unfair. However, such financial rewards happen frequently in. unregulated markets. One approach towards awarding shared savings incentives to utilities would "derate" free driver savings that occurred after the termination of the market transformation program, or after the first several years of the program's operation.

Regulatory Issues: Funding of Market Transformation Programs

One characteristic of many market transformation programs, particularly the Super Efficient Refrigerator Program, is its long term perspective. In order to induce the development of new technologies, utilities must announce the availability of an incentive one or even several years before it is actually available. If the period of availability extends beyond the current rate case of a utility, almost all utilities would find it difficult to budget money for the program in a way that manufacturers could rely upon. But, if a utility cannot budget funds, the risk for developing the technology being incentivized is much higher for the manufacturer.

To solve this problem, utilities must have some way of reserving money in a particular year for use in a future year. This is analogous to the problem that was incurred when utilities invested in multi-year construction programs for power plants. A number of mechanisms, such as "allowance for funds used during construction or construction works in progress," were adopted to solve this problem. Some analogous approach—for example, where a utility receives authorization in a 1995-98 rate case to spend specific amounts of money for specific programs in, for example, 2002, and the regulators commit to the utility that the costs can be recovered in that year-will greatly encourage utilities to engage in market transformation activities.

Summary and Conclusions

Market transformation programs are a new development in energy efficiency policy. This paper has described the evolution of several U.S. programs to induce market transformation, and has provided some evidence of these programs' success. Market transformation program raise a number of interesting and unresolved issues of economic theory, program design, and program evaluation. This paper has attempted to frame several of these questions and suggest directions for their resolution.

References

California Public Utilities Commission (CPUC), *Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs.* Adopted by the CPUC, Decision 93-05-063, Revised November 30, 1993.

Eckman, Tom, Nancy Benner, Fred Gordon, 'It's 2002: Do You Know Where Your Demand-Side Management Policies and Programs Are?" *Proceedings of the ACEEE 1992 Summer Study on Energy Efficiency in Buildings,* Panel 5.

Eckman, Tom, et al., *Acquiring Energy Efficiently.* Northwest Power Planning Council document 93-23, October 26, 1993.

Harkreader, S. A., et al., *Current Construction Practice in Pacific Northwest Manufactured Homes and Upgrade Possibilities.* Pacific Northwest Laboratory, Richland, WA, 1987.

Kitchin, Deborah A., "The Impact of Market Transformation on DSM Evaluation Techniques." *Presented at the 1993 International Energy Program Evaluation Conference*, Chicago, IL, August 1993.

L'Ecuyer, Michael, et al., "Stalking the Golden Carrot™: A Utility Consortium to Accelerate the Introduction of Super Efficient, CFC-free Refrigerators." *Proceedings of the ACEEE 1992 Summer Study on Energy Efficiency in Buildings*, Volume 5, 1992.

NUTEK, the Swedish National Board for Industrial and Technical Development, *Purchasers' Requirements Dictate Development: A Study of Technology Procurement.* Department of Energy Efficiency, the National Board for Industrial and Technical Development, S-117 86 Stockholm, Sweden, 1993.

Schlegel, J., et al., *Evaluation of DSM Shareholder Incentive Mechanisms, Final Report,* prepared for California Public Utilities Commission, Wisconsin Energy Conservation Corporation, 3120 International Lane, Madison, WI 53704. January 1993. Also presented at the 1993 International Energy Program Evaluation Conference, Chicago, IL, August 1993.