Proving Casuality in Market Transformation Programs: Issues and Alternatives

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Market transformation programs will never reach their potential until regulators and utilities agree on ways to measure and reward utility efforts. A primary problem is establishing proof that utility efforts caused a market transformation, and therefore should be compensated for lost revenues. This paper discusses the difficulties inherent in proving casuality and the types of data needed. New techniques will be required of utilities if they hope to receive compensation. This paper also suggests an alternative method for rewarding utilities that actively participate in market transformation programs. Utilities and regulators can collaboratively pre-negotiate targets for new product efficiencies. If these targets are met, utilities would receive compensation without having to prove casuality.

Introduction

Market Transformation: Issues and Challenges

As a means of introduction, let us begin with three controversial statements.

- 1. The real potential for DSM comes not from rebate and direct install efforts, but from programs designed to transform the market place.
- 2. Utilities have not and will not implement effective market transformation programs because regulators do not reward utilities for successful efforts.
- **3.** Regulators have not rewarded utilities for market transformation because current measurement efforts do not justify compensation.

The Ultimate Potential

The "Golden Carrot" or Super Efficient Refrigerator Program (SERP) in which utilities offered refrigerator manufacturers a guarantee of \$30 million dollars in sales to the company that produced the most efficient refrigerator is a good example to discuss the issues raised above. The prize offer was successful in that it produced two manufacturers willing to commercially offer refrigerators that are twice as efficient as current models available.¹ The rather small investment in prize guarantees that the utilities offered could potentially lead to a large reduction in sales. For example, if 25 percent of the refrigerators are replaced in the next ten years with these units instead of ones consuming 250 kWh more, the lost sales to all US electric utilities would exceed \$300 million per year.²

From a societal perspective, it is apparent that programs designed to transform markets are among the least-cost options for DSM. The low initial investment relative to the potential widespread adoption resulting from a market transformation program highlights the desirability of this type of program. In reality, the ultimate goal of traditional DSM rebate programs should be to transform the market by changing the technologies available and/or by changing the buying and use habits of consumers. While there may be some exceptional circumstances, such as where utility avoided costs or investment barriers are very high, for most situations it is probably not necessary or advisable that utilities offer full rebates ad infinitum to customers to use energy-efficient products. Rebates are an effective means of introducing new products and services, but ultimately products should be capable of gaining market share without eternal support.

Defining Market Transformation

Market transformation conjures up numerous meanings across the utility and market research industry. For this paper, we adopt a very broad definition of market transformation. One that is defined as activities directed at the manufacturer, the distributor, the retail outlet, or the consumer which permanently change the market for energy-efficient goods or services. As Prahl and Schlegel (1993) have suggested, the activities that can lead to market transformation are varied and can be directed at any of the actors involved in the product's manufacture, sale, or purchase. Most of the utility efforts, with the exception of the SERP program, have been concentrated on the consumer or in market research parlance "pushing the consumer." These programs are aimed at removing market barriers and thus affecting the demand for energyefficient products. The SERP program is directed at "pulling" the manufacturer in an attempt to change the product or product features.

Maintaining a division of market transformation efforts between push and pull programs artificially and detrimentally draws apart the demand and supply elements that are an essential part of every marketplace. Current consumerbased efforts push products without addressing how products or marketing should be changed to maximize market acceptance. Similarly, the SERP program, to be successful, will need to use consumer-based activities to ensure that the more efficient refrigerators are in fact purchased. It is likely that market transformation programs that combine both push and pull features may be more effective. It is also likely that such efforts will be more difficult to evaluate using current DSM evaluation criteria.

The Uncertain Regulatory Treatment

The importance that market transformation should play in DSM is not reflected in the current regulatory treatment. To date, no utilities have received compensation for market transformation effects other than participant freedrivership. In these cases, additional purchases by participants outside the program have been given credit, though normally only to the extent that the free-driver credits cancel out a free-rider reduction. Yet, participant freedrivers are a minor portion of all free-drivers, and an even smaller component of the total potential market transformation. To date, regulators have not committed to granting utilities compensation for all of the lost revenues that might result from these market transformation initiatives.

If market transformation programs are to be promoted earnestly, utilities and regulators must develop ground rules for compensation. A primary priority for regulators must be establishing the burden of proof. Without these standards clearly specified, utilities face too much uncertainty as to whether their market transformation efforts will be rewarded. Regulators have a choice as to how they might treat market transformation. The options can be broken into three categories, as follows:

- Status Quo: Regulators can encourage utilities to continue direct rebate programs and ignore market transformation effects. The consequences of this strategy will be that utilities will affect little market transformation. To some extent, forces outside the utility will drive changes, though perhaps slower than is socially optimal. Utilities facing these market changes may attempt to hold onto market share by offering promotional rates.
- Struggle with Measurement: Regulators can set guidelines by which they will accept market transformation. These guidelines will designate which party must assume the burden of proof, the level of proof required, what constitutes acceptable forms of evidence, and what level of reward will be granted. For market transformation evaluations, the issues confronting current DSM evaluations with respect to data quality and measurement bias will be magnified.
- Adopt Innovative Regulatory Approaches Such as Prenegotiated Market Transformation Targets: Regulators, the utility, and interested parties can agree to market transformation targets and work collaboratively to achieve those targets. This approach recognizes that casuality proof is unachievable, and eliminates the requirement that utilities prove the extent to which they contribute to market transformation success.

Some innovative regulatory reforms such as the Electric Revenue Adjustment Mechanism (ERAM), and Revenueper-Customer Decoupling avoid some of the difficulties discussed below in trying to establish proof of a utility's contribution to market transformation. In states where the these mechanisms are not available, the utilities must rely on evaluation results to prove market impacts.

Measuring Market Transformation Effects Is More Difficult than Evaluating Other DSM Programs

Measuring market transformation effects is difficult because it is both necessary to measure the changes in the marketplace and the resulting energy efficiency gains, and it is necessary to attribute the change in market behavior to the direct or indirect influences of the utility DSM program. This dual requirement of measuring both impact and casuality is not of primary importance in impact evaluation of direct program measures. Measuring the impacts of market effects is also different from other DSM evaluations, in that the assignment expands from the concentrated measurement of participant and non-participant usage to include the broader measurement of product distribution and sales and consumer behavior.

It is important to stress that the current methods used in the evaluation of DSM programs fall short of the mark when assessing market transformation programs. New approaches are needed to better measure impacts, some of which are discussed more fully in the companion paper by Oswald, Sorrentino, and Wirtshafter (1994); and also Kitchin (1993) and Van Liere et al. (1993a).

In the classic DSM evaluation treatment/control paradigm, casuality is an implied assumption of the analysis. These evaluations are structured so as to assume that the difference between performance of the two groups is measurement of the impact of the experiment. This approach is acceptable because utilities can demonstrate that they gave the treatment group (participants) rebates or direct services, and that the comparison group (non-participants) did not receive similar influences. Only those customers directly affected by the utility program figure in the lost-revenue calculus. Yet even in these types of programs, the implied casuality assumption is sometimes weak, as in the case of free-riders and drivers.

Proving Casuality

For the first two regulatory options listed above, there is a need to establish casuality. In discussing casuality it is essential to recognize that proof has different meanings depending on the circumstances and individual perceptions. As an example, most persons agree that utility DSM efforts to date have helped increase the use of compact fluorescent lamps (CFL). The arguments arise when one tries to be more specific and assign casuality to each lamp that has been purchased.

Regulators have generally accepted that lamps directly distributed to customers through giveaways and rebates were adopted as a result of utility action. Adjustments are made to subtract those lamps given to participants who would have bought the lamps in the absence of the program, and to add those lamps bought subsequently by participants outside the program format.

In most areas of the country, the increased availability of CFLs in retail outlets occurred subsequent to the introduction of DSM programs distributing them. Many of the lamps sold outside the utility effort would not have been purchased if the utilities had not raised people's awareness of their benefits, worked to increase product availability, and provided subsidies so that consumers could become better acquainted with their performance. Concomitantly, other organizations such as the Sierra Club and the Environmental Protection Agency Green Lights Program have promoted CFLs, and share some of the credit for their increased popularity. The issue then becomes how to allocate responsibility.

The other problem facing evaluation of market transformation programs is that there is no effective external comparison group. The natural inclination is to look for a comparison group outside the confines of the program. In a rebate program, the comparison is those customers not receiving a rebate. The theoretical comparison group for a market transformation program would be consumers outside the influence of the market intervention. Several studies have attempted to create comparison groups from consumers in other utility service territories, see for example (Van Liere et al. 1993b, Nelson and Terries, 1993). Unfortunately, these market interventions cannot be isolated to a utility service territory. Most sales data are not easily disaggregated along utility boundaries (Van Liere et al. 1993a). Establishing the true comparability of two regions is also problematic. The biggest deterrent is the very nature of a market transformation program, in that a successful program can change manufacturer behavior in addition to consumers' behavior.

What Must Be Proved?

When a market transformation program succeeds, it can have two quite separate influences: A change in customer purchase behavior, and a change in manufacturer production, shipping, and sales behavior. Each of these are quite complex processes which are not fully treated in current evaluations. The problem is that there are many influences on customer purchase behavior, and it is not always possible to isolate a single factor as being the cause of a change in that behavior.

The purchase decision process engaged in by consumers is a dynamic process and one that does not merely involve a yes/no decision, or one that happens instantly. Lavidge and Steiner (1961) have recognized that a consumer's decision to accept a new product involves stages of transformation from awareness, to positive identification, to attempted purchase. As the consumer's opinion is changing over time, so is the availability and cost of the product. For the purchase to be carried out, the consumer must be able to locate the product and accept its sales price. For most new products, the manufacturer produces the product and then must create the demand through advertising and promotion. Yet, as has been the case for several energy efficiency products including the Golden Carrot initiative, DSM programs can help by creating a demand for products that may not yet be available.

What Constitutes Evidence?

The next element in this particular discussion is what constitutes evidence. We should begin by acknowledging that nothing as conclusive as "fingerprints on the murder weapon" exist for these programs. In these programs, the influence may not even be recognized by the customer. That customer who needs a new refrigerator may select one of the new more efficient models without ever realizing that the utility played a role in its market availability. Any proof available will be, at best, circumstantial.

Prahl and Schlegel (1993) outline the steps that utilities must take to evaluate market transformation. They note that for market transformation measurement of the baseline market characteristics will necessarily be more involved than the sporadic attempts used for traditional studies. They also suggest that the tracking of customer must establish a link between utility marketing and information activities and changes in attitudes and behaviors. Finally, they suggest that better tracking of sales data is required to document changes in markets. As they correctly surmise, "measuring market transformation will be a daunting challenge, requiring major changes in the focus and methodology of DSM evaluation. "

Closer examination of the data requirements indicates that major increases in the costs of evaluation are likely to be required to evaluate market transformation programs. Utilities will need to conduct evaluation activities more often and with a greater concentration on linking changes in behavior to the utility actions taken. A detailed review of evaluation methods used to promote residential CFLs revealed that very little of this type of market research is currently employed in a seemingly market transformation type program, (Wirtshafter et al. 1993). CFL programs normally only question participants at a point substantially after the program has been in effect, usually after at least one year has elapsed. The few questions included in these surveys to collect free-rider/driver values ask respondents to speculate about hypothetical opportunities based on attitudes they possessed before the program began. This type of questioning produces a very weak association between lamp purchase and utility market transformation actions, and it is therefore not surprising that regulators have to date not accepted such claims.

Proof of a program effect on customer behavior will likely involve detailed tracking of the customer prior, during, and after the program. Better free-rider and free-driver results will be obtained if utilities establish the level of awareness and the purchasing likelihood of their customer base, prior to the start of the program. The proper timing of queries is also a factor. If utilities need to know whether a consumer is aware of a product, that evidence should be collected prior to participation. Then immediately after the start of the program participants should be queried to determine if they are free-riders. Utilities must be prepared to show changes in behavior anywhere along the awareness/purchase process, It is conceivable that a utility program could set the stage for a major market transformation by bringing the product to the market and increasing customer positive attitudes towards the product. A situation might occur at this point where a manufacturing improvement could reduce the price, triggering a large change in sales. Though not totally responsible for the change, the utility began the process and deserves a portion of the credit. If a utility only collects data at the end of the program, they will not be able to demonstrate their role in moving the market.

Regulators should consider awarding different levels of compensation depending on the type of consumer who is attracted into the program. Current evaluations do not distinguish as to the stage of the adoption process. However, in a market transformation program, enticing an early adopter to accept the technology has a large potential spillover. This potential diminishes as more consumers adopt the program. Careful tracking of the stage of adoption would better differentiate program success.

If utilities use advertising and promotion schemes to enhance market awareness, they should be prepared to follow the techniques that other advertisers use to measure their effectiveness. Market research companies have established specific test locations for evaluating advertising effectiveness. These tests use either a pre-test to post-test comparison of product awareness or use one of the preestablish test sites where media advertising is controlled. At these sites, households have been divided into test and control groups and targeted marketing to test groups can be compared to the control group.

All of the awareness/attitude/purchase data collected above must be combined with sales data to describe the total picture. Most of the efforts to date have tried to obtain this information as part of a survey, thus linking the attitudes to a direct measurement of actual purchase. It is doubtful whether methods used to collect these data are accurate or effective. Most residential customers cannot accurately describe the efficiency of the product that they purchased, nor is asking them to read the nameplate off of appliances a satisfactory alternative. Nameplate data are often inaccessible, and at best are costly to collect accurately.

Tracking of sales data is the best measure of the movement of the market, and recent innovation in sales data tracking make these data more accessible to utilities. Collecting sales information by electronic scanning may still be difficult and expensive for an individual utility, Cooperation between a group of utilities, manufacturers, retailers, and sales tracking syndicates will be a more practical means by which these data can be made available.

Are the Costs of These Methods Justified?

To date, no one has investigated how much it may cost to perform some of the methods suggested above. The extra data requirements will add to costs, though some reductions could result. Once developed, systems to collect sales data electronically could reduce inventory and data handling costs for distributors and retailers. More surveys of customers will also be needed, though each survey might be shorter and economies could be realized by their repetition. These data would have additional benefits beyond the direct evaluation purpose. Accurate information on customer's attitudes and behavior is essential for all marketing activities. Essentially all firms with products to sell engage in this type of activity. The utility must consider that they too are engaging in the selling of products. Funds spent to better understand customer preferences and market barriers are normally well justified.

In dispute here are the additional funds that utilities would need to prove that it was their effort that stimulated the market changes. These expenditures are unlikely to provide the same level of auxiliary benefits supplied by traditional market research. This is because the evaluation techniques though similar in nature are used after the fact to prove market effects, rather than to prepare the way for market transformation. If utilities are required to provide more stringent evidence, then they will be forced to query a larger sample of their customers more often, and to establish a clearer link between utility efforts and changes in attitudes and behavior. Evidence will also be required that customers actually behave as they report. These requirements will necessitate visual inspections of appliance stock, and much more extensive tracking of individual customer's awareness, attitudes, and changes in behavior over time.

It is uncertain as to how much extra money would be needed to satisfy regulators and interveners that a utility effort was successful. Thinking again of the Golden Carrot program, a utility may have to spend hundreds of thousands of dollars to track changes in sales of new refrigerators, and yet could spend millions of dollars to try to prove that their customers responded because the utility made these new refrigerators available and aggressively marketed them to customers.

Utilities are likely to have millions of dollars at stake in these programs in the form of program expenditures and lost-revenue claims, and so it is not inconceivable that some would invest large sums of money to ensure that their case is a strong one. Some of this money would likely be better spent in providing services rather than in bolstering one's case. The circumstantial nature of the evidence means that regardless of the size of the investment in evaluation activities, utility cost recovery remains uncertain. Ultimately, if the costs of proving the savings or the uncertainty surrounding collection of potential lost revenues rise too high, utilities will shy away from these types of programs, give them perfunctory attention, or even subvert the programs to ensure they are not too successful.

Can Pre-Negotiation Work as an Alternative?

An alternative to the situations presented above is to prenegotiate the entire process. This would require a collaborative agreement similar to those already negotiated between utilities and interested parties. The biggest element of the agreement will be to set target levels for market transformation, and to reward utilities for achieving or surpassing the targets. The stipulation is that if a utility can demonstrate that product sales in their territory have met or exceeded the target, the utility receives compensation without having to prove casuality.

Using refrigerators as an example, a brief description of the process follows. The first step is for the parties to reach an agreement on the baseline average efficiency of refrigerators for the program period, assuming that the utility does not actively participate in a market transformation study. For this example, we will refer to this projection as the baseline forecast, and project that forecast outwards for ten years. The parties must then agree on efficiency goals for the market transformation program for each of the next ten years. This target forecast must be lower than the baseline, though how much lower will depend on the compensation level. For convenience, let us assume that we will set the target at 30 percent below the baseline. A compensation schedule must then be determined. The compensation could be an agreed upon amount or it could be calculated based on the difference between revenues and avoided costs. (It is assumed that not all of the revenue that might have been collected had there been no program would be considered as lost profit. For a market transformation program to make sense in the first place, there must be utility costs which will be avoided).

The schedule may decide that if the utility meets the goal, they will be compensated for 50 percent of the lost revenues minus avoided costs, plus program costs. This difference between revenues and avoided costs would be collectible for every lost kWh of sales. Lost kWh sales could be calculated as the difference between the baseline and the actual-use level achieved for that year multiplied by the number of refrigerators sold in the service territory that year.

The agreement may also penalize utilities that fail to meet the target by not allowing them to collect program costs and by not allowing them to keep revenues collected if the actual-use level exceeds the baseline projection. Agreements could also use a graduated percent of lost profits, so that if a utility achieved a use level that was 25 percent or 50 percent below the baseline, the utility would receive a higher percentage of lost revenues.

Calculating precise values for lost revenues and costs could lead to measurement problems similar to those that this approach is attempting to avoid. A simple graduated reward schedule may be preferred. This reward could establish set compensation amounts for the utility based on the level of average energy use differential (between the baseline and actual). For example, if the average refrigerator sold is 30 percent better than the baseline value, the utility receives \$50 for every refrigerator sold that year. A 40 percent improvement might pay \$80, and a 50 percent improvement might pay \$120.

By tracking the program over a longer period and awarding each year's effort, rewards will reflect the level of sustained effort by the utilities. If a program accelerates the introduction of new refrigerators in a one-shot deal such as the Golden Carrot then the utility will receive lostrevenue benefits in the earlier years but will likely see the baseline and actual converge in later years. On the other hand, the utility that maintains an aggressive development and promotional effort can realize gains throughout the agreement period. This approach would encourage a utility to use non-traditional means to affect the market, including cooperation with manufacturers and other utilities.

One interesting result of this type of agreement is that it puts a premium on utilities that enter into agreements first. These utilities will receive the largest compensation. As other utilities seek to enter the program at a later point in time, the base target should be adjusted downward to reflect gains already achieved. These utilities must either work harder to obtain the same level of compensation or accept a lower compensation for reaching the same targets as earlier utilities. Laggard utilities will receive no compensation, but nonetheless will ultimately lose market share.

The stipulation that a utility receives the compensation without proving casuality does not constitute a blank check to utilities. Setting the target below the baseline means that utilities will probably need to be active in order to reach their goal. Regulators can also stipulate that the utilities perform specific activities in order to ensure the utility's active participation. Nevertheless, there will be instances where utilities that contribute the minimum required by the agreement are rewarded for results achieved largely from efforts of others. There will also be cases where the opposite is true, that utilities actively participate and yet do not achieve the expected results. The nature of this agreement is that there is still some risk involved in the arrangement. The collaborative negotiations must concentrate on distributing these risks and the expected benefits fairly among the parties.

One area of concern centers on how lost revenues will be collected. Are they collected from current customers and maintained in an escrow account until earned, or are they accumulated and billed to future customers? It is the future customers that will benefit and ideally they should bear the costs of this program. The unlikely scenario could develop by which a utility exceeds its wildest expectations for success thus cutting market share significantly. The more successful the effort, the greater the rate impact on remaining customers, if the utility cannot realize corresponding reductions in its production costs. This particular scenario is even more of an issue should competition between utilities become a reality. The utility that loses market share and cannot reduce costs will find it difficult to add the lost-revenue compensation to the remaining customers' bills.

States where ERAMS or revenue-per-customer decoupling are allowed already have a mechanism for ensuring that a utility's profits do not change as a result of variations in sales. The ERAM ensures that a utility receives the same rate of return percentage, though this percentage will be calculated on a smaller rate base as market transformation reduces sales over time. Not all utilities will embrace this arrangement. Some utilities may be reluctant to participate actively in a program that reduces their size, especially if it does not increase their profitability. Regulators may have to consider providing additional incentives beyond the ERAM to encourage participation.

Conclusions

Programs to promote market transformation could potentially be the most cost-effective means available to achieving long-run energy-efficiency. The Golden Carrot program demonstrates that utility initiatives can induce manufacturers to change the products that they produce and market. Yet as currently configured the Golden Carrot program is deficient in that it does not provide sufficient returns to the utilities sponsoring the program. These utilities, with the exception of those with ERAM treatment, are unlikely to be compensated for the lost revenues resulting from the lower electricity sales. This lack of compensation means that it is unlikely that utilities will maximize the successfulness of the program by aggressively promoting the more efficient refrigerators.

Traditional evaluation techniques and regulatory treatment are not appropriate for market transformation programs which affect the marketplace in a variety of non-discrete or measurable ways. Forcing utilities to use these traditional methods is likely to inhibit market transformation programs. If market transformation is to play a role, other approaches such as a pre-negotiated agreement plan will need to be adopted.

Endnotes

- 1. To qualify, refrigerator manufacturers had to propose refrigerators that are 30 percent more efficient than required by the 1993 standards.
- 2. Assuming that 5 million refrigerators are sold each year, Van Liere, Winch and Quigley (1993) quote 1991 Association of Home Appliance Manufacturers data of 5.9 million sales in U. S., by the tenth year, 12 million of these will be the high efficiency models. This amounts to a total reduction of 3 billion kWh, and lost sales at 0.10 \$/kWh of \$300 million/year. How much of this lost sales is absorbed as lost profits depends on the degree to which utilities avoid costs associated with the reduction in sales

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