The Role of Rebates in Market Transformation: Friend or Foe?

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ABSTRACT

Rebates have long been used to promote energy efficiency through traditional demand-side management (DSM) programs. However, as we move into a deregulated energy economy, the role of rebates has changed. The goal is no longer simply to increase the market penetration of energy-efficient products in the current program year, essentially buying load reduction. Instead, the goal of energy efficiency programs is now to establish sustained market share of products over time, even after rebates are discontinued. This change in objectives leads to a new methodology in designing and implementing successful rebate programs.

Rebates can play an important role in market transformation, essentially acting as a catalyst to jump-start markets and overcome initial barriers. However, they also have drawbacks that can actually inhibit market transformation. In particular, they can interfere with market signals between customers and manufacturers, so that markets respond sluggishly. This can delay the broad-based acceptance of new products.

In this paper, we propose a theoretical framework for discussing the role of rebates in successful market transformation programs. Following is a discussion of the potential attributes and drawbacks of rebates in reaching market transformation, and a proposed new bidding process to assist in setting incentive levels and product quantities that are matched with market characteristics. This framework is based on our review of markets and incentives conducted for our work with the California Residential Lighting and Appliances Program and other energy efficiency market transformation programs around the country.

Rebates as Friend to Market Transformation

Rebates have recently fallen out of favor in many market transformation programs around the country. In the past, rebates were used primarily to increase product sales during the period in which the rebates were available, without consideration for long-term market effects. As the goals of the programs shifted to changing consumer attitudes and purchasing habits in the long run, rebates were seen as a costly tactic with few long-term market impacts.

However, rebates can serve an important role in acting as a catalyst towards increasing both supply and demand of energy efficient products. Rebates serve many important functions in overcoming market barriers typically targeted by market transformation programs including:

1) reducing risk for market actors,
2) creating a marketing impact to consumers, and
3) acting as a temporary market support until economies of scale reduce product costs.

Risk Reduction Through Rebates

Reducing prices of energy-efficient products can decrease the risk-related market barriers encountered by consumers, manufacturers and retailers. First, reducing the purchase price of a product decreases the risk to a consumer trying an unfamiliar product, which helps overcome the barrier of performance uncertainties. The expectation is that by lowering the initial price, rebates make consumers more likely to try a new product. Assuming that the consumer has a good experience with the product, the consumer will be more likely to purchase it the next time, even if the rebate has been reduced or removed.

Second, price subsidies decrease the risk to manufacturers of introducing new energy-efficient product lines, thereby reducing the barrier to product innovations in energy efficiency. In our meetings with national appliance and lighting manufacturers in California, they indicated that they specifically introduced new products to capture rebates or other financial incentives offered by utility DSM programs.

Third, because price subsidies increase sales, they reduce the risk to retailers in choosing to stock and display energy-efficient products. This reduces the barrier of limited availability of energy-efficient products.

In each of these cases, rebates may be used to reduce the risk-related barriers in buying, manufacturing and selling new energy-efficient products. In order for rebates to work within a market transformation strategy, consumers trying these products must find the products with rebates superior to the less efficient alternatives. As consumers come to know and value the superior attributes of the more efficient products, rebates should be able to be reduced and eliminated over time without a perceptible decline in market share. There has been some anecdotal evidence for this with market transformation programs that we reviewed. For example, a report of the Northwest Energy Efficiency Alliance's WashWise program found that as consumer acceptance of energy-efficient clothes washers increased, they were able to decrease rebate levels without reducing market share (Hewitt, Pratt, and Smith, 1999).

Marketing Impact of Rebates

In our focus groups with California consumers, we learned again what manufacturers and retailers know very well: price discounts have a powerful marketing impact. Consumers who might have otherwise passed over an energy-efficient product are drawn to further investigate its features when a rebate is offered. Therefore, rebates can act as an attention-grabber in order to help educate consumers about the benefits of energy efficiency, reducing perceived hassle costs in learning about new technologies.

Rebates can also lead to greater retailer acceptance of other marketing materials such as point-of-purchase displays (in some cases in California, field staff reported that stores discarded promotional materials after rebates were discontinued, even if the materials did not discuss rebates). Rebates can therefore contribute to the marketing and education tactics that overcome information barriers for consumers in choosing a high efficiency alternative. Of course, as indicated previously, this market transformation impact can occur only when consumers trying these products find them superior so that rebates can be reduced or eliminated over time.

Rebates as Temporary Market Support

Rebates can also temporarily support a fledgling market until economies of scale can reduce production costs to a level supportable in the marketplace. Here, the objective is to help overcome first-cost barriers. For a broad range of products, from pocket calculators to CD players to personal computers, real costs have declined as technological advances, mass production, and competition reduce manufacturing and distribution costs. We expect a similar trend in energy efficiency developments. For example, consumer prices of energy-efficient clothes washer technologies have gradually fallen over the past five years, and appear to be trending still further downward.

Therefore, temporary market supports through rebates can help stimulate the innovation and sales of these products that can accelerate this long-term trend. Since there is a societal benefit in increasing energy efficiency quickly, there can be a role for rebates to support these markets in the short run.

Rebates as Foe to Market Transformation

Despite their potential benefits, rebates may also have drawbacks that actually inhibit or delay market transformation, including:

1) interfering with market signals,
2) causing a marketing effect that is detrimental to long-term sales, and
3) diverting energy efficiency program resources away from other intervention tactics that may have greater long-term impacts.

Interference With Market Signals

By interfering with the market, rebates also interfere with the market signals that help manufacturers respond to market conditions. In particular, the artificial market support provided by rebates can artificially increase sales to the extent that manufacturers delay making product improvements and cost reductions that would otherwise be required in order to compete successfully against less efficient products. Similarly, rebates that change dramatically over time (on-again, off-again) can confuse consumers as to the appropriate price points for energy-efficient products. This confusion leads consumers to undervalue the energy-efficient features of the products or leads them to wait until rebates are available before purchasing the product. The combined effects of these interferences can be that long-term market acceptance actually takes longer than if rebates had never been introduced.

This scenario is illustrated in Figure 1. The baseline case (no rebates) is represented by curve A, with eventual market transformation at time t_2. An effective rebate program would accelerate market transformation so that market penetration occurs sooner, as shown by curve B. With the accelerated market penetration, transformation is essentially completed earlier, at time t_1. However, a poorly designed rebate program results in a rapid plummet of sales after the rebate program is ended (essentially starting over again from scratch), delaying the eventual transformation of the market from time t_2 to time t_3.

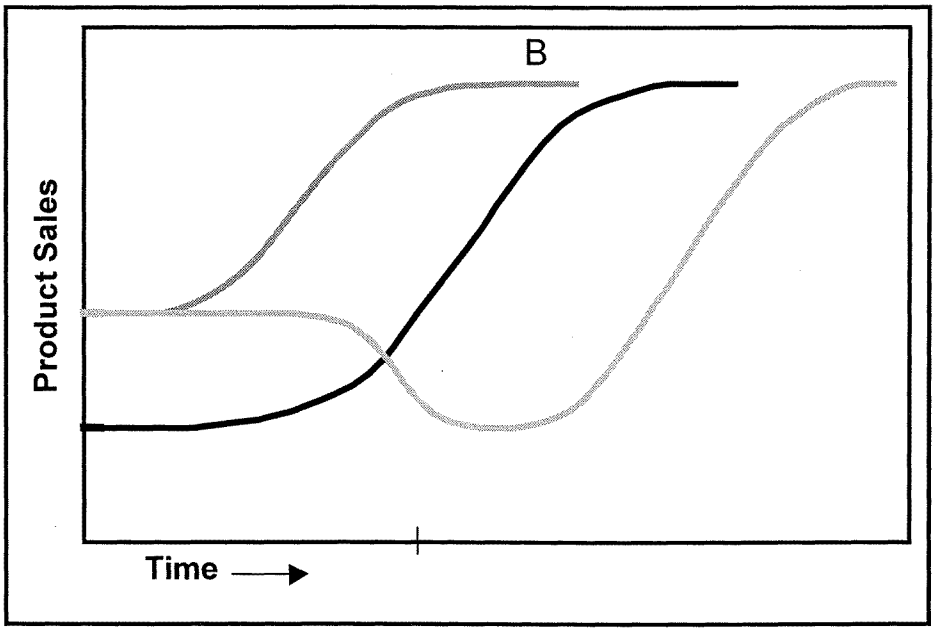

Figure 1. Rebate Effects on Market Penetration Rates

To avoid the latter case, rebates should ideally incorporate mechanisms that provide market signals to both consumers and manufacturers so that products can evolve even when the rebates are offered. One such mechanism is to use an auction strategy to set rebate levels and allocate rebate budgets. This is discussed later in the paper.

Detrimental Marketing Effects

Rebates can have a detrimental market transformation effect when consumers are encouraged to try an inferior product, leading to skepticism in the future and a reluctance to try the product again, even once the product is improved. This lingering perception of the product reduces the acceptance of the product in the long run. For example, this situation is thought to have occurred in some markets with compact fluorescent lamps (CFLs). Early DSM programs distributed CFLs or encouraged consumers to try CFLs at reduced prices when the CFLs had many inferior features including poor light quality, delayed brightening characteristics, and high failure rates.

Today's programs must overcome these negative perceptions before consumers will purchase the latest, high-quality technology. To prevent this phenomenon, rebates for market transformation should be applied principally to high quality products with which consumers will have a positive experience.

High Cost

Rebates are very costly and can quickly diminish limited program funds that could be spent on other tactics that lead to market transformation. First, they tend to reach fewer consumers per dollar than other tactics, such as advertising and education. Second, restricted budget resources will limit the opportunity to make a real impact in the market, both because they reach few consumers and because the dollar amounts are too low to capture the attention

of manufacturers and retailers. Therefore, rebate expenditures must be balanced against opportunities to use limited budget resources for other program tactics. Later in this paper, we discuss some techniques for evaluating the most appropriate program rebate budget.

Guidelines to Successful Rebate Design

In a successful rebate program, program designers should emphasize strategies that focus on the market catalyst effects of rebates while limiting the negative impact rebates can have on market transformation discussed above. We have identified four guiding principles to steer appropriate rebate design for market transformation.

Plan for the long term.

By definition, market transformation is a long term phenomenon. Therefore, rebates should be designed and evaluated according to their impact in the long run. Too often, program funding (and therefore program planning) follows an annual cycle and program planning necessarily does as well. However, to achieve market transformation goals, program planners must consider a longer time horizon when planning the current year's activities. The long-term plan should answer several questions. How will rebates act as a catalyst for long term market acceptance? What is the long term plan for changing rebate levels over time? What pre-determined market characteristics (falling sales price, market penetration levels, etc.) will trigger when rebate levels should be changed?

Long-term planning also has a positive effect on market actors. In our conversations with manufacturers in preparation for the California rebate program, they explained to us that the short planning horizons of rebate programs limit manufacturers' abilities to respond. They indicated that three to six months is not sufficient time for manufacturers to change product lines or manufacturing plans. Hence, under these conditions rebates often have little overall impact on manufacturing decisions, and the main outcome can be that products are shifted from a geographic region without rebates to one with rebates.

Develop individual strategies for each technology.

Clearly, each technology has its own market characteristics and technological potential. Therefore, there is no common rebate strategy applicable to all technologies or even every time period within a technology's development. Each strategy must be planned according to the technology's specific efficiency potential, market channel structure, market share, market barriers, and state and federal standards. Some important questions for mapping out strategies for each technology include the following. What is the technological potential for increasing energy efficiency, and how much will it cost manufacturers to implement those changes? What is the expected consumer satisfaction level with the efficient product, and how visible are the benefits of the new technology? How quickly will costs decline as the result of increased production and distribution? Are there competing products that will put downward pressure on prices?

Use an integrated market transformation strategy.

Rebates alone are not sufficient to achieve market transformation. As discussed previously, rebates can jump-start the market, but long-term market transformation depends on the consumer understanding and appreciating the benefits of the efficient technology. Therefore, successful programs must integrate a suite of education and awareness strategies for consumers, manufacturers, and retailers. As each technology is considered, program planners must determine the appropriate mix of strategies that will best affect market penetration of the technology. Program planners should identify what barriers are inhibiting the product from reaching full market penetration, and then determine the best combination of tactics for overcoming those barriers.

Use market-based rebate levels.

One of the most important considerations in using rebates for market transformation is that they should not inhibit market transformation by interfering with natural market signals to deliver a product at a market-clearing price. That is, rebates should facilitate the market penetration of efficient products to follow the trajectory of curve B in Figure 1, accelerating the market transformation, rather than following curve C, which leads to a delay in full market transformation.

Therefore, rebates should be set at the margin in a way that inhibits noncompetitive producers and inferior products from thriving in the marketplace. While our research has not extended into whether this has actually occurred, we expect that the higher the rebate levels as a percentage of sales price, the more likely that the rebate will interfere with market signals that drive a competitive product market. Below, we propose an auction method to set rebate levels at a market-clearing price.

Using Auctions to Set Market-Based Rebate Levels

In the past, DSM programs could set rebate levels on the basis of "avoided costs." That is, the amount of energy saved by a technology could be translated into a monetary value on the basis of avoided costs of producing electricity. DSM programs could buy load reduction by using rebates to subsidize the cost of efficient technologies. However, the "avoided cost" calculation determines what utility programs are willing to pay, which is not directly relevant to setting the "market-clearing" level determined by consumer and manufacturer/retailer preferences.

The DSM framework was also not overly concerned with the manner in which rebates and other financial incentives were distributed among manufacturers. So long as products could be supplied to ratepayers, the DSM program could succeed. Within the framework of market transformation, the program is specifically concerned with creating sustainable market conditions. Consequently, the manner in which the resources are distributed among manufacturers is important, the goal being to use the available funds to create a sustainable market transformation. The DSM framework provides little guidance for developing mechanisms for accomplishing this goal.

We propose that as a fundamental departure from the DSM framework, market transformation programs should use market-based information for setting rebate levels and

distributing incentives. We turn first to the issue of how to set the per unit incentive levels given a specific incentive budget, and then consider how to determine the size of the incentive budget with the context of the overall program budget.

Market-Based Rebate Levels

To date, market transformation programs have set rebates based on market research and expert opinion. However, in order for programs to choose optimal rebate levels, they must have perfect information about manufacturers' production costs and capacity, and consumers' willingness to pay.

Realistically, market research alone cannot provide administrators with enough information to set accurate incentive levels. This often leads to one of two inefficient outcomes: 1) the program-defined level is too high and manufacturers are able to ship and sell more products at the rebate level than can be supported by the available program budget; or 2) the program-defined level is too low and shipments fall below stated targets, with the result that a portion of the available budget remains unspent.

Figure 2 demonstrates the challenge of setting appropriate rebate levels. The horizontal axis indicates the potential levels at which a rebate can be set in dollars per unit. The vertical axis indicates the total units expected to be sold. The total budget required for a rebate or other incentive program is equal to the rebate level ($/unit) times the number of units that will be sold with the rebate. The figure shows two budget levels, 1 and 2. Along the line representing Budget 1, the total expected expenditure ($/unit times units) remains constant. Budget 2 also has a constant expenditure, but at a higher level than Budget 1.

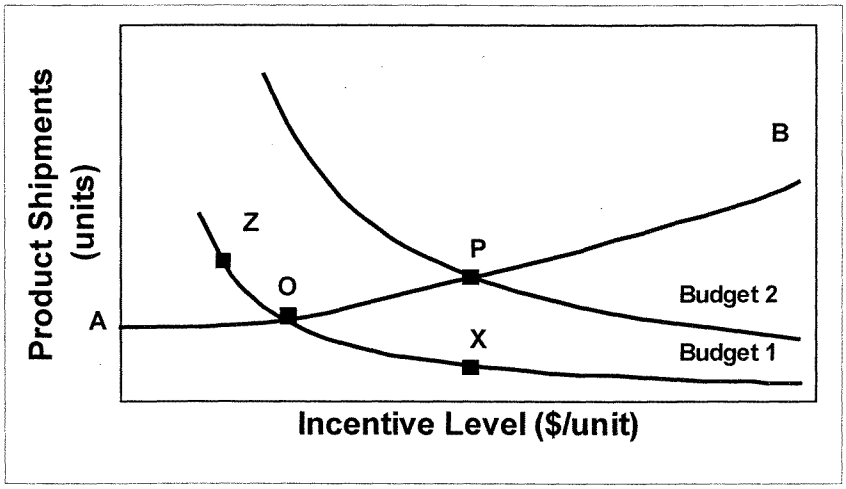

Figure 2. The Challenge of Setting Rebate Levels

As discussed above, through market research and expert opinion, program administrators are trying to determine how a rebate will affect sales. Line AB in Figure 2 illustrates the information that is needed. At higher rebate levels per unit, more units can be sold. Unfortunately, the location of this line is not typically known very precisely. As a result, a mismatch often occurs between the underlying market conditions (represented by Line AB) and the budget.

For example, assuming that the budget is equal to the amount represented by Budget 1, the optimal point at which to set the rebate is Point O. At this point, the rebate level will lead to sales that will just equal the total rebate budget. Because Line AB is not typically known, rebate levels may be set improperly, such as at points X or Z. At Point X, the rebate level is set too high, so that the budget is not sufficient to cover the full quantity of products that could be sold (Point X falls below Line AB). At Point Z, the rebate level is set too low, and the expected amount of sales is not realized, and a portion of the rebate budget remains unspent (Point Z falls above Line AB). Using the same logic, the optimum rebate level assuming that Budget 2 is available would be Point P.

Clearly, knowing the location of Line AB is critical to setting an efficient rebate level. Manufacturers, whose business depends on this information, are likely to have much better data on the location and shape of Line AB than program administrators. Unfortunately, they also have market incentives to not reveal this information perfectly to program administrators. In the following section, we propose that it is preferred to reveal the information through competitive bidding in an auction format.

Rebate Auctions

We propose that a competitively bid rebate "auction" can be used to elicit information about the location of Line AB in Figure 2. Auctions are most commonly used to sell a single item to the highest bidder. To use an auction to elicit the desired market information, the auction would be designed in a different manner, as follows.

What is being auctioned? The incentive budget itself is being auctioned. The budget is a divisible product, meaning that there can be multiple winners. It is not unusual for an auction to be designed to sell a divisible product to multiple winners. For example, T-bills are divisible products sold to multiple winners through auction by the Treasury.

What is bid? The manufacturers are bidding the number of units that they promise to ship at a given incentive level. For example, a manufacturer may bid that it will ship 10,000 units if the incentive level is set at $5/unit. This bid implies a $50,000 payment to the manufacturer ($5/unit times 10,000 units) if the program is using a manufacturer incentive approach. Alternatively, it implies $50,000 in consumer rebates if a consumer rebate is being used.

What market information is elicited? By summing the bids from the manufacturers, the total market response to a given incentive level is estimated. For example, five bidders may bid to supply a total of 100,000 units at a $5/unit level, implying a total incentive budget of $500,000. Additional bids at $7.50/unit and $10/unit could be obtained to determine the overall market response to a range of incentive levels. This information is then used to select the incentive level that matches the incentive budget.

How is the budget allocated? In addition to providing information on market response to various incentive levels, the auction provides a mechanism for allocating the incentive budget. The bidders would be required to ship the number of products that they bid at the selected incentive level. For example, if the final incentive level is set at $7.50/unit, all bidders who said they would ship units at this incentive level would be expected to ship the number of units they bid, thus the budget is allocated among the winning bidders. The auction can be designed to prevent any one bidder from gaining more than a set share of the

overall budget. For example, it can be defined so that no more than 50 percent of the total budget can go to one bidder.

For a rebate auction to work, several conditions must be satisfied. First, there must be sufficient numbers of bidders to ensure competition and a market clearing price. Second, there must be assurance that there is no collusion among bidders. Finally, bidders must be held to their commitments to sell products at the bidding level. If bidders can later renege on their commitment without penalty, the bids are meaningless and the auction process will fail.

We propose a sealed-bid auction in which bidders submit bid sheets for a schedule of subsidy levels. It would be designed as follows:

- **Bid Sheet:** A schedule of potential subsidy levels is first defined. Table 1 illustrates an example schedule of subsidy levels that could be used for a particular product (e.g., CFL torchieres). As shown in the exhibit, the manufacturer is asked to bid the number of products that it would ship at each subsidy level.
- **Budget:** Prior to the bidding, the incentive budget for the product is announced. For example, the budget may be announced as being approximately $1.2 to $1.6 million.
- **One Round of Bids:** The uniform-price sealed-bid auction has just one round of sealed bids. Each bidder fills out and submits the bid sheet once.

Bid Sheet for Torchieres Company: Date Submitted:	
Potential Incentive Level ($/unit)	Total Number of Units I Will Ship
$5.00	
$7.50	
$10.00	
$12.50	
$15.00	
$17.50	
$20.00	

Table 1: Illustrative Uniform-Price Sealed-Bid Auction Bid Sheet

To determine the market-clearing rebate levels, the auction organizer receives the bids and sums the quantities offered at each subsidy level. The subsidy level is set so that the subsidy multiplied by the total number of units offered equals the budget. A single subsidy level is selected for all bidders. Table 2 illustrates how the bids can be added and the subsidy price selected. In Table 2, a subsidy of $12.50/unit is selected with a total number of units of 100,000 bid to yield a total incentive budget of $1.25 million. All bidders who bid to deliver product at or below the selected subsidy level are considered "winners." Winners are required to deliver the number of units they bid at the selected subsidy level.

Summary Bid Sheet for Torchieres							
Total Bids Received: 8							
Date Submitted:							
Potential Incentive Level ($/unit)	Company Bids (units to be shipped)						Total Budget Implied
	Co. 1	Co. 2	Co. 3	…	Co. 8	Total	
$5.00	0	8,000	0	…	0	10,000	$50,000
$7.50	10,000	12,000	0	…	0	25,000	$187,500
$10.00	15,000	12,000	0	…	25,000	65,000	$650,000
$12.50	**20,000**	**18,000**	**10,000**	**…**	**35,000**	**100,000**	**$1,250,000**
$15.00	20,000	26,000	20,000	…	35,000	125,000	$1,875,000
$17.50	20,000	26,000	40,000	…	35,000	146,000	$2,555,000
$20.00	20,000	26,000	40,000	…	50,000	160,000	$3,200,000

Table 2: Illustrative Summary of the Results of a Uniform-Price Sealed-Bid Auction

The U.S. Treasury has successfully run similar auctions for T-bills. It also uses so-called discriminatory auctions, which are the same except for the pricing rule. Whereas in the uniform-price auction the price is the same for all winning bidders, in the discriminatory auction each bidder pays the price he or she bid. We do not recommend using a discriminatory auction because: 1) theory suggests that bidding is more competitive under a uniform-price auction; 2) the outcome, with different bidders receiving different subsidy levels, might be perceived as unfair; and 3) the differing price rebates could be confusing to consumers.

One important advantage of this auction style is that manufacturers have lower incentives to "game the system" by mis-reporting their true preferences. If they under-report sales capabilities at certain rebate levels, they will not receive as many total dollars to help sell their products. If they over-report sales capabilities, they will reduce the "market-clearing" per-unit rebate levels. Additional penalties for not accomplishing stated goals can further deter over-reporting gamesmanship.

In addition to providing a basis for setting rebate levels, this auction framework provides information on the progress toward market transformation. By holding the auction annually over multiple years, the series of auction results obtained over time will provide one indication of the extent to which the market is being transformed. If the auction results show a downward trend in the incentive level required to achieve a given market share, then progress is being made. Alternatively, if the market remains dependent on rebates or other incentives in order to achieve market goals, then self-sustaining market improvements are not being achieved.

Setting Overall Rebate Budgets

Of course, this auction model depends on setting at least an approximate predetermined incentive budget by technology. While the auction will help lead to a more efficient market outcome, it does not on the surface reveal the optimum size of the budget

(e.g., the choice between Budget 1 and Budget 2 in Figure 2). There are several considerations for choosing the correct budget level.

Limited funds. It is clear that this auction strategy requires sufficient funds to penetrate the market effectively with multiple product suppliers. When program funds are severely limited so that they cannot support a significant market penetration of the product, it is unlikely rebates will have a market transformation impact. In this case, greater impacts may be seen through broader-reaching tactics, and no dollars should be budgeted for rebates. It is possible that this auction strategy is therefore viable only for programs with very large budgets available, and we encourage further investigation in this area.

Considering alternatives. In every case, program administrators must weigh the costs and benefits of alternative program tactics in achieving market transformation. The role of rebates versus other tactics will depend on the market barriers encountered, and the relative value of the alternative tactics in overcoming those barriers. In many cases, rebates can only be successful when employed in conjunction with alternative strategies and vice versa (the impact of other strategies can be enhanced by rebates).

Auction information. It is possible that the data gathered through the auction process will reveal important information about appropriate budget levels. For example, program administrators may see that a mild increase in the budget would have a dramatic effect in overall product sales, or the opposite may be true.

Conclusion

Rebates certainly have an ongoing role as a friend to market transformation programs. Indeed, many powerful social campaigns on a variety of issues have been launched through a successful combination of education, persuasion, and financial incentives (sometimes in the inverse form of fines and penalties). Rebates can support market transformation when they reduce perceived risks to market players, capture the attention of otherwise apathetic or uninformed consumers, and temporarily reduce prices until markets naturally trend the prices downward.

However, rebates also have the potential for inhibiting market transformation. They interfere with natural market signals that influence product supply decisions. They thwart long-term sales when they convince consumers to try a product that they do not like. Finally, their high cost may limit the use of other important market transformation tactics.

Successful program administrators must design rebate programs so that they limit the negative potential while they stimulate the markets through a catalytic effect. To use rebates effectively in market transformation, administrators must use long term planning, develop individual strategies for each technology, use an integrated market transformation strategy, and set market-based rebate levels.

One option for identifying market-based rebate levels is to use an auction process to encourage manufacturers to provide information that leads to a market-clearing result. In the paper, we discussed a sealed-bid auction process to reveal true preferences and choose an optimal rebate level.

This paper lays out a comprehensive, theoretical framework based on the research and analysis we have conducted in the course of our work for a variety of energy efficiency market transformation programs. The next step is to apply empirical testing of the data

available to determine which effects are most prevalent and important in the role of rebates for market transformation.

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