DO THE MARKET EFFECTS OF UTILITY ENERGY EFFICIENCY PROGRAMS LAST? EVIDENCE FROM WISCONSIN

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Abstract

A scattering of studies in recent years have suggested that the utility energy efficiency programs of the late 1980s and early 1990s may have had substantial beneficial market effects. However, a fundamental unanswered question is how long these effects are likely to last. Do they have the potential to persist indefinitely, or are markets more likely to revert to their original structure and functioning once a public intervention is withdrawn or reduced?

The experience of Wisconsin over the past decade provides an unusual combination of circumstances facilitating an answer to this question. The level of spending on energy efficiency programs, as well as the energy saved by these programs, has declined significantly since 1993. At the same time, a substantial research effort has continued to explore the changing market effects of these programs. As a result, Wisconsin's experience constitutes a well-documented natural experiment in the effects of introducing and then reducing intervention in energy efficiency markets.

We review a number of market evaluations addressing three specific end-uses: residential heating, C&I motors, and C&I lighting. Utility programs in all three end-uses appear to have generated substantial market effects, as indexed here primarily by changes in efficient market share. However, the persistence of these effects once programs were scaled back appears likely to vary greatly across end-uses. We offer some hypotheses for the causes of this apparent variation, and explore some other implications of the studies reviewed for the nature and persistence of market effects.

Introduction

Since policymakers first became interested in the market effects of utility DSM programs in the early 1990s, a scattering of studies appear to have borne out initial suspicions that the magnitude of these effects may be substantial. However, a fundamental unanswered question is how long these effects -- ranging from changes in the purchasing behavior of consumers, to changes in the marketing practices of resellers, to changes in the production and distribution choices of manufacturers -- are likely to last. Do they have the potential to persist indefinitely, or are markets more likely to revert to their initial structure and functioning once public intervention is withdrawn or reduced?

Numerous methodological and practical barriers impede the generation of concrete answers to this question. At a methodological level, documenting the initial market effects of programs is difficult enough, much less establishing how long these effects last. At a practical level, in order to establish the persistence of market effects, it is generally necessary to wait until an intervention has actually been terminated or reduced. Yet market interventions often end because stakeholder interest or available funding have decreased, and these same factors make it less likely that careful studies of the persistence of any market effects from the intervention will be initiated.

In Wisconsin, however, a number of factors have combined to help overcome these barriers. Since its peak in 1993, spending on utility energy-efficiency programs has decreased substantially, with the result that many (though not all) energy efficiency measures are not being promoted as vigorously. At the same time, a substantial utility-based energy efficiency infrastructure remains, and the continuing interest of policy-makers, combined with the existence of two state-wide energy-efficiency research consortiums, has led to an ongoing research effort to document the market effects of utility programs. Further reinforcing this effort is the fact that, unlike most other states with an active DSM industry, Wisconsin has not provided utilities with shareholder incentives for their energy-efficiency achievements. This has reduced the pressure to devote substantial resources to traditional impact evaluation, thus to some extent freeing resources to study the market effects of utility interventions in energy efficiency markets.

As a result of the confluence of all these factors, a cumulative body of evidence has begun to emerge in Wisconsin regarding the market effects of utility energy efficiency programs. This paper surveys this evidence, drawing on a number of specific studies in which the authors have participated in one capacity or another, and attempts to draw some general conclusions regarding the existence, specific nature and persistence of market effects resulting from customer incentive programs.

Approach

The general approach followed is synthetic. We provide case studies of three specific end-uses: residential furnaces, C&I motors, and C&I lighting. For each end-

use, we begin by reviewing the evolution of marketing efforts in Wisconsin. We then summarize what we regard as key results of the various market evaluations that have been conducted in the past several years, and suggest some conclusions regarding the nature and persistence of market effects for that end-use.[1] At the end of the paper, we consider the implications of our specific findings for the broader issue of the nature and persistence of market effects stemming from utility DSM programs.

Specific studies reviewed include: (1) two evaluations of a state-wide high-efficiency motors program; (2) several studies tracking the market for residential high-efficiency furnaces; and (3) a long-term study tracking the penetration of commercial and industrial high-efficiency lighting measures in the Milwaukee area and in two comparison areas over the better part of a decade.

Most of the studies reviewed in this paper examined multiple market indicators, ranging from vendor stocking and promotional practices, to customer purchasing behavior, to pricing trends. However, for purposes of brevity and ease of exposition, we focus here primarily on a single key indicator: efficient market share, or the ratio of the number of high-efficiency units purchased by consumers to the total number of units purchased. In adopting this focus, the authors do not by any means intend to suggest that efficient market share is the only relevant variable that should be measured in evaluating the market effects of energy efficiency programs. On the contrary, in other papers we have argued that to be effective and useful, market evaluations must generally track and integrate multiple market indicators (Prahl and Schlegel, 1993.) However, in the context of the current paper, efficient market share does have two advantages that recommend its use as a key market indicator. First, it focuses sharply on individual transactions, which arguably constitute the fundamental unit of market structure. Second, it is what might be called an ultimate indicator, in that lasting changes in efficient market penetration are often among the last of a chain of program-induced market effects. Changes in efficient market penetration may thus encapsulate other market effects, making this variable an appropriate one to focus on in any attempt to summarize the implications of multiple studies.

Case Study #1: High-Efficiency Residential Furnaces

The growth in the market share of high-efficiency furnaces in Wisconsin in the 1980s and 1990s is one of the best-documented examples of the market effects of energy efficiency programs to date (Schlegel et al., 1992; Schlegel and Prahl, 1994; Kushler et al., 1996; Winch, 1997b). Beginning around 1982, high-efficiency furnaces (90% AFUE or better) began to be promoted in Wisconsin through a variety of programs, including both utility and state low-income weatherization programs, utility rebate programs, audit and informational programs, and new construction programs. As an apparent result, by the late 1980s, installing high-efficiency furnaces had become the standard practice in many areas of Wisconsin, resulting in efficient market shares in some areas reaching 90%.

Largely as a result of this high level of penetration, Wisconsin utilities and the Public Service Commission of Wisconsin (PSCW) began to phase out incentives for high-efficiency furnaces in the late 1980s. Some utilities ended their rebate programs for single-family homes as early as 1989. Then in 1991, the PSCW directed all other utilities to eliminate these programs. While some financing, fuel switching, and low-income programs continued to provide incentives for high-efficiency furnaces beyond this date, these programs have had much lower funding levels, and covered much more limited market segments, than in previous years.

Despite this phasing out of rebate programs, several subsequent studies showed that for the next several years high-efficiency furnaces retained a market share of at least 85% in Wisconsin (WCDSR, 1994; HBRS, Inc., 1995; Energy Center of Wisconsin, 1997.) Meanwhile, in Michigan, a neighboring state, market share was as low as 37%, and the marginal cost of installing an AFUE 90+ furnace rather than a standard efficiency furnace was substantially higher than in Wisconsin (HBRS, Inc., 1995.) This transformation of the market appears to be attributable to the experience and familiarity with high-efficiency furnaces gained by Wisconsin's heating contractors as a result of all the programs offered in the 1980s (Schlegel et al., 1992; Schlegel and Prahl, 1994; Kushler et al., 1996.)

Thus, as of the mid 1990s, Wisconsin's furnace market appeared to be a compelling example of a virtually completely transformed market. Around 1995, however, disquieting rumors of significant erosion in efficient market share in some corners of the state began to circulate. Reacting to this information, in 1996 the Energy Center of Wisconsin sponsored another sales tracking study based on detailed interviews with distributors, providing more detail on the status of the market than had earlier studies (Winch, 1997a). The results of this study show that by 1996, efficient market share in the southeast corner of Wisconsin had fallen by as much as 20% from its historic peak. Across the rest of the state, efficient market share had fallen much more modestly, on the order of 5%. In inter-

[1] We note that for two of the end-uses covered here, C&I motors and residential furnaces, some of the relevant studies are reviewed in more detail in other papers in these proceedings (Pigg and Prahl, 1997; Winch, 1997b.)

views, distributors cited the ending of rebate programs as a leading cause of the decline.[2]

Why should the ending of incentive programs cause so much larger a decline in efficient market share in southeastern Wisconsin than in the rest of the state? This is a question without a simple answer. However, based on the interviews with distributors, the study argues that there are a multitude of reasons. First, because the Southeast is the most densely populated part of Wisconsin, there are more contractors there, and the heating contracting market is more competitive than in the rest of the state. This large and competitive market appears to have led to the evolution of a market niche for those specializing in standard efficiency furnaces. Subsequently, a price war appears to have broken out in the market for standard efficiency furnaces, with a resulting widening of the price gap between standard and high-efficiency furnaces, and further loss of efficient market share. In addition, the Southeast is the only part of the state in which an urban area in Wisconsin abuts a large metropolitan area in another state (the northern suburbs of Chicago.) As a result, some Milwaukee area builders appear to be switching to standard efficiency furnaces in order to cut overall construction costs, and thus remain competitive with builders moving in from across the state line. Finally, the Southeast has a higher concentration of multi-family housing, somewhat warmer weather, and apparently somewhat greater housing turnover than most of the rest of the state – three factors which may make standard efficiency furnaces economically rational for a greater proportion of customers there than in other corners of the state.

Thus it appears that, even after appearing to be fully transformed for some five years, the market for high-efficiency residential furnaces in Wisconsin is beginning to erode. At the time this article was written, discussions were proceeding as to whether or not this erosion justified a major renewed intervention in the furnace market. However, it is important to place this market erosion in context. As of 1996, high-efficiency furnaces appear to have still had at least an 80% market share in Wisconsin[3], while the most recent figure available for Michigan was 37%. Clearly, the market has a long way to fall before the majority of the benefits of the programs offered in the 1980s are lost.

Case Study #2: High-Efficiency C&I Lighting

In 1987, the Public Service Commission of Wisconsin (PSCW) ordered Wisconsin Electric Power Company (WEPCo) to sharply expand its energy efficiency programs in an attempt to forestall the planned renovation of a major coal-fired power plant. WEPCo responded with the Smart Money program, a comprehensive package of customer energy efficiency services focused largely on rebates. Over the next five years Smart Money became one of the largest DSM programs in the country, both in absolute terms and as a percentage of the utility's total revenue. Rebate programs for energy efficient C&I lighting accounted for the single largest component of this spending.

Around 1994, responding to the pressures of oncoming competition in electricity markets, WEPCo began to reduce spending on Smart Money. In C&I lighting markets, it first reduced the size of its rebates, then phased rebates out altogether in favor of other marketing approaches -- first shared savings and leasing, and then audits and other information services. The level of funding devoted to C&I lighting and other end-uses remained significant, as did the level of savings WEPCo reported to the PSCW. However, the cutbacks did reduce the level of direct program savings WEPCo was able to claim from C&I lighting, as follows:

1992: 211,353 MWh
1993: 185,535 MWh
1994: 150,400 MWh
1995: 61,322 MWh

The history of WEPCo's intervention in C&I lighting markets thus forms a natural experiment in the effects of offering and then withdrawing major rebate programs.

Fortunately, the effects of this natural experiment have been documented. Beginning in 1989, WEPCo collected annual data from a panel of distributors on the market share of various efficient lighting measures in the Milwaukee area and in a comparison service territory, Cincinnati Gas and Electric. In 1992, Cincinnati Gas and Electric began its own DSM lighting programs, and WEPCo responded by adding a second comparison area, Kansas City. The most recent phase of the study was com-

[2] For several reasons, these figures are best interpreted as qualitative rather than quantitative findings. First, while the study used rigorous methods to collect data from distributors on the percentage of their furnace sales with AFUE ratings of 90% or better, it did not include data on the total number of sales for each distributor. Thus no precise weighting of the results at the state level is available. Second, distributors varied greatly in how many years of sales data they were able to provide. Some were able to provide data as far back as eight years ago, while others were able to provide data only for 1996. To assess the change in efficient market share over time the study used that subset of distributors which provided more than one year of data, and, for each distributor, compared the results for 1996 with that year showing the highest efficient market share. Because the base year varies across distributors, this method does not yield a precise quantitative estimate of year-to-year change in efficient market share at the state level.

[3] Again, because the results of the study do not allow for exact weighting to the state level, this is a qualitative interpretation of the data from the most recent furnace study rather than a quantitative result.

pleted in 1996, and included sales data for 1994 and 1995. Thus data on efficient market share for C&I lighting are available both for WEPCo and for two comparison areas, both before, during, and after the peak of WEPCo's market intervention.

A representative example of the results, for low wattage lamps[4], is shown in Figure 1. This figure indicates

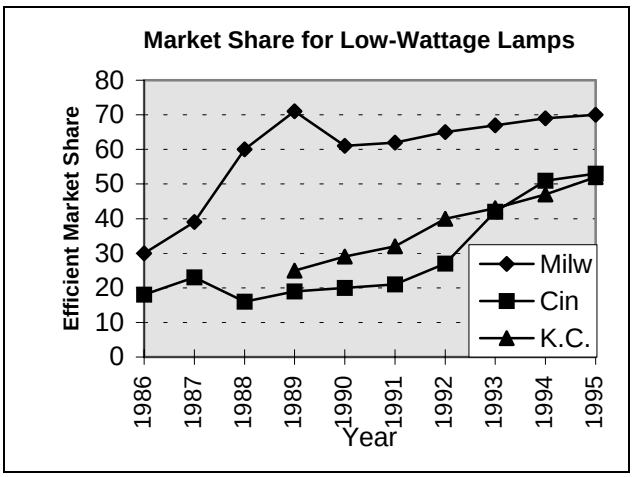

Figure 1

that the market share of low wattage lamps in the Milwaukee area grew sharply in the late 1980s, then slipped in 1990, and then began to grow again, slowly but steadily. When WEPCo's lighting programs began to be scaled back in 1994, efficient market share continued its slow growth. For example, from 1994 to 1995, when the direct lighting savings reported by WEPCo shrank from 150,400 kWh to 61,322 kWh, the penetration of low wattage lamps increased from 69 to 70%. Meanwhile, starting around 1990, efficient market share in the comparison areas, hitherto much lower than in Milwaukee, began to grow relatively rapidly. However, the early gap was so great that by 1995, efficient market share was still about 18 percentage points higher in Milwaukee than in the two comparison areas (70% vs. 53% and 52%).

These results are roughly mirrored by other measures such as electronic ballasts, the most efficient type of lighting ballast. As shown in figure 2, between 1987 and 1992, market share for electronic ballasts in WEPCO's service territory increased from 4% to 33%, while market share in the comparison areas never exceeded 10%. Between 1992 and 1995, during which time the total lighting savings reported by WEPCO fell from 211,353 kWh to 61,322 kWh, market share in WEPCO's service territory fluctuated between 31 and 34%. During the same period, market share in the comparison areas increased steadily but slowly, reaching 15-16% in 1995.

[4] Excluding CFLs.

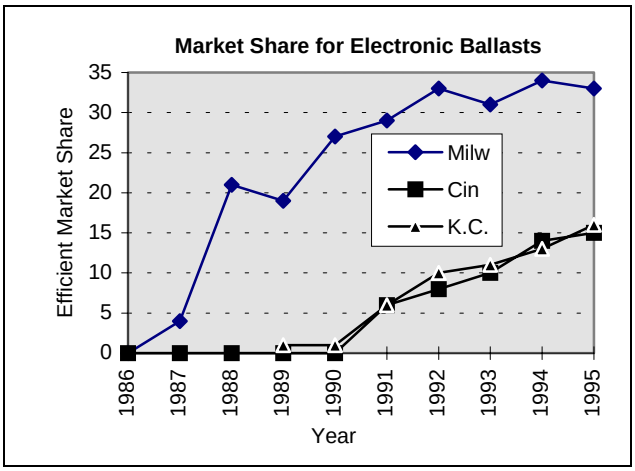

Figure 2

In short, when WEPCO scaled back its market intervention, the market share for efficient lighting measures in its service territory stabilized but did not fall. Meanwhile efficient market share in the comparison areas continued to increase, but remained far below that for WEPCO. Evidently, then, WEPCo's intervention contributed to a relatively long-term acceleration in the diffusion of efficient lighting measures in its service territory.[5] Other evaluations suggest that there are probably two primary mechanisms by which this market effect has occurred: (1) changes in the stocking and promotional practices of distributors; and (2) changes in the awareness of commercial and industrial customers regarding the performance of high-efficiency lighting measures.

What does not seem not entirely clear from the data, however, is whether or not the results for recent years suggest any erosion in these market effects over time. The recent pattern of consistent increases in efficient market share in the comparison areas suggests that, whatever the efficient market share might have been in the Milwaukee area in 1994 in the absence of WEPCO's programs, it would likely have increased in 1995, due simply to the natural diffusion of the technology. The fact that efficient market share in WEPCO's service territory either stabilized or increased only slightly in this period, while steadily increasing in the comparison areas, could be interpreted as evidence that the cumulative market effects of WEPCO's programs are eroding, thus allowing the comparison areas

[5] We note in passing that there is some potential for historical comparisons of efficient market share between areas with and without DSM programs to understate the true magnitude of market effects. Many commentators have argued that the DSM programs of the 1980s and 1990s, particularly for heavily promoted measures such as lighting, had a pronounced enough effect on energy efficiency markets to accelerate manufacturers' plans to introduce and promote new technologies. If this is true, then the cumulative market effects of programs such as WEPCO's may have helped to drive up efficient market share in areas such as Cincinnati and Kansas City, thus leading quasi-experimental comparisons to understate true impacts.

to catch up. However, we would argue that given how much higher efficient market share was in Milwaukee as of 1994, some deceleration relative to the comparison areas was almost inevitable. There is, after all, a theoretical limit for efficient market share at 100%. Thus it appears the only firm conclusion that can be drawn at this relatively early date is that at worst the beneficial effects of WEPCO's intervention in lighting markets are eroding only slowly, and at best they are not eroding at all.

Case Study #3: High-Efficiency Motors

Utilities in Wisconsin offered rebates on 3-phase integral horsepower motors since the early 1990's. In 1993, under the auspices of Wisconsin Demand Side Demonstrations, Inc. (WDSD), a coordinated statewide program called Responsible Power Management was created that standardized the efficiency levels (and in the subsequent year, the rebate amount) for qualifying motors installed in the state. Two efficiency tiers were created: the first tier was equivalent to efficiencies stipulated in motor standards established under the national Energy Policy Act of 1992, and set to go into effect in October 1997; the second tier exceeded the EPACT standards by several percentage points. Between 1993 and 1995, 5,000-6,000 motors received utility rebates in Wisconsin.

The RPM program also created a palette of informational and sales tools for distributors to use in promoting the program. The program strategy was to attempt to accelerate the adoption of the high efficiency motors in Wisconsin by focusing on the middle of the market chain—motor distributors.

In 1996, the utility coalition that maintained uniform rebate standards and levels fractured: some utilities eliminated rebates on motors entirely, while the others eliminated rebates on the first of two efficiency tiers, and reduced rebate levels on the second tier. By 1997 there were no utility rebates on motors in Wisconsin.

Two studies have been conducted to characterize the Wisconsin motor market, and assess the impact of the program on it. The first was conducted in 1994 by the WDSD. That study sought to characterize the market through interviews with motor manufacturers, and surveys of distributors and motor purchasers (both participants and non-participants in the rebate program).

The second study was sponsored by the Energy Center of Wisconsin (with which the WDSD merged in 1995). This study relied on a distributor survey and focus groups to better understand the use of the information and sales tools, as well as update some of the market tracking variables from the earlier study.

Both studies reveal a fairly complex market for which it is difficult to obtain accurate data. There are several hundred motor distributors in the state representing at least 15 motor manufacturers. The size distribution of motor distributors is highly skewed, with the largest 20% of distributors accounting for about 80% of new motor sales. An additional complicating factor is that it appears that about half of the motors sold in Wisconsin go to original equipment manufacturers (OEMs) to be installed in equipment, much of which subsequently is shipped outside the state. It is difficult to disentangle these OEM sales (which are reported to be nearly entirely standard efficiency motors) from sales to Wisconsin end-users.

Nonetheless, the two studies included surveys with about 65 motor distributors (about 1/3 of which were represented in both studies) representing various size distributorships. The surveys asked distributors to estimate the percent of their new motor sales that are energy efficient, along with questions relating to promotional efforts, rewind (that is, motor repair) practices, and firmographic data that allow a ballpark estimate of each firm's Wisconsin motor sales.

The results show that the energy efficient motors represented about 36% of the total market in 1993, then increased to about 50% in 1995, before declining to about 41% in 1996. The decline observed between 1995 and 1996 is significant because it coincides with the scaling back and withdrawal of utility rebates in the state. Closer analysis of the distributor data indicates that the decline mainly arises in data reported by the small and medium size distributors and is consistent across horsepower classes. Distributors reported that fewer customers were requesting energy efficient motors, and mostly attributed the drop in market share to the loss or reduction of utility rebates.

The first study showed that the introduction of utility rebates had a chilling effect on the motor repair business, because the rebates made it more attractive to buy a new energy efficient motor than repair an old one. The survey and focus groups in the 1996 study revealed that distributors felt that the rewind market was picking up. They also reported that the profit margin on rewinds was greater than that on new motor sales. Presumably, distributors will now recommend repair over replacement more often, which will also hurt the market for energy efficient motors.

Stocking practices are another indicator of the operation of the market. The first study showed a clear increase in stocking of energy efficient motors between 1993 and 1994 in all but the largest motor sizes (>200 Hp). The second study did not ask as much detail about stocking, but showed little change in the number of lines carried by distributors.

Both studies asked distributors about the frequency with which they recommend energy efficient motors. The results show an increase between 1993 and 1995 in this frequency. Among the 22 distributors who increased their promotional efforts for energy efficient motors in the past year, several reasons were given. The most common was the proposed 1997 federal minimum motor efficiency standards (6 responses). Several others pointed out that

their stock is made up mainly of efficient motors (4 responses).

Overall, the results from the two studies provide a qualitative sense that the program did accelerate the market for energy efficient motors between 1993 and 1995, and that the market has regressed somewhat since then. There are two factors that would tend to amplify the significance of the recent regression, and one that would tend to attenuate it. First, we note that the withdrawal of utility incentives in 1996 was only partial: presumably an outright elimination of all incentives would have had a bigger impact. Second, this regression occurred within a year of the implementation of the federal efficiency standards, which by all accounts is creating an anticipatory pressure to *increase* the promotion of energy efficient models. On the other hand, economic theory would hold that increasing the effective price of a piece of equipment would reduce demand for it, so regression in efficient market share is not sufficient evidence, in and of itself, to conclude that any improvements in the structure and functioning of the market have been lost. Unfortunately, we have neither a precise measure of the extent of the regression, nor the data to calculate the percent of energy efficient motor sales that have attractive paybacks only when a utility rebate is involved.

Implications

In the remainder of this paper, we discuss some potential broader implications of our findings regarding the market effects of Wisconsin's energy efficiency programs.

1. Customer incentive programs can have substantial, relatively long-lasting, beneficial market effects. For two of the three end-uses reviewed in this paper (residential furnaces and C&I lighting), market transformation was not a major program objective. Instead, like most DSM programs of the 1980s and early 1990s, programs targeting these end-uses were designed to acquire reliable demand-side resources within a traditional integrated resource planning framework. In the case of the third end-use, C&I motors, program design and implementation emphasized both resource acquisition and market transformation.

Nonetheless, for all three of these end-uses, the rebate and grant programs offered by the Wisconsin utilities appear to have generated significant market effects that remain (at least partially) to this date. The benefits generated for Wisconsin residents by these market effects appear to be substantial. For example, Schlegel et al. (1992) estimated that the indirect benefits of Wisconsin's residential furnace programs exceeded the direct benefits by a four-to-one margin, while Kushler et al. (1996) estimate the net present value of the savings realized by Wisconsin residents to date as a result of the transformation of the furnace market at $444 million. This finding of substantial benefits echoes the results of evaluations of the market effects of rebate programs in other parts of the country.

It is difficult to reconcile these beneficial market effects found for rebate programs with the current widespread distaste for rebates as a marketing strategy. All of the programs generating the market effects discussed in this paper were estimated to be cost-effective based on their direct impacts, even after rigorous impact evaluation. When beneficial market effects are factored in, it appears likely that the true benefit-cost ratios of these programs were very high indeed. Why should such programs not be regarded as viable interventions for purposes of market transformation?

An opponent of rebate programs as a market intervention strategy might respond to this question by pointing out that two of the three end-uses reviewed in this paper are already showing signs of market regression, and that the market effects of rebate programs therefore appear to be only temporary. However, such an argument would have at least three weaknesses.

First, it is not clear at this point whether the market effects discussed in this paper will continue dissipating, or whether the market will reach equilibrium at some level of efficient market penetration that is lower than would be socially optimal, but higher than would have occurred without rebate programs. If the latter is the ultimate outcome, then some of the market effects of these programs will have proven lasting after all.

Second, while the studies reviewed in this paper do suggest that not all of the market effects of rebate programs are likely to be lasting, there is little empirical evidence to date of *any* substantial market effects for marketing approaches other than rebates. Why should the only marketing strategy for which there exists a substantial body of evidence pointing to beneficial market effects, be virtually the only marketing strategy that is regarded as out of bounds for market transformation initiatives?

Third, while the studies reviewed in this paper do suggest that rebates have not completely transformed markets for residential furnaces, C&I lighting, and C&I motors in Wisconsin, it is not clear that *any* marketing strategy could have had this effect. There appears to be a growing consensus among energy efficiency analysts that, while it is entirely feasible to develop limited-term interventions that lastingly improve the economic efficiency of energy-efficiency markets, it is exceedingly difficult to develop interventions that permanently eliminate all market barriers without any need for further intervention. Some market barriers, such as split incentives (the tendency of some equipment or building-related decisions to be made by parties other than those who bear the resulting energy costs) are simply too ingrained in the economy to be eliminated. Furthermore, most interventions, even if highly successful, require some continuing presence in the market. For example, even codes and standards require continuing enforcement and training. Finally, one might argue that markets are simply too dynamic for any change in market-oriented behavior to be regarded as permanent.

Thus, the demonstrated effectiveness of rebates in generating long-term improvements to the structure and functioning of energy efficiency markets should be compared not with perfection, but with what is likely to actually be achievable.

2. However, the results reviewed here suggest that there is likely to be a wide range in the persistence of market effects resulting from rebate and other customer incentive programs. The best predictor of persistence may be the mechanism by which the program causes the structure and functioning of the market to change. In the case of motors, the market appears to have begun to regress toward its baseline condition almost immediately after rebates were withdrawn. In the case of furnaces, the market appeared to be virtually completely transformed for some five years, but is now showing early signs of regression. In the case of C&I lighting, while it is still early, there is no clear evidence of erosion to date. What can explain such highly variable results?

In attempting to provide a tentative answer to this question, we follow Prahl and Schlegel (1993) in distinguishing between three mechanisms by which programs may lastingly change the behavior of market actors: (1) by changing what they know, think or believe; (2) by changing the structure of incentives facing them; or (3) by changing the set of options available to them.

We tentatively hypothesize that the persistence of market effects may depend in part on which of these mechanisms is involved. Perhaps the least persistent kinds of market effects are those which occur as a result of changes in market actors' perceptions of their self-interest, and which are not fundamentally irreversible. An example of such an effect is the changes in the promotional practices of distributors found in the first motors evaluation reviewed here. Such changes may last for some time after the program is ended, as market actors persist in the practices that have proven profitable for the several years for which a DSM program was in place. However, eventually some market actors are likely to realize that the world has changed, and that there is once more a profitable niche to be filled in counter-selling against efficiency. Once this niche has been filled, its occupants are likely to exert pressure on the market-oriented behavior of other market actors as well.

Similarly, the most persistent market effects may prove to be those that occur as a result of changes in the knowledge or awareness of market actors. An example of such a change would be contractors becoming familiar with the track record of high-efficiency furnaces as a result of exposure to utility grant and rebate programs. While people can and do forget what they have learned, we would argue that changes in knowledge and awareness are fundamentally less reversible than changes in the structure of incentives facing market actors. One reason for this is that, unlike changes in incentives, changes in attitudes and awareness are largely independent of changes in the behavior of other market actors. Once a customer is convinced of the performance of high-efficiency motors, he or she is likely to seek them out in future purchases, regardless of whether or not vendors promote them. However, when a motor distributor increases its promotion of high efficiency motors because it perceives an opportunity to reap greater profit margins by doing so, it is likely to reconsider this course of action the minute it perceives that another distributor is cutting into its market share.

In between these two extremes may fall market effects falling into two other categories: (1) effects occurring as a result of changes in market actors' perceptions of their self-interest that are to some extent irreversible; and (2) changes in market actors' options. The market effects observed for C&I lighting appear to fall into this category. In greatly increasing the availability of high-efficiency lighting in the marketplace, WEPCO's lighting rebate program appears to have fundamentally changed the lighting options available to Milwaukee area businesses. As measures such as electronic ballasts have become increasingly popular with customers, distributors have apparently realized that they have little alternative but to stock these measures. Because this change in perceived self-interest is the result of changes in customer awareness, it is perhaps less reversible than most other market effects based on perceived changes in incentives.

In practice, this hypothesized explanation for the variation in persistence of market effects is complicated by the fact that market effects beget other market effects. For example, as suggested by the preceding ballast example, program-induced changes in customer awareness are likely to beget changes in vendor practices, and due to the relative irreversibility of changes in awareness, these changes are likely to be relatively lasting.

Finally, we note that, in hypothesizing that market effects attributable to changes in awareness may be more lasting than effects attributable to changes in incentives, we are *not* arguing that programs offering information are preferable to programs offering financial incentives. There is a substantial body of behavioral research showing that information is far from certain to result in behavioral changes, and it seems clear based on the studies reviewed in this paper that incentive programs have the potential to change awareness. Furthermore, changes in awareness following participation in a customer incentive program would be consistent with the well established psychological tenet that changes in behavior are at least as likely to lead to changes in attitudes as the reverse. Thus, our hypotheses regarding the persistence of market effects do not necessarily argue for one particular type of marketing approach. What they do suggest, we would argue, is that the ultimate aim of any program intended to generate lasting market effects should be to create changes in awareness, changes in options, and other relatively irreversible changes in the behavior of targeted market actors.

3. Efficient market share is an indispensable tool for the analysis of the market effects of energy efficiency interventions. However, much more analytic work is

needed to facilitate the use of this tool, and other tools are needed to supplement it. The role of sales data in evaluating the market effects of energy efficiency programs has been much discussed in recent years. Some commentators have highlighted the practical difficulties of collecting such data, while others have argued that the limited potential for sales data to provide timely feedback on why a program is or is not working militates for increased use of proximate indicators, or early indicators of market change, to assess the effects of interventions in energy efficiency markets (Feldman, 1995).

The studies reviewed in this paper suggest that, while collecting sales data is not easy, it is often viable. The studies reviewed used methods ranging from detailed on-site interviews with distributors, to phone and mail surveys with contractors, to random digit dialing customer surveys, in which those customers falling into a broad sample who report installing a particular kind of equipment are asked about its characteristics. Factors contributing to the success of these efforts include: (1) a sustained effort over a period of several years, involving significant trial-and-error; and (2) the establishment of long-term working relationships with distributors, contractors and other players in the market.

We believe the studies reviewed in this paper also show that efficient market share can be a critical tool for the analysis of market effects -- not sufficient in and of itself, but perhaps worthy of playing nearly as central a role under a market transformation paradigm as kW, kWh and therm savings played under a resource acquisition paradigm. For example, the specific market share data collected as part of the studies reviewed here appears sufficient to support two significant conclusions: (1) that programs targeting residential furnaces, C&I motors, and C&I lighting in Wisconsin have had substantial beneficial market effects; and (2) that the probable persistence of these market effects varies widely.

However, it does seem clear that data on efficient market share must be supplemented with other more proximate types of market indicators if timely and informed decisions are to be made on changes to program design. The data reviewed in this paper were collected over the course of some seven years – approximately six and a half years too long to provide program designers with useful short-term feedback.

Furthermore, in discussions among stakeholders regarding the implications of the studies, it became clear that much was still unknown about the policy implications of the market share data collected, despite the fact that most of the studies also collected data on numerous other market indicators. For example, while the studies of the furnace and motors markets suggest that the market effects of the programs targeting each of these end-uses have started to fade, it remains unclear:

- Whether this market regression is enough, in and of itself, to justify further intervention.
- Whether the regression in these markets will continue, rather than stopping while significant market effects are still present.
- How the current level of efficient market share compares with the level that is socially optimal.

The last of these uncertainties seems particularly noteworthy. Clearly, the most efficient option is not always the one that is socially optimal. For example, even if the economics are such that most motors purchasers will be better off with an efficient unit, it may be perfectly rational for a customer to choose a standard unit if he or she anticipates that the unit's operating hours will be relatively low. Therefore, in order to reliably assess whether a given efficient market share for high-efficiency motors justifies a renewed attempt to intervene in the market, at a minimum one needs to know what level of penetration would be economically justified. This requires more detailed information than is usually available regarding the uses to which newly purchased units are to be put. Thus it appears that much more data collection and analysis will be needed before efficient market share can reach its full potential as a key market indicator.

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