

Separating DSM Program Impacts from Technology Trends: A Comparison of National and State Surveys of Manufacturers and Distributors

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While DSM programs can help increase sales of high efficiency equipment over time, there are also concurrent advances in equipment efficiency and cost which are working in the same direction. If we are to understand the overall effectiveness of DSM programs in moving the market and changing the behavior of manufacturers and distributors, then we must be able to separate program impacts from these other effects. Past efforts to do this have been hampered by limited sales data at the sub-state level, and the fact that adjacent utilities may have implemented different types of incentive programs at different points in time.

The eight major utilities of one state present a situation where nearly all of their commercial and industrial retrofit programs were implemented at approximately the same time period (1989), with generally similar designs. This provides a unique opportunity to investigate the aggregate impact of their programs on statewide sales of energy efficient equipment, and to compare those impacts with national trends over the same time period.

To address these issues, a survey was conducted of national and regional manufacturers and distributors of lamps, ballasts, motors and air conditioners. This paper presents findings from that study and discusses implications for DSM program design and evaluation.

Introduction

Needs for Changing Net Impact Measurement

The net impact of a DSM program is the marginal effect of the program on energy savings over-and-above what “would have occurred anyway.” In the case of an energy efficiency rebate program, some energy efficient (e.e.) equipment would have been purchased even without a rebate. The problem for net impact measurement, then, is to establish a baseline of “what would have occurred anyway.” For some impact studies, there is a further interest in separating out two factors that affect net impacts: (1) free ridership—the extent to which some participants would have acquired e.e. equipment even without the rebate program, and (2) spillover—the extent to which non-participants are acquiring e.e. equipment as an indirect impact of the rebate program.

Regardless of the data analysis method, net impact measurement is becoming more complicated by the continuing evolution of local utility DSM programs, in which spillover impacts are becoming an increasingly important aspect of impact. This is occurring for several reasons. One is that, over time, the information dissemination aspect of these programs is increasingly overall awareness of the availability and advantages of energy efficient technologies among the local population. A second reason is that as some DSM customer incentive programs grow over time, they may be having an indirect impact of “transforming the marketplace”—i.e., shifting local dealer stocking to feature more energy efficient products in their offerings to the general population.

The third reason is that there is now a growing element of DSM strategy aimed at directly intervening in the marketplace to shift product mix, either by affecting regulation on equipment standards or by providing financial incentives directly to manufacturers, distributors or local dealers. (The “Golden Carrot” refrigerator program to promote more efficient refrigerators is an example of the latter.) (For further discussion of market interventions, see Eckman et al. 1992, Schlegel et al. 1993, and Nelson and Terries 1993.)

These changes in the nature of DSM programs and their impacts may be good for promoting e.e. equipment, but they can wreak havoc for those impact measurements which rely on pre/post or participant/non-participant comparisons. As DSM programs continue to evolve and mature in the future, they will increasingly have spillover impacts on the general population of an area. It will then be necessary to conduct more evaluations in which we measure overall net impacts on total e. e. equipment purchases in the utility service area (by both participants and non-participants).

Issues and Problems with Sales Data

To date, research comparing overall sales patterns of energy efficient equipment between areas with and without DSM incentives have been limited. Examples of inter-area sales comparisons are Milwaukee-Cincinnati (Brugger 1990), Northern California-Reno-Birmingham (Cambridge Systematic 1993), Northern California and U.S. control areas (Van Liere et al. 1993a) and New York-Pennsylvania (Freeman and Vinhage 1993). In several cases, comparisons yielded counter-intuitive results. Such results highlight the difficulties of finding appropriate control groups for comparison, and the difficulties of isolating impacts of individual utilities when their impacts affect broader distribution systems. (The complexity of distribution systems and issues for sales tracking are further discussed in Van Liere et al. 1992 and Van Liere et al. 1993b).

Nowhere is the evaluation of overall program impacts more difficult than when there are multiple utilities, each with their own different forms of DSM incentive programs, affecting overlapping markets. The eight major investor-owned utilities of New York State, offer a unique situation which minimizes that problem. The unique situation here is that the New York State utilities all implemented roughly parallel commercial and industrial retrofit programs for the same technologies, and nearly all were initiated at the same time (around 1989). This presents an opportunity to investigate the aggregate impacts of these programs on statewide equipment sales.

Project Description

To address these issues, those eight utilities commissioned a study of manufacturers and distributors to learn about how the market share of energy efficient equipment in New York State has been changed by the advent of DSM programs covering various types of lighting, motors and HVAC equipment. This paper summarizes findings of the full report (Weisbrod, Train and Megdal 1994).

Approach

The utilization of sales data for program evaluation is not simple. The problem with simply comparing current sales trends in New York State with prior (pre-DSM program) trends in New York State is that technologies offered in the marketplace have been evolving and changing. Electrical efficiency standards and codes have also been upgraded in some cases. Thus, unless distributors and manufacturers can tell us directly, we cannot be sure whether increases in sales of energy efficient equipment in New York State are truly attributable to the advent of DSM program incentives and marketing, or to changes in the mix of product offerings brought on by technological improvements and regulatory standards.

By comparing trends in New York State with trends over the same time period elsewhere (or nationally), we presumably are provided with a reference that indicates how sales trends elsewhere have generally been affected by technological improvements and regulatory standards. However, one minor limitation with using national trends as a reference for determining naturally occurring conversation is that a small but growing portion of the nation is also being exposed to financial incentives for energy efficient equipment. Thus, this also offers an inexact comparison.

An alternative comparison would be to compare New York State with another state which had absolutely no incentive programs initiated over the study period. Without true matching in terms of electric rates, socioeconomic characteristics and regional business patterns, however, that comparison could be even more subject to error. Thus, there is no clean solution to the need for a reference group for evaluating DSM program impacts on market transformation. The approach used in this study was to utilize national manufacturer data comparing New York sales with national trends, and regional distributor data comparing New York State sales with adjacent state sales patterns.

Survey Description

For the surveys of major manufacturers and regional distributors, the principal means of data collection was telephone survey, with a follow-up survey by fax. The initial target list encompassed 120 manufacturers and 131 distributors of electrical products, compiled from directories and computerized lists. Initial screening eliminated telephone numbers that were not in service (24), firms not selling the type of equipment covered by the study (108) and firms not selling products in New York State (30). Of the remaining 106 eligible firms, a total of 85 surveys were completed. Forty-nine surveys were conducted with distributors and 36 with manufacturers. The interview surveys focused on the following topics: (a) Definitions of Energy Efficiency, (b) Market Share held by energy efficient technologies, (c) Sales Growth Patterns, (d) Distributor Stocking Patterns, (e) Expectation for Future Changes in Sales Patterns, (f) Awareness of Utility DSM Programs and, (g) Suggested Channels of Communications. The discussion here focuses exclusively on items (a) - (d).

The surveys did cover the largest national manufacturers and a majority of the distributors providing lighting, motors and air conditioners in New York State. Exact figures on statistical confidence of the survey results could not be calculated, however, as over half the respondents were only willing to provide information on sales and stocking trends and patterns, and not specific data on their sales volumes.

Study Findings

Definitions of Energy Efficiency

The definition of the “high efficiency” for air conditioning and motors is a matter of judgement, and a concept which is constantly changing. For this study, manufacturers and distributors were asked what level of equipment efficiency did they consider to be “energy efficient” (or “high efficiency”). The finding was that there was some variation in the reported definitions of “energy efficient” which could potentially add an element of random “noise” to any analysis of reported patterns of e.e. equipment sales. For packaged thermal air conditioners, the mean for high efficiency was a SEER of 10.1 (82% had reported a value in the 9-11 range). For motors, the mean for high efficiency was 91.2 percent efficiency (93% had a reported value for the 90-92 range). The question was not asked for fluorescent lighting, as industry standards for it is more generally agreed upon. There were no significant differences between manufacturers and distributors in any of these results.

Manufacturer Market Share Trends

Manufacturers of various types of lighting, air conditioners and motors were asked to report the share of their state and national sales that was energy efficient equipment in 1989 (one year before the advent of most utility incentive programs for this equipment in New York State), and the corresponding share in 1992 (two years after such incentives were initiated). Of the 36 responding manufacturers, 15 were willing to disclose this information for the most recent year and 12 were willing to disclose the information for both years. Figure 1 shows the results of this comparison.

It is important to note that these market shares for e.e. equipment are high for two reasons. The most important reason is that the survey was limited to firms selling e. e. equipment (as well as standard efficiency equipment). Firms selling only standard efficiency equipment were excluded, as the intent of the analysis was to focus on measuring changes in market shares among firms that sold both types of equipment. The second and more minor reason for apparently high market shares for e.e. equipment was that some firms reported utilizing broader or more generous thresholds of energy efficiency for their survey responses, as was noted above. The market shares values reported here are less important, however, insofar as we are interested mainly in the relative change in the market shares, and not in the absolute levels. For more comprehensive estimates of national market shares for e. e. equipment, see ACEEE (1993).

There are two important findings from Figure 1. First, the market shares for e. e. equipment were consistently higher in New York State than nationally, both before and after the advent of incentives. Second, there was a national trend of increasing sales share for energy efficient equipment over that period (from 49 percent to 58 percent), but the statewide trend of increases was even larger than the national trend (from 52 percent to 64 percent). In theory, the national increase may be indicative of “naturally occurring conservation” trends, while any additional increment occurring in New York State sales may be more indicative of the marginal effects of utility incentive programs introduced in the intervening period. In reality, there may be other factors also at work, including differential changes in energy costs and regulations over the period.

Figure 2 shows similar patterns of growing market shares for energy efficient air conditioners, motors and lighting, occurring both in New York State and nationally. However, the *rate of growth* in New York State is only larger than the national rate in the case of air conditioners.

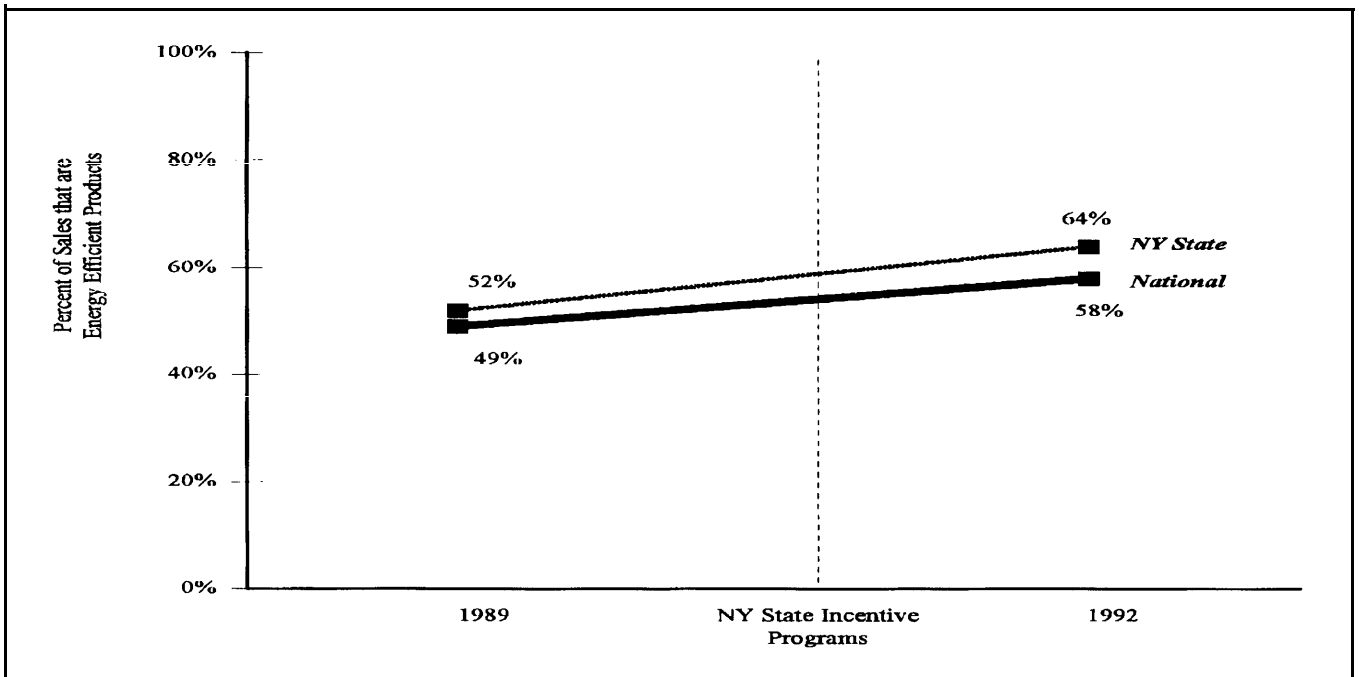


Figure 1. Inter-State Difference in Market Share Trend for Manufacturing of Energy Efficient Products* (Manufacturers Only)

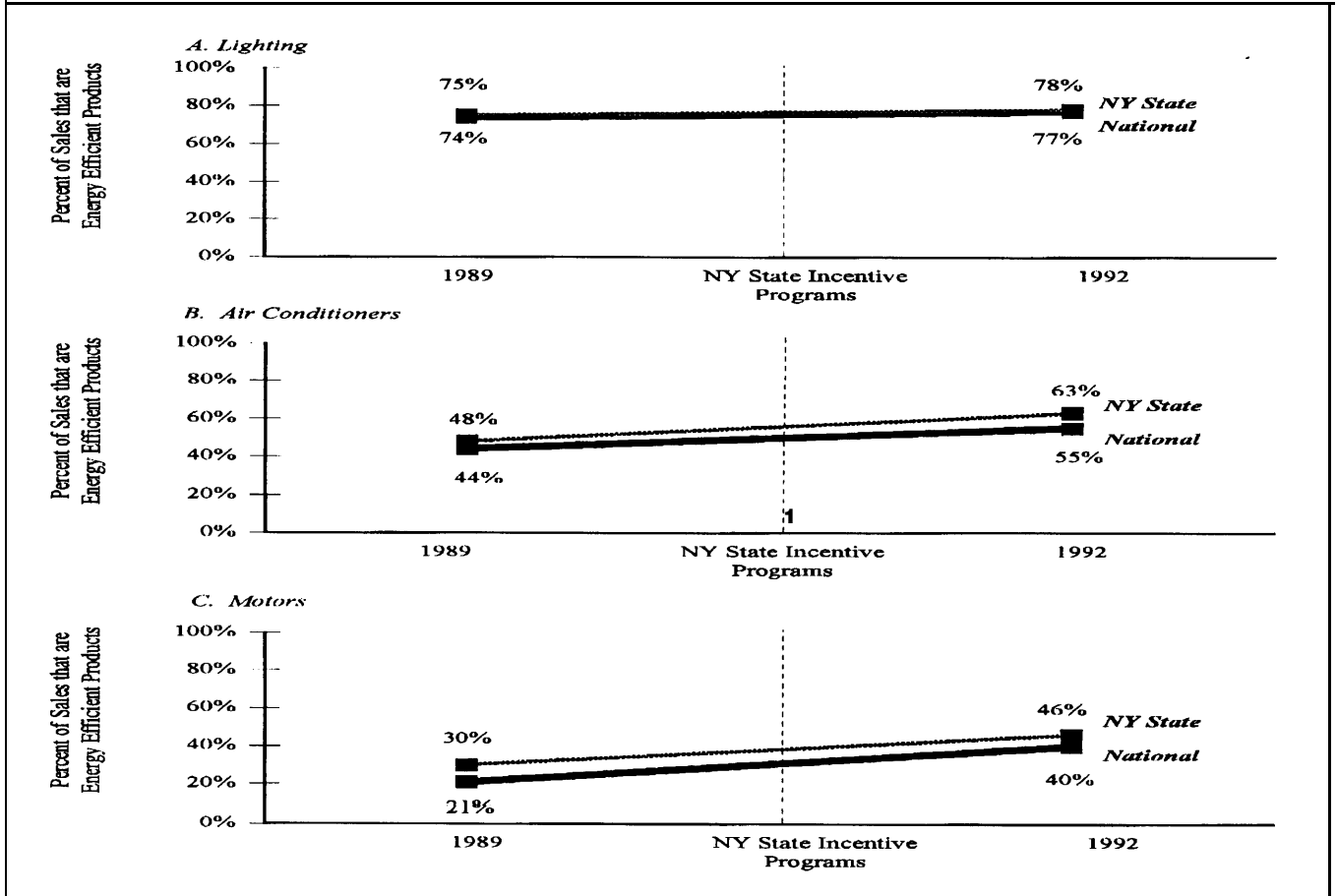


Figure 2. Product Breakdown: Inter-State Difference in Market Share Trend for Manufacturing of Energy Efficient Products* (Manufacturers Only)

The interpretation of these results is unclear. If, for instance, the national market share trend mirrored New York State's trend with a time lag of two or three years, then we might expect to see the national market share catch up to New York State's market share over this time period. The fact that New York State's market share for energy efficient products has continued to grow (rather than stagnate) could thus be a reflection of the effectiveness of new DSM incentives, or it could be a reflection of other factors causing continuation of prior growth trends. We must thus turn to other data to illuminate this issue.

Another indicator of DSM impact in New York State is the set of survey responses in which national manufacturers and area distributors were asked if they had observed a noticeable change in New York State sales of energy efficient products after the state's major utilities adopted incentives for energy-efficient retrofits in 1990. Results, shown in Table 1, were that of those answering the question, 67% of the national manufacturers and 91% of the area distributors reported that they had noticed an increase in New York State sales of energy efficient products over that time period.

Table 1. Reported Noticeable Change in New York State Sales of Energy Efficient Products Since DSM Incentives Started in 1990

	Increase	No Change	Total
Manufacturers	67%	33%	100%
Distributors	81%	19%	100%
Overall	79%	21%	100%
Lighting	89%	11%	100%
Air Conditioning	68%	32%	100%
Motors	81%	19%	100%
Overall	79%	21%	100%

Distributor Sales and Stocking Patterns

Some distributors located in New York State also serve market areas in New Jersey and Connecticut, while other distributors in New Jersey also serve market areas in New York and Pennsylvania. For this study, the largest distributors in New York State and adjacent New Jersey were surveyed concerning their sales patterns in New York State and outside of New York State for the specific types of motors, air conditioners and lighting. Overall, 25

of the 49 responding distributors were willing to disclose this information. The overall average was that 52 percent of New York distributor sales was energy efficient equipment, while only 39 percent of adjacent state sales were energy efficient equipment.

This comparison between New York State and outside state distributor figures can be further split among distributors of lighting, air conditioners and motors. The results, shown in Figure 3, again indicate that differences between current New York State and out of state shares of energy efficient products, which also hold when looking separately at sales patterns for each type of equipment, including lighting as well as air conditioners and motors.

Since adjacent parts of New Jersey do not have utility rebates for energy efficient equipment as prevalent as in New York State, the higher figures for New York State are consistent with the notion that rebate incentive programs among the state's major utilities did help create larger market shares for such equipment there, although other factors may also be at play.

Distributor sales patterns and stocking patterns may not be the same. Some types of products used for retrofit installation are routinely kept in stock to meet demand, while others are sometimes handled by ordering for delivery from the manufacturer. This is one reason why past surveys of equipment stocking patterns by dealers and distributors have not always shown the same trends and results as surveys of sales patterns. To examine this issue, New York State distributors were asked how the energy efficient portion of all equipment stocked by them has changed over the 1989 to 1992 period. The result was that 62% of the distributors reported an increase in stocking of energy efficient equipment over that period. The corresponding figures were 88% for lighting, 43% for air conditioning and 70% for motors distributors. This result on stocking charges can be compared with the corresponding information on sales trends previously discussed. Overall, it appears that the distributor comparisons of New York State with adjoining states provided stronger support for the DSM program impacts than the national comparison.

Finally, manufacturers and distributors were also asked to report the reasons why the volume of sales of energy efficient equipment had increased over the past three years. The results are shown in Table 2. The dominant reasons offered, in order of prevalence, were:

- Utility incentive programs;
- Increased awareness of energy conservation; and
- Higher energy costs.

These were reported to be the dominant reasons driving increases in both national sales and New York State sales.

Other reasons offered by smaller portions of the manufacturers and distributors were: improved products, increased stocking, more product available and changes in state and federal standards and codes.

Issues in Calculating Net Impact

Analysis Model Structure

The survey findings provided here illustrate the complexity of trying to interpret manufacturer and distributor data for the analysis of net program impact. The comparisons with national sales trends and with adjacent state distribution patterns are both subject to error and biases. It is thus clear that appropriate analysis must be based on a fuller conceptual model for explaining observed patterns and trends. This should provide a structure which can account for the various factors affecting trends in sales of efficient electrical equipment, including:

- Regional economic factors affecting the rate of population and business in-migration, which drive rates of new construction for commercial and industrial facilities;
- Demographic and income patterns affecting rates of home expansion and remodeling;
- National and regional economic factors affecting business profits and markets, which drive rates of business facility expansion and remodeling;
- Local and regional energy prices and equipment costs, which affect demand for retrofit replacement of equipment, as well as the relative influence of incentives; and
- Characteristics of utility information and incentive programs.

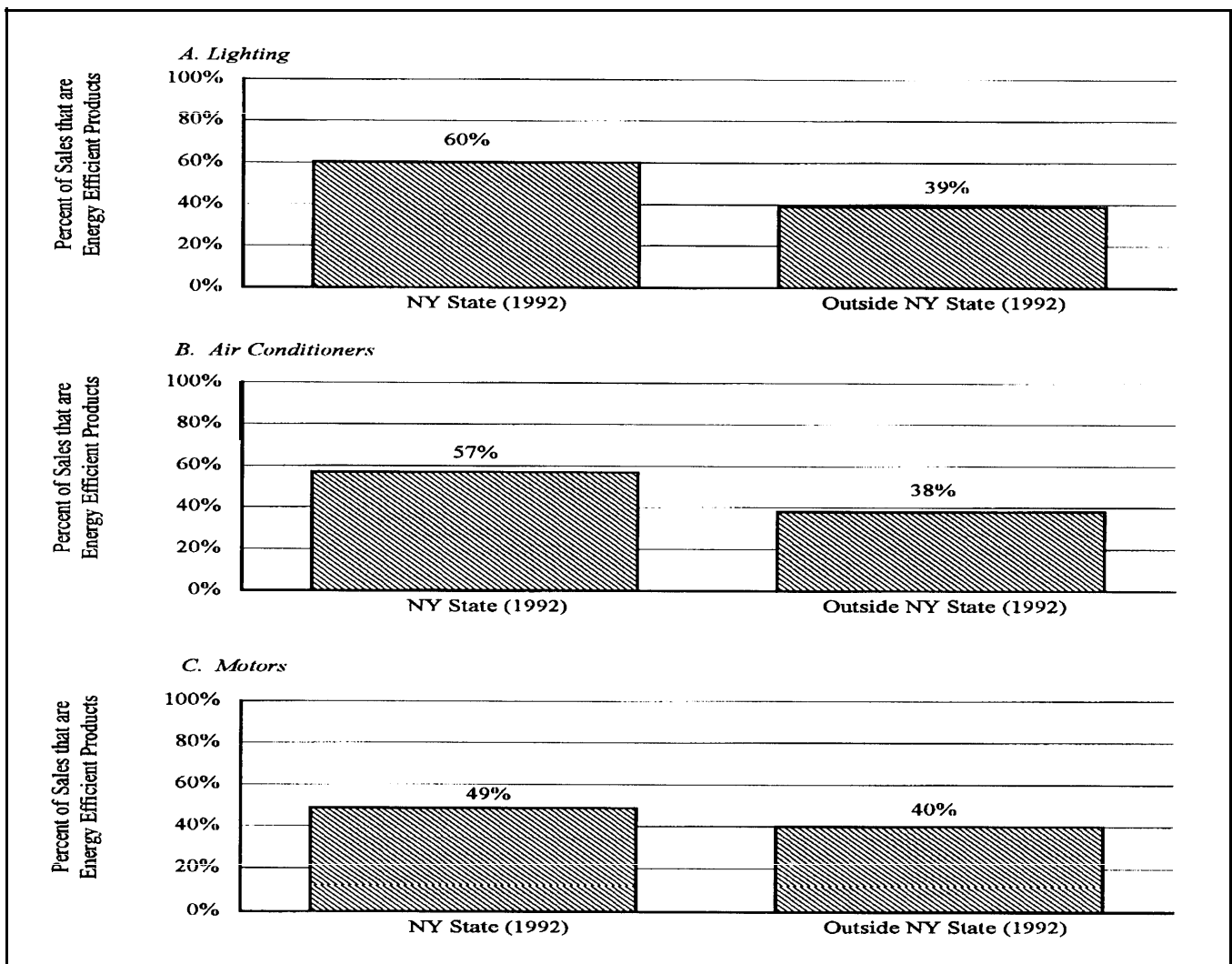


Figure 3. Product Breakdown: Inter-State Difference of Energy Efficient Products' Market Share of Distributor Sales* (Distributors Only)

Table 2. Reason Why E.E. Equipment Sales Have Increased in the Past Three Years (Among Those Reporting an Increase in National or New York Sales of These Products)

	Manufacturers (National Sales)	Distributors (NY State Sales)	Manufacturers and Distributors			Total
			Lighting	Air Cond.	Motors	
Higher Energy Costs and Cost Savings	28%	28%	35%	17%	33%	28%
Utility Incentive and Education Programs	72%	72%	60%	74%	87%	72%
Increased Awareness of Energy Conservation and Efficient Products	44%	30%	50%	22%	33%	34%
Increased Stocking	6%	2%	5%	0%	7%	3%
Improved Products and Warranties	11%	2%	10%	4%	0%	5%
More Product Available	6%	5%	10%	4%	0%	5%
Prices Have Come Down	0%	2%	0%	0%	7%	2%
Environmental Concerns and Regulations	11%	2%	10%	4%	0%	5%
Standards and Codes State or Federal	11%	2%	10%	4%	0%	5%
Economic Growth and More New Construction	0%	2%	0%	4%	0%	2%
Other	6%	10%	10%	9%	7%	9%

To identify overall net impacts of DSM programs, the analysis methodology thus needs to:

1. Track the share of total sales that is energy efficient equipment;
2. Compare how that share has changed over time;
3. Compare the trend with that of an appropriate comparison area;
4. Account for prevalence of e.e. equipment purchases within and outside of the incentive program;
5. Attempt to distinguish between new construction and retrofit impacts; and
6. Account for changes in regulatory standards and other factors affecting overall comparisons.

This approach focuses on relative rather than absolute changes in market shares. The reason is that absolute levels of equipment sales, and comparisons of those sales levels over time, are affected by economic cycles and shifts which are completely separate from the existence of electric utility programs to promote energy efficient

product sales. For that reason, there can be significant value to looking at the portion of total sales that is energy efficient equipment, rather than at the level of sales of such equipment. By examining portions of sales, we have standardized for exogenous year-to-year ups and downs in total sales levels affected by general conditions of the economy.

Lessons Learned for Measurement and Modeling

It is important to note that neither manufacturer nor distributor sales data can, by themselves, provide a basis to distinguish between sales of products for *retrofit use* and sales of products for *new construction use*. This can be roughly approximated only if the utilities routinely track new installations and have data on the total number of retrofits covered by their incentive programs.

In addition, the effect of electric utility incentives on relative differences in equipment costs between standard and energy efficient equipment, as perceived by customers, is affected by the form of marketing and delivery of incentives. If incentives are delivered to nearly all dealers or distributors, then nearly all customers will see a downward shift in the relative price differential between

standard and energy efficient equipment. Widespread marketing can also achieve this same effect for incentives that are delivered directly to customers in the form of rebates. In such cases, it is a straightforward process to attribute net shifts in the energy efficient portion of equipment sales to these programs (after controlling for changes in codes and standards). On the other hand, analysis is more problematic for evaluation of utility programs reaching only some of the customers purchasing new equipment. For those cases, some customers may be making purchase decisions based on an understanding of standard rather than utility-subsidized costs for energy efficient equipment. For analysis of free ridership, it is important to distinguish the portion of total sales of energy efficient equipment which was subject to utility incentives and the portion of sales of energy efficient equipment which was not subsidized by utilities. Utility program data and dealer surveys can be used to help estimate those factors.

Key Issues for DSM Program Evaluation

Surveys of manufacturers and distributors can be of value for estimating the net impacts of DSM programs. The value of manufacturer and distributor data is that they can provide information on how trends in the study area (New York State) differ from baseline trends (e.g., adjoining states for distributors, or national trends for manufacturers). This provides a potentially useful base of comparison for estimating the “naturally occurring conservation” rate, reflecting the underlying trend towards more energy efficient product sales as a result of technological change, price changes, public attitude changes and regulatory changes which may have nothing to do with specific utility DSM incentives.

The results of this survey as well as other past surveys conducted elsewhere indicate that there are very real limitations to the level of detail that manufacturers and distributors are willing to give out to surveyors. In general, we can successfully ask manufacturers and distributors to provide information about relative factors, such as the market shares of energy efficient equipment and general trends in sales for categories of equipment. Unfortunately, however, we cannot regularly obtain detailed data on sales volumes for specific types of equipment through normal survey channels. There may, however, be future opportunities to obtain more such data if initiated through more formal channels of agreements between either state agencies or utility industry representatives and the key manufacturers. EPRI plans for a national equipment sales tracking database can provide one means of pursuing this need.

It is also important to recognize that the success of using sales data alone for the analysis of net program impacts depends on the extent to which program effects can be cleanly isolated. As long as we do not have to separate the effects of multiple programs or multiple components of a single program, sales data can be an effective method for measuring overall impact. (This was illustrated in the case of B.C. Hydro’s specialized motors program for large industrial customers, in which there were no overlapping programs, no such programs in adjacent utility districts, and essentially complete saturation of information dissemination about the incentive program to the vendor and customer markets [see Nelson and Terries, 1993].)

Most fundamentally, however, even the most detailed pre/post and comparison group sales data will need to be used in combination with other survey data sources, and not alone. There are several reasons for this:

- As information programs, audit programs and financial incentive programs grow to overlap and affect the same customer base, it will become more difficult to separate the effects of each type of program and to distinguish influenced groups from non-influenced groups;
- As programs evolve and change over time, it will become more difficult to distinguish marginal impacts of new programs from cumulative effects of past program efforts;
- As DSM programs continue to evolve, it will become increasingly difficult and arbitrary to distinguish participant free ridership effects of specific programs from non-participant spillover impacts of other programs operating in the same or adjacent districts;
- As direct intervention programs and direct incentives to dealers and distributors become even more common, the definition of a participant will also change, as it will be the trade ally rather than the customer who is formally participating in such programs; and
- As DSM programs expand nationally, it will become increasingly difficult to identify appropriate comparison areas for establishing baseline trends.

As DSM programs bring about market transformation, traditional measures of free ridership and spillover will also become obsolete. For instance, as an incentive program helps transform the marketplace, what is today viewed as a spillover impact on non-participant sales (which is a positive contribution to net impact) can in the future be viewed as free ridership (a negative factor in net impact). That would, of course, be incorrect.

On the other hand, there is no need to separate the individual components of overall net impact or the specific impacts of individual programs in an overall package of programs, insofar as changes in overall equipment sales can be appropriately attributed to the DSM package. If it is desired to separate these effects, however, then additional customer survey data, interview data and/or on-site data will be needed to distinguish those elements. Future evaluation designs will have to incorporate redesign and rethinking of data collection and analysis methods to be sure to assess overall long-term impacts and not miss the forest for the trees.

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