Is Market Transformation Happening Right Under Our Eyes?

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This paper examines the results of surveys and focus groups to assess the extent to which homeowners have changed their practices and attitudes in regard to energy efficiency since 1990—a period that roughly corresponds to the advent of widespread utility demand-side management (DSM) programs. Sources examined include the U.S. Energy Information Administration's 1990 Residential Energy Consumption Survey (RECS), a wide variety of DSM program evaluations, and the results of focus groups of homeowners who participated in DSM programs offered by two Iowa utilities.

The conclusions drawn from this research can be summarized as follows.

- The proportion of homeowners who make energy efficiency improvements in a given year has increased since 1990, but this proportion remains fairly small.
- Participants in DSM programs clearly represent the *avant-garde* of any change in energy-efficiency attitudes and practices. They are clearly distinguished from the rest of the population in terms of practices, demographic characteristics, and levels of energy consumption.
- Program participants in the focus groups viewed energy efficiency improvements to their homes as standard operating procedure, and were motivated by environmental as well as flnancial and comfort concerns.

The implications of these findings for policy and DSM program design are discussed in the conclusion.

Introduction

Policy makers and analysts concerned with energy efficiency programs have recently turned their attention to their effects on the product and service markets they address. Examples of these effects, which are often referred to as "spillover," include the following:

- *Participant Spillover:* As a result of knowledge or experience gained through participation in a DSM program, customers spend their own money on purchases of additional efficiency products or services outside the confines of the program.
- *Nonparticipant Spillover:* Nonparticipants are exposed to information about efficiency improvements through program publicity, word of mouth, or product promotions associated with the program. As a result, some of them purchase the efficiency measure without using the program.
- *Market Effects:* Manufacturers, distributors, and retailers increase the efficiency of the products they sell or specify in response to opportunities generated by DSM programs.
- *Market Transformation:* Market effects persist over time as changes in the efficiency of products and services are integrated permanently into product lines and design practices. Alternatively, Prahl (1993) suggests that *market transformation occurs when DSM programs induce a lasting, beneficial change in the behavior of some group of actors within a market system.* This can refer to consumers as well as manufacturers and retailers.

Of course, many improvements to efficiency occur without any reference to DSM programs, public policies, or standards. Examples include the rapid penetration of microwave ovens in the residential market and the

substitution of double-paned windows for older models in the course of regular cycles of home improvement.

Analysis of market transformation is at a very early stage. Market transformation, by definition, is a process of change over time. One prerequisite for its analysis is, therefore, a clear picture of its starting point, or baseline. A thorough examination of the residential market baseline is beyond the scope of this paper. We focus on a few key aspects of this baseline which provide may provide points of departure for further research or energy program design. These aspects are:

- Baseline levels of conservation activity;
- Segmentation of the market by households' level of conservation actions and attitudes and the relationship between such segmentation and DSM program participation; and,
- Detailed description of the behavior and motivations of the most active segment of customers.

Baseline Rate of Conservation Activity

To assess the baseline level of conservation activity among residential customers, we compiled information from a variety of sources on the rate of adoption for various measures. We drew on two sources of data for this compilation: the 1987 and 1990 Residential Energy Consumption Survey (RECS) conducted by the U.S. Energy Information Administration, and a series of 1993 and 1994 surveys of nonparticipating customers, conducted on behalf of various electric utilities in the course of evaluating their DSM programs. The results of this compilation appear in Table 1.

Information Sources

Discussion of the figures in Table 1 must begin with a note on the sources. RECS is a nation wide survey of a multi-staged probability sample of housing units and their occupants. The survey is conducted, for the most part, in-person. It includes visual inspection and measurement of the dwelling unit and subsequent collection of energy consumption records for analysis in relation to household characteristics. The portion of the survey covering conservation behavior was changed substantially between the 1987 and 1990 rounds, so we had to impute some of the annual rates of efficiency improvements from differences between the 1987 and 1990 results in prevalence of certain features, such as caulking and weatherstripping. (Energy Information Administration 1989, 1993)

The nonparticipant surveys from which information in Table 1 is drawn were conducted by telephone with a random sample of customers who did not participate in current DSM programs. They cover only the service

Table 1. Annual Rates of Efficiency Improvements as Percentage of Potential Customers

			Results of Nonparticipant Surveys			
Measure	**RECS (1987)**	**RECS (1990)**	**MW Utility (1993)**	**ISU (1994)**	**ComElec (1994)**	**NE Utility (1994)**
Physical Measures						
Furnace Replacement						
Furnace Replaced	n/a	3.2	5.0	n/a	n/a	n/a
High Efficiency Used	n/a	2.7	2.3	n/a	n/a	n/a
Caulking	5.0	1.0	n/a	13.1	8.9	3.0
Weatherstripping	4.2	0.0	n/a	13.2	7.0	2.0
Attic Insulation	1.8	4.0	n/a	11.2	5.7	8.0
Clock Thermostat	1.0	2.8	n/a	n/a	6.5	n/a
Water Heater Wrap	1.6	n/a	n/a	3.2	6.5	5.0
Compact Fluorescent Bulb	n/a	n/a	n/a	16.9	7.3	4.5
Behaviors						
Winter T-stat Setback	34.1	54.2	n/a	n/a	49.0	n/a

territories of the utilities for which the evaluations were conducted. These utilities include Commonwealth Electric, which serves the City of Cambridge and portions of Southeast Massachusetts and Iowa Southern Utilities, now part of IES Utilities. (Full citations are provided in the references.) In two cases we were unable to obtain permission to associate the name of the utility with the results of the evaluations, which are pending review. These studies are identified in the table as Midwest (MW) Utility and New England (NE) Utility.

While the scope and methods of the RECS and nonparticipant surveys vary greatly, they are both subject to the same kinds of bias in regard self-reporting of energy efficiency measures and behaviors. First, respondents are likely to be motivated to over-report efficiency behaviors in light of the subject matter of the surveys and the expectations they imply. Second, it is difficult in the context of an interview to establish consistent definitions for such terms as "energy efficient furnace" or even "compact fluorescent light bulbs." Therefore, as absolute measures of activity levels or market penetration, the figures in Table 1 should be treated with caution. However, they are more useful as indicators of trends over time.

Trends in Conservation Activity

Taking into account the differences in scope and methods between the surveys, the figures in Table 1 suggest that there has been a general increase in the baseline level of conservation activities since 1990. For example, the 1994 figures for attic insulation are significantly higher than they are for the 1990 RECS results, even though the penetration of full attic insulation was 62.6 percent in the Northeast and 69.8 percent in the Midwest. (Energy Information Administration 1993) The rate of adoption for clock thermostats, caulking and weatherstripping also increased. Moreover, by 1994, a significant portion of nonparticipants had purchased compact fluorescent lamps, which were not widely available at the time of the 1990 RECS survey. Also on this point, evaluations of the New England Electric System's Residential Lighting Program conducted in 1992, 1993, and 1994 found that 17 percent of nonparticipants reported they had purchased compact fluorescent in the previous year. (XENERGY 1994)

Even though the percentage of households who undertake conservation measures in a given year appears to be increasing, this proportion itself is fairly small. For no single measure does it exceed 17 percent, and for most it is far less. Among nonparticipants interviewed for the CornElectric and ISU evaluations, approximately 15 percent had undertaken at least one physical measure in the past year. The longer term results of this activity are illustrated by Table 2, which shows relatively low penetrations for a variety of conservation measures.

Table 2. Penetration of Selected Residential Energy Efficiency Measures in Percent of Potential Customers

Measure	ISU (1994)	MW (1993)
Low Flow Showerhead	39.1	50.0
DHW pipe insulation	20.1	36.4
Hot Water Tank Wrap	25.3	18.9
Faucet Aerator	46.0	35.8
Water Heater Wrap	3.2	6.5
Compact Fluorescent Bulb	30.7	33.4

These results indicate that the vast majority of homeowners generally are not implementing conservation measures and that the segment of "active" homeowners is fairly small.

DSM Program Participants

Compared to the number of homeowners who have recently made efficiency improvements, the number of participants in DSM programs is higher. Among single-family homeowners who responded to the 1990 RECS, 6.5 percent reported that they had participated in a utility demand side management program in the past year. Based on records of utility DSM expenditures, this percentage is likely to have increased slightly between 1990 and 1993. (Hirst 1993) In 1994, many of the larger programs in the Northeast and West are being scaled back. However, a number of large utilities in the Southern, Midwest, and Midatlantic states are now bringing DSM programs on-line for the first time. So the annual participation rate of 5 to 7 percent may hold for some time. The point here is that DSM program participants represent a subset of the "active" homeowners.

It is by now a commonplace of energy program evaluation that participants differ in many systematic ways from nonparticipants. Virtually every study has found that, when compared to the population at large, participants:

- have significantly higher levels of education;
- have somewhat higher average income levels;
- are more likely to live in single family homes;

- are likely to live in larger houses, own more energy-consuming appliances, and use more energy than nonparticipants;
- are more likely to be in the 44 to 65 year age range; and,
- are more likely to be concerned with the environment.

The 1990 RECS analysis also found that, on average, participants in DSM programs who used electricity for space heating and central air conditioning used significantly less electricity than nonparticipants, after controlling for differences in housing and climate characteristics that affect consumption. However, DSM program participation is also associated with occupancy of newer and better-built houses. Using the RECS data, it is difficult, if not impossible, to establish the direction of causation between DSM program participation and greater efficiency of energy usage.

Focus Group Results: A Detailed Look at Program Participant Behavior and Attitudes

For the purposes of market segmentation, it is useful to view DSM program participation as an indicator of membership in the most highly motivated subsegment of "active" homeowners. The focus groups conducted with Iowa residential customers covered the following topics:

- attitudes that encourage their own investment in energy efficiency;
- inclusion of improvements to energy efficiency in the normal planning for improvements to their homes;
- level of knowledge about what can be done to their homes so that they make effective choices about what to do; and
- implementation of such investments in their homes.

Description of Focus Groups

The eight focus groups which form the basis for most of the findings in this section of the paper were fairly typical of other focus groups which have been used in process evaluations for utility DSM programs, except that they probably explored, in more depth, such issues as previous and planned behaviors, attitudes and knowledge about efficiency techniques and technologies, and the environmental consequences of using energy.

All groups were made up primarily of program participants from a specific geographic area within each of the two utility companies' service territories (Iowa Electric and Iowa Southern). Focus group participants were selected by randomly calling lists of participants for each of four program types until the desired number of people had agreed to participate. A total of eighty-one people participated in the focus groups. In addition, phone interviews were held with two or three trade allies in each location to provide a broader understanding of how the program operated in each locale and how trade ally attitudes and knowledge contributed to the success of each program.

All in all, the housing stock occupied by the participants was fairly old; most being at least 15 years old and many over 80 years old. The average house age for most group participants was 35-45 years, except for two groups where the average was 60 years. However, participants in most programs had only lived in their homes for 6-17 years, except that those in the audit program had lived in theirs about 4-6 years. Occupants themselves were generally in two to four person households with a median occupant age between 45 and 54. Most had college educations and household incomes between $25-50,000. There were more who had incomes over $50,000 than under $25,000.

Focus Group Results

This section discusses in depth what was learned about the four aspects of market transformation listed earlier. At several points throughout this discussion, there are statements such as a "majority of participants. . .or the primary..." On these issues, the eighty-one participants were asked to demonstrate their response with a show of hands and a tally was kept by the first author and the group facilitator. Tallies from each group were combined to develop such statements.

- *Homeowners Hold Attitudes that Encourage Their Own Investment in Energy EfFiciency.*

The primary motivation for making energy improvements and participating in utility programs was financial, but this was closely followed by comfort and such sentiments as doing the right thing as an expression of civic responsibility, leaving a decent heritage for future generations, and discouraging construction of more power plants.

Using utility programs to help pay for the efforts was seen as being smart about how they invest their money rather than the only reason for doing the work. Some even planned ahead to use an incentive when they moved to another home.

However, most probably would not have gotten the work done at the time they did without the utility incentive and indicated that they would:

- not have purchased the equipment or made the improvements at all;
- bought a cheaper/less efficient appliance (though not the least efficient); or,
- waited until the unit absolutely had to be replaced or utility costs seemed high enough to warrant making a change.

Virtually all focus group participants had been contemplating improvements prior to participating in the specific utility program. The rebates prompted them to take action in a specific time frame.

> "... I was basically looking at remodeling our house and one of the things I wanted to do was get rid of the chimney . . . and as soon as I went in [to a contractor] and looked at the pulse furnace I was told about the rebate program."

There were two aspects to participants' interest in saving money. Audit participants particularly were experiencing high bills and were looking for ways to reduce them. They were also looking for ways to reduce the capital cost of insulation. The perception of the auditors interviewed was that most people signed up upon receiving notice of the program because they felt their bills were too high and they wanted to know the reason for this.

While customers appreciated other program elements (the free audits and materials), these alone were insufficient to motivate participation.

> "I doubt if I would have [installed insulation] because we really weren't unhappy with our utility bills the way they were . . . so without the audit, we probably would never have been aware that we needed more insulation, and.. the fact that they paid for two-thirds . . made it a real easy decision for that amount of money to go ahead and have it done."

> ".. the support from the power company to offset the cost of the ground source loop, that's what the cost difference is for this type of equipment. And it was down to the point where we knew we was going to be faced with replacement relatively soon..."

Aesthetics was also a concern for some people, and one reason they might not undertake some of the more visible energy improvements.

> "...1 guess I'm too concerned about aesthetics; I'd like to put more energy-efficient doors but I want them to be wood and.. .to have windows with real panes...to look like a 1920's door...Things that really look nice . . . aren't efficient, or if they are, they're very expensive."

When asked how they felt about the amount of money they paid for energy, most felt what they paid was reasonable and thought that 2-3% of their monthly expenses went for utility costs currently, though some indicated as much as 10% during the winter. People generally felt they should not have to pay more than 2-5% of their monthly budget for energy, taking into account a wide range of incomes, seasonal variations and house sizes. A few felt they were willing to relatively low pay whatever it took to be comfortable. Some saw the price of utilities as something taken too much for granted.

When asked if it was important to them to reduce the amount they paid for home energy use each month, some said yes (especially those who were retired) and outlined the things they did to reduce use, but the majority did not see this as a major issue. Most of the types of things people did were behavior changes such as: keeping the thermostat lower or higher depending on the season; getting the family to turn off lights; turning the air conditioning off; and shutting the heat/air conditioning off when gone for an extended period. Some had converted to gas. Quite a number indicated that managing their thermostats had become automatic behavior for several years. A few indicated that they felt it was better to invest in more substantial work or new equipment than take small energy saving steps.

> "Well, you're conscious of it, I think, you get the bill and it's like oh, God, we have to do something, and you think about it when you use things like—"

A secondary, but powerful motivator for many participants was the sense that by participating in these programs they would contribute to the delay, and preferably avoidance, of building a new power plant.

> "... one of the main things that helped me decide to do it [participate in a cycling program] was... if our consumption goes too high and they have to build another production unit. . that's going to make everything higher as far as energy rates and I'd rather conserve than have to build another plant."

It has been theorized that people might undertake more efficiency improvements for environmental reasons than to save energy or money (Kempton, 1993). A series of questions explored this approach.

Very few participants saw any connection between using energy, electricity in particular, and causing environmental damage, or that reducing electrical use could have a beneficial impact on the environment.

> "...It also depends on what appliance you're talking about too, because some of them—how are they going to affect the environment?"

> "...I guess I'm not aware enough of what kind of effect energy efficiency has on our environment, being energy efficient, you know. If you were aware of it, it would be more of a concern maybe..."

Most people did, however, express concern about the state of the environment and probably a guilty conscience about not doing enough to protect the environment. Their primary concerns had to do with the state of the world they were leaving to their children and grandchildren.

When asked to rank cost, comfort and the environment, the environment rarely came in first, but it often came in second, with comfort or cost persistently in first place. For many this had to do with a perception that it was very costly to be environmentally conscientious.

Interestingly, a few participants were convinced that the government is watching out for the environment, so they didn't need to.

> "... I think the government is enforcing laws concerning environmentally safe things, so we really don't have to be that concerned about it."

- *Homeowners Include Improvements to Energy Efficiency in the Normal Planning for Improvements to Their Homes*

From the comments made at these focus groups, it would appear that investing in energy improvements has become an accepted aspect of home improvement, but that this is done on a gradual basis with some people indicating that they began taking action years ago and continue to do so in the present. Other studies have noted a greater tendency to undertake improvements on recently purchased homes (Kempton and Neiman 1987). Some typical comments regarding this were as follows.

> "Yes, every year I try to improve things for energy. My home is insulated well and I put jackets on the water heater, and the outside of the house . . . and, I have good windows and extra-good doors so air doesn't leak in, fuel-efficient furnace and I try to make sure that, every year I do something to improve the efficiency."

> "...I've had ISU come in and do an energy audit several times over the 17 years; tried to follow the basic simple suggestions they had."

- *Homeowners are Knowledgeable About What Can be Done to Improve the Efficiency of Their Homes*

All participants had some understanding of energy efficiency. All were convinced that there are merits to being more efficient. Across the eight groups fourteen different types of energy improvements were made to homes generally categorized as attic, crawl space or basement insulation, replacement of doors, replacement of windows or addition of storm windows, caulking, addition of insulated siding, water heater wraps, attic ventilation, whole-house fans, pipe insulation, closed in porch, weather-stripping and addition of outlet covers.

However, many were not as knowledgeable about the financial aspects of saving energy.

> "Then he showed about how much you would save on this and this and this and this, and we were just amazed-I don't know if it was really true, but it sure sounded good. But it made you realize how much caulking may do."

Lack of customer knowledge about capital investment costs and potential financial rewards is further confirmed by the program auditors who stated that customers do not have a very good idea about what energy improvements for their homes should cost. Many appear to overestimate them, and so don't even consider undertaking those improvements until an auditor provides them with better information.

The primary reason focus group participants gave for not insulating their homes, even when they knew what needed to be done, was lack of funds.

Though they were aware of the options, participants were less likely to have purchased energy efficient equipment than to have made other types of improvements to their homes. Among those who did purchase equipment, the most common were: new furnaces, new air conditioners, new water heaters and ceiling fans.

In trying to determine just how knowledgeable participants were, they were asked what comes to mind when they hear the words energy efficient, all groups came up with quite a laundry list, the primary themes that emerged were:

- Purchase more efficient equipment: light bulbs; replace current equipment with more efficient equipment

when the time comes; insulate; yellow stickers; equipment longevity; use more gas appliances.

- Use resources more wisely: cut back on things you can cut back on; maximum effect for resources put in; won't have to build bigger plants; won't be any left if we don't save now.

- Get the most for the least: best cooling/heating product for the money; get the job done with less energy but the same level of service; save money on bills; more comfort at less cost.

People turn to a wide variety of sources for energy improvement information, with a heavy reliance on TV or local sources such as home shows, local contractors, newspaper columns and the extension service. Utility companies were rarely mentioned as a source of information.

While consumers are knowledgeable about a wide range of actions and technologies that can be used, there appears to be little sense of those things that make the greatest difference or about the most current technologies.

- *Homeowners Actually Make Energy Efficient Investments in Their Homes.*

Almost all participants indicated that they had made numerous efforts to make their property more energy efficient prior to participating in utility programs. And, they took additional action on their own after they had participated in programs.

While savings on the utility bill was reported as the primary motivator for taking these actions, when asked how much they had saved, most people had no idea and generally indicated that the higher comfort they experienced was what they liked best about the improvements. Another major motivator for investing in insulated siding was to reduce the effort of house painting and maintenance.

Those who reported noticing utility bill decreases perceived everything from slight bill reductions up to 30% lower bills. Participants were more likely to notice a variety of other things such as less noise, better heat or cooling distribution, different equipment run-times, fewer allergies, fewer drafts.

The majority of people in all groups had made some type of energy improvement prior to participating in the specific program that was discussed in the focus group. Most people had only done one or two things, but a few had done many things to their homes. Several mentioned that they had lived in several homes during the years and that improving the efficiency of homes had always been a priority for them.

Participants continued to make improvements after they participated in programs. The types of improvements mentioned most often were:

- purchase of efficient light bulbs;
- wrapping old water heaters;
- set-back thermostats;
- enrollment in other utility programs;
- crawl space/basement insulation;
- timers on freezers;
- attic insulation;
- caulking; and
- addition of storm doors, new entry doors.

One final finding of interest was that participants in the focus group generally rated their knowledge of energy efficiency and the efficiency of their home as only average, despite the high level of interest and activity evinced in their responses to the focus group.

Conclusions

Though it is risky to make broad statements on the basis of a few focus groups and a potpourri of surveys, we believe that the findings presented above suggest the following hypotheses for further research and consideration in future program design.

- Twenty years after the first modern energy crisis and five years into the DSM era, the proportion of homeowners who regularly make efficiency improvements continues to be small-perhaps one-quarter to one-third of the market. However, this segment has grown modestly over the past five years.

- Participants in DSM programs represent the most active subgroup of the "active" homeowner segment. However, homeowners who are likely to participate in DSM programs may be shrinking as a target of efficiency opportunities. First, they are already using energy more efficiently than their peers. Second, their ranks are not growing. One symptom of this is reports of high levels of repeat participation in rebate and even audit programs. For example, a recent lighting program evaluation found that 27 percent of 1993 participants had purchased compact fluorescent through the program in the two previous years. (XENERGY 1994)

- Homeowners' attitudes do tend to encourage them to make investments in energy efficiency, but the primary motivators have not changed since the mid-70 s—reducing utility bills and increasing comfort.

- Homeowners do take efficiency improvements into account as part of their normal repair and replacement activities. However, these activities are all moderated by the capital available to make any improvements at the time.

The implications of these findings for future energy program design are as follows.

- Programs that rely on voluntary participation may reach saturation after a few years. Programs that stress market transformation strategies, such as working with manufacturers and distributors to increase the availability and reduce the price of efficient appliances will likely gain in importance.

- New appeals to voluntary participation need to be found to reach the 75 percent of customers who never participate in DSM programs or undertake efficiency independently. These may include convenience (e. g. only having to change a compact fluorescent bulb once every nine years).

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