

METHODS FOR MEASURING MARKET TRANSFORMATION

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Introduction

Market transformation is emerging as a central objective for energy companies and for publicly funded energy efficiency programs. In both cases, the competitive environment will require creating new products and services and gaining widespread acceptance of those products and services in the market place.

This paper addresses three market transformation issues. The first is to briefly summarize current efforts to assess the impacts of energy related market transformation programs and policies and to identify gaps in these approaches. The second is to point readers to a very substantial set of literature on the diffusion of innovations that is directly relevant to assessing markets and the impact of market transformation efforts. The third is to identify how some of the methods from the more general diffusion literature might be applied to energy related market transformation programs.

Background

Although changing markets for energy efficient products has been a goal for many organizations and companies for years, the use of the term market transformation in the energy literature is of fairly recent origin. Papers with market transformation in their title began appearing with some regularity in the 1993 and 1994 time frame (refs. 4, 10). According to Schlegel and Gordon (ref. 13), market transformation initiatives are strategic efforts to induce lasting structural and behavioral change in the markets for products and services. The goal of market transformation is to produce new patterns of "business as usual" for all actors in a market place.

There are probably several reasons why an interest in market transformation has occurred. One probable reason is the desire to increase the effectiveness of demand-side management programs. At least through the end of the 1980s, demand-side management focused primarily on end-users. In the late 1980s and early 1990s, large numbers of practitioners in the field began to recognize the need for partnerships and alliances with other market actors to amplify their efforts. This led to a closer examination of market structures and to looking for ways to intervene in markets more broadly and for alternative points of intervention.

Also in the very late 1980s and early 1990s, the notion of increased competition was being discussed and the use of incentives, which had been a mainstay of many de-

mand-side management programs and the bane of the existence of many utilities, did not necessarily fit well with a competitive future. Strategic interventions in market places with other market actors potentially seemed to be a way to reduce reliance on incentive mechanisms and represented a cost effective strategy for achieving desired ends. Further, market transformation called attention to the regional and national scale of markets and the need for cooperation to influence change in markets at these levels.

More importantly, the move toward competition in the mid-1990s meant the commoditization of energy at the wholesale level and potentially the retail level. In a commodities environment, regulations are no longer a factor and energy suppliers are motivated chiefly by the bottom line. Alternative goals representing public goods that were important in the regulated environment, such as reducing dependency on fossil fuels for national security reasons or reducing air pollution, become motivators only when they can be instrumental in affecting the bottom line. This is why Eto et. al. (ref. 2) suggest that market transformation is a "central policy objective for future publicly-funded energy-efficiency programs in California." In the absence of corporate drivers, the public goods aspects of energy efficiency become a public responsibility.

There is a danger that "market transformation" will become a code word for publicly funded energy efficiency efforts. This would be unfortunate. Market transformation has to do with the process for changing the mix of products and services that are available to customers. Energy efficiency is one characteristic of a product or service. The process of market transformation and its effectiveness is a general issue and not an issue tied solely to energy efficiency.

Market Transformation in the Energy Literature

The market transformation literature in the energy field has primarily focused on methods and case studies. The case studies have been oriented to documenting shifts in the markets for key products and documenting the extent to which the demand for products has changed. There are now numerous case studies and summaries of case studies (refs. 3, 8, 14, 15) that describe penetration of products and services into markets and shifts in markets.

A key issue is the extent to which market directed change efforts have actually influenced markets. Programmatic efforts directed at changing markets and actual changes in markets are often temporally related but correlation is not causation and there are often other confounding factors that can just as easily explain some or all of the changes. Perhaps Suozzo and Nadel (ref. 15) summed up

the current experience best when they said, “the examples presented in this paper provide evidences of shifts in the markets for key products . . . Although it is difficult to attribute particular market shifts to specific policies or programs . . . [and] it is not always clear whether these shifts would have occurred in the absence of the market transformation activities . . . [Also,] it remains to be seen if the shifts are sustainable.”

There are several reasons why the linkages between programs and transformation efforts have been difficult to verify. One of these has been the difficulty of measuring key outcome variables, for example, changes in sales. The assumption is that market transformation efforts can be linked to changes in sales and the changes in the patterns of sales. Early on, there was interest in defining distribution systems and tracking sales through the distribution systems (ref. 16). Obtaining sales data proved less tractable than many thought (refs. 7, 8, 17). Some sales data are available at the national level so that it is possible to track national trends at very aggregated levels.

With the increased competitive pressures within the economy as a whole, these data may become less available. Further, for a variety of reasons national sales data cannot be disaggregated to regional or service territory levels. This limits their usefulness for determining the effects of programs at regional, state or service territory scales. The development of sales tracking systems at distributor levels have largely foundered on the ability to gain participation of adequate representations of distributors. The Wisconsin Motors Study (ref. 9) and its successor study did show that distributors could and would provide estimates of changes in sales as opposed to actual sales data. Thus, the prospects for the use of sales as an outcome variable can be summarized as follows:

- Except at the national level, manufacturer’s sales data are not available and/or are not likely to be available so that an analysis of transformational effects at the geographic scales of interest can be completed.
- Sales data for specific models of products are difficult to obtain from distributors and wholesalers. Distributors are reluctant to divulge such data. Further, distributors’ data systems are not designed to effectively track efficient products and services.
- Wholesalers and distributors can provide reasonable estimates of sales based on their understandings of their markets. Tracked over time these can indicate how markets are changing.

Another issue has been to determine which dependent variables to track (ref. 17). In modeling the diffusion of high efficiency furnaces in Wisconsin, Prah1 points out that the indirect effects of contractor awareness and pro-

motion may have outstripped the direct effects of rebates and low income grants by a factor of 3 to 1.

This really leads to what is perhaps the most important point with respect to the energy literature on market transformation. It appears that program efforts and attempts to assess market transformation largely have been atheoretical and descriptive. While it is possible to point to programs that appear to work, the lack of theory means that there is a lack of good explanations for why programs work that could be used to focus implementation efforts and improve productivity. Further, since explanations for how programs work are lacking, it is difficult to know what and where to measure in order to demonstrate program effectiveness.

There are some notable exceptions to this lack of theory. For instance, Prah1 (ref. 10) provides a typology of market actors and behavior changes that can be used to identify specific types of behavioral changes which would be indicative of changes in markets in the absence of sales data. More recently, Eto, Prah1, and Schlegel (ref. 2) have produced a graphical tool for analyzing market effects. The tool relates market actors, market effects, and market barriers to program stimuli. This graphical tool is very similar in structure to the performance spectrum and program logic models that have evolved out of the evaluability assessment work done by Wholey (ref. 18) and others.

The primary problem with the Prah1 and Eto, Prah1 and Schlegel approaches is that they largely focus on measuring outcomes (Table 2-1 in ref. 2) with somewhat less attention to process. We can measure outcomes and the outcomes may show changes in the structure of markets which may be program driven, but they do not show the results of other factors that are at work in the market place.

Market Transformation and the General Literature

The term market transformation is not as pervasive in the general academic literature as it is in the energy literature. In the general literature, people are more likely to use the term “diffusion of innovation” than “market transformation.” Rogers (ref. 12) defines diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system.” Notice how closely this definition parallels the definition of market transformation. For instance, Prah1 (ref. 10) says that “market transformation occurs when DSM programs induce a lasting, beneficial change in the behavior of some groups of actors within a market system.”

Both the Prah1 and Rogers definitions emphasize operating on systems to effect changes. Rogers uses the term social system of which market systems would be a subset. Rogers emphasizes that change takes place over time. Prah1 suggests that the change is lasting and beneficial. Rogers presents this point differently claiming that change lasts until a new innovation comes along or until

the adopters discontinue the innovation. Also, Rogers does not necessarily see change as beneficial pointing out that change efforts often have unintended consequences that may negatively affect the target system. Rogers' concept of the diffusion of innovation is a more general concept of market transformation that is more open about the consequences of change than Prahl's.

Unlike the energy based market transformation literature, studies of the diffusion of innovations (market transformation) have been around in various guises and for a multiplicity of disciplines since at least the early 1900s. A recent survey of the literature (ref. 12) located and classified almost 3,890 publications dating from 1920 dealing with the diffusion of innovations. This literature has been generated in diverse fields such as sociology and rural sociology, anthropology, education, public health and medical sociology, communication, marketing and management, geography, and general economics. These disciplines have addressed changes such as inducing farmers to plant hybrid seed corn and miracle crops such as rice, encouraging the adoption of family planning, getting doctors (pharmaceutical companies) to use new medicines and new treatments, selling innovative new technologies, etc.

Thus, while the energy based market transformation literature lacks solid theoretical underpinnings, the diffusion of innovation tradition has an extremely rich empirically based literature that provides a solid theoretical foundation for defining practical and effective market transformation programs and for examining the impacts of market transformation efforts on markets. Unfortunately, this literature seems to have been largely overlooked in the current flurry of energy technology market transformation publications. None of the energy based market transformation literature reviewed for this paper contained direct references to this substantial tradition. Ironically, in the early days of the energy conservation movement (late 1970s and early 1980s) the diffusion literature was the basis for a number of studies and programs.

Although it is not possible to fully review that literature here — that would take books and has already been done (Rogers, 1995) — a few of the major points from that literature might be usefully summarized.

The number of people adopting an innovation (for example, e-glass, electronic ballasts, microcomputers, cell phones, fax machines) is approximately normally distributed around the average length of time for people to adopt a particular innovation (a bell curve). If the number or percentage of adoptions is accumulated through time rather than reported as a distribution, the result is an S-curve. The adoption of innovations almost always follow an S-curve. The adoption of an innovation may reach a limit which may be considerably less than 100% of the potential market before discontinuance begins.

This literature identifies two primary modes of diffusion for new products and services. Early adopters learn

about an innovation directly through change agents (a utility marketing representative, for example) and / or information and media channels and make their decision to adopt an innovation on the basis of that information. However, the vast bulk of the adoption of new innovations is driven by the exchange of subjective evaluations of the innovation among peers. Thus, a significant factor affecting the rate of adoption of innovations is the degree to which an innovation penetrates social networks.

The Bass Model (ref. 1) allows one to predict the shape of the S-curve (cumulative adoptions) based on early adoptions, pilot launches of a product, or judgments based on the knowledge of similar product launches. The parameters in the model are a coefficient of mass media influence, a coefficient of interpersonal influence, and an index of market potential. The S-curve can be estimated by fitting a second order polynomial to the first few points of a time series representing the initial levels of penetration and using the resulting coefficients for the terms of the polynomial as a basis for estimating the parameters of the S-curve (ref. 6). The Bass Model and variations of the model based on different assumptions have been widely used and tested (ref. 5).

Critical mass is the point at which enough individuals have adopted an innovation so that the adoption process becomes self-sustaining. This is probably what Schlegel and Gordon (ref. 13) mean when they suggest the goal of market transformation is to produce new patterns of "business as usual" for all actors in a market place. This point often occurs when 10 - 20% of the target population have become adopters and the peer-to-peer communication processes predominate in terms of the adoption mode.

Figure 1 illustrates a widely accepted model of how the diffusion of innovations operates (ref. 12). Basically the model says that in order for target audiences to adopt a new innovation they must become aware of the innovation. Once they are aware of the innovation, they enter a persuasion stage in which they seek and process information about an innovation and weigh the potential of innovation in relation to their current practice. Based on this they make a decision about whether to adopt. The decision about whether to adopt is then implemented. Finally, people confirm their decision subsequent to making it. This may result in discontinuance of the adoption. To the left of the model there are some significant contextual features that influence adoption.

Notice that awareness of an innovation may precede the decision to adopt by months and years. For example, Rogers (ref. 12) has a graph that shows awareness preceded the adoption of hybrid seed corn by about 1.7 years for early adopters and by as much as 3.1 years for later adopters. Further, the decision to adopt and to implement the decision are separate acts and they also may be separated in time (ref. 11).

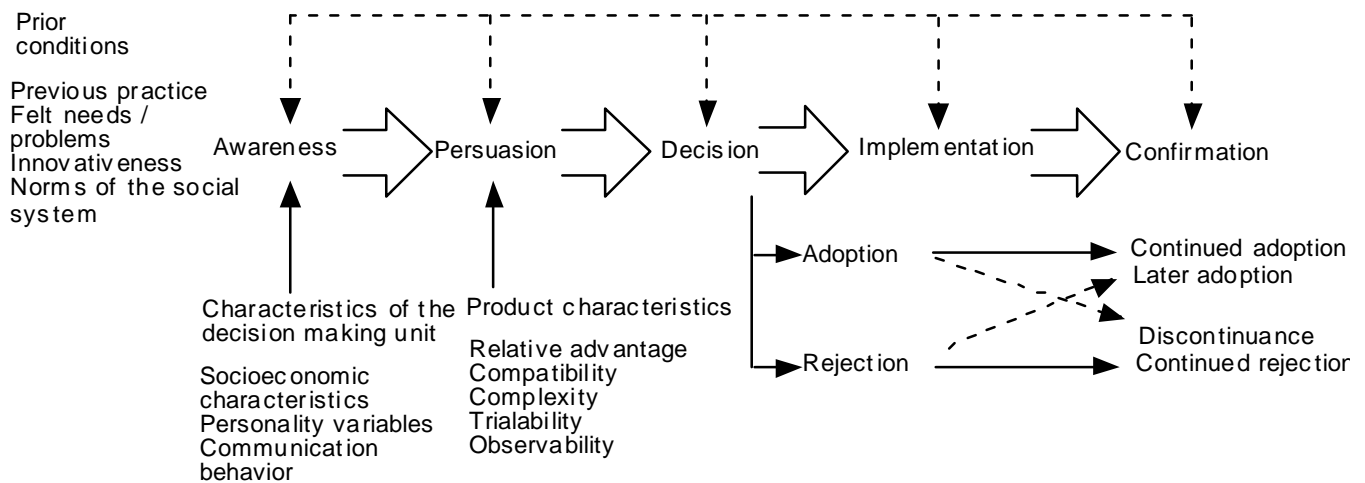


Figure 1. Model For Adoption Of An Innovation (Ref. 12)

There are several variables that determine the rate of adoption. These are the attributes of the innovation, the type of innovation decision, the communication channels, the nature of the social system, and the extent of the promotional efforts. The attributes of innovation include relative advantage (for example, initial cost), compatibility (with existing culture and practice), complexity, trialability, and observability.

Decision types include optional, collective and authority (for example, regulatory). Communication has to do with whether information flows through media or interpersonal channels. Culture, norms, and degree of interconnectedness of networks relate to the social system.

Because networks are a key in the diffusion process, it is important to understand how diffusion of innovation occurs within and between networks. An innovation is likely to diffuse through a social network once the opinion leader(s) within the network have adopted the innovation. The early adoption of an innovation by a social isolate(s) within a network is not likely to lead to further adoption by other members of the network. Diffusion of innovations across social networks occurs when someone having membership in two or more networks is respected but has weak ties (not the same as an isolate) in both networks. Such persons become carriers of innovations between networks.

Another strand of research that is important in the energy arena deals with innovation in organizations. The early general literature focused on characterizing people who were innovators. There is a parallel literature on the characteristics of innovative organizations. Attempts to identify the characteristics of innovative organizations have not been very productive (i.e., the correlation of key characteristics with innovation are universally low) and that line of research is no longer actively pursued. The key finding from that tradition is that large organizations are more innovative than smaller ones. This runs counter to widely held beliefs.

More recent research has focused on the innovation process within organizations. This line of research deals

with how interest in innovations is initiated, how organizations may match innovations to their needs, how the organizations restructure innovations while internalizing them, how organizations clarify the innovation and how they routinize the use of the innovation. This latter approach has proven more productive.

Methods For Measuring The Effects Of Market Transformation

This review of the general literature suggests a number of methods that can be used to evaluate market transformation in the energy field. The value of these methods is more likely to lie in the evaluation of future trends rather than assessing the impacts of past programs. Given a framework, future evaluations will be able to systematically collect data, maintain data in databases and project trends into the future. A key problem with the evaluation of past efforts has been the availability of systematic data.

Using the Diffusion Model to Track Market Transformation

One of the values of the diffusion model in Figure 1 is that target audiences can be tracked through the adoption process. The target audiences can be end-users and/or even intermediate or high level players within markets. By using a series of surveys and repeating questions aimed at determining the stage of adoption through time, the relative percentages of a market segment in each stage of adoption can be tracked. This is an old technique but a useful one none-the-less.

The model is also important because it helps to focus attention on what to measure. Evaluations of marketing programs often focus heavily on measures of awareness and knowledge. Typically, market evaluators have been less careful about separating the persuasion stage from the decision stage and the decision stage from the implementation stage. Questions concerned with the persuasion stage need to ask if: potential adopters have

thought about adopting the technology, they have sought more information about a product or service, they are paying attention to reports in the media or elsewhere about a product or service, or, they have initiated a discussion about a product or service with others or asked for the opinions of others.

The issue is whether they have moved from awareness to more active consideration of a product or service. For example, if a program goal is to increase the number of dealers promoting a technology with their customers, it would be useful to determine if dealers have entered the persuasion stage. This might be done by asking dealers if they have explored some of the ramifications of promoting the technology by talking to customers, have searched for sources of information that could be conveyed to customers, or have discussed the idea with a manufacturer's representative or other dealers.

Likewise, the decision to adopt needs also to be carefully explored. Representatives of target segments who haven't yet adopted or purchased a product or service might be asked if they have decided whether or not to adopt or purchase a product or service. It should be kept in mind that the decision to adopt may be either positive or negative. Thus, questions of potential adopters must allow for this contingency. Also, those who have made a decision can be asked when they made their decision. Those who say that they have decided can be asked when they think they will actually purchase or implement a product or service and what will influence the timing of their purchase. A decision not to adopt may be implemented by doing business as usual. Keep in mind that the model allows for confirmation and discontinuance of adoption decisions. The actual adoption and implementation of an innovation may actually follow a sequence of persuasion stages, decisions not to adopt, and confirmation of the decision not to adopt until one reaches a point of discontinuing the original decision and decides to adopt.

The Internet provides a good illustration of these points. Awareness and even knowledge of the Internet is very high among the general public. Many people are in the persuasion stage in terms of obtaining and evaluating information about the Internet. At a practical level the authors are constantly included in conversations about the Internet, what one needs to use the Internet, and who the best / cheapest suppliers may be. These are signs that people are in the persuasion stage. We also hear people say they are going to "get Internet service as soon as . . ." This is a clear indication of a decision to adopt which hasn't yet been implemented. Then, there are the many who have already implemented. Their conversations are about the best services and probably are aimed at confirming their decisions. There are more than a few adopters who have already discontinued for a wide variety of reasons.

With some well timed surveys from which to derive numbers and rates of change, one can make predictions

about the adoption of a technology. One of the values of monitoring the progression of a population segment through the stages of adoption is the ability to determine if a marketing program is synchronized with the stages of adoption for the target population or segment. If awareness is high but activities are oriented to awareness rather than persuasion or implementation, the program may not be very effective. Another value of monitoring the progression of the population segment through the stages of adoption is that after a few measurement periods, it is possible to predict both awareness and implementation based on the S-curve. Programmatic activity can be related to changes in those curves.

Observing Social Networks to Monitor Market Changes

A major key to both implementing a market transformation program and determining its effects is understanding the structure of the market network. The structure has to do with the positions of participants in the market and how they relate to each other. It is vitally important to understand the formal structures, i.e., the formal contractual relationships among the participants, the informal business arrangements, and the social networks. The assessment of market transformation efforts in the energy arena have been focused almost entirely on the formal structures and the informal business arrangements. There have been a number of studies that provide descriptions of market structures (for a generic attempt see, ref. 16) such as the one in Figure 2 which describes the Wisconsin motors market. This structure represents both formal and informal links. We can see a link between manufacturers and distributors which typically represents a formal contractual link. We also see a link from distributors feeding back to distributors representing an informal business linkage in which certain types of distributors obtain stock from other distributors before selling to end-users.

What is not shown in this diagram and what is missing from most studies of market transformation is the social networks. For instance, the data from the motors project showed that there were different networks with different opinion leaders within each network. Distributors who sold new motors and rewound motors had different associational affiliations than those who only sold new motors. Opinion leaders may or may not be promoters of efficient motors and their opinions and their approach to their business may significantly influence other distributors, both those who sell the same brand(s) and those who sell other brands.

Likewise, there are social networks among end-users. Each target group will have its own set of social networks and opinion leaders. Key decision makers in firms may have very diverse network affiliations. It is important to engage a wide variety of networks to reach decision makers. The chances are high that if opinion leaders are engaged, market transformation will proceed rapidly. If they are not, it is quite likely that transformation will lag.

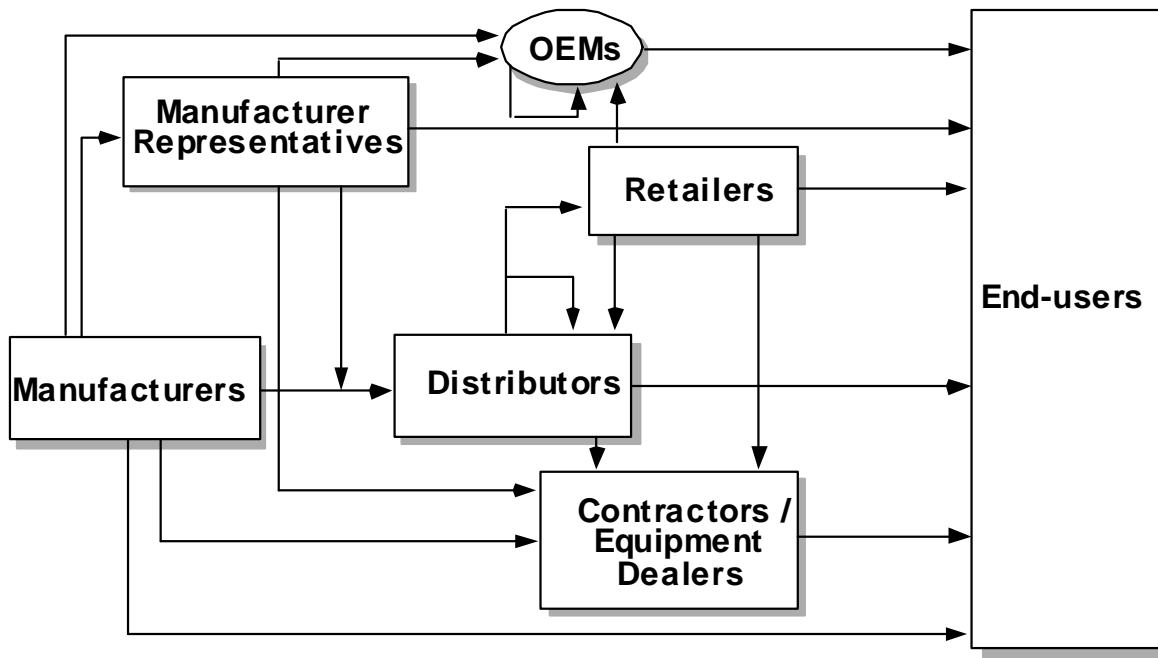


Figure 2. Market Structure of the Wisconsin Motors Market (ref. 9)

Thus, a potentially important measurement strategy for determining the effectiveness of market transformation efforts is:

- to identify the social networks within the various segments of markets;
- to determine who opinion leaders are in those segments;
- to determine the position of the opinion leaders vis-à-vis the desired market change and whether they may adopt the innovation

If opinion leaders in networks are not being reached, then it is unlikely that transformation efforts will proceed rapidly.

Establishing Performance Expectations for Market Transformation Strategies

We are not blind with respect to what the impacts of different market transformation strategies might be. Tools such as the Bass Model described above can be pressed into service to predict impacts. However, in order to use the Bass Model or one of its derivatives, information is needed to construct a coefficient of mass media influence, a coefficient of interpersonal influence, and the index of market potential. In turn this requires a systematic description of the program. In order to do that we need to know the plan, we need to know the timing, and we need to understand the product and services.

Given the plan and knowledge of the implementation of the plan, we can develop estimates of parameters for the Bass Model to predict the results of market transformation efforts. We can also predict what would have happened in the absence of an implemented market transformation plan.

Being able to estimate the Bass Model provides us with at least two ways to evaluate market transformation. In the initial stages of the transformation efforts, we can define alternative market transformation plans and strategies, and we can use models to evaluate the potential effectiveness of plans. In effect, we can conduct a type of portfolio analysis to assess the best strategies.

As market transformation efforts are implemented, we can track the results of the implementation to see if the results correspond to the projections. The models provide us with the potential for a baseline, that is, what would have happened in the absence of the plan, a set of expected outcomes, and, if we monitor results, the actual outcomes.

The market transformation question typically gets asked in a fairly general way. For example, what has been the impact of utility efforts to promote efficient lighting? As a result, evaluators have been fairly lax about describing and understanding program mechanisms in detail. To some extent programs have been treated as a black boxes. If we are to model the effects of programs, we will have to spell out a very clear sequence of goals and levels of activity tied to a time frame and identify the expected outcomes of program activities. Most programs tend to be more ad-hoc and event driven than this approach implies. That being the case, it is extraordinarily important to track and record program events so that projections can be made and modified.

The Impacts of the Characteristics of Products and Services on Market Transformation

Generally, market transformation studies in the energy field have not focused on the characteristics of the product and services being offered. We often ask about satisfaction with a product and we sometimes attempt to assess the relative importance of various features. The gen-

eral literature suggests that we need to go well beyond this to assess product features.

As was pointed out above, the key attributes that lead to the adoption of products and services are relative advantage, compatibility, complexity, trialability, and observability. Of these, relative advantage and observability have been found to be most important.

Relative advantage is the degree to which technologies, products or services, are perceived to be better than other such products and services. The literature identifies key dimensions of relative advantage including the "degree of economic profitability, low initial cost, a decrease in discomfort, social prestige, savings in time and effort, and immediacy of the reward(ref. 12)." Scholars have found that economic profitability may explain considerably less than half of the variance associated with relative advantage. Energy products often have high initial cost. Life cycle costs, a frequent justification for purchasing energy products, focus on long term rewards rather than short term rewards. We know from a large number of works starting with Whyte (ref. 19) that social prestige is an important element of relative advantage. Energy products are often not sold for prestige reasons.

Energy products and services often don't fare well on the remaining product criteria. There are dramatic examples of compatibility issues. For example, there is the case of a low income program that attempted to hard wire fluorescent lighting in dwellings with old wiring. The insulation on the old wiring crumbled in installers' hands.

It is difficult to try a geothermal heat pump. Marketing strategies can incorporate elements that help to finess the trialability issue. For example, geothermal heat pumps can be demonstrated at home shows. People can be invited to buildings with heat pumps to see what the environment is like. People in the field have long talked about the difficulty of observing reduced energy use and the complexity of new innovations.

We would argue that early attention to product evaluation issues is an essential ingredient in any analysis of market transformation programs. We would especially call attention to methods and approaches that look to value added services as a strategy for success (ref. 20). If the characteristics of a product or innovation do not meet customer needs, then it is unlikely that the market will be transformed. Too often it seems, we are dealing with products and services searching for a market rather than searching for or creating a product or service to meet the needs of a market. Our basic point is that we need to look more closely at the value of products and services in markets before we attempt to understand if the market for the products and services is being transformed.

Transformation in Organizations

The existing literature on energy based market transformation has focused more attention on organizations at different levels within the market structure than had been the case in the past. The goal has been to get manufactur-

ers, distributors and others to change products, product lines and services. The measurement focus has been on changes to products and product lines.

In line with the more general literature, it may be more useful to focus on the innovation process as a way to get at the effects of market transformation efforts. Thus, the evaluation focus might be on the match between the characteristics of a innovative product and the ability of a manufacturer or manufacturers to make it or the extent to which a manufacturer may be restructuring an innovation to meet the needs of the manufacturer's organization. These may give clues to the effects of transformational efforts. This is an effort that deserves additional exploration.

Summary and Conclusions

This paper has briefly reviewed efforts to understand market transformation in the energy arena. Early attempts to assess the effectiveness of market transformation efforts by tracking sales data and relating changes in sales to program efforts have failed to establish definitive links between efforts to induce changes and actual changes. Partially this is because of the difficulty in obtaining sales data and partially it is a result of being unable to rule out confounding explanations. This paper has also discussed typologies that have been developed that identify alternative outcome measures for which data might be collected.

The discussion of market transformation in the energy arena has not taken advantage of the very extensive research tradition in the adoption and diffusion of innovations. That tradition is particularly relevant to market transformation and could aid attempts to understand market transformation.

The diffusion model from that tradition provides an explanatory mechanism that is missing in the existing energy based market transformation literature.

The model presented in this paper describes stages of adoption and provides a framework for developing measures that would permit tracking the rates of adoption of new products and services. The model also points to the key role of networks in market transformation and the potential for using those measures and understanding the effects of market programs.

The paper also discusses quantitative models that can be used to estimate the potential of market transformation efforts and, in conjunction with a performance management framework, assess market transformation efforts in real time.

The model points to the key role of the product or service in the adoption decision and that, in turn, suggests the need to pay more attention to this when evaluating activities that are designed to transform markets.

Although these approaches may not be useful in reconstructing the impact of historical market transformation efforts, they provide an opportunity to measure and track future efforts. An important key is to systematically take

the right measurements and to strategically track the measurements through time.

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