

**Integrating Perspectives from Alternative Disciplines to Understand
Market Transformation Policy in Energy Markets**

by

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Introduction

As energy markets are being de-regulated (or re-regulated to separate distribution functions from production functions), many regulatory jurisdictions in the United States are examining methods by which to encourage increasing adoption of energy efficiency. Much of this effort is a push towards requiring distribution utilities or state-wide implementation organizations to implement programs designed to transform energy efficiency markets to remove barriers to the adoption of these technologies. On a theoretical basis, there are at least five ways (from four different disciplines) to approach the issue of sustainability of market effects from market transformation programs. These approaches are derived from:

1. microeconomics theory;
2. transaction cost economics;
3. diffusion studies (sociology);
4. transaction flow analyses from marketing; and
5. financial analyses.

This paper provides an overview of each of these perspectives as it applies to market transformation and the sustainability of market effects. There are advantages of examining market transformation across each of these paradigms. The paper concludes with a proposed way in which to view these different paradigms in an integrated fashion.

From Microeconomic Theory

From microeconomic theory, the basis for intervening in the energy efficiency markets is to change the outcomes from that market by shifting the demand curve, and/or the supply curve for energy efficient products and services. The reason for doing so is that goods and services with external benefits and lower realized costs will be under-invested in from a societal maximization perspective. This results from the fact that energy efficiency has greater benefits for society, lower pollution and overall costs, than is seen in the individual customer's decision-making process. In classical microeconomics, the marginal social benefits (MSB) are greater than the overall demand curve and the marginal social costs (MSC) are less than the overall supply curve. Society's desired DSM quantity and price are significantly greater than the market equilibrium, a case of market failure. This is illustrated in Figure 1. In Figure 1, the market equilibrium is at quantity Q_0 at price P_0 . The societal optimum would be at quantity Q_{soc} at price P_{soc} . The cost of the market failure to society is the difference between these equilibriums $(P_{soc} - P_0) * (Q_{soc} - Q_0)$. This is one of the reasons regulators required

greater demand-side management (DSM) investments than the utility would otherwise make, and why market transformation programs are being examined now.

A utility rebate program (a standard DSM program offering in the US from 1985 – 1996) in economic terms is offering a subsidy to the consumers of energy efficiency equipment. This increased their short-run demand for the product by making the price the consumer sees P_o while the price the market sees is P_1 , as shown in Figure 2. This subsidy, at least while it is being made, increases the price to P_1 and the quantity to Q_1 . As shown in Figure 2, this rebate causes the market quantity and market price to move towards the societal optimum level.

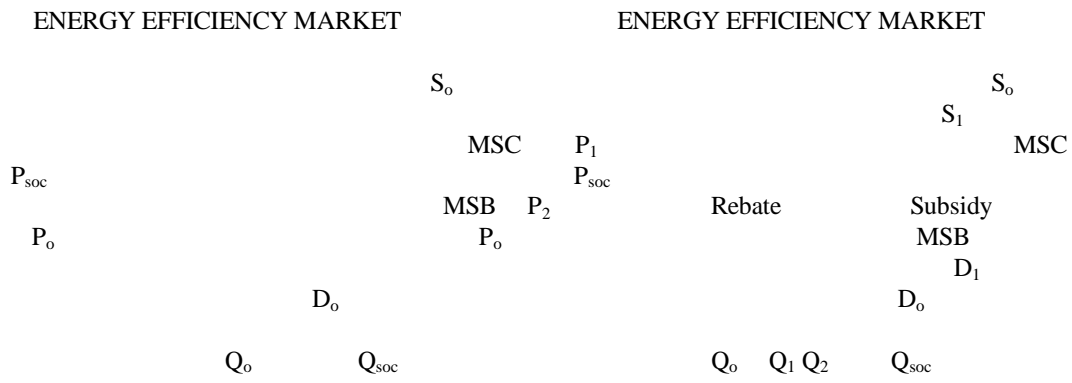


Figure 1

Figure 2

If the only market barrier is the price of energy efficiency, once the rebate is removed demand will return to D_0 . However, if market barriers include doubt about new products, or whether energy efficiency is truly cost-effective, then the rebate-induced trial of the equipment could cause a decrease in these market barriers. If there is a decrease in non-price market barriers, then the rebate program could cause market transformation. Market transformation here is represented as a permanent shift to D_1 after the rebate is removed.

Standard utility DSM programs have also been targeted to the supply-side. For example, there have been dealer rebates to induce dealers to expand their marketing and stocking of energy efficiency products. These rebates also appear as a subsidy. In this case, however, they shift the supply curve to S_1 . Again, the quantity of energy efficiency products sold increases, to Q_2 . The price moves to P_2 . Similar to the demand-side rebates, the supply-side rebates can cause market transformation if they cause a reduction in other non-price market barriers. Also, the supply may fall back to S_0 when the rebate is no longer offered if the only barrier is the equilibrium price.

Standard utility DSM programs have often used both approaches. We see in Figure 2 how these two approaches together can cause the quantity and price of energy efficiency to approach the societal.

Market transformation (MT) occurs when the shifts in the supply and demand curves are permanent after the rebates and subsidies are removed. In other words, the market operates differently after the programs have operated and closed. (The MT term used is exit strategy, i.e., market intervention is exited.) The market after the program has a new market equilibrium that approaches the societal optimum.

Using Transaction Cost Economics

The economists’ perspective is also being used in U.S. policy debate and analysis through examining market barriers and what market interventions may be needed to overcome these barriers. Market barriers follow from use of transaction cost economics. This is exemplified by an extensive examination of this issue as it applies to California’s prior energy efficiency programs in a study by Eto, Prah, and Schlegel for the Lawrence Berkeley National

Laboratory. Their definition of market barrier is: "Any characteristic of the market for an energy-related product, service, or practice that helps to explain the gap between the actual level of investment in or practice of energy efficiency and an increased level that would appear to be cost beneficial" (p. 7). The Eto et. al. list of market barriers similar to the research list of various types of transaction costs. The Eto et. al. List includes:

- Information or search costs
- Performance uncertainties
- Asymmetric information and opportunism
- Transaction costs
- Hidden costs
- Access to financing
- Bounded rationality
- Organization practices or custom
- Misplaced or split incentives
- Product or service unavailability
- Externalities
- Non-externality mispricing
- Inseparability of product features
- Irreversibility

Applying this framework to designing an MT effort (market intervention) is presented in a framework developed by Feldman (1996) for Oak Ridge National Laboratory. The steps for this application are:

- "Assess the market for the energy-efficient product or service of interest
- Describe the transaction costs that are inhibiting the efficiency of that market
- Identify changes in market participants or behaviors that will remove or reduce those costs
- Design an MT program to accomplish the specified changes
- Specify measurable indicators of the pertinent transaction costs and assess their baseline levels
- Implement the program and monitor changes in the indicators, as well as the costs of the intervention(s)
- Assess the effectiveness and cost-efficiency of the MT program as a function of changes in transaction costs"

In the same work, Feldman argues that a major, and generally overlooked component of total program benefit is the reduction of transaction costs and the accompanying increase in consumer surplus. "To focus strictly on the increased sales of the energy-efficient product or service is to ignore much of the value created by market transformation. Indeed...The value created by decreasing transaction costs may often dwarf the value of the new sales, depending upon the total price and the existing level of demand."

Diffusion Studies in Sociology

There is a large body of literature that examines technology adoption or diffusion curves. Though the models examined and used vary somewhat, their shape is normally some type of S-curve. This is caused by the fact that two general types of decision-makers accomplish technology adoption: early adopters and later adopters. The early adopters often obtain their information through agents that provide information on the new technology. The later adopters, however, often operate on information obtained from throughout the marketplace, i.e., other adopters and broader market acceptance. The accelerated rate of technology acceptance (the steep part of the S-curve) occurs as the marketplace has developed momentum from the actions of earlier adopters.

Often MT approaches are attempting to overcome a barrier that is stalling the adoption cycle for a particular technology, or to move the adoption cycle up in time. In essence, the benefits are achieved by moving the accelerated portion of the penetration curve, or S-curve, forward. The benefit of the MT effort is derived from the space between the old and the new adoption curves as shown in Figure 1.

Figure 1 S-Curve of Technology Diffusion

Proportion of Technology
That is High Efficiency
(New Technology)

Market with
no intervention.

Market with
MT effort.

MT Program
Ends

Time

MT efforts stimulate market adoption by removing barriers. The increase in adoption is expected to cause a corresponding increase in the slope of the diffusion curve. This is why evaluators measure proximate indicators to the market decisions during the years of the MT effort, and then expect to see long-run market affects after program intervention ceases (due to greater technology adoptions resulting from removal or reductions of market barriers). The benefits of market transformation programs need to include the long-run market effects beyond the actual period of program intervention. These market effects occur over a period of years, including those years after the market intervention program has ended.

Though the largest body of research concerning the diffusion of innovation falls within sociological research, there are also several areas of diffusion examination in the field of economics. Much of this work applies transaction cost economic principles to the examination of the diffusion of innovation. Reinganum provides a succinct examination of the work in this area. She cites David's work that describes diffusion as firms' decision-making being based upon stimulus variate and a critical level that determine whether any particular firm will adopt the innovation. Their view of profitability of the decision will change over time as time-related elements change the stimulus variate or critical level for them. As these elements will vary across firms, firms will arrive at this critical value at different times. Henceforth, a diffusion curve. Also discussed is McCardle's expansion to explicitly cover costs of information gathering. This perspective was further expanded by Jensen in examining asymmetry in information processing capacity, and through game theory examination by Mamer and McCardle.¹

The View from Transaction Flow Analyses in Marketing

Market mapping and baseline studies provide the information on how the market operates and why actors make the decisions they do. This is often the first step in the research conducted to lead in the design of a market transformation program. Market research to determine optimum marketing points examines similar issues. MT is trying to change final purchase decision-making by changing how a market operates. Transaction flow analyses is an important part of marketing examinations. As such, the two ideas suggest an overlap whereby our MT efforts can view transaction flows as a way in which to determine where market intervention can be applied to best leverage the intervention.

Financial Analyses

A transformed self-sustaining market needs to produce the decisions that are desired for the societal optimal without further market intervention. This means that the actors need to be self-motivated to take the actions we desire. The

probability of sustained self-motivation can be examined by assessing the profitability and cash-flow implications from their making these decisions. These can be estimated by creating proto-typical internal rate of return and cash flow analyses for the various actors by sector (business type, size, and organizational structure).

A Proposed Integrated View

The economic model places its emphasis on individuals acting in their own self-interest. Transaction cost economics does include examination of organization form and governance as it is developed to minimize transaction costs. In this view, transaction costs brings into play the interaction between parties. Hence, the relationship between parties is needed to be able to define the economic situations of asymmetric information or potential moral hazard. Nevertheless, the relationships are often viewed as static and well confined amongst a few parties to the contract being examined (explicitly or implicit contracts as viewed in economics to define transaction).

Similarly, the financial analysis perspective views individual firms making financial decisions. This perspective is almost a subset of the more general economic theory perspective.

The sociology and marketing perspectives, on the other hand, emphasize individuals as social beings. These social beings make decisions based upon information and clues received in their social environment of colleagues, relatives, and social networks. Their decisions are often not independent of the interactions that may arise within these networks as a consequence. Marketing places less emphasis on the sociological theory, yet also examines flows of information between market actors.

The economic and sociology perspectives can be married conceptually through the use of a paradigm developed in labor market and household studies integrating economics and sociology. From microeconomics, the market demand curve is the aggregation (horizontal summation) of individual demand curves at each respective price for each potential buyer (which follows from viewing each consumer as an independent rational decision-maker). The individual's demand curve is derived by examining how the quantity demanded changes with the price of the good, where the individual is always maximizing her marginal utility from the quantity of good purchased as it relates to the price of that good in comparison to the marginal utility and price of alternative goods (uses of the money).

This utility maximization occurs where her budget line intersects an indifference curve that provides her highest level of available utility. The indifference curve represents trade-offs between packages of goods and services that provide equal levels of utility to the individual (for which the individual is indifferent between the packages of goods and services). The subjective benefits an individual receives for each good in each potential package creates the relative slopes of her indifference curves between two alternative goods.

Microeconomics emphasizes the derivation and movement of market demand curves. However, it places little emphasis on how individuals develop or change their indifference curves. These indifference curves measure what value an individual places on a good relative to other goods and services (to include her time). Sociology, socio-economics, social psychology, and psychology all offer a wealth of theory and research that can help explain how individuals make value choices from their own view of their world, and as they obtain influence and interactions from and with their social environment. In other words, the other social sciences can be used to understand how indifference curves are developed and changed, and microeconomics can then examine how these changes follow through into demand curves and market behavior. In turn, the market itself can create an economic environment that can influence the social environment (socio-economics). These economic and sociological interactions, integrating economics and sociology, have been used to better understand household dynamics and their changes in a changing environment, and labor markets among those living ghettos. This perspective can also be used by energy efficiency practitioners to better guide market transformation program planning and measurement.

The diffusion of new energy efficiency technologies is an important part of market transformation efforts. An economic or financial perspective requires that the technology adoption be profitable for the firm/individual given the market operation after market intervention has ceased in order for the MT to be self-sustaining. This new equilibrium

point must have permanently passed the majority of firms critical diffusion threshold, and have transaction costs that in no way impede continual maintenance of this new equilibrium.

From a sociological perspective, the sustainable diffusion curve requires enough adopters such that the social networks are established for positive feedback on this adoption and greater energy (negative feedback) to make an alternative decision. This is equivalent to a minimum transaction costs point and that most firms have stimulus that cause their passage of the critical diffusion threshold.

The greatest probabilities for MT efforts to be successful will be if programs are designed to meet each of the parameters from these varying perspectives. In this way, individuals, the stimulus by which they make the adoption decision, the social networks that influence them, and their ability to maintain these decisions as they are reinforced by their social networks and marketing interactions – will all help to ensure MT sustainability.

Endnotes

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