Energy Efficiency, the Free Market and Rationales for Government Intervention

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ABSTRACT

This paper reviews current perspectives on market barriers to energy efficiency. We find that challenges to the existence of market barriers have, for the most part, failed to provide a testable alternative explanation for evidence suggesting that there is a substantial "efficiency gap" between consumers' actual investments in energy efficiency and those that appear to be in consumers' best interest. We suggest that differences of opinion about the appropriateness of public policies stem not from disputes about whether market barriers exist, but from different perceptions of the magnitude of the barriers, and the efficacy and (possibly unintended) consequences of policies designed to overcome them. We conclude that there are compelling justifications for future energy-efficiency policies. Nevertheless, in order to succeed, they must be based on a sound understanding of the market imperfections they seek to correct and a realistic assessment of their likely efficacy.

INTRODUCTION

The prospect of increased competition in the electricity industry threatens to make obsolete the traditional concept of a retail monopoly franchise for the provision of electric service. In place of utility monopolies, markets will arise for a variety of products, including energy efficiency, currently undifferentiated in the uni-dimensional market of retail electric service. Consumers faced with these unbundled and competitively priced products will be able to choose freely among products and suppliers. Consumers' choices, rather than those of vertically-integrated utilities, will determine the balance between supply- and demand-side resources.

Proponents of active government intervention believe that substantial market imperfections inhibit socially desirable levels of investment in energy efficiency. They maintain that it is unlikely that any future market structure for the electricity industry will ameliorate these "market barriers to energy efficiency." This belief justifies continued government intervention in energy service markets to correct or overcome the distortions inherent in market-based resource allocations. Proponents of reduced government intervention, on the other hand, argue that, given the freedom to operate in a less regulated fashion, the market will achieve efficiencies not previously observed in the electricity industry. They argue that any remaining imperfections or failures in the operation of energy service markets will be either illusory, too small to be of consequence, or best resolved by private actors operating in their own best interest, rather than through some form of government intervention.

There is a rich literature concerning what has become known as the "market barriers to energy efficiency" debate. Contributions to our understanding of these "barriers" have come from many disciplines, including economics, engineering, sociology, anthropology, and psychology. This paper provides an overview of the origins, development, and current status of the debate.[1]

WHAT IS THE "EFFICIENCY GAP"?

Prior to the first oil price shock in 1973, there was little public policy discussion of the efficiency of energy use. Oil, the primary fuel in Western industrialized countries, had been cheap and plentiful — discoveries of new fields offered the promise of many years of unhindered supply. However, during the early 1970s, a new intellectual trend, epitomized in *Limits to Growth* (Meadows et al. 1972), combined with the Arab oil embargo to awaken concerns about threats to that supply. This new vision saw business-as-usual leading to steeply rising energy prices. Increasing energy demand, along with shortages of fossil fuel supplies, would undermine economies built on the promise of cheap energy.

The implications for energy policy of the new vision was articulated in *Energy Strategy: The Road Not Taken* (Lovins 1976). The linchpin of Lovins' argument was the development of the concept of energy efficiency: using less energy to produce the same or even more economic output. This concept, coupled with a review of the apparently highly inefficient use of energy by society at the time led some to the conclusion that the market alone was not working to provide the most desirable social outcome. Soon after publication of Lovins' article, ideas about energy efficiency began having a significant effect on public policy.

These ideas were often expressed as questions about the existence and magnitude of an "efficiency gap." The efficiency gap refers to the difference between levels of investment in energy efficiency that appear to be cost effective based on engineering-economic analysis and the levels actually occurring (SERI 1981). The gap can be represented graphically using a supply curve of conserved energy or SCCE. An SCCE is generally described as a schedule of the quantity of potential energy savings from various technologies, ordered by the per-unit marginal cost of those savings.

Comparison of the SCCE with the cost of developing new energy supplies suggested that energy services could be delivered through the adoption of these energy-efficient technologies at lower costs than could be achieved through the development of new energy supplies. In addition, the financing and energy operating costs of such technologies were below the energy costs of currently installed equipment (Meier et al. 1983). The low market penetration of these energy-efficient technologies, coupled with this unrealized potential, was (and is) taken to imply that significant amounts of energy could be saved cost-effectively through investments in these technologies.

The implicit discount rate suggested by the efficiency gap has frequently been compared to the interest rates offered by other, non-energy-efficiency investments that consumers are purchasing. The difference between these rates was offered as *prima facie* evidence of shortcomings in the functioning of the market for energy efficiency. According to this line of reasoning, these shortcomings were indicated by consumers' willingness to invest in options offering some particular revenue streams, but unwillingness to invest in energy efficiency without receiving substantially higher returns. To explain this apparent discrepancy, some commentators pointed to "market barriers to energy efficiency."

Some argued that the gap was even larger than that indicated using private discount rates because the relevant discount rate from a societal perspective should be the lower rate used by large institutions, such as utilities. They contended that, because of the obligation to serve, utilities should use their borrowing capacity to underwrite cost-effective energy-efficiency investments foregone by consumers (Krause and Eto 1988). Another claim was that the mis-pricing of energy, resulting from regulatory failure and from the existence of negative, primarily environmental, externalities (Holdren 1992), implied that, from a social perspective, the efficiency gap was larger than it appeared from the perspective of an individual participant in the market.

WHAT ARE MARKET BARRIERS TO ENERGY EFFICIENCY?

As the "technologists," mostly physicists and engineers using discounted cash-flow analysis, pointed out in the early stages of the market barriers debate, significant opportunities existed to use energy more efficiently in the sense Lovins had described. An analysis of the causes of the apparent discrepancies between opportunities and exploitation was first presented systematically by Blumstein, et al. (1980). This paper described features of energy services markets claimed to inhibit the exploitation of efficiency opportunities, noting, "Although economically rational responses to the energy crises, energy conservation actions may be hindered by social and institutional barriers." These market barriers, as they have come to be known, are described below.

Misplaced Incentives

Misplaced, or split, incentives are transactions or exchanges where the economic benefits of energy conservation do not accrue to the investor in increased efficiency. The terms have been used to describe certain classes of relationships, primarily in the real estate industry between landlords and tenants with respect to acquisition of energy-efficient equipment for rental property. When the tenant is responsible for the energy/utility bills, it is in the landlord's interest to provide least-first-cost equipment rather than more energy-efficient equipment for a given level of desired service. There is little or no incentive for the landlord to increase her own expense to acquire efficient equipment (e.g., refrigerators, heaters, and light bulbs) because she will not reap the benefits of reducing operating costs. This misplaced incentive is believed to extend to the commercial sector; however, most of the literature on misplaced incentives focuses on the residential sector.

Financing

The financing barrier, sometimes called the liquidity constraint, refers to significant restrictions on capital availability for potential borrowers. While economic theory tells us that, for a risk-adjusted price, the market should provide capital for all investment needs, in the real world we observe that some potential borrowers are frequently unable to borrow at any price as the result of their economic status or "credit-worthiness." This lack of access to capital inhibits investments in energy efficiency by these classes of consumers. Home mortgages are offered as an example of the financing barrier; mortgage qualifications, although purportedly designed to match the ability of the borrower to repay the loan with the loan payback requirements, typically do not consider the operating costs of the home being purchased, despite the impact such costs have on the total cash flow of the homeowner.

Market Structure

The market structure barrier refers to product supply decisions made by equipment manufacturers. This barrier suggests that certain powerful firms may be able to inhibit the introduction by competitors of energy-efficient, cost-effective products. Evidence for the contention that market power has led to imperfect competition, while frequently cited informally, has not been developed systematically in the literature.

Regulation

The regulation barrier referred to the mis-pricing of energy forms (such as electricity and natural gas) whose price was set administratively by regulatory bodies. These procedures and the cost structure of the industries typically resulted in different prices depending on whether they were set based on average costs (the regulated price) or marginal costs (the market price). Historically, the price of electricity as set by regulators was frequently below the marginal cost to produce the electricity. This mis-pricing was claimed to create an incentive to overconsume electricity relative to conservation or efficiency. More recently, marginal costs of electricity production have often dropped below prices as set administratively. This shift has given rise to contentions that the price of electricity now provides an incentive to overinvest in energy efficiency.

Custom and Information

The custom barrier referred primarily to the importance of non-economic variables in decision-making. For example, it has been argued that individuals will forsake cost-effective investments if they believe such investments may be equated with lower economic status. Understanding of the information barrier, now seen as central to the debate, has evolved significantly since its initial exposition and is taken up later in this paper.

Gold Plating

The notion of "gold plating" emerged from research suggesting that energy efficiency is frequently coupled with other costly features and often is not available separately (Ruderman et al. 1987). Although not generally emphasized in economic theory, one assumption required by the neo-classical paradigm is that all goods are separately available. Close inspection reveals that individual products are, in fact, collections of features, each of which may be seen as individual goods themselves. Although some features clearly are separable (for example, one may purchase the same refrigerator with or without an ice-maker), many others are not, either because of technological limitations or producer decisions. As a result, buyers may be forced to purchase unnecessary/undesirable features in order to acquire energy efficiency or to settle for less efficient equipment.

QUESTIONING THE EXISTENCE OF THE EFFICIENCY GAP

One of the important criticisms of the market barriers argument pointed out that the term "market barriers" itself is ambiguous and did not have a consistent conceptual underpinning (Sutherland 1991). Much of the subsequent debate has revolved around perceived inconsistencies. Neo-classical economists, for example, recognize a variety of economic features, known as market failures that, in principle, inhibit the efficient functioning of the market and provide a partial justification for government intervention. Some argue, however, that these market failures are simply not pervasive in today's energy service markets because there are a number of alternative explanations for observed, high implicit discount rates which are consistent with the normal workings of all markets.

This section reviews the most important of the alternative explanations that do not involve market failures. To maintain historical continuity, we also report subsequent responses to some of these critiques. Market failures are taken up separately in the subsequent section.

Energy Efficiency vs. Economic Efficiency

An important clarification for the market barriers debate has come from economists seeking to distinguish between economic efficiency and energy efficiency. Sweeney (1993) pointed out that focusing on energy efficiency (or intensity) as the goal can lead to rejection of investments that *increase* energy intensity, yet *increase* economic efficiency. It is certainly possible, in principle, to conceive of a new technological process that requires, for example, reduced labor intensity yet higher energy intensity, and is more economically efficient than an existing process. By choosing reduced energy efficiency as the objective, this new technology would be rejected, despite the increased economic efficiency offered. This, it is argued, is not consistent with actual (and rational) behavior.

Heterogeneity of Consumers

One straightforward technical critique, also referred to as aggregation bias, observes that, although a technology may be cost-effective on average for a class of users taken in aggregate, the class, itself, consists of a distribution of consumers: some could economically purchase additional efficiency, while others will find the new level of efficiency not cost effective (Sweeney 1993). Thus, although an analysis based on average users may demonstrate the cost effectiveness of a particular technology, in practice we may observe low rates of adoption stemming from the heterogeneity of the population.

This observation suggests that the benefits of a particular technology may be overstated for some subset of a total class of users. Clearly, this is an empirical issue and not one that can be settled in the abstract. Koomey et al. (1995), in a rare study that explicitly considers several possible sources of aggregation bias, find little or no impact of this methodological concern on the cost effectiveness of recent federal minimum efficiency standards for fluorescent ballasts.

Diffusion Rates

Another critique holds that small market shares of efficient technologies are to be expected because the technologies are generally new to the marketplace. These critics argue that efficiency advocates have incorrectly framed questions about investments in efficiency in terms of an idealized equilibrium level of investment. Many efficiency gap arguments have assumed implicitly that cost-effective technologies are adopted instantaneously. However, it has been pointed out that the adoption of new technology is typically gradual (Jaffe and Stavins 1994). Given the rate of technological innovation for energy-efficient technologies over the last few decades, equilibrium states, i.e., stable levels of the diffusion of a particular technology, are not likely in the near future. So a more pertinent question, in a nonequilibrium state, may be about the rate of adoption, rather than about the level of investment.

Risk, Discount Rates, and Modeling the Investment Decision

Two important critiques of market barriers argue that high discount rates are, in fact, warranted given the riskiness of energy efficiency investments. The first is framed in terms of the diversification options available for these investments. The second is framed in terms of the illiquidity of the investments.

The first argument starts with the observation that although engineering/economic analyses assume known and certain future conditions such as energy prices and device lifetimes, in fact such future conditions are uncertain and impose risk on the potential investor (Sutherland 1991). Potential investors, it is argued, will increase their discount rates to account for this risk because they are unable to diversify it away. The capital asset pricing model (CAPM) is invoked to make this point.

The use of CAPM to model energy-efficiency investment decisions has been challenged on several grounds. One criticism points out that CAPM assumes an idealized, frictionless investment environment where all potential investors possess the same information. Although this assumption is reasonable for major financial markets, it does not hold in energy services markets (Johnson and Bowie 1994). A second criticism questions the appropriate portfolio to consider as the basis for evaluating nondiversifiable risk. Although CAPM relies on a portfolio of all available securities, a portfolio designed to minimize energy price risk may be more appropriate for energy efficiency investments. The general insight of this line of argument is that a price lower than current costs ought to be required by an investor in energy efficiency because of the positive correlation between returns on investments in efficiency and energy prices (Metcalf 1994).

The second argument observes that, unlike an investment in a liquid or saleable good, an investment in efficiency must be held by the initial investor regardless of the performance of the investment or the investor's changing needs because secondary markets do not exist or are not well-developed for most types of efficient equipment (Hassett and Metcalf 1993). Thus, as the rated lifetime of equipment increases, the value of future benefits will be increasingly discounted. This argument contends that illiquidity results in an option value to delaying investment in energy efficiency, which increases the necessary return from such investments (Metcalf 1994). Sanstad et al. (1995) challenge the option value approach described by Metcalf. They argue that since the magnitude of the option value declines substantially as the discount rate increases, the option value offers little or no explanatory power for implicit discount rates actually observed for energy efficiency investments.

Hidden Costs

A final criticism of the market barriers position accuses barriers proponents of sloppy accounting. The "hidden cost" argument says that technical potential studies fail to account for either reductions in benefits associated with investments in energy efficient equipment or additional costs associated with the new technologies (Nichols 1994). On the benefit-side, the critics argue that the assumption of equivalent levels of service across technological options is incorrect. On the cost-side of the equation, the critics contend that, among other things, information and search costs have typically been underestimated. Taken together, it is argued that the sum of reduced benefits and omitted costs fully explains any remaining efficiency gap.

In response to the possibility of changes in the energy service amenity delivered, analysts have begun to identify products with characteristics that are fully equivalent except for energy efficiency (Koomey and Sanstad 1994). They have attempted to demonstrate that, for certain appliances, in the absence of hidden costs, investment in energy-efficient equipment is still less than economically efficient.

The Importance of "Noneconomic" Variables

Discounted cash-flow, cost-benefit, and social welfare analyses use price as the complete measure of value albeit in very different ways; behavioral scientists, on the other hand, have argued that a number of "noneconomic" variables contribute significantly to consumer decision making. Stern (1986) argues, for example, that psychological considerations such as commitment and motivation play a key role in consumer decisions about energy efficiency investments. Stern and Aronson (1984) had argued earlier that other factors, such as membership in social groups, status considerations, and expressions of personal values play key roles in consumer decision making.

This position has found empirical support in research focusing on consumer use of air conditioning (McGarity and Kempton 1988); this work revealed that both economists and technologists have oversimplified descriptions of the services provided by certain appliances. For example, rather than viewing the sole service provided by air conditioning equipment as cooling of the air, consumers have a variety of concerns and objectives, such as air flow or noise, for which they are willing to trade off precise air temperature concerns. Likewise, consumers may use air conditioners in part as home security devices, running them when not at home to create the impression of occupancy. This research suggests air conditioning units provide a variety of services and are associated with a variety of costs, rather than providing a single service as is typically assumed.

MARKET FAILURES AND THE EFFICIENCY GAP

The previous arguments questioning the existence of the efficiency gap have attempted to dispute the existence of the market barriers discussed earlier and to minimize the magnitude of inefficiencies resulting from existing market imperfections. At the same time, economists have long recognized a variety of types of market failures in the energy services market (Fisher and Rothkopf 1989). Without commenting on the magnitude of these failures or the additional conditions required to support government intervention, the following discussion describes market failures present in the energy services market.

Externalities

Externalities refer to costs or benefits associated with a particular economic activity that do not accrue to the participants in the activity. For example, air pollution emissions associated with fossil fuel combustion are a negative externality because they reduce the quality and value of the air, adversely affect human and ecosystem health, and damage property well beyond that of the suppliers and consumers of the energy. Externalities are typically understood in economic terms as resulting in a mis-pricing of the relevant good or service (underpricing in the case of negative externalities), and a consequent incentive to over- or under-consume the good. Although there is general agreement on the concept of negative environmental externalities, their magnitude is in dispute. Some argue that the magnitude of the damages is large and represents a serious threat to future economic well-being (Ottinger et al. 1990). Others argue that existing environmental regulation has internalized a significant proportion of these costs (Joskow 1992).

Imperfect Competition

In order for a market to function effectively, all parties to an exchange or transaction must have equal bargaining power. In the event of unequal bargaining positions, we would expect that self-interest would lead to the exploitation of bargaining advantages. Although, in theory, we should be able to identify or measure such positions directly, we can more easily infer this information from observing the structure of the market. A variety of market structures have been identified as likely to reflect unstable or unequal bargaining positions. These structures include monopoly, monopsony, oligopoly, and oligoposony and refer to markets in which there are either one or small numbers of either sellers or buyers and large numbers of the other. It is generally argued that those parties on the side of the market with limited participants have power in the market. In addition, certain types of conduct, such as collusion, while not necessarily reflective of unstable market structures, are considered anti-competitive. Investigation of the prevalence and importance of this market failure in the market for energy services has been limited and represents a significant research opportunity.

Public Goods

Public goods are defined by two characteristics: (1) consumption of such goods by one party does not diminish the benefits to other consumers of the same goods and (2) once such goods have been provided to one consumer, it is difficult to restrict their consumption by others. Because these characteristics violate the assumptions necessary for economic efficiency, public goods are said to represent a market failure. It has been generally acknowledged by both economists and efficiency advocates that public-good market failures affect the energy services market. Investment in basic research is believed to be subject to this shortcoming; because the information created as a result of such research may not be protected by patent or other property right, the producer of the information may be unable to capture the value of his/her creation. This provides a disincentive to produce such information and is widely believed to result in an underinvestment in basic research. This market failure applies to all forms of basic research, including energy efficiency (Howarth and Andersson 1993).

Imperfect Information

In order for markets to work well, participants in a potential exchange must be fully informed about the objects of exchange and about conditions and objects in other markets. Ideally, information is perfect and costless, including knowledge of current and future prices, technological options and developments, and all other factors that might influence the economics of a particular investment. A series of information market failures have been identified as inhibiting investment in energy efficiency: (1) the lack of information, (2) the cost of information, (3) the accuracy of information, and (4) the ability to use or act upon information.

Perfect information includes knowledge of the future, including, for example, future energy prices. Because the future is unknowable, uncertainty and risk are imposed on many transactions. Of course, inability to predict the future is not unique to energy service markets. What may be unique are the difficulties associated with diversification.

Even when information is potentially available, it frequently is expensive to acquire, requiring time, money or both. The limitations on information resulting from the acquisition or search costs is a prominent failure in the energy services market.

Accurate information may be difficult to obtain; those who possess information have strategic reasons to manipulate it. Sellers advertise and promote their goods by providing information about their own goods. Self-interest is an incentive for the provision of misinformation by sellers, and the costs of acquiring additional information may be high enough to inhibit acquisition of sufficient unbiased information to overcome well-distributed misinformation. One reason why consumers may choose not to buy more efficient appliances, even when provided with information (via labeling) establishing the cost effectiveness of such purchases, is that consumers are wary and mistrustful because of past experience with advertised misinformation (Stern and Aronson 1984).

Finally, individuals and firms are limited in their ability to use — store, retrieve, and analyze — information. Given the quantity and complexity of information pertinent to energy efficiency investment decisions, this condition has received much consideration in the market barriers debate. Kempton and Montgomery (1982) examined the methods by which residential consumers computed energy savings from investments in efficiency. They found that prevailing methods systematically underestimate energy savings.

This work is consistent with the notion of bounded rationality in economic theory. In contrast to the standard economic assumptions of perfect information and full rationality, bounded rationality emphasizes limitations to rational decision making that are imposed by constraints on a decision maker's attention, resources, and ability to process information. It assumes that economic actors intend to be rational, but are only able to exercise their rationality to a limited extent (Simon 1957). Important theoretical refinements to this concept, known as prospect theory, have been developed by Tversky and Kahneman (1986). This theory contends that individuals do not make decisions by maximizing prospective utility, but rather in terms of difference from an initial reference point. In addition, it is argued that individuals value equal gains and losses from this reference point differently, weighing losses more heavily than gains. Recent work by Kempton and Layne (1994) established that the conclusions consumers are able to draw from their analytical effort are restricted by the form in which they receive price and consumption data and by their limited analytic capabilities.

The concept of bounded rationality has been extended to decision making by firms (Decanio 1993). In addition to the individual limitations to rationality presented because firms are collections of individuals, firms, themselves, do not behave like individuals in the sense of acting with a single mind. Decanio cites the work of Mancur Olson (1971) who argued that, "the logic of collective action is such that, in general, 'rational, self-interested individuals will not act to achieve their common or group interests" (p. 907). This finding is tempered by the efforts of managers to create the appropriate incentive schemes necessary to align the individual's interest with the firm's interest, but Decanio argues, "Failures of complete maximization are to be expected" (p. 907).

Various market barriers can be understood in terms of market failure in either the neo-classical or transaction cost (as described below) sense. With respect to the liquidity constraint barrier, for example, one explanation for the lack of available capital for low-income individuals and small businesses is that the costs of investigating the credit worthiness of such individuals or firms (acquiring the necessary information to establish an acceptable level of risk) may be sufficiently high to significantly diminish the economic viability of such loans. In other words, if the probability of a loan default rises as the income of the borrower decreases, the percentage of creditworthy investors out of the total pool of low-income individuals and small firms declines and the cost of acquiring adequate the relevant information increases because a larger number of potential clients will need to be investigated per loan.

TRANSACTION COST ECONOMICS: BRIDGING THE GAP

The assumption of frictionless transactions has been increasingly challenged in recent years. The insights developed through these challenges represent an important new way to evaluate the functioning of the energy services market. Arrow (1969) provided an explanation for the general failure of markets to develop; this explanation is only now being applied to questions about the functioning of the energy services market. Arrow noted "market failure is not absolute, it is better to consider a broader category, that of transaction costs, which in general impede and in particular cases completely block the formation of markets" (p. 48). One of the implications of this remark for the energy services market may be that the slow diffusion rates of efficient technologies may be better understood in terms of the transaction costs associated with the development of such markets than by the types of neo-classical market failures discussed earlier. The remark also suggests the difficulty in establishing the range of magnitudes of transaction costs, since evaluation of those costs in transactions that fail to materialize may be impossible, despite their apparent magnitude.

While transaction cost economics is well-defined conceptually, as illustrated by the description, "Transaction cost analysis entails an examination of the comparative costs of planning, adapting, and monitoring task completion under alternative governance structures" (Williamson 1989, p. 142), transaction costs themselves have proven difficult to measure. The findings of Hein and Blok (1994), were largely confined to what are generally referred to as search costs. That they discovered, in Williamson's terminology, relatively high *ex ante* transaction costs, but relatively low *ex post* costs, despite the likelihood that *ex post* costs will generally be much higher, points to the limitations of their analysis. Wolcott and Goldman (1992) concluded that the risk premium demanded by energy service companies investing in the first DSM bidding programs ranged between 0.5 and 2.5 ¢/kWh.

Transaction cost economics also offers support for claims that the illiquidity of certain investments leads to higher interest rates being required by investors in those investments. Williamson (1985) argues that "durable, firm specific assets," creating what he terms "high assets specificity," provide poorer collateral and create higher risk "in that specialized assets cannot be redeployed without sacrifice of productive value" (p. 54), thereby increasing the costs associated with investments in such assets and creating the need for higher corresponding returns from such investments.

Finally, Williamson (1985) argues that the key issue surrounding information is not its public goods character, but rather its asymmetric distribution combined with the tendency of those who have it to use it opportunistically. This contention is consistent with findings presented earlier about consumer skepticism surrounding energy efficiency claims in that consumers recognize the possibility of the opportunistic use of information. Thus, reducing transaction costs becomes a problem of both economizing on bounded rationality along with safeguarding against opportunism.

As a simple illustration of the concept, many utility demand-side management (DSM) programs can be analyzed as attempts to reduce the magnitudes of various transaction costs. Here is a simple example of such a program: A private business establishes a maximum three-year payback rule on investments in energy efficiency as its investment criterion, despite access to capital at a lower cost than this criterion implies. Some portion of the difference between the cost of capital and the payback represents the costs to the firm of the information necessary to evaluate energy efficiency investment opportunities or the risks; however, a second firm (a utility or energy service company), may be in position to acquire the same information for less or diversify its risk and effectively arbitrage the two transactions such that it can profitably underwrite some portion of the efficiency investment for the first firm. In simple terms, the second firm could share the costs of making the investment and still profit by retaining only returns over and above those required by the first firm to meet its payback requirements. Transaction costs are reduced utilizing alternative institutional forms of organization, and the original firm, the facilitating firm, and society benefit in ways that would not be possible for the original firm on its own.

In summary, as Johnson and Bowie (1994) note, "[W]e find considerable merit in a public policy perspective that regards energy efficiency as a coordination problem rather than viewing energy efficiency with reference to an optimized system. Recognition of the important role of institutions in structuring transactions brings a change in emphasis from competition and utility maximization to coordination and incentive structures" (p. 12). The approach offers much promise of enhancing our understanding and improving the functioning of the market for energy services.

IMPLICATIONS FOR PUBLIC POLICY

As they were originally described, "market barriers to energy efficiency" referred to a broad set of market features that appeared to explain why observed levels of investment in energy efficiency were suboptimal from either a private or social perspective. Subsequent discussions have clarified, modified, and increased the precision of these descriptions. While these market barriers were not originally presented strictly in terms of neo-classical market failures, they can now be understood in terms of both neo-classical and transaction cost economics market failures. We would argue that both types of market failures represent legitimate possible objects of government policies.

We have been careful in our discussions to avoid the normative implications of the market barriers debate for energy-efficiency policies. That is, we have made a conscious decision to focus only on the analysis of consumer and institutional behavior provided by the market barriers debate. However, recognition of the shortcomings of the market, whether in neo-classical or transaction cost economic terms, has led to the identification of three possible justifications for government intervention in the market. They may be summarized as follows:

(1) Individuals are seeking to maximize their personal and economic welfare, but are inhibited from doing so by imperfections in the market (i.e., market failures). Government can intervene to reduce market failures, assisting individuals and firms in achieving their rational economic objectives and improving net social welfare.

(2) The transaction costs associated with investments in energy efficiency are high in the market as currently structured. Alternative institutional arrangements, including government regulation and participation in the market can substantially reduce transaction costs, facilitate the development of markets hindered by high costs, and increase net social welfare.

(3) Government can help individuals and firms help themselves. The behavior of individuals and firms is not consistently economically rational. Government can do for individuals and firms what they are unwilling to do for themselves.

ENDNOTES

1. For a more detailed treatment of these issues, along with an analysis of two important end-use markets in light of our findings, please see Golove and Eto (1996).

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