UNDERSTANDING THE MARKET FOR CONSERVATION TECHNOLOGIES IN THE COMMERCIAL SECTOR

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ABSTRACT

The purpose of this paper is to further the understanding of the decision process associated with conservation retrofit investments in the commercial sector. It includes a discussion on: the stages involved in a decision to undertake conservation retrofit activities; the participants that might be involved in such decisions; the decision criteria utilized by different types of organizations; barriers to implementing conservation; and the impact that the attributes of conservation investments might have on the decision outcome.

Based on the findings of this report, a five-step plan is recommended for improving the effectiveness of policies designed to promote conservation in the commercial sector. This plan involves:

1. Segmenting the commercial sector. The segmenting factors that are recommended are: building use, ownership type, and size.

2. Identifying the barriers and decision criteria associated with each market segment.

3. Targeting policies. In order to maximize the impact of conservation promoting policies, it is necessary to identify commercial market segments which are unlikely to undertake retrofit actions on their own, but are likely to respond to policy initiatives. This identification may be completed once the barriers and decision criteria are defined for each market segment.

4. Linking market segments with appropriate technologies. Each conservation investment is ranked according to eight product attributes on a market segment specific basis. The attributes considered are: relative advantage, observability, compatibility, divisibility, complexity, risk, initial cost, and payback period. In addition, the relative importance of these attributes to each market segment is determined based on an analysis of the barriers and decision criteria of that market segment. By examining the manner in which each conservation product ranks according to these attributes and considering the relative importance of these attributes to each market segment, information on conservation technologies may be directed at the market segments for which they are best suited.

5. Utilizing a flexible approach. Use of a flexible approach involves recognizing: the different stages which might be involved in the decision process; the in information needs at each stage; and the variation in participants throughout the decision process.

UNDERSTANDING THE MARKET FOR CONSERVATION RETROFIT TECHNOLOGIES IN THE COMMERCIAL SECTOR

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1. INTRODUCTION

The purpose of this paper is to further the understanding of the decision process associated with conservation retrofit decisions in the commercial sector. In order to accomplish this objective, five areas of literature are explored: available empirical studies on conservation behavior in the commercial sector; marketing research on purchasing behavior in the industrial sector; literature on innovation behavior; models of firm behavior; and two previous literature reviews on conservation investment in the commercial sector (Nieves and Fang, 1986; Temple, Barker, and Sloane, 1984).

This paper examines five aspects of decision processes in the commercial sector. These are: stages in the decision process; participants in decision making; decision criteria; barriers to implementing conservation; and the impact of product attributes. Based on these findings, this paper suggests a strategy for designing effective conservation policies for the commercial sector and provides recommendations for future research.

2. STAGES IN THE DECISION PROCESS

An understanding of conservation decisions in the commercial sector begins with the recognition that organizational decisions are the outcome of a decision process. Numerous researchers have proposed stages characterizing organizational purchase decisions (e.g., Rogers, 1983; Lilien and Wong, 1984). The various series of stages that have been proposed highlight the fact that the decision to adopt a conservation innovation is a process that occurs over time. The implications for conservation marketing and program design include the following:

1. Initial approaches to commercial establishments should be designed to help the decision makers within the organization recognize a need. Information should be focused on the potential savings and/or any other secondary benefits that may accrue through conservation, rather than on the technical details of alternative conservation investments.

2 Technical details are often required later in the decision making process. Outside experts may be needed to provide the technical analysis.

3. Uncertainty is an important element of the decision making process. Consequently, policies that are designed to reduce the uncertainty associated with conservation innovations (such as demonstration projects, providing information on the benefits obtained by other commercial establishments, and guaranteed savings) may hasten the adoption process.

4. Obtaining the commitment of funds to implement the conservation investment is an important part of the decision process. Conservation investments will compete with other investments considered by the firm for limited capital funds. Small firms in particular, have difficulty in obtaining internal sources of capital for conservation investments. These firms may be willing to undertake conservation investments only if policies provide aid in financing.

5. The decision making process extends beyond the commitment of funds to the implementation and confirmation of the decision, and to the maintenance and operation of the equipment. Policies designed to provide follow up information or audits may be useful in eliminating problems that may be encountered at these stages.

3. PARTICIPANTS IN THE DECISION MAKING PROCESS.

A large number of marketing studies have been conducted that examine purchasing decisions in the industrial sector. These studies provide information that is useful in identifying the potential participants in conservation retrofit decisions in the commercial sector. Studies of purchase decisions in the industrial sector utilize the concept of a "buying center". The buying center includes all organizational members involved in the purchase decision. The buying center is a dynamic group that will vary among organizations and among types of purchase decisions for a given organization. However, by examining buying centers in different types of organizations, environments, and for different types of purchasing decisions, patterns of involvement may be identified (Lilien and Wong, 1984; Choffray and Lilien, 1980).

Studies of buying center membership in the industrial sector have revealed that the number of individuals involved in the decision process typically increases as the uncertainty (either technical or financial) associated with the purchase increases (Spekman and Stern, 1979). In addition, studies of industrial purchase decisions reveal that the decision process is best understood by identifying organizational members involved at specific stages in the decision process, as opposed to attempting to identify the individuals that have the most influence on the decision outcome. Research techniques that are useful in identifying decision participants have been identified. These include snowball sampling (Kelly, 1974) and decision matrices (Choffray and Lilien, 1980).

Dornbush and Company (1984) examined the buying center associated with conservation investment decision (for both new buildings and retrofits) in the commercial sector. Based on interviews with thirteen energy service marketing organizations, they identified patterns of decision involvement in companies operating multiple buildings. These types of companies were grouped into three categories: (1) chains and other multiple building owners, (2) leased departments, and (3) franchises. In each category investment decisions were found to consist of both a technical analysis and a financial analysis.

For chains and other multiple building owners, Dornbush and Co. found a wide range of decision making structures. At one extreme, one decision maker

at corporate headquarters made all energy conservation investment decisions. At the other extreme, conservation decisions are made at the regional or building level. Their findings indicate that small multiple building owning companies tend to have decision making structures that resemble the centralized extreme, and as corporations become larger, decision making becomes less centralized. Dornbush and Co. also found cases in which decision making authority did not rest at one level, but was shared by more than one level. This situation was typically found in medium size companies with widely distributed operations and buildings.

In situations in which the building space is leased, the Dornbush study revealed that tenants are normally consulted when energy conservation investments are made. However, unless the tenant acts as a magnet for other tenants, he will have little influence on the decision outcome.

In franchises, as in chains, decision making structure was found to vary widely. In some cases, franchises make their investment decisions independently of corporate headquarters. In other cases, multiple levels of approval are necessary in order to undertake an investment. The degree of corporate headquarters influence over the franchise's investment decision is a function of the financial interest that the parent corporation has in the franchise's operation (Dornbush and Co., 1984, p.6).

The research discussed here reveals the wide range of decision making structures that may characterize the commercial sector. Utilities or policy makers who wish to promote conservation investments should be aware of the potential participants in the decision process. Contact with the purchasing organization should be flexible enough to allow for contact with a variety of decision participants.

The studies on buying center membership in the industrial sector reveal that membership patterns in a given organization may vary over types of investments. For example, the participants in a decision to adopt an energy management system may differ from those involved in an energy-saving change in operation and maintenance (O&M) procedures. This issue was not explored by Dornbush and Co. In addition, Dornbush and Co. did not examine the buying centers found in single building owner organizations. Further research might address these issues. Such research should build upon the findings and research techniques found in the studies of industrial sector buying centers and in the Dornbush and Co. study.

4. DECISION CRITERIA

Traditional economic theory has viewed firms (or organizations) as possessing a clear, well defined, objective function. This objective is to maximize utility, which may be defined as a measure of satisfaction. For many commercial establishments maximization of utility is equivalent to profit maximization; however, other objectives are possible. It is assumed that decisions are made by each firm according to an optimization procedure with utility maximization assumed as the firm's objective. In cases involving uncertainty, it is assumed that individuals seek to maximize expected utility.

Critics of the traditional theory have argued that, in reality, firms do not make "optimal" decisions (For example, see Cyert and March, 1963; Simon, 1979; Schoemaker, 1982; and Nelson and Winter, 1982). The inability of firms to make optimal decisions is attributed to the following factors:

1. Firms may have competing sets of goals that may not be maximized simultaneously.

2 Even if an objective function is agreed on, it may not be clear which actions serve to maximize that goal.

3. Firms are limited in their ability to search for alternative solutions and, therefore, may not seek solutions or may search only for acceptable, not optimal, solutions.

4. Firms may seek to minimize uncertainty rather than maximize a defined objective.

5. Firms may not have the ability to choose optimal solutions but may utilize heuristics, or simplifying decision rules, in choosing among alternatives.

6. Firms have capital limitations that may prevent them from undertaking economically optimal decisions.

These assertions do not provide a clear picture of the type of criteria we may expect firms to utilize in analyzing conservation investments, however, they do provide a theoretical explanation of why potentially profitable conservation investment opportunities may not be undertaken, and why non-optimal alternatives (i.e., ones that are inconsistent with profit maximization) may be chosen. They highlight the impact that uncertainty, capital constraints, and search costs have on the criteria used in the decision making process and they emphasize that decision criteria may differ from firm to firm.

There is only a limited amount of evidence available on the criteria that firms actually use in making conservation investments. This evidence suggests that large firms are more likely to use a traditional investment criterion than small firms. Small firms are less likely to have: access to information on investment alternatives; technical expertise to compare alternatives; and, access to capital. They may also be more likely to face cash flow constraints and may be less able to tolerate the uncertainty associated with conservation investments. These limitations may prevent small firms from making decisions that are consistent with profit maximization.

5. BARRIERS TO IMPLEMENTING CONSERVATION

This section discusses six different types of barriers which may prevent organizations from undertaking conservation retrofit actions. Although each barrier is discussed separately, barriers are often inter-related, with one type of barrier giving rise to another type. The classification of barriers

listed here is a variant of the classification defined by Blumstein et al (1979).

Misplaced Incentives and Market Failures

In some organizations, the individual who is able to, or responsible for, undertaking a conservation action is not the person who obtains the benefits of that action. This situation, where the incentives are misplaced, poses a significant barrier to conservation retrofits. The separation of ownership and occupancy is a common source of misplaced incentives. Owners of rental property in which tenants are responsible for fuel bills, and owner occupants who expect to sell their property in the near future, may not expect to obtain the benefits of conservation improvements. If a premium was obtained on energy efficient rental units, or on the sale of efficient structures, then the owner's incentive to make conservation investments would be restored. If premiums are not obtained for efficient rental properties, or on the sale of efficient structures, then this represents a "market failure", i.e., the market does not effectively capitalize fuel savings into rents and commercial property values. No empirical evidence on this issue was found; however, limited observations by rental property owners indicate that they do not feel that the market prices efficient rental property at a premium (Blumstein et al, 1979).

Lack of Information or Misinformation

Several types of technical and financial information are relevant in the decision to make energy efficiency improvements. This information is often not readily available to firms and, when available, may be imprecise or unreliable. Studies of the preferred sources of information on conservation investments have reached little consensus (Nieves and Fang, 1986). However, it is likely that large firms have access to a greater variety of information than small firms (OTA, 1982). Large firms are also more likely to have personnel who are able to handle technical information on conservation investment alternatives (Michigan Public Service Commission, 1982).

Lack of information is likely to be the source of several other barriers. Lack of information on the potential savings that may be obtained through efficiency improvements may be the source of attitudinal barriers by both owners and operators of commercial buildings and market failures in the commercial property rental and resale market (discussed above). Fortunately, lack of information is also the barrier that may be best addressed by policy actions.

Financing

Capital constraints often pose a significant barrier to major conservation investments. Conservation investments must compete with other investments for limited capital funds. Capital constraints are especially relevant for small firms, which tend to have less access to both internal and external sources of capital than larger firms (OTA,1982).

Building Use and Comfort Constraints

The function of the building and the comfort needs of the building's users serve as a limit to the conservation actions that a firm is willing to undertake. In many cases, however, comfort needs may serve not as a barrier, but as an incentive to conservation investments. For example, the installation of storm windows may prevent drafts and use of efficient O&M procedures may result in improved comfort and fewer breakdowns.

Personnel Constraint

The ability of the firms' personnel to evaluate and implement efficiency improvements may serve as a barrier to conservation investment. As previously noted, small firms may lack the ability to undertake a complex economic analysis of alternative conservation options and O&M staffs may lack information on how to operate the existing systems more efficiently. In addition, certain types of conservation investments require specific technical knowledge by the O&M staff. For example, cases have been cited in which energy management systems have been disconnected because the O&M staff does not have the skills necessary to use them properly (Bevington, 1983; and Haines, 1985).

Customs and Attitudes

Habits and attitudes may pose a significant barrier to conservation changes. As discussed in the previous section, firms may utilize decision rules, or heuristics, rather than seeking optimal improvements. For example, when a furnace breaks down it may automatically be replaced by the same type. Likewise, energy bills may be simply accepted as an unavoidable cost of running a business and methods of reducing them may not be explored (Temple, Barker, and Sloane, 1984).

6. IMPACT OF PRODUCT ATTRIBUTES

In addition to the barriers that a firm may face, the attributes of the conservation measures being considered may have a impact on the decision outcome. The following attributes have been considered to impact firms' decision processes and/or decision outcomes (Rogers, 1983; McDermott and Schweitzer, 1980; Ettlie and Vellenga, 1979):

1. Relative advantage: the extent to which the product is perceived to be superior to the product that it will replace or to alternative products. For conservation investments, the secondary benefits such as increased comfort, may be perceived as a relative advantage.

2. Observability: the degree to which the relative advantages of the innovation (i.e., capital investment or change in procedure) can be observed by, or communicated to, the adopter.

3. Compatibility: the extent to which the innovation is perceived to be consistent with existing attitudes, priorities, and existing equipment and personnel.

4. Divisibility (or triability): the extent to which an innovation may be tried on a limited basis.

5. Complexity: the degree to which the innovation is perceived to be difficult to understand and use.

6. Risk: the degree to which the investment is perceived to involve, a physical, financial, or social risk.

7. Initial Cost: the initial fixed cost associated with the investment.

8. Payback Period: the number the first years worth of savings must be multiplied by to recoup the initial investment cost.

McDermott and Schweitzer (1980) stress the point that it is the decision maker's perception of these characteristics that determine their willingness to adopt the innovation. They conducted an exercise designed to increase the effectiveness of a group of industrial rotary engine salespeople by increasing their awareness of their customers perceptions of how the rotary engine ranked in terms of the characteristics described above (initial cost was not included). The salespeople were divided into groups and asked to rank the product attributes according to the attribute's importance to their customers. Next they were asked to rank the industrial rotary engine according to how it rated in terms of each characteristic. McDermott and Schweitzer found that this exercise increased salespeoples' effectiveness by guiding them in what product features to focus on and by causing them to think of ways to deal with customer concerns.

A similar type of program for commercial auditors may be beneficial. The limitation in conducting an exercise of this type is that the commercial sector is so diverse. As discussed above, the importance of these product characteristics is likely to vary with organizational characteristics. Segmentation of the commercial sector would be necessary prior to conducting an exercise of this type.

7. RECOMMENDATIONS

Based on the findings of this report, a five step plan is recommended for improving the effectiveness of policies designed to promote conservation in the commercial sector. This plan involves: (1) segmenting the commercial sector; (2) identifying the barriers and incentives associated with each market segment; (3) targeting policies; (4) linking market segments with appropriate technologies; and (5) utilizing a flexible approach. Each of these steps is discussed in detail below.

Step 1: Segmenting the Commercial Sector

Policies designed to promote conservation (e.g., the provision of information of financial assistance) are most likely to be effective if they are directed at those individuals who are responsible for conservation investment decisions and are based on an understanding of both the decision criteria utilized in conservation investment decisions and the barriers that may prevent conservation investments. As demonstrated in this literature

review, however, a wide range of these characteristics may be found throughout the commercial sector. A useful step towards improving the effectiveness of policy initiatives, therefore, is to identify segments of the commercial sector that are likely to exhibit similar buying center membership patterns, face similar constraints, and share similar investment criteria. The literature reviewed in the previous sections indicates three readily-identifiable characteristics (which will be referred to as "segmenting factors") that may be utilized to identify such segments. These segmenting factors are: building type, ownership type, and size.

Building type is an appropriate segmenting factor because building use will have an impact on the barriers and criteria associated with undertaking conservation retrofit actions. For example, certain building types, such as health care and lodging facilities, have comfort constraints that limit their ability to undertake conservation actions that reduce comfort (e.g., thermostat setback) and increase their incentive to undertake conservation actions that have significant secondary benefits (e.g., thermopane windows). In addition, Nieves and Fang (1986) illustrated that, for a given size category, there is a substantial variation in the intensity of electricity use among different building types. This difference in energy use intensity may have an impact on firms' awareness of energy expenditures and on their motivation to undertake conservation improvements. The building categories used by the Nonresidential Buildings Energy Consumption Survey: Fuel Characteristics and Conservation Practices (EIA, 1981) may be useful to use in segmenting the commercial sector. These are: assembly, automotive sales and service, education, food sales, health care, lodging, office, residential, retail/services, warehouse and storage. Building types that have similar barriers and similar levels of usage intensities may be combined into one category.

Ownership type is a pertinent segmenting factor since ownership type was shown to have an effect on the patterns of buying center membership found in the commercial sector (as discussed in Section 3). In addition, ownership type will have an impact on the barriers and incentives associated with retrofit actions. As described in Section 5, investor owners lack incentive to invest in conservation retrofits for buildings in which the tenants are responsible for the heating bills, unless they are able to obtain a rent premium for conservation improvements. Finally, ownership type may have an impact on access to capital and information (OTA, 1982).

The system of ownership classification utilized in segmenting the commercial sector should be one that defines ownership types having similar barriers to conservation, investment criteria, and buying center membership patterns. One possible system of classification is one utilized by the Office of Technology Assessment (OTA, 1982). This system defines five different types of investor owners: institutional owners, development companies, national partnerships, local partnerships, and individual. Owner occupants are divided into individual owners and corporate owners. Further research might investigate whether alternatives classification systems are effective in defining ownership types with similar relevant characteristics.

Size is an important segmenting factor because the available evidence suggests that large firms are better able to undertake conservation investments. They have better access to information and capital and have

more expertise in evaluating investment alternatives (OTA, 1982). In addition, the Dornbush and Co. study discussed in Section 3, indicated that, for a given ownership type, variations in decision making participation patterns are found for alternative size organizations.

Step 2: Identifying the Barriers and Criteria Associated with Each Market Segment

Once a specific market segment has been defined, it is necessary to examine the specific decision participation patterns, barriers, and investment criteria that characterize each market segment. This may be accomplished by identifying the impact that each segmentation factor is likely to have on these characteristics. For example, suppose small, owner-occupied office buildings are defined as a market segment. The findings of this literature review indicate that the following decision participation patterns, investment criteria, and barriers, may characterize this market segment:

Segmentation Level 1: Building Use = Office building. This building type is likely to be characterized by: moderate usage intensity and no extreme usage or comfort constraints.

Segmentation Level 2: Ownership type = Individual Owner-occupant. This ownership type is expected to be able to realize the savings from conservation improvements.

Segmentation Level 3: Size = Small. This size category is likely to be characterized by: a centralized decision making pattern; limited access to information and capital; a lack of trained technical personnel; and a concern with cash flow considerations.

This analysis reveals that the motivation to conserve is relatively high for small, owner-occupied office buildings, decision making is likely to be centralized, and that the main barriers faced by this segment are capital and information constraints. By following a similar procedure for each market segment, a better understanding of why firms in a particular market segment may, or may not, undertake conservation on their own is obtained, more effective policies may be designed, and information may be directed at those who are most involved in the decision making process.

Step 3: Targeting Policies

Conservation promoting policies will be most effective if they are targeted at market segments whose characteristics make them unlikely to undertake retrofit actions on their own, but likely to respond to policy initiatives (e.g., information, demonstrations, loans). These types of market segments may be identified by examining the particular barriers and incentives associated with each segmentation factor. The methodology for doing this is described in step 2. Once step 2 has been completed for each market segment, those that are unlikely to undertake retrofit actions on their own, but are likely to respond to policy initiatives, may be targeted.

Step 4: Linking Market Segments with Appropriate Technologies

Once market segments that are likely to respond to policy initiatives have been determined, the technologies which are most appropriate for these market segments may be identified. As discussed in Section 6, conservation technologies may be characterized by eight different attributes: relative advantage, observability, compatibility, divisibility, complexity, risk, initial cost, and payback period. The manner in which a particular conservation investment ranks according to these attributes may vary across market segments. For example, an energy management system may rank high in relative advantage for a large office complex, but not for a small office building. In addition, the importance of each of these attributes may vary across market segments. For example, initial cost may be a more important attribute consideration for small individually owned office buildings than for large corporate owned office buildings. In order to be able to determine which technologies are appropriate for a given market segment, each retrofit technology may be ranked according to these eight attributes on a segment specific basis and the relative importance of these attributes to each market segment may be determined. Information on the relative importance of product attributes to a specific market segment may be derived from the barriers and decision criteria identified for that market segment.

Linking appropriate retrofit investments with each market segment is likely to improve the effectiveness of information dissemination efforts. An additional benefit associated with this linking process is that it may illuminate ways in which changes in the attributes of retrofits will affect firms' willingness to undertake retrofit improvements. For example, small, owner-occupied office buildings may be more willing to adopt relatively risky conservation investments if some form of risk sharing was offered or if the product could be offered for trial on a limited basis. Finally, since linking causes information to be focused on retrofit investments that are appropriate to the market segment receiving the information, it is more likely that firms that do adopt the recommended measures will benefit from that action. This may create a positive diffusion effect.

Step 5: Utilizing a Flexible Approach

Marketing research has revealed the need to utilize a flexible approach in directing information at organizations. This approach must be based on the recognition that a decision to adopt a conservation improvement is the outcome of a process (as discussed in Section 2). This process involves different stages and a variety of organization members. The information needs of a firm will vary with the different stages in the adoption process.

Use of a flexible approach involves aiming conservation retrofit information at key members of the buying center. As discussed in Section 3, the buying center is a dynamic group that varies across organizations and product types. However, research on buying centers in the industrial sector has revealed that it is possible to identify buying center patterns within market segments. Identification of the buying center is an important step in improving the effectiveness of policies designed to provide information on conservation retrofit to the commercial sector.

In addition to being aware of the different stages involved in the decision process and the manner in which buying center membership varies across market segments, use of a flexible approach entails tailoring information to the market segment it is directed at. The literature reviewed in this report indicates that large firms may be more interested in detailed technical and financial information on conservation alternatives, whereas, small firms may be less able to process this type of detail and may prefer information in summary form, such as payback periods.

Finally, use of a flexible approach entails maintaining contact with the organization over the adoption process, rather than providing information at just one point in time. Contact may be made at the initial awareness stage, in the decision stage when alternatives are being considered, and in the implementation and evaluation stage.

ACKNOWLEDGMENTS

Funding for this research was provided by the Office of Building and Community Systems, DOE. The author is grateful for the technical information and insights which were provided by Mike MacDonald and for the reviewers' comments.

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