Designing Successful Industrial DSM Programs

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Utilities have had varying levels of success at achieving high rates of participation in their industrial DSM programs. Part of this problem reflects the difficulty in designing DSM programs that are particularly suited to industrial customers. This paper provides a framework for designing successful industrial DSM programs. This framework is established by blending market research with a technical assessment of energy efficient measures resulting in a suggested program delivery package. To confirm whether this framework actually works, the paper then surveys utility industrial DSM program experience.

The first part of the paper identifies how to effectively draw on market research that identifies industrial customer needs, preferences, and decision-making practices. This includes a discussion of market segmentation techniques and tools used to conduct such analyses. Such information is often collected but under-utilized in designing DSM programs. The second part of the paper provides a technical review of energy efficient measures suitable for industrial applications. This includes a discussion of proven measures and technologies available and a description of the applicable markets to which these measures can be targeted. Finally, the paper identifies successful industrial DSM program concepts and draws on the experience of many North American utilities to compare and contrast how these program concepts are being delivered to industrial customers.

Introduction

For the United States as a whole, industrial customers account for over one-third of total electricity consumption. In a recent study, the Electric Power Research Institute (EPRI) (Barakat & Chamberlin 1990a) estimates the technical potential for energy efficiency in the industrial sector at 24% to 38% of forecasted electricity consumption in the year 2000. In another study that quantifies the effect of utility Demand-Side Management (DSM) programs, EPRI projects that industrial DSM programs will save 5% of forecast energy consumption in the year 2000 (Barakat & Chamberlin 1990b). There is thus a sizeable gap of 19% to 33% between the forecasts of technical potential and of utility DSM impact.

This gap can never be completely closed for at least two reasons. First, several measures that are technically feasible are not economic for either the utility or the customer to invest in. Second, it is virtually impossible to ever get all the customers to participate in a program even if it is economic for them to participate in it. However, the gap can probably be narrowed. Towards this end, this paper reviews the experience of several utilities that are seeking to narrow the gap through more-effective program design and better targeted marketing.

Industrial customers are an attractive target for utility DSM programs for several reasons: they represent a large share of sales, revenues, and earnings, have a high ratio of sales per customer, have a high load factor, and are a source of economic growth for the entire service area. Industrial customers are also a *critical* target because industrial sales are more uncertain than residential and commercial sales. There are many reasons for this. First, industrial sales are often concentrated in a few large customers. Second, many industrial customers compete with manufacturing plants both inside and outside the utility's service area—either because their products are sold in markets that are not defined by utility service boundaries or because their company has other plants producing the same product. This introduces an element of unpredictability into industrial sales. Third, recent trends in the price of electricity relative to the prices of fossil fuels have created a strong interest in self-generation equipment, and many have already installed such equipment. Fourth, industrial customers are looking at new technologies that will make them more competitive in the market place. In some cases, they are installing electrotechnologies; but in other cases they are installing efficient gas-fired equipment. Finally, industrial sales are inherently more volatile because the demand for most industrial products is derived from the demand for final consumer goods. Changes in the demand for consumer goods are magnified through the accelerator principle into greater changes in the demand for industrial goods, and still greater changes in industrial electricity usage. For all these reasons, it is important to understand industrial customer preferences and behavior.

Acquiring such an understanding is, however, a complex task: industrial customers are often reluctant to disclose information about their decision-making practices or their process and end-use equipment inventory because of proprietary considerations. Even when such data is not proprietary, it can be very expensive to collect for a number of reasons:

- As shown in Table 1, energy costs for many industries represent a small part of total production costs. Thus, energy usage cannot be analyzed in isolation from decisions about the entire production process. Data has to be collected on a very large number of variables, not all of which can be easily quantified.
- Industry-to-industry and even plant-to-plant differences in the same industry are substantial. This often means that instead of sample surveys utilities often may have to conduct a census of their largest 100 to 200 customers.
- The industrial buying process is an order of magnitude more complex than its residential counterparts since it involves multiple decision makers, making it harder to understand and influence. To some extent, this constraint can be alleviated by applying the techniques currently being tested for understanding the preferences of commercial customers who also have multiple decision makers.
- Large expenditures per end-use device result in substantial lags in decision-making, since several layers of management are involved in the purchase decision.
- Since most industrial firms manufacture products for sale to either final consumers or other industries, to fully understand their motivating factors, utilities need to understand trends in their customers' end-use markets and anticipate future developments. In other words, utilities need to understand not only their customer but their customer's customer when dealing with industrial markets.

Table 1. Production Cost Components of Selected Industries

		Percentage of Total Costs			
SIC	Target Market	Energy	Labor	Raw Material	Factory Overhead
20	Food and Kindred Products				
202	Dairy Products	7	8	54	31
203	Preserved Fruits and Vegetables	9	12	63	15
28	Chemical				
281	Industrial Inorganic Chemicals	17	17	49	17
30	Rubber and Miscellaneous Plastics				
308	Miscellaneous Plastic Products	4	22	55	19
36	Electronic and Other Electric				
367	Electronic Components	2	30	34	34
37	Transportation Equipment				
372	Aircraft and Parts	3	23	37	37

Source: Bules & Associates (1990).

The Needs and Preferences of Industrial Customers

Case studies of business performance cited regularly in the Wall Street Journal, Harvard Business Review, and Tom Peters' syndicated column indicate that successful companies develop products and services to meet customer needs. Such companies regularly monitor customer needs and preferences so that they can convey the "voice of the customer through to production" (Hauser-Clausing 1988). This suggests that the first step in developing successful industrial DSM programs is to understand the unique needs and preferences of such customers.

To understand the needs and preferences of a utility's industrial customers, one has to look at the world through their eyes. To obtain such a view, in the last few years, several utilities have conducted in-depth, one-on-one discussions with their industrial customers. One major conclusion emerges from these discussions: saving energy is rarely the most important priority for industrial corporations. A bigger barrier is "other demands on management time." Even the high first cost of energy-efficient technologies and the lack of information which prevent many residential and commercial customers from investing in such technologies are comparatively less important barriers in industrial decision making, especially for the medium to large industrial customers. The biggest barrier is not being able to see how energy-efficient technologies and processes can help the industrial customer become more profitable and competitive. This finding suggests that if utilities can find a way to show industrial customers the "value added" features of energy-efficient products, such as more reliable production with premium grade motors and better process controls with adjustable speed drives, then their chances of getting that customer to invest in energy efficiency can rise considerably.

EPRI-sponsored research has defined a framework for identifying the needs and preferences of industrial customers. It characterizes customer needs in three dimensions: general business strategy, general business operations, and energy operations.

The general business strategy dimension deals with needs that relate to the way a firm orients itself in the competitive marketplace. These needs are often seen as being of primary importance by CEOs and stockholders. Specific needs associated with the general business strategy dimension include: providing superior products/service, competing on price, marketing new products/services, motivating the work force to "do it right" the first time, and taking risks to grow the business.

The general business operations dimension deals with needs related to policies and procedures which guide the day-to-day operations of a firm. These needs are most often addressed at the highest levels of the company. Specific needs might include: moving toward new technology to improve operations, reducing environmental emissions, complying with OSHA requirements, and emphasis on line responsibility for cost control.

The energy operation focuses on two aspects of energy needs: those associated with managing energy operations and those associated with service support required from the energy supplier. Specific needs related to managing energy operations might include: investing in DSM technologies, and maximizing equipment efficiency. Specific needs related to service support might include: customized service, rate stability, and power quality and reliability.

Of course, each industrial customer is unique and would deal with these sets of needs uniquely. At the same time, for analysis and planning purposes, utilities cannot deal with each customer individually. Thus, a compromise has to be reached in terms of how to segment the market and how to assess the needs and preferences of each segment. In the next section, which focuses on industrial market research, we address these issues.

Industrial Market Research

Industrial market research is usually based on a combination of primary and secondary data sources which address the utility's industrial customers, their markets, energy use, and economic and financial profiles. Information on industrial demographics, operations, processes, and economics is often referred to as "hard" data. Hard data at the national or regional level is often available through published secondary sources, including Standard and Poor's "Industry Surveys" or the United States Department of Commerce. More detailed data about individual customers may only be available through primary data collection, which is more expensive and time-consuming.

When planning industrial DSM programs, it is important to be receptive to "soft" data sources, which are less scientifically rigorous but nonetheless critical towards understanding the dynamics of the industrial marketplace. Soft data often include information on the progressiveness and risk-bearing nature of corporate decision-makers with regard to new technologies, and customer perceptions of the utility as a provider of end-use energy services, rather than simply as an energy distributor.

Collection of industrial market research data is often complicated by the diversity of industrial markets, firms and products, the limited availability of energy consumption and end-use data, and the reluctance of many industrial firms to disclose sensitive or proprietary information to utility auditors or surveyors. This may require integrating known aspects of the utility's customers (however incomplete or uncertain) with aggregate-level industry trends, models, or the advice of industry experts. Four prevalent areas of concentration with respect to industrial market research include market segmentation, industry segment and firm characteristics, energy usage, and economic and financial data.

Market Segmentation

Market segmentation distributes the utility's industrial customers into groups which have common needs and values, which will likely respond similarly to an offering, and which are strategically important to the utility's operations (Bonoma and Shapiro 1983). Various methods are available to segment the industrial market, the most common of which is the U.S. Standard Industrial Classification (SIC). Another segmentation method uses customer billing records to identify the largest customers in terms of energy consumption and demand. Billing data combined with SIC data will reveal the most prominent market segments in terms of energy and type of product. Similar comparisons can be made by collecting data on load profiles, peak and off-peak energy consumption characteristics, industrial labor and capital intensity, production levels and forecasts, and energy intensity.

Market segmentation schemes can also be based more directly on customers' needs. While less commonly used, this approach can improve a utility's ability to design and market successful DSM programs. EPRI–sponsored research, for example, has investigated approaches for developing needs–based segments from the results of a needs survey of industrial customers. Using a statistical procedure known as cluster analysis, customers can be grouped into a limited number of segments. Each segment represents a relatively homogeneous group of customers with a particular pattern of needs.

Industrial Segment and Customer Characteristics

Once the industrial market segmentation scheme has been designated, data needs to be collected for each segment, and where available, each customer. This phase of market research is intended to refine the planner's perception of the industrial marketplace with respect to DSM program strategy and design. As mentioned above, this may require some investment of time and energy to collect primary data.

The first step is focused on customer segments. The planner should be prepared to study each segment's current and forecasted production, employment, the mix of manufacturing inputs and outputs (i.e., raw materials, energy, transportation, etc.), and the nature of the segment's short and long-term growth expectations. The planner should also be aware of the relationship of industrial customers with the government, including legislative impacts on business, regulation, economic development, and subsidization. A central focus in the relationship of industry and government is on the mitigation of environmental impacts. This focus has fundamental consequences on the way in which industries such as chemical, paper, steel, and utilities conduct their business.

The next step of this research focuses on individual firms. The time and energy needed to conduct and maintain research on every industrial customer served by the utility could easily require an entire department, much less the staff for any single program.

Industrial Energy Usage

The third phase of industrial market research focuses on segment and customer energy usage and the impact of industrial DSM programs. Energy intensity, relative fuel prices, and the relative saturation between electricity, gas, and other fuels help explain the importance of energy as a production input at the segment and customer levels. Further clarity of DSM impact can be achieved by estimating the distribution of energy across industrial end-uses. However, this is a complicated venture, since most customers consider this proprietary, or do not record this sort of information. Even when plant audit results are available, comparisons between customers should be conducted with caution, due to operational differences such as raw materials, fuel choice, equipment types, and production levels.

Electricity consumption in the manufacturing industries is concentrated predominantly in electric motors, with a smaller share of overall electricity consumption devoted to electrolytic processes, process heating, lighting, and miscellaneous end-uses. However, electricity distribution among these end-uses can vary widely across industrial market segments. As shown in EPRI (1988), motors account for nearly all electricity consumption in the pulp and paper (SIC 26), petroleum refining (SIC 29), and cement (SIC 32) industries; about half of electricity consumption in the transportation (SIC 37) and chemicals

(SIC 28) industries; and less than half in the primary metals (SIC 33) industry. Lighting, HVAC, and other miscellaneous end-uses tend to account for a relatively small portion of electric use across most segments. In manufacturing, gas and other fossil fuels furnish four-fifths of all heat and power, specifically as a boiler fuel to create steam, for process heating, and in cogeneration of electricity. Natural gas is also used in the industrial sector as a feedstock for several chemical processes, including ammonia, hydrogen, methanol, and carbon black. Fossil fuels are rarely used in drivepower applications.

Once information about equipment inventories and customer energy usage becomes more available, end-use models like EPRI's Industrial Forecasting Model (INFORM) can be a useful resource to forecast end-use consumption and to investigate how DSM programs will impact energy usage.

Economic and Financial Data

The fourth phase of industrial DSM market research concentrates on the financial and economic aspects of industrial firms. This research is generally conducted for individual customers, and the level of research can be broadly defined or highly specific. Broadly defined data can be collected from a range of sources, such as Standard and Poor, Moody, or Dun and Bradstreet investor services, annual stockholder reports, and corporate financial reports such as the Form 10-K filed with the Securities Exchange Commission (SEC). These sources provide basic information about any incorporated firm. Additional information about corporate focus and executive turnover can often be found in annual reports.

Once this information has been reviewed, the planner may wish to collect more detailed information regarding the customer's key decision-makers, their operational plans and constraints, and their plant's operating characteristics. Due to the sensitive nature of such information, specific information may not be available for many firms until the planner has established a working relationship with the customer, such as a formal program offering or scoping study. Information to be collected might include a list of the customer's key decision-makers for capital investment projects (the "buying center"), the firm's financial strengths and constraints, and its plan for capital investment (Faruqui 1988).

Integrating Market, Energy, Economic, and Financial Research

Finally, the information collected in the other phases of industrial market research needs to be integrated. This usually includes the construction of matrices which directly compare market segments, industrial processes, energy consumption, equipment and end-uses, customer strategic needs, and financial and economic resources (EPRI 1986). This analysis usually highlights significant intersections and clusters within the matrix of customer segments, needs, end-uses, and economic variables, which can provide focus for program strategy, design, and marketing.

For example, the North American steel industry is undergoing a significant shift towards plant modernization and cost-cutting. Steel executives are saddled with reducing operating costs to maintain competitiveness with domestic producers, while at the same time are being forced to modernize their plants to create higher-value steel products and remain competitive with foreign steel producers. Industrial DSM for utilities serving steelmaking customers might target technologies which reduce energy-related operating costs, such as ladle refining or scrap preheating. The program might respond to customers' investment limitations by offering low-interest financing or grants to reduce the capital investment and increase the rate of return for the project.

Industrial DSM Measures

Industrial firms are becoming increasingly aware of and interested in DSM as a strategic response to new conditions developing in their market. The pressure to increase productivity is directed toward research and development focusing on improvements in industrial methods and processes. Controlling the waste of energy and materials is a response to economic signals and environmental regulation, which in turn reflects changing consumer demands.

DSM measures are available for all industrial end-uses, but are most popular for electric motors and lighting. Motor DSM measures include replacement of standard-efficiency and rewound motors with high-efficiency AC motors; addition of an adjustable-speed drive (ASD) for variable load operations; selecting the optimal motor size for the required fan and/or pump load; installing high-efficiency pumps and fans; and replacing v-belts with cogged belts. The first two motor measures have already achieved some market penetration, due in part to utility DSM as well as natural market mechanisms. Lighting measures include high-efficiency fluorescent ballasts; replacement of incandescent, fluorescent, and mercury vapor lamps with higher efficiency lamps (e.g., metal halide and high-pressure sodium lamps); electronic lighting controls; and delamping, daylighting, and reflectance strategies. Lighting measures have likewise already achieved some partial market penetration.

DSM measures for other industrial end-uses have achieved little or no market penetration, due to poor cost-effectiveness of existing measures, the relative scarcity of such measures, and limited utility and customer awareness of these measures. Process heat measures usually involve the consideration of alternative fuels, or are highly site-specific, such as waste heat recovery, insulation, steam piping retrofits, computer controls, and industrial heat pumps and exchangers. Electrolytics measures are likewise site-specific, such as efficient anodes and the replacement of mercury and diaphragm cell technologies with membrane cell systems. Finally, space heating, cooling, and ventilation measures are readily available and often cost-effective, but are less popular in the industrial sector since this end-use does not typically account for a significant portion of electricity costs, and are less competitive with alternative capital investments.

The Art of Industrial DSM Program Design

The objective of program design is to translate the planning estimates and technology options developed in the DSM planning process into programs that work in the real world. The best planning analysis and technology screening will be of little use unless DSM programs are designed around customer needs, overcome market barriers, and are marketed effectively. This section focuses on five key elements in industrial program design.

Bundling DSM Measures into DSM Programs

The first element of industrial program design is bundling DSM options such as energy efficient motors and adjustable speed drives into logical groups for program delivery. In order to package DSM options into logical groups for program delivery, potential options that remain after various screening steps are typically reviewed to determine if there are market barriers significant enough to interfere with measure implementation. This helps identify the measures that are most suited to a utility's customer base, service territory, and market infrastructure, and eliminates those measures that are inappropriate for inclusion in potential DSM programs. The result is a list of DSM measures that can be packaged into logical groups for program delivery.

Obtaining the Internal Buy-in from the Utility

The second element is to obtain a certain level of DSM "buy-in" from internal departments and groups within the utility. This concept is commonly referred to as the "internal sell" and typically includes departments such as rates, forecasting, customer marketing, and many times, the highest groups in the company (i.e., CEO and the board of directors) (Engel 1990). With industrial DSM programs, this point becomes even more important given the potential for competing objectives among departments within a utility. For example, the marketing department may have the responsibility of maintaining any and all contacts with large industrial customers. However, if the DSM department pursues its agenda without coordinating with the marketing department, certain problems will arise. The so-called internal sell is a crucial component in making industrial DSM programs work. Involvement, communication, and training are the key aspects of the internal sell.

Design Program Features to Meet Customer and Utility Needs

The third element is to design program features to meet customer and utility needs. It is important to be clear about what that program is intended to accomplish. Though there may be general agreement on the purpose of the program—for example, to increase use of efficient motors in industrial customer facilities -- it is useful to list objectives as specifically as possible. The technology selection, market segmentation, and customer needs assessment steps described earlier add valuable information that will enable program designers to flesh out program objectives.

Develop Marketing Strategy and Methods

The fourth element is developing marketing strategies and methods. Strategic marketing is a long-term process involving many facets of the utility. Many view marketing, in the context of designing and implementing DSM programs, as more tactical than strategic. It encompasses the promotion, recruitment, and sales aspects of the program. For industrial DSM programs, a marketing effort many times boils down to making one-one-one contacts with customers.

Forecast Program Impact

The final element of industrial program design is forecasting program impacts. Much analysis is normally devoted in DSM planning stages to the expected impact of various programs. In the program design stage, however, the analysis must become more specific and pragmatic. The reason for this is that with the heterogenous nature of the industrial sector, there is considerable site-specific variation in savings. An example from a recent industrial lighting program effort by the Bonneville Power Administration illustrates this point (Wikler and Faruqui 1991b). Measured savings from the program varied from less than 1% to nearly 70% yielding an average of less than 5%. There are three primary measures of impact that should be estimated prior to implementation: size of the eligible market, participation rate, and energy and demand impacts.

Types of Programs

This section reviews two facets of DSM program design: (1) the types of programs offered at U.S. utilities, and (2) the types of strategies utilized by utilities to deliver these programs to the marketplace.

The heterogenous nature of industrial end uses, technologies, and customer types often complicates and precludes designing DSM programs with sector-wide applicability and appeal. To achieve industrial DSM objectives, many utilities have relied on traditional program approaches that rely on alternative rate designs such as interruptible and time-of-use rates. Although these programs are still common and represent a significant proportion of total industrial DSM activity in the United States, more and more utilities are moving into a marketing-oriented approach to influence energy decisions of industrial customers.

A recent EPRI survey reveals a total of 407 industrial-sector DSM programs at 154 different electric utilities in the United States (Battelle 1991). Table 2 provides a summary of the regional allotment of reported U.S. programs by type of program. Note that this table provides figures for all types of DSM program categories. The following categories typically represent energy efficiency-oriented programs:

- Motors and motor drive: Includes programs involving high-efficiency and premium-efficiency motors and/or adjustable speed drives.
- Audit/building envelope: Includes programs dealing with industrial building system and process energy efficiency ranging from facility walk-through audits to detailed process energy assessments and feasibility studies.
- Lighting: Includes programs dealing with efficient lamps and fixtures and task lighting, outdoor lighting, and lighting control systems.
- HVAC: Includes programs dealing with space heating, cooling, ventilation, and air quality equipment.

It is worth noting that many of these programs are offered to both industrial and commercial customers rather than just to the industrial customers exclusively.

Industrial DSM programs are often not always delivered to the marketplace in the categories outlined above. Utilities are beginning to design their DSM programs in a more market-oriented format. This reflects an emerging program design philosophy that shifts priorities toward making these programs work in a "market friendly" format. This includes three general delivery categories: (1) replacement programs, (2) retrofit programs, and (3) new construction/remodel programs.

- *Replacement programs* generally provide incentives to replace old or worn out equipment including motors, lighting, and HVAC systems. This program is delivered to customers through direct or prescriptive rebates where the measures are listed on an application form. The objective of this program is to convey simplicity both to the customer and the trade allies. This is commonly referred to as an emergency replacement program which means that trade allies play a key role. In many instances, the customer's equipment needs do not readily fit into what the utility offers on the direct rebate application form. In these cases, customized rebates are offered. Here, the customer provides engineering calculations or an audit report that identifies savings opportunities. Utilities often offer comprehensive incentives either on a $/kW, $/kWh, or $/therm basis. Customized measures are difficult to implement for emergency replacements, although they can work for planned replacements.
- *Retrofit programs* provide for incentives to replace inefficient equipment prior to the end of the service. Typically, these opportunities are identified for customers through an energy audit or process assessment. Incentives can be either prescriptive or customized.
- *New construction/remodel programs* provide for incentives to incorporate efficient building systems or industrial process designs during the so-called "window of opportunity" when a new facility is being built or an existing facility is be substantially remodeled. The program can be delivered either in a

Table 2. Industrial DSM Programs by Type and Region

Program Type	North-east	East Central	South-east	West Central	South Central	North-west	West	Total*
Energy Efficiency:								
Motor and Motor Drive	19	5	0	8	3	5	10	50
Audit/Building Envelope	15	5	10	6	2	2	9	49
Lighting	29	4	4	10	3	5	8	63
Heating/Cooling/Vent	18	1	1	3	1	1	5	30
Electrotechnology	17	11	10	13	7	10	8	76
Thermal Storage	15	4	4	5	4	0	6	38
Other:								
Special Rate	23	15	20	15	13	5	14	105
Load Control	3	3	4	7	2	0	5	24
Economic Development	4	8	6	10	9	1	2	40
Standby Generation	5	2	4	3	0	1	3	18
Power Quality	0	3	3	4	1	2	2	15
Total	148	61	66	84	45	32	72	508

* Totals exceed actual number of programs because this table allocates multiple-technology programs to each of the appropriate technology categories.

Source: Adapted from Battelle (1991).

prescriptive format (less common) or a comprehensive format. The latter provides for design assistance and rebates for the implementation of efficient measures or practices.

Program Experience

Utilities have been offering DSM programs such as interruptible rates to industrial customers for well over twenty years. Since the mid–1980s, however, the number of industrial DSM programs has increased dramatically as utilities have begun to turn their attention to the huge DSM potential of this sector. Much of this increased DSM effort has taken the form of energy–efficiency programs. Of these, the majority of programs have been oriented toward building systems, especially lighting, HVAC, and building envelopes. In large measure, these programs represent adaptations or expansions of commercial–sector DSM programs.

In just the last several years, greater utility emphasis has been placed on applying energy–efficiency programs to industrial processes (Nadel 1990). Efficient motor rebates, ASD rebates, customized audits and rebates, and other programs are increasingly tapping the DSM potential of process loads. Since such loads generally represent more than 90% of an industrial facility's electricity consumption, this direction should expand the opportunities for industrial DSM.

This section provides a summary of the experience utilities have gained with industrial–sector energy-efficiency programs and outlines suggestions for utility DSM program designers involved in this area. Six key areas are discussed, with supporting examples.

Focus on Customer Needs

To be successful, program designs need to be based on a firm understanding of industrial customers and their needs. As noted earlier, these needs can be organized in a structure consisting of business strategies, business operations, and energy operations. Given this range of needs, utility DSM planners should expand their focus beyond just energy issues; a needs-based segmentation approach can help in this regard. Generally, industrial plant managers are most concerned about achieving production quotas by the end of the month, meeting environmental regulations to avoid EPA penalties, or some other non-energy issue. Accordingly, productivity, environmental compliance, product quality, or other issues may represent opportunities for the utility to work cooperatively with their industrial customers (Bules 1990). This interaction may provide the "foot in the door" needed to successfully market energy-efficiency programs. Additionally, it may solidify a long-term relationship which encourages the industrial customer to look to the utility for technology-oriented assistance and information.

Target Particular Markets Within the Industrial Sector

Given the huge diversity among industrial customers, it is preferable to avoid treating all industrial customers the same. Segmentation schemes, as outlined earlier in this paper, provide the opportunity to identify groups of customers that have generally common characteristics and needs. Targeting particular industrial markets with DSM programs that match the markets' needs can be an effective way to increase customer acceptance. For example, in developing its energy audit programs, Northern States Power (NSP) segmented its C/I market by size. NSP developed a range of audit programs: simple audits for the smallest customers, more thorough audits for medium-sized customers, and more detailed audits for large customers (XENERGY 1992).

Work Directly with Customers Through Simple Programs

Simple audit and/or incentive programs will help meet the needs of many industrial customers. The most successful programs are generally provided directly by the utility and are easy to participate in. As noted with NSP's audit efforts, a simplified audit is appropriate for smaller C/I customers. Similarly, straightforward rebate programs will be appropriate for many of these same customers.

The New England Electric System (NEES) worked hard to simplify its rebate programs. The Energy Initiative (EI) program evolved from earlier program which had more complex incentive schemes and relied on ESCOs for program delivery. EI is operated by NEES, employs a simple incentive structure, and as of mid-1991 was so well received that a temporary hold had to be put on the program (Plexus 1992).

Involve Process Loads

As noted earlier, more than 90% of a typical industrial facility's electricity usage is due to process loads. Nonetheless, only a relatively small minority of industrial DSM programs focus on these loads. Furthermore, even fewer programs consider the energy usage and efficiency potential of industrial systems in an integrated fashion. Replacing a conventional motor with a high-efficient motor will generally reduce that load's consumption by about 4%, but optimizing the entire system in which the motor fits can often produce much greater savings (Nadel et al. 1991).

While approaching process loads in an integrated fashion can yield substantial benefits, it is clearly a difficult undertaking. Industrial processes are very complex and very diverse, so analysis must be performed on a case-by-case basis through detailed audits and engineering calculations. In addition, plant personnel are often understandably reluctant to deal with the downtime, capital costs, and potential risks associated with installing new, energy-efficient equipment or processes.

Despite the difficulties, some utility programs are making significant advances into process-load energy efficiency. Motor rebate programs represent a simple form of this activity. Larger savings, however, are accomplished through customized audit and rebate approaches which generally pay incentives per kWh or kW saved or have a payback threshold. For example, NU's Energy Action Program is a combined audit/rebate program available to C/I customers. By increasing incentives to allow participants a one-year payback, NU found it possible to significantly reduce the reluctance of plant personnel to modify process loads (Sayko 1991). Additional examples can be found at BPA and Ontario Hydro. BPA's Energy $avings Plan has sparked the installation of a variety of process changes with incentives that can range up to $250,000 (Riewer and Spanner 1991). Ontario Hydro's process audit program has employed outside consultants to perform 135 specialized audits of industrial facilities. These audits uncovered an average of 1.5 MW of load reduction per facility (Fraser 1992).

Target New Facilities and Major Process Changes

It is generally easier to encourage the adoption of process changes during the initial design or modification of the process line. As a result, DSM programs which offer incentives for such changes can be helpful. BPA's Energy $avings Plan, for example, provides incentives for new plants as well as existing facilities. Other utility programs have successfully focused specifically on new construction in the commercial and industrial sectors. NEES's Design 2000 Program, for example, has been very popular, with 280 participating customers during 1991 (McAlteer 1992). Technical assistance and a marketing approach which clearly defines the benefits to customers have proved crucial to the program's success. Most of these new construction programs, however, have largely involved commercial-sector customers.

Market to Reach the Decision-Maker

As with all DSM marketing, reaching the right people is key. In the industrial sector, however, the right people may be in different departments that seldom interact, they might be thousands of miles apart, and they might be greatly over-committed. Getting corporate agreement from the customer to proceed on a DSM effort can become a difficult task, and follow-up (after audits or any other type of customer contact) is vital.

One-on-one contact via customer service reps is clearly the desired marketing approach for most types of industrial-sector DSM programs. This encourages the building of a partnership with the customer that will facilitate the acceptance of energy-efficiency program promotions. Nonetheless, this close one-on-one contact is generally used for only medium to large customers. Use of trade allies represents an excellent way to leverage utility marketing efforts. Manufacturers, suppliers, contractors, trade associations and the like are often crucial to getting the message out about programs. They can also provide product services, reduce customer perception about risk, and reach customers at the crucial stage of purchase decisions.

Conclusions

This paper has reviewed a variety of innovative and creative ways of designing and delivering industrial DSM programs. While the experience with these new program designs and delivery mechanisms is somewhat limited to date, we are optimistic that they will produce much higher levels of customer participation and satisfaction. We expect that in the next few years, as a result of these and several new innovations, utilities will be able to achieve a much larger share of the technical and economic potential savings in the industrial sector.

References

Barakat & Chamberlin (1990a), *Efficient Electricity Use: Estimates of Maximum Energy Savings,* EPRI CU-6746, March.

Barakat & Chamberlin (1990b), *Impact of Demand-Side Management on Future Customer Electricity Demand: An Update,* EPRI CU-6953, September.

Barakat & Chamberlin (1990c), *Review and Assessment of North American Utility Experience with Industrial Energy Efficiency Programs,* Prepared for Ontario Hydro, September 29.

Battelle (1991), *1990 Survey of Industrial-Sector Demand-Side Management Programs,* EPRI CU-7089, January.

Battelle, Resource Dynamics Corp., Synergic Resources Corp., and Enviro-Management and Research (1986), *Demand-Side Management: Volume 5: Industrial Markets and Programs,* EPRI EA/EM-3597, November.

Bonoma, Thomas V. and B. Shapiro (1983), *Segmenting the Industrial Market* (Lexington, MA: O.C. Health & Company).

Bules & Associates (1990), *Industrial Load Shaping: An Industrial Application of Demand-Side Management,* EPRI CU-6726, May.

Ciliano, R.E. and M.A. Chapman (1990), "A System to Identify, Assess, and Track Industrial DSM Opportunities, Targets, and Accomplishments," *Proceedings of the Canadian Electrical Association Demand-Side Management Conference,* Winnipeg, May 17-18.

Electric Power Research Institute (1990), *Industrial Market Information System (IMIS)*, September.

Engel, Daniel (1990), "The 'What Do You Mean We' Syndrome: The Importance of the Oft-Overlooked Internal Sell," *Proceedings of the Canadian Electrical Association Demand-Side Management Conference,* Toronto, October 22-24.

Faruqui, Ahmad (1988), "Customer Preference & Behavior: Industrial Customers and A&E Construction Firms," A scoping study for the Electric Power Research Institute, August.

Fraser, Marion (1991), *Demand Management in Ontario,* Ontario Hydro, Toronto, Canada, December.

Hauser, John R. and Don Clausing (1988), "The House of Quality," *Harvard Business Review,* May-June.

McAlteer, Michael (1992), "Design 2000: New Construction and Equipment Replacement Program, The NEES System's Three-Year Experience: What Works, What Doesn't, What's Changed," *Proceedings of the Conference on New Construction Programs for Demand-Side Management,* South Lake Tahoe, May 3-5.

Nadel, Steven (1990), *Lessons Learned: A Review of Utility Experience with Conservation and Load Management Programs for Commercial and Industrial Customers,* American Council for an Energy Efficient Economy (ACEEE).

Nadel, Steven, Michael Shepard, Steve Greenberg, Gail Katz, and Anibal T. deAlmeida (1991), *Energy-Efficient Motor Systems: A Handbook on Technology, Programs, and Policy Opportunities,* American Council for an Energy Efficient Economy (ACEEE).

Plexus Research, Inc. (1992), *1991 Survey of Commercial-Sector Demand-Side Management Programs,* EPRI TR-100329, January.

Resource Dynamics Corp. (1988), *Electrotechnology Reference Guide, Revision 1,* EPRI EM-4527, August.

Riewer, Sheila and Gary Spanner, "Performing Impact Evaluations in Industrial Retrofit: The Energy $avings Plan Program," *Proceedings of the 1991 International Energy Program Evaluation Conference,* Argonne National Laboratory, 1991.

Sayko, Jan L. (1991), "Marketing DSM to Industrial Customers Using the Energy Action Program," *Proceedings of the 5th National DSM Conference,* August 1991.

Wikler, Greg and Ahmad Faruqui (1991b), "Industrial Energy Efficiency: What Are the Measures?" Presentation to the PRO-N-CON Productivity and Energy Conservation Conference, Santa Barbara, CA, February.

XENERGY, Inc. (1992), *Demand-Side Management Implementation Guidelines,* EPRI, TR-100349, January.