UTILITY DSM: WHAT HAVE WE LEARNED, WHERE ARE WE GOING?

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ABSTRACT

Utility demand-side management (DSM) programs have been operating for approximately two decades. During this period DSM has progressed from an emphasis on information and loan programs to a resource acquisition strategy emphasizing rebates. Now, the electric utility industry is being restructured, including the role of DSM. This paper reviews the experience and lessons of the past two decades, so that as DSM is restructured, we can build upon the lessons of the past. This paper then proceeds to make some predictions about the role of DSM in the electric utility industry of the future.

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DSM OVER THE PAST TWO DECADES

The Three Eras of DSM

Utility demand-side management (DSM) programs began in the late 1970's, beginning on the west coast of the U.S. and gradually spreading to the east coast, north central, and other regions of the U.S., as well as to British Columbia, Ontario, and other provinces in Canada. In recent years DSM has begun to spread to Australia and several countries in Europe, Latin America, and Asia, although thus far DSM efforts outside of North America have been limited.

Since its inception, utility DSM has gone through three major eras: (1) information and loans; (2) resource acquisition; and (3) preparation for a more competitive utility industry. The resource acquisition era is itself divided into three phases: rebates, comprehensive/direct installation, and market transformation. The boundaries between these different eras and phases are indistinct; they have overlapped to some degree and have taken place at different times in different regions, and some regions have skipped one or more eras or phases. In the paragraphs below we briefly introduce each era and phase and the prime rationales that existed for evolution to the next one. Later in this paper we discuss the strengths and weaknesses of these different program approaches in more detail.

Information and Loans. Information and loan programs began in the period following the first energy crisis of the 1970s and were primarily designed to educate consumers and businesses, under the rationale that once consumers and businesses were educated, they would invest in cost-effective DSM measures. Education efforts primarily involved energy audits and printed materials. To help encourage customer investments, some utilities offered loans, often at subsidized interest rates. In addition, during this period some utilities encouraged customers to work with energy service companies (ESCOs) that helped customers install measures and often financed measures under a shared savings arrangement (in which ESCOs received a share of the value of the energy savings achieved). Also during this period, load management programs began to encourage customers to reduce energy use during peak demand periods. Gradually, however, utilities learned that education alone resulted in limited energy savings[1] and that the majority of customers were not interested in loans or shared savings agreements.[2] These limitations led utilities to consider rebates.

Resource Acquisition. In the 1980s, states and regions began implementing integrated resource planning (IRP) processes that, among other considerations, looked at DSM as a resource option that could provide conserved power and energy at a lower cost than new power plants. Many IRPs included DSM as a central program element,

and many of these DSM programs were rebates. Rebates, which generally consisted of fixed payments for use of specified energy efficiency measures (e.g., a $5 rebate for each energy-saving fluorescent ballast installed), were easy for customers to understand and thus tended to have higher participation rates, and hence greater energy savings, than loans and shared savings.[3] However, while rebates were fairly effective at promoting certain specific types of efficient equipment such as efficient lighting and HVAC equipment, and high efficiency motors and refrigerators, rebates alone were not very effective at promoting the integrated packages of measures that represented a large portion of the savings potential. Also, while many customers participated in rebate programs, the majority of eligible customers did not, which left a large gap between the savings achieved and the economic savings potential.[4] In an effort to capture a greater share of the savings potential, some utilities began to offer comprehensive/direct installation programs.

Comprehensive/direct installation programs typically assisted customers to identify, finance, and install comprehensive packages of DSM measures. In some programs, particularly those for residential and small commercial customers, a utility conducted an energy audit, prepared specifications for the work to be done, and arranged for measure installation. In other programs, particularly programs for large commercial and industrial customers, the utility and customer worked closely together to identify a comprehensive package of measures and arrange and finance measure installation. In both cases, the utility paid a large portion of measure costs. Due to the comprehensive services provided and the low cost to the customer, comprehensive/direct installation programs generally had very high participation rates (up to 90% of targeted customers in some cases)* and, due to the comprehensive packages of measures, savings per customer were high. However, providing all of these services took a lot of time and money, with the result that direct installation programs tended to be expensive to the sponsoring utility. Also, the time required to serve each customer meant that only a limited number of customers were served each year and it would take a decade or more to serve all eligible customers that wanted to participate.[5] In order to address these

* Participation rate, as used in this paper, is the cumulative number of participating customers divided by the number of targeted customers. In some cases a much broader group of customers is eligible for a program but not specifically targeted. In these cases, if participation rates were calculated on the basis of eligible customers and not targeted customers, participation rates would be much lower. However, a high participation rate among a small group of targeted customers is indicative of the participation rates that can be achieved in the long term among all eligible customers. In the text and tables we point out cases where high participation rates are limited to small groups of targeted customers.

problems, in the past few years some utilities have started to emphasize a market transformation approach to DSM.

Market transformation seeks to change the market for particular equipment and services so that efficient practices become the norm and utility involvement is no longer needed. For example, utilities in the Northwest sponsored a series of programs to promote efficient residential construction practices including demonstration projects, builder training and incentives, and inducements to local and state governments to adopt building codes that mandate energy-efficient construction. As a result of this eight-year effort, the major states in the Northwest have adopted strong energy efficiency requirements in their building codes and utility programs for the residential new construction market have been dramatically cut back.[6] Relative to other program approaches, market transformation programs have the potential to save more energy because when markets are transformed, participation rates approach 100%. Once markets are transformed, utility involvement and costs can be reduced or eliminated. However, organizing a market transformation effort generally requires a lot of work and coordination of many diverse parties. Also, while the long-term costs of market transformation can be low, most of the investment is up-front and thus initial costs can be fairly high. In addition, it is difficult to evaluate the impact that an individual utility has on a market transformation effort involving many organizations and a variety of program and policy interventions.

Preparation for a More Competitive Utility Industry. During 1994–1995, the issue of increased competition in the electric utility industry has come to the forefront. While no one knows the form of this new competition or when it will occur, many utilities have begun major cost-cutting programs in an effort to keep electricity prices down and prepare for a more competitive era. With the focus on short-term prices, acquiring cost-effective DSM resources has moved down on many utilities' priority lists. As a result, many of the remaining rebate and comprehensive/direct installation programs are being cut. Market transformation still remains a focus for many utilities. In addition, some utilities are returning to the first era of DSM – information, loans and shared savings, in part because these program approaches are less expensive to the utility and in part due to a belief that they can design more effective information, loan, and shared savings programs than existed during the 1970s and early 1980s.

Cumulative Impacts of DSM

Another way to look at the history of DSM is to look at data on the number of programs, money spent, and savings achieved. The available data are limited, and it is difficult to compare different years because of methodological differences in collecting data. Still, the data that are available paint an approximate picture of what has happened.

Probably the leading source of information is the U.S. Energy Information Administration (EIA) that has been collecting data since 1989 on utility DSM expenditures and estimated savings.[7] In 1993, approximately 1000 utilities reported DSM programs to EIA. From 1989–1994, U.S. utilities spent approximately $12 billion on DSM, resulting in an estimated peak demand reduction in 1994 of 55,000 MW. This was more than 7% of peak summer load in the U.S. in 1994. Energy savings were also substantial and totaled nearly 200,000 GWh over the 1989-1994 period, including more than 50,000 GWh in 1994 alone (1.5% of total U.S. electricity sales). These data are illustrated in Figure 1 of Hirst, Cavanagh and Miller's paper in this issue.

The cost-effectiveness of utility DSM programs has been hotly debated in recent years, with some analysts arguing that DSM "is a lunch you are paid to eat" and others that published DSM cost estimates "are likely to seriously underestimate the full costs of these programs."[8] In the past year several comprehensive studies have come out that analyze the cost per kWh of utility DSM programs based on impact evaluation results and/or large data sets. These results are summarized in Table 1. In general, these recent evaluations tend to indicate that typical DSM programs cost utilities $0.025-0.035 per kWh saved on average, and have a total resource cost (TRC) of $0.04-0.06 per kWh saved on average.** Of course some programs have costs substantially above or below these averages. The costs for different types of DSM programs are discussed in the section below. Overall, for the programs covered by these evaluations, program total resource and utility costs are generally less than long-term avoided costs, indicating that these programs are cost-effective.[9, 10] On the other hand, for many utilities with a surplus of capacity, short-term avoided costs are only $0.02-0.025 per kWH;[11] some DSM programs will not be cost-effective in the short term for these utilities.

In comparing program costs from past years to current short-run avoided costs, it is important to keep two considerations in mind. First, past DSM programs were designed in an era of $0.05-0.10 per kWh avoided costs. Many of the program designs used in the past are not appropriate for today's avoided costs. Second, as new generating, transmission, and distribution resources are needed, avoided costs will increase from

** In this paper we primarily use the utility cost (UC) and total resource cost perspectives because they are the most widely used tests over the past decade. The TRC perspective is the most complete because it includes utility and customer costs. However, data on customer costs are frequently not collected, so many of the costs available in the literature are primarily based on utility costs. Also, as utilities prepare for increased competition, they are usually more concerned with utility costs and not total resource costs.

today's short-term levels, although they will probably not go as high as the levels of a few years ago.

Table 1. Cost of DSM per kWh Saved.

Programs Covered	Period Covered	Levelized Cost ($ per kWh Saved)	
		TRC Perspective	Utility Cost Perspective
C&I Lighting[a]	various	0.039	
Commercial[b]	1992	0.043	
Massachusetts[c]	1990-93	0.057	
Niagara Mohawk[d]	1993	0.018	
California[e]	1991-94		0.025
Consumers Power[f]	~1992-93		0.026
Seattle City Light[g]	1993		0.029
Nationwide[h]	1993		0.035

Note: All levelized cost figures in this paper are based on a 5% real discount rate. In the case of the Massachusetts data, we adjusted the figures from the original source to reflect this discount rate.

[a]Eto, Joseph, E. Vine, L. Shown, R. Sonnenblick, and C. Payne. 1994. *The Cost of Performance of Utility Commercial Lighting Programs.* LBL-3467. Berkeley, Calif.: Lawrence Berkeley Laboratory.

[b]Eto, Joseph. 1995. "The Total Cost and Measured Performance of Utility-Sponsored Energy Efficiency Programs in the Commercial Sector: A Status Report." Paper presented at the 7th National Demand-Side Management Conference, Dallas, Tex., June 30.

[c]Coakley, Susan E., and Jeffrey A. Schlegel. 1995. "Comparing Electric Utility DSM Planning and Evaluation Estimates in Massachusetts: Are We Getting What We Planned For?" In *Energy Program Evaluation: Uses, Methods, and Results.*

CONF-950817. 303-308. Chicago, Ill.: National Energy Program Evaluation Conference.

[d]Niagara Mohawk Power Corp. 1994. *Annual Evaluation Report, 1993 Demand-Side Management Program.* Syracuse, N.Y., as cited in Hirst, Eric, Ralph Cavanagh, and Peter Miller. 1995. *The Future of DSM in a Restructured U.S. Electricity Industry*. Oak Ridge, Tenn.: Oak Ridge National Laboratory and San Francisco, Calif.: Natural Resources Defense Council.

[e]California Public Utilities Commission. 1995. *Demand-Side Management Expenditures and Cost-Effectiveness: Trends and Patterns, 1988-Current.* San Francisco, Calif.: Division of Ratepayer Advocates, as cited in Hirst, Eric, Ralph Cavanagh, and Peter Miller. 1995. *The Future of DSM in a Restructured U.S. Electricity Industry*. Oak Ridge, Tenn.: Oak Ridge National Laboratory and San Francisco, Calif.: Natural Resources Defense Council.

[f]Kushler, Martin G. 1994. Testimony before the Michigan Public Service Commission. November 18.

[g]Seattle City Light. 1994. *Energy Conservation Accomplishments: 1977-1993.* Seattle, Wash.: Energy Management Services Division, as cited in Hirst, Eric, Ralph Cavanagh, and Peter Miller. 1995. *The Future of DSM in a Restructured U.S. Electricity Industry*. Oak Ridge, Tenn.: Oak Ridge National Laboratory and San Francisco, Calif.: Natural Resources Defense Council.

[h]Hadley, Stan, and Eric Hirst. (1995). *Utility DSM Programs from 1989 through 1998: Continuation or Cross Roads?* ORNL/CON-405. Oak Ridge, Tenn.: Oak Ridge National Laboratory. Only some of these savings are based on impact evaluation results.

Another measure of DSM economics that has received extensive attention is the impact of DSM on electric rates. A 1994 study examined more than 100 published estimates of the rate impacts of DSM portfolios on specific utilities. Rate impacts varied substantially by utility and portfolio, with DSM impacts ranging from a 3.3% decline in rates to a 10.2% increase. Overall, the median impact was a rate increase of 1.7%; for 90% of the sample the impact was a rate increase of 5.1% or less.[12] These results indicate that on average DSM increases rates, but that the rate impacts are generally modest.

PROGRAM TYPES AND RESULTS

As utility DSM programs are modified to meet the needs of a restructured utility industry, it is important to summarize the lessons of the past so that new program designs can build upon these lessons and not seek to "reinvent the wheel." In this section we

look at experiences with the different types of DSM program approaches that have been offered over the past two decades, how well they have worked (based primarily on the criteria of high participation rates, high savings, and good cost-benefit ratios from the utility and/or total resource cost perspective),*** and the lessons that have been learned about how to make each program approach function most effectively. In this review we emphasize four program types that are the subject of increased utility interest today (information, loans and leasing, performance contracting, and market transformation), but we also discuss other major program types (load management, rebates, comprehensive/direct installation and bidding).

Information Programs

Information programs range from simple educational brochures that are mailed to customers to training programs to industrial energy audits. Hundreds of information programs have been run by utilities, but data on program results is rarely compiled or published. However, the limited data that are available indicate that information programs can have a positive impact, but that participation rates and savings are usually small. For example, Collins et al.[13] found net or gross energy savings**** of 0-2% among recipients of pamphlets, videos, and other energy-saving information services.

Perhaps the most common type of information program is the energy audit. Most U.S. utilities (electric and gas) offered residential energy audits during the 1980's as part of the federally mandated Residential Conservation Service (RCS) program. According to an evaluation of the program six years after the RCS program began, approximately 7% of eligible customers nationwide had participated in the program.[14] Other evaluations of the program found audited households had average net savings of 3-5%,[15] while some programs had higher participation rates and savings. Factors linked with high participation and savings included a high degree of state and utility commitment to the program, the provision of financing assistance, and assistance helping customers arrange for measure installation.[16]

Similar participation rates and savings are typical with commercial audit programs, although a few programs that emphasize personal, one-on-one marketing and

*** We also note programs with good cost-benefit ratios from the rate impact measure (RIM) perspective.

**** Net savings are the difference in savings between a group of program participants and an otherwise similar control group of program non-participants. Gross savings are the savings achieved by a participant group without comparison to a control group.

provide financial incentives have achieved participation rates up to 90% and net savings up to 8%. Commercial rebate programs typically cost the utility $0.01 per kWh saved.[17] We are not aware of any estimates of the TRC cost of these programs.

Another common type of information program is labeling. These labeling programs come in several varieties. Federal government labels for appliances provide an estimate of the annual operating cost of each appliance. Evaluations of this program have generally found that consumers have difficultly understanding the information on the label and that savings from this program are limited.[18] Utility labeling programs generally do not contain energy consumption information, but instead just identify high efficiency homes or products, helping consumers to differentiate between efficient and less efficient offerings. Utility labeling programs have been largely limited to two areas — new homes and new appliances. Several new home labeling programs have achieved considerable success, with net participation rates (gross participation minus free riders) of up to 40%, energy savings relative to conventional homes of up to 25% (based on engineering estimates), and costs to the utility on the order of $0.02 per kWh saved. These successful programs work closely with builders to elicit their participation and support, and include extensive consumer education programs (including advertising) in order to create a demand for efficient products. Labeling programs for appliances have generally had lower participation rates and savings — for example, one impact evaluation of a refrigerator labeling program estimated net savings of 1.5% relative to new refrigerators that would have been purchased without the program.[19]

The discussion above largely pertains to programs that only provide information and do not provide other services. When information is combined with financial incentives participation and savings can be higher than either program type individually.[20, 21]

Loans and Leasing

Utility-operated loan programs were popular in the early 1980s, particularly for residential customers. For example, perhaps the most successful of these loan programs was the Tennessee Valley Authority's (TVA) Home Weatherization program. This program provided zero interest loans to families for weatherization improvements. Over the ten-year period in which it operated (1978–1988), over 600,000 homes participated, which represented 23% of eligible households. Reasons for this high participation rate included the attractive interest rate, the availability of free energy audits, and extensive advertising during a period of high consumer interest in energy issues. The TVA program had a utility cost of approximately $0.01 per kWh saved and a total resource cost of approximately $0.03 per kWh (both figures are based on engineering estimates).[22]

In the mid- and late-1980's some utilities started offering rebates, including several programs that offered both loans and rebates. These utilities found that most customers prefer rebates. For example, both Wisconsin Electric and Puget Sound Power and Light offered C&I customers a choice between a zero interest loan or a rebate that was approximately equivalent to the interest subsidy on the loan. In both programs, over 90% of the participating customers chose rebates instead of loans, although loans were useful for the minority of customers who lacked capital to finance measures on their own. Also, these utilities found that the rebates were generally easier to administer than loans.[23] Comparisons of residential loans versus grants have reached similar conclusions.[24] As a result of these findings, most utilities discontinued their loan programs in favor of rebates.

In the 1990s, in an attempt to lower the utility share of DSM costs, some utilities started experimenting with loans again and a few utilities also experimented with leases. Several of these programs have achieved good participation rates, although program operators generally note that it is much more difficult to market a loan program than a rebate program. Among these model programs are Burlington Electric Department's Smartlight program, PacifiCorp's Energy FinAnswer Commercial New Construction Program, Connecticut Light & Power's Hospital Revolving Loan Fund,[25] and Wisconsin Public Power's and Wisconsin Gas Company's New London Community Resources Project.

The Smartlight program has achieved a participation rate of more than 40% by leasing compact fluorescent lamps to residential customers, primarily by using a door-to-door marketing approach. The FinAnswer program has achieved an estimated participation rate of more than 50% when evaluated on a square foot of new construction basis. The program includes extensive technical assistance identifying, installing, and commissioning energy-saving measures and also finances measure installation at the prime interest rate. The program's success is probably attributable to the extensive and high-quality services provided. FinAnswer programs for residential and industrial retrofit have not been nearly as successful. The Hospital Loan Fund is administered by the local Hospital Association and has served half of the 28 eligible hospitals.[26] The New London program combines 6% utility loans with a community-based marketing approach. After one and a half years, approximately one-third of the 300 eligible commercial and industrial customers have participated, primarily to implement lighting efficiency measures.[27]

In addition, one other program that has received a lot of publicity and is worth mentioning is ENVEST (a subsidiary of Southern California Edison). ENVEST is similar to many comprehensive direct installation programs, except that financial incentives are limited and most of the program costs are financed through loan or lease

arrangements with each participant. ENVEST is still midway through its pilot phase, but initial results are that the program is effective at promoting comprehensive efficiency packages to institutional customers such as government agencies and hospitals. As of mid-1995, contracts have been signed that call for investments of around $45 million. However, no non-institutional customer has signed up for the program.[28]

All of these programs serve some type of niche market, either because they are offered for a single community (Burlington or New London), a single type of customer (hospitals or public buildings), or a particular market type (commercial new construction). Additional experimentation is needed to see whether loan and leasing programs can be effective in other customer segments.

All of these successful loan and leasing programs feature aggressive marketing (generally by organizations trusted in the community) and extensive technical assistance. However, despite the original objective of reducing utility costs, these programs may not save utilities a lot of money. Both the Smartlight and FinAnswer programs cost the utility approximately $0.03 per kWh saved (based on engineering estimates), which is approximately similar to successful rebate-oriented compact fluorescent and commercial new construction rebate programs offered by other utilities. These loan and leasing programs have significant utility costs because while the customer pays equipment costs, the utility pays substantial marketing and administrative costs.[29, 30]

Performance Contracting

Performance contracting programs generally rely on energy service companies to provide services to customers. The ESCOs identify the measures to be installed, finance and install the measures, and sometimes assist in measure maintenance. Typically the ESCOs receive payments from the utility for each kWh or kW saved and/or they receive payments from the customer based on a share of the value of the savings achieved.

Left to their own devices, most ESCOs will choose to concentrate on the largest customers and the most lucrative energy-saving measures (particularly lighting and cogeneration).[31, 32] Limited side-by-side comparisons indicate that other program approaches can achieve greater participation than ESCO-based programs.[33] A 1994 survey found that the highest cumulative participation rates in performance contracting programs were only 9-14% of eligible customers. Due to the complexity of the performance contracting process, these programs take a lot of time to implement. Also, performance contracting programs tend to be more expensive per kWh saved than many other program approaches.[34, 35] On the other hand, to the extent ESCOs assist with measure maintenance or guarantee persistence of savings, extra value is created for the utility and the customer. Also, ESCO programs, like loans and leases, can be useful for

customers who lack financial resources and technical skills to implement energy efficiency improvements on their own. For example, approximately 60% of ESCO work nationwide over the 1980-1994 period has been with institutional customers, one-third with commercial customers, and less than 10% with industrial customers.[36]

Due to the limited participation and relatively high cost of performance contracting programs, by the early 1990s, most utilities that offered performance contracting programs either phased-out these programs or chose to complement them with other types of programs. However, in the past year there has been renewed interest in performance contracting, particularly in programs where customers are largely responsible for paying ESCOs. Results of these new programs are not yet available.

Market Transformation

Market transformation is a process whereby energy efficiency innovations are introduced into the marketplace and over time penetrate a large portion of the eligible market. Market transformation also implies lasting change such that the market does not regress to lower levels of efficiency at some later time. Instead of saving energy building-by-building, a market transformation approach seeks to change the entire market for particular products or services so that efficient products or services are the norm and do not need to be promoted with incentives. Relative to conventional program approaches, market transformation programs can potentially increase the amount of energy that is saved (because participation rates approach 100%) while lowering long-term program costs per unit of energy saved (because transformed markets do not require incentives).

An important characteristic of market transformation efforts is that they usually involve many organizations (utilities, government agencies, and private companies) working together rather than individual utilities running separate, often uncoordinated DSM programs. Also, these organizations attempt to identify and address the barriers inhibiting widespread energy-efficiency improvements at all levels — from manufacturing through the distribution chain to end users — rather than focusing entirely on consumers.

Many specific policy and program approaches exist that can contribute to market transformation, ranging from traditional utility program approaches such as information and rebates to commercialization incentives and support for changes in building codes and equipment efficiency standards. Often a market transformation strategy will involve several of these program and policy approaches operating in tandem.

Utility DSM programs have contributed to the transformation of several different markets, including the transformation to more efficient refrigerators and ballasts

throughout the U.S., the transformation of the electric motor and refrigerator markets in British Columbia, and the transformation of residential building practices in the Pacific Northwest.[37, 38] Many of these market transformation efforts were ad hoc rather than the result of a carefully planned market transformation strategy.

In the past few years several national and regional consortiums have been formed to develop and implement market transformation strategies for specific energy-saving equipment and practices. Among these efforts are the Super-Efficient Refrigerator Program, the High Efficiency Commercial Air Conditioning Initiative, and a multi-pronged effort to change the market for residential clothes washers.[39]

A recent review of eight market transformation case studies concluded that: (1) market transformation is feasible for many energy-saving technologies and practices; (2) the preferred market transformation strategy varies from product to product, depending on the characteristics of the technology and the market being served; (3) in developing market transformation strategies it is important to pay attention to quality control so that new technologies stand the test of the marketplace and deliver the long-term energy savings that are needed; and (4) minimum efficiency standards and building codes often play a critical role in completing the market transformation process.[40]

The limited data available to date indicates that market transformation programs can have very low long-term costs to utilities. For example, an analysis of long-term utility cost of four specific market transformation efforts — residential new construction in the Pacific Northwest, electronic ballasts and super-efficient refrigerators throughout the U.S., and electric motors in British Columbia — found that utility efforts have contributed to the adoption or expected adoption soon of building codes or efficiency standards that will complete the transformation process, resulting in a long-term utility cost in all four cases of less than $0.01 per kWh saved.[41] Estimates of the total resource cost of these efforts are not available. However, while market transformation can be low cost in the long term, much of the money needs to be invested in the early years of the transformation process and these investments can be substantial. Utilities in particular are reluctant to make long-term commitments because of uncertainties about future regulatory policies and increasing competition in the utility industry.

There are also other limitations to the market transformation approach. In order to transform markets, coordination among many parties is often needed. Achieving coordination was often difficult under the old regulatory system; as utilities increasingly compete with each other in a restructured utility industry, achieving coordination will become even more difficult in the future. Also, the ability to transform energy efficiency varies among technologies and end-use markets. Of the successful market transformation efforts, most have relied on a government mandate (efficiency standards and building

codes) to complete the transformation process. Technologies whose feasibility is application specific, and thus do not lend themselves to mandates (e.g., compact fluorescent lamps and adjustable speed drives), may not be amenable to a market transformation approach.

Load Management Programs

Load management programs shift electric loads from one period to another (typically from peak to off-peak periods) but generally do not reduce electricity use. Because they do not save energy, they do not cause revenue losses from reduced electric sales, and, as a result, they are one of the few types of DSM programs that generally pass the rate impact measure cost-effectiveness test. Over the past two decades, the most popular types of load management programs have probably been load control programs and interruptible and time-of-use rates.

Load control programs primarily involve direct utility control over residential air conditioners and water heaters. In exchange for an incentive, customers permit the utility to use a timer or radio controlled switch to shut off customer equipment during peak periods. Nationwide, the average incentive payment per participant is approximately $25–30 per year. Davis et al.[42] report on a number of air conditioner and water heater cycling programs that have achieved participation rates of 25% or more, including a few programs with participation rates of approximately 50%. Factors linked with high participation include high incentives, program duration (participation rates tend to steadily increase with time), and an intensive marketing effort including print and broadcast media and direct mail. Savings per participant average nearly 1.0 kW for air-conditioner programs (typically each air conditioner is cycled off for 20 minutes each hour) and 0.6-1.0 kW for water heater programs, with savings towards the upper end of this range in the winter.[43] However, savings per customer vary with climate and cycling schedule. Savings increase as the length of the shutoff period increases, but the longer the shutoff period the more likely customers are to complain of discomfort or lack of hot water.

In an interruptible rate program, customers agree to reduce their demand during peak periods when requested by the utility. In exchange, customers receive a discount on their electric bills. The size of the discount depends on the demand reduction; one study found an average incentive of $85 per kW annually.[44] These programs are primarily oriented towards large commercial and industrial (C&I) customers. The number of participants are generally low (even the most successful programs typically only include a few hundred customers), but load reductions per customer can be significant (up to several MW) and overall load savings substantial. For example, one study of 50 industrial programs found an average contracted reduction per customer of

1.5 MW and an average contracted reduction per program of 105 MW.[45] Actual reductions are generally less than contracted reductions because not all customers are able to fully shed loads during all shedding periods.

Time-of-use rates vary the cost of energy by season or time of day. Rates are higher during periods of peak demand and lower during off-peak periods. Some utilities have made time-of-use rates mandatory for large C&I customers. In the residential sector, time-of-use rates are often limited to electrically heated homes — other homes do not use enough electricity to justify the cost of time-of-use electric meters that cost several hundred dollars more than standard meters. One review found that peak load savings averaged 1% for C&I program participants and 6-20% for residential program participants. However, savings from time-of-use rates vary depending on the size of the peak/off-peak price differential and the length of the peak period — it is easier to shift loads out of a four-hour period than out of a twelve-hour period.[46]

Another type of load management program that has received a lot of interest in the past few years is real-time pricing (RTP). Under RTP the price of electricity varies by day and for several different periods during the day. Prices are sent to customers a day or so in advance and customers seek to adjust their loads in response to these price signals. Many utilities are now engaged in experimental RTP programs for some of their large C&I customers. Results of these experiments are generally not yet available.

Rebate Programs

Rebates are probably the most common type of financial incentive offered by electric utilities over the past decade. In the residential sector, rebates have been commonly offered for the purchase of efficient appliances and compact fluorescent bulbs. In the C&I sectors, lighting rebate programs and multiple end-use rebate programs (i.e., programs that provide rebates for measures affecting several different end-uses) have been most common, followed by air conditioning programs and motor rebate programs. Custom rebates for measures proposed by customers have also been popular, particularly for promoting industrial process improvements. Rebate levels vary widely, from approximately 20-100% of the cost of a measure, with rebate levels most commonly towards the middle of this range.[47]

Results of rebate programs have been uneven, with some programs having low participation, low savings, and high cost per kWh saved, and other programs having just the opposite impacts. For example, in the C&I sectors, the vast majority of rebate programs have achieved cumulative participation rates of less than 4% of eligible customers, but the most successful rebate programs have served approximately 25% of eligible C&I customers over a 3–7 year period. In a few cases, rebate programs have

helped transform the market for specific products by increasing the market penetration of particular products to the point that government agencies can adopt mandatory equipment efficiency standards based on rebate program eligibility levels. Such has been the case with electric motors and refrigerators in British Columbia.[48, 49] Programs with high participation rates often feature simple application procedures, catchy marketing materials, active involvement of equipment dealers and other trade allies, free energy audits to help customers identify conservation measures, and extensive personal marketing with an emphasis on developing a personal relationship with larger customers.[50, 51]

In the residential sector, results vary widely from program to program depending on how efficient an appliance must be to qualify and how effectively the utility markets the program. If eligibility levels are too low, then a high proportion of available models qualify for rebates, which results in high gross participation rates, high free riders, and low savings per rebate (due to the influence of free riders and the fact that eligible appliances are only slightly more efficient than the average appliance). These problems have plagued a number of appliance rebate programs.[52]

As a corollary, greater success follows stricter eligibility levels and strong marketing efforts. For example, New York State Electric and Gas (NYSEG) conducted a major refrigerator rebate experiment in 1985-86. Program eligibility was limited to the 25% most efficient models offered by the industry at that time. Different marketing and rebate strategies were employed in different regions. Participation rates (as a percent of refrigerator purchases during the program) were 15% in a no-treatment control area, 35% in an information and advertising-only area, 49% in a $35 rebate area, and 60% in a $50 rebate area. Dealer cooperation and promotion of efficient models were higher in the rebate areas and were considered critical to achieving high levels of participation.[53]

Research on C&I rebate programs also indicates that marketing, educational efforts and rebate level all have an important influence on participation rates and savings.[54, 55] Also, program eligibility levels have a strong effect on free rider levels. When measures with high current market shares and/or with rapid payback periods are promoted, free riders tend to be high; when products with low market shares and/or less rapid payback periods are emphasized, free riders tend to be low.[56, 57]

The most successful of these rebate programs have reduced C&I electricity use by approximately 6-7% (net savings)[58, 59] at costs to the utility of approximately $0.01-0.03 per kWh saved.[60] Industrial custom rebate programs are typically at the lower end of this cost range.[61] These cost figures are generally based on engineering estimates. In the residential sector, rebate program costs have varied widely. For example, a 1994 review of high-participation refrigerator and compact fluorescent rebate programs found

utility costs ranging from $0.01-0.07 per kWh saved. Programs with costs near the lower end of the range generally used dealer or manufacturer rebates instead of customer rebates.

Looking at total resource costs, one recent study of C&I lighting incentive program impact evaluations found average TRC costs of $0.038 per kWh for the 16 rebate programs examined.[62] Preliminary results from a forthcoming review of impact evaluations on 35 of the largest commercial DSM programs found an average TRC cost of $0.043 per kWh. Most of these programs were rebate programs.[63] In the study of lighting rebate programs, all of the programs were cost-effective to the sponsoring utility from the utility and total resource cost perspectives.[64]

Most rebate programs, due to the fact that they save energy and thus result in lost revenues, fail the rate impact measure cost-effectiveness test. Exceptions to this rule are that some air conditioning and commercial lighting rebate programs narrowly pass the RIM test because a substantial portion of their energy savings are during on-peak periods.[65]

Rebate programs have proven most effective at promoting basic lighting and equipment improvements. In particular, rebates can be effective at encouraging customers to purchase high-efficiency equipment around the time existing equipment needs to be replaced. On the other hand, most rebate programs have devoted limited or no attention to promoting advanced technologies or "system" improvements (i.e., efficiency improvements that involve the interaction of multiple pieces of equipment).[66] Recently, rebate programs have devoted more attention to advanced technologies as rebate programs are used as one element of market transformation strategies (see market transformation section below).

Overall, the most successful rebate programs combine a large number of eligible customers, moderate participation levels, and moderate savings per customer to produce substantial energy and peak demand savings at medium cost per kWh saved. However, due to the large number of eligible customers and substantial energy savings, overall budgets can be substantial, making it difficult to run large-scale rebate programs with limited DSM budgets. Due to recent DSM budget cutbacks, many utilities are cutting back on their rebate programs as of 1995.[67]

Comprehensive/Direct Installation

Comprehensive/direct installation programs provide comprehensive services to customers to make it easy for customers to participate and to encourage customers to install packages of measures, thereby achieving high energy savings in each facility

served. Services provided typically include audits, arranging for measure installation, financing assistance (loans or grants), and sometimes operations, maintenance and other follow-up services. In direct installation programs, utility-hired personnel install the measures. In other comprehensive programs, customers and utilities work together to oversee measure installation. In many of these comprehensive/direct installation programs, utilities pay for all services as well as a large proportion of measure cost. These programs are designed for customers who lack the time, money, and/or expertise to identify and implement conservation projects on their own. Comprehensive/direct installation programs can achieve higher participation rates than other program approaches used to date, although many of the most successful programs have only been operated on a highly targeted basis. Participation rates of 70% or more have been reported for programs such as the Bonneville Power Administration's Hood River Conservation Project, New England Electric's Small C&I lighting direct installation program, and Southern California Edison's Large Commercial Plan.[68]

Comprehensive programs can also achieve higher savings than other program approaches. In the C&I sectors, impact evaluation results have ranged from 8-13% for comprehensive lighting retrofit programs to 11-26% savings for programs that address many energy end-uses.[69] In the residential sector, net savings of 10-15% have been achieved.[70, 71] While comprehensive programs can achieve high participation and savings, these results come at a price — comprehensive programs typically cost utilities $0.02-0.07 per kWh saved in the C&I sectors and $0.04-0.10 per kWh in the residential sector. Total resource costs are generally similar to utility costs since with most comprehensive programs, customers pay very little. These comprehensive program costs are near or in excess of the long-term avoided cost of many utilities today, and above the utility cost of a typical rebate program. However, when customer costs are included in the analysis, the price gap between comprehensive and rebate programs narrows considerably because customers generally pay a higher share of measure costs in a typical rebate program than in a typical comprehensive program.[72, 73, 74]

Comprehensive/direct installation programs have been primarily used for hard-to-reach customer segments such as small commercial and industrial customers and low-income residential customers. They have also been used to promote comprehensive home weatherization and commercial retrofit packages. Important attributes linked to program success include offering high-quality and comprehensive services that make it easy for customers to participate, readily available financing, and personal marketing such as site visits by program staff.[75] In the past few years, due to the high utility costs of these programs, many utilities have reduced their grant levels under these programs and/or switched to loan financing. Evaluations of these revised programs indicate somewhat lower participation rates and utility costs. For example, NEES found that the percentage

of customers who installed measures recommended by the audit decreased from 91% to 71% after the utility share of measure costs decreased from 100% to 80%.[76]

Bidding

In recent years there has been considerable interest in bidding programs where utilities request proposals from outside parties to supply demand-side and/or supply-side resources. Successful bidders are selected on the basis of price and other factors. The purpose of bidding programs is to let the market determine the price of new resources and the proper mix of program efforts, including the mix between demand- and supply-side resources and/or the mix of utility sponsored programs relative to the efforts of non-utility parties. In some bidding programs, bids are limited to specific sectors (e.g., C&I) or end-uses (e.g., lighting); in other programs, bids for any sector or end-use can be submitted. Many bidding programs are essentially a form of performance contracting, however not all bids are awarded on a performance contract basis and not all performance contracting projects are solicited on the basis of bids.

Goldman and Kito examined 18 bidding programs and found that bids are primarily for large C&I projects — residential and small C&I bids have been limited. The vast majority of demand-side bids (87%) have been submitted by ESCOs. Most bidding programs receive bids for far more capacity than they need, allowing utilities to be very selective and only choose the best bids. Most bidding programs have emphasized lighting measures; even programs that encourage comprehensive packages of measures have found that lighting measures account for 70-100% of savings. Overall, as of October, 1993, utilities have contracted for approximately 425 MW of DSM resources through bidding programs, which accounts for less than 5% of DSM savings during this period. However, for some utilities, such as Central Maine Power, Public Service Electric and Gas, and Public Service of Colorado, over 40 MW of DSM contracts have been awarded through bidding.[77]

Bidding programs, by definition, cost less than utility avoided costs (because bid prices are capped at avoided costs), although there is a tendency for bids to approach utility avoided costs. For example, Goldman and Kito found total resource costs of $0.054-0.08 per kWh saved, which is more than most other types of DSM programs. These costs are based on an 11% nominal discount rate.[78] However, as with performance contracting programs, ESCO payment in part is dependent on savings over time, and thus savings with bidding programs should be more persistent than with program approaches that lack good measure monitoring and maintenance mechanisms.

In the past year, due to the high cost of many bidding programs and to uncertainty about the future structure of the electric utility industry, issuance of DSM bid requests

has slowed down. Requests for proposals that were issued were driven primarily by regulatory pressures, and not utility initiative.[79]

LESSONS LEARNED

From this review of program experiences, a number of important lessons emerge:

1. Different program approaches fill different niches. For example, market transformation programs can achieve substantial long-term energy savings at moderate utility cost, but they are not suitable for all measures nor will they meet the needs of utilities with a short-term need for substantial energy savings. For these latter situations, which include T&D constrained areas, rebate and comprehensive/direct installation programs can be useful. Comprehensive/direct installation programs are also useful for hard-to-reach customer segments such as low-income customers. Rebates can also be used as an element in market transformation strategies, particularly for equipment replacement situations where there is little time to influence consumer decisions and where time-consuming program approaches such as loans and performance contracting are not appropriate. Loan and performance contracting programs can be useful for the minority of customers who lack capital to finance improvements, such as many government agencies. Information programs generally result in only limited participation rates and energy savings, but they are usually important complements to other program approaches. Information on experiences with these and other program approaches and their appropriate market niches are summarized in Table 2.

2. Marketing strategies and technical/construction support services have a large impact on program participation and savings. Personal one-on-one marketing strategies and community-based marketing can be particularly effective. Equipment dealers, contractors, and design professionals can be important allies in promoting programs. In designing programs, it is important to keep customers' needs in mind, involve customers in the program design process, and make sure that marketing materials and program participation procedures are easy for customers to understand. These marketing lessons become particularly important when financial incentives are limited.

Table 2. Summary of Lessons Learned and Appropriate Market Niches for Different DSM Program Approaches.

	Cumulative Participation Rate		Savings (% of pre-program use of participating customers)	Typical Levelized Cost ($ per kWh)		
	Typical	Best		TRC	Utility	Appropriate/Best Niches
Load Management	NA	50% for residential load control; 100% for mandatory C&I rate programs	1-20% during peak	NA	$25-85/kW-yr	Peak reduction; utilities concerned with RIM test
Information: Audits	1-7%	90%	3-8%	NA	$0.01	Provides customer service and contact; useful complement to incentive programs
Labeling	NA	40%	0-25%	NA	$0.02	Residential new construction in areas where prevailing construction practices are not very efficient
Rebate	0-4%	25%	2-7%	$0.04	$0.01-0.03	Element in market transformation strategies; areas where DSM savings are needed quickly
Loans and Leasing	0-3%	50%*	NA	$0.03-?	$0.01-0.03	Customers lacking capital; utilities seeking to transfer a substantial share of costs to program participants
Performance Contracting	0-2%	14%	Up to 18%*	NA	$0.03	Institutional customers and other large customers lacking capital; utilities looking to transfer performance risk to 3rd parties

Comprehensive/ Direct Installation	1-2%	90%*	8-26%	$0.06	$0.06	Low-income customers and other hard-to-reach customer segments; areas where substantial DSM savings are needed quickly
Market Transformation	NA	>90%	NA	NA	<$0.01	Equipment replacement and new construction measures; where savings are needed in the long-term
Bidding	NA	NA	NA	$0.05-0.08	NA	Utilities w/o expertise to implement programs on their own; utilities looking to transfer performance risk to 3rd parties

* Based on experience from pilot and/or limited scale programs.

Sources:

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3. All other things being equal, financial incentives tend to increase program participation and savings. Examples of these effects include the NYSEG refrigerator rebate programs and NEES small C&I direct installation discussed

above, the fact that many of the highest participation rates and savings per customer have been achieved by comprehensive/direct installation programs in which utilities pay most costs, and experiments by several utilities in which participation rates among moderate rebate groups were higher than among low-rebate groups.[80, 81]

4. While some new program approaches have succeeded in particular instances, more experience is needed before definitive conclusions can be drawn. A number of new approaches have been suggested to achieve significant energy savings at lower cost to the utility than the programs discussed above, including a new generation of information, loan and performance contracting programs and various market transformation initiatives. In fact, some of these new program ideas build upon program approaches that have not been very successful in the past and thus success in the future is highly uncertain. Further experimentation to develop, test, and refine these new program approaches is needed.

In addition to these programmatic level lessons, a review of the literature shows a number of other factors that can contribute to the success of DSM programs. An understanding of these factors is helpful for suggesting appropriate roles for DSM in the future. Among these factors are the following:

5. Top management support is important for DSM to prosper. Most of the utilities operating successful DSM programs have senior company officials who actively support DSM efforts and transmit this commitment to staff. Also, DSM departments at these utilities are filled with capable staff who are innovative, willing to take risks, and adapt to new information.[82] In the past year or so, top management has generally focused on industry restructuring issues, and thus support for DSM in executive suites is not as strong as before.

6. Regulator support is also important. For example, a recent empirical study found that use of DSM resources tends to increase when regulators: (a) stimulate utilities to examine potential DSM resources; (b) ensure that a broad range of interests are actively represented in the process; (c) increase the cost-effectiveness of DSM resources relative to the alternatives; and (d) ensure that the pursuit of DSM resources will enhance, or at least not diminish utility revenues, and profits.[83]

7. Developing substantial DSM resources takes several years. Equipment manufacturers and local distributors need time to produce and stock efficient equipment. Local contractors need time to develop the skills to design, specify, and install DSM measures. Utilities need time to develop and refine their DSM

program designs and marketing strategies. These "ramp-up" rates need to be accommodated in DSM planning. Likewise, drastic cutbacks in DSM efforts can cause dislocations in the DSM industry, making it more difficult for the industry to respond quickly in the future.[84, 85]

8. Two market niches where DSM can be particularly useful are "lost-opportunity" situations and geographically targeted DSM in areas with transmission and distribution capacity constraints. Lost-opportunity situations refer to new construction, building remodeling, or equipment replacement where there is a one-time opportunity to improve the efficiency of the building or equipment for only the cost difference between "conventional" and "high efficiency." It is usually easier and more cost-effective to improve energy efficiency in these situations rather than through retrofits. For example, a 1994 review of high-participation programs found that comprehensive commercial new construction programs typically cost the utility about $0.005-0.015 *less* per kWh saved than comprehensive commercial retrofit programs.[86]

   Similarly, most utilities need to improve their transmission and distribution (T&D) systems in several portions of their service area each year. The cost of some of these improvements can be substantial. By offering intensive DSM programs in a region a few years before the T&D improvements are needed, loads can be reduced and T&D improvements can be postponed for several years, thereby saving money and improving the cost-effectiveness of DSM programs. Among the utilities that have successfully employed this strategy are Idaho Power,[87] Pacific Gas and Electric,[88] and Portland General Electric.[89]

9. Program evaluation is critical to the success of DSM efforts. Impact evaluations provide utilities with estimates of how much energy is really being saved; these savings estimates can then be used to estimate program cost-effectiveness and to adjust forecasts of future electricity demand. Savings should be evaluated over several years in order to estimate the persistence of DSM savings over time. Program evaluations also reveal which program aspects are working well and which are not, providing valuable information for improving the design and operation of future DSM programs.

WHERE ARE WE GOING?

The utility industry is now going through a transition, from a highly regulated industry to one in which market forces and competition become more important. However, the future structure of this industry has yet to be determined and will take many years to resolve. There are many restructuring proposals and limited real-world

experience upon which to base decisions. Utility DSM is likewise going through a transition, from the DSM programs of a regulated monopoly to the DSM programs of a more competitive industry. Until the future structure of the utility industry is determined, we will not know for sure what role DSM will play. Still, based on the discussions that have taken place and the lessons of the past two decades, we can make some predictions about the future of DSM:

1. Load management programs will continue to operate. These programs can reduce peak demand at lower cost than the cost of new peak generating capacity, thereby saving utilities money. These programs, due to the rate breaks they often provide, save consumers money and can be an important ingredient in utility strategies to retain customers. Finally, these programs generally pass the rate impact measure test and thus can help lower rates. As a complement or supplement to current load management offerings, increasingly sophisticated load management programs will be offered to large customers, such as real time pricing and other pricing options that unbundle traditional utility services. These load management programs will often be sponsored by distribution utilities. They might also be sponsored by independent private companies who will offer these programs in response to seasonal and time-of-day prices provided by utilities.

2. Energy efficiency programs that pass the RIM test will also continue, primarily operated by distribution utilities. These programs have many of the same benefits as load management programs. As discussed earlier in this paper, these programs will tend to promote lighting and space conditioning efficiency measures (addressing cooling needs in summer-peaking areas and heating needs in winter-peaking areas) because these are the efficiency measures that tend to have the largest impact on peak power demand. These programs may also include a broader array of DSM measures in T&D-constrained areas.

3. For large commercial and industrial customers, DSM programs will primarily be used as part of a strategy to provide enhanced value and service to customers, thereby helping utilities to retain their existing large customers and attract new customers from other service areas. These programs will tend to emphasize technical assistance for identifying and implementing DSM measures, although financing at market rates may often be offered to customers who want it. These programs will not just promote energy savings but will also address other needs of large customers such as power quality, reliability, increasing productivity and product quality, and meeting environmental requirements. These programs will try to address industrial process improvement to a greater degree then the previous generation of DSM programs. Most of these programs will emphasize a partnership arrangement between the utility and its large C&I customers,

usually on a customer-by-customer basis. These programs will be primarily paid for by participating customers, with perhaps some cost-sharing by stockholders. Many industrial DSM programs are already moving in this direction.[90]

However, for some generic energy efficiency opportunities, such as motor systems, many customers may work together with their local utility or a number of utilities may band together so as to achieve greater market power. For example, the Consortium for Energy Efficiency, a coalition of utilities, government agencies and non-profit organizations, is now developing a series of model programs to promote improved efficiency motors, fans, pumps, compressors, motor repair practices, and motor system optimization.[91]

For large C&I customers, experiences in Britain and Norway indicate that average electricity prices will fall significantly. For example, recent studies estimate that large C&I electricity prices are 16% lower in Britain and 18% lower in Norway than pre-restructuring prices.[92, 93] Due to reduced utility incentives for DSM, somewhat lower electricity prices likely to be brought on by increased competition, and a desire by some utilities to emphasize load building instead of energy savings, electricity savings from these C&I programs will probably be less on average than those of recent incentive-oriented DSM approaches. DSM services for large C&I customers will be offered by many different players, including distribution utilities, power brokers, and energy service companies.

4. For residential and small C&I customers, the future is very uncertain. For example, price reductions are not as likely for small customers as for large customers. In Britain and Norway, average residential prices have changed very little since restructuring.[94, 95] The role of DSM in serving small customers will depend in particular on how local distribution companies are restructured. If distribution companies are subject to price-cap regulation, increasing sales will generally increase profits, and, all other things being equal, distribution utilities will tend to deemphasize energy-saving programs. If distribution utilities are subject to revenue-cap regulation, profits will generally increase by reducing costs, and DSM programs that are less expensive than supply-side options will be one way distribution utilities can reduce costs.[96] In some states, responsibility for small-customer DSM programs (and perhaps some large-customer programs as well) may shift to state-established organizations (labeled "DSMCOs by one observer) established explicitly to operate DSM programs. These programs could be funded by fees on all transmission or distribution service within a state, as has been proposed in California and several New England states.[97, 98]

Given lower near-term avoided costs and greater concern regarding rate impacts, distribution utilities and DSMCOs will try to get more "bang for the buck" and will therefore emphasize market transformation programs, lost-opportunity programs, and support for improved building codes and equipment efficiency standards. Rebate levels will decline and customers will be expected to pay a larger portion of the cost of energy-efficient measures, or DSM providers will offer market-rate loans. Programs to assist low-income households will also continue, justified by a combination of economic and social equity considerations. In addition, in some states political considerations will lead to the continuation or establishment of programs to finance energy-saving home improvements, based on a desire to provide services to all customers.

5. Utilities will increasingly convert DSM into a line of business rather than a "societal good." These businesses will include traditional ESCO energy-saving projects as well as attempts to provide other value-added services to customers, such as system optimization, building commissioning, and operation/maintenance services. Utilities are rapidly establishing ESCO subsidiaries to serve their customers as well as their competitors' customers. The ESCO industry has been growing rapidly[99] and may continue to grow as more utilities enter this area. It is unclear, however, whether "for- profit utility DSM" will be as successful at generating electricity savings and net economic benefits as "ratepayer-based DSM" and whether ESCOs can successfully branch out beyond their current primary market niche — institutional customers.

6. For all DSM programs, be they offered by utilities or independent companies and for small or large customers, a more targeted approach will be used than was typical in the past. Programs will be designed for specific market segments and for overcoming specific market barriers. As was discussed in previous sections, many of the successful DSM programs operated in the past made extensive use of market research to identify consumer needs and develop special services for particular types of customers. With financial incentives playing less of a role in the future, such market research and targeting will become even more important. Similarly, evaluation of marketing efforts will grow in importance.

7. A major uncertainty facing utilities in the coming decades is future environmental regulations, in particular potential regulations to deal with the threat of global climate change. Current U.S. plans to deal with climate change call for extensive savings from voluntary utility DSM programs.[100] To the extent that greenhouse gas emissions rise as a result of utility restructuring (e.g., reduced energy efficiency efforts and/or increased load building efforts), regulations on greenhouse gas emissions will become more likely. Utilities will tend to continue

DSM programs voluntarily in part to limit the growth of greenhouse gas emissions and discourage future regulations in this area. For example, as part of the U.S. Department of Energy's Climate Change Action program, at least 38 utilities have agreed to reduce greenhouse gas emissions, including five utilities who have developed specific action plans to reduce emissions to 1990 levels by 2000.[101]

8. The next few years will be a particularly "bumpy" period for DSM. Many utilities are looking for quick cost savings as they attempt to demonstrate to regulators, stockholders, and customers that they are preparing for a new more competitive industry. DSM spending will be a target for some of these cutbacks. Eventually, as a new industry structure evolves, more stable funding sources are likely to emerge. Existing, incentive-oriented DSM programs will often be scaled-back or eliminated. Overall, in response to utility restructuring, utilities will experiment with many new program approaches. Some of these experiments will fail and others will be successful, with the result that program offerings will go through frequent changes.

Overall, utility DSM will continue although it will probably be very different in 2005 from what it is in 1995. Many utilities will attempt to provide valued DSM services to their customers but at lower utility cost. New DSM service providers may enter the picture as well. Will there be more or less energy savings from utility DSM programs in 2005 as compared to 1995? Only time will tell.

NOTES

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