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## DEMAND-SIDE MANAGEMENT'S IMPACT ON THE GEOTHERMAL RESOURCE INDUSTRY

Bill LeBlanc

Barakat & Chamberlin, Inc., Oakland, California

### ABSTRACT

Demand-side management (DSM) is increasingly used by utilities to meet their resource needs, while at the same time the independent power (IPP) industry is growing rapidly. Out of a total need for 80-110 GWs by the year 2000, DSM is predicted to meet 25-35 GW while IPPs meet 40-50 GW. Several major concerns about DSM remain, including potential for overstated savings, measurement difficulties, and whether utilities should intervene in the marketplace. However, these concerns are waning as actual experience becomes more robust. DSM may become even more dominant if fuel prices increase, environmental concerns become more intense, new technologies take hold, or if regulators push harder for DSM regulatory incentives. IPP growth may be greater if DSM fails in the field, fuel prices drop, the economy grows rapidly, or if regulators provide additional incentives that promote independent power. Both markets will continue to grow through the year 2000.

### BACKGROUND

A few years ago only a small group of people understood the meaning of the term demand-side management (DSM). Today, however, DSM plays a prominent role in meeting the resource needs of many utilities across the United States. Although most DSM activities have been concentrated on the East and West coasts, these activities are quickly expanding to all sections of the country. The National Energy Policy Act of 1992 virtually guarantees that integrated resource planning, which includes DSM, will be on the regulatory agenda in every state by 1995. Many energy experts contend that DSM will cut deeply into the markets for alternative power generation sources, including geothermal power.

### WHAT IS DSM?

In its simplest form, DSM means "the modification of customer energy use through utility intervention." DSM programs include the promotion of energy-efficient technologies like motors, lights, and air conditioning, the use of dynamic pricing signals such as interruptible rates and real-time pricing, and the control of appliances by utilities during peak periods. However, DSM also includes load growth programs, in which customers use new technologies to enhance their productivity, comfort, or convenience.

However, DSM is a more complex concept than the preceding simple definition implies, and this complexity has profound implications for the electric power industry. DSM changes the fundamental way that utilities think about

electricity. Although utilities have traditionally thought of electricity as a supply-side commodity, the advent of DSM means that the electricity business is about providing a blend of energy services. The electric industry is now in the middle of a paradigm shift, and DSM is strongly influencing the evolution of the new structure of the business. DSM is forcing the industry and its regulators to come up with a fundamentally different way of rewarding utilities. The result is that the industry is slowly moving away from the rate-of-return regulation that has characterized it for the past 60 years. The DSM paradigm approaches electricity as a derived demand. Electricity is a derived demand in the sense that customers do not want electricity per se but instead want the work, comfort, light, entertainment, etc., that electricity provides. Thus, the DSM paradigm holds that a utility that can supply an energy service at a lower cost through DSM than through supply-side options should consider the DSM option. In fact, DSM programs often come in at less than half the cost of the avoided supply alternative.

In at least three senses, the independent power industry is partly responsible for the evolution of the demand-side management industry. First, qualifying facilities (QFs) and independent power producers (IPPs) have demonstrated by their relatively small size that the economies of scale that drove electricity prices down from 1920 to 1970 have disappeared. The existence of QFs and IPPs has also meant that there is no longer a monopoly on the generation side. As they lose their vertical monopolies, utilities are seeking new ways to develop their businesses and to make profits. Second, cogeneration has become a realistic option for many industrial and commercial customers. This competition has forced utilities to become more sensitive to their customers' needs. DSM is one major tool that utilities use to help their customers become more efficient. Third, the IPP industry has demonstrated the benefits of short lead times and incremental additions of power. One of the greatest attributes of DSM is that it can be ramped up and down quickly and that it can be added in small increments, which lowers the risk that an investment will become stranded. Fourth, bidding for new power resources has brought the integrated resource planning process out in the open and under the scrutiny of interest groups, many of whom favor demand-side options.

### HOW FAST IS DSM GROWING, AND WHAT ARE THE FORCES BEHIND THIS GROWTH?

By almost any measure, DSM is growing at a rapid pace across the United States. According to internal data sources at Barakat & Chamberlin, expenditures on DSM are increasing at more than 25% per year. This growth is correlated closely with states that have adopted some form of regulatory incentive

mechanisms to make DSM more financially attractive to utilities. Without these incentive mechanisms, aggressive DSM programs can lead to the erosion of revenues and lower profits. Figure 1 indicates the status of incentives across the United States.

Why is DSM so popular now? One reason can be traced to the relative neglect of energy efficiency at federal and state levels over recent years. Just as PURPA was the spark that ignited the IPP fire, a simple statement in 1988 by the Conservation Committee of the National Association of Regulatory Utility Commissioners (NARUC) that "... a utility's least-cost plan should be ... its most profitable plan" may have started the DSM surge.

A number of factors have come together to support DSM as a preferred resource option (see Figure 2). First, from an economic standpoint, utilities can improve the overall welfare to customers by choosing lower-cost DSM measures over more-expensive supply-side alternatives. This factor assumes that utilities can overcome market barriers that are keeping customers from making appropriate purchase decisions on the demand side. Second, there appears to be a large pool of low-cost energy-efficiency improvements that utilities can tap at less than half the cost of supply-side alternatives. These improvements would allow customers to enjoy both enhanced service and lower energy bills. Third, many consider that DSM is the environmentally preferred option. Fourth, utilities are

seeking ways to lower the risks involved in acquiring future resources, and many utilities see DSM as an appropriate part of their future portfolios.

**IPPs, DSM, AND MARKET SHARE**

In each year since 1978, IPPs have gained a larger portion of the power generation market in the United States. NERC projects that nonutility generators (NUGs) will account for 19,000 of the 78,000 MW that need to be added to the U.S. system by the year 2001.<sup>1</sup> Other studies based on different assumptions estimate that NUGs may account for as much as 50% of new capacity in the United States in coming years.<sup>2</sup>

Like the figures for NUGs, projections of DSM vary depending on the assumptions incorporated into the analysis. In a report prepared for the Electric Power Research Institute (EPRI) and the Edison Electric Institute (EEI) in 1990, Barakat & Chamberlin estimated that DSM would account for 44,600 MW in the year 2000, up from 19,800 MW in 1990.<sup>3</sup> This growth of nearly 25,000 MW over the decade of the 1990s will meet nearly 20% of future demand growth, which is expected to total 124,000 MW. The report also estimated high and low projections within a 90% confidence band. The high projection estimates that DSM could account for up to 97,000 MW, which would represent a growth of 77,000 MW by the year

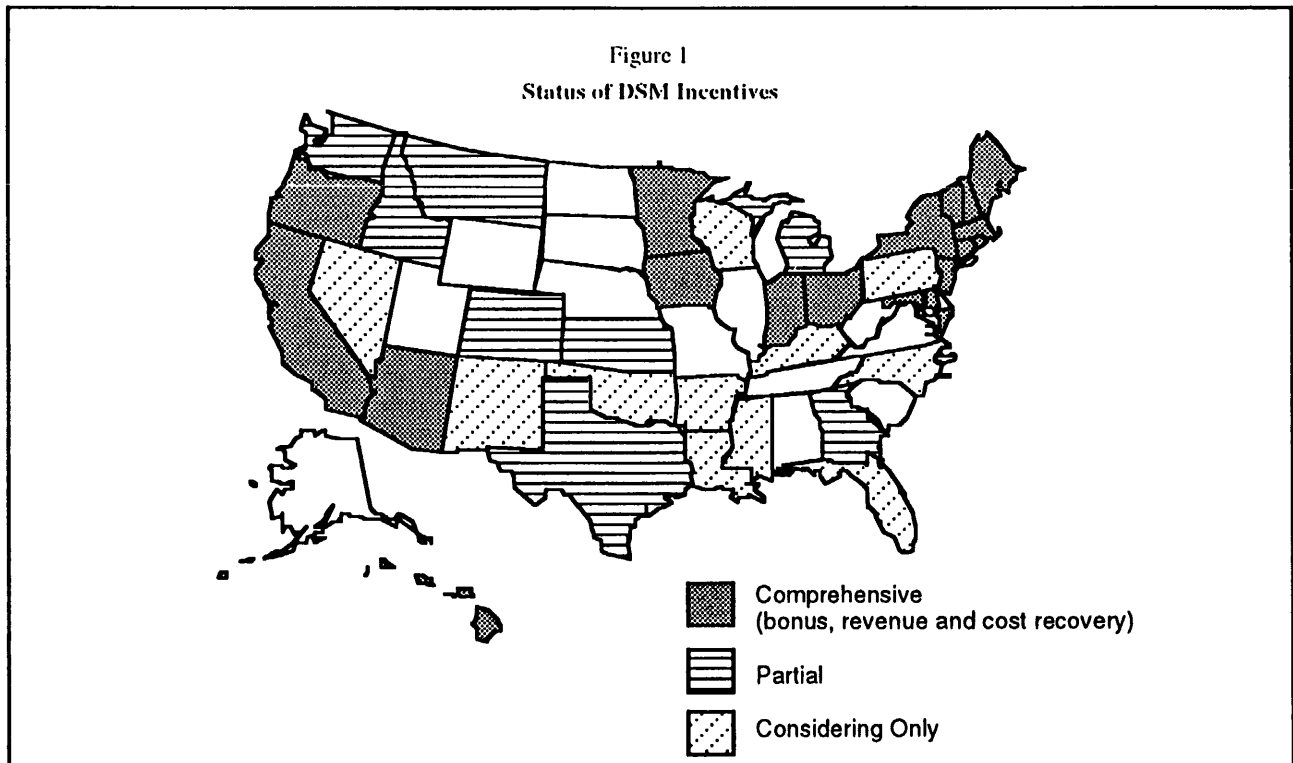
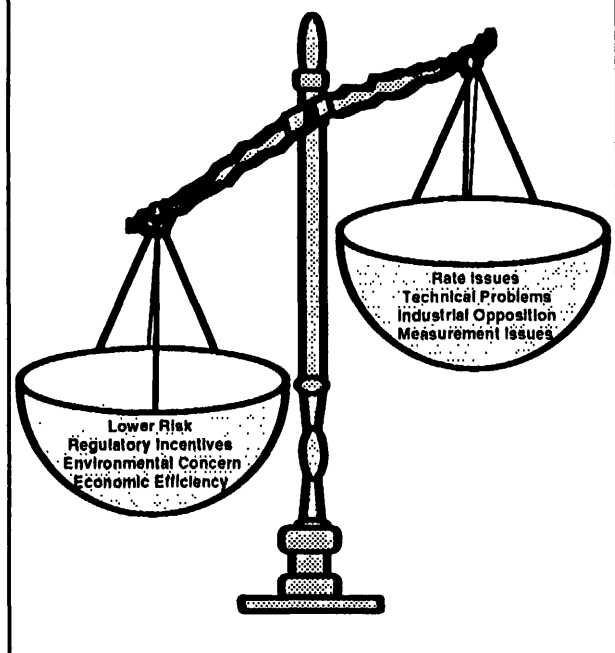


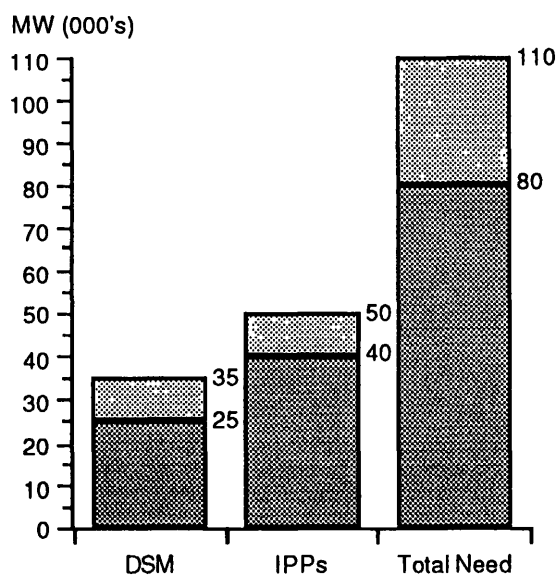
Figure 2  
Forces Behind DSM



2000. Under these conditions, DSM would account for over 60% of total future demand growth in the United States. However, if conditions are not favorable toward DSM, the low projection estimates that DSM might only account for about 33,000 MW or about 10% of future load growth. Using optimistic assumptions, Oak Ridge National Laboratory conducted a study of DSM potential that concluded that DSM could meet 55% of the load forecast in the years 1990–2010.<sup>4</sup> However, this study assumes aggressive program implementation and regulatory conditions throughout the United States that are similar to those currently in place in California and some states in the Northeast.

Clearly, both DSM and independent power will have a large stake in meeting future resource requirements. Every year the estimates of the size of the market for independent power rise. At the same time, DSM estimates are becoming a larger part of utility resource plans. Although DSM will increase in importance, I do not believe that it will substantially alter the market structure for independent power. The market for independent power will continue to grow and will be competitive with other sources no matter what happens to DSM. Although DSM may affect IPPs on the margin, other effects, such as the rate of economic growth and the rate of deregulation, will play a larger role in increasing or decreasing the uncertainty that characterizes the markets for independent power. The numbers for DSM can look substantial, but it must be kept in mind that customer conservation has always been

Figure 3  
Estimates of DSM and IPP Growth by Year 2000\*



\* Author's depiction of the range of estimates in recent studies

built into electricity forecasts. For example, as energy prices rose rapidly in the 1970s, the elasticity of demand for energy meant that consumer demand went down. Because DSM conducted through utilities is more explicit, it is more evident in the resource-planning process.

#### POTENTIAL PROBLEMS WITH AND FALLACIES ABOUT DSM

DSM is a relatively new concept. Therefore, there is substantial uncertainty about its impacts on the electric industry and its customers. In particular, there are questions about the effectiveness of DSM in meeting future demand. Critics of DSM express several common concerns:

- **DSM savings estimates are overstated.** Although engineering estimates of DSM impacts made in the 1990–1992 time frame often overestimated actual savings, the industry has largely adjusted to these differences. For example, Barakat & Chamberlin uses up-to-date results from current programs to develop its future DSM plans and forecasts. As the industry gains more experience, forecasted and actual impacts will converge.
- **DSM cannot be measured directly.** Although it is true that the DSM industry uses various statistical techniques to estimate DSM impacts, the savings are

nonetheless real and have resource value. Unlike metered kilowatt-hour data coming from a power plant, there will always be a band of uncertainty surrounding DSM estimates. This uncertainty is analogous to that surrounding forecasts of energy demand, which are influenced by factors beyond the control of electric utilities. DSM evaluation is becoming much more sophisticated, and estimates are becoming more accurate all the time.

- **The market should choose the “right” amount of energy efficiency.** In the ideal world of market-based economics the market would be left to determine the optimum amount of energy efficiency. However, the monopoly structure that dominated the electric power industry for years has created market barriers that cause customers to underinvest in demand-side options. DSM can improve overall customer welfare by encouraging demand-side investments. Also, the current regulatory framework encourages customers to make uneconomic purchase decisions because it does not set prices equal to marginal cost.

The list of criticisms about DSM is often extended to include competition and equity issues, antitrust concerns, doubts about the persistence of savings, etc. However, as in any new industry, the professionals in the industry are addressing the problems as they arise and overcoming them as they gain experience. It should also be kept in mind that counting on DSM is not like counting on ten large nuclear power plants. Any differences between estimates and actual impacts will be relatively small, and utilities can make adjustments from year to year.

Like the IPP industry in its early days, the DSM industry faces many skeptics who contend that the new suppliers will be less reliable and more costly than the old counterparts. In the IPP industry, there have been both successes and failures. The same will hold true in the DSM industry. However, the benefits of DSM to date far outweigh the problems that have been encountered, and by all indications the United States will be counting on energy efficiency to a greater degree in the future than it has in the past.

#### CONDITIONS THAT WOULD INCREASE RELIANCE ON NUGs AND REDUCE THE IMPORTANCE OF DSM

Given the uncertainty in the estimates of generation from NUGs and demand savings from DSM, certain conditions may develop that could substantially alter the relative importance of these two resources over the rest of the decade. If DSM fails to achieve its forecasted estimates, it is likely that NUGs would fill in the gaps. The conditions that would lower forecasted

estimates of DSM and increase reliance on NUGs are as follows:

- DSM fails to reach the market penetration rates assumed in DSM plans (this result might ensue if customers and trade allies become reluctant to participate in DSM programs, technologies fail in the field, or the costs of DSM go up);
- Key customer groups resist DSM implementation because of equity and rate issues, and regulators agree with them;
- Fuel prices drop further;
- Regulators reverse the current trend toward rewarding utilities for successful DSM programs;
- Utilities receive regulatory incentives to purchase the independent power contracts that are most beneficial to customers; and
- Rapid economic growth necessitates large additions of new power.

In the next five years, I believe that only two of these trends are likely to have a significant impact on the market. First, not all industrial customers may choose to participate in DSM programs for energy efficiency. This result would lower the level of potential savings by some 10–20%. Second, utilities may begin to receive incentives for the purchase of independent power.

Barakat & Chamberlin has been involved in the development of many of the DSM regulatory incentive mechanisms around the country. Although DSM faces disincentives under current rate-of-return regulation (i.e., successful DSM conservation programs can lead to reduced revenues), a new regulatory framework may still want to allow utilities to receive some form of incentive to purchase effective, low-cost supply. San Diego Gas & Electric Company recently made a proposal for a performance-based ratemaking system. SDG&E customers and shareholders would share the benefits of power that was lower cost and more environmentally benign than some benchmark level. This type of system may well become popular in the next five years if it provides overall benefits to customers.

Beyond the five-year horizon, the regulatory picture becomes fuzzy, but it could dramatically alter the roles for both independent power and DSM. For example, if the United States decides to go the route of New Zealand and the United Kingdom and pursue privatization, DSM would not have the same structure that it has today. With retail wheeling, customers would have a full choice of power suppliers.

Although utilities, other suppliers, energy service brokers, and various appliance vendors could provide energy-efficiency services, the utility rebates we see today would not be compatible with retail wheeling. The independent power market would also be transformed if retail wheeling were to be implemented, and the current statewide resource-planning process would be replaced by the marketplace.

#### CONDITIONS THAT WOULD INCREASE RELIANCE ON DSM AND REDUCE THE IMPORTANCE OF NUGs

Some conditions could promote DSM while taking away from the independent power market. These conditions might include:

- Fuel price increases;
- An increased emphasis on environmental impacts, including the imposition of emissions adders;
- The emergence of enhanced cooperation among utilities, manufacturers, and trade allies that accelerates the evolution of energy-efficient technologies and associated marketing programs; and
- Strong regulatory support for integrated resource planning, including incentives for successful DSM programs.

If the conditions outlined above came to pass, they would lead one to suspect that the high projection of DSM outlined in the EPRI/EEI report will be closer to reality than the other estimates. I believe that there is a relatively high likelihood that one or more of these conditions will in fact occur.

#### STRUCTURE OF THE DSM INDUSTRY

The DSM industry involves many players in addition to utilities. Although DSM and marketing departments at utilities are growing at a rapid pace, the energy service industry as a whole is also expanding quickly. Many energy service companies (ESCOs) provide turnkey DSM to utilities, and they are often paid according to the kilowatt and kilowatt-hour savings that their projects realize over time. ESCOs also submit bids in utility resource auctions. Other service companies work with utilities as extensions of their labor forces in a variety of capacities.

Some utilities are forming independent subsidiaries to implement DSM. Of course, several utilities have already formed subsidiaries to develop independent power projects. Although there are substantial profits to be made in the DSM industry, the risks can also be high. Only companies that have substantial technical experience, excellent customer service, and strong management will be successful over the next five

years. There will be new entrants in the DSM industry, but their numbers will be limited because of the shortage of capable professionals. Also, utilities have been careful about selecting partners for their DSM projects because these partners will have extensive interactions with utility customers.

#### CAN THE GROWTH OF DSM BE SUSTAINED?

In answering this question I reflect back on the experience of the solar industry in the late 1970s and early 1980s. During that time, heavy subsidies through tax incentives created a booming solar industry. The economics were too good to pass up, and many solar businesses popped up around the country. Unfortunately, when the tax incentives disappeared, so did the support structure for all of the solar systems put into place. As a result, solar energy acquired a bad reputation in the areas of service, support, and performance.

Demand-side management may follow a similar path if it is not careful in its growth and development. The overall goal must be to develop a self-sustaining industry in which energy efficiency plays a strong role in customer decision making. The DSM industry hopes to encourage existing and new technology companies to place higher emphasis on the energy efficiency of their products. Another industry goal is to help create a high-quality trade ally support structure that will be in place well into the future. In addition, the industry hopes to permanently change the way that people think about their energy purchase decisions.

To accomplish these goals, those of us in the DSM industry must carefully balance the regulatory push that is provided through ratemaking treatments and incentive structures with the development of a market-driven energy-efficiency industry. This balancing act can be accomplished by constantly reviewing the evolution of the industry, studying customer decision-making processes, tracking technology developments, and monitoring competitiveness. The goal of achieving greater levels of energy services for lower costs is worth pursuing, and DSM can move us in that direction.

#### THE FUTURE ROLES OF DSM AND INDEPENDENT POWER

DSM and independent power will both play a prominent role in meeting the electric power needs of the United States for the remainder of the decade. I believe that it is important that the IPP industry understands the role of DSM and the reasons behind its recent growth and prominence in order that the IPP industry can plan for its own future. Many utilities see DSM as a way to offer their customers superior service for a lower cost while meeting environmental requirements. Unlike five years ago, most utilities now plan on using substantial amounts of nonutility generation sources in their 20-year plans. Thus, both industries can follow parallel growth paths, and

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opportunities are available to quality suppliers of DSM and independent power. Some companies may see opportunities to be suppliers of both independent power and DSM. Although the technical and marketing skills needed to succeed in these two industries are quite different, the financial requirements and the need to understand the utility business are common to both industries.

The current role of DSM is highly dependent on the regulatory treatment of expenditures and investments. If this regulatory structure changes, so too will DSM investments by utilities. The independent power industry is more immune to changes in regulatory structure, especially in the likely event that we move more toward deregulation than toward tighter control. The winners in both of these industries will have common attributes: they will be able to anticipate changes in the marketplace, act quickly to capture opportunities, and deliver fully on their promises.

1. "Mountain of Imponderables Hides Industry's Future," *Electrical World*, November 1992.
2. Ibid.
3. Barakat & Chamberlin, Inc., "Impact of Demand-Side Management on Future Customer Electricity Demand: An Update" (Electric Power Research Institute and Edison Electric Institute, CU-6953, September 1990)
4. Eric Hirst, "Possible Effects of Electric Utility DSM Programs," 1990-2010 (Oak Ridge, Tenn.: Oak Ridge National Laboratory, ORNL/CON-312, January 1991).