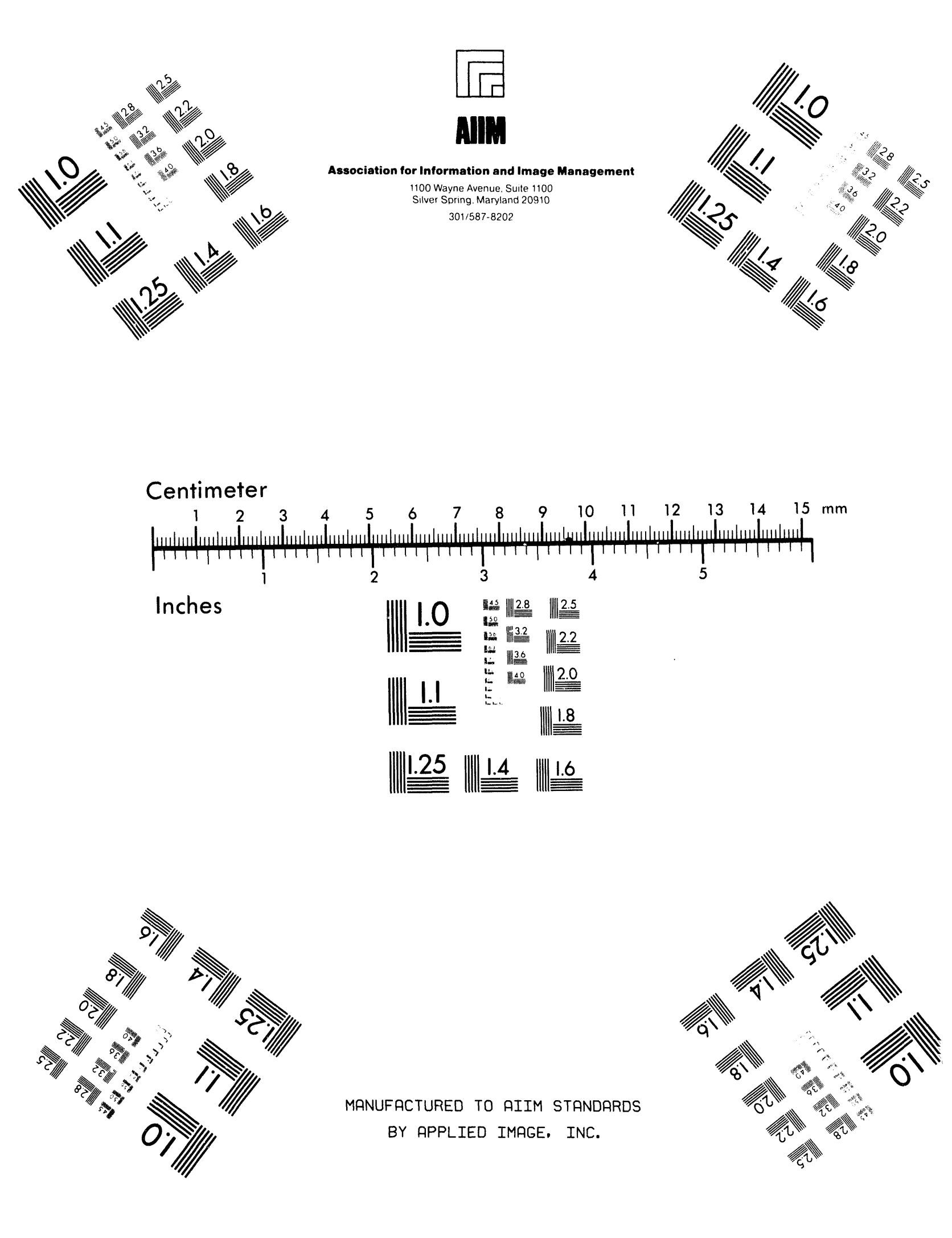
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ENERGY DIVISION

DATA AND PROJECTIONS ON U.S. ELECTRIC-UTILITY DSM PROGRAMS: 1989-1997

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MASTER

ABSTRACT

All U.S. electric utilities are required to report to the Energy Information Administration (EIA) data on their demand-side management (DSM) programs. These data provide a comprehensive view of utility DSM-program costs and effects (energy savings and load reductions) for 1989, 1990, 1991, and 1992 as well as projections for 1993 and 1997.

For 1992, U.S. utility DSM programs cost almost $2.4 billion, saved 31,800 GWh, and cut potential peak demand by 32,900 MW. Normalized by retail revenues, sales, and peak demand, utilities spent 1.3% of their revenues to achieve energy and demand reductions of 1.2 and 6.0%, respectively.

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All U.S. electric utilities are required to report to the Energy Information Administration (EIA) data on their demand-side management (DSM) programs. These data provide a comprehensive view of utility DSM-program costs and effects (energy savings and load reductions) for 1989, 1990, 1991, and 1992 as well as projections for 1993 and 1997.

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INTRODUCTION

In the current debates about retail wheeling, utility restructuring, and the possible demise of utility DSM programs, it is too easy to forget all that those programs have accomplished. During the past several years, more and more U.S. electric utilities have relied increasingly on energy-efficiency and load-management programs to provide energy and capacity resources as alternatives to the construction and operation of new power plants. In addition, these programs provide valuable customer services, including ways to meet customer energy-service needs at lower environmental costs.

Beginning in 1989, EIA, through its form EIA-861, required all U.S. electric utilities to report annually on their DSM programs. For the years 1989, 1990, and 1991, Schedule V of EIA-861 required all utilities that ran DSM programs and had sales greater than 120 GWh/year to provide information on the costs, energy savings, and load reductions of their DSM programs. Beginning with the 1992 form, EIA expanded the scope of DSM information collected to include disaggregations by program type and customer class.

Of the roughly 3250 U.S. electric utilities, 905 reported to EIA that they operated a DSM program in 1992 (EIA 1994b; Hirst 1994). Of these 905 utilities, 504 had annual sales greater than 120 GWh and were required to complete all of Schedule V of EIA-861. The remaining 401 utilities had to complete only parts of Schedule V. These 905 utilities accounted for 86% of the electricity sold to U.S. retail customers in 1992 and for 89% of the revenues collected from these customers that year [Edison Electric Institute (EEI) 1993]. Thus, the vast majority of electricity customers are served by utilities that offer DSM programs. Of the 905 DSM utilities, 142 are investor-owned utilities (IOUs), accounting for just over half the 260 such utilities. The remaining 763 DSM utilities are consumer-owned utilities (COUs), including municipal, cooperative, federal, and state utilities. These COUs, which are typically much smaller than the IOUs, account for about one-fourth of all such utilities in the United States.

In 1992, utilities spent almost $2.4 billion on DSM programs, cut energy use by 31,800 GWh, and cut potential peak demand by 32,900 MW. Compared to national totals for the electric-utility industry, DSM accounted for 1.3% of retail revenues, 1.2% of sales, and 6.0% of peak demand (Table 1). (The national totals, from EEI, are $186.7 billion retail revenue, 2,730 GWh retail sales, and 548,700 MW of summer peak demand.)

TABLE 1. ANNUAL EFFECTS AND COSTS OF ELECTRIC-UTILITY DSM PROGRAMS, 1989 TO 1992

	Program cost (million $ and %[a])		Energy savings (GWh/year and %[a])		Potential peak-demand reduction[b] (MW and %[a])	
1989	870	0.5	16,300	0.6	20,100	3.8
1990						
Totals	1,180	0.7	18,700	0.7	23,300	4.3
Investor-owned utilities	1,060	0.8	13,200	0.7	17,500	4.3
Consumer-owned utilities	120	0.3	5,500	0.9	5,800	4.7
1991						
Totals	1,750	1.0	23,300	0.9	26,700	4.8
Investor-owned utilities	1,510	1.0	17,600	0.8	19,500	4.5
Consumer-owned utilities	240	0.6	5,700	0.9	7,200	6.1
1992						
Totals	2,360	1.3	31,800	1.2	32,900	6.0
Investor-owned utilities	2,020	1.4	24,000	1.1	24,200	5.3
Consumer-owned utilities	340	0.9	7,800	1.2	8,700	9.9

[a]These percentages reflect, respectively, total U.S. retail electric revenue, retail electricity sales, and summer peak demand for 1989, 1990, 1991, or 1992.

[b]Utilities report to EIA estimates of actual and potential peak-demand reductions (17,700 MW vs 32,900 MW for 1992). The actual figures are the amount of load shed during system peaks. The potential figures represent the amount of load that the utility could have shed. The difference between the two numbers represents, as examples, interruptible contracts that were not exercised and load-control devices that were not activated. All the numbers presented in this paper are potential estimates.

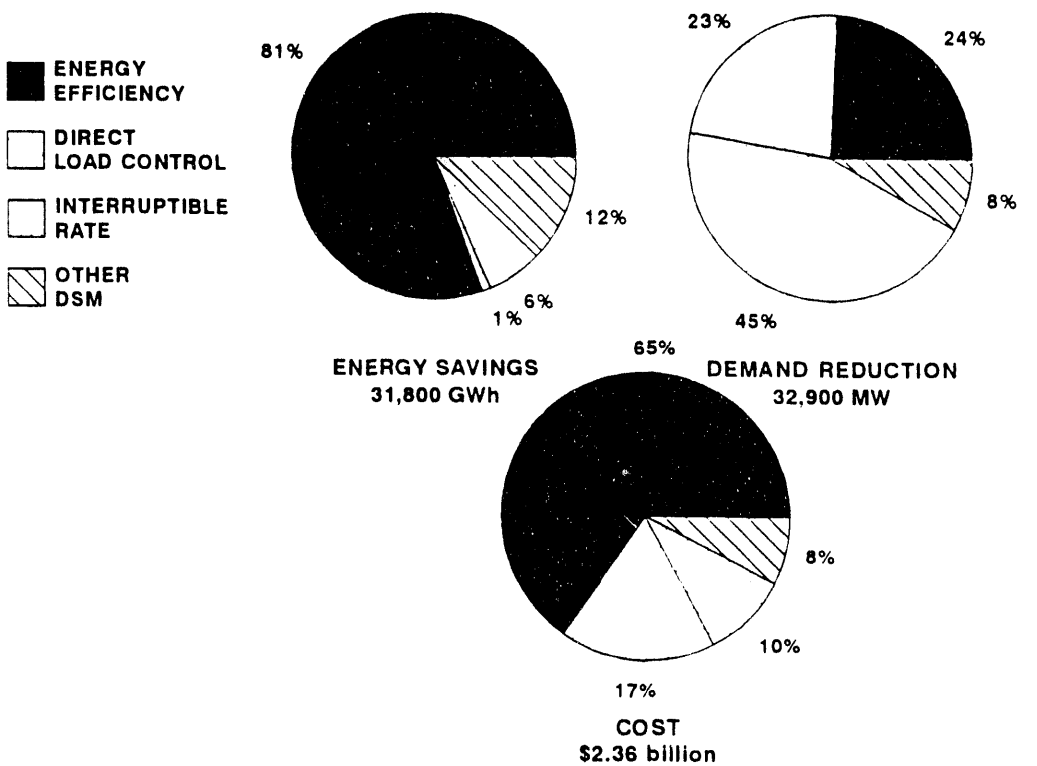

FIG. 1. DISTRIBUTIONS OF 1992 DSM-PROGRAM EXPENDITURES AND EFFECTS AMONG PROGRAM TYPES.

The 1992 figures show continued growth in DSM expenditures and effects from 1989 on. For example, utility DSM expenditures increased from 0.5% of revenues in 1989 to 0.7% in 1990, 1.0% in 1991, and 1.3% in 1992.

As was true in prior years, IOUs devoted larger fractions of their revenues to DSM than did COUs. However, the COUs reported larger energy and demand reductions. These differences might be real. Or the IOUs might conduct more careful evaluations (leading to more conservative estimates of DSM-induced energy and demand reductions) than do COUs, perhaps because IOUs are, on average, much larger.

Energy-efficiency programs dominated DSM expenditures and energy savings (Fig. 1). Specifically, these programs accounted for 65% of total utility DSM costs and 81% of energy savings but only 24% of peak-demand reductions. Direct-load-control programs were second in terms of expenditures, accounting for 17% of utility DSM expenditures, 23% of demand reductions, and 1% of energy savings. And interruptible-rate programs contributed the most to demand reductions, accounting for almost half of this total.

Utility DSM expenditures are highly correlated with incremental energy savings (r^2 = 0.70) and potential demand reduction (r^2 = 0.52). Not surprisingly, the greater the expenditures, the greater the benefits.

1992 DSM-PROGRAM EXPENDITURES

In 1992, utilities spent $2.36 billion on their DSM programs. Almost 80% ($1.85 billion) was for direct program costs, with the remaining 20% ($0.51 billion) for indirect costs. Almost two-thirds of these costs were devoted to energy-efficiency programs. In addition to these utility costs, customers and other participants in DSM programs spent $0.48 billion, bringing the grand total to $2.84 billion. (Only about 70 of the 504 utilities reported such nonutility expenditures.)

As was true in prior years, the distribution among utilities in DSM expenditures is skewed. The two top utilities, Pacific Gas & Electric and Consolidated Edison, alone accounted for almost 15% of the national total. About one-fourth of the utilities spent less than 0.1% of revenues on DSM (Fig. 2). At the other end of the spectrum, 28% of the utilities spent more than 1% on such programs. Compared to the 1991 distribution, utilities tended to shift from the 0.1-to-0.5% category to the 1.0-to-2.0% category.

The utilities in seven states—California, Florida, Massachusetts, North Carolina, New York, Washington, and Wisconsin—spent more than $100 million on their DSM programs in 1992. On average, the utilities in California, Connecticut, the District of Columbia, Florida, Maine, Massachusetts, New York, Rhode Island, Vermont, Washington, and Wisconsin spent more than 2% of revenues on DSM in 1992 (Fig. 3). Of these 11 states, 6 (California, Connecticut, Massachusetts, Rhode Island, Washington, and Wisconsin) were on the comparable list for 1991.

1992 DSM-PROGRAM ENERGY SAVINGS

In 1992, EIA-861 requested for the first time utility estimates of incremental and annual energy savings. Incremental savings is the annualized savings achieved by those customers that began participation in 1992, while annual energy savings is the savings in 1992 caused by all prior and current participants in the utility's DSM programs. Annual savings in 1992 amounted to 31,800 GWh, 1.2% of retail sales. Incremental savings totaled 5,800 GWh, 18% of annual savings.

Energy-efficiency programs accounted for the vast majority (92% of incremental and 81% of annual) of total energy savings. Dividing the levelized utility cost of these programs by the incremental savings caused by energy-efficiency programs yields an estimated 4.3¢/kWh cost of conserved electricity. Including the customer costs of DSM raises the total to 5.2¢/kWh. These estimates assume a 10-year lifetime of the efficiency measures and a discount rate of 8%. If the DSM measures last, on average, only five years, the utility cost of conserved energy is 7.2¢/kWh; if the measures last 15 years, the cost drops to 3.4¢/kWh. (Changes in the discount rate have much less effect on the cost of conserved electricity than does the estimated lifetime of the measures.) These calculations ignore the value of the demand reductions caused by energy-efficiency programs.

The residential sector accounted for 41% of the annual DSM-induced energy savings, much more than its 34% of retail sales. The industrial sector, on the other hand, accounted for a smaller share of energy savings than of retail sales. Incremental savings, however, paint a different picture. Here the commercial sector dominates, with both the residential and industrial sectors accounting for smaller shares of savings than of sales. These comparisons show that the historical focus of DSM programs on the residential sector has shifted strongly to the commercial sector. The industrial sector continues to get less attention in terms of energy savings.

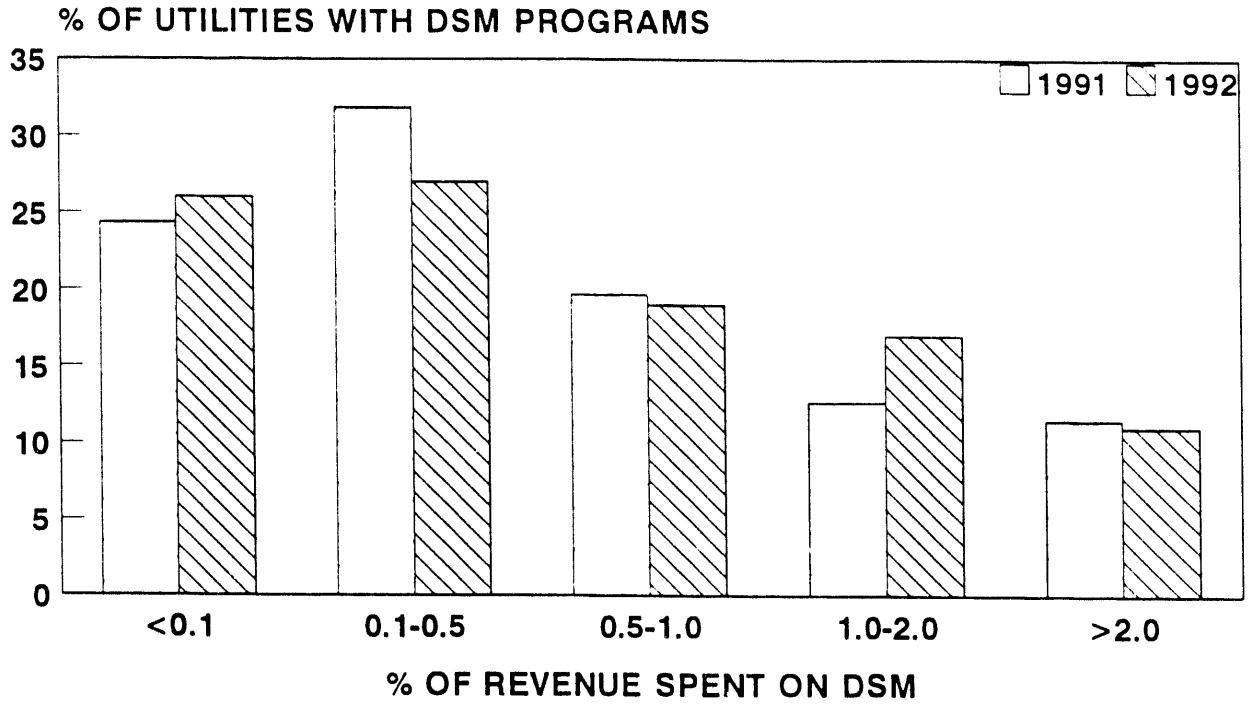

FIG. 2. DISTRIBUTION OF THE 504 UTILITIES WITH DSM PROGRAMS BY PERCENTAGE OF 1992 REVENUES SPENT ON THESE PROGRAMS. ON A NATIONAL-AVERAGE BASIS, UTILITIES SPENT 1.3% OF 1992 REVENUES ON DSM. THE FIGURE ALSO SHOWS THE COMPARABLE DISTRIBUTION FOR THE 439 UTILITIES REPORTING DSM DATA IN 1991.

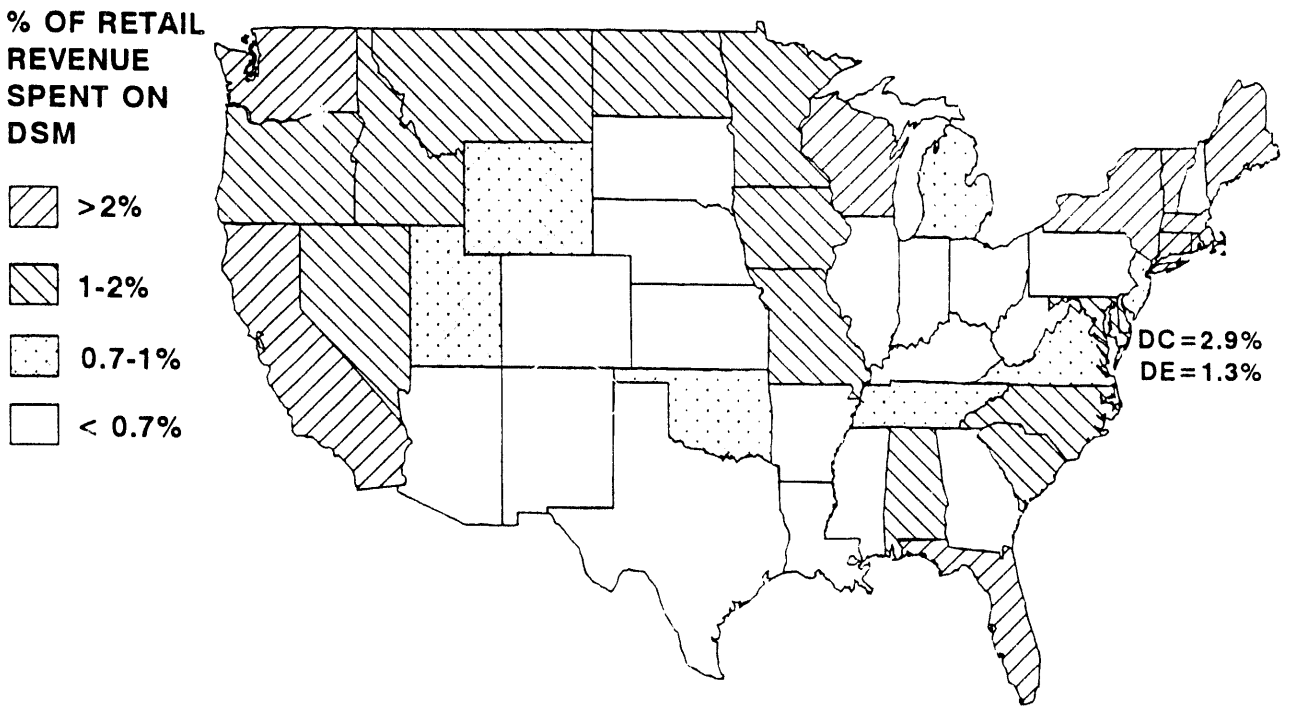

FIG. 3. THE PERCENTAGE OF RETAIL REVENUES SPENT ON DSM PROGRAMS BY STATE.

As was true in past years, the distribution across utilities in DSM-induced annual energy savings is more skewed than the distribution of DSM-program costs. Almost 60% of the utilities reported savings of less than 0.1% of total sales in 1992. At the other end of the spectrum, only 10% reported savings of 2% or more.

The utilities in Connecticut, Florida, Maine, Massachusetts, Montana, North Carolina, Rhode Island, South Carolina, Tennessee, Washington, and Wisconsin all saved more than 2% of their retail sales in 1992. Six of these eleven states (Connecticut, Maine, Massachusetts, Rhode Island, Tennessee, and Wisconsin) saved more than 2% in 1991 also. Nine other states saved between 1 and 2% of their retail sales in 1992. Utilities along the east and west coast and the upper midwest dominate in both DSM expenditures and energy savings. Relative to 1991, DSM is diffusing into the interior regions of the country from the east, west, and north.

1992 DSM-PROGRAM DEMAND REDUCTIONS

Utility DSM programs provided capacity equivalent to 32,900 MW in 1992. Interruptible-rate programs accounted for 45% of this capacity, with energy-efficiency and direct-load-control programs each accounting for almost one-fourth. The incremental demand reductions from DSM in 1992 totaled 8,200 MW, roughly one-fourth of the annual total. Interruptible programs accounted for more than half the total incremental demand reduction. Some DSM programs, such as interruptible rates and direct load control, are dispatchable (i.e., the utility can call on that capacity much as it would turn on a combustion turbine). Other programs, such as energy efficiency, are not dispatchable (i.e., they provide capacity regardless of system need).

The much larger percentage reduction in peak demand than in energy savings is reflected in the utilities' conservation load factor. CLF is the ratio of DSM-program induced average demand reduction to peak reduction and is analogous to a utility's system load factor. The national average CLF for 1992 was 11%, far lower than the U.S. system load factor of 49%.

The industrial sector dominates DSM-induced demand reductions. Its peak-demand reductions substantially exceed its contribution to peak demand. Recently, utilities have focused more DSM attention on demand reductions in the industrial sector, as shown by differences between incremental and annual demand reductions.

Calculating the cost of reduced demand is complicated because some of the costs (in particular, for interruptible-rate programs) are recurring and provide savings only for the year in question. Other costs (in particular for direct-load-control programs) are for capital investments (e.g., switches, controls, and communications equipment) that provide load reductions for several years. The cost of interruptible programs is $53/kW-year, and the cost of direct-load-control programs (with the same 8% discount rate and 10-year lifetime assumptions used for energy efficiency in the preceding chapter) is $35/kW-year. Together, these programs account for three-fourths of the incremental demand reduction at an overall cost of $48/kW-year.

The distribution of utilities by percentage reduction in peak demand is much broader than the distributions of DSM costs and energy savings. Roughly equal percentages of the utilities reported potential demand reductions of less than 0.5% or more than 10% (about 25% in each case). Fully 10% of the utilities reported demand reductions greater than 20%, which seems unlikely.

Fourteen of the top 25 utilities in terms of annual demand reductions for 1992 were also among the top 25 in terms of incremental demand reductions. Four utilities reported zero incremental demand reductions for 1992, which suggests that reporting error played a role, as it did in reporting incremental energy savings. The 11 utilities that ranked among the top 25 in terms of incremental, but not annual, demand reductions include Cleveland Electric Illuminating, Georgia Power, Gulf States Utilities, Jersey Central Power & Light, Long Island Lighting, Minnesota Power & Light, Northern Indiana Public Service, Pennsylvania Power & Light, Public Service Electric & Gas, Texas-New Mexico Power, and West Penn Power.

The utilities in six states—Delaware, Florida, Mississippi, North Carolina, North Dakota, and Vermont—reported demand reductions of 10% or more. DSM energy savings and demand reductions differ substantially among states (Hirst 1994). While the utilities in the Pacific Northwest spend substantial fractions of their revenues on DSM, their programs focus on energy savings, not on demand reductions, surely a consequence of the large hydroelectric resource in that region. On the other hand, utilities in the middle of the country (roughly from North Dakota to Texas) focus much more on peak reductions than on energy savings.

UTILITY FORECASTS TO 1997

EIA asked utilities to estimate DSM-program costs and effects for 1993 and 1997. These estimates were developed in spring 1993. I normalized these estimates

with EIA's Reference Case Projection, prepared for the *Annual Energy Outlook 1994* (EIA 1994a). EIA developed projections for the United States as a whole and for each of the nine census divisions. The EIA projections show average annual growth in electricity sales of 1.3% between 1992 and 1997, essentially zero change in real electricity price, and inflation that averages 2.6%/year.

Utilities expect their expenditures on DSM programs to increase from 1.3% of revenues in 1992 to 1.5% in 1993 and 1.8% in 1997 (Fig. 4). Similarly, forecast reductions in annual energy use increase from 1.2% in 1992 to 2.5% in 1997, and potential demand reductions grow from 6.0% to 8.4%. Thus, while energy savings are expected to more than double over this five-year period, demand reductions and DSM costs are likely to grow by 50% and 70%, respectively. These projections for 1997 DSM expenditures and effects are more ambitious than the utility projections for 2001 made in 1991. For example, the utilities' 1991 estimate of energy savings for the year 2001 totaled 2.7%, only slightly above the 1992 estimate of 2.5% for 1997, four years earlier. These projections imply that utility DSM programs will become more cost effective.

In absolute terms, utility DSM expenditures in 1997 are expected to reach $4.0 billion (in 1993 dollars). Energy savings and potential peak demand reductions are expected to reach 72,800 GWh and 49,500 MW, respectively. The correlations (r^2) between 1992 and 1997 DSM costs and effects are quite high, ranging from 0.78 for DSM expenditures to 0.90 for demand reductions. Thus, the utilities likely to be DSM leaders in 1997 were, by and large, leaders in 1992.

See Hirst (1994) for discussion of the regional forecasts of utility DSM activities and effects.

CONCLUSIONS

With four years of data (1989 through 1992), EIA-861 provides a comprehensive time series, cross-sectional view of U.S. utility DSM activities. Although the utilities surely reported the costs and effects of their programs in different ways, the level of detail and near-100% coverage of the industry makes EIA-861 a rich source of information.

The 1989–1992 results and 1997 projections lead to several findings:

- The costs and effects of utility DSM programs grew steadily each year from 1989 through 1992. In 1992, utilities spent 1.3% of their revenues on DSM and cut electricity sales and peak demands by 1.2 and 6.0%, respectively.

- Energy-efficiency programs dominated DSM expenditures and energy savings, accounting for 65% of total utility DSM costs and 81% of energy savings but only 24% of peak-demand reductions. Interruptible-rate programs were the most important in cutting peak demands, accounting for almost half the 1992 annual demand reduction.

- The residential sector accounted for a disproportionate share of DSM-induced electricity savings, with the industrial sector getting much less attention. However, the industrial sector dominated demand reductions, accounting for almost half the total reduction. Utility attention is shifting from the residential and industrial sectors to the commercial sector for energy savings and from the residential sector to the industrial sector for demand reductions.

- Although DSM activity is concentrated among a few utilities, this concentration is less than it was in previous years. Whereas only 24% of the 439 DSM utilities in 1991 spent more than 1% of revenues on DSM, 28% of the 504 reporting utilities spent more than 1% in 1992. And 10% of the utilities reported energy savings of greater than 2% in 1992, compared with only 7% in 1991.

- Utility DSM activity is also concentrated among a few states. Here, too, the concentration is less than it was in 1991. To illustrate, the number of states in which utilities averaged more than 2% of revenues on DSM jumped from 6 in 1991 to 11 in 1992.

- On average, the utilities delivered energy savings at a cost of 4.3¢/kWh and demand reductions at a cost of $35/kW-year. These utility costs are often lower than the costs of providing new baseload energy or peaking capacity, respectively.

- Utility projections show continued growth in DSM activity between 1992 and 1997. While annual utility DSM expenditures are expected to increase 70% during this period, energy savings are expected to jump 129% and potential demand

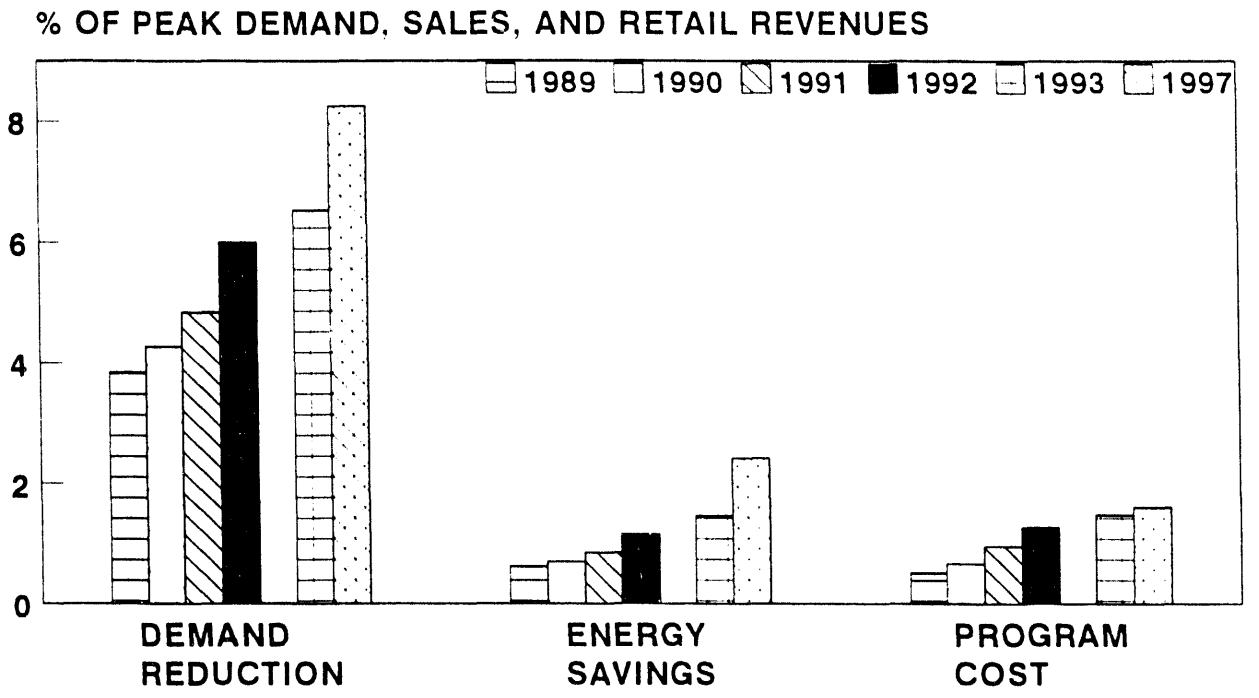

FIG. 4. UTILITY DATA ON DSM-PROGRAM COSTS, ENERGY SAVINGS, AND POTENTIAL PEAK-DEMAND REDUCTIONS FOR 1989 THROUGH 1992 AND FORECASTS FOR 1993 AND 1997.

reductions are expected to increase 50%. These projections show that energy efficiency is likely to become more important over time, relative to demand reductions. Also, DSM programs are expected to become more cost effective.

The utility reports on EIA-861 paint a positive picture of the past, present, and future for DSM programs. But much is happening within the electricity industry that could change its use of DSM programs. In particular, increasing competition at the wholesale and even retail levels could lead to a much greater focus on electricity *prices* than electricity *costs*. Such an emphasis on price would make it difficult for utilities to run DSM programs that provide broad societal benefits. State regulatory commissions have a substantial influence on the nature and extent of utility DSM programs. If competition erodes the retail monopoly franchise, regulators will have less ability to impose DSM requirements on utilities.

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