

**Results of the EEI / PLMA 2001
Demand Response Benchmarking Survey**

April, 2002

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I. Introduction

With the increased awareness of demand response in the United States, in addition to the increase in the number and type of programs being offered, the Edison Electric Institute (EEI) and the Peak Load Management Alliance (PLMA) established a system to help program managers benchmark their demand response programs.

The benchmarking system is an on-line system, where program managers can input program information on a dedicated web site. After a period of “data scrubbing” by the operators of the system, the program managers can view the results on-line, or download them for their own data analysis.

The system was operated by the firm of Collet and Schafer, Incorporated, which operates the EEI DataSource benchmarking system (which benchmarks utility customer services operations, such as call centers). The survey questions were created with the assistance of EEI, and the system was beta tested and then rolled out in 2000.

Based on user feedback, the survey was streamlined for 2001 and obtained more participation.

The results shown in this report are based on data that has been submitted and “scrubbed” as of April 1, 2002. There may be more data entries in 2002 for 2001 programs.

The data shown is summarized based on the input data. No company or entity names are shown in this report, and the analysis shows statistical results based on information from multiple programs, not from individual programs. Only those entities that submitted data to the system are allowed to see detailed data from the benchmarking system.

If a company or entity is interested in participating and is eligible to participate, it can fill out a registration form that is located at the following web site:

www.eeidatasource.com/eeilreq/index.cfm

II. Summary

As of April 1, 2002, the EEI/PLMA Benchmarking Survey had received partial or complete program information from 25 companies or entities. They included:

- Investor-Owned Utilities
- Municipal Utilities
- Cooperative Utilities
- Energy Services Companies
- Curtailment Service Providers

The majority of the data was received from investor-owned utilities. No Independent System Operator (ISO) or Regional Transmission Organization (RTO) submitted data.

Program Target Sectors

The companies or entities provided partial or complete information on 35 demand response programs. Of these, 8 were residential sector programs, and 27 were non-residential (commercial, industrial, commercial and industrial, or agricultural) programs. The number of demand response programs offered by survey participants ranged from 1 to 10.

Program Participation

The number of program participants ranged from a low value of 0 (due to poor market conditions) to a high of 450,000. In terms of reasons for joining, the reason most often cited for joining a program was bill credits or incentive payments. However, the number two reason given was to help the company or entity during peak load situations. The main reasons for dropping out of programs were small incentives or bill credits and too much interference with production process.

Program Costs

Program costs ranged from a low of \$1,800 to a high of \$105,007,000. In terms of costs per program participant, the range was \$1.33 to \$177,677 per participant.

Summer Program Results

For summer program results, the largest maximum kW reduction during the summer was 999,000 kW while the lowest maximum kW reduction was 0 kW. When comparing actual maximum load reduction results to potential results, the average maximum/potential ratio was 0.67, while the median ratio of maximum/potential was 0.80.

For the average reductions during the operation of the programs, the average value of average/potential results was 0.49, while the median value was 0.43.

Winter Program Results

For the winter program results, the largest maximum kW reduction during the summer was 300,000 kW while the lowest maximum kW reduction was 0 kW. When comparing actual maximum load reduction results to potential results, the average maximum/potential ratio was 0.75, while the median ratio of maximum/potential was 0.84.

For the average reductions during the operation of the winter programs, the average value of average/potential results was 0.67, while the median value was 0.72.

Energy Impacts

In terms of energy impacts, the minimum summer program energy impact was 0 kWh, and the maximum summer program kWh impact was 218,544,700 kWh.

Customer Financial Incentives

Under the category of customer financial incentives, the lowest value recorded was \$0, while the highest financial incentives offered by one program totaled \$103,650,700.

Program Operation Parameters

In terms of program operations, the summer only programs started in the customer billing months of May or June, and ended in the customer billing months of September or October. Many programs operated throughout the year. In terms of incentive payments, there was very high correlation between program months of operation and months when incentives could be paid.

Control Strategies

For commercial and industrial programs, the top control strategies were: 1) a utility warning and the customer controlling on-site equipment usage, and 2) a utility warning and the customer controls and operates on-site generation.

Measurement and Verification

For measurement and verification results, the top methods used were billing data analysis, statistical analysis, and end-use metering data analysis. Many companies use a combination of measurement and verification procedures.

Communication Systems

For communication used to warn the program participants and/or to signal the control switches, the top three methods were telephone systems, the Internet, and paging systems. Several companies/entities use a combination of systems.

Program Operational Parameters

In terms of operational parameters, the maximum number of demand response events per year ranged from 12 to 365. In terms of maximum hours per event, the range was 4 hours to 24 hours per event. For 2001, the minimum number of events (and hours per event) was 0. The maximum number of events in 2001 was 228, and the maximum number of hours was 5,472.

Internet Usage

Nearly 61% of the programs in 2001 used the Internet, while slightly more than 39% did not use the Internet. For 2002, slightly more than 71% of the planned programs will use the Internet, while slightly less than 29% will not.

It should be noted that much more detailed information is provided to benchmarking survey participants.

III. General Program Information

Table 1 - Program Target

Residential	8 (22.9%)
Non-Residential	27 (77.1%)
N =	35

N = number of responses

Table 2 – Residential Sector Program Targets

Single-Family Homes	8
Multi-Family Residences	3
Co-operatives	1
N =	12

Some residential programs were targeted to multiple sectors.

Table 3 – Commercial Sector Program Targets

Small Commercial	11
Medium Commercial	19
Large Commercial	22
N =	52

Many commercial programs are targeted to all sizes of commercial customers. The definition of “small”, “medium”, and “large” customers varies by company or entity. Parameters may include facility square footage, annual peak kW demands, monthly or annual kWh energy usage, and other factors. The designation may be broken out in rate schedules or tariffs that are regulated by state utility commissions.

In some cases, a “small” commercial customer has a peak kW demand of less than 25 or 50 kW. A “medium” sized customer will have a peak kW demand ranging from 25-50 kW to 250-500 kW. “Large” commercial customers typically have peak kW demands greater than 500 or 1,000 kW.

More detailed data on facility type targets (e.g., grocery, warehouse, retail, large office, education, etc.) is provided to survey participants.

Table 4 – Industrial Sector Program Targets

Small Industrial	10
Medium Industrial	19
Large Industrial	23
N =	52

Many industrial programs are targeted to all sizes of commercial customers. As with commercial customers, the definition of “small”, “medium”, and “large” industrial customers varies by company or entity. Parameters may include facility square footage, type of industrial process, annual peak kW demands, monthly or annual kWh energy usage, and other factors. The designation may be broken out in rate schedules or tariffs that are regulated by state utility commissions.

In some cases, a “small” industrial customer has a peak kW demand of less than 50 or 100 kW. A “medium” sized industrial customer will have a peak kW demand ranging from 50-100 kW to 500-1,000 kW. “Large” industrial customers typically have peak kW demands greater than 1,000 kW.

IV. Program Participation

Table 5 – Total Number of Customers in the Program Target

Minimum	5
Maximum	3,000,000
Average	251,989
Median	11,000
Standard Deviation	604,544
N =	28

Different programs will have different numbers of targeted customers or participants. In the U.S., the number of residential electric utility customers in 1999 was 109,817,057 and there were 13,963,937 commercial customers. In 1999, there were 527,329 industrial customers.¹

Table 6 – Number of Targeted Customers Qualified or Eligible for the Program

Minimum	5
Maximum	3,000,000
Average	194,033
Median	5,000
Standard Deviation	571,807
N =	30

For many demand response programs, there are customers that will not be able to participate. For example, for a residential central air conditioning cycling program, those customer in multi-family housing units and customers in single-family homes that do not have central cooling systems will not be qualified for the program.

Table 7 – Percentage of Customers Qualified or Eligible for the Program

Minimum	4.4%
Maximum	100.0%
Average	74.4%
Median	97.5%
Standard Deviation	30.0%

¹ Edison Electric Institute, *Statistical Yearbook of the Electric Utility Industry 2000 Edition*, 2000, Edison Electric Institute, Washington, D.C.

N = 28

This table shows that there can be a significant percentage of customers in a target that are not eligible or qualified to participate in a demand response program. The reasons for ineligibility may include type of facility, type of on-site equipment, on-site metering arrangement, and other important factors.

Entities that participate in the benchmarking survey can obtain information on the number of participants per program, the percentage of target customers participating, and the percentage of *eligible* customers that are participating in a program.

Table 8 – Number of Customers that Joined the Program in 2001

Minimum	0
Maximum	450,000
Average	20,221
Median	33
Standard Deviation	85,482

N = 28

Residential programs will likely have larger yearly “joining” numbers than commercial or industrial programs.

Table 9 – Number of Customers that Dropped out of the Program in 2001

Minimum	0
Maximum	4,191
Average	334
Median	0
Standard Deviation	893

N = 28

As with sign-up numbers, residential programs may have larger drop out numbers than commercial and industrial programs.

Entities that participate in the benchmarking survey can obtain information on the percentage of eligible customers that joined a program in 2001, as well as the percentage of customers that dropped out of a program in the same year.

Table 10 – Reasons for Joining the Program

REASON	RANKING
Bill Credits / Incentive Payments	#1
Non-Financial Product or Service	#4
Help your Company during Peak Situations	#2
Help the Community	#3
Other	#5

Table 11 – Reasons for Dropping out of the Program

REASON	RANKING
Bill Credit / Incentive too Small	#2
Occupant Discomfort During Control Time	#4
Controlled Too Many Days in a Row	#5
Interference with Production / Process	#3
New Owner / Tenant does not Want	#6
Other	#1

In this case, “other” reasons were #1 due to the fact that not enough reasons were provided as check-off entries to the survey participants.

Exact values and explanation of “other” reasons are provided to survey participants.

Table 12 – Minimum Peak kW for Program Participation

Minimum	0
Maximum	2,000
Average	339
Median	200
Standard Deviation	462
N =	22

For some commercial and industrial programs, one of the qualifications is a minimum level for the peak kW demand. Typically, the larger the peak demand, the larger the demand reduction that can be obtained from the customer.

V. Program Costs, Results, and Benefits

Table 13 – Total Summer Program Costs in 2001

Minimum	\$1,800
Maximum	\$105,007,000
Average	\$6,893,197
Median	\$525,099
Standard Deviation	\$21,770,510

N = 23

As the table shows, there is a very wide range of demand response program costs. Survey participants are provided information on direct program costs and indirect program costs for summer and winter programs.

Table 14 – Average Summer Total Program Costs per Participant in 2001

Minimum	\$1
Maximum	\$177,677
Average	\$19,658
Median	\$3,361
Standard Deviation	\$39,515

N = 22

Program costs per participant vary widely, due to the amount on on-site equipment, controls, communication infrastructure, personnel requirements, and other program support.

Table 15 – Potential Summer Program Peak Load Reduction Available in 2001 (kW)

Minimum	150
Maximum	702,000
Average	170,338
Median	78,500
Standard Deviation	213,226

N = 26

The variation in potential load reductions is due to the program target segment (residential versus commercial versus industrial), the size of the eligible customer base within the target segment, and the operation of the program in 2001.

Survey participants can access the actual maximum load reductions achieved and the minimum load reductions achieved, as well as average load reductions achieved for summer and winter programs.

Table 16 – Potential Average kW Reduction per Participant (Summer Program)

Minimum	0.0
Maximum	33,333
Average	3,092
Median	629
Standard Deviation	7,017
N =	24

The program target segment and the number of participants will be key factors in this calculation.

Survey participants can obtain information on the actual maximum, average, and minimum kW load reduction per program participant for winter and summer programs.

Table 17 – Cost per Potential kW Load Reduction (Summer Program)

Minimum	\$0.00
Maximum	\$9,295.75
Average	\$487.26
Median	\$33.88
Standard Deviation	\$1972.46
N =	22

There are many factors that can affect the costs per potential kW reduced. Programs that are more sophisticated in terms of equipment, controls, and support, are likely to have higher costs.

Survey participants are able to obtain information on the costs per actual maximum, average, and minimum kW reductions for summer and winter programs.

Table 18 – Ratio of Maximum Actual kW Load Reduction to Potential kW Load Reduction (Winter Programs)

Minimum	0.26
Maximum	1.00
Average	0.75
Median	0.84
Standard Deviation	0.29
N =	7

The survey obtains information on potential kW demand reductions, maximum actual reductions, minimum actual reductions, and average reductions for summer and winter programs. The ratio of actual to potential load reductions can be useful to program managers, since lower ratio values may indicate where programs may need improvement.

Table 19 – Summer Program Energy Impacts (kWh)

Minimum	0
Maximum	218,544,700
Average	38,905,444
Median	1,940,551
Standard Deviation	78,167,770
N =	8

For 2001, the kWh energy impacts for summer programs varied widely. For many programs, kWh impacts are not measured, since kW demand reductions are the key performance factor. Energy impacts on per participant basis, as well as costs per kWh impact, are detailed for summer and winter programs for survey participants.

Table 20 – Cost of Program Participant Financial Incentives in 2001

Minimum	\$0
Maximum	\$103,650,700
Average	\$10,126,377
Median	\$1,312,615
Standard Deviation	\$25,118,517
N =	18

For programs that are voluntary in nature, there are no customer financial incentives. Most programs provide financial incentives, and the amounts vary widely.

Table 21 – Cost of Program Participant *Non*-Financial Incentives in 2001

Minimum	\$0
Maximum	\$681,252
Average	\$142,663
Median	\$1,000
Standard Deviation	\$258,392
N =	7

Some programs offer non-financial incentives to participants. The type and cost of non-financial incentives can vary widely, depending on the target market. Non-financial incentives may provide participants more reason to join or participate in a program.

Companies and entities that use the benchmarking survey are able to see explanations of non-financial incentives, as well as viewing the cost of non-financial (and financial) incentives on a per participant, per kW, and per kWh basis.

Table 22 – Type of Financial Incentive for Program Participants in 2001

INCENTIVE DESCRIPTION	RANKING
None	#1
Fixed \$ per Month	#5 (tie)
Fixed \$ per Event	#5 (tie)
Dollars per kW Reduced	#4
Rate / Tariff Incentive	#2
Other	#3

For the programs surveyed, it is likely that non-financial incentives were provided to program participants.

Descriptions of rate incentives, as well as explanations of “other” incentives, are provided to survey participants.

VI. Program Equipment and Control Information

Table 23 – Program Starting Month (when equipment can be controlled or participants are notified to act)

January	11
May	4
June	7
N =	22

The summer programs begin in May or June, while many programs operate through the calendar year.

Table 24 – Program Ending Month

January	3
September	8
October	3
December	8
N =	22

It is possible that the programs that end in January are due to the fact that the for many participants, the “December” billing month ends at some point during the calendar month of January.

Table 25 – Program Incentive Starting Month

January	1
May	2
June	5
October	1
November	1
All Months	11
N =	21

Programs that marked “all months” provide incentives during each calendar or billing month to program participants.

Table 26 – Program Incentive Ending Month

January	1
August	1
September	5
October	3
December	1
All Months	11
N =	21

Survey participants also receive information on whether the months indicated in Tables 23-26 are billing months or calendar months.

Table 27 – Type of Control Strategy for Commercial and/or Industrial Program

CONTROL STRATEGY	RANKING
Utility Control, Equipment Cycled or Shut Off	#4
Utility Control, Temperature or Thermostat Adjustment	#5
Utility Warning, Participant Controls Equipment or Strategy	#1
Utility Warning, Customer Operates On-site Generation	#2
Other	#3

Benchmarking survey participants are able to see “other” control strategy information, as well as the number of programs utilizing each strategy.

Table 28 – Type of Communication System(s) Used to Signal Control Switches or Program Participants

COMMUNICATION SYSTEM	RANKING
VHF Radio	#5
Telephone	#1
FM Radio	#6 (tie)
Internet	#2
None (timer or temperature control / activation)	#6 (tie)
Paging System	#4
Other	#3

Survey participants can view the “other” types of communication systems used for demand response programs, as well as the frequency of use of different communication systems.

In addition, in terms of control equipment, survey participants are able to see the names of the control switch hardware manufacturers, communication equipment manufacturer, and failure rate information.

Table 29 – Methods Used to Measure and Verify Program Equipment and/or Control kW and kWh Results

MEASUREMENT & VERIFICATION METHOD	RANKING
Engineering Analysis	#4
Statistical Analysis	#2 (tie)
Billing Data Analysis	#1
Building Load Metering Data Analysis	#5
End-Use Equipment Metering Data Analysis	#3
Other	#2 (tie)

The survey provides information on “other” types of measurement and verification methods that are used. It also shows the frequency of use of each method. The survey also has information about the usage of Automated Meter Reading (AMR) for measurement and verification.

VII. Miscellaneous Program Information

Table 30 – Maximum Number of Events Per Year (or Control Season) for this Program

Minimum	12
Maximum	365
Average	206
Median	243
Standard Deviation	167
N =	16

For those programs without limits on the number of events per year, the survey participants were instructed to enter 365. A significant number of programs did not have a limit on the number of events.

Table 31 – Maximum Number of Hours Per Event for this Program

Minimum	4
Maximum	24
Average	12
Median	6
Standard Deviation	9
N =	20

For those programs without limits on the number of hours per event, the survey participants were instructed to enter 24. A significant number of programs did not have a limit on the hours per event.

Information on the actual number of events, and the total hours of program operation, during 2001 is provided to survey participants.

Table 32 – Yes or No: Is there customer choice of electric suppliers in any state that the program is in operation?

Yes	8
No	20

Restructuring of the electric industry can have a dramatic impact on the operation of a demand response program.

Table 33 – Yes or No: If there is customer choice in any state that the program is run, did the demand response program change in 2001, or are they being changed in 2002?

Yes	6
No	6
N/A	16

Survey participants can find out how programs are being altered due to industry restructuring, such as changes to the incentives, changes in the features of the program, hardware/software changes, and other options.

Table 34 – Yes or No: Did you use the Internet for this demand response program in 2001?

Yes	17
No	11

Table 35 – Yes or No: Are you planning to use the Internet for this demand response program in 2002?

Yes	20
No	8

Survey participants are provided details on how companies/entities used the Internet for programs in 2001, and how they plan to use the Internet for their programs in 2002.

Table 36 – Average Participant Non-Response Rate (Signal Received, No Action Taken)

Minimum	0.0 %
Maximum	100.0 %
Average	18.0 %
Median	1.0 %
Standard Deviation	35.6 %

N = 9

With demand response programs, there are times when program participants, who are in control of all actions, receive signals from program providers but do not respond. There can be several important factors that can be involved when participants do not respond.

Participants in the benchmarking survey can see the reasons why participants do not respond, as well as viewing data on peak non-response rates.

As discussed earlier in this report, EEI and PLMA may receive more information about 2001 demand response programs, at which point this report can be updated. The system is designed to help companies and entities that operate demand response programs by allowing them to compare their program operations against other operations in a confidential manner.

Questions about this report and the benchmarking may be directed to Steve Rosenstock of the Edison Electric Institute (srosenstock@eei.org, 202-508-5465).