Osage Municipal Utility
Comprehensive DSM Program
Profile #5, 1992

Executive Summary

The Osage Municipal Utility's Comprehensive DSM program has been heralded as one of the most effective DSM efforts ever. In large part, Weston D. Birdsall, Osage's recently-retired General Manager, is to be credited to this exemplary DSM effort. Birdsall believed and proved that the citizens of a small community could collectively take responsibility for their energy use (both electric and gas) and profit! By marshalling the support from all members of the community, from schoolchildren to professionals, Osage's success in terms of gross savings and the remarkably low costs of the savings, has yet to be replicated.

The Osage program was designed to reduce the utility bills of all customers to improve the economic well-being of the community. Its other purpose was to reduce the growth rate of electric peak demand to delay the need to expand its generating capacity. Both objectives were met, the town actually experienced three electricity rate reductions and the capacity additions are still not necessary. For a total cost of less $500,000 over eighteen years, Osage has been able to save some 92.4 GWh, 4 MW, and about 8 million therms of gas since 1974. Furthermore, 100% of OMU's customers have participated in the program, at an average cost of only about $100 per customer total, or just over $6 per customer per year!

The most unique element of the Osage effort is the positive relationship that the utility has built with its customers. Through a series of educational programs and successful DSM measures, OMU has earned the trust of its customers. Once the people in the community realized that the utility was trying to help them reduce their bills and save money, it became successively easier to implement programs and achieve high participation rates.

Not only was OMU successful in achieving its main goals but an indirect benefit of economic development was realized. By keeping rates relatively low and helping businesses and industries reduce their energy consumption the economic viability of these businesses was also increased. This not only helped businesses and industries expand but also attracted new ones. Thus, the Osage community has enjoyed a stable local economy and unemployment rates far below the national average.

Comprehensive DSM Program

Utility:	Osage Municipal Utility
Sectors:	All
Measures:	Comprehensive
Mechanism:	Education, direct assistance, infrared scans partnership programs, rebates, and voluntary load management.
History:	Began in 1974, still in operation

1991 Program Data

Electricity Savings:	10.5 million kWh
Gas Savings:	1.16 million therms

Cumulative Data (1974-present)

Electricity Savings:	~92.4 million kWh
Gas Savings:	~8 million therms
Capacity Savings:	4 MW
Cost:	~$476,500
Participation:	100%

Conventions

For the entire 1992 profile series all dollar values have been adjusted to 1990 U.S. dollar levels unless otherwise specified. Inflation and exchange rates were derived from the U.S. Department of Labor's Consumer Price Index and the International Monetary Fund's International Financial Statistics Yearbook: 1991.

The Results Center uses three conventions for presenting program savings. **Annual savings** refer to the annualized value of increments of energy and capacity installed in a given year, or what might be best described as the first full-year effect of the measures installed in a given year. **Cumulative savings** represent the savings in a given year for all measures installed to date. **Lifecycle savings** are calculated by multiplying the annual savings by the assumed average measure lifetime. **Caution:** cumulative and lifecycle savings are theoretical values that usually represent only the technical measure lifetimes and are not adjusted for attrition unless specifically stated.

Utility Overview

Osage Municipal Utilities (OMU) is a municipally owned and operated gas and electric utility company formed in 1942. It is located in northeast Iowa and services approximately 2,100 electric and 1,600 gas customers in the town of Osage.

Most of OMUs electricity is purchased wholesale from Dairyland Power Cooperative of LaCrosse, Wisconsin at \$0.028/kWh. In addition OMU owns and operates five dual-fueled generators, giving them an independently owned total generating capacity of 11,700 kW. They use their generators to provide power for emergencies such as downed power lines and shortages from their supplier. Having their own generating plant (which is capable of carrying their entire load if necessary) allows OMU to buy interruptible or nonfirm power, which is purchased at a relatively low price. Their own generating facility operates approximately 1-2% of the time over the course of the year.

OMU purchases its natural gas wholesale from Northern Natural Gas at \$0.288/therm, and then sells to its gas customers in the utility's service territory.

OMU 1991 STATISTICS

Electric Statistics		
Number of Customers	2,100	
Electricity Sales	34,609	MWh
Electricity Sale's Revenue	\$1.690	million
Summer Peak Demand	8,525	kW
Generating Capacity	11,700	kW
Reserve Margin	37	%
Average Electric Rates		
Residential	5.24	¢/kWh
Commercial	4.84	¢/kWh
Industrial	4.84	¢/kWh
Average	4.99	¢/kWh
Gas Statistics		
Number of Customers	1,600	
Gas Sales	3.33	million therms
Revenue from Gas Sales	\$1.31	million
Gas Rates		
Average	39.70	¢/therm

Utility DSM Overview

Prior to 1974 Osage Municipal Utility, like most other utility companies, had no DSM program. However, in 1974 demand-side management was implemented by OMU for two basic reasons. First, the oil embargo of 1973 clearly illustrated that fuel price and availability could not be guaranteed, and that the effect of these variables on rates to customers were beyond the control of OMU. Second, if the utility's demand continued to grow at the 1973 current rate of 7.2%, OMU would have to invest in more generation capacity within a decade. The management of OMU decided that the best way to address these issues in a way that would best serve the interests of their customers was through a comprehensive DSM program. (This thinking was very progressive for its time. With few exceptions, it was another 10 years before utility policies began to include DSM programs.)

Utility DSM Overview Table	DSM Expenditure	Energy Savings	Dollar Savings
Gas	~$91,600	~8 Million Therms	~$3.2 Million
Electric	~$118,400	~92.4 Million kWh	~$4.6 Million
Load Management	~$266,500	~4 MW	~$3.3 Million
Total	~$476,500		~$11.1 Million

Under the guidance of Weston D. Birdsall, OMU's General Manager, the first steps of a long range comprehensive DSM program were taken. For approximately two years Mr. Birdsall and the OMU staff concentrated on educating the public about the benefits of energy efficiency. (This education element has continued through the present.) After the educational groundwork was laid, OMU began implementing specific measures. The savings by the customers resulting from the early programs lent credibility to the utility and made it easier for them to implement successive DSM measures. Since 1974 OMU has introduced about twenty different measures (described in the Implementation section) in a seemingly ad hoc way. This "seat of the pants" approach, as Mr. Birdsall describes it, has been highly effective for OMU.

The accompanying table shows an overview of the total expenditures and savings for OMU's DSM program. It should be noted that the capacity savings is captured from both load management and energy efficiency.

Program Overview

Unlike many other Results Center profiles that focus their attention on a specific program within a utility's portfolio of programs, for the purpose of presenting the Osage "experience" we will consider all of the measures as a single integrated program. This is how both the community and OMU perceive and implement demand-side management in Osage. The program was conceptualized by Mr. Birdsall and his Board of Trustees. Mr. Birdsall is largely responsible for getting the program established and his enthusiasm continued to sustain the momentum of this exemplary effort.

The OMU DSM program was initiated with two goals in mind: reduce customers bills and reduce the rate of peak demand growth in order to delay construction of new capacity. Knowing their control over utility rates was somewhat limited, they chose to help customers hold down their energy bills by showing them how to reduce usage through energy efficiency measures. Many of these same measures were also effective in achieving their second purpose of reducing the peak demand growth rate. A goal of limiting this growth rate to 3% per year was set (the 1974 growth rate was 7.2%) because it would delay new construction by at least another twelve to fifteen years and it was feasible to achieve this objective. OMU has successfully limited peak demand growth to 3% or less each year since 1975.

The selection of many of the mechanisms listed in the following section on implementation were established through a simple process. Mr. Birdsall and his staff actively searched for successful efficiency programs to help increase the chances of their program's success in providing significant energy savings and cultivating the trust of their customers. When they discovered programs that had proven results, were affordable, and could be effectively applied to Osage, they incorporated these measures into their own effort. The approach was one of cautious and rapid learning -- "to be one of the first, but not the first."

Implementation

Osage Municipal Utility used a variety of methods to promote and deliver their DSM program to the community. The mechanisms listed below are not necessarily in order of their implementation. Instead, similar types of mechanisms have been grouped together under descriptive headings. However, it is true that some type of education element (the first category listed below) preceded the implementation of most of the DSM measures. Almost all of the information in this section was drawn from a paper, by Mr. Birdsall, which is listed in the Reference Section as [R#4].

MARKETING AND DELIVERY

EDUCATION

• During the first years of the program (1974-1980) numerous ads and articles were placed in the local news media to emphasize the value of wise energy use. This and other public education measures were the cornerstone of OMU's early DSM efforts.

• Since 1980, and continuing through the present, a free bimonthly newsletter with information on efficiency techniques and local energy achievements has been sent to all of the utility's customers instead of using the local media. (The local newspaper reaches 50-60% of the utility's customers while the newsletter is sent to 100% of the customer base.) This publication has proven to be very effective at showing the public the benefits of energy efficiency and in providing checklists for weatherization and other efficiency measures. It is also useful for promoting initiatives such as the recent water-efficient showerhead giveaway. The mailing of the newsletter is strategically timed to arrive a few days before the bills. With this advance notice, customers using the utility's drive-up window to pay their bills can also take advantage of the latest OMU efficiency promotion such as picking up a water-efficient showerhead. Also, signs in the drive-up window are used to promote efficiency.

• Since the program's inception Mr. Birdsall has given talks to a wide variety of community groups on the advantages of energy efficiency. Curiosity and interest often turn Mr. Birdsall's 20-minutes talk into one and one-half hour discussions on efficiency. (More recently many of these lectures have become out-of-town engagements where he explains how and why OMU was so successful with its DSM program.)

• Direct involvement with the local schools' energy education programs started in 1986 and continues to the present. OMU provides teacher support which includes energy conservation instruction, tours of the power plant, discussions of utility operation, and energy efficiency literature. In addition OMU supports energy fairs exhibiting students' projects.

INFORMATION ASSISTANCE

• One of the first services provided by OMU was the free lending of electricity-use test meters to locate inefficient appliances. The lending of these meters first began in 1974 and is still available to OMU customers.

• In 1978 aerial thermograms (infrared scans) were taken of all homes and businesses to reveal roof heat loss. Mr. Birdsall has commented several times that the success of this measure was based on the intrigue that infrared photography creates. Everyone wanted to see how their home or business was depicted. The bright spots on the photographs revealed places where heat loss was occurring or where undetected moisture was collecting reducing the insulation's R-value. This service was provided by an independent consultant. Although this was a one-time scan the infrared photos are still available to anyone who wishes to see them.

• In 1885 OMU contracted to have an infrared corner scan taken of every building in the town. (A corner scan shows two outside walls.) These scans were similar to the aerial thermograms but showed heat loss through the outside walls instead of the roof. Approximately 2,100 scans were taken and 700 customers visited the utility for an explanation of the pictures. A copy of the pictures was mailed to the remaining customers.

• Energy checks of homes and businesses using blower doors and hand-held infrared scanners for indoor scanning have been done since 1987. These tests can be used to illustrate the need for weatherization improvements and to evaluate the effectiveness of recently added insulation or weatherstripping. Approximately 59-60% of all homes and businesses have had indoor infrared scans done at no cost to the customer. This program brings the total number of infrared scans done on each building up to three. Customers have the opportunity see infrared pictures of their building's roof, exterior walls, and interior walls.

• Complete energy checks of industrial accounts were done by professional engineers (outside consultants) at no cost to the customer. All seven of OMU's industrial customers had this done yielding a participation rate of 100%. These audits were first offered in 1987 and continue to the present for any new industrial accounts.

NEW CONSTRUCTION STANDARDS

• In 1975 OMU set minimum insulation standards for all new gas or electric heat customers, commercial and residential. This includes retrofits as well as new construction. The standards established called for at least R-14 in walls and R-24 in ceilings. Inspections by utility personnel confirm compliance. Those who fail to comply are not eligible for gas or electric service. The standards are still in place, but for the past eight years, all new buildings have exceeded these specifications. It has become common practice to insulate walls in the range of R-19 to R-24 and ceilings to R-40 to R-60.

INSTALLED MEASURES

REBATES AND GIVEAWAYS

• In 1987 and 1988 home weatherization for low-income customers was done with the help of a local community group, the Jaycees. The utility company provided materials (free of charge) such as water heater jackets and weatherstripping, and the Jaycees volunteers did the installations.

• Water heater jackets (R-11) have been given away since 1988. They are still available but are currently installed on 98% of all water heaters, gas and electric in the OMU service territory.

• Water-efficient showerheads were given away with a limit of 2 per household. After the giveaway was announced, the response was enthusiastic. (About 1,300 were given away in the first two weeks.) The shower heads cost $2.25 each, have a flow rate of 2.5 gallons per minute, and provide a spray that received widespread approval.

• The showerhead giveaway was followed by a water-efficient faucet aerator giveaway. Both the showerhead and the faucet aerator giveaway programs began in 1991 and it took only one year to reach near saturation. The program continues but the current demand for both devices is small.

• In 1989 a rebate program to encourage the sale of compact fluorescent lamps (CFLs) was implemented. To avoid competing with local hardware stores that had taken the initiative to stock compact fluorescents, the utility offers a $7.50 per lamp rebate coupon to utility customers who purchased compact fluorescent lamps within the Osage community. Osage customers are eligible for any number of lamps. Eligible lamps include any stocked by local suppliers (mostly GE and Panasonic). Customers received their rebate by bringing a paid receipt and proof of purchase (lamp box) to the utility. The program is still in effect.

• Another early program which began in 1975 was the encouragement of tree planting to reduce air conditioning costs. A hydraulic tree planter can be leased at a nominal cost and trees are donated by a utility owned and operated nursery. The Park Department also has trees available and will plant these trees for $20 each. This ongoing program has resulted in the planting of several hundred trees. (It is estimated that three well placed shade trees will reduce the A/C load by 20-40%). [R#3]

• In 1988 OMU offered to pay two years' interest on the cost of extra energy efficiency measures installed by any of their commercial customers. Eligible efficiency measures were those that went beyond OMU's minimum insulation standards such as energy-efficient lighting, HVAC systems, and envelope improvements. The financing was arranged by the commercial customer but when the customer presented the utility with an interest statement, a refund check was issued. Half of this cost was paid by a grant from the Iowa Department of Natural Resources and half by the utility. With the help of this program, one business reduced energy use by 66%, another by 74%. The program ran for two years (`88-`90). Less than 10% of the commercial customers took advantage of this opportunity, the lowest participation rate ever experienced for any of OMU's DSM programs. No new applications are being accepted, and the utility's last interest payment on existing loans was May 15, 1992.

UTILITY SYSTEM IMPROVEMENTS

• Utilizing the same hand-held scanners used for detecting heat loss in buildings, OMU's staff took infrared scans of their distribution system in order to detect faulty electrical connections which result in line losses. A combination of measures including repairing these faulty connections, replacing wires with an appropriately larger gauge, and properly calibrating meters, reduced losses by ~75%. Scans are taken periodically as a maintenance measure. This has been done twice since 1978 and Mr. Birdsall says they are now due for another one.

LIGHTING RETROFITS

• During 1981 and 1982 all street lighting in Osage was changed over to efficient high-pressure sodium lights. This lighting retrofit paid for itself in 4½ years.

LOAD MANAGEMENT

• Voluntary load management programs first introduced in 1979 reduce electric peaks by 9 to 10%. This is done by interrupting power to air conditioners (both central air and large window units) and water heaters in commercial and residential sectors. Over 96% of all central air conditioners are voluntarily under utility control (this voluntary program with extraordinarily high penetration rates has also been effectively demonstrated in Sioux Center, Iowa.) The utility installs the radio controlled switch on an air conditioner free of charge. When summer peak demand is high, a computer at the utility plant sends out a radio signal that causes the controllers to turn off the air conditioners' condensers, but not their fans, for up to 7½ minutes every half hour. The controller also provides added protection for the condenser in the event of a power outage (by delaying restarting for 7½ minutes). As an incentive to participate, Osage customers are offered either a free R-11 insulation jacket for their water heaters or two high-efficiency 15 watt compact fluorescent lamps.

In order to identify possible participants the meter reader checks a box on each customer's meter card to indicate the presence of a large air conditioner. Using this information, the utility offers controllers to customers who do not have one installed. Plumbing and heating contractors also recommend the controllers to customers upon installation of air conditioning equipment.

The controllers were initially installed by an outside contractor, but quality control problems convinced the utility to use their staff for subsequent installations. The utility has used its own people to install the controllers during the last two winters ('89-'90, and '90-'91). Winter installations work well for the utility because their crews are less busy with the outdoor work that fills their summer schedules.

The other end-use device on which OMU installs radio controlled switches is electric water heaters. Controllers were initially offered to customers with electric water heaters in 1979. Even without offering incentives, OMU fitted about 75% of the electric water heaters with a utility activated controller. The high voluntary participation rates (see Program Savings Section) for both the water heater and the A/C controllers may be in part attributed to the excellent community relations OMU has developed over the years. Installing controllers on water heaters and A/C units is an ongoing load management program.

STAFFING REQUIREMENTS

OMU did not hire additional staff to administer any of their DSM measures. Instead they educated existing personnel so that they all understood the programs and were able to answer questions about them. This is consistent with the overall approach of involving the entire community in the DSM measures. The community involvement approach is a significant part of the broad success of that DSM has enjoyed in Osage.

Monitoring and Evaluation

MONITORING

Although some general monitoring was done at OMU it was not comprehensive nor was it done equally for each program. Perhaps sophisticated or high levels of monitoring were not essential in the case of OMU due to its relatively small size and the high level of community involvement.

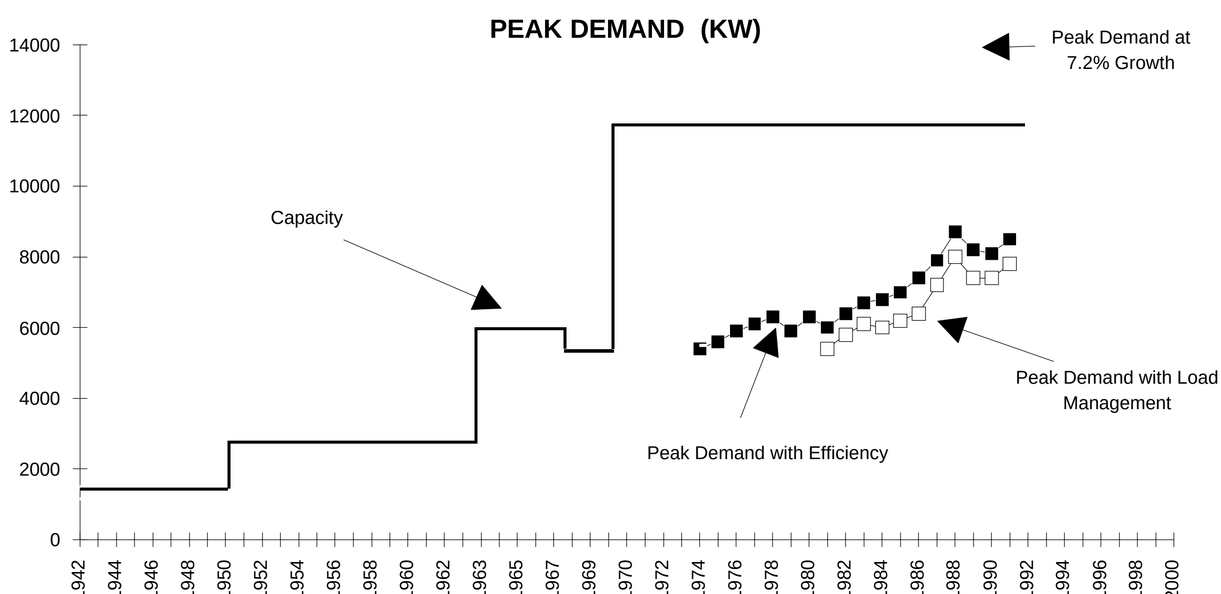
Monitoring for a few particular programs was extensive enough to merit some discussion. For example the water-efficient showerhead giveaway was monitored fairly closely. OMU knows that as of March 1992, 1,183 residences received at least one of these showerheads. Because the showerheads were picked up at the utility's offices OMU's staff was able to find each customer in the computer data base and check their names as they received their showerhead. The participation rate was then determined by comparing the number of customers that picked up the showerheads with the total number of residences. This level of monitoring, although not extensive, allowed OMU to determine the participation rate at any given time. This gave them a good sense of how successful the program was and when to end it or shift emphasis to another program.

Another program that continues to be monitored is the radio controlled water heater and air conditioner load management program. The meter readers check which residences have air conditioning units and this information is compared to the computer record of those who already have a controller installed. The customers who do not have one installed are then contacted.

When this program began the field equipment was installed by a private business. However, OMU field personnel did spot checks of installations and found a number of them to have either been done poorly or not at all. Feedback from customers was encouraged and became part of the monitoring process. In fact, it was an inquiry from a customer that first alerted the utility that there might be an installation problem. After only a few months OMU decided to install the radio controlled switches on the water heaters and air conditioners themselves. This arrangement has worked well and OMU continues to use its own personnel for this program. Again, although the amount of monitoring was minimal it was adequate for determining the participation rate and detecting problems and making the necessary adjustments.

EVALUATION

OMU evaluates its DSM programs based mainly on participation rates. When the utility feels that a saturation point of participation for a particular program has been reached they then move on and emphasize a different program. Sometimes the lack of participation is used as a signal to terminate a particular program and shift emphasis to a program that is more accepted. (This has only happened once.) The overall effectiveness of all the programs is evaluated in the context of whether or not the primary goals of reducing peak demand growth and customer's bill are being achieved. The small size of the utility and its service territory makes it relatively easy to evaluate the success of a program without using an elaborate record keeping scheme.



The high degree of participation in several of the programs gives a strong indication that OMU's approach and selection of programs are widely accepted by its customers. The well-established communication and good will that OMU has developed with its customers allows for quick feedback, both good and bad, on any of their programs. OMU staff can take this feedback and make the necessary adjustments to maximize the program's benefits.

DATA QUALITY

There is a wide range of reliability in data quality for OMU's DSM programs. Some numbers are estimates while others are more exact. The more exact numbers are participation rates, current energy usages, and current expenditures. All of the general information data in the Utility Overview Section involving current energy sales and the comparison of peak demand with generating capacity are exact. The cost numbers for load management measures stated in the Cost of the Program Section are also well documented.

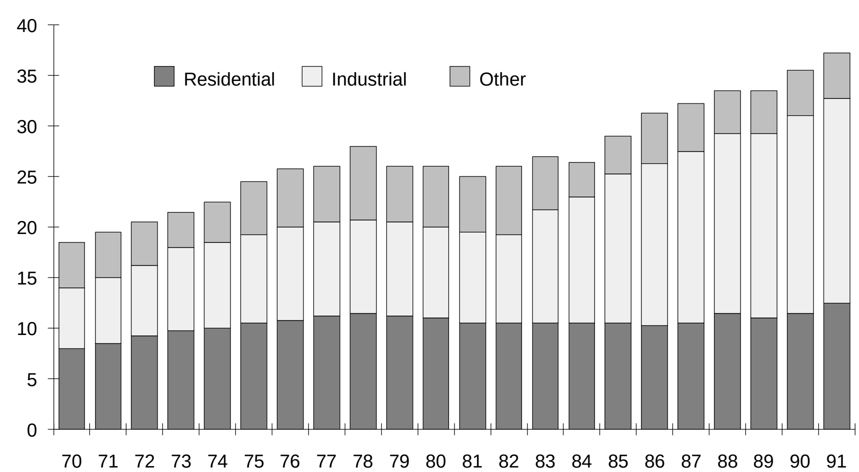
However, the costs of the energy efficiency part of the program are not as precise. The table in the Cost of the Program Section giving a breakdown of the costs of the load reduction contains estimates in nine categories. The miscellaneous expense category is included to ensure that the overall cost will not be underestimated. Although the numbers in this table are based on estimates, they are reasonably accurate.

Most numbers involving savings are also estimates. The electricity savings are based on the OMU load chart shown below. These estimates were made by comparing the actual use since the DSM program began with the projected use assuming a 2.8% annual growth rate (the national average since 1979). A 10% reduction of the estimates was then made as a conservatism. This estimate along with the total cost of electric load reduction, the life of the measures, and the discount rate is used for the cost of saved energy table in the Program Savings Section. Because of the uncertainty of the average life of the measures and the discount rate, the table lists the cost of saved energy for a range of these two variables. Although this method involves a range of error, it is clear that regardless of the assumptions, the cost of saved energy for the OMU DSM program is so low compared to the already low average OMU electric rate of 4.99¢/kWh, that the cost effectiveness of the program is not called into question.

The overall gas savings of 25% estimated by Mr. Birdsall, is based on average customer use per degree day for each year since the program began. Because this savings estimate relies on actual usage before OMU'S DSM program compared to usage after its implementation this savings is probably more reliable than the electricity savings estimate which relies on load projections.

The graph on page 9 was used to estimate capacity savings. It contrasts actual peak load growth with the historical 7.2% growth rate experienced before the implementation of OMU's DSM programs. It also compares both curves to OMU's capacity which provides a means of estimating the number of years that the need for new capacity was delayed. It should be noted that the capacity savings in the Program Savings Section would be smaller if we assume a projected growth rate without DSM of less than 7.2%.

CUSTOMERS' ANNUAL ELECTRICITY USE (KWH)



Program Savings

Since 1974 when OMU began its DSM program, the utility has reduced both the rate of peak electric demand growth and gas and electric energy bills for its customers. Peak demand growth has been held to less than 3% per year, thus delaying any capacity expansion until after the year 2000. Since 1983 electric rates to Osage customers have been reduced by a nominal 19%, offsetting a 20% rate increase to OMU from Dairyland Power Cooperative. Overall average energy savings for all of OMU's customers are ~25% for both electricity and gas. Conservative calculations indicate that the measures have saved the community over $1 million per year for the last nine years. The overall savings are ~92.4 million kWh saving ~$4.6 million and ~8 million therms of gas saving ~$3.2 million. In addition there is a savings of ~$0.2 million per year from deferring the construction of new generating capacity. Lower utility rates also added to the overall dollar savings. Due to lack of close monitoring and the integrated nature of OMU's DSM efforts, it is impossible to determine the size of the savings from each individual measure of the DSM program. However, it is possible to discuss the savings in three general areas: gas savings, electricity savings, and electricity capacity savings.

Savings Overview Table	All Sectors Electricity Savings (kWh)	Residential Electricity Savings (kWh)
1979	1,580,000	1,200,000
1980	2,280,000	2,000,000
1981	3,900,000	3,000,000
1982	3,740,000	3,200,000
1983	5,390,000	3,400,000
1984	7,980,000	4,000,000
1985	8,330,000	4,400,000
1986	8,940,000	5,000,000
1987	9,120,000	5,200,000
1988	9,350,000	5,200,000
1989	10,420,000	5,600,000
1990	10,900,000	5,600,000
1991	10,500,000	5,600,000
Total	92,430,000	53,400,000

GAS SAVINGS

Since the DSM program began gas savings are estimated at ~8 million therms saving OMU's customers ~$3.2 million. In 1991 OMU's actual total billing for gas sales was $1,306,000. At the average rate of 39.7¢/therm this represents ~3,290,000 therms sold. Mr. Birdsall estimated the total billing without the DSM program would have been ~$1,761,000. This 25% reductions represents a dollar savings of ~$455,000. The corresponding 1991 gas savings is 1,164,000 therms. Savings in the residential sector are even larger averaging about 35% for the last seven years, compared to the gas use in 1974. In addition OMU's customers saved another $76,000 in 1991 from reduced gas rates. The DSM measures that contributed to these significant savings include energy audits, hookup standards, infrared scans of buildings, weatherization, water heater jackets, and the showerhead giveaway.

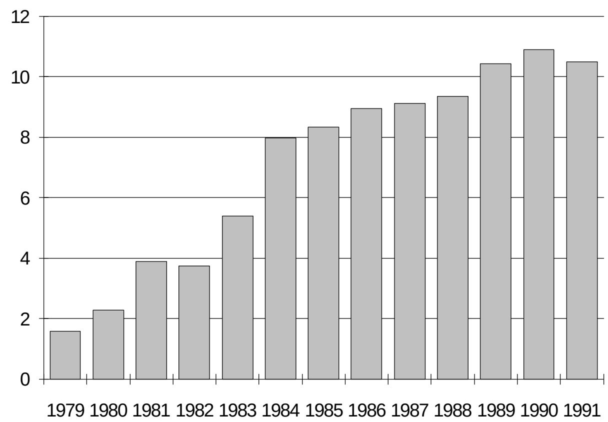
ELECTRIC SAVINGS

The overall electricity savings since the program began is ~92.4 million kWh, saving OMU's customers ~$4.6 million. Actual electricity sales for the most current year, 1991, were $1,690,000. Estimated sales without conservation were $2,210,000 for a savings of $520,000 and an energy savings of ~10.5 million kWh. OMU customers also saved an additional $410,000 in 1991 from reduced rates that were directly related to the DSM program. Measures that contributed to the electric savings include CFL rebates, street light retrofits, lending of electric-use test meters, tree planting, and part of the measures mentioned under gas savings. (For example, the showerhead giveaway saves energy for both gas and electric water heaters.) In addition, both gas and electric savings are due in part to the educational element of the DSM program.

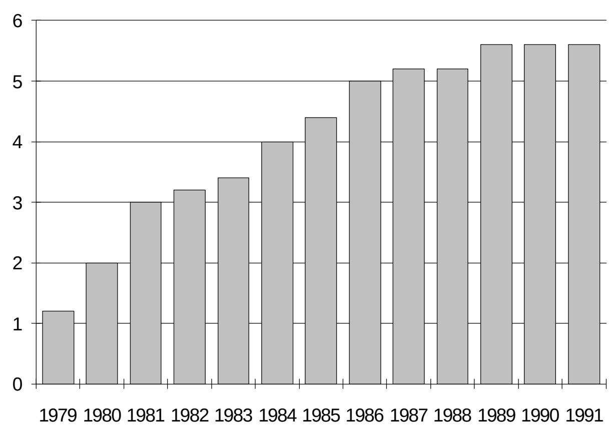
MARGINAL CAPACITY SAVINGS

One of the stated goals was to delay the need for new capacity by slowing the annual growth of peak demand. The OMU DSM programs delayed the construction of 4 MW of capacity for about 12-15 years. At Mr. Birdsall's conservatively

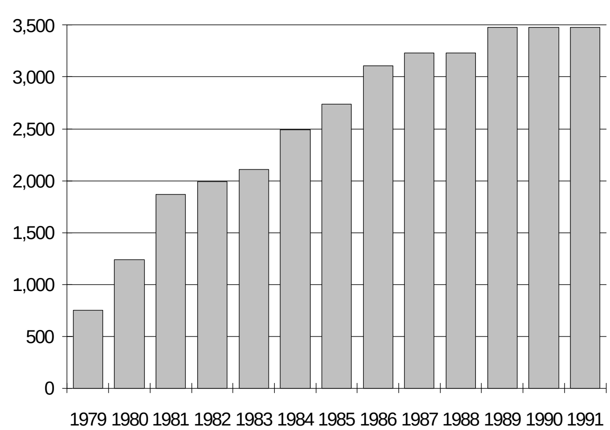
ANNUAL ENERGY SAVINGS (GWH)



CUMULATIVE ENERGY SAVINGS (GWH)



ANNUAL ENERGY SAVINGS PER RESIDENTIAL CUSTOMER (KWH)



estimated cost of $500,000/MW, the new 4 MW plant's projected avoided capital cost is $2,000,000. Assuming this plant is delayed by 15 years the savings to the customers is $133,000 per year. The average interest on $2,000,000, at 7%, is $70,000/year. Adding the two avoided annual expenses yields a total savings of $203,000 per year in avoided capital costs. These savings calculations are dependent on an assumed growth rate (absent of DSM measures) of 7.2%. If a lower growth rate is assumed the time delay for new construction will be less as will savings.

MEASURE LIFETIME

While it is relatively easy to assign lifetimes for specific energy efficiency measures, such as lighting and building insulation, it is far more difficult to assign an average lifetime for all the measures that OMU has supported since 1974. For the sake of electricity cost of saved energy calculations a range of lifetimes is assumed. However, an aggregate average lifetime of 10 years is probably very reasonable. Mr. Birdsall agrees that this is a conservative estimate considering it includes building insulation measures that have lifetimes as long as several decades. One measure whose lifetime is difficult to state is education. It could be assumed that it will last the life of the individual. However, under ideal circumstances this information is passed on, creating a legacy of information about energy efficiency that becomes part of the culture of future generations.

PROJECTED SAVINGS

Savings are projected to continue at least at the current levels. Mr. Birdsall does not expect to see any dramatic increases because of the high saturation rates of current measures. The two areas that might see increased savings are residential appliances and commercial lighting use. Mr. Birdsall expects that appliance savings will be achieved through the Federal Appliance Standards but that OMU may be able to increase savings with some type of commercial lighting retrofit program.

PARTICIPATION

Because of the strong emphasis on educating the public about the benefits of energy efficiency OMU enjoys high participation rates for most of its programs. After 18 years of DSM programs virtually 100% of OMU's customers have participated in at least one and most have participated in several of the programs offered by OMU. Once an individual has had a positive experience with a program (i.e. they have saved energy and money) it is easier to enlist participation in subsequent programs. The table at right shows the participation rates for some selected programs. Information on participation rates is not available for each of OMU's programs.

Program	Participation rate
Water heater jacket	98%
Water efficient showerhead giveaway	71%
Industrial plant audit	100%
Radio controlled switch for A/C	96%
Radio controlled switch for water heaters	75%
Building-interior infrared scans	60%
Interest rebate on efficiency investments	10%

Cost of the Program

Costs Overview Table	Cost	Cost per Customer	Annual Cost per Customer
Gas Efficiency	$91,600	$57.25	$3.18
Electric Efficiency	$118,400	$56.38	$3.13
Load Management	$140,000	$66.67	$5.56
Load Management Grant	$126,500	$0.00	$0.00
Total	$476,500	$180.30	$11.87

The overall cost of OMU's DSM program is estimated at ~$476,500 since 1974 including load management. Of the total $210,000 was for energy efficiency and $266,500 was for load management. (Mr. Birdsall estimated the cost of the combined gas and electric energy efficiency programs at ~$188,000, and then added $22,000 for miscellaneous expenses as a conservatism against underestimating program expenditures.) A rough breakdown of expenditures reveals that of the $210,000 spent on energy efficiency, approximately $118,400 was for electric savings and about $91,600 was for gas savings. The first load management program in 1979 was largely paid for with a $126,500 grant. The money was used to purchase radio signal transmitters and receivers as well as the computer equipment necessary to control the signal. OMU spent another $52,500 of their own money installing the equipment. In 1989 OMU initiated another load management program similar to their 1979 effort. However, unlike the first program OMU did not receive a grant and paid ~$87,500 themselves for its implementation. The table to the right shows the cost breakdown for gas and electric efficiency and load management, as well as the cost per customer for each category.

Cost Effectiveness

The cost of saved energy table assumes a range of average lifetimes for the measures which reveals a cost of saved energy varying between .07 and .21¢/kwh. This falls well below the figure necessary for cost effectiveness because the cost of saved energy is compared to OMU's purchase rate of ~2.8¢/kWh and its average sale rate of 4.99¢/kWh. In addition to direct cost effectiveness is the economic development benefits (see Economic Development Implications Section). The cost effectiveness of the gas savings investment part of the program can be done using a similar analysis. Assuming a program cost of $91,600, an average lifetime of the measures of 10 years, a discount rate of 5%, and savings of 8 million therms, the cost of saved gas is ~1¢/therm. This is also cost effective (even for a range of discount rates) when compared to OMU's average gas rate of 39.7¢/therm. The cost effectiveness of the load management expenditures is harder to determine. However, because new capacity costs (spread over 15 years) are $203,000/yr, even a short construction deferment makes OMU's $266,000 load management investment cost effective.

Cost per Customer

The average cost per customer for the energy efficiency part of the program is calculated to be ~$56 per electric and

Cost of Saved Energy Table (¢/kWh)	Discount Rates						
	3%	4%	5%	6%	7%	8%	9%
5 yrs	0.18	0.19	0.19	0.20	0.20	0.21	0.21
10 yrs	0.10	0.10	0.11	0.11	0.12	0.12	0.13
15 yrs	0.07	0.08	0.08	0.09	0.09	0.10	0.10

~$57 per gas customer. However, most customers use both gas and electricity making the average cost per customer on the order of $113. This cost has been spread over 18 years and amounts to an average yearly expenditure of ~$3.15 per gas or electric customer and ~$6.30 for customers having both services.

The total expenditures to date for load management are $266,500. However, only $140,000 of this amount was an OMU expense while the rest was a grant. Because the load management programs affected only the electricity customers, the cost per customer calculation is $140,000 divided by the utility's 2,100 electric customers yielding $66.67 per customer. The annual cost is ~$5.50 per customer for the 12 years since the program began.

COST COMPONENTS

The following table is a breakdown of the estimates for the energy efficiency part of OMU's DSM program.

FREE RIDERSHIP

Free ridership was a very insignificant issue in Osage because of OMU's general approach of maximizing the amount of information given to its customers and minimizing the rebates and giveaways. By educating its customers, and throwing in the occasional token giveaway (i.e. the showerheads), OMU was able to motivate its customers to make their homes and businesses more energy efficient. OMU deliberately tried to stay away from giving large rebates. Although some were given, they were a small part of the overall program. Instead OMU used their newsletter as well as other educational efforts to help their customers realize the benefits of investing in energy efficiency. The energy-use meter lending program allowed customers to see first hand how much energy particular appliances in their homes were using. Because energy-efficiency investments are so good, once OMU's customers had the facts many of them took the next step of implementation without the need for rebates or incentives.

Cost of Efficiency Measures	Gas	Electric	Combined	% of Total Expenditure
Streetlight Retrofit	$0	$73,500	$73,500	35.0%
Infrared Scans	$37,980	$4,220	$42,200	20.1%
Newsletters & Ads	$13,450	$13,450	$26,900	12.8%
Water Heater Jackets	$13,600	$3,400	$17,000	8.1%
Tree Planting	$6,300	$700	$7,000	3.3%
Showerhead & Aerators	$8,160	$2,040	$10,200	4.9%
CFL Rebates & Giveaways	$0	$10,000	$10,000	4.8%
Draft Stoppers	$1,000	$0	$1,000	0.5%
Miscellaneous	$11,100	$11,100	$22,200	10.6%
Total	$91,590	$118,410	$210,000	100.0%

Environmental Benefit Statement

Marginal Power Plant	Heat Rate BTU/kWh	% Sulfur in Fuel	CO2 (lbs)	SO2 (lbs)	NOx (lbs)	TSP* (lbs)
Coal	**Uncontrolled Emissions**					
A	9,400	2.50%	199,279,000	4,728,000	956,000	96,000
B	10,000	1.20%	212,497,000	1,830,000	617,000	458,000
	Controlled Emissions					
A	9,400	2.50%	199,279,000	473,000	956,000	8,000
B	10,000	1.20%	212,497,000	183,000	617,000	31,000
C	10,000		212,497,000	1,220,000	610,000	31,000
	Atmospheric Fluidized Bed Combustion					
A	10,000	1.10%	212,497,000	559,000	305,000	153,000
B	9,400	2.50%	199,279,000	473,000	382,000	29,000
	Integrated Gasification Combined Cycle					
A	10,000	0.45%	212,497,000	376,000	61,000	153,000
B	9,010		191,145,000	136,000	46,000	9,000
Gas	**Steam**					
A	10,400		115,907,000	0	264,000	0
B	9,224		100,656,000	0	630,000	30,000
	Combined Cycle					
1. Existing	9,000		100,656,000	0	386,000	0
2. NSPS*	9,000		100,656,000	0	183,000	0
3. BACT*	9,000		100,656,000	0	25,000	0
Oil	**Steam--#6 Oil**					
A	9,840	2.00%	167,760,000	2,542,000	300,000	285,000
B	10,400	2.20%	177,928,000	2,521,000	377,000	183,000
C	10,400	1.00%	177,928,000	360,000	303,000	96,000
D	10,400	0.50%	177,928,000	1,057,000	377,000	58,000
	Combustion Turbine					
#2 Diesel	13,600	0.30%	222,664,000	443,000	688,000	38,000
Refuse Derived Fuel						
Conventional	15,000	0.20%	264,350,000	681,000	897,000	199,000

Avoided Emissions Based on 92,430,000 kWh Saved (1979 - 1991)

In addition to the traditional costs and benefits there are several hidden environmental costs of electricity use that are incurred when one considers the whole system of electrical generation from the mine-mouth to the wall outlet. These costs, which to date have been considered externalities, are real and have profound long term effects and are borne by society as a whole. Some of environmental costs are beginning to be factored into utility resource planning and, in NEES's case, are indirectly factored into the shareholder incentives discussed later. Because energy efficiency programs present the opportunity for utilities to avoid environmental damages, environmental considerations can be considered a benefit in addition to the direct dollar savings to customers from reduced electricity use.

The environmental benefits of energy efficiency programs can include avoided pollution of the air, the land, and the water. Because of immediate concerns about urban air quality, acid deposition, and global warming, the first step in calculating the environmental benefit of a particular DSM program focuses on avoided air pollution. Within this domain we have limited our presentation to the emission of carbon dioxide, sulfur dioxide, nitrous oxides, and particulates. (Dollar values for environmental benefits are not presented given the variety of values currently being used in various states.)

HOW TO USE THE TABLE

1. The purpose of the previous page is to allow any user of this profile to apply OMU's level of avoided emissions saved through its DSM Program to a particular situation. Simply move down the left-hand column to your marginal power plant type, and then read across the page to determine the values for avoided emissions that you will accrue should you implement this DSM program. Note that several generic power plants (labelled A, B, C,...) are presented which reflect differences in heat rate and fuel sulfur content.

2. All of the values for avoided emissions presented in both tables includes a 10% credit for DSM savings to reflect the avoided transmission and distribution losses associated with supply-side resources.

3. Various forms of power generation create specific pollutants. Coal-fired generation, for example, creates bottom ash (a solid waste issue) and methane, while garbage-burning plants release toxic airborne emissions including dioxin and furans and solid wastes which contain an array of heavy metals. We recommend that when calculating the environmental benefit for a particular program that credit is taken for the air pollutants listed below, plus air pollutants unique to a form of marginal generation, plus key land and water pollutants for a particular form of marginal power generation.

4. All the values presented represent approximations and were drawn largely from "The Environmental Costs of Electricity" (Ottinger et al, Oceana Publications, 1990). The coefficients used in the formulas that determine the values in the tables presented are drawn from a variety of government and independent sources.

*** Acronyms used in the table**

TSP = Total Suspended Particulates

NSPS = New Source Performance Standards

BACT = Best Available Control Technology

OMU AVOIDED EMISSIONS

The power that OMU buys from Dairyland Electric is coal generated. To supplement this, OMU generates its own power 1-2% of the time. OMU's generating facility usually burns diesel but has the capability of burning natural gas. Because most of the avoided emissions resulting from the electric savings of OMU's DSM program come from coal-fired power plants, for the purposes of this analysis we assume this to be the marginal power plant type. The two largest Dairyland coal generators, which represent about 75% of their total generating capacity, have precipitators for removing suspended particulates but do not have scrubbers for removing SO2 and NOx. The following table therefore, reflects the avoided emissions (based on average emissions from the two coal fired plants) of OMU's DSM program.

OMU Avoided Emissions	Plant Heat Rate (BTU/kWh)	% Sulfur in Fuel	CO2 (lbs)	SO2 (lbs)	NOx (lbs)	TSP *(lbs)
1991	10,000	2.20%	22,638,000	231,000	70,000	3,880
1979 - 1991			199,214,000	2,035,000	619,750	34,220

Avoided emissions based on Dairyland Electric's two largest coal-fired plants.

Lessons Learned / Transferability

The key element to OMU's success with its demand-side management program was education. Most of the DSM effort during the first two years went toward educating customers about the benefits of energy efficiency and assuring them that the utility really wanted to help. This approach gave the people in the community the facts necessary for making intelligent energy decisions and helped the utility earn the trust of the community. The educational component is largely responsible for the remarkable support and commendable results that Osage has enjoyed. Community education continues to be a significant part of the program.

Osage has also effectively taken advantage of its municipal utility status. Unlike investor-owned utilities who are accountable to their shareholders, municipals are free of this outside interest and can focus on providing maximum social benefit. Osage's management has been very clear that its primary financial responsibility is to its customers who are effectively its owners. Therefore, OMU could without reservation, pursue a policy aimed at reducing the bills of its customers without considering the impact of losses in revenues. (DSM programs do not necessarily create a conflict of interest between customers and shareholders with investor-owned utilities, but the considerations associated with DSM are less complicated for a municipally-owned utility.) Naturally OMU's success is not simply a function of being a municipal as much of the success can be attributed to the forward thinking that went into developing a comprehensive program that carefully addressed both technical and social dimensions of DSM.

The most important social dimension was encouraging total community involvement. The educational aspect of the program was the first way of encouraging everyone's involvement. The offer to lend, free of charge, electric use meters allowed people to see for themselves how much electricity each appliance in their home was using. The free infrared scans allowed people to see where the heat loss was in their buildings. Encouraging the involvement of community groups such as the Jaycees, for the weatherization program reinforced a feeling that the community was working together to lower utility bills. The high voluntary participation rates for both the water heater and the A/C radio controlled switches were in part attributed to the excellent community relations OMU has developed over the years plus the involvement of plumbing and heating contractors who recommended the controllers to customers upon installation of air conditioning equipment.

One of the interesting effects of running both load management and energy efficiency programs concurrently was that the impact of later load management programs was lessened by the success of energy efficiency programs. For instance, it was observed that the amount of capacity savings from installing radio controlled switches on air conditioners and water heaters dropped from 1.5 kW for air conditioners and 0.5 kW for water heaters in 1979 to a savings in 1989 of 1.0 kW and 0.25 kW for air conditioners and water heaters respectively. The capacity savings difference was due to the energy efficiency programs and clearly illustrates a strong interconnection that should be taken into account when considering load management programs.

Mr. Birdsall kindly offered his own perspective on lessons learned. He commented that if he were to do it over again, he would probably initiate a DSM effort with a showerhead giveaway because it is a simple, low cost retrofit that provides quickly-recognizable savings and makes it clear that the utility is genuinely interested in its customers. He also stated that it was essential that all employees be well informed about all DSM initiatives. He feels that a utility needs to be invested in the program, and confident about the benefits -- from receptionists to meter readers to linemen right up through top management. In addition, Mr. Birdsall emphasized the need for utilities to be run according to good business practices. In his opinion, it's very easy for a monopoly, such as a utility, to become inefficient.

Finally, this program's success can be directly linked with the strong leadership that Mr. Birdsall has given to Osage. Today this small Iowa town and its utility serve as a model for what can be accomplished when a utility works in concert with the people of the community for the benefit of all concerned.

Economic Development Implications

An unstated objective and indirect effect of OMU's DSM program has been enhanced economic development in the Osage community. Energy efficiency improvements in the industrial, commercial, and residential sectors have all had a positive impact on Osage's economy.

INDUSTRIAL

While the utility did not explicitly intend to encourage industrial expansion this was a direct result of the utility's efforts to reduce energy usage. There have been four sizable plant expansions and one new plant in the Osage area since the early 1980s. One company, Fox River Mills, has added 300 new employees since 1984. Part of the reason they were able to expand was that they were able to reduce energy costs for knitting a dozen socks from 48 cents to 34 cents. This made their product more competitive and increased its demand which resulted in the expansion. While many communities are experiencing high unemployment rates, the Osage unemployment rate has risen to only 3.5%. According to Mr. Birdsall low electric rates and the productivity of the local residents have proven inviting for industries wishing to expand or locate in Osage.

COMMERCIAL

Many of the commercial businesses have become economically more viable by reducing their energy overhead costs. For example, Everett Steele, the owner of the local Super Value supermarket, reduced his heating bills by capturing waste heat from refrigeration compressors. Mr. Steele figures the savings on his heating bill translate into lower food prices by about 5% -- enough, he says, to keep people shopping locally rather than driving to big discount supermarkets in nearby Mason City. One of OMU's energy efficiency incentive programs helped two other businesses reduce their energy use and costs by 66% and 74% respectively.

RESIDENTIAL

Energy efficiency in the residential sector helps the local economy in a least two ways: investments in energy-efficient hardware are usually purchased locally which helps local business, and the money saved in the residential sector can then be spent on other things in the local economy.

Reducing the utility bills for all sectors of the community has two additional economic development implications: first, because of each dollar spent on energy; typically 70¢ to 90¢ leaves the community (in the case of Osage 54¢ per electric and 84¢ per gas dollar leaves) energy expenditures represent a drain on the community's financial resources, and second, money spent on gas and electricity create relatively fewer jobs than money spent in other sectors of the local economy. For example, for each $1 million a utility collects only four or five jobs are created. By contrast $1 million spent on light manufacturing products creates 8-10 jobs, on retail purchases creates 10-15 jobs, and on schools creates about 20 jobs. [R#3]

Mr. Birdsall sees the $1 million plus annual savings from wise energy use as a significant contribution to the local economy. According to Birdsall, "I don't see any difference between a dollar brought in by a new business and a dollar that's saved by energy conservation. And the economic benefits multiply: the state estimates that every dollar spent in town circulates in the local economy at least 2½ times."

References

1. Weston D. Birdsall, General Manager, Osage Municipal Utility, personal communications, 1986 - present.

2. Skip Laitner, Economic Research Associates, Beaverton, Oregon, personal communication, April, 1992.

3. Art Rosenfeld, Lawrence Berkeley Laboratory,personal communication, April 1992.

4. Weston D. Birdsall, "Energy Eficiency - The Osage Experience," Osage Municipal Utilities, Box 207, Osage, Iowa 50461.