United Power Association

Off - Peak Program

Profile #56

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Executive Summary

United Power Association's (UPA) off-peak load management program accounts for the large majority of the utility's DSM expenditures and savings. The off-peak program formally began in 1980, following participation in a Department of Energy electric thermal storage demonstration project. In 1981, a system-wide load control system was put in place covering 95% of UPA's service territory using a VHF (very high frequency) one-way radio system to control participating loads. By controlling customer loads UPA is able to shift demand to off-peak hours, reducing peak demand.

UPA controls this system by generating and transmitting signals to keep the related equipment off during the peak periods. The system is comprised of a master controller, transmitters, and receivers. Depending on the system load and the time of day, the master controller instructs the transmitters when to send the appropriate "off" commands to the receivers controlling participating customers' loads.

Loads eligible to participate in the program include: electric thermal storage space heating, electric thermal storage water heating, dual fuel space heating, interruptible air conditioning, and controlled irrigation. The different eligible loads have different control times assigned to them by UPA. Approximately 98% of the program participants are residential customers.

The off-peak program has flattened out UPA's load shape very effectively. In 1992, UPA's load management programs controlled approximately 14% of winter peak demand and 7% of summer peak demand. Program participation is encouraged through lower electricity rates, equipment rebates, and equipment financing. Through 1992 UPA had achieved cumulative winter peak demand reductions of 92 MW and cumulative summer peak demand reductions of 46 MW. In 1992, 5,853 loads joined the off-peak program. UPA controls a grand total of 56,244 loads, with 17.4% of their customers participating in the program.

In 1992, total off-peak program expenditures were $4,843,100. Of this amount UPA contributed $1,533,740 and UPA's member cooperatives provided $3,309,360. Incentive costs for the year totaled $399,500, advertising costs totaled $55,700, and the remaining expenditures ($4,387,900) went towards administration and implementation. In 1991, UPA spent $1,820,354 on the program and member cooperatives spent $3,426,646, for a program total of $5,247,000.

Off-Peak Program

Utility:	United Power Association
Sector:	Residential
Measures:	ETS space heating, ETS water heating, dual fuel space heating, controlled air conditioning, and controlled irrigation
Mechanism:	Reduced electric rates, rebates, and financing available to participating customers
History:	Started in 1980

1992 Program Data

Energy savings:	44.1 GWh
Peak demand reduction (w):	6 MW
Peak demand reduction (s):	7 MW
Cost:	$4,843,100

Cumulative Data (1980 - 1992)

Energy savings (1991-1992):	68.9 GWh
Peak demand reduction (w):	92 MW
Peak demand reduction (s):	46 MW
Cost (1991-1992):	$10,090,100

Conventions

For the entire 1993 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 U.S. Federal Reserve's foreign exchange rates.

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.

United Power Association (UPA) is a nonprofit generation and transmission electric cooperative headquartered in Elk River, Minnesota that supplies wholesale electric power to 15 member distribution cooperatives which are called "member systems," which in turn serve approximately 245,000 "member-consumers." In addition to the member systems, UPA serves power to eight Minnesota municipal systems.

UPA is a member of the Mid-Continent Area Power Pool (MAPP), a regional power pool consisting of electric utilities with interconnected transmission facilities. Through MAPP, UPA is able to sell excess capacity. In addition, UPA will purchase power from MAPP when it is cheaper to purchase than generate power.[R#1,6]

UPA employs 428 people in Minnesota and North Dakota. There are an additional 792 employees at the 15 member system cooperatives. UPA has a 28,000 square mile service area that covers 34 counties in Minnesota and three in Wisconsin. The utility's service area is sparsely populated and the landscape is dominated by lakes and forests. Heating requirements across the service area range from 8,300 to 10,500 heating degree days.[R#1,6]

UPA owns 2,398 miles of transmission and subtransmission line. UPA's primary baseload generating facilities are two lignite coal-fired power plants located in North Dakota: Stanton Station (177 MW) and Coal Creek Station (475 MW is UPA's 44% share of the jointly-owned facility). UPA also owns one smaller baseload facility, Elk River Station, a 50 MW facility powered with refuse-derived fuel. The remainder of UPA's capacity comes from three combustion turbine peaking stations.[R#1]

Total energy sales in 1991 were 4,598 GWh, with 3,142 GWh sold to members and 1,456 GWh sold to nonmember utilities. Of the 237,542 member consumers served in 1991, 94% (223,289) were classified as residential, farm, or irrigation customers. Energy sales to members increased 6.9% in 1991 and sales to nonmember utilities dropped 10%. The sales increase to members exceeded the 5% average growth rate experienced the previous five years, due primarily to weather differences. The decrease in sales to nonmember utilities was due to less available energy because of increased sales to members. Energy sales revenues totaled $166 million in 1991. The 1991 system peak of 647 MW was up more than 3.5% from the 1990 system peak of 625 MW. UPA's reserve margin for 1991 was 17%; MAPP requires its members to have at least a 15% reserve margin.[R#1]

UPA 1991 STATISTICS

Number of Customers (1992)	245,000
Energy Sales	4,598 GWh
Energy Sales Revenue	$166.42 million
Winter Peak Demand	609 MW
Winter Peak Capacity	779 MW
Summer Peak Demand	647 MW
Summer Peak Capacity	754 MW
Reserve Margin	17 %
Average Electric Rates	4.56 ¢/kWh

UPA focuses on generating and transmitting electricity to the member systems at the lowest possible cost. In November of each year UPA sets member rates for the upcoming year based on forecasted energy and demand requirements. Member rates are designed to produce revenues that, when combined with nonmember revenues, will cover all expenses and yield a relatively small net margin. This margin is allocated among the member systems in proportion to their patronage, measured in terms of member revenues. In 1991, the average member billed rate was reduced to 4.56 ¢/kWh, a slight decrease from the 1990 rate of 4.88 ¢/kWh.[R#1] ■

Utility DSM Overview

DSM Overview	*Annual C&LM Expenditure (x1000)*	*Annual Energy Savings (MWh)*	*Cumulative Winter Peak Demand Savings (MW)*	*Cumulative Summer Peak Demand Savings (MW)*
1991	$5,985	28,146	86	39
1992	$5,758	49,603	92	46
Total	$11,743	77,749		

In terms of conservation and load management (C&LM) activities, UPA has spent the large majority of its time, effort, and money on load management programs, specifically load shifting programs from peak periods. UPA formally began its full scale off-peak activities in 1980. In 1981, a system-wide load control system was put in place covering 95% of UPA's service territory using a VHF (very high frequency) one-way radio system to control participating loads.[R#6]

UPA DSM PROGRAMS

A) LOAD MANAGEMENT
- Electric Thermal Storage Space Heating
- Electric Thermal Storage Water Heating
- Dual Fuel Space Heating
- Interruptible Air Conditioning
- Controlled Irrigation

B) ENERGY CONSERVATION
- Add-On Heat Pump
- Ground Source Heat Pump
- High Pressure Sodium Vapor Security Lighting
- Energy Check
- Home Light
- Planting for the Future
- Refrigerator Harvest

UPA's off-peak program is the primary component of their Integrated Resource Planning (IRP) process through which UPA determined that load management was its least cost means of providing reliable electric service. UPA got its start in load management during the 1978-1980 period when it participated in a Department of Energy (DOE) Electric Thermal Storage (ETS) demonstration project. In 1979, based on first year results of the DOE program, UPA's Board of Directors passed a resolution approving the use of storage space heating and storage water heating as load management strategies. The off-peak program really took off in 1980 when dual fuel space heating and controlled air conditioning were added as load management strategies.[R#1,6]

UPA was also involved with energy conservation activities throughout the 1980s. One program provided free energy audits and encouraged weatherization measures. Another program was a contest for grade school children where participants designed posters expressing ideas for energy conservation. The contest winner and his/her family were sent by UPA to Washington, D.C. In a similar vein UPA created a film featuring the pink panther cartoon character encouraging energy conservation that was shown in elementary schools. The basic idea behind these last two programs was to get kids interested in energy conservation and in turn encourage their parents to become more energy efficient.[R#6]

In 1991, the state of Minnesota mandated that all power suppliers in the state spend at least 1.5% of gross Minnesota revenues on DSM activities. In 1991, UPA and

its member cooperatives far exceeded this requirement and spent $5.9 million, or 4.25% of gross Minnesota revenues, on C&LM programs. A large majority of UPA's C&LM expenditures were designated for load management programs.

UPA saved 28,146 MWh, 86 MW of cumulative winter peak demand, and 39 MW of cumulative summer peak demand as a result of its energy conservation and load management programs in 1991. Load management programs accounted for most of UPA's energy savings and peak demand reduction. These 1991 savings are somewhat low as certain programs did not have energy or demand savings assigned to them.[R#2,6,8]

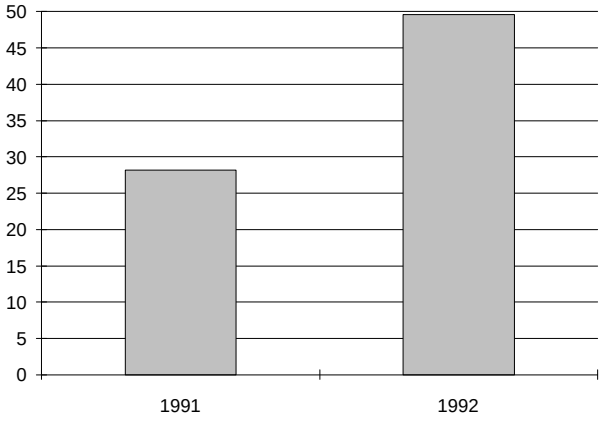
In 1992, UPA and its member cooperatives spent $5.7 million on energy conservation and load management activities. UPA controlled 92 MW of cumulative winter peak demand and 46 MW of summer peak demand, along with 49,603 MWh of energy savings as a result of all C&LM programs.[R#3]

Energy conservation programs for 1992 included the Add-On Heat Pump program, the Ground Source Heat Pump program, the Energy Audit/Weatherization program, In-House Energy Efficiency Improvements, and High Pressure Sodium Vapor Security Lighting. These programs accounted for total annual energy savings of 5,507 MWh.[R#6]

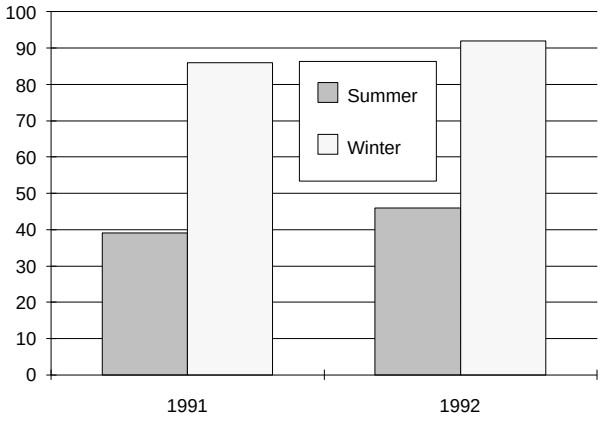
For 1993, UPA offers four new energy conservation programs: Energy Check, Homelight, Refrigerator Harvest, and Planting for the Future. The Energy Check program is an energy audit program covering the residential, commercial, and industrial sectors. The Refrigerator Harvest program seeks to remove CFCs and save energy by collecting outdated, but functioning, refrigerators and window air conditioners. (For profiles of other utilities' appliance turn-in programs see The Results Center Profiles #10 and #24.) The goal of the Planting for the Future program is to teach customers the proper siting of the correct species of trees when planting to reduce summer cooling needs. Homelight is a lighting program still in the final design stages.[R#6] ■

ANNUAL DSM EXPENDITURE ($1,000,000)

ANNUAL ENERGY SAVINGS (GWH)



CUMULATIVE CAPACITY SAVINGS (MW)



Program Overview

The UPA Board of Directors approved four load types which qualify for one of two wholesale off-peak rates. Storage space heating and storage water heating qualify for a wholesale electric thermal storage rate, while dual fuel space heating and controlled air conditioning qualify for a wholesale interruptible rate. The electric thermal storage rate was approved in 1979 and the interruptible rate was approved in 1980. These become "approved" loads when they are used as designed and in accordance with the rules and regulations established by the UPA Board, and when a Load Approval Form is approved by UPA's Energy Management Division. A small number of irrigation systems participate in UPA's off-peak program as well.[R#5,6]

In 1992, UPA's off-peak program had five program components. These programs were as follows: Electric Thermal Storage (ETS) Space Heating, Electric Thermal Storage Water Heating, Dual Fuel Space Heating, Interruptible Air Conditioning, and Controlled Irrigation.[R#3] Approximately 98% of the participants in UPA's load management programs are from the residential sector and the remaining 2% come from the commercial sector.[R#3,6]

The load management programs have done a very effective job of flattening out UPA's load shape. In 1992, UPA's load management programs controlled approximately 14% of winter peak demand and 7% of summer peak demand. Please note the accompanying chart which shows the changes in UPA's load shape from 1980 through 1990 and reflects a flattening out of the load profile while overall demand has risen over the years.[R#3,6]

UPA's load management programs use a variety of incentives to encourage participation. Program participants are charged lower electricity rates and certain load management technologies receive rebates to help cover their initial costs. In addition, financing for the total costs of certain load management equipment is available to customers. Member cooperatives are billed a lower energy charge and are not billed demand charges for customers participating in the program.[R#6]

HOW DOES THE LOAD MANAGEMENT SYSTEM WORK?

The VHF radio load management control system is provided and controlled by UPA. It generates and transmits signals to keep the controlled equipment off during the peak times. The system is comprised of a master controller, transmitters, and receivers. The master controller is located in UPA's Energy Control Center and monitors UPA's system load through a SCADA (supervisory control and data acquisition) system. Depending on the load and time of day, the master controller will instruct the transmitters when to send the appropriate "off" commands. The off command is sent every five minutes during the control periods to refresh the fifteen minute off timer in the receivers.[R#5]

The master controller sends its signals to a network of 31, 300-watt transmitters. Each of these has a 20-mile plus transmitting radius. In 1992, this system of transmitters covered roughly 95% of UPA's service area. These transmitters provide one-way communications with the load management receivers. Each transmitter operates independently and broadcasts a specific group of discrete cooperative codes which gives each member system control without affecting other UPA coops.[R#5]

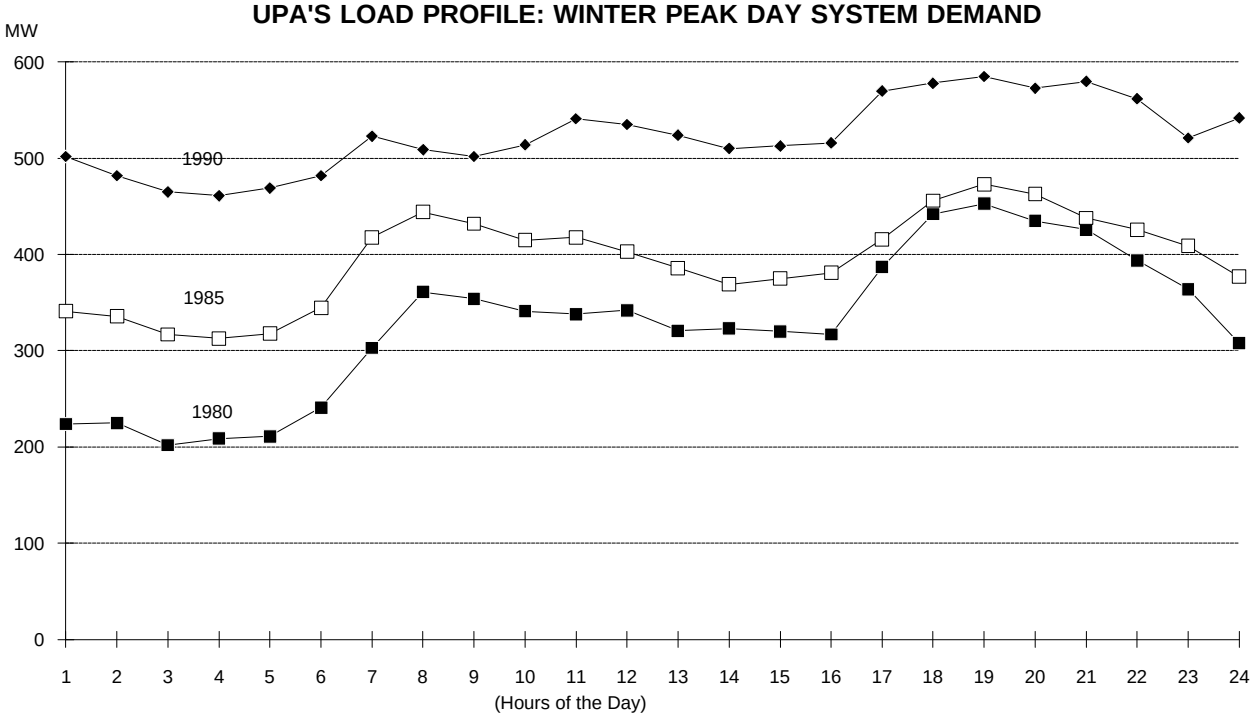
UPA provides receivers to their member cooperatives for use on all approved loads. Receivers currently in use were purchased from three different manufacturers: Motorola, Scientific-Atlanta, and RELM. All of these receivers operate in a similar fashion using several built-in

functions. Function 1 controls space conditioning including storage space heating, dual fuel space heating and/or air conditioning. Function 2 controls storage water heating and swimming pool heaters only. Function 3 controls storage space heating only. Irrigation codes broadcast both Function 1 and Function 2 during control times. Typically receivers cost less than $80.[R#5]

Receivers have normally closed contacts that are held open during control times. When the signal is received the contacts open to turn off the controlled load and keep it off for approximately 15 minutes after the transmitter signal stops. Receivers at the transmitter sites acknowledge all codes and this information is transmitted back to UPA, so that UPA knows which codes are sent by each transmitter. Because these transmitters are not two-way, UPA does not know absolutely if the loads are turned off. UPA believes that if it had waited until cost effective two-way technologies were available, its load management program would still be in the planning stages.[R#5,6]

Receivers that fail to perform in the field are repaired by UPA. Because UPA owns all receivers it covers all repair costs. UPA has also performed biannual receiver audits on selected receivers. Audits are performed with the goal of determining the long term reliability of the load control system. UPA seeks to test a wide cross-section of all receiver types.[R#5] ■

UPA'S LOAD PROFILE: WINTER PEAK DAY SYSTEM DEMAND



MARKETING

In 1992, UPA did not actively advertise its off-peak programs to customers. That responsibility was left to the member cooperatives. Member cooperatives are motivated to promote the program due to reduced wholesale power bills and the customer satisfaction that results. Upon request UPA will provide space and water heating brochures to trade allies such as equipment vendors, architects, and contractors.

For cooperatives that do elect to advertise, UPA provides funding up to an allocation limit based on each member coop's share of customers compared to the total number of UPA customers. UPA provides 100% funding (up to the member coop's allocation limit) for approved TV, radio, newspaper, yellow pages, and trade journal advertising. UPA also pays 100% of the costs (again up to the coop's allocation limit) for ads done in cooperation with trade allies. UPA also makes contractor incentives available to member cooperatives to encourage installation of approved loads. Overall, UPA has found that word of mouth advertising is the best program promotion.[R#6,7]

DELIVERY

IMPLEMENTATION OF UPA'S OFF-PEAK PROGRAMS 1992

Electric thermal storage space heating systems store electricity produced during off-peak hours in the form of heat for use in heating homes and businesses during on-peak hours. This type of system effectively removes whole-house electric heating demand from the utility peak. ETS space heating equipment that can operate effectively on an eight-hour daily charge qualifies for a special ETS rate averaging 2.9 ¢/kWh, compared to the average retail rate of 7.9 ¢/kWh. UPA controls ETS space heating equipment every day of the year for 16 hours (loads are controlled in the summer for three coops located along Lake Superior). Peak diversified demand reduction per installation is typically 7 kW compared to conventional electric heating. As ETS equipment costs approximately three times conventional equipment, rebates are offered to help participants pay up-front costs.[R#3,6]

Similarly, **ETS water heating systems** store electricity produced during off-peak hours in the form of heat for use in providing domestic hot water needs during on-peak hours. Typically, installations consist of either one 120 gallon tank or a dual tank system, with a combination of 52 and 80 gallon tanks standard for larger facilities. Heat is stored in the water and the tanks are usually insulated to R-20. These systems basically remove water heating demand from the utility peak. Equipment operating effectively on an eight-hour daily charge qualifies for the same off-peak rate averaging 2.9 ¢/kWh. UPA controls ETS water heating systems every day of the year for 16 hours. Because equipment capacity must be increased to provide adequate hot water, rebates are offered to make costs comparable to conventional systems. Peak diversified demand reduction per installation averages 0.9 kW for the winter and 0.8 kW for the summer compared to conventional heating.[R#3]

Dual fuel space heating systems incorporate an electric primary system and a fossil-fired secondary system sized to heat the customer's particular structure. During times of peak electrical demand or system emergencies, electric heat is interrupted and the fossil-fired system takes over. To date, the longest continuous interruption has been 19 hours, and the heating season interruption for 1992 was 60 hours system-wide. Dual heating systems qualify for an interruptible rate averaging 3.4 ¢/kWh. Because equipment costs only slightly more than conventional fossil-fired systems, UPA does not offer rebates. Many UPA customers already have dual fuel systems installed (wood/electric) so the only additional cost to participate in the program is the control equipment cost. All consumer classes are eligible for this program.[R#3,6]

With the **interruptible air conditioning program**, central air conditioners are cycled off 15 out of every 25

minutes during peak summer days. This control strategy ensures temperature increases of a tolerable level and yields utility benefits of 1.2 kW per cycled AC at 95°F. Participants get an interruptible rate averaging 3.4 ¢/kWh. Since customers do not need any additional equipment beyond control equipment for this feature of the program, UPA does not offer rebates or equipment incentives. In 1992, UPA interrupted controlled air conditioners a total of 63 hours.[R#3,6]

Through the **controlled irrigation program**, six member distribution systems have consumers whose irrigation systems are interrupted up to five hours daily during peak summer days. Participants get a time-of-use rate established by their member distribution system. In 1992, UPA interrupted irrigation systems a total of 46 hours.[R#3,6]

PARTICIPATION PROCESS

To participate in the UPA off-peak program, interested customers must sign an off-peak agreement provided by a member services employee at their district cooperative. The customer is given a list of approved contractors that perform the load management installations. Once the load management measures are installed, a member services employee inspects the measures and sets the meter. After the load is inspected and approved an approval report is sent to UPA. At this point the member cooperative pays the customer a rebate for eligible loads. For customers joining the program, the entire participation process (from initial inquiry to equipment installation and inspection) can take anywhere from one week to two months.[R#6]

OTHER UPA SERVICES

Equipment Services: UPA bulk purchases storage space heating equipment, as well as repair parts, which member cooperatives can purchase from UPA at cost. UPA will also order water heaters upon request and arrange for free delivery to member coops for orders of at least 40 units. UPA provides a limited ten-year warranty on parts and labor for all approved space heating equipment purchased. For cooperatives not wishing to participate in the ten-year warranty program, UPA offers a three year parts and labor warranty. UPA also offers a five year parts and labor warranty for all new ETS water heating systems installed.[R#6,7]

Each cooperative decides which of the above warranty options it will make available to its customers. UPA offers a one year satisfaction guarantee to customers participating in the ETS space heating portion of the load management program. If, after one year, the customer is not satisfied with their equipment, UPA will refund the original purchase price of the equipment and pay all reasonable costs associated with its removal.[R#7]

Equipment Financing: UPA encourages equipment financing on the part of member cooperatives, although such financing is voluntary.

To participating member cooperatives, UPA offers no money down, 6% financing for establishing a seven year installment loan program to coop customers purchasing and installing approved ETS space heating equipment in new or retrofit applications. If ETS water heating is being installed at the same time these expenses can be included in the loan (maximum $7,500).[R#7]

For customers wanting to purchase and install an approved dual fuel space heating system, UPA provides no money down and 6% financing to the member cooperatives for three year loans (maximum $2,000). Customers installing ETS water heating at the same time can include these costs as part of the loan. UPA will not finance ETS water heating systems as stand alone installations.[R#7]

UPA estimates that less than 25% of its load management customers use UPA or member cooperative financing. Member cooperatives make the decision as to what financing options will be available to their customers. Some cooperatives use UPA funds, some use their own general funds, and some use REA financing.[R#6] ☞

Incentives: UPA also encourages member cooperatives to offer contractor incentives and customer equipment rebates, although cooperatives are not required to do so. All of UPA's member cooperatives do offer rebates, but the amounts vary by cooperative. UPA makes available an allocation fund from which each cooperative can draw. Member cooperatives choosing to offer incentives receive funding from UPA based on the average of the previous two years' incentive needs. Each cooperative is encouraged to provide any additional incentives it considers necessary to maintain program growth. The actual incentive amounts are determined by the individual member cooperatives. Some of the incentives are a set dollar amount for measures installed while other incentives are based on a $/kW scale. The incentives based on the $/kW scale range from $10/kW to $100/kW. The one time payment incentives range from $45 to $500. The large majority of incentives are offered for ETS space heating systems and ETS water heating systems.

Training: Every other year UPA offers a 3-day all expenses paid off-peak contractor workshop and during years that the workshop is not offered, UPA provides local contractor training upon request. UPA will also perform on-site equipment training, provide seminars on load management activities to builders, developers, and real estate brokers, and consult with architects and engineers as requested.

MEASURES INSTALLED

There are four general load types approved for UPA's program: electric thermal storage space heating, electric thermal storage water heating, dual fuel space heating, and controlled air conditioning. There are several types of heating systems eligible under the storage space heating category, including central storage, room storage, slab storage heating, combination storage/general service resistance, warm room concept, and water storage space heating. All of these systems can be installed in new and retrofit situations except for slab storage heating.

Customers wanting to qualify a storage water heating system have the following installation options: a single 120 gallon electric water heater, two 52 gallon electric water heaters plumbed in series, or for larger users, a combination of 52, 66, and/or 80 gallon electric water heaters. Dairy barn storage water heaters are also eligible. Dairybarn ETS water heaters are large capacity heaters (up to two 120 gallon tanks) which operate at elevated temperatures (165°F and above). With dual fuel heating, conventional electric is the primary heating system and oil, gas, LP, or ETS is the secondary or backup system. Other acceptable loads include off-peak pool heating and interruptible irrigation.

STAFFING REQUIREMENTS

The load management program at UPA is administered by energy management division manager Vance Zehringer who devotes 1/4 of his time to the program. In addition, UPA has roughly 3.5 full-time equivalents (FTEs) devoted to the program, including a heat pump specialist (who specializes in central ceramic ETS furnaces), a load management specialist, a customer service representative, a conservation specialist, and a marketing specialist. The member cooperatives have approximately 50 member services personnel that work on the load management program, equivalent to 16 FTEs. Finally, there are about 100 contractors that work in some capacity with the load management program.[R#6] ■

MONITORING

A master controller, located in UPA's Energy Control Center, monitors UPA's system load through the existing SCADA system. This system monitors gross system effects, not individual loads.

UPA monitors every installation and tracks capacity savings by having all approved loads metered. However, due to the one way control system, UPA cannot be positive that each load is in fact controlled at a given time. Such verification could only be achieved through a two way system or dispatching a utility employee to the given site.

EVALUATION

In 1991 and 1992, UPA was required by the state of Minnesota's Department of Public Service to present an annual report on all energy conservation and load management programs. These annual reports contain brief program descriptions, program expenditures, program participation statistics, and program savings. Before 1991 UPA did not track C&LM expenditures for its member cooperatives. For service areas outside of Minnesota, the individual coop is responsible for reporting its own C&LM expenditures.[R#2,3]

In addition, UPA publishes a monthly newsletter ("C.A.L.M. News, the Conservation, Alternative Energy and Load Management Newsletter") which provides updates of the total number of loads controlled, along with totals for each load type and a breakout by member cooperatives of the number of each load type controlled.

UPA also produces an annual "Load Management in Review" report that covers the hours of load control exercised, the number of controlled loads, along with load shape graphs.[R#4]

In 1991, Wulfinghoff Energy Services performed a process evaluation of UPA's off-peak programs. This evaluation also contained recommendations for implementing approximately a dozen energy conservation programs.

UPA attributes very high energy savings to its load management programs. These savings are calculated as follows:

UPA assigns energy savings to its ETS water heating program based on a study done in the early 1980s on 65 homes whose water heating was controlled by UPA. UPA found that these customers used on average 6% less water and energy than customers whose water heating was not controlled. Based on the results of this study, UPA takes 6% of typical annual usage (5,400 kWh per system times 0.06 = 324 kWh) to calculate annual energy savings for the ETS water heating program.[R#6]

UPA assigns some energy savings to its Interruptible Air Conditioning program by taking 5% of the average annual usage per unit (1,200 kWh times 0.05 = 60 kWh).[R#6]

UPA does not technically consider its dual fuel space heating program an "energy saving" program, but instead considers it an electric conserving one. UPA calculates the hours that the fossil backup systems are used for all the dual fuel systems and counts this as electric energy conservation, as is encouraged by the State Department of Public Service.[R#6] ■

Program Savings

Savings Overview Table	*Annual Energy Savings (MWh)*	*Annual Incremental Winter Peak Demand Reduction (MW)*	*Cumulative Winter Peak Demand Reduction (MW)*	*Annual Incremental Summer Peak Demand Reduction (MW)*	*Cumulative Summer Peak Demand Reduction (MW)*
1985	N/A	N/A	42	N/A	17
1986	N/A	2	44	3	20
1987	N/A	12	56	3	23
1988	N/A	9	65	2	25
1989	N/A	12	77	10	35
1990	N/A	2	79	3	38
1991	24,788	7	86	1	39
1992	44,096	6	92	7	46

Participation Table (Controlled Loads)	*ETS Space Heating*	*ETS Water Heating*	*Dual Fuel Space Heating*	*Interruptible Air Conditioning*	*Controlled Irrigation*	*Total Number of Loads*
1980	9	10	124	0	0	143
1981	9	10	125	0	0	144
1982	84	947	765	41	0	1,837
1983	100	1,214	1,058	120	50	2,542
1984	147	1,843	1,751	272	47	4,060
1985	256	2,285	1,798	285	6	4,630
1986	353	2,036	1,602	237	12	4,240
1987	533	2,126	1,412	386	98	4,555
1988	565	1,965	1,504	3,204	18	7,256
1989	571	2,601	1,209	2,391	24	6,796
1990	844	2,448	1,005	2,302	24	6,623
1991	1,015	2,043	863	3,618	26	7,565
1992	621	1,549	548	3,123	12	5,853
Total	5,107	21,077	13,764	15,979	317	56,244

Data Alert: Although UPA has implemented load management programs since 1980, confirmed annual demand reduction figures are only available beginning in 1985.

Please note that annual incremental demand reduction is as much a reflection of weather conditions as it is an indication of the number of controlled loads added.[R#6]

Energy savings attributed to dual fuel systems make up 70% of all off-peak energy savings for 1991 and 77% of 1992 savings (see the preceding evaluation section for an explanation of how these savings are calculated).[R#6]

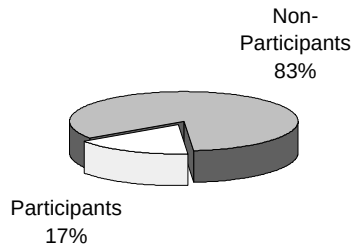
For 1992, UPA's off-peak programs achieved cumulative winter peak demand reduction of 92 MW, cumulative summer peak demand reduction of 46 MW and achieved annual energy savings of 44,096 MWh. In 1992, UPA added 5,853 new loads to its load management program that accounted for 6 MW of annual winter peak demand reductions and 7 MW of annual summer peak capacity reductions.[R#3,6]

In 1992, cumulative seasonal peak demand reductions were divided in the following way: ETS space heating accounted for 36 MW of winter peak demand reduction, ETS water heating accounted for 19 MW of winter peak demand reduction and 16 MW of summer peak demand reduction, dual fuel space heating accounted for 37 MW of winter peak demand reduction, interruptible air conditioning loads had 15 MW of summer peak demand reduction, and controlled irrigation loads had 15 MW of summer peak demand reduction.[R#6]

In addition to peak demand reduction, program participants see large electric bill savings because off-peak kWh sales receive a discounted rate that is less than half the standard electric rate. UPA's coops are billed a monthly demand charge coincident with the UPA system peak. They are not billed for those loads that are off when the monthly billing peak is established.[R#6]

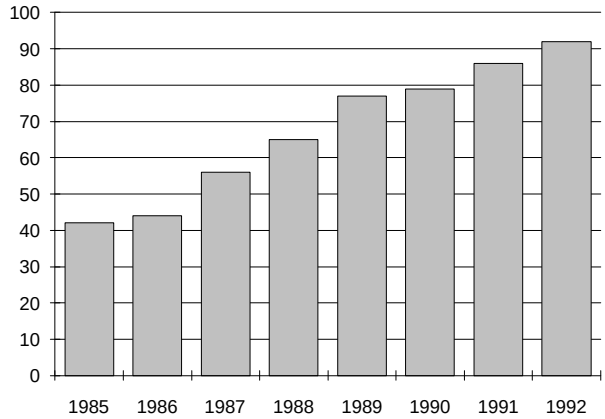
PARTICIPATION RATES

In 1992, 621 ETS Space Heating systems were added to the program. A total of 5,107 systems have participated in the program since it began in 1980. ETS Water Heating systems added to the program totaled 1,549, with 21,077 installed since 1980. In the same year 548 Dual Fuel Space

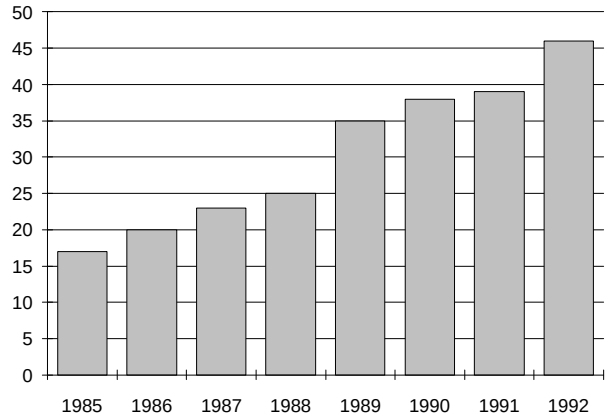


Heating systems were added to the program, bringing the total to 13,764 since the program began in 1980. With the Interruptible Air Conditioning program 3,123 cycled air conditioners were added to the program for a total of 15,979 since 1982. The Controlled Irrigation program added 12 irrigation systems in 1992 for a total of 317 since 1983. Thus, UPA's load management program added 5,853 controlled loads in 1992, bringing the grand total of UPA controlled loads to 56,244. A total of 17.4% of UPA's customers participate in the off-peak program with one or more controlled loads in their homes or businesses.[R#3,6] ■

CUMULATIVE WINTER PEAK DEMAND REDUCTION (MW)



CUMULATIVE SUMMER PEAK DEMAND REDUCTION (MW)



Cost of the Program

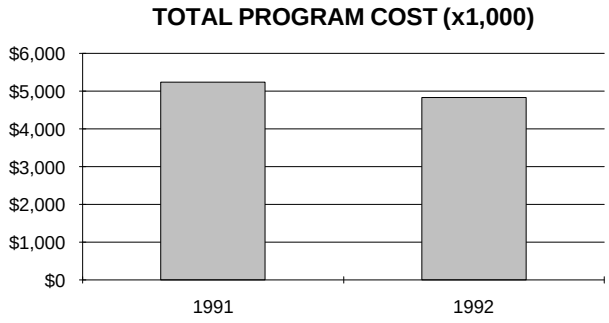
Costs Overview Table	*Rebates Paid (x1000)*	*Advertising (x1000)*	*Administration and Implementation (x1000)*	*Total Program Cost (x1000)*
1991	$474.2	$150.5	$4,622.3	$5,247.0
1992	$399.5	$55.7	$4,387.9	$4,843.1
Total	$873.7	$206.2	$9,010.2	$10,090.1

Data Alert: Although UPA's off-peak program began in 1980, UPA did not track costs incurred by the member cooperatives until 1991. Therefore, total program costs are not available prior to 1991. Please note that program costs include all indirect and direct costs.[R#6]

In 1991 and 1992, UPA and its member cooperatives spent a total of $10,090,100 on off-peak programs. Of this amount UPA spent $3,354,094, while the member cooperatives spent $6,736,006. In 1992, total expenditures were $4,843,100 with $1,533,740 coming from UPA and $3,309,360 coming from member cooperatives.[R#3,6,8]

COST EFFECTIVENESS

UPA evaluates the cost effectiveness of its off-peak programs based on the degree to which program goals have been achieved. UPA hopes to achieve 100 MW of controlled load by 1995, and achieve an annual load factor of 65%. UPA also seeks to increase off-peak kWh sales and provide competitive rates to customers without negatively impacting non-participants. To date, UPA can control 92 MW of its peak winter load and has achieved an annual load factor of 64.6%, up from 55% at program inception. Off-peak sales were 9.9% of total kWh sales to the member cooperatives in 1992.[R#6]



In terms of $/cumulative peak kW, UPA and the member cooperatives have spent $279/kW (unlevelized) over the course of the program. This figure is based on total unlevelized program costs ($25,700,000) divided by 92,000 kW of cumulative winter peak demand savings.[R#6]

According to UPA, some of the managed loads do not defer capacity additions. Those loads that would have been non-electric were it not for the program do not contribute to the peak, but neither can they be used in determining program capacity benefits. They do, however, enhance the bottom line by improving load factor and by increasing kWh sales. These revenue increasing loads are projected to generate $32 million in gross revenues by 1995.[R#6]

The utility asserts that if capacity had been required to serve the peak-reducing managed loads, it most likely would have been with combustion turbines. UPA projects it would have installed three 25 MW oil-fired combustion turbines before 1995 without the program. The total annual fixed and operating costs for these units would total almost $25 million through 1994. The off-peak program has allowed UPA to avoid these costs.[R#6]

Savings due to load factor are more difficult for UPA to quantify. If the goal of 65% is attained by 1995, the best estimate of savings since program inception is $1 million due to the improved heat rate attained in operating the utility's baseload generating stations.[R#6]

COST PER PARTICIPANT

In terms of customer costs, typical installed costs for the various off-peak measures include: $5,200 for whole-house ETS space heating, $450 for ETS water heating retrofits, $650 for new ETS water heating systems, $850 for dual fuel space heating retrofits, and $150 for cycled air conditioning systems.[R#6]

COST COMPONENTS

In 1992, UPA spent $399,500 on incentives. For 1992 UPA set a limit of $450,000 that it would pay out in incentives to its member cooperatives. Prior to 1992 UPA did not place a ceiling on incentive payments. UPA gave $55,700 to member cooperatives for advertising in 1992. UPA and member cooperatives spent $4,387,900 on administration and implementation.[R#6,7] ■

LESSONS LEARNED

With 56,244 controlled loads out of a 245,000 person customer base, it is clear that UPA's off-peak program has achieved a high level of market penetration.

UPA is very satisfied with the program design and as a result few changes have been made to the program since its inception.[R#6]

UPA firmly believes that it made the right decision in emphasizing off-peak (load shifting) rather than the conventional peak shaving approach. The valley filling benefits of ETS space heating and ETS water heating have been instrumental in improving load factor without creating secondary (restoration) peaks. Dual fuel space heating likewise eliminates problems associated with restoration peaks if the backup is automatic and controlled by a common thermostat.

One key lesson learned is wood-backed dual fuel systems should not be allowed in the program. They are usually not whole-house and/or they are not fired-up unless the interruption time is significant. They create a restoration peak in the magnitude of 50% to 80% higher than the load interrupted.[R#6]

The utility also believes they made the right decision by sticking with direct load control and separate metering instead of time of use metering. UPA does not want the effectiveness of the program to be influenced in any manner by participating customers. With time of use programs, UPA believes that customers do not always resist temptation. For example, on a hot summer day a customer participating in a time of use program might ignore their prescribed air conditioning schedule and turn up their air conditioning. With UPA's load management programs, customers do not have the option of manipulating the use of load controlled measures.[R#6]

Perhaps the biggest measure of program success from UPA's point of view comes from the public relations side. The lower electric rate encourages program participants to lobby for retaining service area boundaries rather than protesting for municipalization. Loss of service territory, especially in more densely populated areas, would equate to many millions of dollars in lost revenues.[R#6]

TRANSFERABILITY

UPA admits it has been a challenge designing and implementing a load management program that fits the needs of both the wholesale power supplier and 15 individual distribution systems. Investor-owned and municipal utilities might have an easier time implementing a similar program because of their integrated structure. They would be able to introduce a single rate structure, single rebates and warranties, and a common financing package. With UPA's program, each of the 15 member cooperatives (with certain UPA restrictions) selects how they are going to set up the program incentives, the warranties, and the financing for their customers. UPA and the member systems believe solidly in their approach and have been very pleased with program results.[R#6]

A large scale residential load management program similar to UPA's is clearly transferable to other utilities. Florida Power Corporation (see The Results Center Profile #54) has had incredible participation numbers with their residential load management program. Similarly, Buckeye Power's Residential Load Control program has been a marked success, using some similar and some quite different mechanisms to control a large number of loads and thus effectively flatten its load profile. (See Profile #58) ■

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