
Midwest Resources

Rock Valley Energy Efficiency

Research Project

Profile #43

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Executive Summary

The Rock Valley Energy Efficiency Research Project (RVEERP) sponsored by Midwest Resources is a comprehensive DSM program designed to demonstrate the potential of a community-based approach to influence the energy consumption of an entire community. The program addresses technological, financial, social, regulatory, energy-efficiency, and research goals.

RVEERP is being implemented in Rock Valley, a town with a population of about 3,000 located in northwest Iowa. All of the town's residents, businesses, and industries are eligible to take advantage of the program's offerings regardless of whether their primary heating fuel is electricity or gas. Implementation of RVEERP was done in three basic steps. First, customers were invited to schedule an Energy Study and the study was performed and results explained to the customer. Second, customers could participate in any of four financial incentive programs: rebates, no-interest loans, appliance trade-in, or maintenance coupons. Third, Energy Study participants were offered the opportunity to have free blower door tests performed.

The centerpiece of RVEERP's monitoring plan is the installation of Metricom two-way communicating meters at every electric and gas meter in the town of Rock Valley. The meters are capable of transmitting electricity and gas use data and can provide information for load research, distribution automation, direct load control, rate experiments, and customer feedback.

RVEERP's annual savings have been estimated in several ways. First, staff determined the potential savings that could be realized in Rock Valley if 100% of the population installed 100% of the measures recommended in the Energy Studies. Because so much of the energy savings in Rock Valley are through natural gas, RVEERP converted the electricity and gas savings to Btus, finding total potential savings of 64,411 MMBtus, equivalent to 27% over the base year. Second, a survey of 612 residential participants revealed that 39% of the energy-efficiency measures that had been recommended in the Energy Study either had been implemented or the customers had concrete plans to implement them. Based on an analysis of 742 residential customers, 65 small commercial and industrial customers, and 60 large C/I customers, the estimated annual energy savings per participant is 341 kWh per residential customer, 2,215 kWh per small C/I customer, and 8,367 kWh per large C/I customer.

Almost \$4.4 million has been spent on RVEERP since the project was initiated in 1990. Using a methodology that takes into account both electricity and gas savings, the cost of saved energy of RVEERP based on all expenditures through December 31, 1992, ranges from 4.59 ¢/kWh to 8.14 ¢/kWh, depending on the discount rate used.

Rock Valley Energy Efficiency Research Project

Utility:	Midwest Resources
Sector:	Residential, Commercial, Industrial
Measures:	Appliances, heating and cooling equipment, building envelope, water heating efficiency, lighting, and other measures identified through Energy Studies.
Mechanism:	Community-based DSM program offering Energy Studies, cash rebates, no-interest loans, appliance turn-in, heating/cooling system maintenance coupons, and other special promotions.
History:	Planning began in 1989; program started in 1990 and implemented through 1992; evaluation to continue through 1993.

Program Data

Electricity savings:	898 MWh
Lifecycle electricity savings:	22.5 GWh
Natural gas savings:	155,889 therms
Total utility cost:	\$4,369,800
Energy study participation rate:	91%
Cash rebates participation:	54%
Overall average uptake:	39%

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 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.

Selecting the Site : Rock Valley, Iowa

The Rock Valley Energy Efficiency Research Project (RVEERP) is sponsored by Midwest Power and Midwest Gas, two divisions of Midwest Power Systems, Inc., which in turn is held by Midwest Resources. This corporation is the product of a merger between Iowa Public Service (IPS) and Iowa Power in late July of 1992. Midwest Power Systems serves more customers than any other investor-owned utility in Iowa.

This profile does not contain Utility Overview or DSM Overview sections. The Rock Valley Energy Efficiency Research Project was initiated by IPS prior to the 1992 merger that formed Midwest Resources. The project is a pilot program carried out to test and develop effective DSM strategies and financial incentives.

IPS's Integrated Resource Utility Planning Task Force selected the site and made plans for the project. The Task Force considered several criteria in choosing the town of Rock Valley as the location for what became the Energy Efficiency Research Project. Of primary importance was the criteria that the town had to have a representative mix of customers served by Midwest Gas and by IPS Electric. In February 1990, IPS Electric had 1,009 residential customers, 182 commercial customers, 10 industrial customers, and 23 institutional customers in Rock Valley. Midwest Gas had 844 residential customers, 135 commercial customers, and 8 industrial customers. [R#3]

The task force considered all towns with populations between 2,000 and 10,000. The 1990 census revealed a population in Rock Valley of 2,750. Additional considerations included the proximity of the town to the utility's corporate offices, which at the time were located in Sioux City, about 60 miles due south of Rock Valley. (Midwest Resources, which acquired IPS Electric and Midwest Gas as part of a merger described earlier, has headquarters in Des Moines.) The IRUP Task Force also considered the town's attitude toward IPS Electric and Midwest Gas, and the mix of customer types.

Rock Valley has a large agricultural community and several light industries, including machining and fabrication. The town has two private schools and one public school system, two banks, a main street commercial retail core, a hospital and a nursing home. A large work training organization, which includes a handicapped housing program, is one of the unique resources available to the residents of Rock Valley.

Two baseline studies were conducted in Rock Valley and seven other communities in Iowa prior to the beginning of RVEERP. The residential baseline study was based on surveys of 500 residential customers in Rock Valley and 500 residential customers in the other seven towns. The commercial and industrial baseline study presents the results of a survey of 173 non-residential accounts in Rock Valley whose annual electricity consumption in 1989 was more than 1,000 kWh. The comparison survey included 299 non-residential accounts in the seven communities. The overall response rate for the residential survey (with 979 valid accounts), was 87%. The response rate for non-residential Rock Valley customers surveyed, after some accounts were determined to be invalid, was 82%. [R#15,16]

The demographic characteristics of Rock Valley were determined based on the responses to the survey. For the residential sector, 86% of the Rock Valley respondents occupied single family homes, and 86% owned the homes. The mean size was 1,420 square feet, and the mean age of the homes was 23.9 years. An average of 2.5 people of mean age 55 years occupied each residence, with the mean duration of occupancy of 13.3 years. Forty-seven percent of the respondents in Rock Valley were employed on a full-time basis, and 42% were two-income families. The mean income was \$26,437. [R#15]

Seventy-nine percent of the residential respondents in Rock Valley relied primarily on natural gas for heating fuel, with 80% using forced hot air systems. The mean age of heating equipment was 14.0 years. A total of 35% also used some type of supplemental heat, such as space heaters, electric baseboards, or wood stoves. Additionally, 93% of the respondents in Rock Valley reported that they had air conditioners. Average annual electricity use for the respondent group in 1989 was 9,105 kWh and average natural gas use was 1,015 ccf, (101 million Btu's).

Most respondents in the non-residential sector in Rock Valley were either from non-food retail establishments (20%) or offices (19%). Eighty-eight percent occupied one building, and the mean age of the buildings was 22 years. Mean size was 8,214 square feet, and average duration of occupancy was 13 years. Seventy-six percent of the respondents owned their place of business. Mean annual electricity consumption in 1989 for the non-residential Rock Valley respondents was 64,085 kWh; mean annual natural gas consumption was 4,722 therms, (472 million Btu's). [R#16]

Program Overview

The Rock Valley Energy Efficiency Research Project (RVEERP) was designed as a five-year comprehensive DSM program to demonstrate the potential of a community-based approach to influence the energy consumption of an entire community. RVEERP is being implemented in Rock Valley, a town with a population of about 3,000 located in northwest Iowa. All of the town's residents, businesses, and industries are eligible to take advantage of the program's offerings regardless of whether their primary heating fuel is electricity or gas.

The program focus has been to introduce all members of the community to DSM through a concentrated educational effort. Energy Studies (energy audits), an energy center and other promotional efforts provided information to customers regarding energy efficiency concepts and how customers can utilize program services to improve energy efficiency in their homes, businesses and industries. Through the Energy Studies, customers became acquainted with DSM and learned of opportunities to participate in RVEERP financial incentives programs. The program sought 100% participation in the Energy Study element, and achieved 91%.

PROJECT HISTORY AND SCHEDULE

Planning for RVEERP began in 1989. In order to identify specific project goals and formulate a project plan, an Integrated Resource Utilization Program (IRUP) Task Force was convened in July, 1989. The group was comprised of a chairman and five members from different departments within Iowa Public Service and Midwest Gas. Included in this group's responsibilities was the identification of the target population and evaluation of customers' reactions to the project prior to finalization of the project plan. To this end, the IRUP Task Force conducted four focus group discussions with 15 residential and 14 business customers [R#3] in Rock Valley. The focus groups provided feedback to the task force on the importance of energy efficiency, the need for information, their reactions to the overall concept of the program, and their reactions to specific proposed elements of the program.

Utilizing this feedback along with information available from other utilities' efforts, project planners carefully considered each component for inclusion in the project. The final project plan was completed in July, 1990. By that time, an aerial thermogram had already been completed, and thus was available for use by the project as soon as project implementation began in June, 1990.

Between July, 1990 and December 31, 1992, Energy Studies were conducted and community members could participate in RVEERP financial incentives programs, which included an appliance turn-in program, an energy-efficient equipment rebate component, a no-interest loan program, and a maintenance coupon program. At the end of the implementation period, all Energy Study participants were offered a blower door test as a follow-up on the Energy Study and to stimulate further participation in the financial incentives programs, as well as to determine the effectiveness of measures that had been installed as recommended by the Energy Study. The Energy Studies, blower door test, and financial incentives programs are the primary subjects of this profile.

In addition, RVEERP included several other important initiatives which were completed during this implementation period. A recycling program was implemented and several demonstration projects were initiated, including Renewable Energy Resource Demonstrations and Leading-Edge Technology Demonstrations. These project components were designed to increase awareness and arouse interest in innovative technologies and DSM in general.

Research and evaluation activities have been occurring for the duration of the project and will continue through the project's completion in 1993. (Note that the project schedule was shortened by one year as a result of the Midwest merger.) Baseline studies were conducted prior to the introduction of RVEERP in the community, and evaluation reports are produced each quarter. An interim evaluation was completed in 1991 with the final, comprehensive evaluation expected to be completed in 1993.

Project evaluation is based on customer surveys and feedback obtained during the process of implementing the program. Empirical data continues to be generated through billing analyses and information from the newly installed two-way communications metering system. While the new metering system will be vital to the project's evaluation effort, it also has a variety of capabilities that will be useful to the utility in implementing load management programs and operations control and research. Installation of the metering system will be completed in 1993.

OBJECTIVES

RVEERP was conceived to demonstrate the effectiveness of a well planned and integrated energy-management program. One of the program's goals is to provide evidence that will help promote the widespread implementation of community-based DSM programs by fostering confidence among regulators and utility investors that such programs are optimally cost-effective.[R#3]

The program's specific objectives address technological, financial, social, regulatory, energy-efficiency, and research goals.

1. Technological objectives include demonstration of the efficacy of energy-efficiency technologies, electrical load management technology, two-way communication meters, and newly introduced state-of-the-art technologies. Additionally, the program seeks to determine the technical potential for energy-efficiency improvements within the entire community.

2. The program's financial objectives are to evaluate the influence of financial incentives and rate structures on customers' installation and proper use of energy-efficient technologies. Additionally, RVEERP seeks to determine the economic potential for energy-efficiency improvements within the entire community and to demonstrate the positive influence of energy-efficiency on the economic health of the community. The program also seeks to encourage customers to regard energy costs

separately when they are devising their budgets. Finally, RVEERP will provide baseline information upon which the utility can base its energy-efficiency investment strategy.

3. The social objectives include enhancement of the relationship between the utility and its customers. The program also seeks to evaluate the community's perception of energy-efficiency improvement and to positively affect that impression on a community-wide and a national level.

4. On the regulatory front, the project's objectives are to improve the regulatory incentives available to utilities for developing successful DSM programs, to propose DSM programs that are likely to be accepted by regulators and public policy makers alike, and to develop a cooperative relationship between the utility and its regulators.

5. The program has several specific energy-efficiency objectives. First, RVEERP seeks to reduce the average unit consumption of energy in Rock Valley. Second, load factors will be increased, and goals developed for reducing peak demand. Third, annual and cumulative energy saving goals will be pursued over the course of the program. Finally, a method by which to determine whether goals have been attained will be developed that incorporates year to year changes in weather.

6. Research objectives include an evaluation of the cost-effectiveness of the program, development of methods for utilizing evaluation results for program planning and integrated resource planning, and development of a standardized data base for reporting and documenting the costs and savings of the program.[R#3]

Implementation

MARKETING

As part of the project plan RVEERP developed a detailed marketing and promotional plan. A theme and logo were designed in March and May, 1990 to be included on all project marketing materials and official documents. The project was officially kicked off with the opening of the Energy Center in July, 1990. [R#4] The Energy Center, which is located on the business corridor of State Highway 18 in Rock Valley, serves as the hub for program marketing and implementation. Printed materials concerning the project and energy-efficiency in general are available at the center and displays of energy-efficient products are set up for viewing. Mailings and telemarketing originate at the Energy Center. [R#4] The program brochures include a postage-paid mailing card that customers can send in to initiate participation in a particular program component.

The project has also been widely promoted through presentations to community groups, participation in community events, and signs at local businesses and energy-efficient product dealers. Additionally, the project administrator had written a biweekly column in the local newspaper to keep the community apprised of the project. [R#4]

DELIVERY

RVEERP was planned as a five year project, and later revised to four years. Most of the active program implementation was completed during the period July, 1990 to December, 1992. After December 31, 1992, requests by Rock Valley customers who had not yet received an Energy Study or participated in any of the financial incentives programs would be referred to system-wide programs for which they are eligible. [R#6(9)] Project activities in 1993 will be dedicated primarily to evaluation of the project achievements.

Implementation of RVEERP was done in three basic steps. First, customers were invited to schedule an Energy Study and the study was performed and results explained to the customer. Second, the customer could participate in any of four financial incentive programs: rebates, no-interest loans, appliance trade-in, or maintenance coupons. Third, Energy Study participants were offered the opportunity to have a free blower door test performed.

Throughout the process, personal attention was emphasized. RVEERP was designed to provide multiple opportunities for personal contact and communication among implementation staff and customers. This individual attention allowed the project to collect detailed information on customers and their energy-usage patterns. With each personal contact, customers were further educated and made more aware of energy-efficiency and the DSM programs for which they are eligible.

ENERGY STUDY

Eligible residential customers received a mailing informing them of the availability of the Energy Study and inviting them to call or stop by the Energy Center to schedule an appointment. Follow-up telephone calls were made to those who did not respond to the mailing. Non-residential customers were invited to schedule an Energy Study through telemarketing – no direct mail was involved.

One of two contractors to the project conducted Energy Studies in customers' homes, businesses, and facilities. The residential Energy Study typically took about one hour to complete. The contractor interviewed each customer about their energy-use behaviors, installed a water heater jacket and 6 feet of pipe insulation, and toured the home or business to identify energy-efficiency improvement opportunities.

The results of the Energy Study were presented to the customers, either at their place of business for non-residential customers, or at the Energy Center for residential customers. The Energy Study report included a detailed analysis of energy use, broken down by appliance, and recommendations of appropriate energy-efficiency measures that the customer should consider. Installation costs and payback periods were estimated and the customers were informed of the financial incentives and loan programs for which they were eligible. [R#4]

FINANCIAL INCENTIVES

Customers could then participate in any of the program's financial incentives components: rebates, zero percent interest financing, an appliance turn-in program, and a maintenance coupon program.

Rebates: Rebates were available on any appliance or equipment which was determined to be of greater efficiency than existing equipment. To receive a rebate, the customer went to the Energy Center with the invoice for the qualifying purchase and the Energy Center staff assisted with filling out the rebate application forms and calculating the rebate amount. The rebate application procedure provided yet another opportunity for RVEERP staff to learn about the participating customers and their energy use behavior.

The Energy Center staff would then submit a "Request for Check" to the Centralized Accounts Payable office in Sioux City, and about two weeks later, rebate checks would be sent back to the Energy Center. Rebate checks were hand-delivered, giving the project staff the opportunity to perform a post-installation inspection of the equipment installed. During the rebate-delivery visit, information on the installed equipment, such as model number, manufacturer, and a copy of the EnergyGuide label for appliances, would be collected. The post-installation inspection was also used to generate additional information on the customers and their energy-usage patterns.

Zero interest loans: No interest loans between \$500 and \$5,000 were available for qualifying energy efficiency improvements. Customers who were interested in the loan program arranged for an estimate of the work to be performed, and then went to the Energy Center where the project was reviewed by staff and the application forms filled out. The customer could then go to the lender of their choice with the RVEERP application form and apply for a loan in the specified amount. Upon approval of the loan application, usually in 7 to 10 days, RVEERP was notified, and the customer could proceed with the project or installation. Upon completion, the final invoice was submitted to RVEERP and a post-installation inspection was conducted. Then the bank paid the customer and billed RVEERP for the interest on the loan, which RVEERP paid in one lump sum. In this way the bank assumed the risk of the loan and received the benefit of the full interest payment up-front.

Appliance turn-in program: Through the appliance trade-in program customers could receive a \$100 savings bond if they turned in a refrigerator or freezer, and a \$50

savings bond in exchange for an air conditioner. (The RVEERP appliance turn-in program is similar to those implemented by B.C. Hydro and Wisconsin Electric. See The Results Center Profiles #10 and #24.) The appliance did not have to be in working order since one of the goals of the program was to facilitate CFC reclamation as well as energy and demand reduction. To participate in the program the appliance dealers would arrange pickup (usually in conjunction with delivery of a new appliance) and store the used appliances at their shops. Once a month, or more frequently if necessary, a local salvage dealer would pick up the appliances from the dealers' shops for removal to his rural location. The salvage dealer reclaimed CFC's, removed any PCB capacitors, and prepared the old appliances for scrap. [R#8]

Maintenance coupon program: The maintenance coupon program provided coupons that customers could use to cover the full cost of a check up of their heating and cooling systems. Each customer was eligible for one heating system check up and one cooling system check up annually. Customers simply requested a coupon by returning the postage-paid mailer on the program brochure or by going to the Energy Center. Upon receipt of the coupon, the customer scheduled an appointment with a local contractor for a routine maintenance visit and used the coupon to pay for the check-up. The local contractors completed a checklist during the maintenance visit. The checklist, coupon, and a copy of the invoice were then submitted to the RVEERP office for reimbursement to the contractor.

At first, the coupon had a face value of \$25, which was generally adequate to cover the cost of the check-up. Later, in order to alleviate confusion and promote participation, reference to the coupon's dollar value was omitted and the coupon was offered as a service coupon. In this way, customers did not have to worry about the price of a service call, or whether they would have to contribute any costs.

BLOWER DOOR TESTS

Finally, RVEERP offered blower door tests to all residential customers who had received an Energy Study. While performing blower door tests after the Energy Study and the installation of measures is a somewhat

Implementation(continued)

RVEERP RESIDENTIAL REBATE AMOUNT TABLE

Equipment Type	Efficiency Range	Rebate Range
Air conditioners	9.0 or greater	\$5 - \$7 / 1000 Btu / Hr
Heat pumps -- air-to-air	9.0 or greater	\$75 - \$125 / ton
Heat pumps -- water-to-air	11.0 or greater	\$200 / ton
Natural gas furnaces	87% or greater	\$100 - \$150
Air-to-air heat exchangers		\$100
Water heaters	R-11	\$30 if replacement; \$74 - \$100 if new
Low flow showerheads	<3.0 GPM	\$5
Refrigerator / Freezers	Max annual operating cost \$46 - \$62, depending on size	\$50
Freezers	Max annual operating cost \$28 - \$39, depending on size and type	\$50
Compact fluorescent lamps		\$5 / lamp
Clock thermostat		\$25

atypical practice, the blower door tests were used primarily as another opportunity to follow-up with customers. During the blower door visit, information was obtained regarding which Energy Study recommendations had been implemented, and customers were further influenced to install measures identified during the original Energy Study. The blower door test also provided an opportunity for participants to focus on basic weatherization measures; when appropriate, customers received starter insulation kits containing caulk, V-seal insulation, and an outlet gasket and were shown how installation of these items could further influence the air-tightness of the home. [R#8]

MEASURES INSTALLED

Through the Energy Studies, financial incentives programs, and blower door tests a variety of measures have been installed in Rock Valley homes and businesses. Rebates for commercial and industrial customers are calculated to reduce the payback period of qualifying equipment down to halfway between the actual payback period and 2 years. Measures with payback periods of less than two years, or greater than 15 years are not eligible for

rebates. Residential rebates vary as shown in the Residential Rebate Amounts Table.

Typical measures installed include high-efficiency refrigerators, freezers, and other household appliances, space conditioning equipment and appliances, clock thermostats, insulation improvements, and lighting efficiency improvements. For residential customers, insulation improvements were not eligible for rebates, though a project that cost between \$500 and \$5,000 would qualify for the zero-interest loan. Additionally, a three month insulation promotion in the Fall of 1991 provided free insulation to residential customers whose Energy Study had identified a need for insulation improvement. The promotion was targeted at projects that fell below the \$500 loan threshold. The customers were responsible for the insulation installation.

STAFFING REQUIREMENTS

Over its five-year life, RVEERP is anticipated to require approximately 6,200 person days, for an average of 5 full time equivalents (FTEs). [R#3] This figure includes the time of RVEERP staff as well as contractors

involved in the project. The program is primarily administered by the Project Administrator, who spends 100% of his time on the program. He was assisted by one full-time assistant between August, 1990 and October, 1991. About 2.5 FTEs covered the Energy Center, which was open 11 hours 4 days per week (Monday through Thursday), 8 hours on Fridays, and 3 hours (8 am to 11 am) on Saturdays. Additional staff for the project has been provided on an as-needed basis to support installation of the Metricom metering system and to provide promotional materials.

Three different consultants have been involved in the project performing energy studies and blower door tests, writing reports, and participating in project planning.

A-TEC Energy Corporation was primarily responsible for conducting the residential and small commercial Energy Studies and Michaels Engineering primarily conducted institutional, industrial, and large commercial Energy Studies. These two contractors committed approximately 1,224 and 1,295 person days; assuming they complete their responsibilities over two years, this figure translates to approximately 2.4 FTE for each of the two contractors. The primary role for HBRS, another consulting firm, was providing marketing research and evaluation consulting services to the project. The budget allows for a total of 262 person days, or approximately 1 FTE for one year, for HBRS services.[R#3] For 1993, HBRS and Michaels Engineering continue to provide services to the project on an as-needed basis.

CASE STUDY: CASEY'S GENERAL STORE

Casey's General Stores, Inc. is a chain of convenience stores operating throughout much of the Midwest. RVEERP performed an Energy Study on a Casey's store in Rock Valley, identifying several energy-saving opportunities for the store. Many of Casey's stores had similar layouts and operating schedules, and thus were likely to benefit from the same energy conservation measures as were identified in the Energy Study of the Rock Valley store. IPS contacted Casey's headquarters and provided them with a copy of the Energy Study, suggesting that they consider implementing some of the recommendations on a chain-wide basis.

The Energy Study had found significant opportunity for improving lighting efficiency in Casey's 1,800 square foot Rock Valley store which had annual energy usage of 177,029 kWh. Just by upgrading standard fluorescent lamps to T8 lamps, the audit estimated Casey's could save 11,874 kWh annually. The payback period on the T8 retrofit was estimated at 4.9 years. Other lighting efficiency improvements were also identified. Replacement of incandescent lighting with screw-in compact fluorescent lamps was estimated to save 1,807 kWh annually, with a payback period of 2.8 years; installation of reduced wattage three-, four-, and eight-foot fluorescent lamps was estimated to achieve annual savings of 701 kWh, with a payback period of 3.8 years. These payback periods were further reduced by the RVEERP rebates for which they were eligible.

After seeing the potential for saving at the Rock Valley store, Casey's decided to install energy saving lamps and electronic ballasts at all of their stores. They estimate that the retrofit will save up to \$500,000 annually.

Casey's is also looking into implementing other recommendations that arose from the RVEERP Energy Study of the Casey's store in Rock Valley. These recommendations included such low-cost measures as changing thermostat settings, lowering water temperatures, installing low flow faucet aerators, wrapping hot water heating tanks, and maintaining air conditioning equipment. The Energy Study also recommended consideration of more involved procedures such as adding roof and ceiling insulation, installing ceiling fans, instituting a routine maintenance schedule for the refrigeration system, installing case barriers in the walk-in refrigerator, and implementing cooking improvements. Potential annual savings at the Rock Valley store would be 32,836 kWh if all identified measures were implemented.

Monitoring and Evaluation

MONITORING

RVEERP has an extensive monitoring and evaluation plan which was finalized in May 1991. The centerpiece of RVEERP's monitoring plan is the installation of Metricom two-way communication meters at every electric and gas meter in the town of Rock Valley. The meters are capable of transmitting hourly electricity and gas use information via a radio link to a LAN at the Midwest Power/Midwest Gas area office in Rock Valley, with a link for billing data to the corporate mainframe computer system in Sioux City. Besides being capable of automatic meter reading, the Metricom meters can provide information for load research, distribution automation, direct load control, rate experiments, and customer feedback. By the end of 1992, Metricom meters had been installed at all electric meter locations with the exception of some of the larger customer locations. Installations at gas meter locations are expected to be completed in 1993.

In addition, several sub-metering studies are being implemented in some of the larger commercial, industrial, and institutional facilities in Rock Valley. The sub-metering will include pre- and post-installation data for energy-conservation measures installed through the program. Interim recording meters have been operating at the 15 largest commercial and industrial customers' facilities since July, 1990 and will continue to operate until the Metricom installation is completed. Sub-metering is also being installed at the substation level and boundaries of the project in order to provide overall energy-in/energy-out data for the project. Additionally, some check meters have been installed on appliances to record pre- and post installation data. [R#5,8]

Industrial use is being investigated on a case-by-case basis as there are only 16 large volume industrial customers in Rock Valley. For each industrial customer RVEERP will determine the effects of the program on energy-use, decision making, and attitudes toward implementation of energy conservation measures. [R#5]

The RVEERP monitoring plan also includes a significant customer survey component. Baseline surveys were conducted prior to the start of the project to determine demographics and attitudes toward energy-use before the project was introduced. These surveys were conducted in Rock Valley and in seven comparison communities. Five hundred residential customers and 175 commercial and

industrial customers were surveyed in Rock Valley, and a total of 500 residential and 175 commercial and industrial customers were surveyed in the comparison communities. Follow-up energy-use surveys are ongoing. A follow-up to the baseline surveys completed in 1990 will be conducted as part of the Final Project Evaluation. [R#8]

Each customer who received an Energy Study or financial incentive through the program was sent a survey asking questions about their satisfaction with the new product or technology, as well as their impressions regarding RVEERP, and demographic data. Application forms also contain questions which RVEERP can use to evaluate free-ridership and determine participation trends. Participant surveys and application forms were color coded and numbered for ease in tracking. The surveys were designed to be simple to read and fill out. The inclusion of subject headings over groups of related questions allowed customers to be aware of the purpose of the survey and the program.

RVEERP staff have and continue to take advantage of the extensive personal contact afforded by the program to gather and record detailed information on customers' energy uses, the appliances and equipment that they use, as well as their perception of RVEERP. All customer contacts are recorded in the individual customer's files, which also contain hard copies of each customer's energy study, program application forms, participation records, and follow-up surveys. The files note whether customer contacts were by telephone, personal contact, or letter. This information in turn is entered into the project database. [R#8]

RVEERP is tracked through a database system comprised of multiple elements. The system is designed to accept demographic information about customers, the programs they participate in, and details regarding their participation. These data include measures recommended and installed, estimated energy savings from Energy Studies, metering data, and rebate or loan amounts. Information is confirmed through post-installation inspections conducted in conjunction with the rebate program and the financing program. All data are entered into the comprehensive system where they are available for evaluation purposes. The data can be sorted and analyzed by program, customer type, or a variety of other configurations. [R#5]

EVALUATION

The RVEERP monitoring and evaluation plan describes a schedule by which process and impact evaluations will be produced. Quarterly and annual reports document the project's status, including budget and schedule status, number of participants in each of the project components, and data regarding customer eligibility, weather information, and metering and billing data. In the quarterly and annual reports, no attempt is made to analyze available data.

Data analysis is accomplished through the project Interim Evaluation and a Final Project Evaluation. The original monitoring and evaluation plan called for two interim evaluations, however the schedule was modified to eliminate the second interim evaluation and proceed with completion of the Final Evaluation ahead of schedule. The First Interim Evaluation was published on January 28, 1992.[R#4] The Final Project Evaluation will be conducted in 1993, with scheduled completion by the end of 1993. The First Interim Evaluation and the Final Evaluation both include a detailed process evaluation, and an analysis of energy-efficiency potential. The Final Project Evaluation will also include an evaluation of actual impacts, a cost-effectiveness analysis, and an environmental analysis.[R#5]

The First Interim Evaluation presented an overview of the results of customer surveys completed in the first year of the program – between June 1990 and July 1991. The number of participants in each program component who responded to the surveys were: 445 Energy Study, 115 cash rebates participants, 88 no-interest financing, 58 appliance trade-in participants, and 45 heating/cooling maintenance coupon participants. The surveys requested information on participation in the program, including how the customers learned of the program, their level of satisfaction with the program and the equipment that they installed as a result of their participation, expected savings and cost of the measures they installed, and demographic data.[R#4,7]

The evaluation of survey responses found that the Energy Center was important in influencing customers to participate in the program. Dealers and contractors also had a significant influence on customers' decisions to participate in the program. Notably, participation in the heating/cooling maintenance coupon component was

influenced primarily by the results of the Energy Study report.[R#4]

The effects of the program on participants' actions were also addressed in the surveys. Between 51% and 78% of the survey respondents who had participated in one of the four financial incentives components indicated that they intended to make energy-efficient purchases in the future even in the absence of financial incentives. Between 41% and 62% of the rebate and zero-interest financing participants indicated that they would have made a similar purchase of an appliance or equipment had there not been a financial incentive available. However, of these, 69% to 81% said that they would have bought equipment with the same efficiency level and only 19% to 20% said they would have bought the same number of appliances as they did under the program. (Note that participants who only purchased one appliance are included in the latter figure.)[R#4]

Overall, most program participants surveyed indicated that they were satisfied with the program. Between 86% and 99% of participants in the financial incentives components said that overall, they were very satisfied or somewhat satisfied with their participation in the program.[R#4]

Additionally, the report presents results of a non-participant survey conducted of 102 residential customers who refused an Energy Study, finding that 88% were aware of the program but did not participate for a variety of reasons. Thirty-two percent did not participate because they were not interested; 15% were satisfied with the condition of their home. Other reasons for not participating included beliefs that the home was too old to benefit from participation or that participation was too expensive.[R#4]

The First Interim Evaluation also presents preliminary energy savings and these are discussed further in the Program Savings section of this profile. RVEERP will conduct a comprehensive impact evaluation as part of the final project evaluation. The impact evaluation will include adjustments for weather, economic changes, and free-ridership. Weather data are being collected in Rock Valley and the Princeton Scorekeeping Model (PRISM) will be used to weather-normalize program savings data. The impact evaluation will also include a detailed analysis of the cost-effectiveness of the program.

Program Savings

Electricity and Natural Gas Savings Table	Electricity Savings (MWh)	Lifecycle Savings (MWh)	Natural Gas Savings (therms)
Residential	253	6,314	102,519
Small C/I	144	3,588	10,281
Large C/I	502	12,554	43,088
Total	898	22,456	155,889

DATA ALERT: Actual savings for RVEERP have not been determined. Weather-normalized analyses of savings as determined from billing and meter analyses will be reported in the Final Evaluation which will be completed at the end of 1993. Thus, savings are estimated based on the RVEERP analyses that have already been completed. Most of the information on savings in this section is based on data reported in the First Interim Evaluation and includes participants and surveys completed between July 1990 and October 1991. Participation is based on project-to-date figures that cover the period July, 1990 to September 30, 1992 as reported in the Ninth Quarterly Report. [R#6(9)]

Note that lighting measures for large commercial and industrial customers result in negative gas savings. In determining savings due to lighting measures for this customer class, RVEERP factored in the increased winter heating load and the decreased summer air conditioning load that would result from removal of lamps.

Savings reported in this section were not adjusted for free-ridership. However, RVEERP plans to include a free-ridership adjustment in the Final Project Evaluation.

Table (pg. 15) shows electricity and natural gas savings for three customer classes under this 100% assumption.

These figures, however, are not very realistic. A RVEERP survey of 612 residential participants revealed that on average, 39% (2,035 of 5,152) of the energy-efficiency measures that had been recommended in the Energy Study either had been implemented or the customers had concrete plans to implement them. (See table pg. 15) The Residential Customer Uptake Table at right presents customer uptake rates based on the survey and shows calculations of customer uptake savings based on the potential savings identified in the 742 residential Energy Studies that had been completed by October 1991. Annual electricity savings by residential customers are estimated at 253 MWh, and natural gas savings are 102,519 therms.

The C/I Estimated Customer Uptake table at right assumes that non-residential customers would have the same rate of uptake of recommended measures. (Lighting measures are assumed to be installed at the average rate of 39%.) The energy savings potential is based on the results of Energy Studies conducted for 65 small commercial and industrial customers, and 60 large commercial and industrial customers. Annual electricity savings by small and large C/I customers are 144 MWh and 502 MWh, respectively, and natural gas savings for small and large C/I customers are 10,281 therms and 43,088 therms.

Thus, the total estimated annual electricity savings for those customers who had an Energy Study by October 1991 (75.6% of the participant goal) would be 898 MWh as shown in the Electricity and Natural Gas Savings Table. By September 30, 1992 an additional 171 participants had completed Energy Studies (totaling 90.6% of the participant goal), suggesting that the estimated annual electricity savings could be as much as 1,076 MWh.

Annual savings that will be achieved by RVEERP have been estimated in several ways. First, RVEERP determined the potential savings that could be realized in Rock Valley if 100% of the population installed 100% of the measures recommended in the Energy Studies. Because so much of the energy savings in Rock Valley are through natural gas, RVEERP converted the electricity and gas savings to Btus, finding total potential savings of 64,411 MMBtus, equivalent to 27% over the base year. The Potential Savings

Residential Customer Uptake Table	Residential			
	Energy Savings Potential (kWh)	Estimated Customer Uptake (kWh)	Energy Savings Potential (therms)	Estimated Customer Uptake (therms)
Building Envelope	61,653	22,812	144,321	53,399
Heating and Air Cond.	200,008	59,402	88,874	26,396
Domestic Hot Water	71,536	47,214	33,602	22,177
Other	439,805	123,145	1,954	547
Total	773,002	252,573	268,751	102,519

PARTICIPATION RATES

By September 30, 1992, RVEERP had achieved a 91% participation rate for the completion of Energy Studies. These customers have participated in many of the other programs offered through RVEERP. Participation rates in the four financial incentives programs are shown in the Financial Incentive Programs Participation Table. RVEERP reports that participation in the financial incentives programs is significantly higher than typical participation rates for similar stand-alone programs sponsored by this and other utilities. [R#2]

Energy Studies Participation Table	Eligible Sites	Sites Complete	Percent Complete
Residential	1,009	906	90%
Small C/I	77	72	94%
Large C/I	60	60	100%
Total	1,146	1,038	91%

[R#6(9)]

C/I Estimated Customer Uptake Table	Small C/I				Large C/I			
	Energy Savings Potential (kWh)	Customer Uptake Savings (kWh)	Energy Savings Potential (therms)	Customer Uptake Savings (therms)	Energy Savings Potential (kWh)	Customer Uptake Savings (kWh)	Energy Savings Potential (therms)	Customer Uptake Savings (therms)
Building Envelope	19,377	7,169	8,675	3,210	40,666	15,046	21,333	7,893
Heating and Air Cond.	57,194	16,987	22,217	6,598	324,950	96,510	114,538	34,018
Domestic Hot Water	11,778	7,773	717	473	14,557	9,608	5,818	3,840
Lighting	263,809	104,195	0	0	522,115	206,216	(8,288)	(3,273)
Other	26,361	7,381	0	0	624,161	174,765	2,182	611
Total	378,519	143,505	31,609	10,281	1,526,44	502,145	135,583	43,088

Program Savings (continued)

Financial Incentive Programs Participation	Rebates		Zero-Interest Financing		Appliance Trade-Ins		Maintenance Coupons	
	Number of Customers	% of Eligible Customers	Number of Customers	% of Eligible Customers	Number of Customers	% of Eligible Customers	Number of Customers	% of Eligible Customers
Residential	563	56%	374	37%	268	27%	289	29%
C/I	59	43%	25	18%	22	16%	53	39%

[R#6(9)]

Fifty-six percent of the 1,009 eligible residential customers, and 43% of the 137 eligible non-residential customers have participated in the Rebates component of the program. Additionally, 37% of the residential customers and 18% of the non-residential customers have received zero-interest financing for their energy-efficiency projects. Non-residential customers have also achieved a high participation rate for the Maintenance Coupon program with 39% of the eligible commercial/industrial customers participating. These participation figures are based on strict percentages of number of customer participants compared to total number of eligible customers in Rock Valley.

Based on the analysis of 742 residential customers, 65 small C/I and 60 large C/I customers, the estimated annual energy savings per participant is 341 kWh per residential customer, 2,215 kWh per small C/I customer, and 8,367 kWh per large C/I customer.

FREE RIDERSHIP

RVEERP evaluated free-ridership in the First Interim Evaluation Report. [R#4] The study found that 29% of the Energy Study customers who installed recommended measures were already planning to install that measure prior to receiving the Energy Study. The highest level of free-ridership was in the heating equipment category. Eighty percent of the residential customers reported that they already planned to clean or tune their heating equipment, install stack dampers, or replace their furnaces. The lowest levels of free ridership were in the water heating and refrigerator measures, at 9% and 17%, respectively.

The evaluation also assessed free ridership by installation cost and payback period. Measures with installation costs between \$101 and \$500 had the highest free-ridership rate of 63%. Measures with installation costs less than \$100 had free ridership of 18% to 26%, and measures costing more than \$500 had free-ridership of 22%. The evaluation assessed free-ridership by payback period in five categories at the following rates: one year or less, 18%; two to five years, 76%; six to ten years, 16%; 11 to 15 years, 28%; and more than 15 years, 50%. Evaluators concluded that the results of the payback period analysis indicated free-ridership “is not strongly related to length of payback.” [R#4]

MEASURE LIFETIME

An average lifetime has not yet been determined for RVEERP. Measures implemented included building envelope measures, with lifetimes of 20 years or longer (lifetimes of 35 and 44 years were used in Espanola and Hood River, where building envelope measures predominated the projects), heating and air conditioning equipment with lifetimes of 10 to 20 years, and lighting measures with lifetimes of 5 to 15 years. The Results Center used 25 years to calculate lifecycle savings and cost of saved energy.

PROJECTED SAVINGS

In the First Interim Evaluation, the technical potential for annual savings in Rock Valley was determined to be 3 GWh and 540,832 therms. [R#4] Assuming an overall implementation rate of 39% [R#4], actual annual savings due to the project could be 1 GWh and 210,900 therms.

Potential Savings All of Rock Valley	Electricity Savings (kWh)	Natural Gas Savings (therms)	Total Potential (MMBtu)	Total Potential Energy Savings Over Base Year
Residential	1,051,158	367,805	40,368	35%
Small C/I	448,399	37,445	5,275	16%
Large C/I	1,526,449	135,583	18,768	21%
Total	3,026,006	540,833	64,411	27%

[R#4]

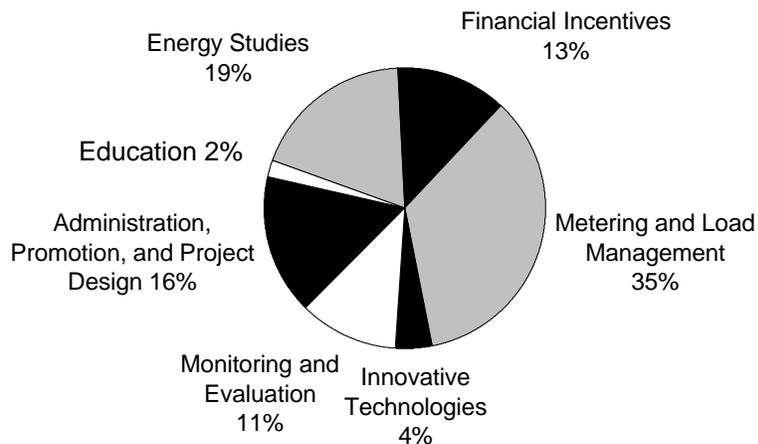
Summary of Measures Recommended to 612 Residential Customers	Number of Measures Recommended	Number of Measures Implemented or Planning to be Implemented	% of Measures Likely to be Implemented
Building Envelope	2,671	988	37%
Heating and Air Conditioning	1,275	379	30%
Water Heating	869	574	66%
Refrigerator Replacement	337	94	28%
Total	5,152	2,035	39%

[R#4]

Cost of the Program

Costs Overview Table	Administration Promotion & Project Design (x1000)	Education (x1000)	Energy Efficiency Studies (x1000)	Financial Incentives (x1000)	Metering & Load Mgmt. (x1000)	Innovative Technologies (x1000)	Monitoring & Evaluation (x1000)	Total Program Cost (x1000)
1990	\$530.8	\$12.9	\$174.9	\$55.7	\$384.1	\$3.5	\$101.6	\$1,263.6
1991	\$96.8	\$41.9	\$479.9	\$244.7	\$973.8	\$136.8	\$222.3	\$2,196.2
1992	\$87.7	\$19.1	\$165.2	\$260.5	\$168.6	\$38.9	\$170.0	\$910.0
Total	\$715.2	\$74.0	\$820.1	\$560.9	\$1,526.6	\$179.2	\$493.9	\$4,369.8

[R#6]



Cost of Saved Energy Table (¢/kWh)		Discount Rates						
		3%	4%	5%	6%	7%	8%	9%
Electric Savings	All Inclusive Cost	29.49	32.87	36.44	40.17	44.07	48.11	52.28
	Cost Not Including Metering or Evaluation	16.07	17.91	19.86	21.89	24.02	26.22	28.49
Gas and Electric Savings	All Inclusive Cost	4.59	5.12	5.67	6.25	6.86	7.49	8.14
	Cost Not Including Metering or Evaluation	2.64	2.94	3.26	3.60	3.95	4.31	4.68

DATA ALERT: The 1992 costs appearing in the Cost Overview Table are unaudited figures. The 1990 costs for administration, promotion, and project design include about \$77,000 which were used for project startup and have since been deleted from the total project expenditures. Thus, the actual levelized project costs for the period July, 1990 to December 31, 1992, were \$4,292,800.

Almost \$4.4 million has been spent on RVEERP since the project was initiated in 1990. In 1992, \$910,000 was spent. Most of the project expenditures occurred during the first two years. Significant costs were incurred in project planning and in the metering component of the project. In 1990, \$1.3 million was spent, primarily on administration, promotion, and project design. In 1991, \$2.2 million was spent, with most costs (\$1.0 million) due to metering and load management.

COST EFFECTIVENESS

The Results Center calculated the cost of saved energy for RVEERP based on four different scenarios as shown in the Cost of Saved Energy Table. In the first two calculations, expenditures between 1990 and 1992 as shown in the Cost Overview Table and only electricity savings as shown in the Electricity and Natural Gas Savings Table were used. For "Cost Not Including Metering or Evaluation," expenditures for metering and load management and monitoring and evaluation were not included in the calculation. For "All Inclusive Cost" the total expenditure of \$4.4 million was used.

Because such a high percentage of the savings in Rock Valley are natural gas savings and not electricity efficiency, the cost of saved energy calculation based solely on the electricity savings may not accurately portray the cost-effectiveness of the program. It would be difficult to disaggregate spending attributable to gas and electricity savings. However if gas savings are converted to kWh and added to the electricity savings, a closer approximation of the cost of saved energy may be calculated. (The conversion is based on one therm = 100,000 Btus and one kWh = 3,413 Btus, or one therm = 29.30 kWh.) Using this methodology, the cost of saved energy of RVEERP based on all expenditures through December 31, 1992, ranges from 4.59 ¢/kWh to 8.14 ¢/kWh, depending on the discount rate used. Subtracting metering and evaluation costs from the total expenditure and then calculating cost of saved energy for both electricity and natural gas savings reveals a cost ranging from 2.64 ¢/kWh to 4.68 ¢/kWh, depending on the discount rate.

The Final Project Evaluation of RVEERP will include an extensive analysis of its cost-effectiveness.

COST PER PARTICIPANT

Note: The following cost per participant figures are based on program results from the years 1990, 1991, and 1992. These cost figures are not levelized.

RVEERP analyzed the cost per participant for the rebates and financing programs through February 1992. At that time, 348 residential customers had participated in the cash rebates component. These customers had received \$32,645 in rebates, and had contributed a total of \$449,191 toward completion of their projects. These figures translate to a utility cost of \$93.80 per customer, with the average customer contribution being \$1,291 per customer. By the end of February 1992, 258 residential customers had received no-interest financing for a total of \$551,534.80. Interest on these loans was paid by RVEERP totaling \$145,869, for an average utility cost of \$565.40 per participant.

For commercial customers participating in the rebates and financing programs through February 1992, 21 commercial customers received \$34,601 in rebates and spent \$60,373 on projects. Thus for the rebates component the average utility cost was \$1,648 per commercial customer and the average commercial customer contribution was \$2,875. Eleven commercial customers participated in the financing program with \$78,520 financed and \$24,204 in interest payments covered by RVEERP. The average project cost for the financing component was thus \$2,200 per commercial customer. [R#8]

COST COMPONENTS

In 1992, \$910,000 was spent primarily on financial incentives, monitoring and evaluation, and metering and load management. This represents a shift in program expenditures from the previous year when most of the budget was spent on metering and load management and Energy Studies. In the first year of the program almost 50% of the program budget was spent on administration, promotion, and project design, and about one-third was spent on metering and load management. The overall breakdown between project components based on expenditures between 1990 and 1992 is shown in the pie chart. Most expenditures (35%) have been spent on the installation of the Metricom metering system and related activities. Energy Studies have required almost 19% of the budget, and administration, promotion, and project design have used 16%. Financial incentives have used about 13%, and monitoring and evaluation have used about 11% of the project expenditures, with the innovative technologies and educational elements rounding out the expenditures at 4% and 2%, respectively.

Environmental Benefit Statement

Marginal Power Plant	Heat Rate BTU/kWh	% Sulfur in Fuel	CO2 (lbs)	SO2 (lbs)	NOx (lbs)	TSP* (lbs)
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Coal Uncontrolled Emissions

A	9,400	2.50%	1,937,000	46,000	9,000	1,000
B	10,000	1.20%	2,065,000	18,000	6,000	4,000

Controlled Emissions

A	9,400	2.50%	1,937,000	5,000	9,000	0
B	10,000	1.20%	2,065,000	2,000	6,000	0
C	10,000		2,065,000	12,000	6,000	0

Atmospheric Fluidized Bed Combustion

A	10,000	1.10%	2,065,000	5,000	3,000	1,000
B	9,400	2.50%	1,937,000	5,000	4,000	0

Integrated Gasification Combined Cycle

A	10,000	0.45%	2,065,000	4,000	1,000	1,000
B	9,010		1,858,000	1,000	0	0

Gas Steam

A	10,400		1,126,000	0	3,000	0
B	9,224		978,000	0	6,000	0

Combined Cycle

1. Existing	9,000		978,000	0	4,000	0
2. NSPS*	9,000		978,000	0	2,000	0
3. BACT*	9,000		978,000	0	0	0

Oil Steam--#6 Oil

A	9,840	2.00%	1,630,000	25,000	3,000	3,000
B	10,400	2.20%	1,729,000	25,000	4,000	2,000
C	10,400	1.00%	1,729,000	3,000	3,000	1,000
D	10,400	0.50%	1,729,000	10,000	4,000	1,000

Combustion Turbine

#2 Diesel	13,600	0.30%	2,164,000	4,000	7,000	0
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Refuse Derived Fuel

Conventional	15,000	0.20%	2,569,000	7,000	9,000	2,000
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Avoided Emissions Based on 898,223 kWh Saved (7/90 - 10/91)

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 environmental costs are beginning to be factored into utility resource planning. 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 Midwest Resources' level of avoided emissions saved through its Rock Valley Energy Efficiency Research Project 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 include 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

Lessons Learned / Transferability

LESSONS LEARNED

RVEERP has had many successes, not the least of which is the timely completion of the implementation phase of the program. Between July 1990 and December 31, 1992, a total of 91% of the town's residents, businesses, and industries received an Energy Study. By mid-1991, customers indicated that they had implemented or were planning to implement almost 40% of the measures recommended by that time.

While the priority for RVEERP was to achieve the highest possible participation rates, even if cost-effectiveness was sacrificed, the system-wide program has cost-effectiveness as a priority. Before RVEERP, participation in Midwest's DSM programs by customers in Iowa's smaller communities was limited. RVEERP showed that by educating customers about the benefits and accessibility of energy-efficiency, increasing customer awareness of the programs available to them through the utility, and making participation in the programs simple, customer participation rates could be increased significantly.

RVEERP emphasized personal contact as an important element in accomplishing its goals. Customers indicated that the Energy Study and the Energy Center were instrumental in their decisions to participate in the financial incentive programs and to install energy-efficient measures.

In addition, many local economic benefits were realized in Rock Valley as a direct and indirect result of RVEERP. Rock Valley experienced growth in all sectors during the early 1990s, a period when most other cities and towns in the United States were in decline. While many factors would contribute to such growth, it is likely that the RVEERP presence in town, and its investment in the community had some effect. Through the program, appliance and equipment sales were stimulated, home contractor projects became in demand, and local bank activity increased. Through the no-interest financing component, the project paid all interest due on loans for energy-efficiency projects and equipment up-front to the lenders. The banks that received these early payments then had more available to invest than they would have if the loans were paid on their regular schedule. Though not all the lenders involved were based locally in Rock Valley, and though there is no guarantee that the money would be reinvested in the local community, the potential

impact of this scenario cannot be denied. In addition, through the loan program, some customers who had credit difficulties were allowed the opportunity to begin establishing credit.

TRANSFERABILITY

RVEERP was designed to demonstrate which elements of a comprehensive DSM strategy could stimulate participation and remain cost-effective. Although the final savings and cost-effectiveness analysis will not be completed until the end of 1993, it is reasonable to assume that the program has demonstrated some very effective DSM components. The financing implementation strategy will likely be particularly attractive to other utilities. Additionally, setting up an Energy Center in small communities or assembling a mobile energy center, as Midwest is considering, seems to be an effective means to educating consumers and increasing participation rates.

Many utilities already have energy audit programs, however the potential impact of an Energy Study program was demonstrated in Rock Valley. By using the Energy Study as a marketing tool for the other programs offered by the utility, awareness of the programs is increased, and participation enhanced.

Energy Studies were used in both Hood River and Espanola (see The Results Center Profiles #12 and #16) to introduce customers to the energy-efficiency programs and to determine the potential for energy savings in the communities. However, the underlying approach in Hood River and Espanola differed from that of Rock Valley. In Hood River and Espanola, the projects focused on weatherization and building envelope improvements in order to determine the achievable savings by implementing identified measures. While RVEERP also intends to determine the achievable savings, the project has perhaps a greater emphasis on demonstrating the influence on participation in utility-sponsored financial incentives programs.

Regulatory Incentives and Shareholder Returns

Traditional utility ratemaking practices, where each and every kilowatt-hour sold provides profit, is a major barrier to utilities' implementation of energy efficiency programs. Several state regulatory commissions and their investor-owned utilities have been pioneers in reforming ratemaking to a) remove the disincentives in utility investment in DSM programs, and b) to provide direct and pronounced incentives so that every marginal dollar spent on DSM provides a more attractive return than the same dollar spent on supply-side resources. The purpose of this section is to briefly present exciting and innovative incentive ratemaking mechanisms where they're applied. This we trust, will not only provide some understanding to the reader of the context within which the DSM program profiled herein is implemented, but the series of these sections we hope will provide useful snapshots of incentive mechanisms being used and tested across the United States.

IOWA OVERVIEW

In 1977 state legislation established an integrated resource planning process in the State of Iowa by requiring the state's utilities to submit evaluations of all resource options to the Iowa Utilities Board prior to issuing certificates for large generating plant additions. In 1990, the Board's powers were broadened by the state legislature to require that utilities establish DSM programs before receiving rate increases. The legislation established utility DSM spending targets of at least 2% of gross operating revenues for electric utilities and 1.5% of gross operating revenues for gas utilities. The Board subsequently issued rules on cost recovery and energy efficiency plans in the spring of 1991.[R#18]

Iowa uses a parallel, or mini rate case system to determine the cost recovery of DSM program expenditures and related expenses, and of course now DSM incentives. These rate cases are separate from the major, or regular rate cases, that typically occur every two or three years but in some cases in Iowa have been skipped for as many as eight years. The first group of utilities to engage in cost recovery hearings (four of the state's investor-owned utilities including Midwest Power's Iowa Power division) will go through the hearings in the summer of 1993. (Another four utilities will engage in the process in the summer of 1994.) The hearings are likely to be contested, putting the onus on Midwest Resources to prove the effectiveness of its programs.

TREATMENT OF DSM EXPENDITURES

According to the rules issued in 1991, utilities in Iowa can recover their DSM expenditures. This is done using a deferred accounting structure whereby utilities aggregate their expenses in a separate account. These "investments" are then reviewed for prudence and if approved can be ratebased, thus providing utility shareholders with a return on their investment over time. Provided that the expenditures are determined to be prudent, utilities can also earn "carrying charges" on their expenditures pending ratebasing approval. (The carrying charges represent compensation for the cost of capital, or interest on the funds.)[R#18,19]

TREATMENT OF LOST REVENUES

To date, the Board has not approved a specific lost revenue recovery for Iowa utilities such as ERAM (see the incentives section of any Results Center profiles of programs in California). However, according to the rules adopted in April 1991, the Board treats lost revenues as "related costs" for which recovery is allowed if the utility can show that DSM reduces revenues below test year revenues. Similar to the provisions stated above for expenditures (actual program expenses), utilities can be compensated for lost revenues (which represent economic costs or opportunity costs) provided they can prove the effect of their DSM programs compared to the test year. In short, utilities will have to prove that the net effect of their DSM programs has suppressed revenues below test year levels.[R#18,19]

PROVIDING ADDITIONAL INCENTIVES

A majority of incentive mechanisms adopted since 1989, including the Iowa incentive, have emulated the shared-savings approach pioneered by the Orange & Rockland and Niagara Mohawk Power Corporation (see Profile #41) decision in New York State. Shared savings bonuses appear to be finding favor with both utilities and regulators because the concept is simple and readily understood by all parties and the general public. In the shared savings mechanism, the program's costs are subtracted from the gross benefits, as determined using the total resource cost test for cost effectiveness, then a percentage is paid to shareholders (10-20%).[R#17]

Regulatory Incentives (continued)

Shared savings mechanisms motivate both cost effectiveness and greater spending on DSM. The utility can maximize its bonus by pursuing all opportunities for which benefits exceed costs. Finally, the mechanisms are being developed such that ratepayers get over 75% of the benefits of the DSM programs, limiting windfall profits to shareholders. [R#17]

In its April 1991 order, the Iowa Utilities Board issued rules establishing an efficiency reward/penalty mechanism for utility shareholders. One mechanism is in place for all of the state's investor-owned utilities and is similar to the shared-savings mechanism discussed generically above. If a utility's efficiency programs have overall benefit cost ratios greater than 1.25, a bonus will be rewarded; if the ratios fall below 1.0, or if spending is below 75% of the Board-approved spending level, a penalty will be assessed. The maximum reward is 25% of net benefits as measured by the societal test on a present value basis; the maximum penalty is 15% of planned net benefits. Incentives will be considered in the context of utility cost recovery filings for energy efficiency programs approved by the Board. [R#18,19]

ROCK VALLEY ENERGY EFFICIENCY RESEARCH PROJECT

For the regulatory treatment of energy efficiency programs in Iowa, Iowa Public Service (which initiated RVEERP) and Iowa Power, are being treated separately. In July of 1991 IPS filed its energy efficiency plan, in August it was contested, and in November of the same year, IPS, the state consumer advocate, and an intervener filed a joint motion to refile the utility's energy efficiency plan to address some of the shortcomings in the original plan and to accurately present the changing DSM environment at the now-merged utilities.

In the winter of 1993 the Board ruled that only a portion of the total RVEERP expenditures would be allowed to be considered for cost recovery. In 1994 the Board will rule on cost recovery (expenditures and lost revenues) for IPS. The Board determined that approximately \$1.8 million of the total project costs will be considered for recovery because the Board felt that IPS did not design the project so that useful conclusions about cost effectiveness would result. Of the portion that will be considered for recovery, \$1.2 million is the portion equal to the benefits of energy savings expected to be achieved and \$600,000 is for the Metricom metering system. [R#19,20]

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