

Rural Electric Efficiency Prospects

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Executive Summary

Introduction

Growth in the use of electric power, especially in the rural Southwest, has fostered economic growth and increased the level of energy services enjoyed by residents of the region. But high growth in electricity demand has also contributed to problems such as rising energy costs, controversies over new power plants or transmission lines, and increased greenhouse gas emissions contributing to global warming. There is growing interest in promoting more efficient electricity use as a way to mitigate these problems.

This report focuses on the prospects for improving the efficiency of electricity use in rural areas of the Southwest, in particular rural areas of Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming. The primary emphasis is on electricity use in residential and commercial buildings. These buildings constitute the majority of rural electric load in many parts of the Southwest, and are an important contributor to demand peaks throughout the region. The report also focuses on existing rather than new buildings. New construction in rural areas is unlikely to add more than 20% of the load in 20 years, so addressing existing buildings that will account for at least 80% of the load in the foreseeable future makes the most sense.

Improving energy efficiency (meaning less energy use for a given level of service; e.g., more efficient lights or appliances) and promoting conservation (meaning reducing unnecessary energy use; e.g., turning off lights or appliances when not needed) pays off on nearly every level. An energy-efficient building is more comfortable and less expensive to operate. Energy-efficient appliances and equipment do the same work as standard ones, but cost less to operate. Finally, improving efficiency and conserving energy are almost always less expensive than producing, transmitting, and distributing power from new resources—whether from a new coal-fired plant, natural gas-fired plant, or renewable energy facility.

Most of the technologies discussed in this report for saving energy in buildings are not new. Most have been in use for decades, and are mature, well understood, and readily available in the marketplace. Other technologies, such as compact fluorescent lamps, are now less costly and perform much better than models available even 5 or 10 years ago. In addition, many strategies discussed in the report are not technologies, but practices (i.e., different ways of accomplishing the same objectives). All the technologies and actions described here are proven, off-the-shelf ways to reduce energy use cost effectively. This aspect is important in rural areas where service and trouble-shooting assistance for newer, riskier technologies are less available.

Given the wide array of energy efficiency and conservation measures and practices now available, we believe it is technically feasible and cost-effective to achieve 20-40% electric savings throughout the Southwest. Such savings can be achieved while base functions (i.e., safety, comfort, services, and lifestyle) are maintained. This potential is not determined using the cost effectiveness tests required by utility commissions—it represents an intentionally looser definition and allows for the more creative conception of non-hardware solutions and benefits, as we believe are appropriate for rural areas.

The Rural Context

A. The Land and People

The Southwest is drier and sunnier than any other region in the United States, and with larger temperature variations. Some rural areas of the Southwest have high space heating requirements, while other areas require substantial space cooling and just modest space heating. People who live in the Southwest are more able and likely to use evaporative cooling rather than refrigerated air conditioning due to the arid climate.

The production, transmission, and use of energy is a challenge in this region because electricity must travel farther to less densely populated areas, at greater expense, and is used to heat and cool buildings that are, on average, older and less energy-efficient than those in urban areas. Thus, per-household energy use is relatively higher in the rural Southwest than in urban areas. In addition, windshield time—the large amount of time that program staff and contractors must spend traveling to and from customers—is a consideration in the design and implementation of energy efficiency and conservation programs.

Rural residents of the Southwest are often described as independent, politically conservative, and wary of unproven changes to the way they do things. They also tend to be intensely loyal to their local institutions, and communicate much more informally than their city relatives. Recent discussions with residents also indicated they are mostly unaware of the effect their daily energy-using behavior has on utility costs. Most people are skeptical that anything they could do would make a difference in their energy bills, without greatly modifying their lifestyle (“we don’t want to freeze in the dark”), but appeared to be open to demonstration. And while some were interested in doing something to save energy, in general they said they did not know what to do or where to go for help.

B. The Economy

Electricity use in the residential sector in rural areas is similar to that seen in urban or suburban areas. Major end-uses include space heating and cooling, water heating, appliances, electronics, and lighting. In addition, there is greater rural use of domestic well pumps and security lighting.

The major rural industries are more often agriculture-, forest-, or extraction-related, as compared to the heavy manufacturing industries in urban areas, and each relies more heavily on liquid fossil fuels than electricity. In agriculture, electricity is mainly used in motors for powering irrigation pumps, compressors, fans, conveyors, and the like; resistance heating of buildings, water, and products such as milk; lighting of offices, processes, and livestock shelters; and electronics. The recent growth in energy and mineral extraction has changed the load profile of some rural utilities in the Southwest, and increased their load factors due to addition of 24/7 loads such as motors, pumps and compressors.

The rural commercial sector uses fewer and smaller motors, and concentrates its electricity use in lighting, electronics, and resistance heating. The load profiles of shops, businesses, and offices on Main Street in any small rural town resemble those in urban areas.

C. Electricity Suppliers

Rural electric cooperatives (co-ops) built the far-flung distribution infrastructure that serves these less-populated rural areas; they operate and maintain the facilities to provide reliable electricity at the lowest possible cost. As nonprofit, member-owned organizations, their focus is different than that of the better known investor-owned utilities (IOUs). Co-ops serve their member-customers rather than shareholders, but have far fewer customers per mile of transmission line (an average of 7 compared to about 35 per mile for IOUs, and nearly 47 for municipal utilities). As a result, they also have far less revenue per mile of line. In small towns, rural customers may pay their bills to their local municipal utility, which may buy power from an IOU or a public utility. Rural utilities are pragmatic organizations and have had to be unusually knowledgeable about electricity distribution.

Distribution co-ops typically buy their power from larger IOUs or co-ops with generation facilities. Most of the co-ops in Colorado, New Mexico, and Wyoming buy power and transmission services from Tri-State Generation and Transmission (Tri-State G&T), a wholesale electric power supplier owned by the 44 electric co-ops and public power districts that it serves. Five of the six co-ops in Arizona buy their wholesale power from a G&T cooperative, the Arizona Electric Power Cooperative. The six Utah co-ops buy wholesale from a Utah G&T, Deseret Power, while the four Nevada co-ops buy wholesale from Bonneville Power Administration (BPA). Other co-ops and municipal utilities in the region buy power from Xcel Energy (in Colorado and New Mexico), PNM (in New Mexico and Arizona), the Western Area Power Administration (all SWEEP states), and other generators.

A major consideration in planning for improved electric efficiency is the relatively limited experience with energy efficiency program delivery in rural areas of the Southwest. Lack of financial incentives and other considerations, too, will likely prompt institutional reluctance to fielding extensive efficiency efforts, putting the achievability of deep rural energy savings in question. These barriers must be addressed.

Finally, the lack of energy efficiency program history and product and service delivery systems (except for the Federally-funded Weatherization Assistance Program for low-income households) means that a comprehensive efficiency program infrastructure in the rural Southwest must be built almost from scratch. On the positive side, this will provide many rural entities and entrepreneurs the opportunity for new jobs and profit opportunities. The downside is that it will require determination and creativity to develop programs that have an impact in the short- to mid-term, during infrastructure build-out.

Energy Efficiency and Conservation Potential

Energy use and costs can be reduced by 20-40% in all parts of the rural Southwest by employing a wide range of no-cost, low-cost measures and practices, as well as investment-grade energy efficiency measures. Low-cost, no-cost measures and practices for households will pay themselves back in less than a year and include:

- better control of lights, temperatures, and appliances
- reducing water heater temperatures
- installing low-flow showerheads and faucet aerators
- using clothes lines instead of electric dryers
- installing compact fluorescent lamps (CFLs), and
- unplugging or using power strips to shut off electronic devices when not in use, thereby eliminating standby power waste.

Investment-grade opportunities include retrofit of the building envelope, ENERGY STAR appliances, high efficiency heating and cooling equipment, and sealing leaky heating and cooling ducts.

In rural businesses, a wide range of efficiency measures and practices are available including some of the same no-cost, low-cost options available in homes, more efficient lighting devices, and efficient heating and cooling equipment. And on farms and ranches, efficiency measures include premium efficiency motors and variable speed motor drives, more efficient irrigation pumps, and more efficient ventilation systems. Part 2 of this report discuss these and other efficiency and conservation opportunities in greater detail.

The good news is that all of these measures and practices are cost effective; i.e., they yield utility bill savings that are greater than their initial cost. In many cases the payback on the first cost is three years or less, meaning a return on investment of 33% or greater. As both Great River CEO David Saggau and Colorado Governor Bill Ritter have said, “The cheapest kilowatt-hour is the one we don’t have to produce.”

Besides the economic benefits, this report examines the other drivers for, and impediments to, increased energy efficiency and conservation in rural areas. New findings show that non-energy benefits such as better comfort, enhanced productivity, and greater self-reliance can be important drivers for the adoption of energy efficiency and conservation measures. With a growing understanding of the ways energy impacts our economy, our national security, and our environment, more and more households, businesses and utilities are making energy efficiency their first choice among energy options.

Utility Program Recommendations

Considering the institutions available to carry out energy efficiency and conservation programs in rural areas, electric co-ops and municipal utilities appear to be in the best position to lead the campaign. These utilities are already in the field, know about energy use, are respected institutions, and already charge customers through monthly utility bills. At the same time, these utilities will have to accept a new and challenging action agenda if they are going to become effective champions for more efficient electricity use.

To gain the most for their specific system, utilities should analyze energy savings opportunities and achievable demand reduction potential, and develop energy savings goals that reflect the types of customers and loads they serve. Utilities should view promoting energy efficiency as a way to better serve their customers (by helping them reduce their energy use and energy bills), not as a threat to utility revenues and margins. Furthermore, delivering new energy efficiency services can and should be viewed as a business opportunity and potential new source of revenue for co-ops and municipal utilities.

Rural utilities should involve their rate-payers early on. These end-users will want to know the estimated impacts of the measures on their power bills, the broader economies in the overall service area, and other non-energy public benefits. Such early involvement builds credibility and trust in the utility, develops understanding of and support for the program, improves the speed and ease of program launch (which translates to program cost savings), and improves the performance of practices and measures implemented (which translates to improved program cost effectiveness). Finally, utilities should view their customers as partners in the pursuit of greater energy efficiency. Customers after all must agree to adopt efficiency and conservation measures. To motivate customers, utilities can appeal to both self-interest (saving money) and community pride with statements such as “we, the owners and end users, can improve costs and reliability in this electric service area by taking informed, responsible action.”

A. Begin with the Current Energy Harvest

This report suggests launching the first phase of energy efficiency and conservation programs through rural Southwest utilities without delay, and highlights the elements we suggest including in these programs. We cite many successful models for such programs, and they are applicable in one form or another in most service territories in the Southwest. Generally, efficiency and conservation programs should include educating customers regarding low-cost/no-cost options (paid for by the end-user) as well as promoting investment-grade efficiency measures that are paid for in part through utility rebates or financed by the utility through low-interest or zero-interest loans. These programs will deliver the most payoff where the utility also provides supporting rates, incentives, and regulations; optimizes program budgets by leveraging program partner contributions; provides consumers with credible and practical information; and performs a “prospects triage” specific to the region to focus limited program resources. At the same time, we urge utilities not to ignore underserved market segments such as low-income households, in order to achieve broad customer benefits.

B. Prepare for the Follow-On Energy Harvest

To support program growth and continuity beyond the initial phase, utilities will need to address a range of underlying market and behavioral barriers. Doing so will open up new market niches in this second phase and increase the cost-effectiveness of the program as it moves beyond the Early Adopters and into the range of Late Adopters and Laggards, market segments common to marketing campaigns of all types. In this phase utilities should improve energy-use awareness, program delivery, and communications to overcome end-user apathy and perception of “hassle”; find ways to make energy saving visible and desirable; address split incentives; develop a private sector marketing and delivery infrastructure; develop major rebate programs and low-interest or zero-interest loan funds to reduce first-cost resistance; and resolve the “windshield cost” issue with innovative program delivery that minimizes site visits.

Utilities also could encourage the adoption of state-of-the-art building energy codes in rural communities to ensure that new buildings and major renovation projects meet a minimum level of efficiency. Energy codes help to address the split incentives between builders (who want to minimize first cost) and buyers (who will be paying the energy bills). Good energy codes make sense in part because it is more practical and cost effective to construct buildings “right” than to try to retrofit energy efficiency measures later. In addition to advocating for state-of-the-art codes, utilities can offer builder and contractor training on how to comply cost effectively with energy codes, and how to prosper through the substantial rural building renovation effort that will result if utilities implement comprehensive energy efficiency programs.

C. Help Plant the Next Energy Efficiency Crops

Utility energy efficiency and conservation programs place most of their emphasis on promoting and encouraging widespread adoption of well-established measures and practices. But utilities in rural areas may also want to engage in research, development, and demonstration (RD&D) on the next generation of efficiency practices and measures. Utilities can test and demonstrate such promising technologies as adding thermal mass to buildings, improved daylight harvesting, light-emitting diodes (LEDs), retrofit passive solar heating, new evaporative cooling technologies, heat pump water heaters, low-cost demand indicators and controls, and localized heating and cooling of people rather than entire buildings. By performing RD&D, utilities can evaluate what impact the new technologies will have on customers’ energy use and load profile, assess how customers react to the technologies, and determine whether the technologies are likely to be cost effective and accepted. If the results are positive, the utility may want to take the lead in marketing and promoting a new technology; e.g., as some rural utilities have done in the case of ground-source heat pumps.