Rural Realities

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Tackling the Rising Cost of Electricity:

Options for Rural America

By Amy Glasmeier, Massachusetts Institute of Technology

In Brief...

The Situation:

Rising and volatile energy prices are straining household budgets and particularly those of rural residents who often pay a higher percentage of household income for basic goods such as energy, including electricity and gasoline.

With demand for electricity growing and the existing infrastructure stretched, consumers are shouldering considerable costs for new generation, transmission and distribution facilities.

Even in regions where no new facilities are planned, consumers likely will see higher costs as utilities implement new state and federal policies mandating reductions in emissions.

Innovative solutions to lower prices and conserve electricity exist, but strong leadership and vision are needed to facilitate adoption and implementation throughout all of rural America.

Policy and Community Options:

Given that rural consumers are least likely to be able to shoulder the costs of more comprehensive energy strategies, financial incentives are needed to encourage conservation and energy efficiency. These can take the form of:

- Programs with cash rebates and low-interest loans to help homeowners and businesses purchase and install more energy-efficient equipment including lighting, water-heating equipment and heating and cooling systems;
- Installation of advanced metering technologies that enable customers to monitor their use.

Communities also need to look into adopting more stringent building codes for both renovation and new construction. At the same time, utilities can implement programs to promote energy efficiency and conservation. These can include:

- Calculating bills using real-time pricing of electricity;
- Instituting demand-curtailment programs in which customers agree to suspend or interrupt service at peak demand in exchange for lower rates or monthly credits;
- Encouraging smaller electricity customers to join together in “power pools” to increase their scale of demand and thus, reduce their cost per kilowatt hour.

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High Cost of Electricity Strains Rural Consumers

Rapid increases in energy prices are hitting the average American hard as their costs outpace wages. Rural families are hit even harder than their metro counterparts because they earn lower wages and face greater pressure from global competition owing to their dependence on jobs in manufacturing, natural resource extraction and processing, and the low-wage service sector. Those living in rural areas also tend to pay higher prices for electricity due to long distances between population settlements and variations in terrain, which add to transmission costs. Pressures on household budgets are even greater in states that have deregulated electricity generation and distribution as rates have risen anywhere from 10% to 60% after rate caps or freezes were lifted.

Utilities are in the business of producing and selling energy. Consumers, on the other hand, must figure out on their own how to reduce consumption and lower their electric bills. While individuals can experience immediate relief by reducing demand, more profound and longer-term change is needed in how Americans manage their electricity. Our research shows that the benefits of lower electricity consumption can be enjoyed without major lifestyle changes or sacrifices in the quality of life or in the nation's economy.

No single set of policies can address the needs of all American communities. Nevertheless, policies from across the country, some of which we outline below, provide a variety of options for taking the sting out of price hikes, maximizing public and member funds, and potentially eliminating the need for new, large power generating plants.

How the American Power System Works

Historically, electric utilities owned every step of the supply chain. They generated power and sent it over utility transmission and distribution lines to customers within a defined geographical area. As monopolies, electric providers controlled geographic territories and dominated markets for energy. Utilities were granted monopolies by states because to be efficient, power plants had to be large. To protect consumers from price gouging, states regulated electric rates.

Recently, a number of states chose to deregulate electricity generation by decoupling generation from distribution. The expectation was prices would decline as new competitors entered the market for energy generation. In states that deregulated, new entities—called load-serving entities (LSEs)—

emerged to sell the power to consumers. These LSEs also own the distribution lines.

Deregulation has not produced anticipated decreases in energy prices. Decoupling production and distribution failed to entice new competitors into the market. New generation capacity is very costly and new competitors face significant economies of scale and high barriers to entry. Thus, the absence of market competition has resulted in rising energy costs. The states that have deregulated have large urban centers, but many such as New York, Pennsylvania, Ohio, Iowa and Minnesota also have large rural populations. Some states have such high demand that they must buy electricity from neighboring states or regions while other states have ample supply to sell.

Unlike the national interstate highway system, whose cross-state grid of roads is regulated by the federal government, the electrical grid is a mix of investor-owned utilities (IOUs) and publicly owned utilities in

Table 1: Market Share of Electric Utilities by Ownership

	Number of Utilities (2006)[1]	Market Share (2006)[2]	Governance Structure[3]
Description of Fields Above	*Number of utilities with this ownership model in the U.S.*	*Share of the total electricity market in the U.S. based on number of consumers*	*Description of Governance Structure of utilities by type*
Investor-Owned	236	68.1%	Privately owned entities that occupy service monopolies to generate, transmit, and distribute energy
Member-Owned/ Cooperatives	933	12.7%	Owned and operated by members, often located in rural areas
Municipal-owned/ Public	1954	14.7%	Nonprofit government agencies that distribute power and provide energy to consumers at cost

Notes:
There is a clear divergence between the ownership model with the greatest number of entities in the energy market and the number of consumers they serve. Investor-owned utilities account for less than 8% of the number of utilities but serve 68% of the U.S. electricity market. **SOURCE: This table and brief analysis were prepared by Michael Patullo.**

[1] Numbers and Market Share calculated from data available at www.eia.doe.gov/cneaf/electricity/esr/table10.xls.

[2] Percentage market share does not equal 100% due to the existence of federally-owned and power market ownership structures that make up 4.5% of consumption.

[3] Adapted from http://www.eia.doe.gov/cneaf/electricity/page/prim2/toc2.html.

a regulatory environment that varies from state to state. Also known as private power companies, IOUs are regulated by state public utility commissions, which determine consumers' rates and set policies. While fewer in number than publicly owned utilities, IOUs serve many more customers.

Public utilities are municipally owned (MOUs) or member-owned called cooperatives (that is, rural electric coops or RECs). MOUs can cover rural and urban areas and can provide power to residents and businesses outside the specific municipality. Elected or appointed officials generally govern these municipal utilities. RECs are dedicated to providing electricity to rural customers. Their member-elected boards function as the decision makers although some state commissions have regulatory authority over such entities (See Table 1 for information on the market share of electric utilities by ownership type).

The size of the customer base is a critical characteristic of electric power systems, particularly as companies face volatile fuel prices and cost management pressures. IOUs' large customer base allows them to more readily invest in new energy-efficiency technologies as they can spread the costs of those investments across a wider base of customers. In contrast, small distribution systems, whether municipal or cooperative, have fewer customers among which to spread those costs, which impede the adoption of new technologies, particularly those requiring significant capital outlays. Their size may also limit the ability of individual MOUs or RECs to influence regulations and legislation. Those that do not own generation may be at a disadvantage as well in bargaining with suppliers.

Also significant are power systems' energy sources. States with access to large supplies of coal and hydropower, for instance, have traditionally had lower energy costs than those that must buy power to meet electricity demand, such as California or states in the Northeast. This is also one reason why both California and states in the Northeast have pioneered programs to take the bite out of energy prices.

Volatile and increasing fuel prices, however, are making cost management an issue beyond California and the Northeast. So are brownouts and blackouts caused by strains on the power grid. In this uncertain climate, policies and actions are needed to help citizens rein in energy costs.

Promote Energy Efficiency Through Public, Private Investment

Energy-efficiency policies have been shown to reduce electricity consumption, a first step in addressing price volatility and protecting the environment. These practices and programs focus on lowering energy use by upgrading building codes and by investing in more efficient lighting, water-heating equipment and heating and cooling systems and processes. Energy-efficiency strategies can be tailored for homeowners and farm operators, businesses and industries, school districts and government agencies. Estimates are that energy-efficiency improvements alone can reduce by 20 percent the amount of electricity Americans are projected to consume in 2030.

A recent report by the American Council for an Energy-Efficient Economy (ACEEE) shows the effectiveness of energy-efficiency policies. The dozens of programs profiled by ACEEE have collectively reduced consumption by more than 2,400 gigawatts (GW) of electricity —or the amount of power used by the entire state of New Hampshire for a year. In doing so, they have saved customers hundreds of thousands of dollars. In some states, these award-winning programs are administered by utilities. In others, government agencies or public-private partnerships have administrative oversight.

ACEEE recently outlined energy-efficiency policies for Maryland after two of the state's utilities proposed rate hikes of between 13% and 72% following deregulation of the industry. These policies are estimated to cut electricity bills by a net of $860 million by 2015 and to have a return of $4 in lower bills for every $1 invested. The policies, which include more stringent building codes and expanded demand-reduction programs by utilities, also have a goal of reducing per capita consumption by 15% by 2015.

Such savings come with a price. Estimates are that an energy-efficiency policy with a goal of a 5% reduction in electricity use by Pennsylvania consumers, for instance, would cost between $400 million and $800 million annually. But the benefits from lower market prices and less intensive use of peak-demand generation would be about $1.9 billion annually.

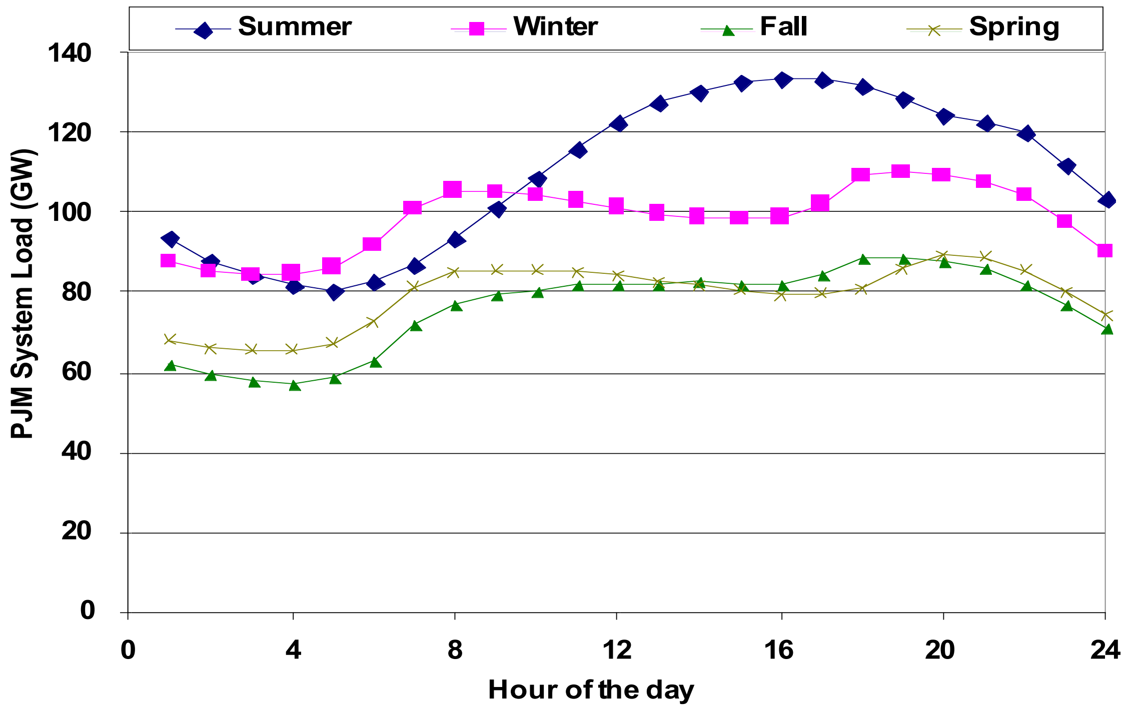
States with energy-efficiency policies typically have adopted a "public benefits charge" to pay for the programs. Some states use a per kilowatt (kW) charge, others a per kilowatt-hour (kWh) charge, and still others a flat percentage of the electricity bill.

In Vermont, customers are assessed an "Energy Efficiency Charge" based on their total or peak demand, a charge that will generate almost $31 million in 2008. Efficiency Vermont, created by the legislature in 2000 to run the state's energy-efficiency programs, will use funds on services including energy audits, evaluations of energy-efficient equipment and processes and coordination of purchase programs. According to the 2005 audit of Efficiency Vermont, the return on investment (ROI) for each dollar spent in the residential sector is $1.51; in the commercial and industrial sectors, $1.97.

Wisconsin's energy-efficiency programs are funded by the utilities' payment of 1.2 percent of electricity and natural gas revenues—a rate calculated on a three-year average—which was expected to generate about $63 million in 2008. About half of that will provide financial incentives such as cash rebates and low-interest loans to help homeowners and businesses purchase and install more energy-efficient equipment and technologies. The remainder will provide technical assistance and consulting services, education and training programs and marketing.

In 2007, Minnesota revised its energy-efficiency legislation to require utilities to fund energy efficiency programs at a minimum of 1.5% of their gross annual retail energy sales. These programs help finance retrofitting, purchase of new appliances and installation of more efficient lighting for residential customers and commercial/industrial entities. According to the Midwest Energy Efficiency Alliance (MEEA), the programs ". . . could save Minnesota families and businesses . . . $525 million in direct electricity savings over the next five years . . ." In addition to programs run by the Conservation Improvement Program (CIP), the Minnesota Housing Finance Agency (MHFA) offers low-interest loans for property owners looking to develop energy efficient housing or retrofit an existing site.

Figure 1: PJM Load Curves by Season



Demand for electricity historically peaks during the summer months. Figure 1 shows a typical seasonal demand pattern for the PJM Interconnection, which includes much of the Mid-Atlantic. To meet that demand, utilities must dispatch generators known as "peakers." Typically, these peakers can be turned on and off quickly, but are highly inefficient, more expensive to operate and more apt to have high emissions of greenhouse gases and other pollutants. Peaking generation represents 15% of the total capacity in the PJM Interconnection, but this capacity is used only 1.1% of the time. Lowering peak demand by even a few percentage points would reduce the need to use these plants and would lead to considerable savings.

Reining in Electricity Consumption by Reducing Total and Peak Demand

Changing patterns of energy use are another means of lowering the rising cost of electricity in rural communities. These policy options include voluntary reduction of total energy consumption, particularly at peak demand when heat waves or cold spells ratchet up demand.

Real-Time Pricing

One effective strategy in lowering total consumption is calculating bills using real-time pricing of electricity. Currently, most electric customers pay an electricity rate calculated by averaging the cost of generation over all hours in a day and over many days. Yet, the cost of generating electricity varies with demand. During peak demand, utilities must add generating units called "peakers" that typically have higher operating costs than the more efficient units that provide electricity on an ongoing basis. Because consumers do not know when peakers are added, they have no incentive to reduce their power consumption or shift consumption to nonpeak times. Real-time pricing makes the peaks explicit. Figure 1 presents an example of seasonal demand for electricity at various times of the day in the mid-Atlantic region.

A year-long project sponsored by the U.S. Department of Energy's Pacific Northwest National Laboratory demonstrated that consumers will vary their consumption when they know the price of electricity. Armed with the ability to check their electric usage and the price for electricity, 112 homeowners in Washington's rural Olympic Peninsula changed their behavior and reduced their electric bills by an average of 10%. With that average savings, homeowners could recoup investment in such systems within four years—if they were commercially available.

Demand-Curtailment Programs

Some utilities have pegged demand-curtailment programs to peak times when the grid is strained and the price for electricity is higher. In these programs, customers agree to suspend or interrupt service for lower rates, monthly credits or even payments. Such programs have been available to large commercial and industrial customers in urban areas for years. But demand-curtailment programs also can benefit rural customers who are able to lower consumption by turning down or off noncritical equipment, changing settings on HVAC (heating, ventilating and air conditioning) equipment or using backup generators. In addition, smaller electricity customers could join together in "power pools" to create large entities for demand reduction. This would make for more cost-effective contracts for both an electric utility and for customers.

Advanced Metering Technologies

Advanced metering is another opportunity to reduce demand. These options include "next generation" automated meters and advanced software and communications technology that enable customers to control their appliances from hot water heaters to air conditioners in response to real-time prices

Wastewater Plant Turns Down the Power for Big Savings

Peter Laramie, head operator of the Fair Haven (Vt.) Wastewater Treatment Facility, got a bonus when he solved a pH problem—an $8,200 savings in the plant's electricity bill.

Needing to increase alkalinity in the plant's treatment process, Laramie changed how often he ran the plant's aerators which had been running around-the-clock. That not only balanced the pH but also reduced the plant's annual $58,000 electricity bill.

The savings prompted Laramie to contact *Efficiency Vermont* about other ways to cut electricity consumption—which had been increasing.

With a $9,000 rebate from *Efficiency Vermont*, Laramie purchased variable frequency drives (VFDs) to further improve the treatment process. These VFDs adjust treatment equipment as needed to meet oxygen requirements. Estimates are the VFDs could save the plant up to an additional $9,000 a year by further lowering electricity consumption.

And the good news for the facility's 850 customers? No rate increases.

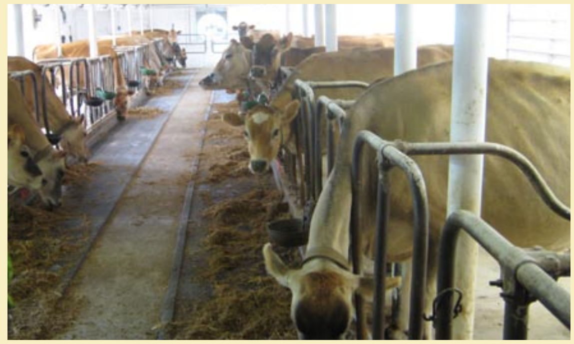
Wisconsin Dairy Farmer "Milks" Electricity Savings

In fall 2007, Wisconsin dairy farmer Tom Seuss installed a new piece of equipment which can lower the temperature of milk collected from his 50-cow herd in about half the time needed by his old system. The equipment reduced his electricity bill, too—by close to 10 percent.

While other factors may have influenced that drop, Seuss knows the bulk of the savings can be attributed to his investment in the more energy-efficient equipment.

Prior to purchasing the plate cooler, the fourth-generation dairy farmer from Green Bay had to run the 5-HP compressor serving his milk tank between six and eight hours a day—equivalent to about 31 kilowatt-hours of electricity. Now that compressor only has to run three hours a day.
To make the upgrade, Seuss took advantage of Wisconsin's public-private *Focus On Energy* program which first helped him to identify where he could save energy and then offset some of the purchase price with a rebate.

That program, funded annually by 1.2 percent of the gross revenues of the state's electric utilities, provides residential property owners and business owners with direct technical assistance through energy audits and equipment referrals. It also



includes financial incentives such as low-interest loans, rebates and incentives to help with purchase and installation of more energy efficient technologies.

Seuss participated in the Agriculture and Rural Business Program, administered by private contractor GDS Associates, Inc. Since the program's inception in 2001, GDS Associates has helped more than 2,000 farms and agribusinesses save more than $11.5 million annually by reducing purchases of electricity, natural gas and propane. Overall, for every dollar invested in the program, $2 is saved.

Next up for Seuss is the purchase of a variable-speed vacuum pump, which GDS Associates estimates will double the energy savings of his plate cooler. "Sometimes you got to spend a little to see the savings," Seuss says.

and conditions. In these systems, consumers can "see" their electricity use on in-home devices and over the Internet and can lower thermostats or turn off appliances at home or remotely when electricity rates are high. Although these technologies require substantial investment, pilot projects like the one in the Olympic Peninsula point to short-term gains in changing customers' energy habits and long-term benefits in improving power plants' operational efficiencies.

Rural Americans' Self-Reliant Attitude Important for Defusing High Energy Costs

Today's high energy costs challenge consumers to actively manage their energy use. Conservation does not require large sacrifices, just good decisions and management of our energy use. A target of 5% reduction in electrical energy generation is reasonable given new technologies and greater monitoring of energy use. Resources are readily available showing consumers how to be energy efficient.

Without question, increasing energy efficiency will lead to immediate relief from volatile prices. The key, however, is introducing new technologies and changing the behavior of consumers.

New technologies make increased efficiency and conservation not only possible but convenient. Unfortunately, not all utilities are ready to roll out these technologies. Rural residents must demand that their utility companies, regulators and political leaders invest in energy-efficient technologies that will result reduce peak and total demand.

Rural communities also need better and more complete information about their energy use, so that they can make good choices about consumption. As the above examples of initiatives show, consumers will change their behavior and reduce demand when provided with real-time information about costs.

This brief offers examples of communities and states that have successfully taken charge of their energy futures by informing themselves, defining targets for utilities and investing in currently available technologies. Rural communities can and should expect more from their utilities in the form of information and new energy efficiency technologies. However, the quickest way to lessen the sting of high energy prices is to provide incentives for consumers to conserve.

Glossary of Terms

Blackout — Term used to describe a loss of electricity; differs from "brownout" which involves a momentary voltage sag as occurs when lights flicker.

Demand response/demand curtailment programs — Involve a contractual agreement between customers and utilities or regional electricity-grid manager whereby the utilities can suspend or interrupt electricity service. The customers are compensated for the voluntary suspension or interruption of their service either by credits or payments. The goal of these programs is to reduce peak demand, so that the more expensive generating plants—known as "peakers"—do not have to be fired up. The contracts can cover day-to-day service or years.

Deregulation — Until the 1990s, states' electricity utilities had their rates set by state regulators. These rates covered the utility's costs, plus a guaranteed rate of return set by the regulators. With deregulation, utilities compete to sell power, and rates are determined by competition.

Gigawatt (GW) — One billion watts of electricity. One GW of electric generation capacity could produce enough electricity to power more than 14.5 million homes (http://www.newton.dep.anl.gov/askasci/eng99/eng99151.htm).

Interruptible load contracts (see also demand response/demand curtailment programs) — A contract offered by utilities to individual customers which enables the utility to suspend or interrupt electric service during specified periods (e.g., when prices are high or when blackouts could occur). Typically, customers receive an incentive for participating in the form of a monthly credit or a payment.

Kilowatt (kW) — A measure of electricity use at any given point in time or the amount of electricity required to operate a device.

Kilowatt-hour (kWh) — The total amount of electricity used during the course of one hour. One kilowatt-hour is approximately the amount of electric energy required to serve one household for one hour during the day.

Megawatt (MW) — One thousand kilowatts or one million watts of electricity.

Peak demand — The specific time of year when demand for electricity is highest. Peak demand in many states generally occurs during the summer.

Public utility commission — A state regulatory body that sets rates and terms of service for electric utility companies.

Real-time pricing — A pricing mechanism which charges customers based on the actual cost of electricity service at the time of consumption. Real-time pricing contrasts with the pricing mechanism typically used under regulation, where consumers faced fixed or average electricity prices.

About the Author

Dr. Amy Glasmeier is Head of the Department of Urban Studies and Planning at Massachusetts Institute of Technology (MIT). Prior to joining the faculty at MIT, Glasmeier served as professor of geography and regional planning at The Pennsylvania State University, where she also served as director of the Penn State Center for Policy Research on Environment, Energy and Community. Her research focuses on economic opportunity in rural America with particular emphasis on the geography of poverty. Ongoing projects include analyses of the renewable energy industries and energy efficiency as an economic engine for Appalachia and other rural regions; accessibility and adequacy of health care for rural-based Iraq war veterans through the Veterans Administration; and regional resilience in Appalachian communities. This research is supported by the Ford Foundation, Appalachian Regional Commission, U.S. Department of Agriculture and the Center for Rural Pennsylvania. Dr. Glasmeier is a co-editor of Cambridge Journal on Regions, Economy, Society and of Economic Geography.

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The *Rural Realities* Editorial Board has identified the following as high priority issues:

- The housing and financial crisis: The potential for a looming farm crisis?
- The knowledge and creative economies: Are these feasible in rural America?
- Changing mental health and healthcare needs of rural areas.
- Impact of high cost of energy/fuel for rural America.
- Rural development in regions heavily impacted by immigration.
- The digital divide, telecommunications, and rural development.
- Local food systems and agricultural diversification.

Interested in addressing one of the high priority topics, or suggesting other possible issues for the series? Potential authors should prepare a one-page abstract of their proposed article and submit it to the new series co-editors, or contact them to discuss your ideas.

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Mark Brennan
University of Florida
brennanm@ufl.edu
352-273-3524

Deborah Tootle
Univ. of Arkansas Ext.
dtootle@uaex.edu
501-671-2228

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Rural Realities is a quarterly publication of the **Rural Sociological Society (RSS).** Its purpose is to: (1) Provide valuable insights on the current and emerging issues impacting people and places in rural America and beyond; and (2) Offer policy and program options that might prove effective in addressing important rural challenges and opportunities. Articles showcased in the series draw upon high quality social sciences-based studies conducted by researchers and practitioners located within universities/colleges, government, philanthropic, and nonprofit organizations.

The **Rural Sociological Society** is a professional social science association that promotes the generation, application and dissemination of sociological knowledge. The Society seeks to enhance the quality of rural life, communities and the environment through research, teaching, and outreach/extension education.