

# Energy Alternatives

Renewable resources provide cost-effective, reliable rural energy.

by *Meghan Soderstrom*

**F**armers and ranchers interested in reducing their energy bills gathered at the 100th National Western Stock Show (NWSS) in Denver, Colo., Jan. 14 for an educational presentation on renewable energy systems. The workshop was titled “Solar, Wind and Biomass Energy for Farm, Ranch and Home.”

Led by engineers from the U.S. Department of Energy (DOE) National Renewable Energy Laboratory (NREL), Golden, Colo., the workshop introduced the advantages of solar, wind and biomass energy systems and described how energy efficiency can combine with renewable energy to meet rural electricity needs.

“Renewable energy systems provide the cheapest and most reliable way to meet the electricity needs of farms and ranches,” John Thornton, NREL engineer, said.

“For many rural families, installing a solar or wind system is often cheaper than running a new power line if electricity is needed one-quarter mile or more away from an existing power line,” he continued.

Using alternative energy can help rural families reduce their utility bills, stabilize their electricity supply and reduce America’s dependence on foreign energy supplies, NREL engineer Ralph Overend said.

In his 2006 State of the Union address, President Bush outlined his national goal to replace more than 75% of U.S. oil imports from the Middle East by 2025. Alternative and renewable energy can help meet that goal.

Rural applications for renewable energy can include pumping water for livestock, powering electric fences, providing hot water for home and farm use, and powering buildings and equipment far from utility lines. Because renewable resources provide reliable energy independent from the electricity grid, it can help protect users from electricity price spikes and power outages. And, the environmental benefits of renewable energy are not to be overlooked, Thornton reminded workshop attendees.

## Energy efficiency

Thornton encouraged attendees to improve their energy efficiency before implementing an alternative energy system. “Energy efficiency is the quickest, cheapest and cleanest way to reduce your fuel bill.

“If you don’t use the energy in the first place, you don’t have to generate it, you don’t have to buy it, and you don’t have to store it somewhere,” he said. “The best way

to save money is to decrease your energy use.

“That doesn’t mean going back to pre-1900 living conditions,” he explained. “You can have a very modern, energy-efficient house with all the modern conveniences and still use energy efficiently that is powered by renewable sources.”

Take a look at your monthly utility bill to see how much energy you’re currently using. The average U.S. household spends more than \$1,500 annually on energy, according to the DOE. Thornton said purchasing energy-efficient appliances is one of the easiest ways to reduce your energy usage and, in turn, your expenses.

“For every dollar spent on energy-efficient appliances, you can save between \$3 and \$7,” he said. “Home Depot, Lowe’s and other such stores sell everything that you would need to improve your efficiency.”

For in-home energy saving tips, visit [www.eere.energy.gov/consumer/tips](http://www.eere.energy.gov/consumer/tips).

## Solar power

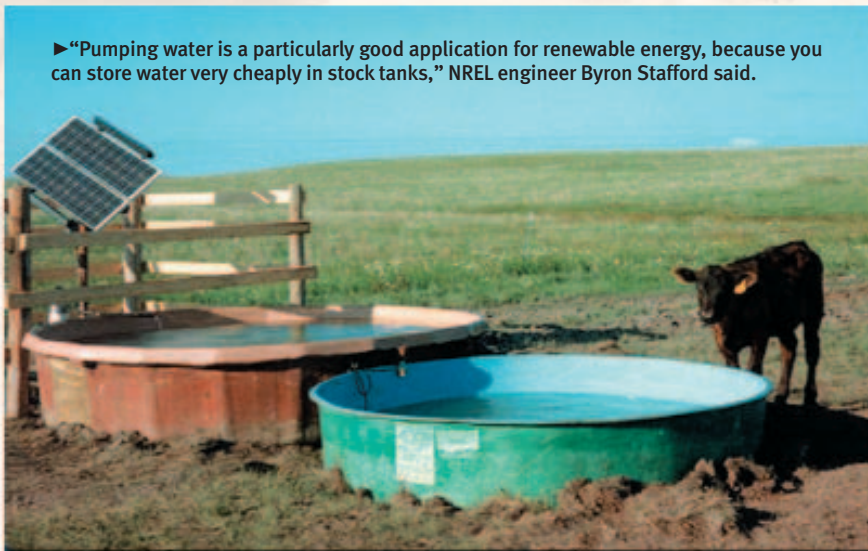
Solar panels, NREL engineer Byron Stafford said, are an efficient option for the world’s top priority in energy use — pumping water.

“Pumping water is a particularly good application for renewable energy, because you can store water very cheaply in stock tanks,” Stafford explained.

When new livestock watering sites are needed in remote areas, solar panels are often an economically efficient alternative to extending power lines. Stafford said a typical system, including two solar panels and a submersible pump, costs approximately \$4,700 for installation and equipment. Other than minimal routine maintenance, that is the extent of the system’s expenses.

One way to increase the efficiency of a solar-powered water pump is to install a solar tracker. Although they are optional for most systems, Stafford said solar trackers optimize energy production by rotating the panels so they face the sun as it moves across the sky. This increases the effective

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PHOTOS COURTESY OF THE NATIONAL RENEWABLE ENERGY LABORATORY



► To provide supply security, livestock watering tanks should be large enough to hold a three-day supply of water.

length of the pumping day and decreases the number of panels needed to deliver the same amount of water.

“You will be able to pump a lot more water with solar trackers on your panels,” Stafford said. “Even though they’re optional, they’re worth it because they increase your ability to store water.”

Managing water storage is a key component of a successful solar-powered water system. In calculating the volume of water needed, consider the daily requirements of each animal and the season of use, since daily requirements can fluctuate. To provide supply security, livestock watering tanks should be large enough to hold a three-day supply of water, according to Altair Energy Natural Electric Solutions, a company specializing in solar-powered livestock watering systems. Greater storage volume may be required if a backup source of energy is not available.

Solar power also has practical applications in preventing livestock watering tanks from freezing in the winter, Stafford said. In addition to powering water bubblers, solar panels can economically heat the water to prevent the temperature from reaching the freezing point.

Depending on your area, the cost of extending a power line may be more or less than installing a solar-powered water system. However, Stafford said you should remember that traditional electricity continues to generate expenses after it is hooked up, because you must pay for your usage. Renewable energy, on the other hand, generates minimal expenses once installed because the source of power — the sun — is free.

### Wind power

Rural America harnessed wind power many years ago, NREL engineer Jim Green said, and windmills continue to be used on farms and ranches today. Texas and California lead the nation in wind power produced on commercial wind farms, but all 50 states have enough wind to power turbines sized for home use. Thirty-seven states have wind resources that would support utility-scale wind power plants, according to the DOE.

In addition to using windmills and wind turbines to generate electricity for farm use, Green said landowners can receive payments from “big wind farm companies” for having a utility-scale wind turbine on their property. Since wind turbines have a small “footprint,” very little land is removed from farm use, and livestock can be grazed right up to its base.

Combining solar and wind power can be very complementary for water-pumping systems, he said. Wind power picks up in the spring and winter, but it falls off in the summer when more solar power is available. Wind resources are greatly influenced by your location, specifically the land’s topography, as well as the height at which you plan to put the turbine.

“For wind turbines, the taller the tower, the better the wind resource,” Green said.

### Biomass

Increased gasoline and diesel prices appear to be around to stay, so the switch to homegrown fuels looks more promising, Overend said. Biomass is any plant material or animal waste that can be used for fuel.

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### Customize your system

Before installing a renewable energy system, engineers from the U.S. Department of Energy (DOE) National Renewable Energy Laboratory (NREL) strongly encourage farmers and ranchers to evaluate their specific situation and develop a system that matches their energy needs to the natural resources available. They suggest following these steps:

1. Determine your current energy usage (look at your energy bill) and account for predictable future usage increases.
2. Determine your current annual energy costs based on your usage. Consult with your local utility provider about the expenses of extending existing power lines if you desire electricity in a new area.
3. Implement energy-saving and conservation measures to improve your energy efficiency. By more efficiently using energy, you decrease the amount of energy you would need to produce from renewable sources.
4. Evaluate different sources of renewable energy, and determine which natural resource best fits your location.
5. Design a hypothetical renewable energy system based on that resource’s performance in your location. Ensure it is properly sized to meet your energy needs.
6. Divide the renewable system’s installation and equipment expenses by its expected years of life to determine the annual cost. Look into financial assistance programs, and compare the annual cost of the renewable system to the annual cost of traditional electricity.
7. Choose the system that best provides economical, reliable energy for your needs.

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The United States' most well-known biomass is probably ethanol. U.S. ethanol production is growing at a rate that would double the industry every five years. Other biomasses, such as gasohol and biodiesel, are also becoming more popular, Overend explained.

Gasohol is created by adding 10% ethanol to gasoline, which reduces carbon monoxide emissions. Biodiesel is made from waste cooking oils, such as soybean oil. It can be used in 5% blends in tractors and other vehicles, he said.

Using biomass is an environmentally friendly substitute for fossil fuel. It is an efficient and affordable substitute for fuels used on the farm or ranch, Overend said.

### Financial incentives

Renewable energy systems have minimal input costs once they are installed because, unlike traditional electricity, their power source is free, Thornton stressed. He reminded workshop attendees that if power is needed more than one-quarter mile away from existing power lines, installing a renewable system is usually cheaper than extending power lines; however, the initial investment required for system installation can still be a bit pricey.

"A typical solar-powered water pump producing 1,500 gallons from a 100-foot well will cost in the neighborhood of \$4,700. However, if you need to pump deeper or if you need a greater volume of water, you're going to need more energy to run the system, and that means initially higher equipment costs," Stafford said.

Fortunately, many state and federal programs are willing to provide financial assistance to farmers and ranchers.

"There are a lot of financial incentives available right now to use renewable energy equipment. There are federal incentives and state incentives. And, 2006 is going to be a banner year for paybacks," Thornton said.

Green agreed, saying, "Incentive programs offered by states, utility companies or by the USDA (U.S. Department of Agriculture) can be really valuable in making these alternative energy systems very cost effective."

The Farm Security and Rural Investment Act of 2002, often called the Farm Bill, can be a great resource for farmers and ranchers, Thornton said. "Section 9006 of the Farm Bill created grant and loan programs to help fund renewable energy systems and energy efficiency projects in rural America."

In 2003 and 2004, a total of \$44 million in grants were awarded to 281 agricultural producers and rural small businesses in 33 states, according to USDA. Under this year's program, the amount that can be awarded to a producer in the form of a working capital grant has been doubled to \$300,000.

"Contact your USDA Rural Development office, and they will help you put together your grant application," Thornton said. "The grant process will be easier in 2006, because USDA

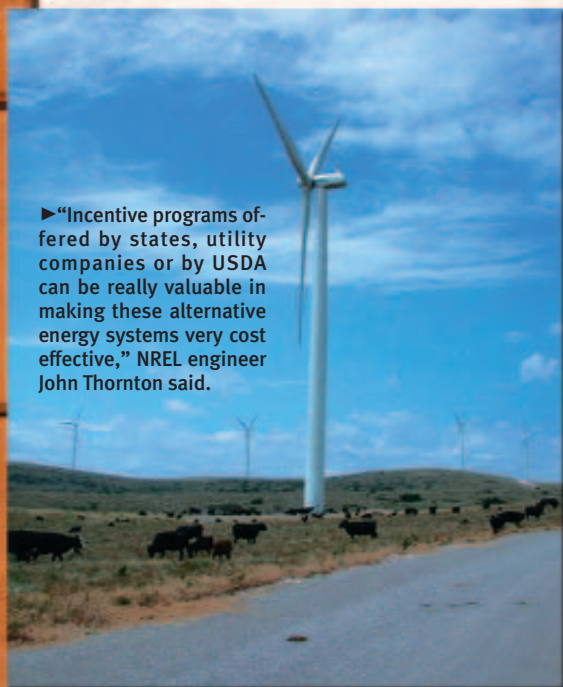


► NREL researchers in the DOE Biofuels Program are developing technology to produce ethanol from fibrous material.

has simplified the application process for grants on projects costing less than \$200,000." For more information visit [www.rurdev.usda.gov/rbs/farmbill](http://www.rurdev.usda.gov/rbs/farmbill).

Workshop attendees were also encouraged to visit [www.dsireusa.org](http://www.dsireusa.org). The Database of State Incentives for Renewable Energy (DSIRE) is a comprehensive source of information on state, local, utility and selected federal incentives that promote renewable energy. The Web site contains state-by-state listings of applicable financial incentives; state rules, regulations and policies; related programs and initiatives; and federal incentives.

The DOE also provides state-by-state information on renewable energy resources available in your area, including biomass, geothermal, hydropower, solar and wind energy. State maps showing wind and solar energy potential are also available, along with additional information about financial assistance programs. Visit [www.eere.energy.gov/states/alternatives/resources\\_by\\_state.cfm](http://www.eere.energy.gov/states/alternatives/resources_by_state.cfm) for more information.



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