Nebraska's Mr. Energy

When he needs power or heat or to get somewhere, Robert Byrnes' first question is always: is there any way for me to do this on my own?

BY LARAYNE TOPP

Robert Byrnes is a tinkerer and dreamer, a visionary and inventor. An organic chemist by education and an industrial chemist by trade, Byrnes' passion is renewable energy. His may not be a household name, but among those in the field he is well-known and well-respected for his contributions. He has testified about energy issues numerous times before Nebraska legislature because, "citizens are stakeholders," says Byrnes. "They have some skin in the game."

Byrnes bemoans some of our country's current energy policies, and how the general public forgets all about *going green* whenever energy costs dip. He reminds legislators at every opportunity about the potential for wind power that lies within reach. As a military veteran, he also sees a patriotic connection to energy issues: alternative fuels derived from local resources can reduce our country's dependence on foreign oil.

"Green is red, white and blue," he says.

Byrnes works with biofuel and solar energy researchers and producers across the state. "If Nebraska is to realize all of the opportunities that present themselves through renewable energy, we must first change the way we perceive and consume energy," he says. "We must not only be wise stewards of our current resources, we must be able to recognize energy in all its forms."

He is just one person, but Byrnes has vowed to make a difference. "I'm planted here," he says. "God's given me the opportunity, the training and the background to be here. My challenge is to make a difference, to work with legislators, to keep in touch with federal congressman. We need to be doing our part to supply our energy needs for our kids."

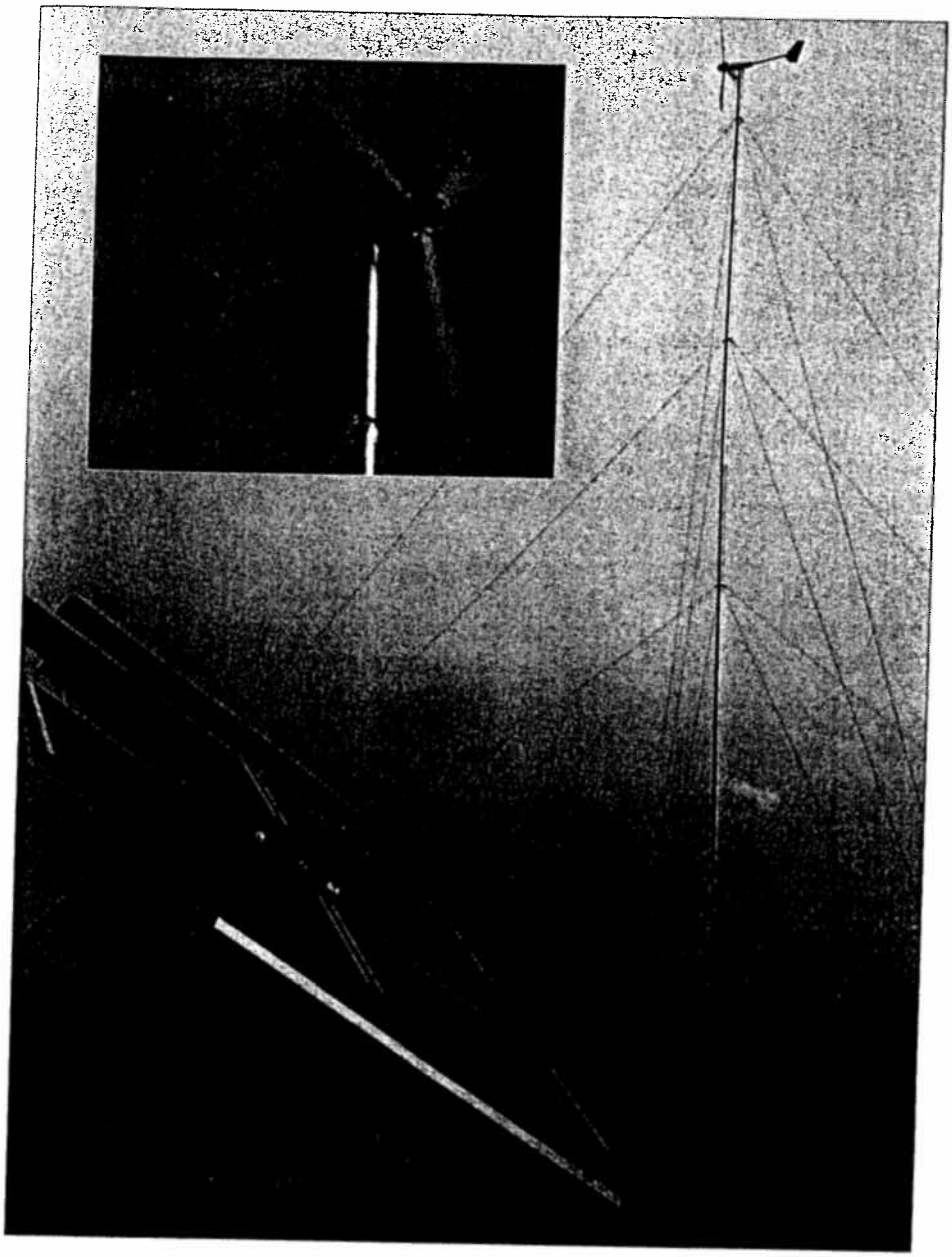
LaVern Raabe of Pilger, Nebraska, is Byrnes' co-worker in the push to harness the state's wind power. A retired mechanical engineer who worked in jet engine development, Raabe describes Byrnes as a true original thinker and doer. "Robert has certainly developed his skills in a large variety of alternative energy disciplines, which is an accomplishment in itself. We need people like Robert to push the boundaries of our thought processes."

When asked about the impact Byrnes can make in the uphill battle to convince people of the potential for renewable energy, Raabe compares Byrnes to a mosquito: if you think one person can't make a difference, just think of the power of a single mosquito when you're trying to take a nap.

Robert Byrnes is a relative newcomer to Nebraska. He grew up in New Jersey, and after serving in the military and working on the east coast, he realized he wanted to spend more time with his wife, Terra, and their four children. As Byrnes searched for a new home, he established three qualifiers. First of all, he was looking for a place to raise a family. He had discovered during his time in the military that soldiers from the Midwest were good, solid citizens. That piqued his interest in the center of the country.

Secondly, he narrowed his search geographically. Some states were too cold, others too hot, or too crowded. His third qualifier was prayer – with that, could there be any question Nebraska would come out on top? Byrnes took a position as an ag chemist and moved to Lyons in 1999.

After Byrnes arrived in Nebraska, he knew he wanted to live on a farm. Midwestern soldiers had told him they were proud of the degree of self-reliance they'd obtained through hard times on the farm.



Renewable electricity utilized on the energy farm is generated through a wind/solar mixture, with 500-watt solar panels capturing and directing energy from the sun to battery storage. Inset is the wind turbine that is used to power the farm.

"Kids who were beat the hardest bragged the loudest," Byrnes says.

That's how Byrnes found himself on a Nebraska acreage, which he labeled a *farmette* after seeing the size of most Midwestern farms. The move was quite an adjustment for the Easterners. They found themselves carrying water to their hilltop home from a well situated at the bottom of a hill. They attempted to raise and dress chickens without knowing that their feathers pick easiest when the bird has been scalded first.

"We had a couple of grand learning experiences," he says.

In addition to poultry, Byrnes soon found himself growing an interest in renewable energy. "Food, feed and fuel, they're all the same thing. Their basic energy components are the same," he says, throwing off ideas like sparks of static electricity.

Byrnes set out to make his *farmette* self-sufficient in energy, which led him to study the amount of electricity required to run basic appliances. An electric coffee maker uses 1,000 watts to brew coffee, as an example. His wind turbine could generate that amount of power in a 30-mile-an-hour wind, but the $5,000 his system cost made for a very expensive cup of coffee. "These inefficiencies stand out when you have your own power," Byrnes says.

That meant some appliances went out the door. The Byrnes family learned to live with less, using a fourth of the electricity they had previously. Solar panels manufactured electricity for lights, and ran a small refrigerator and television. They utilized wood and a solar-run corn stove for heat. They used a solar shower and propane-fueled water heater. A biodiesel generator ran their clothes washer, water pump and vacuum cleaner, as well as the family's tractor and car.

After several grapples with the local power company, Byrnes decided to take his *farmette* off the grid. In other words, he terminated his electrical service, and eventually asked the company to remove the poles that supported the electric lines running to their house and outbuildings.

Because that process happened sooner than Byrnes had planned, he wasn't fully prepared, he says, and found himself having to hook up a generator to the family's well. The immediate concern was water for the farm's livestock. Byrnes did the electrical wiring himself and miscalculated, connecting 220 volts to a 110 volt system without the use of a step-down transformer. He realized his mistake when smoke came rolling out of one of the kitchen appliances.

"I fried everything at the house," he says with a chuckle. "I'm trained as an organic chemist, not an electrician!"

The Byrnes' spent six years living off the grid, before moving to nearby Oakland. They were constantly making the 30-mile round trip to town to deliver youngsters to Cub Scout meetings and other activities, and with Byrnes as a Scout leader, the move into town made sense.

It was good timing, coinciding with Byrnes' plan to turn his home place into an energy research farm, providing examples of what certain energy systems look like, how they operate, and how they can be adapted for use in other locations. The goals of the energy farm, Byrnes says, are to showcase renewable energy resources, including wind, solar, biodiesel and methane, and to help individuals gain their own stake in their energy future by utilizing the resources available to them. Or as Byrnes' car license reads: *RENU NRG*.

"By seeing operating systems and equipment, people with renewable energy interests can better visualize how such a process could be integrated into their farm and home," Byrnes says. "This is not a white lab coat kind of research project. It is a functional application of renewable energy production and utilization in an agricultural environment."

In addition, college students can enroll in an internship program at the energy farm. Byrnes found that they needed to actually live on site to achieve the best results.

A look around the energy farm shows a number of projects: passive solar heat warms a chicken house; an old water heater gets new life as a biodiesel converter and brews 80 gallons a day; a methane digester in a farm animal lot turns manure into biogas that can cook meals and run a water heater, while the sludge airs in a drying bed for future use as fertilizer. All projects prove on a small scale what the possibilities are for a much larger installation.

"It's pioneering," Byrnes says, "but a lot of it's old technology."

FOR YOUR INFO:

To learn more about Byrnes' enterprises, check out the Nebraska Renewable Energies websites at: http://nerenew.com; www.NebraskaREA.org; www.NebraskaScrewPress.com; and www.NebraskaGreenFuels.com.

Windmills, which once operated on every farm across the Midwest, point the way toward wind turbines. "Nebraska has very good potential in this area, and solar technology works well with wind," Byrnes says. "Typically, cloudy days have plenty of wind, and windless days are generally very sunny. They dovetail nicely together. Wind power should be the first choice of strategically placed Nebraskans, but others in town or low areas can consider the silent power of solar energy. The beauty of solar is that the systems just sit there, no noise, nothing moving, just making electricity in the sun."

Essentially, the electricity utilized on the energy farm is generated by a hybrid wind/solar system: a one kilowatt wind turbine coupled with 500-watt solar panels that capture energy from the sun. Like most other small scale systems, it uses a direct current (DC) charging system to store power in a battery bank for use when the wind is not blowing, according to Byrnes. This energy is then converted to alternating current (AC) as needed. Power from a biodiesel-fueled generator is also available when necessary.

Byrnes thinks biodiesel used on a farm should be derived from raw materials produced in the area. He combined fats rendered from livestock raised on the energy farm with oil from oilseeds such as soybeans, mustard and sunflowers to create biodiesel. Byrnes has also experimented with other raw materials.

LaVern Raabe teases Byrnes that his kids' breakfast isn't even safe unless they padlock the refrigerator. Byrnes has been known to sneak out the strawberry jam and use it to make biodiesel. Evidence that Raabe's joking might not be far off the mark can be seen in row upon row of jars that line the shelves at the research farm, each with a type of biodiesel made

from various kinds of materials.

Byrnes takes advantage of unusual opportunities to educate the public. Every year since 2006, Byrnes has spoken to hundreds of attendees at the Nebraska State Fair about renewable energy. To demonstrate that the potential for such energy is everywhere, he retrieves the used cooking oil from vendors – oil that was used to prepare everything from corn dogs to fried pickles on a stick – and disposes of it safely and efficiently by transforming it into biodiesel.

At one fair, Byrnes was cruising the midway in his old farm truck with a couple of empty 55-gallon drums in the back when he caught sight of a life-sized cow sculpture fashioned from 600 pounds of butter. Byrnes convinced the butter donor and sculptor to let him recycle the golden spread, and he was able to produce more than 75 gallons of biodiesel from something that is typically thrown away.

"Everyone involved was very pleased to know the materials used were recycled, and it was a great opportunity to help broaden our definition of where energy can be found," Byrnes says. "While not economically practical at $15 per gallon, butter biodiesel represents the production of fuels from a dairy source, not a fat or vegetable feedstock." Plus it was, "kind of neat to think about milking diesel for the truck from old Bessy."

Soybeans, not butter sculptures, are typically utilized in the manufacture of biodiesel. Accordingly, Byrnes and partners have worked together to come up with a soybean crusher, under the first biodiesel license issued in the state. As they were the first ones to apply, the group worked with the Department of Revenue's Motor Fuels Division to set up a revenue code.

"You need a license for the first gallon," Byrnes says, and there are now three classes for biodiesel production in Nebraska: self-consumption, which covers up to 5,000 gallons; micro-scale, in which the producer can make up to 100,000 gallons and sell it to others; and a full commercial license.

For first-time projects such as these Byrnes aligns himself with investors he calls early risk takers. Those risk takers set up the Northeast Nebraska Biodiesel plant at Scribner several years ago, one of the first large biodiesel facilities in the state. Unfortunately, the price of commodity inputs, corn and soybeans, soon skyrocketed and dealt it a death blow. "It hurts me when early risk takers take a beating," Byrnes says, adding that it would help such investors if the state showed more support for their efforts.

Byrnes has thrown his hat into the ring for other enterprises as well, all directly related to renewable energy. In 2006, Byrnes and other risk takers formed Nebraska Renewable Energy Association, a non-profit association dedicated to networking, education and raising awareness about renewable energy issues.

Another partnership known as Nebraska Screw Press commandeered an abandoned pork packing plant in Lyons and set up an oilseed crushing station, designed after studying oilseed processing facilities across the United States and India. The press in Lyons has the capacity to process 20 tons per day. The soybean product that remains after crushing can be resold as animal feed, and the resulting oil is sold through the cooperative.

"Some farmers want oil, some fuel, and some want to sell soybeans," Byrnes says. In the future, the NSP facility will serve as a training and research center for algae oil sources.

Byrnes and other partners formed Nebraska Green Fuels, a fuel station in Lyons for cooperative members that offers E85, a blend of ethanol and gasoline. Other projects involve hydrogen, sustainable ethanol, algae and fuel cells, retrieval of oil from water-based materials, and a gasification process to convert materials such as household waste and compost into energy.

"We are determined to make the Energy Farm a first-class facility for farm scale research and implementation," Byrnes says, though he is quick to add, "I want to emphasize that I am certainly nothing special in all this." It's the idea, he says, that *anyone* can work for renewable energy *anywhere* that's important.

LaRayne Topp is a freelance writer and lifelong product of northeast Nebraska. She and her husband make their home at Wisner, Neb.