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From coal mine to wind farm

In the rolling hills of Wyoming, Rocky Mountain Power has reclaimed the land of one of its coal mines and turned it into an innovative wind farm.

BY DANIEL TERDIMAN / JULY 24, 2009 4:43 AM PDT



The Glenrock Wind Farm, a 237-megawatt project that can produce power for 66,800 households, sits on the site of the former Dave Johnston Mine.

Daniel Terdiman/CNET

GLENROCK, Wyo.--Walking across the former site of the Dave Johnston Mine here, about half an hour outside Casper, you'd never know that over the course of 42 years, 104 million tons of coal was taken out of the ground.

But now, instead of having a heavy carbon footprint--and coal certainly does--these rolling hills have a green footprint. Today, the site is home to a 158-turbine wind farm that produces 237 megawatts of power, enough electricity for 66,800 households for a year.

And what's particularly notable about the site is that while the wind farm is among the newest and most state-of-the-art in the country today, it is also likely the first full-scale wind power project to be installed on the site of a former coal mine.

From 1958 until 2000, the Dave Johnston Mine stretched for 9 miles through this otherwise barren landscape. But in the late 1990s, after the mine's operator, Rocky Mountain Power, determined that it was no longer economical to run it, a full-scale reclamation project began.



Photos: Wind farm rises up from former coal mine

19 

As part of [Road Trip 2009](#), I visited the wind farm to get a first-hand look at how such a scar on the earth can be successfully converted to a graceful and clean power project.

According to Rocky Mountain Power, a division of PacifiCorp that provides power to Utah, Wyoming, and Idaho residents, "Full-scale final reclamation efforts to restore the nearly 9-mile long stretch of land affected by mining began in 1999 and were completed in 2005. Mountains of dirt were moved, miles of land reseeded with native vegetation and major contouring performed in order to return the landscape to its pre-mining appearance. More than 85 million yards of earth were moved to accomplish this feat."

A big part of the reclamation project was providing long-term grazing land and habitat for a variety of wildlife. To that end, Sagebrush and many other forms of vegetation were planted throughout the property as a source of habitat and food for animals such as pronghorned antelope and deer. Further, the team behind the reclamation concentrated on habitat for birds, including building five nesting platforms for eagles and cover for other, smaller bird species.

And more than 120 "rabbitats," rock shelters for rabbits and other small animals, were built around the property.

All told, the Glenrock Wind Farm is home to antelope, deer, mountain lions, foxes, bobcats, rabbits, and golden eagles.



There are about 1,400 antelope and 600 deer roaming the Glenrock Wind Farm.

Daniel Terdiman/CNET

While it's easy to link the reclamation of the former coal mine and the new, giant wind farm, Rocky Mountain Power didn't originally set out to convert its property from greenhouse gas-intensive power to green power. Rather, the company realized after the decision was made to shut down the coal mine that the property was ideally suited to building a big wind farm.

And that's because the company already owned the property, had a significant system of transmission lines already installed nearby, and understood that these rolling hills had the wind strength to support a multi-hundred-million-dollar wind project.

But Rocky Mountain Power has by no means abandoned coal. In fact, it still has a coal-processing plant adjacent to the former Dave Johnston Mine, which is one reason the transmission lines are still there. Still, the company, and other power generators, have certainly begun to see the value--and the economics--of wind farms like these. Indeed, the day after I visited the Glenrock Wind Farm, the front page of the Casper, Wyo., newspaper had an above-the-fold front-page headline trumpeting another giant wind farm that will soon be developed in the same area.

Twenty-one species of vegetation

My hosts for the visit to the wind farm were Chet Skilbred, Rocky Mountain Power's vegetation scientist at the property, and Doug Mollet, the director of wind operations at Glenrock Wind Farm. Skilbred explained that as part of the reclamation project, he and his team were required to replace all the indigenous plants that had been there prior to the coal mine. So, a big part of the project was the planting of 21 different species of vegetation, including warm season grasses, cool season grasses, shrubs, and many more.

But, with 158 soaring wind turbines dominating the landscape today, Skilbred told me a joke about the process: "I had no idea my seed mixture included wind turbines."

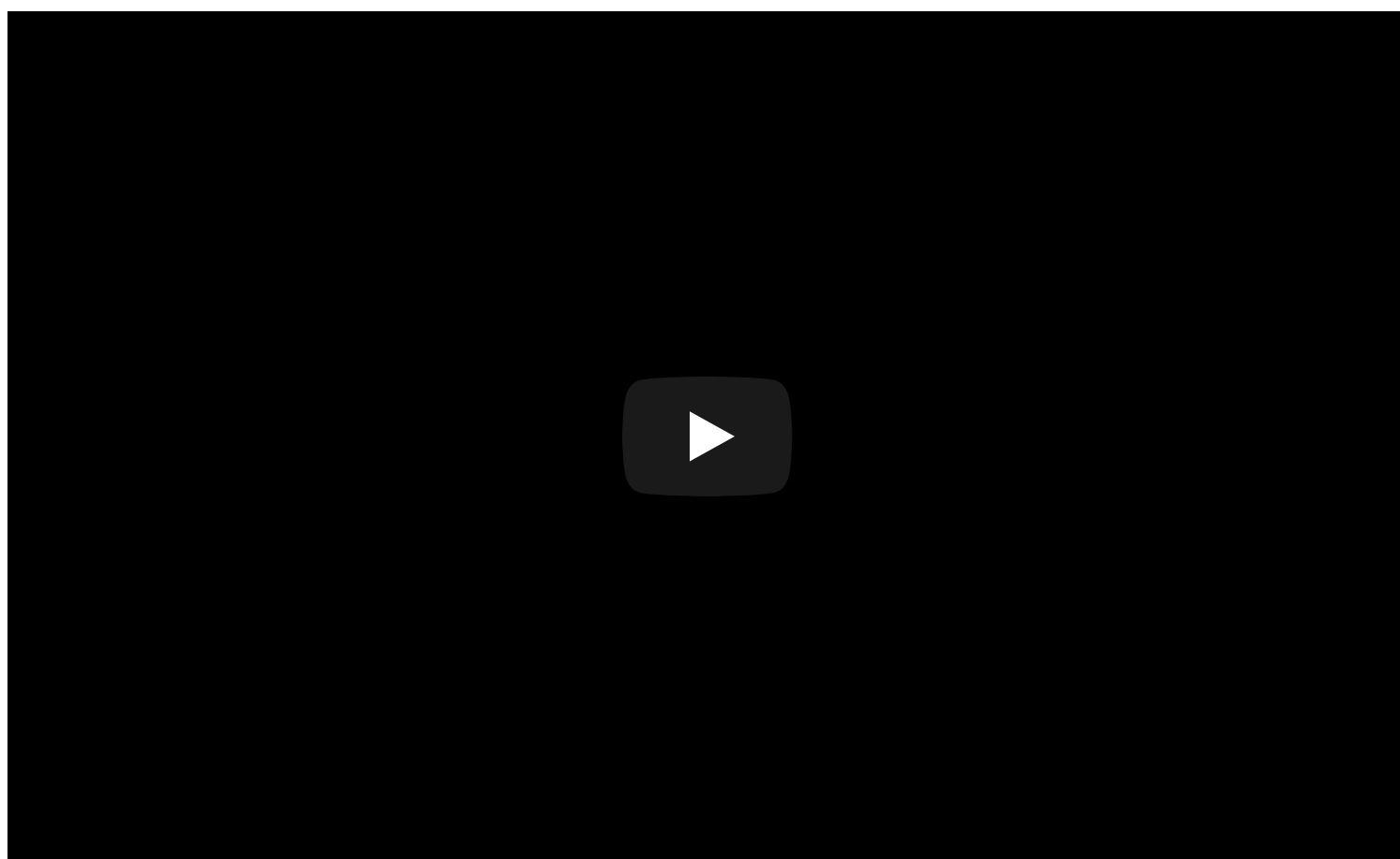


This is a photograph of an aerial image showing the coal mine when it was fully operational.

Daniel Terdiman/CNET

To get back the remaining \$2.6 million of an original \$56 million bond that was put up when the coal mine was opened, Rocky Mountain Power must monitor the land through 2017 for things like ground water and surface water hydrology, wildlife, and vegetation. But I have to hand it to them: If they hadn't told me there had been a coal mine here, I never would have known.

Instead, I would have been simply overwhelmed by the majesty and breadth of the wind farm. (See video below, but turn your volume down because of the wind noise.) Big enough to be visible from many miles away, the 158 turbines are breathtaking up close. That's in part because, when the tips of the 125-foot-long blades are pointing upward, the turbines are 340 feet tall.



That, of course, casts a large and long shadow. Many of the animals on the property--no matter where we went, we would see some of the 1,400 head of antelope or 600 head of deer bounding about--use those shadows to escape the intense Wyoming sun.

In a sense, because there is so much new habitat for animals, as well as the fact that there is no hunting allowed on the property, the wind farm area is tantamount to a nature preserve, Skilbred said.

Indeed, while there had been wildlife on the property before, life is better for them now, Skilbred said: They are no longer getting stuck in the mud inside the mine.

Company sees energy mixture in its future

When in operation, the coal mine was at least 180 feet deep, and 9 miles long. So to complete the reclamation project, Rocky Mountain Power had to dig up the mine, reconstitute the soil, and replant all the vegetation.

But to Skilbred, the project has been a big success. "You couldn't ask for a better ending for a coal mine," he said, "to go from a carbon footprint to a green footprint."

For Rocky Mountain Power, wind is just one power source, and the company sees a mixture in its future: wind, natural gas, coal, geothermal, hydro and, likely, nuclear.

But here, driving around amid these giant turbines, it's hard to think of anything but wind power. And what's amazing is that the turbines are so big, you feel like you're always right in front of one. In fact, however, they are a minimum of a half-mile apart, east to west, and 600 feet, north to south. Put them too close together, and the vortexes coming off the blades affect the wind flow of other turbines.

The actual placement of the 158 turbines, done in what is sort of like a staggered, Z-shaped configuration, was done by turbine specialists who examined the property and developed placement models based on the terrain, the topography and the prevailing wind conditions.

You might think that a company spending several hundred million dollars on such a project would expect full-time production. But that's not realistic. Mollet said that over the course of a year, the best the company can expect is 40 percent average production. But of course, that's an average. Between November and March, that number is much higher, and between late August and September, it's much lower.

The turbines, while a simple concept, are controlled by advanced electronics. And among the tasks those systems have is shutting down the turbines if the winds go above 60 miles an hour--otherwise, they can be destroyed--as well as figuring out where the wind is coming from and automatically rotating the head so that the blades are always working with the best wind. The heads can spin around three full times in search of the strongest wind, in fact, before the system runs out of wire and must reset itself.

Tracking the wind is a major innovation for modern turbines. In the past, the heads were stationary, and so wind farms had limited production when the wind shifted. But now, Rocky Mountain Power and other companies with such projects can maximize the power production.

\$2 million a 'stick'

Mollet said that the cost of the turbines averaged about \$2 million "a stick," and that they are intended to last for 20 to 30 years. However, Rocky Mountain Power thinks of them more as 100-year assets, given that they can replace aging systems within the turbines, or even the blades themselves.

Keeping them working properly means constantly monitoring how they're behaving in the wind. So the wind farm utilizes two types of equipment, anemometers and wind vanes to measure wind velocity and direction to ensure that the pitch of the blades is optimal and won't result in them rotating too fast.

This is all new technology, something previous generations of wind farms couldn't take advantage of. But today, wind power is a growing resource and companies like Rocky Mountain Power are demanding new technology. They're also demanding more people who know how to run and maintain these systems,

despite there currently being a shortage.

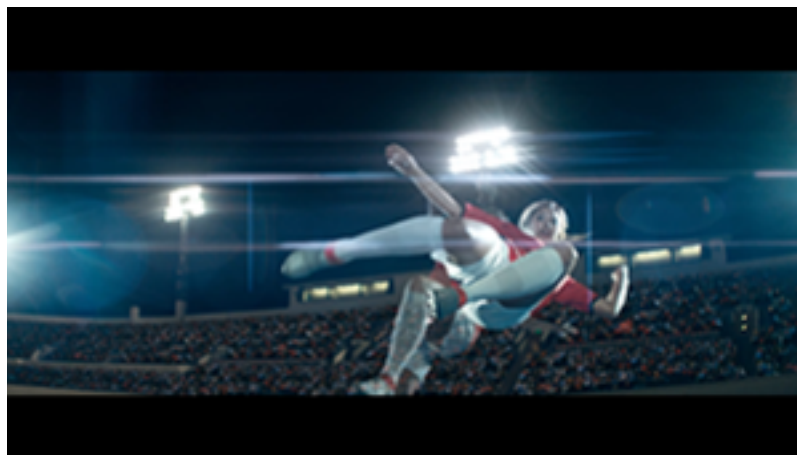
That's why, for example, the company is working with local colleges in the Casper area to create new, two-year associate degree programs in wind turbine technology.

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"We're going to build 1,000 turbines in the next 10 years," Mollet said. "We need to grow some people."

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