

DISTRIBUTED WIND CASE STUDY: RURAL ELECTRIC CONVENIENCE COOPERATIVE

How coal formed the foundation for a distributed wind energy project in rural Illinois



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RADWIND Project

This is the third in a series of case studies on distributed wind projects at electric cooperatives for NRECA Research’s Rural Area Distributed Wind Integration Network Development (RADWIND) project. RADWIND’s goal is to understand, address, and reduce the technical risks and market barriers to the adoption of distributed wind technologies by rural utilities. Distributed wind projects can use any scale of turbine from small kilowatt-scale units up to large multi-megawatt units, as long as they are connected on the distribution side of the electric grid. Turbines may be connected on the customer side of the meter to serve a local load, directly to the distribution grid as a utility generating asset, or directly powering an off-grid load. For more information on the project and additional resources, please visit the project landing page at www.cooperative.com/radwind.

The distributed wind project profiled in this case study is a front-of-meter wind turbine, connected to the co-op’s distribution grid.

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Project Snapshot

Cooperative	Project Ownership	Project Size	Turbine Size	Other System Equip.	Connection	Energy End Use
Rural Electric Convenience Cooperative (RECC)	RECC	900 kW	900 kW	none	Front-of-meter, distribution grid	Offsets wholesale power purchases

Cooperative Profile

The Rural Electric Convenience Cooperative (RECC) is an electric distribution cooperative headquartered in Auburn, Illinois, about 15 miles south of Springfield. See Figure 1. The co-op serves 5,700 members across five agricultural counties in south central Illinois. In addition to farms, the co-op's membership includes commercial accounts, as well as an increasing number of suburban homes on the outskirts of Springfield and other nearby towns.

South central Illinois is known for corn and soybean crops, but beneath the ground, it is rich with another resource – coal. The co-op's territory is located within the Illinois Basin, one of the largest coal reserves in the country. Mining began here in the early 1800s. As recently as 2018, nearly 15% of coal mined in the U.S. came from the Illinois Basin, but the industry is now in decline due to changing energy markets. Analysts expect coal mining in this region to cease by 2040.¹

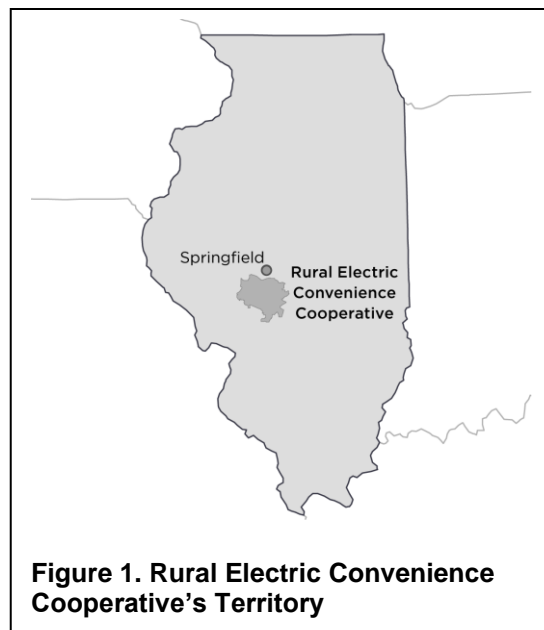


Figure 1. Rural Electric Convenience Cooperative's Territory

In 2006, RECC decided to investigate wind potential in their territory and discovered that an abandoned coal mine in their territory was an ideal location for a wind turbine. Shortly thereafter, the co-op leveraged state, federal, and non-profit funding and partnerships to install the “GobNob wind turbine,” named for its location on top of a pile of coal mine tailings, or *gob*. The U.S. Department of Energy recognized RECC as a 2013 Wind Cooperative of the Year² for its innovative re-purposing of this waste site.

Project Background

In 2005, several members of RECC's board toured a wind turbine owned by nearby Illinois Electric Cooperative. During that visit, board members wondered if RECC could put up a wind turbine as well. They did not waste any time finding out. In 2006, the board hired Tom Wind, PE, of Wind Utility Consulting PC to conduct a technical study to assess wind speeds in their territory and to estimate project cost.

“Green energy is important. We believe our members think green energy's important, and I think we wanted to try to develop what we could, what we could afford. I think for a small co-op, we're pretty progressive and we saw that our members wanted this,” explained Chris Wilcox, RECC director, in a video about the project.³

¹ Feaster, S. and Cates, K. (December 2019). *Dim Future for Illinois Basin Coal*. Institute for Energy Economics and Financial Analysis (IEEFA).

² Old Dominion Electric Cooperative, a G&T headquartered in Virginia, also received the 2013 Wind Cooperative of the Year award.

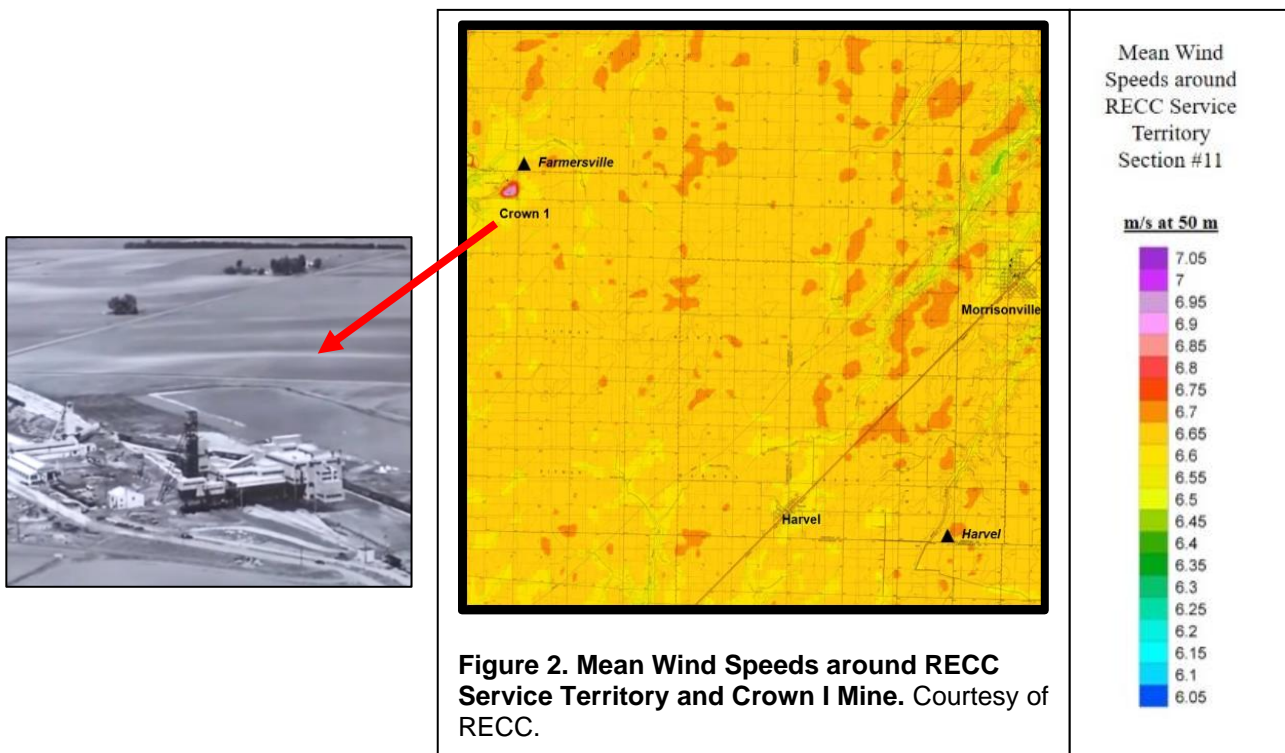
³ GobNob video on YouTube, produced by the Illinois Association of Electric Cooperatives. <https://youtu.be/DF-nmxRoH9Y>

RECC had a clear goal from the project’s inception to install a single wind turbine that was right-sized for one of their substations. The co-op did not consider solar photovoltaic (PV) for this project, since at the time, solar PV was not as common nor as cost-effective as it is today for projects of this scale.

Concept, Planning, and Design

The first step in the design and planning phase was to identify a suitable location within the co-op’s territory. Three key factors were land availability, proximity to a substation, and wind speed.

The feasibility study showed that RECC’s territory generally had enough wind for a large wind turbine, but one location stood out. Said David Stuva, RECC’s President/CEO, “I remember we were in a board meeting going over the wind maps and we noticed a speck of very high wind speeds.” David White, RECC director at the time, recognized the site as the tailings pile from the former Crown 1 Coal Mine, which operated from 1951 through 1971. See Figure 2. “At first we dismissed it as a possibility, but the more we thought about it, we said, ‘You know, we need to investigate that further.’”⁴



The co-op learned that the 14-acre, 60-foot-high slag pile had been deeded to the state as a hunting area. Stuva contacted the Illinois Department of Natural Resources (IL DNR) to inquire about installing a wind turbine there. Leslie Sgro of the IL DNR recalled, “I smiled, and I thought, that is just a tremendous idea.” The state had been restoring the area over the previous decade and felt the project aligned with their efforts. The IL DNR worked cooperatively with RECC to navigate various state processes and land lease arrangements. In the end, the co-op was able to lease the land for the small fee of \$1,200 per year, which

⁴ GobNob video on YouTube, produced by the Illinois Association of Electric Cooperatives. <https://youtu.be/DF-nmxRoH9Y>

has escalated to just over \$1,400 in 2021. “In return,” said Sgro, “the community gets clean energy on top of an old slag pile. You just can’t ask for anything more perfect than that.”⁵

In late 2006, the co-op formally announced plans for the GobNob wind turbine. By the fall of 2007, it began construction of a road to the site and the foundation. The buried coal waste turned out to be a very stable base. See Figure 3. In December of 2007, the turbine arrived and was installed over a period of months in 2008. The fact that construction was delayed several times due to high winds only increased the co-op’s confidence in their site selection. By March of 2009, the turbine was producing electricity.⁶



Figure 3. Buried coal waste forms the foundation for the GobNob wind turbine.
Courtesy of RECC.

Technical Details

The project’s wind turbine is the EWT DW54-900 kW (AC) direct drive wind turbine. EWT⁷ (Emergya Wind Technologies D.V.) is a Netherlands-based manufacturer that had recently begun selling and installing wind turbines in the U.S.⁸ Today, EWT has offices in the U.S. and Canada, with distributed wind turbine deployments in the Midwest, New York, California, and multiple isolated grids in Alaska.⁹

RECC selected a turbine around 1 MW to fit the average load on the substation it would be connected to. The direct drive design of the EWT turbine was an especially important feature for the co-op’s board, whose members felt that the lack of a gearbox would reduce maintenance expenses.¹⁰

The GobNob wind turbine’s tower is 230 feet tall with 80-foot-long blades, so that when one blade is pointed straight up, the blade’s tip is 310 feet above the ground. The manufacturer’s expected lifetime of this model is 25 years.¹¹

The wind turbine’s annual capacity factor and availability varies from year to year according to weather and maintenance needs. In 2019, capacity factor was 26% and in 2020, capacity factor was just over 23%. In its highest yield years, the GobNob wind turbine’s capacity factor has reached 30%.

Siting and Interconnection

The turbine is located half a mile away from RECC’s 5 MVA Farmersville substation and is connected in-front-of-the-meter to the substation at 3-phase 7.2 kV line voltage. Nearly all of the electricity generated

⁵ GobNob video on YouTube, produced by the Illinois Association of Electric Cooperatives. <https://youtu.be/DF-nmxRoH9Y>

⁶ <https://www.recc.coop/renewable-energy/gobnob-wind-turbine/gobnob-information/>

⁷ <https://ewtdirectwind.com/>

⁸ <https://ewtdirectwind.com/about-ewt/history/>

⁹ <https://ewtdirectwind.com/about-ewt/locations/ewt-united-states/>

¹⁰ For more information on direct drive vs. geared turbines, see <https://www.energy.gov/eere/articles/advanced-wind-turbine-drivetrain-trends-and-opportunities>

¹¹ <https://ewtdirectwind.com/wp-content/uploads/2020/02/EWT-CaseStudy-RECC-USA-HR.pdf>

by the GobNob wind turbine is used by the approximately 380 homes and farms served by the substation. According to Cassie Eigenmann, RECC director, “When the blades are turning, we’re powering everyone on that substation in Farmersville.”

Metering

Energy production is metered in two places. Both EWT (in their Netherlands headquarters) and RECC can see real-time production through the wind turbine’s internal monitoring and control system. In addition, excess wind energy not used on the Farmersville substation feeders is metered separately before it is distributed to the grid.

Production

The feasibility study predicted that the GobNob wind turbine would generate about 2,300 MWh every year. Performance has been close to that prediction. For example, in 2019, it produced approximately 2,056 MWh and 1,843 MWh in 2020, about 1.5% of RECC’s total energy needs that year.

Because the co-op sized the turbine to fit the substation’s load, very little excess energy is produced. In 2020, all but 20 MWh, or 1%, of the wind turbine’s energy, was used by members on the Farmersville substation.

Planning & Engineering

Because the turbine was installed on state-owned land, the planning and engineering phase involved more regulatory and technical assessment hurdles than projects of this size typically require. In addition to a formal technical viability study (entitled *Qualification of Project and Certification of Technical Viability*) and equipment selection, the project’s planning and engineering phase required:

- core drilling for soil testing, especially because the project would be built on a pile of coal waste;
- permitting by the Federal Aviation Administration (FAA),¹² which is required of turbines with overall tip heights of more than 200 feet;¹³
- an interconnection agreement with Ameren,¹⁴ the regional grid operator;
- approval from Montgomery County, IL, the local county;
- installation of a transformer and a 3-phase power line from the wind turbine to the nearby Farmersville substation;
- building a road to the site; and,
- land lease agreements with the IL DNR.

¹² <https://oeaaa.faa.gov/oeaaa/external/searchAction.jsp?action=showWindTurbineFAQs>

¹³ <https://oeaaa.faa.gov/oeaaa/external/searchAction.jsp?action=showWindTurbineFAQs>

¹⁴ <https://www.ameren.com/>

The interconnection agreement was straightforward and did not require any improvements to grid equipment, because the project was relatively small and the wind turbine was unlikely to generate significant excess energy.

Operations & Maintenance

RECC has a maintenance agreement with EWT and this arrangement works well for the co-op. EWT performs site visits and routine maintenance about twice a year or as needed. Routine parts and maintenance are covered, so that RECC usually has predictable operations and maintenance (O&M) expenses. In 2020, the co-op paid just under \$60,000 for all O&M expenses, including the maintenance agreement.

The wind turbine's operational availability is usually 80% or better. In 2019, it was available 84% of the time, and in 2020 availability was just under 81%. The only major mechanical issue the wind turbine has experienced was a faulty generator that became apparent in 2009, during the first year of operation. This required a total generator replacement, which fortunately for RECC was covered by the warranty.



Figure 4. Abandoned Crown I Coal Mine buildings at the GobNob wind turbine site.
Courtesy of RECC.

Economic Details

The GobNob wind turbine is wholly-owned by RECC, and improves the co-op's bottom line because its per kWh generation cost is below the co-op's wholesale power purchase price. In 2020, after total project expenses approximately \$127,000, including O&M, interest, and depreciation were accounted for, the project saved the co-op more than \$90,000 that year. In 2019, the project saved the co-op more than \$120,000.

Financing

Total upfront project cost, including wind turbine, installation, and interconnection, was about \$1.8 million in 2009. To offset that, RECC secured \$750,000 in grants¹⁵ from the following organizations:

- United States Department of Agriculture's (USDA) Rural Development program (9006 grant) – \$375,000

¹⁵ <https://www.recc.coop/renewable-energy/gobnob-wind-turbine/gobnob-information/>

- Illinois Department of Commerce and Economic Opportunity - \$225,000
- Illinois Clean Energy Community Foundation - \$150,000 for 10 years of renewable energy credits (RECs)

For the balance, the co-op secured 15-year financing through CoBank using the federal zero-interest Clean Renewable Energy Bonds (CREBs) program. The co-op pays less than 0.05% interest for CoBank to issue the bonds.

Many commercial wind energy projects benefit financially from the federal Production Tax Credit (PTC); however, electric co-ops cannot take the PTC directly, because they are non-taxable entities. When CREBs became available to electric cooperatives as part of the Energy Tax Incentive Act 2005, they proved to be a valuable renewable energy financing tool in lieu of tax credits. However, CREBs were eliminated by the 2017 Tax Cuts and Jobs Act, and are no longer available.¹⁶

RECC's annual CREBs payment to CoBank is \$65,000, with three years left on their repayment term. By the end of 2023, RECC will own the GobNob wind turbine outright. Property taxes and insurance will continue at approximately \$15,000 per year.

Power Purchase Agreements and Renewable Energy Credits

RECC offsets its wholesale power purchases with the generated wind energy. When the project began, RECC's wholesale power provider was Prairie Power, Inc.,¹⁷ a generation and transmission (G&T) cooperative.¹⁸ The GobNob wind turbine's projected generation fit within the G&T's allowances for distribution co-op self-generation. Soon thereafter, RECC became an independent distribution cooperative and currently has had a power supply contract with NextEra Energy Resources.¹⁹ The offset arrangement was continued in the contract with NextEra Energy Resources, and RECC is paid a wholesale rate for the very small amount of excess generation (20 MWh in 2020) that is not used on the Farmersville substation.

The project's Renewable Energy Credits (RECs) belonged to the Illinois Clean Energy Foundation for the first ten years of operation as part of the co-op's funding arrangement with the Foundation. In 2019, the RECs transitioned back to the co-op; however, their current value is negligible, so that the co-op does not attempt to monetize them due to the administrative overhead that would be required.

Members and Community

The GobNob wind turbine is a fixture in the area and is widely considered an asset for members and the broader community. RECC has done several things to encourage that. Starting with the site preparation and foundation construction, the co-op used local contractors and materials whenever possible. For example, all of the project's concrete was manufactured locally.

¹⁶ https://www.energy.gov/sites/default/files/2018/02/f48/QECB_CREBs_Eliminated_Fact_Sheet.pdf

¹⁷ <https://ppi.coop/>

¹⁸ RECC is an independent distribution cooperative. Their current wholesale power provider is Next Era Energy.

¹⁹ <https://www.nexteraenergyresources.com/what-we-do/energy-marketing.html>

The wind turbine is also clearly visible from Interstate 55, a major thoroughfare, and has informational signage explaining the project's history and partnerships. RECC has actively enabled community access from the very beginning. Members were invited to visit the former mine site and tour the tower's base at the dedication ceremony. More than a decade later, the co-op continues to use the wind turbine to engage and educate. "Since 2009, hundreds of school kids and college students have learned about wind energy by visiting GobNob," said Stuva. And the statewide association, Association of Illinois Electric Cooperatives, produced a series of informational videos on the project that include footage of all phases of construction and interviews with co-op staff, directors, and project partners. These videos are posted publicly on YouTube and are a valuable project archive.²⁰

Members and the community were excited about the project at the time of construction and continue to value it. Sentiments from RECC directors²¹ illustrate that.

- "I am extremely proud to be part of this co-op, and I'm extremely proud every time I drive by that site and I see those blades turning." Cassie Eigenmann, RECC director
- "Taking an old coal pile and turning it into productive energy from wind is a very fortunate aspect of this project." Jimmy Ayers, RECC director and Board Chairman during the project
- "I haven't heard a single comment about our rate adjustment but I've heard probably at least 50 direct inquiries about the wind turbine from how much each part weighs to how long it took to get it there and how far it had to come from. So, there's just a lot of interest at every phase of this project. People that aren't even customers of ours are interested and enthused about the project." David White, former RECC director

Project Experience, Opportunities, and Challenges

Twelve years into the project, the GobNob wind turbine is still viewed as a success for RECC. As of April of 2021, it has produced nearly 2,300 MWh, providing clean energy for members, helping educate the community on wind energy, and giving new life to a state-owned brownfield. In fact, the GobNob wind turbine was the first wind turbine to be located on Illinois state-owned land.

The co-op's partnership with the state is one of the project's biggest accomplishments, but according to Stuva, securing the state land was also one of the most challenging aspects. "Our DNR encompasses all kinds of things, from agricultural practices, to hunting and fishing, to coal mining, to water quality, to wildlife management, and the environment. It's a huge organization, and we essentially have our turbine sitting on public land – it's actually in a state park. To get that negotiated, we had to be there at the right time, in the right place," said Stuva. The land immediately surrounding the GobNob remains open to hunting, and yes, there are a few small dings in the turbine's tower. Luckily, area hunters are more interested in aiming at pheasants than wind turbines.

The GobNob wind turbine is expected to be fully operational for another eight to thirteen years (until 2029 – 2034). RECC has proactively negotiated to extend the land lease to 2047. At this point, the co-op is enjoying the project's success and predictable operation. No future plans around retiring, repowering,

²⁰ See: Part 1- <https://youtu.be/DF-nmxRoH9Y>, Part 2- <https://youtu.be/8SfwVu0ti2Y>, Part 3- <https://youtu.be/Co73ZBCSamM> and GobNob bearing replacement: <https://www.youtube.com/watch?v=U5B6klUmljk>

²¹ <https://youtu.be/Co73ZBCSamM>

or replacing the turbine have been made, but RECC may consider replacing the blades and the direct drive generator when the current equipment has reached the end of its useful life. This would enable the co-op to continue to get value from their existing investments in site infrastructure and the turbine tower. RECC may also consider installing a solar PV demonstration project at another location.

Key Lessons and Insights

RECC is now seeing the public's interest shift from wind to solar, but that does not detract from the co-op's accomplishment of producing green energy on a brownfield. Stuva emphasizes that even a single 900 kW wind turbine project, which is small by utility-scale standards, can have a big impact: "I've received nothing but positive comments on the cooperative's involvement in this renewable energy project. I think we all feel good about it whether we view wind power as a way to cut carbon emissions or possibly view wind power as a way to cut our dependence on foreign oil, it seems to strike a common goal with just about everybody you talk to," he said. He encourages other distribution cooperatives to consider similar wind and solar projects, if they are permitted to do so by their wholesale power supply contracts because it is a good thing to do, and in many cases, co-ops can produce green energy for less than it costs to buy it from their supplier.

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Want to stay informed of our progress with the RADWIND project, and provide your input and feedback? We welcome all NRECA members to join the project as an advisor. Contact our team at: RadwindProject@nreca.coop.