DISTRIBUTED WIND CASE STUDY: ADAMS ELECTRIC COOPERATIVE

Experience owning and operating two distributed wind projects

Adams Electric Cooperative, Inc.
A Touchstone Energy® Cooperative

RADWIND Project

This is the ninth 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 projects profiled in this case study are two front-of-meter wind turbines in separate locations, connected to a 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
Adams Electric Cooperative (AEC)	AEC	2.4 MW total capacity	0.9 MW & 1.5 MW	none	Front-of-meter, distribution grid	Offsets wholesale power purchases, hedge power costs

Cooperative Profile

Adams Electric Cooperative (AEC),[1] headquartered in Camp Point, Illinois, is an electric distribution cooperative that serves 9,000 members across seven counties in western Illinois. The territory includes some large electric consumers including a correctional facility and a national food distributor, but the membership is predominantly residential and agricultural. Corn and soybeans are the main crops, and many members also have livestock.

Adams Electric is a member of Prairie Power, Inc. (PPI),[2] a generation and transmission (G&T) cooperative owned by ten electric distribution co-ops in Illinois. AEC relies on PPI to fulfill most of its power supply needs, but owns two utility-scale distributed wind turbines that provide about 2-3% of the co-op's power supply.

Figure 1. Adams Electric Cooperative's Territory in Western Illinois. Courtesy of AEC.

Like many distribution cooperatives, AEC does more than just provide electricity to its community. Supporting local economic development and education are top priorities. AEC participates in the United States Department of Agriculture (USDA) Rural Economic Development Loan and Grant (REDLG) program, a zero-interest loan program to help fund local business projects that will create or retain jobs in rural areas.[3] In addition, AEC collaborates with Ameren, a nearby investor-owned utility, and the University of Illinois Extension to offer "Electricity School" during the summer. Students aged 8-18 come to the co-op's headquarters to learn about electricity through hands-on projects, such as building lamps, wiring circuits and switches, making GIS maps, and touring the co-op's wind turbines.[4]

Project Background

In 2006, when utility-scale wind farms were being promoted across the country, AEC decided to investigate developing its own distributed wind turbines to "supplement current power supplies and act as a hedge against rising fuel costs."[5] According to Alex Mossman, distribution system engineer at AEC, "The way things were trending – and the way things *are* trending – it just made sense" to add renewable energy to the co-op's portfolio. Other distribution co-ops in the region were drawing similar conclusions. In 2005, Illinois Electric Cooperative[6] installed a distributed wind turbine, followed by Rural Electric Convenience Cooperative (RECC) in 2009, which was profiled in a 2021 RADWIND case study.[7] With the availability of the USDA Clean Renewable Energy Bonds (CREBs) program at that time, which

[1] https://adamselectric.coop/ (Note that there is a different Adams Electric Cooperative, Inc. in Pennsylvania, https://www.adamsec.coop/)
[2] https://www.ppi.coop/
[3] https://adamselectric.coop/community/economic-development/
[4] https://adamselectric.coop/community/youth/electricityschool/
[5] https://adamselectric.coop/member-services/wind-turbines/
[6] https://e-co-op.com/about-us/wind-energy/
[7] https://www.cooperative.com/programs-services/bts/radwind/Documents/RADWIND-Case-Study-RECC-May-2021.pdf

offered low- to zero-interest rates that co-ops could use to finance renewable energy programs, along with other grant opportunities, "everything kind of aligned and made sense for us financially," Mossman said.

Concept, Planning, Design, and Engineering

The co-op hired a consultant to help develop project plans and identify grant opportunities. It then worked with wind turbine manufacturers on engineering and construction. Throughout the process, the board of directors and the membership were supportive. In addition, Illinois Electric Cooperative[8] and Rural Electric Convenience Cooperative (RECC)[9] helped by sharing information about their nearby projects.

Pigeon Creek Wind Turbine was installed in Adams County in 2009, followed by the Brown County Wind Turbine in 2011. In 2017, the Brown County Wind Turbine was renamed the Randy D. Rigg Memorial Wind Turbine in honor of a long-time co-op employee. Both were the first utility-scale wind turbines in their counties.[10]

Technical Details

Pigeon Creek Wind Turbine[11] (Adams County):

- Rated capacity—900 kW (0.9 MW), direct drive
- Manufacturer: Emergya Wind Technologies (EWT)
- Model: EWT DW54-900 kW
- Expected lifetime: 25+ years
- Cut-in speed:[12] 6 mph
- Full-capacity speed: 31 mph
- Physical size: 246-foot hub height, 335 feet to blade tip, 89-foot-long blades
- Estimated production: 2.5 million kWh/year, enough for 200-300 homes

Figure 2. Pigeon Creek Wind Turbine.
Courtesy of AEC.

[8] https://e-co-op.com/about-us/wind-energy/
[9] https://www.recc.coop/
[10] The second utility-scale wind turbine in Adams County is owned by RECC. See: https://www.whig.com/archive/article/adams-electric-cooperatives-wind-turbine-near-airport-moves-closer-to-completion/article_73abbf74-045d-5928-a90b-98da511276a6.html
[11] https://adamselectric.coop/pigeon-creek-wind-turbine-2/
[12] Wind speed required for the wind turbine to begin generating electricity.

Randy D. Rigg Memorial Wind Turbine[13] (Brown County):

- Rated capacity—1,500 kW (1.5 MW), direct drive
- Manufacturer: VENSYS
- Model: VENSYS 77
- Expected lifetime: 25+ years
- Cut in speed: 6.7 mph
- Full-capacity speed: 24.6 mph
- Physical size: 279-foot hub height, 401 feet to blade tip, 122-foot-long blades
- Estimated production: 4 million kWh/year, enough for 300-400 homes

Figure 3. View from the top of the Randy D. Rigg Memorial Wind Turbine.
Courtesy of AEC.

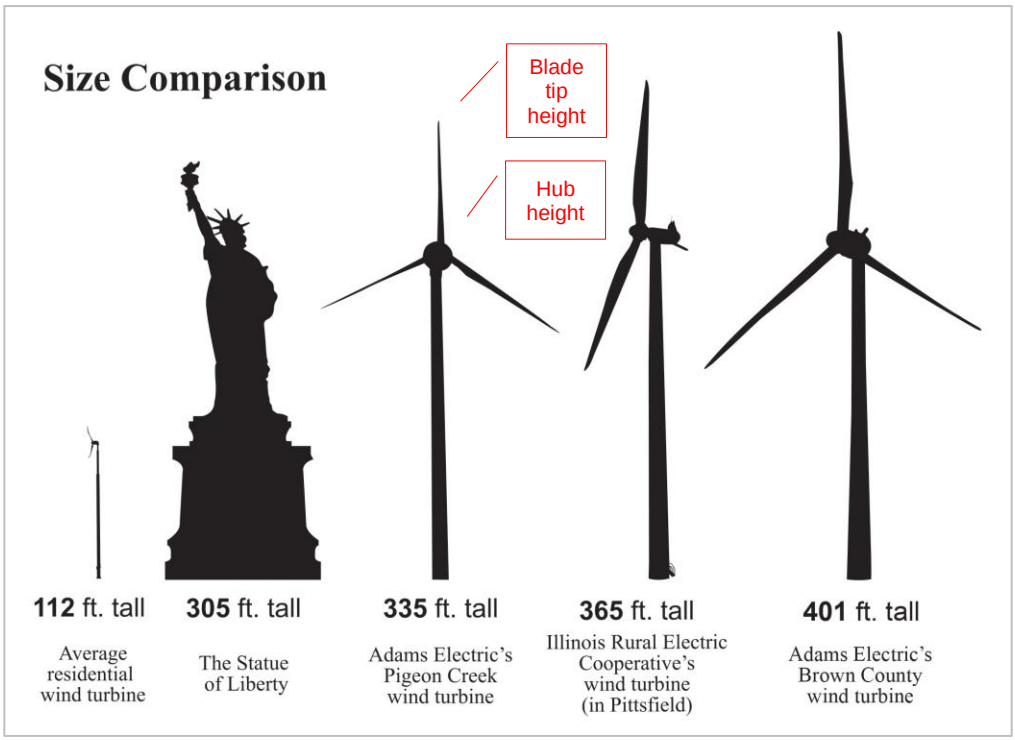

Figure 4. Size comparison of AEC wind turbines. Courtesy of AEC.[14]

[13] https://adamselectric.coop/randy-d-rigg-memorial-wind-turbine/
[14] https://adamselectric.coop/member-services/wind-turbines/#:~:text=The%20Cooperative%20owns%20two%20wind,Sterling.

Siting and Interconnection

For both projects, the co-op identified several sites with wind speeds feasible for wind energy project development that were near its distribution substations.[15] The two best sites were both on members' land, and fortunately both landowners were amenable to leasing land to AEC. The landowners were both "great" to work with from the beginning, and "they still are," according to Mossman. Both leases are for 25 years, with an option to renew for another 25 years.

Both sites are near regional airports, and Federal Aviation Administration (FAA) approvals were required prior to construction due to the wind turbines' heights.[16] Because AEC owns the distribution system, no interconnection agreements or other outside approvals were needed. The co-op completed all the interconnections with "material we utilize every day," said Mossman. Both wind turbines are interconnected at 7.2/12.47 kilovolts (kV) and are within a quarter mile of the substations to which they are connected. The majority of the wind turbines' production is used by members on the substation feeders, including the regional airports and nearby industries, with any excess going back onto AEC's distribution grid.

Metering and Production

AEC meters both turbines and submits that information to PPI. PPI also has substation meters at both substations and can see power flow in any direction.

From 2018 to 2022, Pigeon Creek Wind Turbine produced more than 7 million kWh, with an annual average of just over 1.45 million kWh, making the average capacity factor for these years 18.4%. For this same time, the Randy D. Rigg Memorial Wind Turbine produced 14.8 million kWh, with a yearly average of nearly 3 million kWh, resulting in an average capacity factor of 22.6%.

Adams Electric shares the monthly production data on both of wind turbines with its consumer-members through dedicated websites.[17,18] Using data from these websites, Figure 4 graphs the average monthly production for both turbines over the five-year period, 2018-2022. The figures shows that production at both sites is higher in the cooler months, from November through April, and lower from May through September.

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[15] For information on minimum recommended wind speeds, see p. 7-8 of the RADWIND report, *Value Case for Distributed Wind in Rural Electric Cooperative Service Areas*, available here.

[16] For more information on Aviation Impact Screening, see the Project Screening section of RADWIND's report, *Distributed Wind Project Development Practices in Rural Electric Cooperative Service Areas,* available here.

[17] https://adamselectric.coop/pigeon-creek-wind-turbine-2/

[18] https://adamselectric.coop/randy-d-rigg-memorial-wind-turbine/

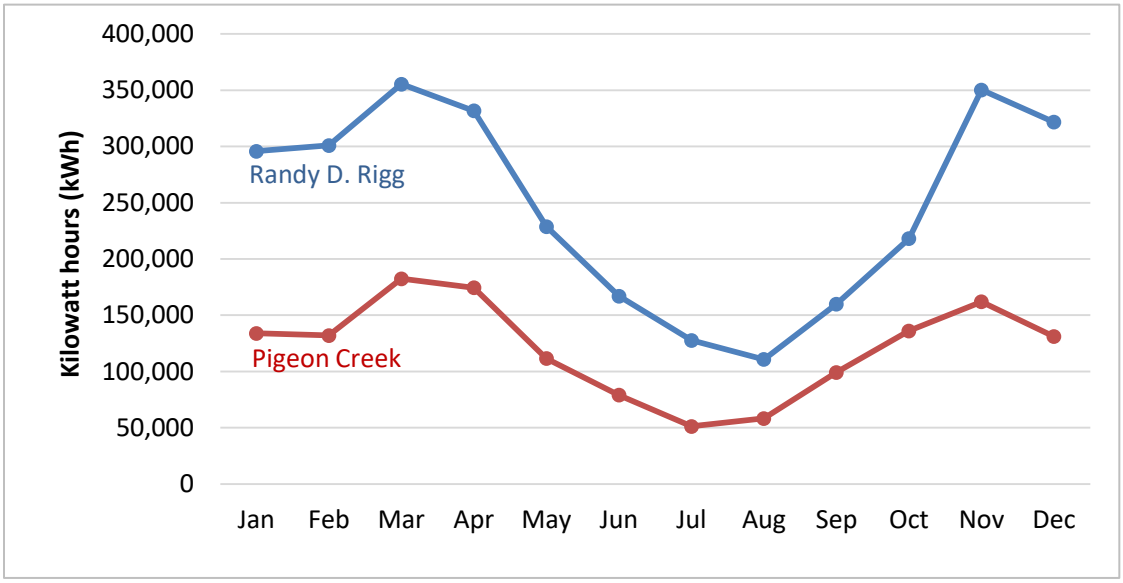

Figure 5. Average Monthly Production, 2018 - 2022

During this five-year period, both turbines generated less energy than the original annual generation estimates. This variance was due to several circumstances, including less wind than historical levels at times, maintenance needs, and curtailment for endangered species.

Operations & Maintenance

AEC has operation and maintenance (O&M) contracts with each manufacturer; however, these agreements are quite different. The O&M contract with EWT for the Pigeon Creek Wind Turbine has "a bumper-to-bumper warranty with guaranteed availability requirements in the contract," explained Mossman. EWT monitors the wind turbine remotely. If technicians detect any issues, they will repair them remotely, if possible, or send a repair person to this site if needed. The service contract guarantees that the wind turbine will be operational for 95% of the time that wind speeds support operation, "so they are extremely motivated to get their turbines fixed." The primary technician used to be located a few hours away, but is now in Alaska where EWT has several turbines deployed.[19] Nonetheless, EWT will send a technician within a few days' time for nearly any type of maintenance need or repair. "We hardly have to work on that turbine," said Mossman.

For the Randy D. Rigg Memorial Wind Turbine, AEC has an O&M contract with VENSYS that is primarily for major repairs and warranty issues. For example, explained Mossman, if we "lose a pitch motor or something, [VENSYS] will ship it to us. We'll get it all prepped and on site, and then they'll come on site. We'll be down tower, and if they need anything, we can actually come up and help them out." Otherwise, Mossman and other AEC engineering staff conduct the bulk of standard maintenance and repairs.

[19] Including two turbines with Kotzebue Electric Association, featured in a RADWIND case study, available here.

To enable the co-op to do its own repairs, AEC staff complete regular tower climbing and safety trainings at ENSA, a provider of "work at height" safety trainings for wind, telecom, and other industries.[20] One of AEC's meter technicians has also completed maintenance trainings at VENSYS facilities in Germany and Rhode Island and assists with repairs and maintenance if needed.

Overall, both turbines have performed generally as expected, requiring standard maintenance and repairs. O&M issues have been covered by the service contracts. An exception occurred when lightning struck a blade on the Pigeon Creek Wind Turbine, which was covered by insurance rather than the service contract.

An unforeseen operational challenge has been curtailment due to the likely presence of bats at certain times. While the wind industry has long taken into consideration migratory bird patterns and bird deterrent strategies, less has been understood about impacts to bats until recently.

Figure 6. Technician repairs lightening damage to Pigeon Creek Wind Turbine blade tip. Courtesy of AEC.

The Renewable Energy Wildlife Institute,[21] formerly the American Wind Wildlife Institute, actively conducts and consolidates research on this topic, along with many research institutions and universities.[22] Hundreds of thousands of bats are estimated to collide with onshore wind facilities in North America every year. Although distributed wind turbines are smaller, less numerous, and less densely sited than utility-scale wind farms, all wind asset owners and operators should be aware of this issue. Bat activity near wind turbines typically increases during low wind speeds, so curtailment during low wind speeds is now practiced to protect bats.[23] AEC curtails operation so that blades do not rotate at wind speeds below 3 meters per second (m/s) (6.7 mph) or 5.5 m/s (12.3 mph), depending on the season and the temperature. In addition, blades must be pitched as close to 90 degrees as possible, until the allowable wind speed is reached.

Economic Details

AEC owns both turbines. To finance them, the co-op relied heavily on CREBs. When CREBs became available to electric cooperatives as part of the Energy Tax Incentive Act of 2005, they proved to be a valuable renewable energy financing tool in lieu of tax credits that were not directly usable by not-for-profit utilities. The program was eliminated by the 2017 Tax Cuts and Jobs Act.[24] However, a new "direct pay" option in the Inflation Reduction Act of 2022 (IRA) will enable electric cooperatives and other not-

[20] https://www.ensa-northamerica.com/
[21] https://rewi.org/
[22] For more information on bat collision mitigation research and strategies, see: https://www.cooperative.com/programs-services/bts/Documents/TechSurveillance/Surveillance-Advanced-Technology-Wind-Generation-March-2019.pdf
[23] For a detailed study on wind turbine-related bat mortality and curtailment, see: https://rewi.org/wp-content/uploads/2021/11/journal.pone .0256382.pdf
[24] https://www.energy.gov/sites/default/files/2018/02/f48/QECB_CREBs_Eliminated_Fact_Sheet.pdf

for-profit organizations to receive the value of applicable tax credits as direct payments. NRECA called this new direct pay provision a "huge victory" for electric cooperatives and is continually adding fact sheets,[25] podcasts,[26] and other resources to cooperative.com on direct pay as more guidance becomes available.

AEC financed both of its distributed wind turbines similarly:

- Pigeon Creek Wind Turbine:
  - Total installed cost—approximately $2 million
  - CREBs financing—$1.5 million, will be paid off in 2024
  - Illinois Clean Energy Community Foundation (ICECF) grant—$150,000
  - Illinois Department of Commerce and Economic Opportunity (DCEO) grant—$250,000
- Randy D. Riggs Memorial Wind Turbine:
  - Total installed cost—approximately $3 million
  - CREBs financing—$1.75 million, will be paid off in 2026
  - USDA Rural Development program (9006 grant)—$450,000

From a cost perspective, the turbines will be about breakeven for the co-op until they are fully depreciated over a 25-year depreciation schedule. AEC has not yet determined how the wind turbines' finances will change after that.

Power Purchase Agreements and Renewable Energy Certificates

Because the combined generation from the two wind turbines fits within PPI's renewable energy carve-out allowance in its wholesale power supply contract with AEC, there are no power purchase agreements (PPAs) as part of these projects. Further, AEC owns all of both project's renewable energy certificates (RECs).[27] Rather than trading the RECs on the open market for their monetary value, the co-op retains them, so that it can claim the generation as renewable.

Members and Community

AEC developed the wind turbines primarily to offer its members locally generated renewable energy. After more than a decade in operation, the wind turbines continue to generate member interest. AEC offers at least one tour per year to school groups and community members, but this is somewhat reduced from previous years. "When we first built them, we felt like we were on a presentation tour," noted Jim Thompson, general manager of Adams Electric.

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[25] https://www.cooperative.com/programs-services/government-relations/Documents/Legislative%20Issues/NRECA%20IRA%20short%20summary%20-%20PUBLIC%20LAW.pdf
[26] https://www.electric.coop/along-those-lines-direct-pay-incentives
[27] https://www.epa.gov/green-power-markets/renewable-energy-certificates-recs

Although the newness may have faded somewhat, both wind turbines are still very much a part of the community. The Randy D. Rigg Memorial Wind Turbine is clearly visible from Interstate 24, which is also the town of Mt. Sterling's Main Street, and located near a large distribution center and air strip owned by Dot Foods, North America's largest food industry redistributor.[28] In addition, the co-op posts photos of the turbines and major events, like the lightning strike repair, on its "Adams Outlet" Facebook page.[29]

Figure 7. Open house at the Randy D. Rigg Memorial Wind Turbine (2011). Courtesy of AEC.

Project Experience, Opportunities, and Challenges

As of 2023, the wind turbines have been operational for 12 and 14 years, and AEC expects at least as many years remaining in the projects' lifetimes. The wind turbines are meeting the needs of the membership to have renewable energy located in the community without adding a significant strain on the co-op—both projects were right-sized and properly located. Both wind turbines have required maintenance and repairs, but neither has had issues that have caused significant disruption. Additionally, some of AEC's staff benefit from the career development opportunity of learning to climb towers and maintain wind turbines safely.

Importantly, the co-op's relationship with the landowners is excellent, which is likely due to Adams Electric's good neighbor practices. "Every time we go out [to the sites], we make sure that we leave it better than when we got there. [The landowners] are very respectful of us, and we most certainly return that," said Mossman.

Key Lessons and Insights

Mossman advises other co-ops with desirable wind sites near substations to consider distributed wind. Based on his experience, he recommends that those considering wind projects learn about endangered species in their area, especially bird and bat migratory patterns, so that they can avoid these zones and/or plan for ways to mitigate wildlife impacts.

Adams is open to developing similar projects in the future, if the finances make sense. Although CREBs are no longer available, the pending availability of direct-pay tax credits and other financial incentives, including updates and expansions to the Investment Tax Credit (ITC), could be used to help offset project development costs. Further, provisions in the Infrastructure Investment and Jobs Act of 2021 (IIJA),[30] also known as the Bipartisan Infrastructure Law (BIL),[31] created many other grants and incentives that can significantly improve financial models. With the many new funding and financing sources becoming

[28] https://www.dotfoods.com/
[29] https://www.facebook.com/adamselectricadamsoutlet/
[30] https://www.congress.gov/bill/117th-congress/house-bill/3684/text
[31] Summary available here: https://www.gfoa.org/the-infrastructure-investment-and-jobs-act-iija-was

available, Mossman expressed a predicament shared by many co-ops in early 2023— "I'm not a grant writer; we're not grant writers. It's difficult to know what you qualify for, what you don't, and how to write the grants." He welcomes complete proposals from manufacturers and developers that "put together a really good case," including how much funding is available from different sources, along with support for grant writing and applications.

To help co-ops navigate new federal funding opportunities, NRECA hosts an Infrastructure Resource Hub on cooperative.com that provides information about programs relevant to cooperatives, upcoming deadlines, and grant writing resources.[32]

At this point, Adams Electric is highly satisfied with its two existing distributed wind turbines, and co-op staff and leadership are keeping their eyes open for financially viable new projects. "We are always looking for opportunities," said Mossman. Given the timing of new financial incentives for renewable energy coupled with the co-op's pragmatic approach and wind experience, Adams Electric is well-positioned to move forward with future opportunities and to help other co-ops with less hands-on experience navigate distributed wind projects.

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Additional Information on NRECA's RADWIND Project

For more information on the RADWIND project and additional resources, please visit the project landing page at www.cooperative.com/radwind.

For inquiries, please contact our team at: RadwindProject@nreca.coop.

[32] https://www.cooperative.com/programs-services/government-relations/infrastructure-resource-hub/Pages/Secure/home.aspx