# Business & Technology Advisory

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# DISTRIBUTED WIND CASE STUDY: IOWA LAKES ELECTRIC COOPERATIVE

*CREBs, corn, and community: How a pioneering wind project was made possible by favorable financing, ethanol plant industrial substations, and a co-op's perseverance and partnerships.*

## RADWIND Project

This is the first 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 directly to the distribution grid as a generating asset, on the customer side of the meter to serve a local load, 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 sited next to two large industrial loads and connected to their associated front-of-meter distribution substations, although the project does not directly power those loads.

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## Project Snapshot

| Cooperative | Project Ownership | Project Size | Turbine Size | Connection | Energy End Use |
|---|---|---|---|---|---|
| Iowa Lakes Electric Cooperative | Co-op Owned | 21 MW (at two 10.5 MW wind farms) | 1.5 MW | Front-of-meter - connected to distribution grid through industrial substations | 100% sold to G&T (PPA) |

## Cooperative Profile

Iowa Lakes Electric Cooperative (ILEC), headquartered in Estherville, IA, is a distribution cooperative that serves 12,950 farms, homes, businesses, and industries in northwest Iowa. With 62 employees, the co-op sells about 650 million kWh annually and maintains more than 4,800 miles of distribution lines.

Iowa Lakes' generation and transmission (G&T) membership is somewhat unusual because they are members of two G&Ts. Formerly a member of only Corn Belt Power Cooperative, ILEC is now a member of Corn Belt Power Cooperative and Basin Electric Cooperative because Corn Belt became a full member of Basin Electric in 2009. This three-tiered arrangement means that all of ILEC's wholesale power sales and purchases are supplied by Basin Electric through Corn Belt's transmission system.

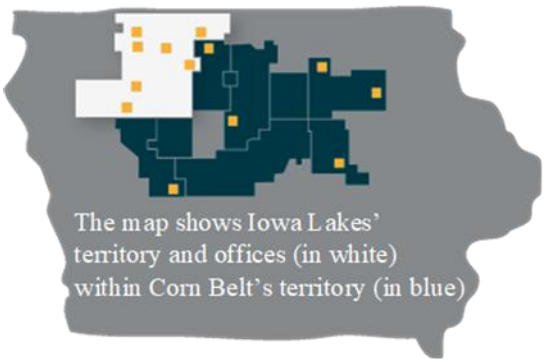


**Figure 1. Iowa Lakes' Territory.**
Image courtesy of Corn Belt Power[1]

Iowa Lake's territory is located on the eastern slope of the Buffalo Ridge, one of the nation's premier wind resources. Leading industries in the area are biotech, dairy, advanced manufacturing, farming, trucking and warehousing, and, not surprisingly, wind energy.[1] In fact, Iowa ranks first in the nation for having the highest share of wind energy in the state's portfolio – nearly 42%.[2]

Iowa Lakes achieved national attention for the project profiled in this case study – two wind farms that went online in 2009. The combined capacity of 21 MW made this the largest wind project to be designed, financed, and owned by any distribution electric cooperative at that time. For this innovation, the co-op was honored by the U.S. Department of Energy's (DOE) Wind Powering America initiative as the 2011 Wind Cooperative of the Year.

## Project Background

According to Aaron Ruschy, ILEC's vice president of operations and engineering, the decision to own wind farms was originally driven by the co-op's board of directors in the early 2000s. At that time, there was "a lot of buzz around the environment, and a new administration that promoted clean energy. And, we have *a lot* of wind."

For context, "a lot of wind" results in about 11,000 MW of installed wind capacity today in the state. Iowa covers just 2% of the U.S. land mass, but has the country's second highest wind capacity, behind only Texas. In 1983, Iowa became the first state in the country to pass a renewable portfolio standard (RPS), a state mandate for increased renewable deployment. While many renewable technologies qualify, the vast majority of this was met with wind by 1999.[3]

[1] https://www.northwestiowa.com/

[2] https://www.awea.org/Awea/media/Resources/StateFactSheets/Iowa.pdf

[3] https://www.eia.gov/state/analysis.php?sid=IA

Fast forward to 2007 when, after years of design iterations and discussions, the pieces came together and the project raced ahead. The co-op broke ground in August of 2008 and was generating electricity by March of 2009.[4]

**Figure 2. Iowa Lakes Wind Farm - Superior Site.** Image courtesy of ILEC.

## Concept, Planning and Design

While solar is increasingly common in Iowa Lake's territory today, it was not part of the discussion for this project. "Solar wasn't even on the horizon," said Ruschy. This was a wind project from day one.

Besides Iowa's excellent wind resource and their RPS, a major driver of utility-scale wind farms at the time was the federal Production Tax Credit (PTC).[5] The policy has gone through several iterations, but is generally credited for the growth of today's wind industry in the U.S.[6] However, as tax-exempt entities, electric cooperatives cannot take advantage of it directly. Only investor-owned utilities (IOUs) and for-profit developers with tax appetites can use it.

Starting in 2004, Rick Olesen, who is now Iowa Lakes' CEO but at the time was vice president of operations and engineering, commissioned a few business studies to see what would be financially feasible. Under their all-requirements contract, ILEC would need to sell all generated energy to Corn Belt and ultimately Basin Electric through a power purchase agreement (PPA); generated energy could not be used to offset ILEC's wholesale electricity purchases. The co-op considered several creative

[4] https://www.esthervillenews.net/news/local-news/2009/08/21/iowa-lakes-electric-cooperative-dedicates-wind-energy-project/

[5] https://windexchange.energy.gov/projects/tax-credits#:~:text=The%20Production%20Tax%20Credit%20(PTC,generation%20for%20utility%2Dscale%20wind.&text=Wind%20projects%20will%20qualify%20if,end%20of%20the%20designated%20period.

[6] https://www.awea.org/policy-and-issues/tax-policy

approaches, including locating individual 900 kW turbines at different existing substations, but nothing penciled out. At one point in the process, Olesen recalled, an analyst asked him exactly how much money he wanted to lose.

The board did not give up hope and Olesen continued to look for opportunities, even meeting with his senator, who conveniently was Sen. Chuck Grassley, one of the authors of the PTC. Even so, the co-op could not find a cost-effective path to owning wind generation in the absence of the PTC and with the inability to offset their usage. Eventually, a few local, state, and federal developments shifted things in Iowa Lakes' favor.

**Figure 3. Iowa Lakes Wind Farm - Lakota Site.** Image courtesy of ILEC.

Locally, two large ethanol plants were moving into the co-op's territory, and both would require much larger substations than the traditional size.

At the state level, Iowa adopted a $0.01/kWh production tax credit – Iowa Code Chapter 476B[7] – for qualified wind facilities placed into service between 2005-2015. Although the co-op could not take advantage of the federal PTC, they would be able to monetize the state credit.

Also, the federal Energy Policy Act of 2005 introduced a 0% interest Clean Renewable Energy Bonds (CREBs). This program was designed to help electric cooperatives, municipal utilities, and other entities that could not take advantage of the PTC finance renewable energy projects. The co-op's access to CREBs turned out to be what the project needed to make a margin. According to Olesen, "That was a clear line, bright line. No CREBS, no go." Fortunately, Iowa Lakes received the needed CREBs and was

[7] https://www.legis.iowa.gov/DOCS/ACO/IC/LINC/Chapter.476b.pdf

able to move forward. Unfortunately, the program was eliminated under the Tax Cuts and Jobs Act of 2017 and is no longer available for new projects.[8]

After several engineering studies on interconnection and wind resources, the next phase of the project involved procuring wind turbines. Because wind was booming at that time, major manufacturers were not responding to requests for proposals (RFPs) for projects this small. ILEC worked with Basin Electric to pool their turbine order in with a much larger order the G&T was making at the time. As luck would have it, the co-op got an offer of turbines much sooner than expected. A GE customer cancelled an order of the exact turbines that ILEC wanted before the RFP process was complete. The co-op's board had to decide, then and there, if they wanted these turbines nearly a year ahead of schedule. Even though the co-op had not secured the necessary land easements or conducted meteorological evaluation testing (MET) tower measurements to evaluate weather conditions at turbine height, the board voted "yes." Olesen and team were off to the races, completing what would have been a 3-year project in only 18-months.[9]

## Technical Details

The 21 MW Iowa Lakes wind project consists of two 10.5 MW wind farms. Each site has seven GE 1.5 MW turbines (model: 1.5 sle with ESS pitch system) with 80-meter (262-foot) hub heights.

### Siting and Interconnection

ILEC strategically sited the wind farms, Superior and Lakota, right next to two very large load centers in their territory — ethanol plants that had large industrial substations installed by Corn Belt to serve them. The ethanol plants' substations have up to 15 MW of transformation available, and the ethanol plants themselves are approximately 6 MW and 7 MW each. The 15 MW substations enable the wind farms to be interconnected to the distribution grid, which is different from large utility-scale projects which are typically interconnected to the transmission grid.

The interconnection system is a separate qualified distribution system, and is connected at 3-phase distribution voltage – 7.2 kV phase voltage, 12.47 kV line voltage, in a grounded Y connection. This is a distinct difference from more common large utility-scale wind farm connections, which are typically 34.5 kV Delta connections that are interconnected to the transmission grid. The substations that receive the wind energy are each just a mile away from the associated wind farm.

### Metering

The wind energy is metered right before it is supplied into the low side of the substation. From there, it is distributed out onto the feeders for the ethanol plant or it can go through transformers to the 69 kV transmission line. Although in practice, much of the wind energy is used by the ethanol plants, ILEC sells all of the wind energy directly to Basin Electric. The ethanol plants purchase all their electricity from ILEC through separate consumption meters, the same as any other member.

[8] https://www.energy.gov/sites/prod/files/2018/02/f48/QECB_CREBs_Eliminated_Fact_Sheet.pdf
[9] https://www.recinfocenter.com/UserDocs/Pages/2011_Wind_Cooperative_of_the_Year_Award_March_2012.pdf

## Production

Since the wind turbines became operational in 2009, they have consistently averaged 40% capacity factor with a high of 42%, meeting and often exceeding their annual average output projection of 72,000 MWh/year, with a maximum of 84,000 MWh in 2014. Aside from annual weather fluctuations, production is fairly predictable, as these sites are small enough to be Federal Energy Regulatory Commission (FERC) Qualifying Facilities (QF) and therefore not subject to curtailment.

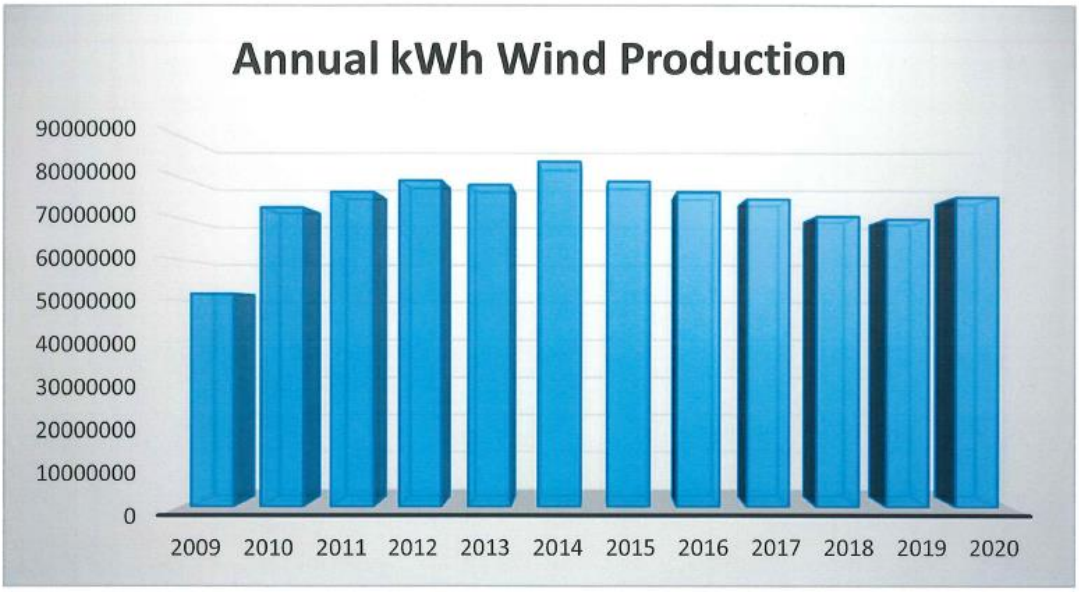


**Figure 4: Annual Production from Iowa Lakes Superior and Lakota Wind Farms Combined (kWh).** Chart courtesy of ILEC.

## Planning and Engineering

The co-op needed to conduct a number of system impact studies to move the project forward. The first was a simple system impact study that cost about $8k - $10k to determine the maximum capacity that could be connected to the ethanol substations without causing power quality problems. ILEC learned they could add up to 12.5 MW safely. Their goal was then to get as close to that number as possible, to maximize economies of scale, but not go over. Hence, they developed two 10.5 MW sites connected to different substations. As a requirement of purchase, GE was consulted throughout engineering and installation.

Next, the Mid-Continent Area Power Pool (MAPP) required a system impact study to determine if any improvements to the regional grid, from Estherville to Omaha, were needed to accommodate the project. The study cost ILEC about $100,000 to conduct. Results of the study were such that the project could enter the interconnection queue without ILEC having to make distribution system improvements.

Finally, although the likelihood of the wind energy ending up on transmission grid is small given the proximity of the ethanol plants and the distribution substations, the co-op completed a Transmission Service Request Authorization.

## Operations and Maintenance

**Benefits of In-House Maintenance**

- $100,000 savings/year
- 98% technical availability
- Faster maintenance response

While the turbines were under warranty, ILEC was required to contract out the operations and maintenance (O&M), but they brought that in-house as soon as possible after the warranty expired. “It’s a night and day difference,” said Olesen. Today, ILEC has three full-time wind generator technicians and the co-op is very happy with this decision. Compared with contract maintenance, in-house maintenance saves about $100,000 per year, technical availability improved to around 98%, and maintenance response times are faster. “You get much better attention to detail when there’s ownership," said Al Zeitz, manager of renewable energy services, who has more than 25 years’ experience in the wind industry.

Outside of standard maintenance, ILEC has replaced some gearboxes, bearings, and transformers, but nothing out of the ordinary for turbines of their era. For transformers, they learned you should not replace wind turbine transformers with standard distribution transformers. “They can take a beating with wind generation,” said Ruschy. ILEC uses the best transformers possible for any replacements, and has also observed that transformers in general have become stronger over the past ten years.

Notably, the co-op has a proactive blade maintenance program. Every year, they conduct detailed blade inspections using telephoto lenses to look for damage. “We have experienced leading edge erosion,[10] but we're trying to stay ahead of that problem,” said Zeitz. If needed, ILEC brings in contractors to apply specialized tape to the leading edge of the blades, where erosion can occur. Because they use experienced contractors who specialize in blade tape application, the co-op is getting slightly better than expected performance from the tape before reapplication is needed – 5 to 6 years. For more information on leading edge erosion, see NRECA’s related advisory: *The Effects of Leading Edge Erosion on Wind Turbine Blades.*

That ILEC has a ready pool of wind technician talent is largely of their own making. In 2004, Zeitz was instrumental in establishing the nation’s first Wind Energy and Turbine Technician AAS program at nearby Iowa Lakes Community College.[11] This forward-thinking co-op/community partnership helps local students gain entry into the fastest-growing profession in the country,[12] while keeping the co-op supplied with highly trained staff and interns.

The co-op budgets about $200,000 per year for O&M at both sites, including staffing and parts. They continue to set aside funds for repairs as the turbines age, but they are unlikely to repower the turbines, as many for-profit developments of the same era are currently doing, in the near future. Repowering has the potential to increase both capacity factor and energy production with existing turbine structure, but it is not cost-effective without the federal PTC. However, even though ILEC’s turbines are more than 10 years old, they are still performing optimally, thanks to careful maintenance.

[10] For more information on wind turbine leading edge erosion, see https://www.cooperative.com/topics/power-supply-wholesale-markets/Pages/Wind-Turbine-Leading-Edge-Erosion.aspx

[11] https://www.iowalakes.edu/sertprograms

[12] https://www.bls.gov/ooh/fastest-growing.htm

## Economic Details

### Financing

Iowa Lakes financed the entire project with $43 million of 0% interest Clean Renewable Energy Bonds. Even with 0% interest bonds, there can be costs associated with issuing the bonds as well as uncertainty about how much interest the market will bear when the bonds are sold. CoBank[13] stepped in to both issue *and* buy the bonds, enabling ILEC to end up with a true 0% interest rate. “I think we're the only [CREBs] project in the country to achieve that,” said Olesen.

**Estimated Earnings Over the 20-Year PPA**

Over $300,000 a year in margin

The repayment term is 15-years and ends in 2024. However, project finances will change in the coming years, before the CREBs are paid off. The project’s Iowa 476B PTC of $0.01/kWh expired after ten project years, ending in 2020. The co-op has been deferring revenue to cover the intervening years with no PTC before their investment is paid off. However, as soon as their annual $2.8 million bond payment is no longer due, project income will not change, but “from a cash flow perspective, we’ll really throw off cash,” explained Olesen. Over the 20-year PPA term, the co-op estimates their wind farms will earn them well over $300,000 a year in margin.

### Power Purchase Agreements and Renewable Energy Credits

Initially, ILEC entered into a PPA with Corn Belt, but in 2012, the PPA was renegotiated with Basin Electric as part of Corn Belt’s becoming a Class A[14] member of Basin Electric. At that time, the renewable energy credits (RECs) associated with the wind farms transferred from ILEC to Basin Electric and are now pooled with Basin Electric’s other RECs. According to Jacob Olberding, Corn Belt’s vice president of power supply, on average, the wind farms produce between 65,000 and 70,000 RECs per year. Prices for RECs fluctuate from year to year, but from 2012 to 2019, Green-e[15] Wind REC prices averaged $0.30 - $0.90 per REC. Recent (2020) prices have been higher at $1.60 - $1.70 per REC.

## Members and Community

ILEC’s community is invested in the wind farms, literally and figuratively. Because the co-op is the full owner of both wind farms, all of its members own them. The significant annual revenue for the co-op helps keep costs down for members and the wind farms improve the local tax base.

In addition, several members profit directly by leasing farmland to the co-op for the turbines. Leases are for 50 years and not tied to production, so that landowners make the same amount of money every year regardless of maintenance down time or weather. Wind turbine leases are more profitable and predictable than existing corn and soybean crops. According to Zeitz, "the landowners who lease land to the wind farms are all very positive; we don’t get any complaints." In fact, other landowners regularly inquire about future wind farm lease opportunities.

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[13] https://www.cobank.com/

[14] Basin Electric’s G&T members are class A members that sell wholesale power to their distribution members in a three-tier system. For more information, see https://www.basinelectric.com/about-us/organization/Governance-Model.

[15] https://www.green-e.org/

Also, members continue to be interested in the project even though the wind farms have been online for more than a decade. Said Ruschy, "We're always getting questions from members on how [the turbines] are doing and what's the history on it. People are involved and like to keep track of how it's going." ILEC includes regular project updates in their newsletter to keep their members informed. "When we first went out and did this, it was a big undertaking," explained Ruschy. "It's a matter of pride that our co-op could get this project to be so successful."

## Project Experience, Opportunities, and Challenges

More than ten years after it began, Iowa Lakes is still very pleased with the project. They would like to keep it going as long as possible or even upgrade it, but whether the project can continue to be financially viable depends on several unknowns:

- Potential changes to the federal PTC or other wind energy legislation to be more beneficial to electric cooperatives.
- Planning between ILEC, Corn Belt, and Basin Electric on distributed energy resource deployment and how such resources can fit into the current organizational business model.
- How Corn Belt and Basin Electric will adapt resource and transmission planning to account for distributed energy resource growth.
- Programs and services which could provide a certain level of generation to be owned or managed by Iowa Lakes, or other innovative approaches which support additional renewable resources to be developed by Iowa Lakes.
- Evaluation of pricing, rates and other policies in any future wholesale power arrangement with Basin Electric (current wind project PPA expires in 2029).

Having some flexibility in its wholesale power contract to allow ILEC the ability to self-generate a portion of its power, or some other contractual solution which would provide for Basin Electric to purchase the renewable energy output developed by ILEC, is Olesen's real desire. This would enable cost-effective repowering and possibly project expansion, so that the co-op could leverage all the wind generation expertise it has built to date. NRECA's *2018 Distributed Energy Resources Compensation and Cost Recovery Guide*,[16] along with the Rural Electric Management Development Council's 2019 *Opportunities for Cooperatives to Lead Transformational Change through Energy Innovation*[17] report offer guidance on this complex and timely issue. Said Olesen, "Co-ops like Iowa Lakes are leaders. We're trying to push the envelope or at least show that there is a way that we can change. The world's changing, the industry's changing, so cooperative utilities need to change too."

Olesen attributes a lot of the project's success to Iowa Lakes' ongoing partnerships with its co-op family, including both G&Ts and its members. Basin Electric supported the project early on by allowing Iowa Lakes to pool its wind turbine order with theirs, and by sharing their easement contracts with Iowa Lakes.

[16] https://www.cooperative.com/topics/distributed-energy-resources/Pages/2018-DER-Compensation-and-Cost-Recovery.aspx

[17] http://www.remdc.org/da/userfiles/site/8dee4114-7062-11e6-b0b9-068f1ad31f7d/files/REMDC%20Transformative%20Opportunities%20-%20FINAL.pdf

Because both co-ops use the same wind turbine model, they share experience on operations, maintenance, and performance. And since 2012, Basin Electric has purchased all of the wind farms' production through its PPA. Corn Belt enabled the project from the beginning by forming the original PPA in 2009, and working with ILEC on connections to the substations. Corn Belt continues to maintain the related transmission system and substations.

In addition, Iowa Lakes' relationship with members was also critical. When Olesen approached members about land easements, they asked repeatedly, "This is the co-op running this, right?" They wanted assurance that the co-op, not an outside entity, would own it, operate it, and benefit from the energy. When he assured them that the co-op was the sole owner and offered to cover their legal costs for contract review, "within a couple of weeks, we had [all the easements] we needed."

## Key Lessons and Insights

Over the many years of this project, Iowa Lakes has built expertise that they would like to leverage in their own future wind developments, as well as by helping other cooperatives. Their project highlights the power of a holistic approach involving the board, staff, members, G&Ts (in this case, two), and the local economy.

The project was successful due to several defining factors, including:

- **Enthusiasm and determination from the board**: The board stayed committed to the project idea even though it took years for the right conditions to arise.

- **Creativity and pragmatism from staff**: This combination enabled staff to wait and watch for a good opportunity, and then act quickly when one presented itself.

- **Appetite for calculated risk**: The 60-employee, 13,000-member co-op took on $43 million in debt. At the time, Olesen cautioned his staff that this was a serious undertaking, and "if this goes bad, the world for Iowa Lakes is going to be very bad. Failure is not an option."

- **Ability to flex with changes**: During the project timeframe, Corn Belt became a Class A member of Basin Electric providing new PPA opportunities and renegotiation, a move from the Mid-continent Power Pool (MAPP) to Southwest Power Pool (SPP) resulted in a loss of $1.3 million in loss factor credits, and the market value of the project's green tags declined sharply.

For other co-ops considering similar projects, Iowa Lakes offers insights. Regarding project design, Ruschy points out, "Large wind farms may have curtailment issues, if the transmission system can't support the size of the farm. Size your project for where you are and where the load is." Zeitz is a big proponent of in-house O&M, not only to create local jobs, but also for co-op staff to be truly invested and feel a sense of ownership in the project's performance. And, as someone who's shepherded the project from the very beginning, Olesen advises co-ops to expect change in everything from established revenue streams to operating conditions. Both wind and electric utility industries are evolving rapidly. "That's one thing to always keep in mind," he said, "things can change."

Despite the changes over the years, ILEC's wind farms continue to draw a connection between two of the region's most plentiful resources – wind and corn. But the real story of the project is about how

dedication and perseverance from the co-op's board and staff enables the co-op to generate clean energy, revenue for the co-op and community members, and a great deal of local pride.

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### Additional Information on NRECA Research's RADWIND Project

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

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