Business & Technology Advisory

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RURAL ENERGY STORAGE DEPLOYMENT PROGRAM (RESDP) CASE STUDY:

West River Electric Association

West River Electric Association, Inc.

Your Touchstone Energy® Cooperative

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RESDP Project

This is the third and final in a series of case studies on the deployment of battery energy storage systems (BESS) projects at electric cooperatives through NRECA's Rural Energy Storage Deployment Program (RESDP). RESDP's goal is to successfully deploy BESS at rural critical infrastructure served by electric cooperatives to increase resiliency, improve system efficiency, and to collect best practices and lessons learned from these deployments with electric cooperatives across the country. The U.S. Department of Energy's Pacific Northwest National Laboratory (PNNL) and Sandia National Laboratories (Sandia) are technical advisors to NRECA on the project. For more information on the project and additional resources, please visit the project landing page at www.cooperative.com/RESDP.

The project profiled in this case study is an effort by West River Electric Association and NRECA to deploy a battery for a critical infrastructure site located in South Dakota.

This material is based upon work supported by the U.S. Department of Energy, Office of Electricity (OE), Energy Storage Division.

Project Snapshot

Cooperative	Project Ownership	BESS Chemistry	BESS Capacity	BESS Energy	Other System Equip.	Use Case
West River Electric Association, Inc.	West River Electric Association, Inc.	Lithium Iron Phosphate (LFP)	75 kW	277 kWh	LYNC Microgrid Controller	Peak Shaving and Resilience

Cooperative Profile

West River Electric Association, Inc. (WREA)[1] is an electric distribution cooperative serving more than 20,000 meters in western South Dakota. With their headquarters in Wall, SD, the physical plant of West River Electric consists of over 2,500 miles of line and associated substations and equipment located within Pennington, Meade, Haakon, Ziebach, Jackson and Oglala Lakota Counties. West River's distribution system covers nearly 100 percent of an area of 4,500 square miles. See Figure 1 below for territory details.

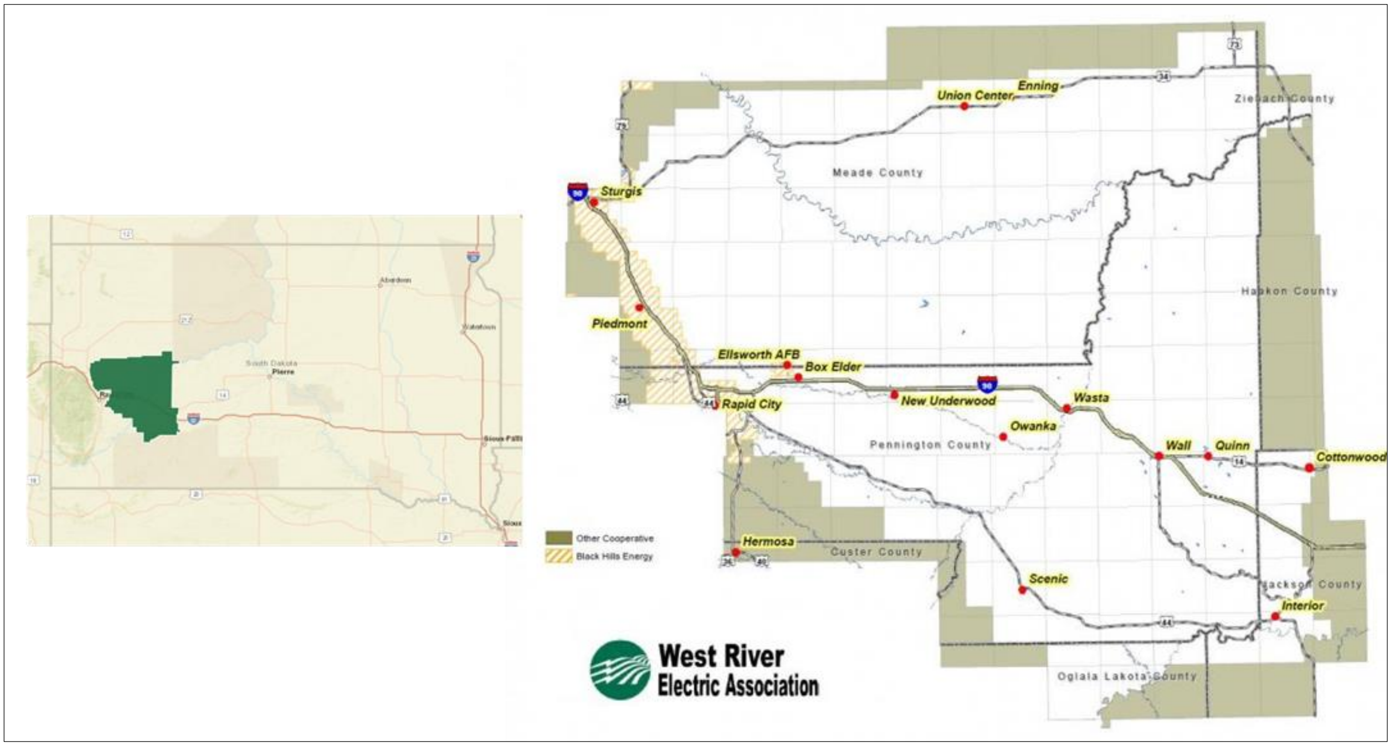

Figure 1 – West River Electric Association's Service Territory in Western South Dakota

Project Background

In the last few years, the U.S. Department of Defense (DoD) has put a strong emphasis on resilience at its domestic military installations to ensure that some of the most critical loads on those installations can withstand a long duration outage for as long as a week or two. As part of meeting its resilience goals, the DoD has focused on battery energy storage systems to ensure continuity of mission and resilience. As of the beginning of 2024, more than 10% of NRECA's membership serves a military installation. Electric cooperatives proudly serve over 145 military facilities in 42 states across the United States and have been collaborating and innovating with their military members on microgrids, batteries, and electric vehicles.

For West River Electric Association, bringing economic development to western South Dakota is just part of their cooperative spirit. When CEO, Richard (Dick) Johnson was approached by NRECA in 2019 to bring a microgrid to Ellsworth Air Force Base (AFB) as part of the RESDP project, he jumped at the

[1] https://www.westriver.coop

chance to provide resilience to a critical economic engine in his service territory. Even if a cooperative does not serve an entire base, as was the case with WREA which only serves part of Ellsworth AFB, that does not mean there are not opportunities to provide energy services. Currently, the base receives a federal hydropower allocation, with additional purchases during the summer to meet its peak demand. Based on RESDP's objectives, a BESS centered microgrid was the preferred solution. The battery energy storage system solution focuses on providing an uninterruptible power supply (UPS) to provide resilience for a mission critical load, with an additional use case of peak shaving during normal grid operations in collaboration with Rushmore Electric Power Cooperative, WREA's generation & transmission (G&T) cooperative. The microgrid also allows for integration with a future solar deployment, if the co-op chooses to pursue it.

Ellsworth AFB is located 10 miles east of Rapid City, just outside of the City of Box Elder. Home to the 28th Bomb Wing, it is one of only two B-1B bomber bases in the world. The base has over 3,000 active duty personal with another 3,000 dependents. According to its 2022 Economic Impact Statement, Ellsworth AFB has a $489 million annual economic impact on South Dakota and the local community.[2] In 2021, Ellsworth AFB was awarded a new mission as the home to the B-21 Raider, a new bomber aircraft, which will increase the electricity demand and need for resilience at this base.

Technical Details

Siting

Siting a new energy asset on a military installation presents many unique challenges. In determining where to site the BESS, WREA's goal was to find the optimal location and critical load to provide the greatest resilience value for its member. The co-op learned that on a major installation like Ellsworth AFB, almost any part of the base can be considered "critical" because they are interdependent, relying on each other to achieve the mission. Several loads were considered, as these would determine the capacity and energy capabilities of the BESS solution.

One major challenge the co-op encountered is that Ellsworth AFB has only a single master meter for the entire base, which is not uncommon for military installations. This presented a challenge because at a large installation like Ellsworth AFB, different buildings and other loads can have very different load profiles (e.g., how much energy they use and when). Without separate meters, it is more difficult to size and scope a resilience resource to a specific critical load. Furthermore, the base relies on a third party for meter monitoring with standard reporting on a monthly basis, though the master meter itself was capable of more frequent reporting. For scoping the BESS to meet varying load files across the days, WREA ideally would have needed to collect a full year of data reporting at a 15-minute interval level to establish trends over time.

To overcome these challenges, base authorities allowed WREA to install temporary meters on specific critical loads around Ellsworth AFB that were considered good potential sites for the BESS. The timeline of the project did not allow the collection of a full year of data, so WREA enlisted assistance from the experts at PNNL and Sandia, NRECA's RESDP technical advisors, to assist in collecting and back forecasting load data to create an annual profile at the required 15-minute increments.

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[2] https://www.ellsworth.af.mil/Portals/146/documents/2023%20-%20EIS%20Trifold.pdf?ver=pGySqo3bqMfTfSWe9apcTA%3d%3d

Additional considerations included integration with existing backup diesel generators around the installation and connection with existing wiring. As is common at military facilities, many critical loads already have legacy backup generation, most commonly diesel or jet fuel. But many of these lack the "smart" controls necessary to operate in parallel with a BESS, which ruled out sites where this integration was required.[3] Additionally, the wiring at many military facilities has been added to continuously over several decades, increasing the difficulty of interconnecting new distributed energy resources (DER).

While site selection was ongoing in 2021, an additional wrinkle arose when the United Facilities Criteria (UFC 3-600-01), which sets requirements for federal properties including military installations, was updated. Among many changes, this revision included a requirement that any lithium-ion BESS located on federal property be sited at least 100 feet from any "occupied structure or identified outdoor use area."[4] This was a significant new constraint on siting and led to a reconsideration of sites. Ultimately, WREA was able to identify a site that was mission critical and needed to be operated 24/7, where direct integration with an existing generator could be averted and interconnecting with existing infrastructure was relatively straight forward. This made the new site a perfect candidate for the BESS deployment.

BESS Details

The BESS is a 75kW/277kWh lithium-ion phosphate procured by Go Electric Inc. (a Saft company), a leading U.S.-based developer of distributed energy resiliency solutions for microgrids at commercial and industrial customers. The battery itself was procured from a third-party supplier to meet specific contractual requirements, including non-standard sub-megawatt capacity and domestic content, while Go Electric provided the balance of plant. "Go Electric's microgrid power controller technology, combined with energy storage, plays a key role in enabling customer sites to 'keep the lights on' by islanding them from the grid should a power outage occur. The technology also helps to integrate higher levels of distributed renewable energy and reduce energy costs. Go Electric's solution has been deployed in military microgrids and commercial sites across the U.S. and Canada."[5]

In order to meet the military's resilience goal for this critical load, the BESS had to provide uninterruptible power supply to the load while transferring it to islanded mode in case of any outage on the bulk power grid. This is where Go Electric's LYNC SECURE® Power System for Microgrids comes in. This system "combines grid-forming Power Conversion and advanced microgrid controls to deliver uninterruptible power to facilities, lower facility energy costs, integrate renewables and other DERs into a resilient microgrid, and provide grid-stabilizing energy services to utilities."[6] The balance of the plant was provided by Go Electric and WREA.

Planning & Engineering

Since this was the first BESS deployed by WREA, at the beginning of the project the cooperative put out a request for proposals (RFP) to hire a general contractor to manage contracting for the project. The project continued to run into significant hurdles such as code changes and siting issues, each of these requiring major changes to the scope and site of the BESS. The initial phase of the project also occurred during the global pandemic, which caused significant delays and supply chain concerns.

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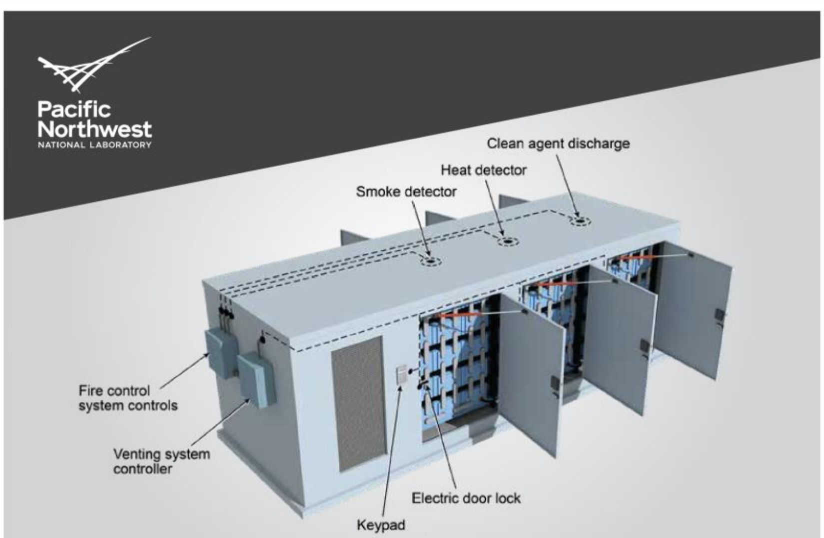
[3] WREA learned that integrating existing backup generators with a BESS is a challenge even when these controls are present, and that this sort of integration is most feasible when they are deployed together rather than retrofitted later.
[4] https://www.wbdg.org/FFC/DOD/UFC/ufc_3_600_01_2016_c6.pdf
[5] https://saft.com/media-resources/press-releases/saft-strengthens-its-energy-storage-business-acquisition-go-electric
[6] https://saft.com/products-solutions/products/lync-secure%C2%AE-power-system-microgrids

During this period, WREA had the opportunity to talk to other RESDP participants to learn about their experiences.[7] As Sean Bestgen, systems engineer at WREA noted, "as an engineer, it was interesting to be a part of this technical project. Learning about the standards and regulations around battery storage has been eye opening. These rules are needed to safely move to sustainability. The connections I've made within the co-op family through this project were awesome; there's so much we can learn from each other." By the time the site was selected, WREA had gained enough familiarity with the needs for this battery deployment to demystify the process, recognizing that many of the site preparation requirements for a BESS were not that different from other distribution projects they were already experienced with. For example, the concrete pad, wiring, and conduit required were similar to those required when building a substation. Before construction began, the co-op decided it would save money and time to bring the general contracting in-house, utilizing the same trusted partners they already used for other distribution grid projects. As CEO of WREA, Dick Johnson noted, "as an electric distribution provider, we are used to projects taking a long time to come to fruition. This project, however, forced us to be more patient and diligent in our approach to make sure it was a success."

Safety Considerations with Battery Energy Storage Safety

Since the BESS will be located on federal property, the codes and standards that govern the installation are slightly different than on a utility's own distribution grid. The UFC requires that all lithium-ion batteries be compliant with the National Fire Protection Association Standard (NFPA) 855,[8] which cites to one of the key BESS product safety standards, UL 9540. As part of the UL 9540 standard the battery supplier must provide thermal runaway data by performing a UL 9540A test: "UL 9540A is not a certification, but a standardized fire test method for BESS, primarily Li-Ion batteries to demonstrate that thermal runaway events – both fire and toxic gas releases – can be contained and not propagated to adjoining units."[9]



[7] https://www.cooperative.com/programs-services/bts/Rural-Energy-Storage-Deployment-Program/Pages/default.aspx
[8] Please see NRECA and PNNL's "Battery Energy Storage System Safety Report, Design Considerations for Electric Cooperatives," at https://www.cooperative.com/programs-services/bts/Rural-Energy-Storage-Deployment-Program/Documents/NRECA-PNNL-Battery-Energy-Storage-Safety-Report-July-2024.pdf.
[9] https://www.sandia.gov/energystoragesafety/2024/05/07/ul-9540-and-ul-9540a/#:~:text=UL%209540A%20is%20not%20a,not%20propagated%20to%20adjoining%20units.

To meet the codes and standards that were listed in the RFP (by version and year), the project team decided to deploy PNNL's IntelliVent™ system. PNNL explains this fire safety system as follows:

> The IntelliVent™ system is a deflagration prevention design that utilizes the cabinet doors to open when triggered by gas, smoke, or heat detection to allow passive exhausting of gases. This approach offers many advantages over mechanical exhaust systems and may still be designed to meet requirements of NFPA 69.[10]

To ensure that the BESS has the highest safety protocols possible, WREA and NRECA leaned on PNNL and Sandia's expertise for the best practices in battery energy storage safety in design of this project. At the end of the project, to ensure that all local civilian and military first responders are trained on the safe operations of the BESS and in case of an event, the national labs will be conducting an in-person safety training which will go over what to do in the case of a fire at the site. The culture of safety was a central piece of this project, even though it led to a longer timeline than originally anticipated.

BESS FEND Data Diode Implementation and Security Assurance

The project team was intentional and thought about both safety and cyber security at the beginning of the project. IntelliVent™ was integrated for fire safety. For cybersecurity, a DoD approved technology to increase the cybersecurity posture around the BESS was procured and the project team hired BlackByte Cyber Security LLC to help us implement the solution. The implementation of data diodes (i.e., network isolation and protection of uni-directional data) is a concept used in many Internet of Things (IoT) and Industrial Control System (ICS) environments where isolation is needed to support a strong cybersecurity posture. These devices provide a high assurance of intrusion prevention from outside entities, whether in deployed private networks or across the internet. This approach is necessary to provide situational awareness of critical components and data to external stakeholders where devices are highly isolated from each other, or the desire is to provide absolute protection from external threats attempting to disrupt or compromise the integrity of a critical control system and associated process.

The FEND Data Diode has completed successful non-destructive and destructive testing with Government partners via the DoD ESTCP (U.S. Department of Defense, Environmental Security Technology Certification Program), Army TSMO (Threat Systems Management Office), and NAVFAC-CSTB (Naval Facilities Engineering Systems Command – Control Systems Test Bed) programs to ensure all security objectives are met. These tests have resulted in determinations of impenetrable electronic isolation capabilities, and fortified hardware configurations to maintain operational integrity and enforcement of electronic data boundaries. These proven electronic and physical characteristics are currently deployed throughout ICS critical infrastructure.

The specific implementation depicted below allows *all* data to flow outbound to a central monitoring server while isolating any input back into the control system. This will ensure that the remote site will always maintain the highest level of isolation from even internal trusted systems and other digital devices, computer workstations, and servers while maintaining data flow to appropriate resources. The data itself does not contain information that could compromise the operational system regardless of dissemination. However, the data is also highly encrypted in flight to thwart its use until it reaches the final monitoring and status platform destination.

[10] https://www.pnnl.gov/available-technologies/intellivent

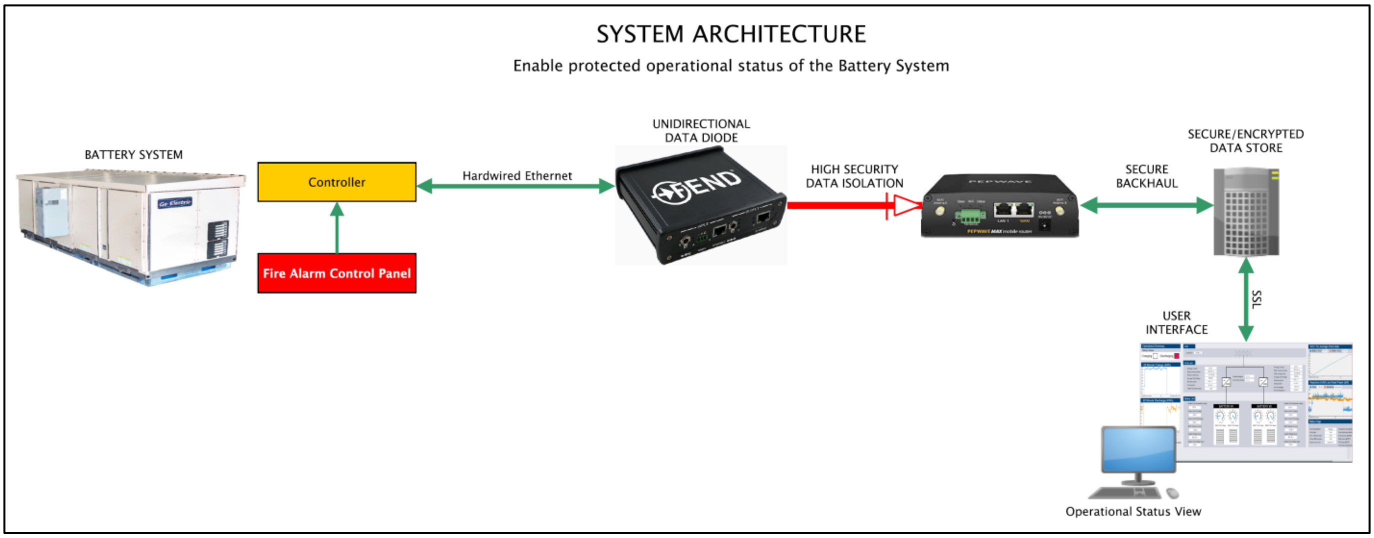


Figure 2 – Technical Diode Implementation

Economic Details

The project is paid for by a combination of a federal grant, tax credit, and cooperative funds. The Rural Energy Storage Deployment Program grant is funded by the U.S. Department of Energy's Office of Electricity in collaboration with NRECA Research. Additionally, the cooperative will be taking advantage of the Direct Pay Investment Tax Credit for a stationary battery energy storage installation that was included in the Inflation Reduction Act passed by Congress and signed into law in 2022.[11]

Key Lessons and Insights

- **RFP Process**: Request for proposals should include all of the most current versions of applicable codes and standards. These details are needed to ensure that vendors meet or exceed all safety and code requirements in the local jurisdiction. Follow Rural Utilities Services (RUS) material procurement standards; use RUS Form 198.
- **Codes and Standards**: The applicable codes and standards for BESS deployment were updated after WREA launched their project, which created additional fire safety requirements to be included in the final RFP and contract with the battery developer and procurement partner. Make sure that you are aware of any potential changes to any pertinent codes or standards.
- **Contracting**: While WREA began the project working with a general contractor, the decision was later made to save time and money by bringing project contracting in-house. This was after co-op staff became more familiar with the site preparation needs of BESS installation, including through discussions from other RESDP participants with deployment experience. WREA learned that BESS site-prep is not that different from other distribution grid projects like substation construction and can be handled by existing trusted contractors.
- **Domestic Content Requirements:** WREA's BESS project received federal funding through NRECA's RESDP project and will also be seeking applicable direct-pay tax credits that became

[11] For more information, please visit: https://www.cooperative.com/programs-services/government-relations/regulatory-issues/Pages/Secure/IRA-Funding-Opportunities.aspx.

available as part of the Inflation Reduction Act. All of these federal programs have Buy American or similar domestic content requirements. It is important to work with vendors and OEMs to ensure that the applicable requirements are met or that a waiver is received to ensure that full funding or tax credit value can be received.

- **Supply Chain Issues:** Pandemic and post-pandemic supply chain challenges impacted this project. While most of these issues have been worked out, there are continuing supply chain issues in the battery energy storage market. When planning a project, a clear assessment of supply chain risk is an important part of due diligence.
- **Procurement for Smaller Projects Can Be More Complicated:** WREA sized their BESS's capacity and output to meet the resilience needs of a critical load at Ellsworth Air Force Base. This meant a relatively small 75 kW/277 kWh system. Many well-known BESS OEMs (e.g., Tesla) sell standardized grid scale systems with a minimum capacity of 1 MW or greater, and often sell them in bulk orders to clients deploying multiple systems. These larger systems also tend to meet relevant fire and safety codes and standards already. WREA discovered that there is a market gap for smaller, more customized deployments like theirs, and ensuring that their BESS meets fire and safety and other requirements (e.g., domestic content) can be more challenging for this type of project, requiring significant oversight from cooperative staff to ensure that all contract and code requirements are met.
- **Cybersecurity Should be Built In:** In the initial planning phase, the project team thought about how to transmit data securely from the battery to the cooperative. The proactive nature allowed us to find the most optimal solution for the BESS and the cooperative.

Conclusion

As rural electric cooperatives continue to explore battery energy solutions as an option to meet their operational and resilience needs, there are important opportunities to learn from other cooperatives' experience with these newer technologies. As Adam Daigle, Energy Services Advisor at WREA explains, "being part of this important project has been truly rewarding. The insights gained will hopefully help guide electric cooperatives in assessing the advantages and disadvantages of such a project for their members. It was a pleasure working with the various organizations that made it such a success!"

Contacts for Questions

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