

Increasing Control: Tips from KCEC for Energy Communities

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Kit Carson Electric Cooperative (KCEC), a rural cooperative in New Mexico serving approximately 31,000 members, achieved its 100% daytime solar target in 2022. More than three years later, KCEC's achievements still stand out: 100% daytime solar since 2022 with an extended solar day, flat residential electricity prices since 2016, fixed out to 2040 and lower than the US average residential electricity price, emissions on track to be back at 2002 levels, and assets built by a local workforce. KCEC has grown its generation portfolio from 2.5 MW of solar in 2015 to ~100 MW of solar, batteries, microgrids, and hydrogen operating or under construction today. Annual electricity consumption is ~75-80% renewables (~45% locally produced solar, and ~35% wind through a supply agreement).

KCEC's journey started because KCEC wanted more control and flexibility for its members and to prevent further rate increases. KCEC started early when *"no one thought that renewables were going to be a workhorse resource."* The journey is one full of incremental steps, experimentation, creativity, and pragmatism, with a win-win approach to partnerships and a relentless pursuit of new ways to add value to the service KCEC provides its members.

This article reflects on KCEC's experience and extracts tips in six capability areas for energy communities and the distribution network operators that serve energy communities.

Descriptions

Energy Community/Community Choice:

legal entity that allows citizens, small businesses, and local authorities to jointly own and manage energy projects.

Distribution Network Operator: Licensed entity responsible for owning, operating, and maintaining the wires, poles, and transformers that deliver electricity to homes and businesses and manage the transmission interface.

Rural Cooperative (KCEC): Private, non-profit utility business owned by the people it serves, managing the electricity supply, distribution infrastructure, and transmission interface.

Capability 1: Management of Activity Scope, Contracts, and Partners

Before 2016, KCEC was a member of Tri-State, a large regional, coal-heavy, generation and transmission (G&T) provider. KCEC sought separation from Tri-State because, at the time, Tri-State prohibited member cooperatives from generating more than 5% of their own power locally and between 2000 and 2016, Tri-State’s wholesale rates had nearly doubled. To exit the contract (which was not set to expire until 2040), KCEC had to pay a \$37 million exit fee to "make whole" the remaining Tri-State members. KCEC partnered with Guzman Energy who financed the exit fee in return for a power supply contract. Although how KCEC delivered power under the existing infrastructure did not fundamentally change, KCEC had to restructure who would be responsible for the activities that were previously the responsibility of Tri State. Over the last 10 years, KCEC’s understanding of the electricity system has grown as its activities have expanded beyond the distribution network to solar, batteries, microgrids, and hydrogen. Refer Table 1.

Table 1: KCEC Activity Scope in 2015 vs. Today

Activity	2015	Today
Electricity delivery and billing to end consumer in Taos	KCEC	KCEC
Build, Design, and Operations and Maintenance (O&M) of distribution network	KCEC	KCEC
Generation and storage assets (ownership/control)	Tri State / KCEC limited to 5% solar	KCEC – mix of direct and PPA solar, batteries, microgrids, hydrogen
Generation and storage asset Operations and Maintenance (O&M)	Tri-State	Third party provider to KCEC. Future could be KCEC
Electricity supply and real-time desk and scheduling and wholesale market interface	Tri State member	KCEC contract with Guzman for load not covered by solar (incl. large share from wind), sells excess solar, operates batteries
Transmission Line Access	Tri State member	KCEC Contract with Tri State and PNM
Relationship with PNM (Public Service of New Mexico) Balancing Authority	Tri State member	KCEC contracts with PNM but Guzman manages operational interface (bidding and schedules). KCEC has real-time visibility of its own generation and load and works with Guzman.
Annual Electricity Plan	Tri State member	KCEC

Tips from KCEC:

- Secure Technical Utility Expert:** One of the biggest challenges that energy communities face is the lack of technical capacity to talk to the utility. KCEC knew that its understanding of the electricity system was narrow, so KCEC hired retired investor-owned utility (IOU) executives who were familiar with the interconnections, grid codes, and FERC regulation and could support the contract negotiations. This proved invaluable.
- Shared Control/Checks and Balances:** Historically, KCEC gave all control to Tri-State, so when an opportunity came up (e.g., to site a battery or develop a solar farm in KCEC), KCEC

had no control. In the current model, KCEC has contracts for transmission access and the balancing authority, while Guzman manages the real-time desk, scheduling, and wholesale market access. If KCEC finds an opportunity to add solar and storage that would be cheaper than Guzman providing the power, KCEC can take advantage of that opportunity. Additionally, with this split of activity, KCEC has oversight and understands the entire system and can make conscious decisions regarding risks and scope.

- **Test Period and Contract Flexibility to Expand and Explore:** The first six years of the KCEC supply contract with Guzman were a test period, and Guzman did impose more limits than KCEC wanted. Understandably, Guzman wanted to see if KCEC would/could really build the amount of generation KCEC planned. In the first contract, KCEC worked with Guzman on the first four projects. From that success, the contract evolved. This flexibility has enabled both KCEC and Guzman to expand their activities as they gain experience, build new skills, and find new areas of value. (e.g., optimizing the use of batteries, exploring concepts like virtual power plants). KCEC and Guzman are in the seventh amendment of the initial contract signed 10 years ago.

Capability 2: Portfolio, Project, and Asset Management

There are only 146 employees across KCEC's three businesses – electricity, propane, and broadband. There are 98 people on the electricity team and only three engineers (including the CEO and COO) and 25 linemen. With this small core team, working with customers and members to site projects, partnering with developers and specialist contractors, and leveraging local companies and workers for construction and maintenance has been critical.

KCEC has built a portfolio of solar and battery projects, has a wind PPA, and is now expanding to include three microgrid projects and one green hydrogen project. The assets are a mix of ownership including: KCEC owned, pueblo-owned, and PPAs. Refer to Table 2.

There are also more than 700 homes with residential solar or solar + battery in KCEC. KCEC's philosophy is "*solar for all*" - all members benefit from the solar (vs. those who cannot afford residential solar paying for those who can), so KCEC's utility scale solar (~ 51 MW, ~94%) and battery storage (~105 MWh) capacity is much larger than the residential solar (~3.5 MW, ~6%) and battery storage (~4 MWh).

Table 2: KCEC Projects

Project Name	Technology	Capacity (MW/MWh)	Status	Ownership
Taos Mesa Solar	Solar PV	15.0 MW	Operational	KCEC Owned
Taos Mesa BESS	Battery	12.5 MW / 25 MWh	Operational	KCEC Owned
Amalia II Solar	Solar PV	8.75 MW	Operational	PPA (Luminance)
Amalia II BESS	Battery	8.75 MW / 17.5 MWh	Operational	KCEC Owned
Angel Fire Solar	Solar PV	7.5 MW	Operational	KCEC Owned
Angel Fire BESS	Battery	3.75 MW / 7.5 MWh	Operational	KCEC Owned
Taos Ski Valley BESS	Microgrid	3.75 MW / 18 MWh	Under Dev	KCEC Owned
Taos Pueblo Solar	Solar PV	5.0 MW	On Hold	Jointly Owned by KCEC and Taos Pueblo
Taos Pueblo BESS	Battery	5.0 MW / 10 MWh	On Hold	Owned by Taos Pueblo
Peñasco (Posco) BESS	Microgrid	2.5 MW / 13.5 MWh	Under Dev	KCEC Owned
El Rito West BESS	Microgrid	1.25 MW / 6.75 MWh	Operational	KCEC Owned
Taos Water Treatment	Solar PV	3.0 MW	Operational	PPA
Picuris Pueblo	Solar PV	1.0 MW	Operational	PPA (Picuris Pueblo)
Eagle Nest Lake	Solar PV	1.0 MW	Operational	PPA
Questa Solar	Solar PV	1.5 MW	Operational	PPA
Tres Piedras Solar	Solar PV	2.0 MW	Operational	PPA
Questa Green H2	Hydrogen	60 MW Solar/20 MW H2	Breaking Ground	Questa owns solar/ KCEC owns H2
Nuvve BAAS Fleet	BESS	10 MW / 40 MWh	Under Dev	Taos Pueblo (Nuvve)
Shallow Basket	Solar+BESS	140 MW / 50 MWh	Operational	PPA (Guzman)
Panorama Wind (in Colorado)	Wind	145 MW	Operational	PPA (Guzman)
Picuris Pueblo II	Solar PV	1.0 MW	Operational	PPA (Picuris Pueblo)
Picuris Pueblo BESS	BESS	1.0 MW/ 4.0 MWh	Under Dev	PPA (Picuris Pueblo)

Tips from KCEC:

- Balance external expertise with in-house and local skill development.** Guzman has been a trusted partner in virtually all KCEC projects, but KCEC has also trained its own staff using courses from the National Rural Electric Cooperative Association (NRECA), with vendors who offer training on their equipment, and, most importantly, through a four-year apprenticeship program for linemen and metermen. KCECs works with University of New Mexico Taos, Northern New Mexico College, and the local high school where KCEC employees also act as instructors to many of the courses. For example, the microgrid at Northern New Mexico College in El Rito is a working microgrid that is also used for teaching, so students can have hands-on experience with the microgrid and battery equipment.
- Aligned model for residential solar.** KCEC’s philosophy is solar for all, so the focus has been on a front-of-meter solar (94%) to ensure all KCEC members have access to the benefits. For members who want residential solar, KCEC right-sizes the size of the solar system (to avoid significant excess imports when the system already has too much), requires batteries with the solar, and uses technologies like load limiting inverters. Residential solar is netted out at

the retail rate (13-14 cents), and any excess can be exported to KCEC's network at no compensation or, for those that want compensation, at a cost avoidance rate (3 cents).

- **Experimentation.** Ideas and opportunities can come from KCEC's own team, external developers, partners, and members. The first thought should not be cost. KCEC's current portfolio includes solar, batteries, microgrids, hydrogen, broadband, and propane, but KCEC has explored topics such as agrivoltaics and community farms, biomass, and landfill gas. KCEC is now exploring virtual power plants and geothermal. KCEC has leveraged the national labs, including the NREL (now called the National Laboratory of the Rockies), Los Alamos National Labs, Sandia National labs, Argonne National Labs, and New Mexico's Universities.

"We've tried a lot of things. Many of our team have gone way out of their comfort zone."

Capability 3: System Resilience and Risk Management

KCEC's rural territory is characterized by fire risk and severe cold winter weather. For example, in February 2011, the Groundhog Day Blizzard of 2011 left Taos, Questa, Red River, and Española without heat during record-breaking sub-zero temperatures when natural gas supply was cut-off. The lack of natural gas resulted in a significant increase in electricity loads as residents plugged in space heaters and used electrical appliances and hot water to keep warm. Working with its members and largest customers to reduce loads, KCEC managed this crisis, but now KCEC can use microgrids and batteries to manage through severe weather events.

For example, if there is a fire risk, the protocol is for KCEC to alert the NMPRC (New Mexico Public Regulation Commission) and execute a power safety shut off and deenergize the power lines. This would also likely cut off communications and water from wells. In its first application of microgrids, KCEC worked with the county and its members to identify the highest risk areas for forest fires and will build microgrids in these communities. One microgrid is being built in Taos Ski Valley (TSV). During an event, TSV would have ~ 6 hours that could stretch to 10 hours by matching the meter and the battery and turning off the power to unoccupied second homes. Most importantly, TSV will have critical infrastructure available (e.g., water, wastewater, fire tank, communication, broadband, cell tower) and the time and control to make important decisions during the most critical first few hours of an event. In the spirit of prevention, KCEC is also investigating the opportunity to replace generators with batteries to avoid/reduce burning propane or gasoline in the forest.

A particularly novel application of batteries is a pilot that KCEC is conducting to assess the potential of using batteries in a virtual power plant construct to monitor and back-up medical devices and critical equipment for the older vulnerable population who are the most at risk of serious health complications during power outages. The pilot will work with the hospital to select "vulnerable" residents, create a mechanism for collecting and storing information, develop proper response mechanisms during outages, and use batteries aggregated in small virtual power plant pilot to back-up the medical equipment. KCEC will also use the batteries when the back-up is not being used to support the commercial viability of the scheme.

Tips from KCEC:

- **Understand the value of an extra 6-10 hours and local control.** Communities/regions are susceptible to different risks. Decisions during the first minutes/hours of these events can make a significant difference, so the time that a battery or microgrid can provide can be incredibly valuable.
- **Maximize the value to the disaster planning team.** KCEC is part of a local emergency planning committee that includes the town, county, first responders, and fire departments who gather monthly. Understand the role of the energy community and how tools like microgrids, batteries, and local generation can support all members in their roles and activities.
- **Leverage tethered (connected to the distribution system) microgrids to increase distributed resiliency and control.** Even for energy communities that are not rural, leveraging microgrids that can be activated when the distribution network is deenergized for key areas and adding a battery to fire, water and waste, and medical services can give valuable time to first responders to prioritize critical resources and make decisions during outages and emergency situations.

Capability 4: Electricity System Planning

Prior to the separation from Tri-State, Tri-State developed and filed the load requirements and energy production forecasts required by PNM (the balancing authority) and the state regulator, with KCEC acting as a reviewer. After the separation, it became KCEC’s responsibility to develop the plans, which are then reviewed and critiqued by Guzman Energy, Tri-State, and PNM. KCEC now produces two plans, the “Long-term Energy Requirements and Resource Production” and the “Export Forecast.”

The “Long-term Energy Requirements and Resource Production” includes load forecasts, solar and BESS production forecasts, and forecasts for the load served by local production until 2040. The forecasts also include 10 years of historical loads (since 2015), information on new projects coming online, and an Appendix including information on the annual export forecast. KCEC also has to produce an annual “Export Forecast” with the estimated electricity exports from its solar production for the following year, providing historical peak export data and explaining the models used to create the forecast, how KCEC will comply with the export limits, and how KCEC will use BESS to reduce electricity exports and minimize transmission charges.

Tips from KCEC:

1. **Leverage third-party expertise but be closely involved.** In developing its first load forecast and energy production plan, KCEC used a third party with expertise in developing resource

plans and still uses this third party today. However, KCEC is actively involved in the annual plan development, providing and reviewing the data on loads, energy production, and future projects. Today, if KCEC had to takeover the plan development, it could.

2. **Upgrade metering and infrastructure.** When KCEC took over the responsibilities of the G&T (generation and transmission provider, Tri-State), the metering that was in place was not sufficient to monitor the exports to the bulk transmission system or support two-way electricity flows. The equipment upgrade and access to real-time data have been critical to managing export limits, optimizing the BESS, and solving for the lowest cost electricity.
3. **Use the plans to reflect objectives and strategy.** The plans are not only used for compliance. They are a mechanism to bake in objectives like minimizing transmission charges through the optimal charging of BESS or increasing system resiliency through long-duration storage and microgrids.

Capability 5: Communications, Data, and Technology

“The Ferrari of broadband”

KCEC launched its broadband business in 2000. During Covid, KCEC, a rural cooperative, had one of the fastest broadband speeds in New Mexico and the US. As an internet service provider (ISP), KCEC must support data hungry streaming services like YouTube and Netflix and has become expert at managing congestion and routing (and rerouting) internet traffic. Relative to streaming and gaming applications, real-time electricity consumption, solar, battery, and microgrid data are small. This communications infrastructure has allowed KCEC to meter its electricity assets, visualize, monitor, and remotely manage assets through two-way communication channels, provide real-time data to support activities like battery optimization and participation in wholesale electricity markets, and test new innovative applications.

The IT team oversees who is connected and what is connected to KCEC’s broadband and electricity networks. Key responsibilities include management of:

- Cybersecurity surveillance software and protocols to manage cybersecurity risks.
- Data flows, including data sharing and transfers with Guzman and PNM
- Third-party applications, including the visualization of electricity loads, assets production, and battery utilization.
- Pilots to test new applications- e.g., using AI to determine the path of a fire.

There is also an electricity dispatch “command center” that:

- Monitors equipment on the electricity network for outages and faults, with the ability to remotely troubleshoot, fix, shut off, and redirect power.
- Monitors solar production and battery use.

Manages the dispatch workflow – i.e., an application that tracks the activities from initial detection of a fault until the fault is fixed.

The triple capability of IT function, broadband control room, and electricity dispatch command center has given KCEC the ability to explore new applications, reach beyond the meter to support its members, and expand the economic opportunity for the communities it serves by taking advantage of the changing economic trends in remote education and remote working.

Tips from KCEC:

- **Communications partner.** Most energy communities (or their distribution network operators) cannot become ISPs, so finding a communications partner is critical. Real-time monitoring and data have enabled KCEC to find new value pools to improve the economics of the batteries, participate in electricity markets, and reduce the impact of outages through re-routing and reducing response times.
- **Be a willing partner/pilot.** KCEC has a small IT team who works with a wide range of third-parties, academia, and national labs. Through these partnerships, KCEC has participants in several pilots, for example, AI to detect and evaluate smoke and send notifications, drones with lidar and sensors to assess the health of electricity poles.
- **Develop a local workforce.** KCEC's IT Manager teaches introductory computer classes. KCEC shares what it is learning in the communications, data, and technology space with the local university, college, and high school.

Capability 6: Benefit to Members – the Stakeholder Rosetta Stone

KCEC's service territory is a melting pot of cultures that bridges a wide ideological spectrum, including the historical Native American communities of Taos Pueblo and Picuris Pueblo, conservative, retired military and traditional Hispanic ranching and farming communities of Red River and Questa, progressive, liberal-leaning artist enclaves and academic circles of Taos, and the skiers and hikers of Taos Ski Valley.

“We have a lot of member meetings. The board is ½ Republicans and ½ Democrats who set aside political differences to vote for benefit of members. KCEC has no opinion. We represent the members of the coop.”

Tips from KCEC:

- **Use value language from the stakeholder's perspective.** KCEC respects the different perspectives of these communities and engages with each community on what's important to that community. Some groups want lower costs, others an alternative revenue stream to a casino, others to be able to hunt elk drinking from a clear stream under a blue sky from four

hundred meters. The value of the battery that back-ups an oxygen machine is peace of mind knowing that the oxygen tank will not go offline. Increasing renewables is only an objective of a small number of KCEC members.

- **Explain every project with direct answers.** Many of the stakeholders are not energy people. For example, concepts like treating and using produced/non-potable/wastewater for hydrogen and fire prevention are not well understood. For every project, KCEC reach out to ~70 consumer advisories across its five districts and does public presentations to legislators, public officials, local emergency planning, and others. KCEC also has a good relationship with local media outlets- newspaper, radio, and social, and reaches out to members using emails and texts to solicit views and feedback (good and bad) and answer questions.
- **Support joint solutions and a new utility whole system model.** Don't stop at the meter. For example, the Picuris tribe want to develop their own power plant. From a traditional utility perspective, this would be a challenge because of the investment that has been made. But if you take the perspective that KCEC and its members are on the same side and adopt a whole system approach that includes optimizing the assets that will be behind-the-meter, a solar plant with a battery on the Picuris site can be good for the Picuris tribe and also the wider KCEC community.

What's next for KCEC? - Workforce, microgrids, and geothermal.

An increasing emphasis for KCEC is developing the next generation of leaders. KCEC can now offer a pathway to high demand jobs in the clean energy sector, and many of KCEC's employees teach courses at the local high school, college, and university.

Resiliency, particularly in the event of fire or cold weather events, is a priority for KCEC's members, and microgrids will provide KCEC with an opportunity to minimize shut offs/provide power during events and to also improve the economics of the overall system by optimizing production, storage, and loads. KCEC is working with its communities to use batteries and microgrids to support fire prevention, crisis management, and increased protections during outages for critical assets and vulnerable communities. KCEC will also explore the potential of using the batteries for resilience (in a virtual power plant construct) to improve the economics of the system by minimizing imports into the KCEC distribution network and exporting to the wholesale market where the economics are attractive.

The next technology that KCEC is evaluating is geothermal given the local geology and drilling expertise in New Mexico. Local geothermal would enable KCEC to be 100% renewable 24 hours a day/365 day a year.