



Tribal Energy Storage Analysis

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Abstract: Several Native American reservations in the United States are located in areas where electricity is costly and the power grid is unreliable, in spite of the existence of resources for local power generation. As a result, several power generation projects have been launched on tribal lands. Now, tribes are considering the integration of energy storage systems to boost economic value, enhance grid resilience, and improve power quality. With support from DOE OE Energy storage program, the Sandia team is providing assistance to two energy storage analytics projects in tribal lands. One project supports the deployment of an energy storage system for emergency backup power and integration with local power generation in the Picuris Pueblo, while the other evaluates economic and power quality benefits of a storage system at Red Mesa within the Navajo Nation. In both cases, the team is providing technical support to help Native American communities make informed decisions about their energy futures.

Picuris Pueblo

Background

- Picuris Pueblo is located in Sangre De Cristo mountains in northern New Mexico
- Frequent power outages occur due to the remote location and long travel times for utility maintenance personnel.
- The community is pursuing energy resilience by enabling microgrid operation through local generation and storage in partnership with the local utility, Kit Carson Electric Coop

Project Goals

- Size an energy storage system (ESS) that will integrate with existing generation to allow for microgrid operation
- Estimate economic savings and enhance grid resilience benefits
- Provide support for project implementation

Relevance

- Address the challenges of power outages in an area with limited distribution infrastructure
- Provides critical infrastructure resilience to ensure reliable power supply during outages and emergencies
- Promote energy independence through the development of a sustainable and self-sufficient energy system

Current progress

- The technical analysis and initial sizing study have been finalized
- Picuris Pueblo has secured grant funding for the capital costs
- Sandia's Energy Storage Demonstrations team is now actively supporting the request for proposals (RFP) scoping process to move the project into the implementation phase

Next steps

- Finalizing the detailed design based on responses to the RFP.
- Moving forward with procurement and installation of the ESS.
- Integrating the ESS with the microgrid.
- Conducting ongoing performance assessments to validate economic benefits and resilience enhancements post-implementation.

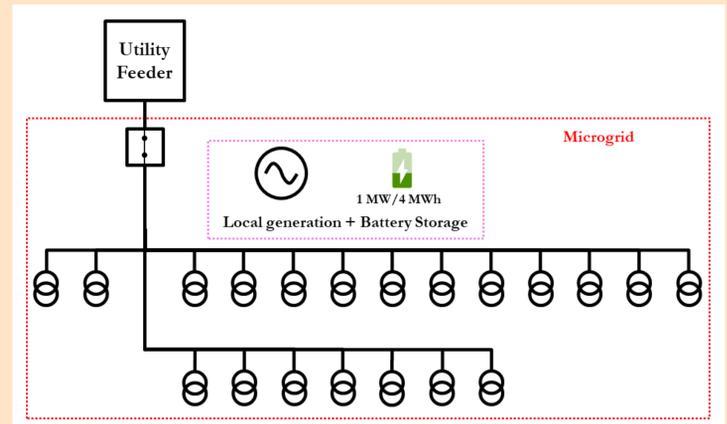


Fig. 1 Microgrid will be equipped with a 1MW/4MWh ESS plus 750 kW of onsite generation.

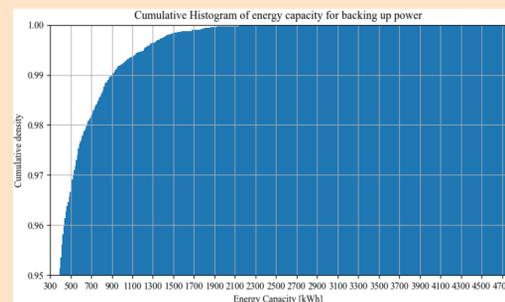


Fig. 2 Cumulative probability of capacity for energy backup of the microgrid [1].

Table 1. Overview of microgrid capabilities

Energy Storage Size	1MW/4MWh (4 hours)
DOE Cost Share	\$441k
Onsite generation	750 kW
Application	Resilience

Increasing Economic Value and Power Quality to the Navajo Nation

Background

- 72 MW generating facility owned by Navajo Tribal Utility Authority (NTUA) and operated by SOLV Energy
- **Curtailment:** Power line congestion may occur when generation is close to rated capacity
- **Voltage issues:** Power generation fluctuation causes power quality problems in the region

Project Goals

- Evaluate how energy storage systems (ESS) can provide power quality and economic benefits
 - **Recover curtailed energy** to by storing excess energy during line congestion times
 - Provide **voltage support** or energy firming during intermittent generation events to mitigate voltage fluctuations

Relevance

- **Economic benefits:** Recovering curtailed energy could translate into significant revenue
- **Improved power quality and critical infrastructure support :** loads connected to the same power line as the local power generation report power quality problems caused by power output fluctuation. By stabilizing voltage, the ESS would help prevent unnecessary activations of backup systems, preserving the reliability and longevity of critical infrastructure (such as the nearby hospital)
- **Strategic impact:** The project informs how energy assets can be optimized using storage to overcome grid limitations, benefiting NTUA and end consumers.

Current Progress

- **Site and Stakeholder Engagement:** Conducted technical visit with NTUA and SOLV Energy at Red Mesa. Held meetings with NTUA engineers to clarify operational challenges
- **Data Collection & Initial Analysis:** Historical energy usage data has been gathered alongside with generator output estimates. Curtailment has been quantified and preliminary revenue calculations based on average and peak energy price scenarios have been completed.

Next Steps

- **Technical Modeling & Simulation:** Conduct analyses to model potential ESS configurations for both AC and DC side integration and evaluate optimal ESS sizing
- **Stakeholder & System Coordination:** continue working with NTUA to clarify control over curtailment protocols necessary for ESS integration. Address the voltage drop challenge by developing strategies to mitigate impacts on the hospital's backup system.
- **Detailed Design & Recommendations:** Finalize recommendations that balance economic optimization with grid technical requirements. Prepare a comprehensive report that includes cost-benefit analysis, simulation insights, and actionable next steps for incorporating ESS

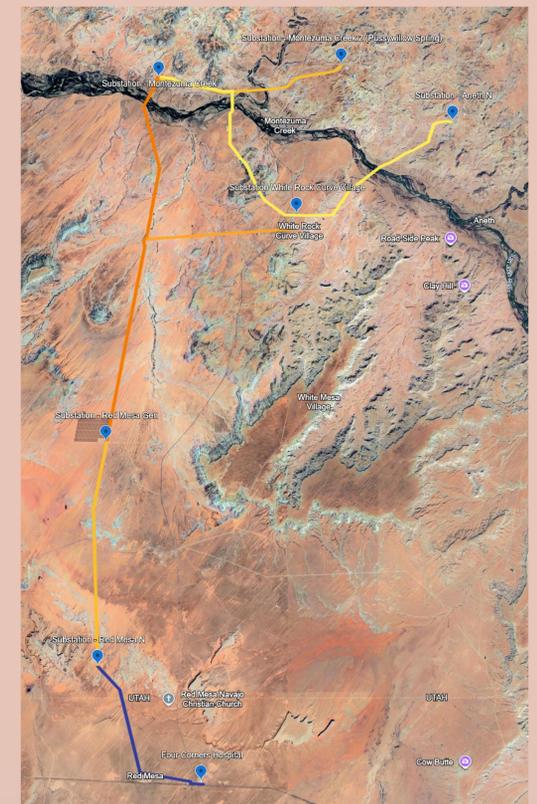


Fig. 3. Connection between the Red Mesa Tapaha generator and the NTUA system. Source: Google Earth.

Upcoming projects

- The Sandia team continues to prospect new projects supporting US Native American Tribes
- New projects might include analysis in the Hopi Tribe (AZ) and Isleta Pueblo (NM)

References

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- [2] R.D. Trevizan, T.A. Nguyen, A.J. Headley, and S. Atcity, "Valuation of Behind-the-Meter Energy Storage in Hybrid Energy Systems," in Proc. 2022 IEEE Innovative Smart Grid Tech. (ISGT) North America, Apr., 2022.
- [3] R.D. Trevizan, A.J. Headley, R. Geer, S. Atcity, and I. Gyuk, "Integration of energy storage with diesel generation in remote communities," *MRS Energy and Sustainability*, vol. 8, no. 2, p. 57-74, 2021.

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