The Iowa Tribe of Kansas and Nebraska: Advancing Clean, Resilient, and Sovereign Energy

The Iowa Tribe of Kansas and Nebraska (ITKN) is a federally recognized Native American Tribe located along the Missouri River on the border of northeast Kansas and southeastern Nebraska. There are over 800 residents (Tribal citizens and non-Tribal residents) who live on the reservation, as well as more than 500 people who visit or work on the reservation on a daily basis.

The ITKN faces many energy challenges, including rising service costs and dozens of power outages annually that impact resident well-being and business activities on Tribal lands. Power service issues are made more challenging by the remoteness of the reservation, which is 20 miles from the nearest town. Despite this, the ITKN has a long history of cultural and economic resilience: local self-reliance, environmental stewardship, respecting the carrying capacity of the land, and strengthening the community are Tribal communities' traditional strengths.

Long-term energy goals for the ITKN are centered around achieving energy sovereignty. Priority actions include:

- Establishing a Tribal Utility Authority (TUA) to promote social welfare and community development.
- Deploying renewable community microgrids with ground-mount solar arrays and sustainable energy storage systems to advance energy sovereignty, resilience, and reliability.

To advance these goals, the ITKN partnered with the U.S. Department of Energy's (DOE's) Communities LEAP (Local Energy Action Program) pilot. From August 2022 to March 2024, the ITKN community coalition collaborated with technical assistance providers at DOE's National Renewable Energy Laboratory (NREL) and Sandia National Laboratories to evaluate TUA planning needs and microgrid deployment scenarios.

Opportunities for Energy Sovereignty

As part of Communities LEAP technical assistance, Schaff Martin Consulting prepared a pre-feasibility assessment for the ITKN that discusses key regulatory, technical, and economic considerations to establish and operate a TUA. This section discusses the information and decision considerations shared with ITKN in the pre-feasibility assessment.

Tribal governments have special rights and authorities to regulate electric power and other "behind-the-meter" energy services on trust and other Tribal lands. Tribes might consider establishing new energy laws and regulations to exercise sovereignty, promote the best interests of the Tribe and its members, or advance clean energy goals. The ITKN collaborated with Communities LEAP to evaluate the advantages and disadvantages of regulatory options to manage electric power service through Tribal law, including pathways to establish and operate a TUA.

In addition to traditional utility responsibilities, such as purchasing or generating electricity and distributing it to Tribal consumers, a TUA can be designed to perform a variety of other needed functions for the Tribe. Examples include installing solar panels or wind turbines, managing energy programs, issuing grants, or performing other non-wires energy services. Establishing a TUA can be a complex, multiyear process to determine regulatory jurisdiction over the service area, develop business and administrative plans, negotiate and acquire distribution infrastructure, perform technical feasibility studies, and enact supporting Tribal laws.

As an alternative (or in parallel) to establishing a TUA, Tribes might consider establishing new laws and regulations to govern existing third-party utility service. Measures that Tribes might consider include establishing a Tribal utility commission or delegating regulatory actions to a Tribal court, enacting new policies or codes for energy use on the reservation (e.g., solar net metering), negotiating franchise agreements, or participating in utility board meetings. Installing self-generation (including distributed solar or microgrids) on Tribal lands can also be an important tool to advance energy sovereignty, improve energy service for Tribal consumers, and increase resilience.

ITKN Community Coalition:

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Developing a Clean and Resilient Microgrid

Microgrid Technical and Economic Modeling

To support the ITKN's goal of deploying a renewable community microgrid, NREL collaborated with the ITKN community coalition to develop techno-economic models for five proposed microgrids (see Figure 1) designed to serve various buildings on the reservation, including a casino, gas station, daycare center, police department, fire department, a Tribally owned and operated clinic, administrative offices, wellness center, Boys & Girls Club, and numerous residences. Techno-economic modeling is a key step in the microgrid planning process and is used to help determine the appropriate sizing and combination of clean energy technologies and the associated costs that are needed to meet energy and resilience goals.

When evaluating microgrid configurations, ITKN's goals were to ensure that Tribal loads are met during grid power outages, and to maximize onsite renewable energy production. NREL worked with the ITKN community coalition to collect monthly utility bills from residents and businesses on the reservation, which were then used to evaluate peak power demand and seasonal load changes.

The Hybrid Optimization of Multiple Resources (HOMER®) microgrid simulation and optimization tool was used to estimate energy production from ground-mount solar photovoltaic (PV) systems, the proportion of the renewable energy used onsite versus exported to the utility, the amount of energy cycled through the batteries, and the amount of fuel used by existing back-up diesel or propane generators (Table 1). Solar PV arrays were sized so that annual production is roughly equal to the annual consumption of the load being served. Battery storage systems were sized to meet 3–5 hours of average load in the event of a blackout. Propane and diesel generators, either existing or new, were modeled to serve the loads during longer outages. Estimated capital, operating costs, and available incentives, such as federal investment tax credits, were used to evaluate project economics and determine the appropriate combination of various investment streams needed to implement these projects.

Table 1. Preliminary Modeling Results for Microgrid Component Sizing

Microgrid	Annual Consumption (kWh)	Annual PV Production (kWh/year)	PV Capacity (kWdc/kWac)* and PV Array Type	Battery Capacity (kW/kWh)	Generator Capacity (kW)
M1 – Casino White Cloud**	1,720,000	1,045,000	700/600 (1-axis)	300/1,200	500
M2 – Police and Fire Station	220,000	210,000	140/125 (1-axis)	50/100	75
M3 – Gas Station and Convenience Store	155,000	145,000	100/80 (1-axis)	50/100	45
M4 – Tribal Administrative Buildings and Health Clinic	170,000	155,000	125/100 (Fixed Tilt)	50/100	75
M5 – Boys & Girls Club and Tribal Housing Complex	760,000	740,000	600/600*** (Fixed Tilt)	300/600	500

* kW_{dc}: PV array capacity, kW_{ac}: PV inverter capacity

**PV capacity for M1 constrained by 200 kW export limit. For the other microgrids, the PV is sized so that annual PV production roughly matches annual consumption.

*** For this (notional) microgrid, the AC and DC power ratings are identical (inverter load ratio = 1.0)

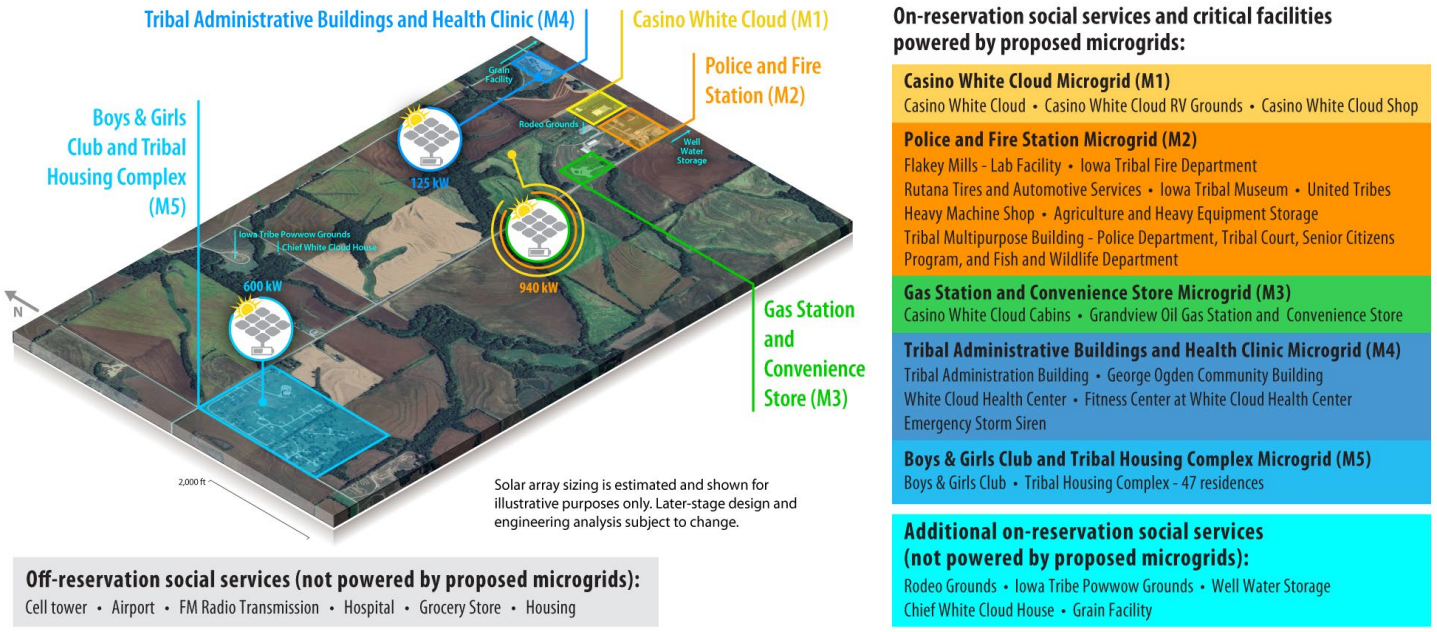


Figure 1. Proposed siting for clean energy microgrids and associated critical services and other loads on the ITKN reservation.

Social Burden and Resilience Modeling

To support ITKN's community-focused resilience planning, Sandia National Laboratories performed a Social Burden assessment using the Resilient Node Cluster Analysis Tool (ReNCAT) and the QGIS Social Burden plugin. This analysis quantified the social (non-financial) impact of a representative power outage on the availability of critical services and increased burden on ITKN residents. The analysis also measured the degree to which different microgrid alternatives could increase community resilience to grid outages.

Sandia worked with the ITKN community coalition to collect and refine a list of critical services relevant to ITKN residents and map the on-reservation infrastructure facilities providing them. A limited number of off-reservation facilities regularly accessed by ITKN residents were also included in the analysis (see Figure 1). ITKN estimated the degree to which each facility provided each of the critical services to the community during regular day-to-day operations.

Three power scenarios were compared to calculate the impact of power outages on social burden and the impact deployment of a microgrid might have on community resilience through improved service availability:

- Blue Sky (baseline scenario): The grid provides steady power across its entire service territory.
- Black Sky (outage scenario): The grid is not providing service and no new resilience resources are available to mitigate the outage. All facilities, except those powered by existing reliable backup generators, are offline and provide no service (e.g., a sewer lift station without power does not provide wastewater service).
- Microgrid (mitigation scenario): The grid outage is mitigated by one of three theoretical microgrid scenarios (the "casino cluster" M1-M4, the "housing microgrid" M5, or "both microgrids"M1-M5), which provide stand-alone power to those facilities that fall within their respective footprints (see Figure 1).

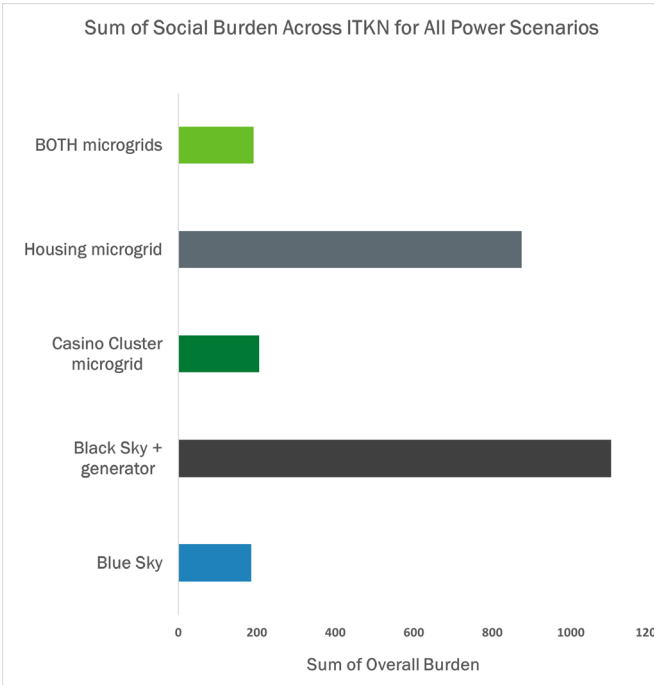
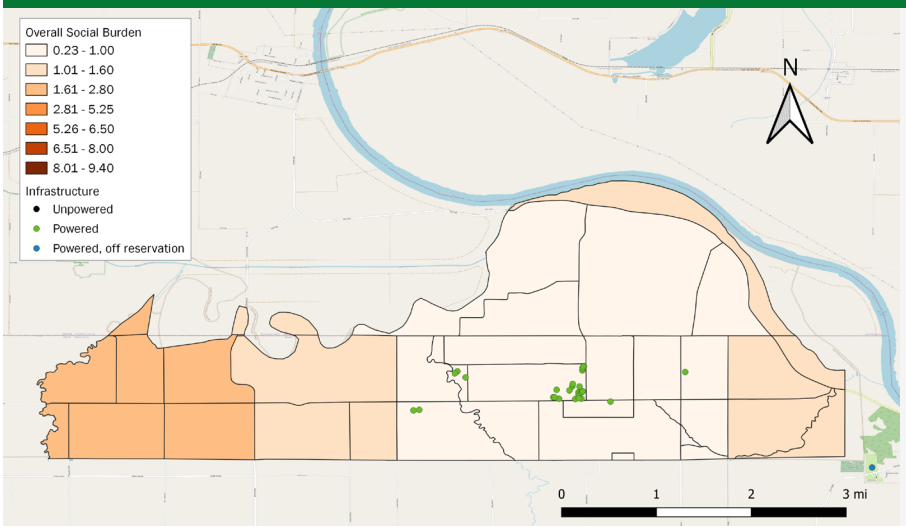


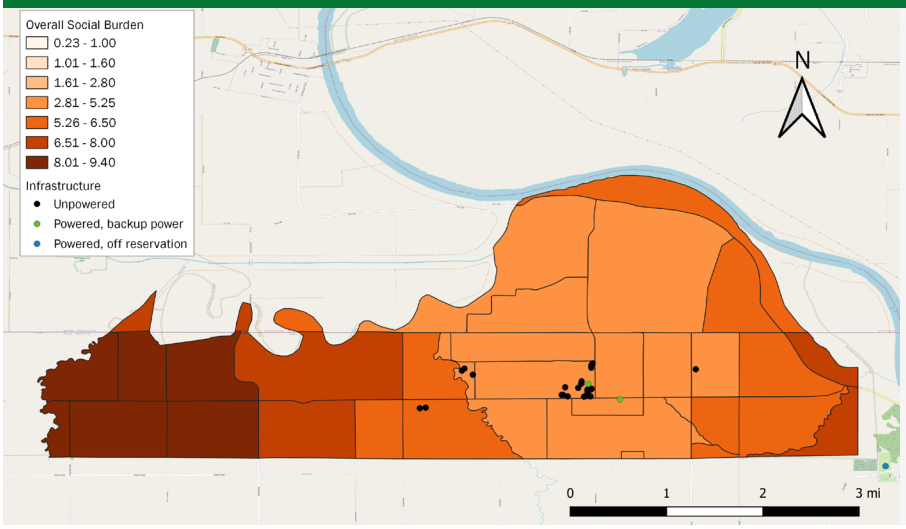
Figure 2. Cumulative overall Social Burden across the AOI under the "Blue Sky", "Black Sky", and one of the three "Microgrid" mitigation scenarios. Note that the Social Burden values displayed in this figure are summed across all population groups and across all service types.

3A. “Blue Sky” Per-Capita Social Burden Distribution



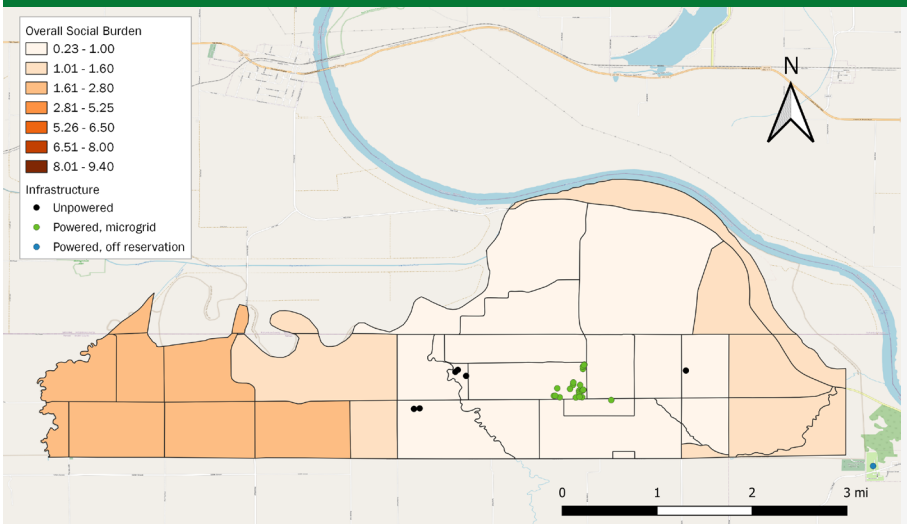
The grid provides power to the entire service territory, including the ITKN reservation. All on-reservation and off-reservation facilities are powered and provide services.

3B. “Black Sky” Per-Capita Social Burden Distribution



An outage impacts power provision to the ITKN reservation. All on-reservation facilities, aside from those with independent backup power (i.e., Casino, Well) are without power and off-line. Offline facilities do not provide services. Facilities with backup power and facilities outside of the reservation remain online and continue to provide services as usual.

3C. “Casino Cluster Microgrid (M1-M4)” Per-Capita Social Burden Distribution



The same outage as in the “Black Sky” scenario is experienced, however, the M1-M4 microgrid is activated. The microgrid provides power to those facilities which fall within its footprint. Microgrid-powered facilities remain online and continue to provide their complete (“Blue-Sky”) level of service. Facilities powered by existing backup resources (e.g., Casino, Well) and those located outside of the reservation remain online and continue to provide their complete level of service. Facilities falling outside of the microgrid footprint are offline and do not provide services.

Figure 3. Spatial distribution of social burden across the ITKN reservation (“Blue Sky” baseline, “Black Sky” outage, and one of three “Microgrid” mitigation scenarios).

Technical Training on Microgrid Modeling Tools

Staff from Grey Snow Green Energy visited NREL's Golden, Colorado campus for a week of training in early November 2023 to learn how to develop and evaluate microgrid models developed as part of the Communities LEAP technical assistance using publicly and commercially available tools. This microgrid training was led by NREL and Sandia National Laboratories, and the community coalition was joined by collaborators from 10Power, SunSource, and SolarTAC, working together on advancing clean energy for ITKN and other Tribes.

Tools that attendees were trained on included:

- **Resilient Node Cluster Analysis Tool (ReNCAT)** to analyze urban, suburban, rural, and Tribal areas to determine optimal placement of microgrids and line hardening to ensure utility services are equitably available, specifically during grid outages.
- **QGIS Social Burden plugin** to evaluate how microgrid deployment can reduce overall social burden, relative to a business-as-usual case.
- **Renewable Energy Integration & Optimization (REopt®)** to optimize planning of generation, storage, and controllable loads to maximize the value of integrated distributed energy systems for buildings, campuses, and microgrids.
- **Hybrid Optimization of Multiple Energy Resources (HOMER)** to optimize microgrid design for communities ranging from village power and island utilities to grid-connected buildings.

Grey Snow Green Energy visits NREL's Golden, Colorado campus.
Photo by Werner Slocum, NREL

Next Steps

ITKN aims to focus on the following areas to reinforce its energy independence, contribute to environmental sustainability, and promote economic prosperity for the Tribe and the wider Indigenous community.

- **Implement the outcomes from technical assessments** by focusing on the practical execution of recommended energy projects, particularly the deployment of microgrid technologies and renewable energy systems by leveraging the technical assistance provided through Communities LEAP.
- **Formalize energy policies** through the development and implementation of policies and regulations that increase energy sovereignty. This may involve the establishment of a TUA to manage energy resources more effectively and independently.
- **Expand ITKN's workforce** to build knowledge in renewable energy technologies and microgrid systems through training programs and partnerships with institutions like NREL and Sandia National Laboratories.
- **Create economic development through sustainable energy technologies** that reduce energy costs, enhance the reliability of power supply, and stimulate economic growth within the community.
- **Actively participate in and support inter-Tribal exchanges** to share clean energy technology insights, knowledge, and learnings gained from the ITKN energy sovereignty journey. With the support of Grey Snow Green Energy, ITKN will also utilize the microgrid modeling and analysis tools and skills gained during the Communities LEAP initiative to support other Tribes in achieving their energy goals and foster economic development through inter-Tribal trade. This highlights ITKN's dedication to using their journey as a blueprint for empowering other Tribes, fostering a network of Indigenous communities united in their quest for energy independence.

COMMUNITIES LEAP
U.S. DEPARTMENT OF ENERGY

For more information about Communities LEAP, visit:
energy.gov/communitiesLEAP

Produced for the U.S. Department of Energy by the National Renewable Energy Laboratory (NREL).
DOE/GO-102024-6320 · December 2024