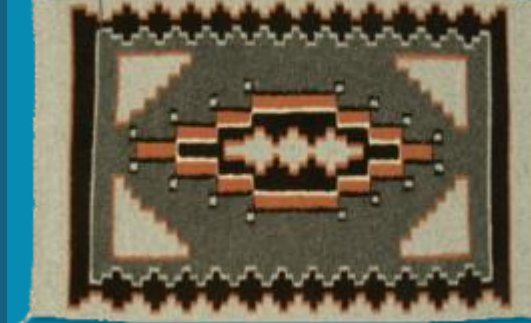


Native American Energy Sovereignty and Tribal Colleges & Universities



Stan Atcitty, Ph.D.

Senior Scientist, IEEE Fellow

Nuclear Fuel Cycle & Grid Modernization, Center 8800



SANDIA HAS FACILITIES ACROSS THE NATION

Activity locations

- Kauai, Hawaii
- Waste Isolation Pilot Plant,
Carlsbad, New Mexico
- Pantex Plant,
Amarillo, Texas
- Tonopah, Nevada

Main sites

- Albuquerque, New Mexico
- Livermore, California



DOE OFFICE OF ELECTRICITY ENERGY STORAGE PROGRAM



- The goal of the DOE Office of Electricity (OE) Energy Storage Program is to develop advanced energy storage technologies and systems in collaboration with industry, academia, and government institutions that will increase the reliability, performance, and sustainability of electricity generation and transmission in the electric grid and in standalone systems. The program also works with utilities, municipalities, states, and **tribes** to further wide deployment of storage facilities.
- This program is part of the Office of Electricity (OE) under the direction of Dr. Imre Gyuk.

“Working with tribal entities to help them achieve energy sovereignty, is a valuable part of the DOE-OE Energy Storage Program. Storage plus renewables and microgrids are not only viable solutions for the Tribes; but are also the way of the future for the U.S. and the world.” – Dr. Imre Gyuk

<http://www.sandia.gov/ess/>

ENERGY STORAGE R&D AT SANDIA



BATTERY MATERIALS

Large portfolio of R&D projects related to advanced materials, new battery chemistries, electrolyte materials, and membranes.



CELL & MODULE LEVEL SAFETY

Evaluate safety and performance of electrical energy storage systems down to the module and cell level.



POWER CONVERSION SYSTEMS

Research and development regarding reliability and performance of power electronics and power conversion systems.



SYSTEMS ANALYSIS

Test laboratories evaluate and optimize performance of megawatt-hour class energy storage systems in grid-tied applications.



DEMONSTRATION PROJECTS

Work with industry to develop, install, commission, and operate electrical energy storage systems.



STRATEGIC OUTREACH

Maintain the ESS website and DOE Global Energy Storage Database, organize the annual Peer Review meeting, and host webinars and conferences.



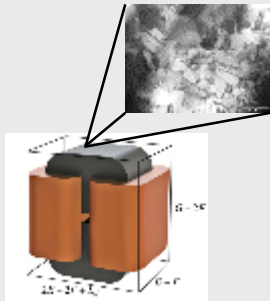
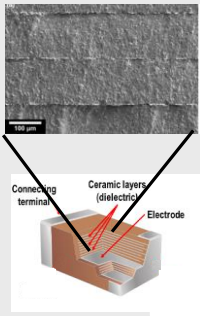
GRID ANALYTICS

Analytical tools model electric grids and microgrids, perform system optimization, plan efficient utilization and optimization of DER on the grid, and understand ROI of energy storage.

Wide ranging R&D covering energy storage technologies with applications in the grid, transportation, and stationary storage

ENERGY STORAGE POWER ELECTRONICS PROGRAM

Materials R&D



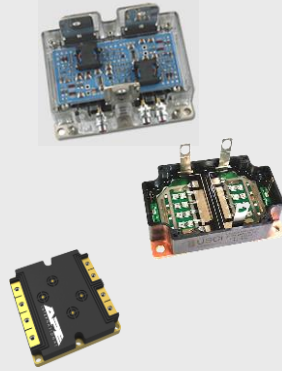
- Advanced Magnetic Cores
- Advanced Capacitor Dielectrics

Devices



- ETO
- SiC Thyristors
- Monolithically integrated SiC transistors
- WBG Characterization & Reliability
- High energy dielectric capacitors

Power Modules



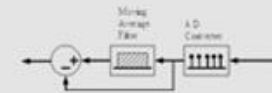
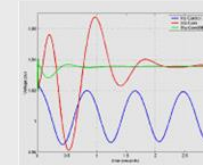
- SiC High Temp/density Power Module
- HV SiC JFET Module
- HV, HT Reworkable SiC half-bridge modules

Power Conversion System



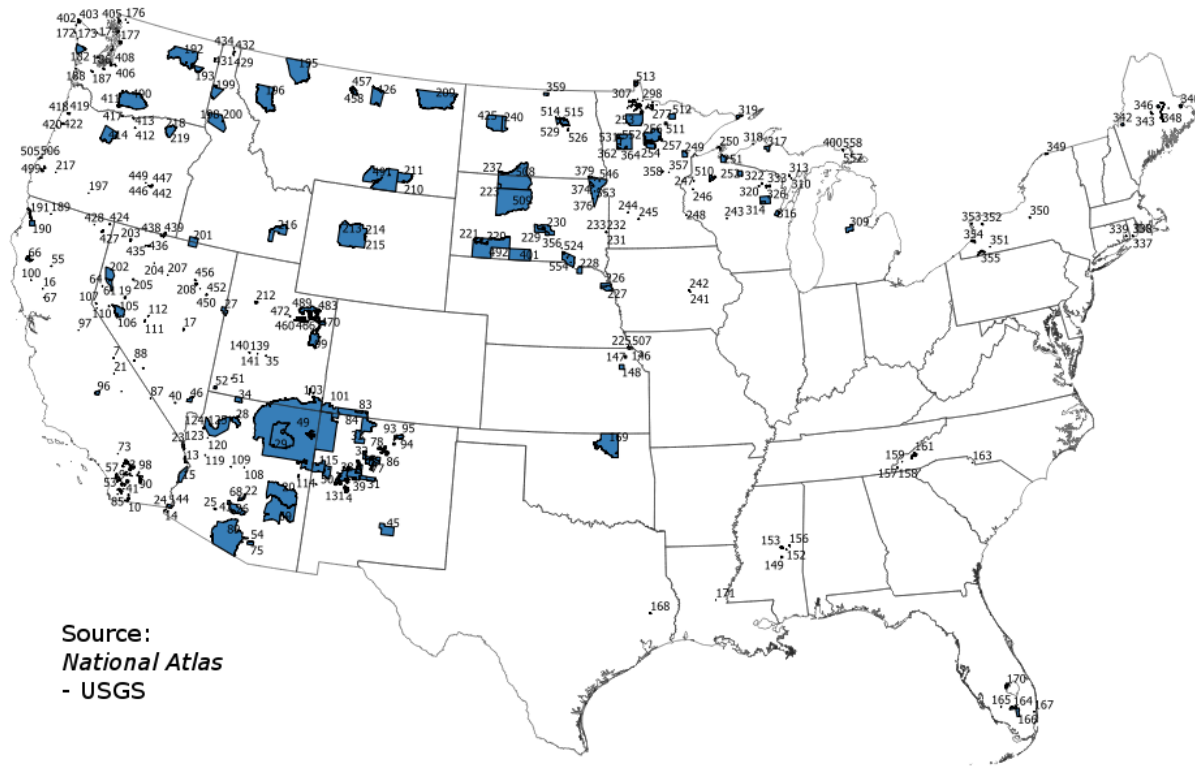
- Dstatcom plus energy storage for wind energy
- Optically isolated MW Inverter
- High density inverter with integrated thermal management
- High temp power inverter

Applications



- FACTS and Energy Storage
- Power smoothing and control for renewables
- Dual active bridge for advanced energy storage system designs

7 574 FEDERALLY RECOGNIZED TRIBES IN THE U.S.



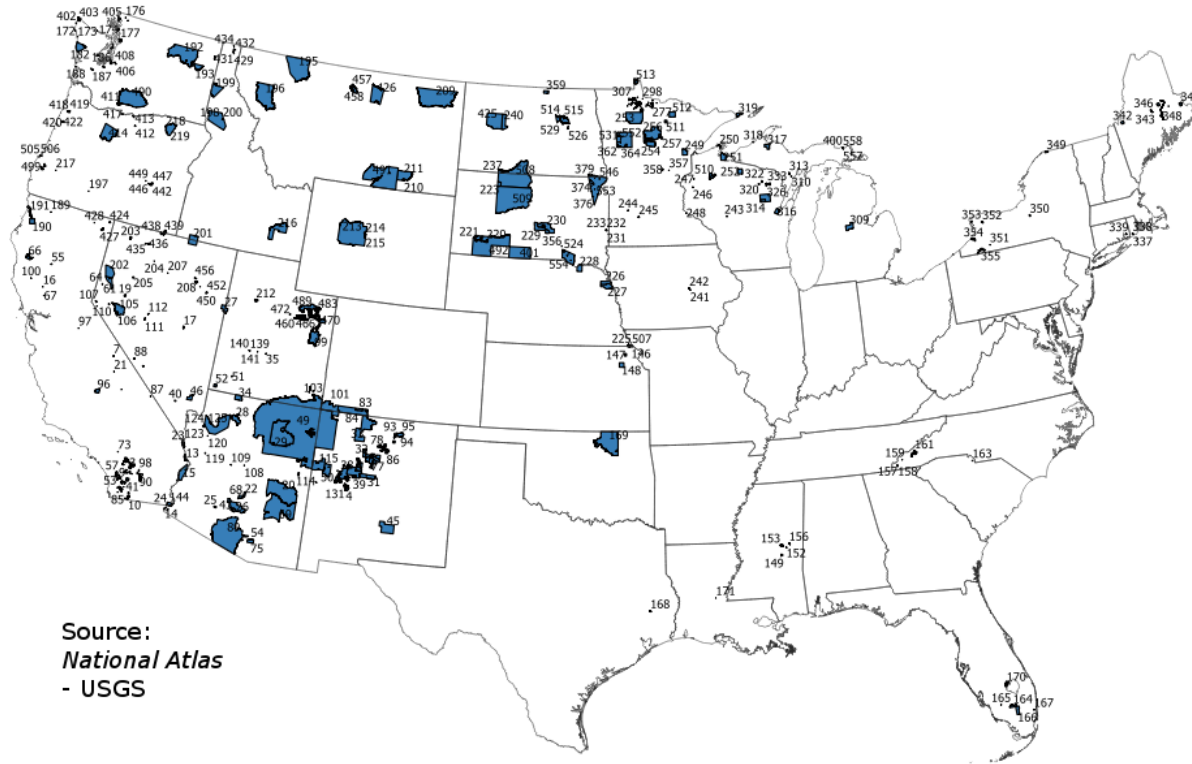
Source:
National Atlas
- USGS



- Alaska is divided into 13 regional Native Corporations (229 tribes)

- 326 Native American reservations in the US (most are in the 34 or lower 48 States)
- Known variously as Villages, Nations, Pueblos, Communities, Bands, Rancherias, etc.
- American Indian and Alaska Native or Native American terms may be used interchangeably as collective reference to tribal communities and peoples unless Tribal affiliation is specifically stated.
- There are also some state recognized tribes.
- Current population is **6.79 million (2.09%)** of the entire U.S. population – U.S. Census Bureau

574 FEDERALLY RECOGNIZED TRIBES IN THE U.S.



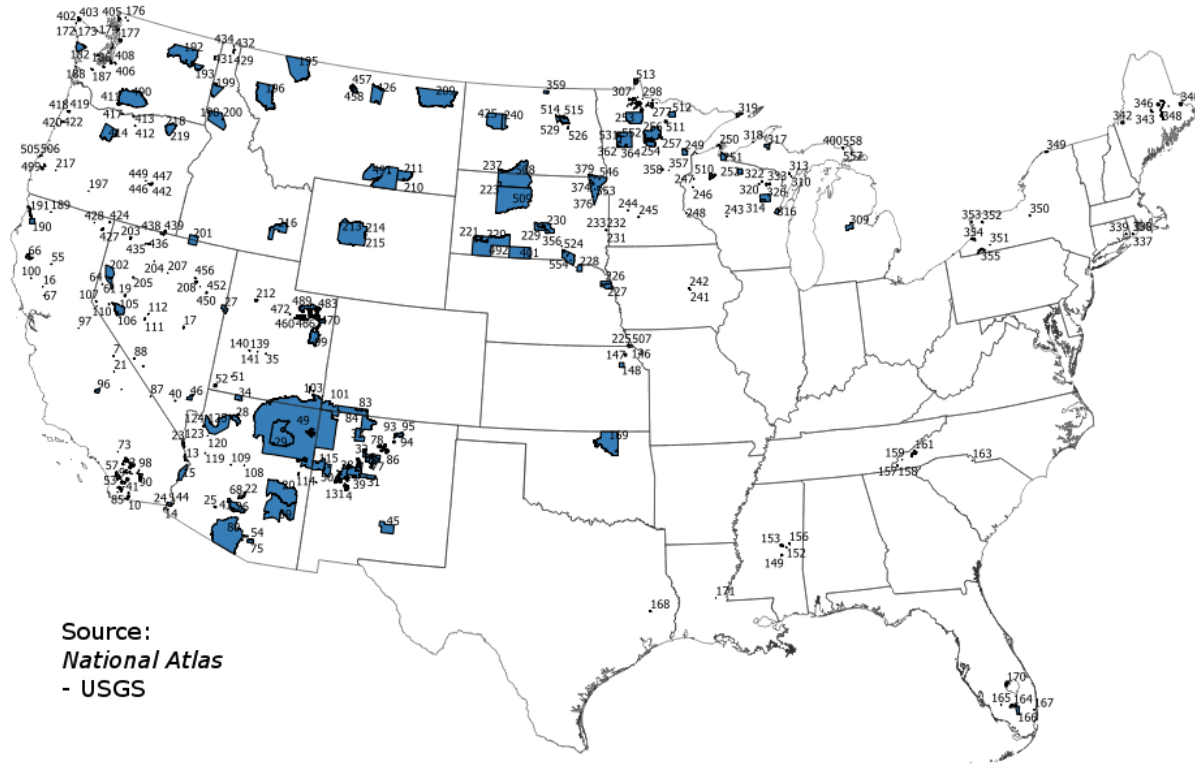
Source:
National Atlas
- USGS

- **Tribal sovereignty:** tribes have their own government, traditions, culture, etc. and have a unique relationship with the federal and state governments.
- The tribal government exercise **single-point of authority** over their critical infrastructures and share common critical infrastructure modernization and protection concerns – **Energy Sovereignty.**



- Alaska is divided into 13 regional Native Corporations (229 tribes)

9 RENEWABLE ENERGY POTENTIAL ON TRIBAL LANDS



Source:
National Atlas
- USGS

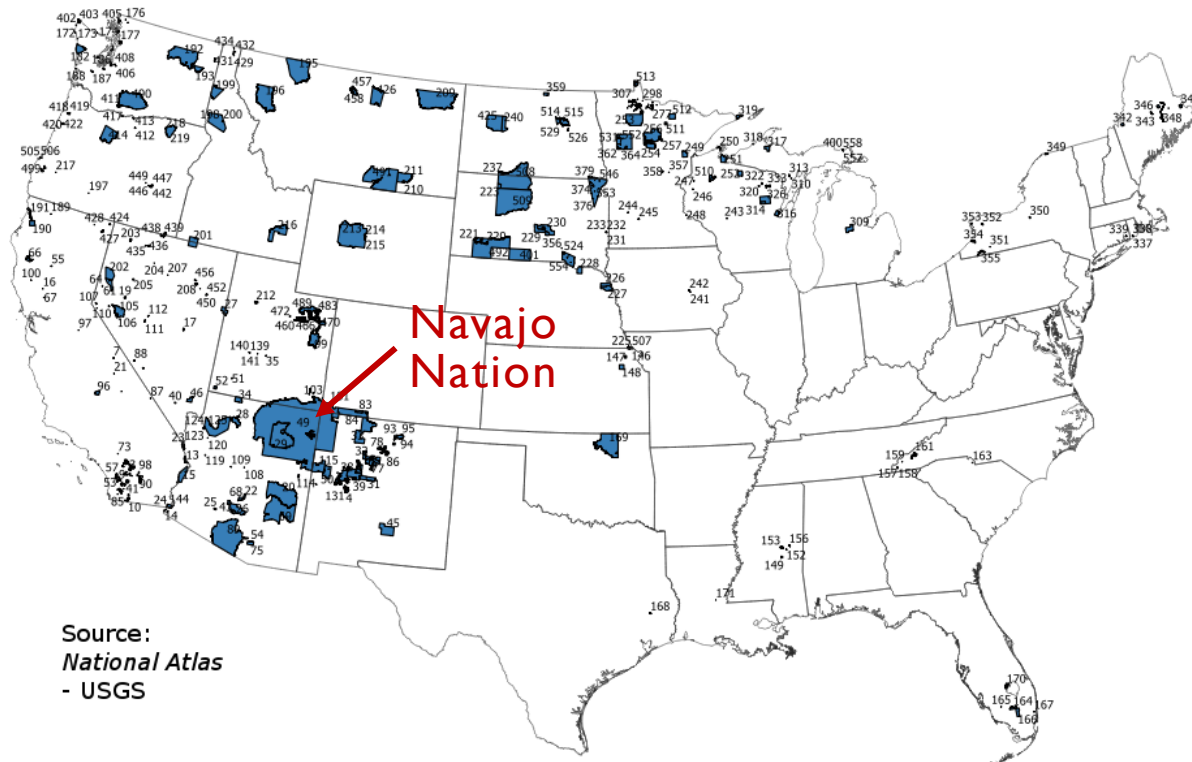
- Collective geographical area of all reservations is 56.2M acres, ~ size of the State of Idaho
- Range: 1.32 acres (Pit River Tribe CA) to 17M acres (Navajo Nation)
- Tribal lands comprise of about **5.8% of the land area** in the conterminous U.S. land
- Utility-scale renewable energy potential is **~6.5% of total national potential** – DOE Indian Energy



Source: NTUA

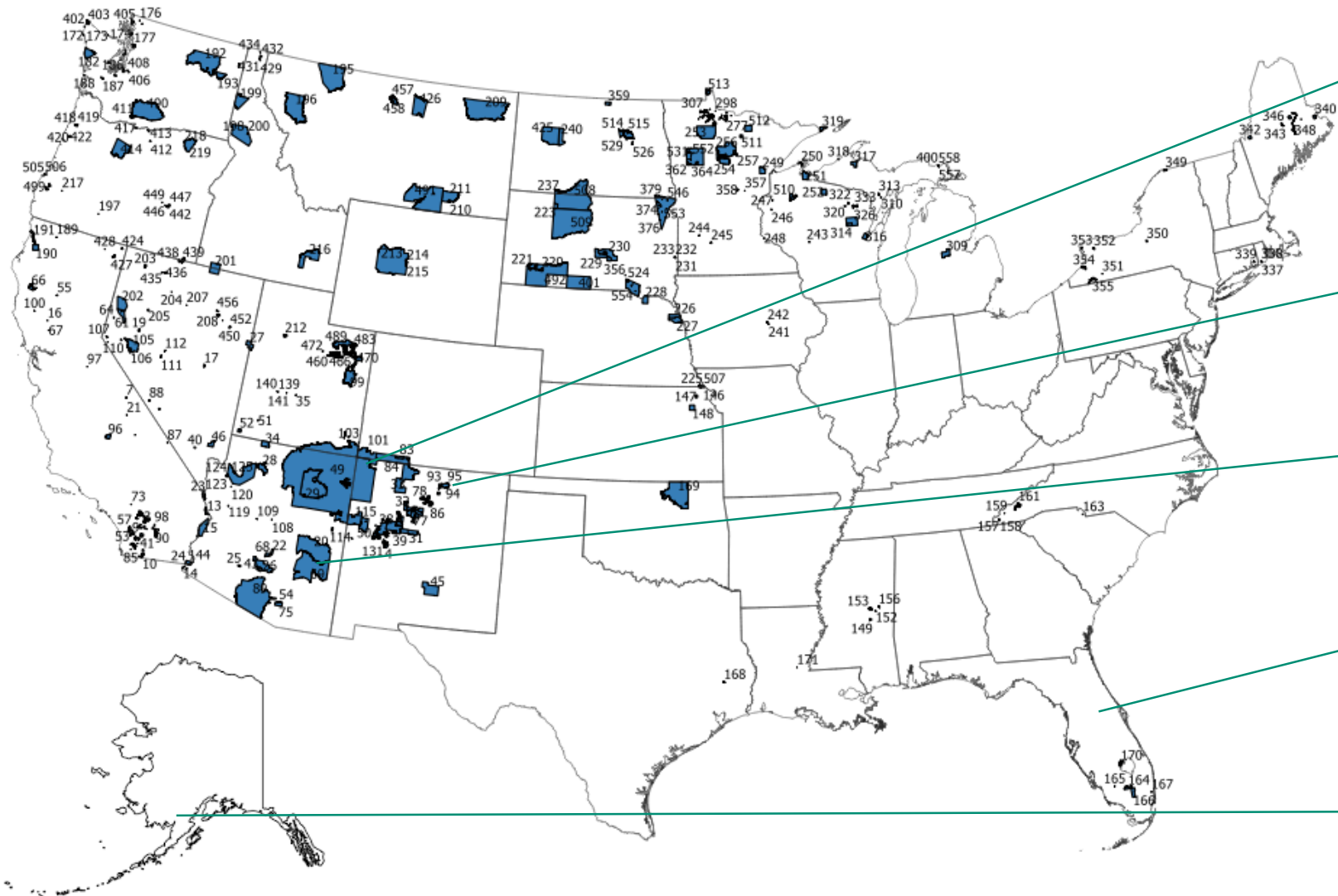


NAVAJO NATION



- Extends into the states of Utah, Arizona, and New Mexico
- Covers ~27,000 sq. mi (~size of West Virginia)
- 2010 U.S. Census: 332,129 enrolled tribal members
- About **37% of tribal members lack electricity** – Energy Information Admin.
- Homes without electricity can be greater than **40 miles from the electric grid** thus cost prohibitive to provide electricity
- **Navajo Tribal Utility Authority (NTUA)**, a non-profit distribution utility is addressing the lack of utility on the Navajo Nation

11 DOE OE ENERGY STORAGE TRIBAL ENERGY PROJECTS



Navajo Nation, Navajo Tribal Utility Authority (NTUA), Urban Electric Power, Georgia Tech Project

Picuris Pueblo Energy Storage Microgrid Project

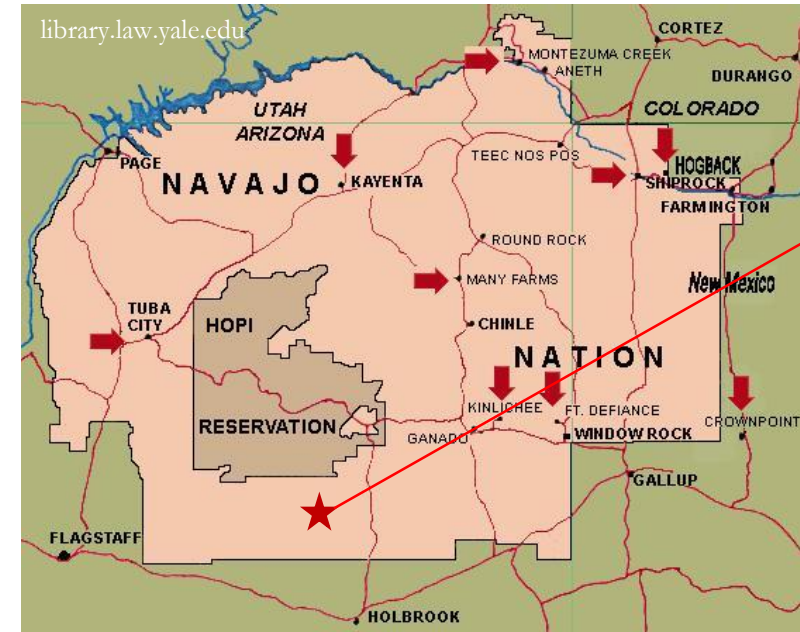
San Carlos Apache Tribe Energy Storage Microgrid Project

Seminole Tribe of Florida Energy Storage Microgrid Project

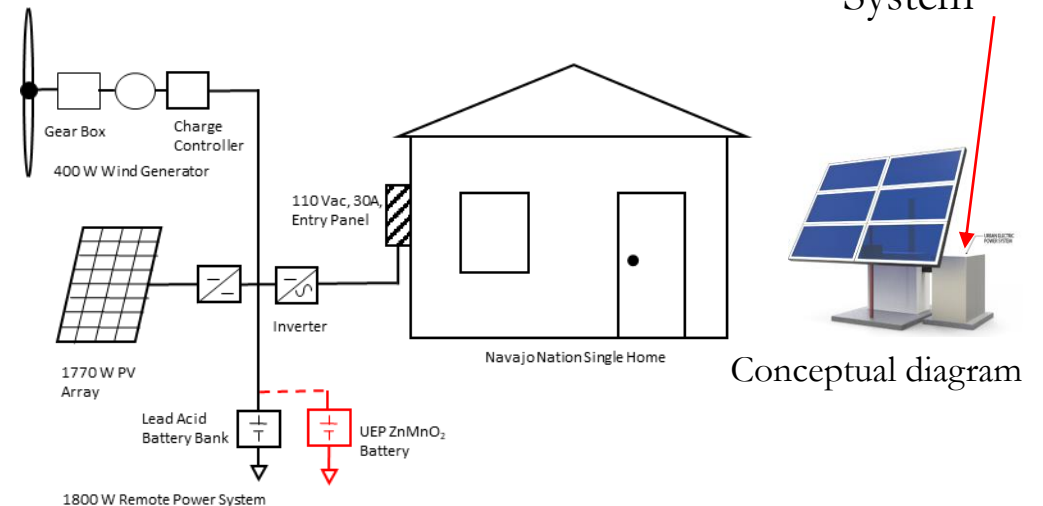
Alaskan Village of Levelock Energy Storage Microgrid Project

ENERGY STORAGE BENEFITS TO THE NAVAJO NATION

- **Problem Statement:**
 - Many residents are off-grid due to expense of installing electrical infrastructure to their homes
 - Traditional lead acid batteries have proven to work but come at a cost with **replacing every 3-5 years**
- **Approach:**
 - Procure batteries that are comparable in size to existing lead acid system of 13 kWh capacity
 - Install and monitor performance over a few years
 - Evaluate **UEP Zn-MnO₂** technology compared to traditional lead acid batteries
- **Project Impact:**
 - Tribe will have access to alternative batteries that have better performance, is safer, and more environmentally friendly since UEP technology does not contain lead
 - Enhanced understanding of new battery technology and associated power electronic controls resulting in a more consistent delivery of off-grid power



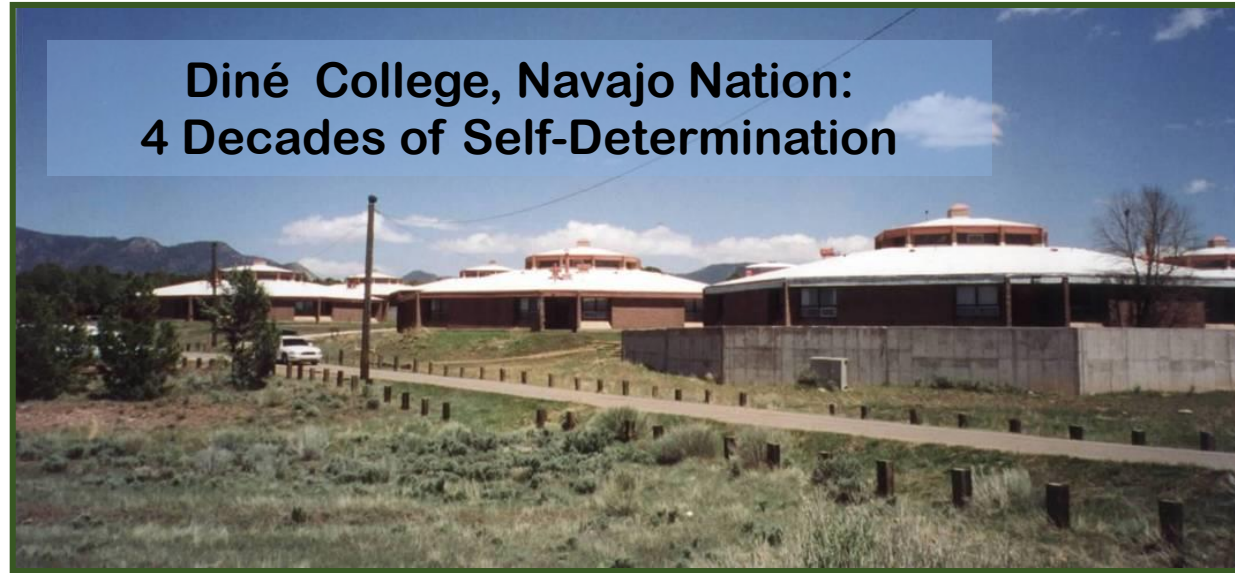
UEP Batteries & Power Conversion System



Self Determination: Tribal College Movement

The collective
spirit and unifying
voice of our
nation's Tribal
Colleges and
Universities.

Diné College, Navajo Nation: 4 Decades of Self-Determination

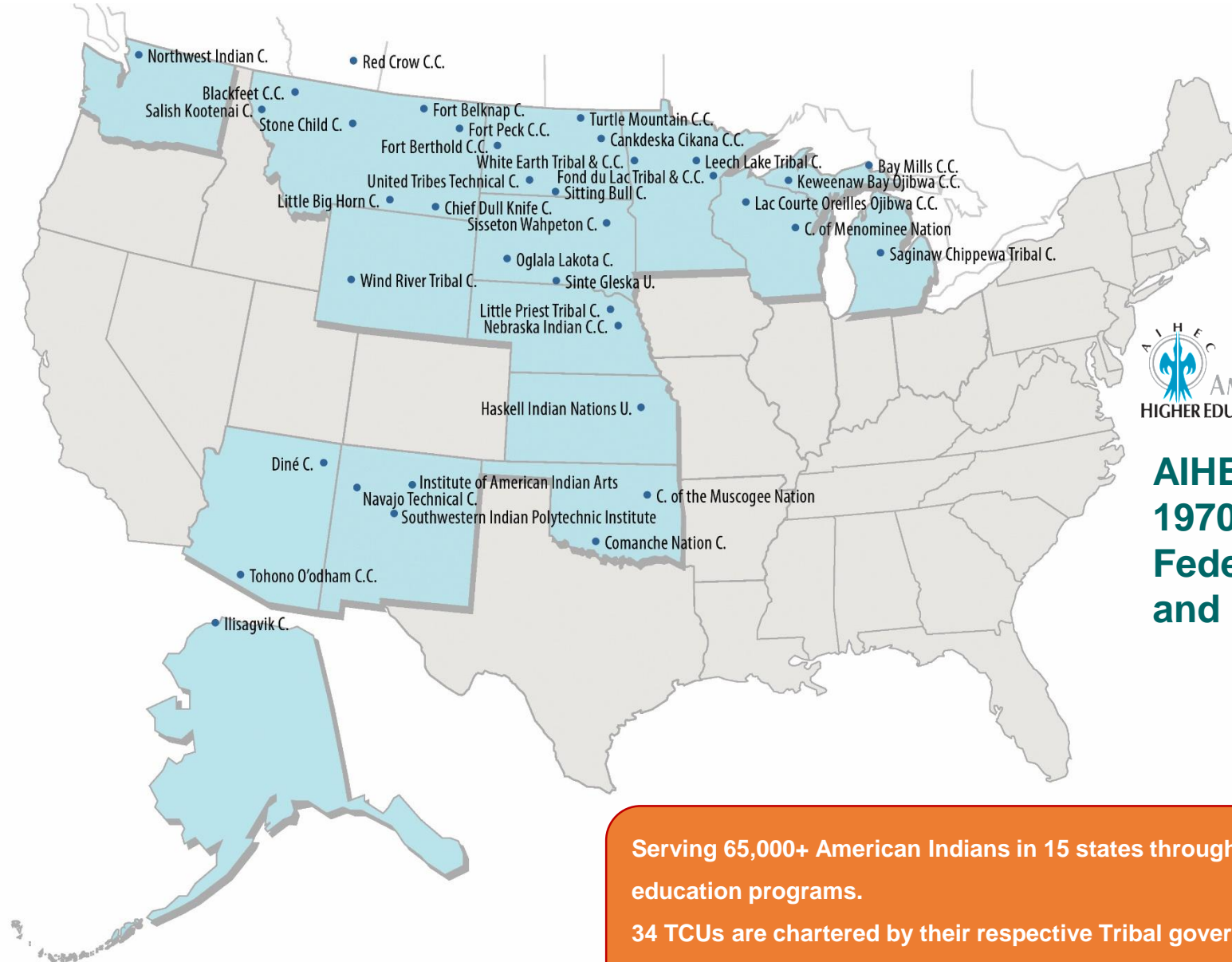


**In 1968, the first tribal
college was created**

***by Native
Americans***

***for Native
Americans***

37 TCUs – Over 88 Campus Sites in U.S.



AIHEC: Established in mid-1970s to Advocate for Federal TCU Legislation and Funding

Serving 65,000+ American Indians in 15 states through academic and community education programs.

34 TCUs are chartered by their respective Tribal governments; 3 are chartered by the U.S. government)

NNSA MSIPP/Tribal Colleges & Universities

Overview

National Nuclear Security Administration (NNSA) - Minority Serving Institute Partnership Program targeting Tribal Colleges & Universities (TCUs)

- Hired 8 TCU summer interns in 2022 – highest for NNSA MSIP Program (14 total since 2016)



Established in 2016 MSIP-TCU

POC: Stan Atcitty satcitt@sandia.gov

<https://energy.sandia.gov/programs/tribal-energy-security/>



United Tribes Technical College-
Summer Camp



Urban Electric Power, Navajo Tribal
Utility Authority, Sandia - ZnMnO₂
battery deployment

TRIBAL ENERGY STUDENTS



2019 Summer Interns

- DOE Indian Energy Summer Internship Program
- Minority Serving Institute Tribal Colleges & Universities Program

The Energy Storage Power Electronics Program is supported by Dr. Imre Gyuk and the Energy Storage Program in the DOE Office of Electricity.



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Questions?

Ahéhee' (Thank You!)