MICROGRIDS: ADVANCING TRIBAL SOLAR ENERGY OPPORTUNITIES

STEWARDING NATIVE LANDS PRESENTS
WEBINAR MANAGEMENT

All attendees will be muted throughout this webinar.

If you have questions, please type them in the question box. They will be addressed during the Questions section.

This webinar is being recorded.
First Nations’ mission is to **uplift** and **sustain** the lifeways and economies of Native communities through **advocacy**, **financial support**, and **knowledge sharing**.
OUR STRATEGIES

DIRECT FINANCIAL SUPPORT THROUGH GRANTMAKING

TECHNICAL ASSISTANCE & TRAINING

CONVENINGS & WEBINARS

RESEARCH ON BEST PRACTICES & MODELS

COALITION BUILDING & FELLOWSHIPS

ADVOCACY
STEWARDING NATIVE LANDS

ENVIRONMENTAL SOVEREIGNTY & JUSTICE
Protecting communities and lands from harmful practices, projects, and policies

ECOLOGICAL STEWARDSHIP
Sustainably managing and restoring lands for our communities and future generations

CLIMATE
Addressing ongoing and anticipated impacts of climate change to preserve lands and cultural lifeways

COMMUNITY PATHWAYS
Upholding traditions and amplifying knowledge
Advancing Tribal Solar Energy Opportunities: Microgrids 101

April 9, 2024
Meredith Cowart
Rocky Mountain Institute
RMI is an independent, non-partisan, global nonprofit organization of 600+ experts across disciplines working to accelerate the clean energy transition and improve lives. We focus on transforming the global energy system to secure a clean, prosperous, zero-carbon future for all.
RMI has partnered with community organizations to build solar plus storage microgrids to increase resilience, reduce costs, and lower emissions.

A critical facility microgrid in Puerto Rico

A community resilience hub in Millvale, PA
A solar + storage microgrid consists of three main parts:

- **Solar panels generate electricity on-site**
- **Batteries store electricity on-site**
- **Controllers coordinate power flows**
Solar + storage microgrids provide critical services in an outage and can serve as community "resilience hubs"
Microgrids present Tribes with an opportunity to lead the way in the energy transition, while achieving many key goals:

- Resilience during power outages and natural disasters
- Greater energy independence
- Cost savings
- Increased access to electricity
- Financial investment stays in the community
Solar + storage microgrids can be paid for upfront through a combination of loans, down payments, and grants

- Energy Improvement in Rural and Remote Areas (ERA) ($1B)
- Energy Efficiency and Conservation Block Grant program ($9M to Tribes)
- Grid Resilience State and Tribal Formula Grants program ($2.5B)
- Investment Tax Credit – 30% Base credit + Bonuses
- Production Tax Credit

Capital stack:

- State and federal grants/incentives
- Philanthropic support
- Low-interest loans
- Down payment

- Tribal Energy Loan Guarantee Program ($20B in loan authority)
- Clean Communities Investment Accelerator – Grantees ($6B)
- National Clean Investment Fund – Grantees ($14B)
Tax-exempt organizations can now receive direct payments for the Investment Tax Credit (ITC) for solar panels and battery storage.

Before IRA, Tribal governments (and other non-taxable entities) couldn't monetize the ITC since they do not have tax liability – They had to partner with a third-party financier who could monetize the credit.

With "direct pay", tribes can now receive the ITC as a direct cash payment for their solar + storage investments.
Microgrids on Tribal lands are eligible for a up to 70% Investment tax credit

Caveat: ITCs will be realized at the end of Year 1 in a project’s life, so projects likely require “bridge financing” between construction and receipt of the tax credit.
The Greenhouse Gas Reduction Fund may also be a source of funding or low-cost finance for your solar + storage projects.

- **National Clean Investment Fund**: $14B, 2-3 awards
- **Clean Communities Investment Accelerator**: $6B, 4-7 awards
- **Solar For All**: $7B, ≤60 awards

RMI's Microgrid for Resilient Communities Workshop
Blackfeet Community College

Micro grid presentation
2024

Melissa Little Plume Weatherwax
BCC Director of Institutional Development
Amskapii Piikanii

Blackfeet Community College is located on the Blackfeet Reservation which includes 1.5 million acres managed by the Blackfeet Tribal Business Council.

The Blackfeet Tribe is represented by more than 17,000 members with ancestral connections extending throughout Canada and the United States half of the members reside on the Blackfeet Reservation.
Net Zero Source Energy: A source NZEB produces and exports (or purchases) at least as much renewable energy as it uses in a year, when accounted for at the source. Source energy refers to the primary energy used to extract, process, generate, and deliver the energy to the site. To calculate a building’s total source energy, imported and exported energy is multiplied by the appropriate site-to source conversion multipliers based on the utility’s source energy type.

NREL/TR-7Z2-46065 November 2009
Sustainable Energy Project 2021

Project Description

To reduce campus energy costs, BCC Renewable Energy Program plans to install four grid-tied, solar photovoltaic (PV) Systems on campus facilities totaling approximately 53.2 kW-DC. To advance knowledge about renewable energy, the project will provide hands on paid training in the solar PV technology to students at BCC and Blackfeet High schools, as well as community members.

- Project Budget Contractual $204,401
- Equipment-Modules, Inverters, Racking, Electrical BOS, Data Acquisition System O&M, labor,
- Projected savings Red Fox Business Division, Little Star Blackfeet Child Care, Medicine Shield Fitness Center, and the Muskrat Lodge Media Center. These solar PV systems are estimated to produce 68mW hours of purchased electricity per year for the lifetime of the system
- Training-Recruited from TERO, BCC, Heart Butte High School- 14 interested 10 selected and 8 completed.
Project Goal

The goals of this project include: creating access to solar and renewable energy benefits for the Blackfeet community, generating energy cost savings for Blackfeet Community College, and creating an educational opportunity for students from schools to learn about renewable energy, explore career pathways, and participate in workforce development and hands on paid training for 10 students and community members.
Project schedule to date

- **Installation-Complete**
  - **April-May** Ordering
  - **May-June** Mobilization

- **Trainees-3 weeks Complete**
  Recruiting-BCC, Heart Butte Schools, BTERO.
  8 trainees, 2 continued on with GRID Alternatives

- **Finish date Complete**
  - **June 30, 2021** Installation completed

- **Monitoring**
  - **August-September** Complete training BCC IT Staff

Week 2-3 Hands on Training, Racking installation, minor maintenance, small equipment, wiring, harnessing.
Deliverables

Milestone 5.1: System performance verified.

Task 6.0: Monitoring
Task Details: Vendor and BCC staff continue to monitor system performance through remote monitoring system and utility bills.

Task 7.0 Verification of Energy Savings
Task Details: Vendor will work to verify energy savings by collecting utility bills paid by BCC. Systems not performing as expected will be evaluated for potential issues.

Milestone 7.1: Vendor staff collect utility bills in coordination with BCC staff and prepare reports to submit to DOE staff.

Milestone 7.2: BCC and vendor complete and submit comprehensive final report. As part of this Task, at least one BCC representative and a vendor staff member will attend the annual Tribal Program Energy Review in Lakewood for both years of the grant.
Challenges

Location was a challenge on the equipment ordering for the project.

Unexpected Outcomes

Decrease in Match requirement due to COVID-19
2 Piikanii Trainees continued on with GRID Alternatives joining the alternative energy workforce across Indian Country.
# Savings 1st quarter

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$746.26 / 2 month
BFCC Energy Trainings
Thank you

Department of Energy Office of Indian Energy
Blackfeet Trainees, GRID Alternatives
Bonneville Environmental Fund
First Interstate Bank,
Glacier Electric, Heart Butte Public Schools, Blackfeet TERO
Clean Energy Innovation Fellow

Exciting News! Blackfeet Community College is proud to be one of 27 organizations chosen to host a 2023 Clean Energy Innovation Fellow as part of the U.S. Department of Energy’s Clean Energy Innovation Fellowship program.

Our Mission: To advance clean energy solutions, decarbonize power systems, electrify transportation and industry, and enhance energy resilience.

Project Focus: Our Fellow will draw Tribal energy resilience planning, working closely with Tribal and community stakeholders, and collaborating with utilities to strengthen Grid Resilience Formula Grant program efforts. Deliverables: Expect technical and narrative reports for our community.

Our Fellow will join us on November 1, 2023. He’ll be on campus from November 7-9, 2023, for project planning and will also attend the Department of Energy Program Review in Denver, Colorado. Johnathan will work both remotely and engage in in-person community activities throughout his fellowship.

Meet Johnathan Kongoletos

My name is John Kongoletos and I am an incoming Clean Energy Innovation Fellow working with Blackfeet Community College. During the coming year, I’ll be helping the community develop comprehensive energy resilience metrics and sustainability plans, encouraging healthy buildings, and assisting with energy- and buildings-related concerns along the way. I bring a background in building technology with experience in thermally autonomous housing design in India, airborne contaminant distribution (indoor air quality), electric vehicle design, and sustainable energy systems. Overall, I’m a hands-on, bottom-up engineer who is happily stuck in a learning mindset and enjoys exploring how people interact with their energy environment. While I will be primarily based in the New York City suburbs, I look forward to being on campus to help unravel the challenges and collectively build plans grounded in an achievable reality. Outside of my professional life, I enjoy beach running, trail biking, hiking, kayaking, and entry-level car maintenance. I’m also starting to dabble in astronomy, but will freely admit that I’m still in the information-sponge/wonder stage at our local observatory. With so much to learn, I look forward to meeting you in person, learning together, and building towards a better future.

See you soon,
John
TRANSITIONING TRIBAL COLLEGES AND UNIVERSITIES TO CLEAN ENERGY –

2023 AWARD $792,630
174 kW Microgrid

Training for 3 students
Project Overview

The Blackfeet Community College Transition to Clean Energy Project will install a **147.6 kW DC ground-mounted** Solar Photovoltaic (PV) system on the Blackfeet Community College (BFCC) campus. This project will build off previous solar installation efforts to transition the campus to renewable energy and will **offset 120% of BFCC’s energy usage**. At a cost of **$700,926.3**, GRID Alternatives (GRID) will function as the Contractor and Trainer for this project. The **installation and training** will take approximately 10 weeks and the system will be approved and interconnected by the local utility, Glacier Electric Co-op. At least 3 students will be recruited by BFCC to go through GRID’s Installation Basics Training (IBT) program. During its 25 year lifetime, the system is estimated to **produce 4,801,209 kWh of clean energy and save BFCC $432,109 in energy costs**.
THANK YOU
Blackfeet Community College
USDA Extension staff and interns
Piikani Knowledge Carriers
Blackfeet Tribal Business Council 2016-2020
Institutional Development
Department of Energy Office of Indian Energy
Blackfeet Community College Workforce Development
Blackfeet Community College Facilities
First Nations Development GRID Alternatives
Clean Energy Fellow ORISE and DOE
Bonneville Environmental Fund
First Interstate Bank, BIE
Glacier Electric, Heart Butte Public Schools, Blackfeet TERO
QUESTIONS

Contact Information:
Blackfeet Community College Institutional Development
Melissa Weatherwax Director
melissa@bfcc.edu, Kutoyis 517 South East Boundary Street 406-338-5441 ext.2762
Energy Resiliency
Blue Lake Rancheria

Heidi Moore-Guynup, MA

First Nations Webinar
April 9, 2024
About Blue Lake Rancheria

A Federally Recognized Tribe

Within the aboriginal territory of the Wiyot people, Blue Lake Rancheria (BLR) was founded in 1908 as a ‘refuge for homeless Indians’.

BLR was terminated in 1958, & reinstated to federal recognition in 1983.

Since then, BLR has made concerted efforts to exercise rights as a Sovereign Nation:

Build economic enterprises, solar microgrid, social & emergency services, & are co-managers of the Baduwa’t (Mad River) watershed

Goal to achieve net zero carbon emissions by 2030
Microgrid 1.0

Partners: Schatz Energy Research Center, PG&E
Funders: California Energy Commission, CPUC, Blue Lake Rancheria-$5,000,000

• 2016: 420 kW photovoltaic array
• 1150 kW / 1950 kWh battery energy storage system
  • microgrid management system
  • PCC protective relay
• legacy 1 MW backup diesel generator

• 2017: A second low-carbon, facility microgrid at the convenience store is launched
  • Uses the “solar ready”
• 60kW solar PV, 169kWh battery storage, advanced building controls; islanding controls
• Replicable “resilience package” for small commercial buildings

• 2019: Added 1 MWh Tesla Battery Storage
Microgrid 2.0

Nested

7 microgrids that can work independently or together and will serve as an exemplar for three Tribal Partners across the region

BLR is seeking funding from the Department of Energy to support their Micro Grid 2.0 proposal which includes support for the Hoopa, Yurok, and Karuk Tribes. Supported by the Redwood Coast Energy Authority and the Schats Energy Research Center.
Why it Matters...

Tribal Resilience
Economic Enterprises
Emergency Services
Lifeline Sector
Economic Savings
Additional Sustainability Foci

Offshore Wind Engagement & Briefings
- Participation in Summits & Community-led Working Group: Redwood CORE Hub
- Lead Community Benefits Agreement
- Green Port

Land Back/Climate Mitigation Practices/Food Sovereignty
- Great Redwood Trail
- Leavey Ranch
- Mad River Estuary
- Regenerative Farming/Preserving

Workforce Development
- Aquaculture
- Apprenticeship Accelerator
- T’Am Resilience Campus
- Hula Health Clinic
BLR...Advancing Clean Energy Goals

Thank You!

Heidi Moore-Guynup
hguynup@bluelakerancheria-nsn.gov

“...The tribe also sees microgrids and solid electrical infrastructure as being economy-enabling. Since we built the first microgrid in 2016, 2017, we've had over 30 major outages in this region that the microgrids have helped avoid. So, the microgrids have kept the power on and the lights on and the services flowing.

JANA GANION
BLUE LAKE RANCHERIA
One Megawatt Solar Array for Grand Canyon West

LAND AREA FOR ARRAY: 3.7 ACRES

PROJECT BUDGET: $3,690,000

DEPARTMENT OF ENERGY GRANT: $2,430,000 (DE-IE0000128)

TRIBAL MATCH: $1,260,000 FROM VARIOUS SOURCES INCLUDING FREEPORT McMORAN
Introduction to Hualapai

The People of the Tall Pines, 2,394 enrolled members as of February 20, 2024 with 1,245 living on the Reservation.

Reservation comprises approximately one million acres established by Executive Order in 1883.

Traditionally, Hualapai inhabited an area up to seven million acres, with archeological evidence dating to 600 AD.

The homeland stretched from the Grand Canyon southward to the Bill Williams and Santa Maria Rivers and from the Black Mountains eastward to the San Francisco Peaks located near what is today Flagstaff, Arizona.
Hualapai Population

Population
- Median age is 30.1 years
- 513 households
- Average household size is 3.15 persons
- 27% of adults do not have a high school diploma

Employment & Poverty
- Sectors include arts & entertainment, education, transportation, and government
- Labor participation is 43% for those 16 years of age and older.
- Unemployment rate = 20.4% (pre-Pandemic)
- Median Annual Income = $37,679
- Poverty rate = 35.3%

Housing
- 578 dwelling units (513 occupied)
- $60,300 median home value (91% SFDUs)
- 73% of homes have internet subscription

Source: 2020 Census and 2016-2020 American Community Survey
Grand Canyon Resort Corporation Profile

Founded in 1988 with operations in Peach Springs and Grand Canyon West to administer several enterprises employing 350 full and part-time employees as follows:

Grand Canyon West - Skywalk & Western Town
Hualapai River Runners & Pontoons
Hualapai Lodge & Diamond Creek Restaurant
Walapai Market and Fuel Station

Approximately 5,000 tourists take the rafting trip each year with most staying at the Hualapai Lodge in Peach Springs the night before.

Visitation to Grand Canyon West averaged some 1,000,000 persons per year from 2015 thru 2019. Visitation for the first 9 months of 2022 is 555,000 as the tourist industry recovers from the Pandemic.
Project Summary

In 2014, the tribal council formed the Hualapai Tribal Utility Authority to connect GCW to the regional electric grid via a new 69 KV line from an off-reservation utility. The tribe’s diesel generators provide the only form of electric service to this part of the reservation.

The micro-grid, also commissioned in 2014, is composed of three Caterpillar 750 KW diesel generators, energizing some five miles of buried 20.8 KV 3-phase cable, and has an extremely high operating cost and is prone to go offline for scheduled repairs which become more frequent after 20,000 of generator run time. After the numerous delays and setbacks to connect the tribe’s new power line to the grid, the HTUA began exploring a solar option in 2019 to save costs and extend the life of the generators.

The goal of the project is to improve the resilience of the non-grid-connected electrical generation system at GCW to withstand short-term disruptions and rising energy costs by installing a 885-kW solar PV and 750-kW/2,145-kWhr battery storage system.

The system will be capable of providing some 1,600 MWhrs per year (25 year lifetime average) or about 50% of the annual energy needed at GCW to supplement the existing diesel generator energized micro-grid, saving approximately $450,000 in fuel cost per year and over $11 million dollars over the 25-year life of the system. These dollar values will likely increase as the price of diesel fuel rises over the next decade.
Issues Encountered:

1. Connection to GCW Micro-Grid Cat 750 Generators
   a) Upgrade of Caterpillar controllers from EMCP 4.2 to 4.4 ($110,000)
   b) Setting Cat 750s to run in “droop” mode (grid following) from synchronous mode, a role which is now handled by the Tesla Site Controller.
   c) Unexplained generator shut down on February 18 is under investigation.

2. Technology decisions were recommended by design-build contractor – Solon

3. Operations have been smooth except for 2/18/2024 event.

4. Some early-afternoon curtailment of the PV array when battery is fully charged and loads are light.
Spring of 2019: HTUA requests staff to look into developing a solar project at Grand Canyon West to help power the micro-grid, save on diesel fuel costs and reduce emissions.

Summer of 2019: HTUA requested proposals from vendors to construct a 2 MW solar array at Grand Canyon West to cover 100% of micro-grid’s output.

October 2019: Discussion with tribal council on the cost of the project led to a reduction in scope to a 1 MW solar array to offset 50% of micro-grid’s energy needs. HTUA issues addendum Nos. 5 & 6 with Solon’s proposal considered the most responsive & responsible.

February 2020: Hualapai updates 2012 BIA feasibility study applies to DOE for a grant to fund a 1 MW solar array with a lithium battery bank.

May 2020: DOE notifies tribe of successful application and begins negotiations on $2.7 million award w/ tribe contributing $1.35 million (50/50 match).

Summer of 2020: Planning begins work on EA with input from IDT, TERC, HTUA, GCRC, FAA and DOE. Public survey and radio interview done in November 2020 to discuss preferred location of solar array.
Solar Array Alternate Site Nos. 2a, 2b & 2c (Proposed Action)

Option for new Switch

Switch No. 3

Maintenance Facility

Pro Action - 2c (1,500’ to switch)

Alt - 2b (1,950’ to switch)

Alt - 2a (1,650’ to switch)

Alternative Site No. 2c (Proposed Action) as seen from Diamond Bar Road
November 2020: Tribe requests reduction in cost share and receives approval from DOE for 10% match ($270,000) on December 29th.

December 2020: TERC reviews community surveys and preliminary glare analysis and recommends Site No. 2c as the Proposed Action in the draft EA. Site location adds $400,000 to project cost to extend 20.8 KV electrical line to nearest micro-grid switch.

February 2021: Draft EA distributed to IDT, TERC, HTUA, GCRC and tribal council for review and input.

April 27, 2021: Tribal Council recommends Site No. 2c which allows for future expansion for a 100% solar power solution at GCW.

May 19, 2021: TERC approves EA with FONSI signed in June. General Permit pending council review upon completion of contract negotiations between vendor and HTUA.
Project Status Since Approval of Environmental Assessment

July 2021: HTUA solicits third-party cost estimate which calculates $2,705,983 to construct the fence-line project.

August 2021: DOE’s contracting officer approves Solon as the competitively selected vendor and approves the NEPA review performed by the tribe.

September 2021: Solon requests a price increase due to rise in aluminum, steel and copper prices bringing the cost to $2,967,589. Price is still lower than bids received by other vendors in 2019.

October 2021: HTUA’s estimate for off-site work to connect array to micro-grid increases from $400,000 to $500,000 (25% increase) based on Solon’s cost increases.

Summer to Early Fall 2021: Contract with Solon reviewed and revised by HTUA Board and attorney over a four month period to address questions of tribal sovereignty. Tribal council signs contract on November 6, 2021.

May 9, 2022: Tribal council approves battery upgrade & use of screw mounts increasing contract to $3,277,558.

October 11, 2022: Groundbreaking.

June 22, 2023: Mechanical completion.

Construction Photos

- Clearing 3.7 Acre Site
- Pre-Drilling for Screw Anchors
- Screw Anchors for PV Module Rack
- Solar Array and Equipment Pads
- Off-Loading MegaPack
- 20.8 KV Grid Extension to Array
Site Photos of Completed Project

Two CPS 60 KW String Inverters

Communications & MegaPack

Mr. Anderson describes Comm Sys

Solar Array within fence line

Solar Array from Newtown Road

Solar Array from Diamond Bar Rd
### Solar Project Summary

<table>
<thead>
<tr>
<th>Component</th>
<th>Count</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Modules</td>
<td>1,638</td>
<td>Boviet Bi-Facial 540W (144 Cells)</td>
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<tr>
<td>Inverters</td>
<td>14</td>
<td>CPS 60KW (6 to 7 strings per Inv)</td>
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<tr>
<td>Strings</td>
<td>912</td>
<td>2 to 3 Strings per MPPT</td>
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<td>Modules/String</td>
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<td>36 to 54 modules per MPPT</td>
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<td>KWDC</td>
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<td>KWAC</td>
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### Component Count Description

- **Modules**: 1,638 Boviet Bi-Facial 540W (144 Cells)
- **Inverters**: 14 CPS 60KW (6 to 7 strings per Inv)
- **Strings**: 912 (2 to 3 Strings per MPPT)
- **Modules/String**: 18 (36 to 54 modules per MPPT)

### Array Layout

- **Modules**: 1,638
- **Inverters**: 14
- **Strings**: 912
- **Modules/String**: 18

### System Description

- **Array**: 1,638 Boviet Bi-Facial 540W (144 Cells)
- **Inverter**: CPS 60KW (6 to 7 strings per Inv)
- **String**: 912 (2 to 3 Strings per MPPT)
- **Module**: 18 (36 to 54 modules per MPPT)
Payback - Fuel Savings and Maintenance from Feasibility Study

Solar array will supply 48% of the energy requirements for the GCW micro-grid and reduce other operating costs by 20%. (Labor-Service Contract)

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<thead>
<tr>
<th>CURRENT GCW Generator Operating Costs</th>
<th>Projected Yearly Savings</th>
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<tr>
<td>1. Diesel - Red Dye</td>
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<td>2. Grid Generator Service Agreement</td>
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<td>3. Grid generators - Labor Parts</td>
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Note 1: Reduction in diesel generation Maint. costs offset by solar Maint. cost.

Hualapai Tribe will recover its $1,260,000 investment in approximately 35 months*

* Increasing diesel prices will likely reduce the pay back period to less than 24 months
Technical Considerations - Primary Infrastructure Additions

1. Anchoring of Solar panels & fence into shallow granite bedrock
2. Construction and installation of:
   i. Solar panels and racking system
   ii. Concrete pads/conduits/fence
   iii. Tesla Battery Mega Pack with system site controller
   iv. Step-Up Transformer, ground detection, electrical switchgear
3. Extension of existing 20.8 KV micro-grid to solar site
4. New fiber optic communications path between existing generators and battery/solar system to ensure constant communications between the Solar and Diesel site which are nearly a mile apart.
5. Change out existing generator “EPIC” controls from EMCP 4.2 to 4.4
Technical Considerations - Operational/Maintenance

1. Tesla Mega Pack and controller provide “grid forming functions.” voltage regulation and frequency control

2. Typical solar installations rely on the regional electrical grid to provide “grid forming functions.”

3. Existing diesel generators follow the Mega Pack’s “lead” but revert back to “grid forming” if the battery system is unavailable due to:
   i. Lack of solar irradiation or battery charge falls to less than 20% of rating
   ii. Loss of communications path
   iii. Micro-grid interruption

4. Creation and monitoring of a generation dispatch model and optimization of integrated system

5. HTUA created a Generation Manager position to ensure proper operation and maintenance
Technical Considerations Summary

The resulting system is at the forefront of today’s deployed Solar technology in Indian Country and non-Indian Country as well

- All electric assets are owned and operated by the Hualapai Tribe thru its utility - HTUA

- The Hualapai Tribe distributes power throughout the GCW campus via its own 20.8 KV underground micro-grid

- The 9,000 acre GCW campus is not connected to the regional utility grid operated by UniSource which serves this part of AZ

- The tribe’s prior experience with solar installations is from 3 KW residential, grid-tied to 17 KW ground-mounted systems

- The Hualapai Tribe independently managed all permitting, engineering, procurement & construction for the project, with Solon being the third-party solar contractor
### Generation Sources from 10/19 thru 11/4

Solar produced 60% of GCW’s energy requirements during the first few weeks of operation

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<th>Date</th>
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<th>%</th>
<th>Diesel</th>
<th>%</th>
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<td>5,109</td>
<td>59%</td>
<td>3,547</td>
<td>41%</td>
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<tr>
<td>10/20/2023</td>
<td>5,051</td>
<td>72%</td>
<td>1,917</td>
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<tr>
<td>10/21/2023</td>
<td>4,827</td>
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<td>3,294</td>
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<td>8,121</td>
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<tr>
<td>10/22/2023</td>
<td>4,328</td>
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<td>1,427</td>
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<td>5,755</td>
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<td>10/23/2023</td>
<td>4,126</td>
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<td>1,898</td>
<td>32%</td>
<td>6,024</td>
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<td>10/24/2023</td>
<td>4,141</td>
<td>68%</td>
<td>1,940</td>
<td>32%</td>
<td>6,081</td>
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<tr>
<td>10/25/2023</td>
<td>4,017</td>
<td>61%</td>
<td>2,536</td>
<td>39%</td>
<td>6,553</td>
</tr>
<tr>
<td>10/26/2023</td>
<td>3,943</td>
<td>64%</td>
<td>2,262</td>
<td>36%</td>
<td>6,205</td>
</tr>
<tr>
<td>10/27/2023</td>
<td>4,339</td>
<td>82%</td>
<td>967</td>
<td>18%</td>
<td>5,306</td>
</tr>
<tr>
<td>10/28/2023</td>
<td>4,536</td>
<td>61%</td>
<td>2,879</td>
<td>39%</td>
<td>7,415</td>
</tr>
<tr>
<td>10/29/2023</td>
<td>4,878</td>
<td>97%</td>
<td>174</td>
<td>3%</td>
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<tr>
<td>10/30/2023</td>
<td>3,847</td>
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<td>3,285</td>
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<tr>
<td>10/31/2023</td>
<td>3,748</td>
<td>54%</td>
<td>3,187</td>
<td>46%</td>
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<tr>
<td>11/1/2023</td>
<td>4,699</td>
<td>70%</td>
<td>2,037</td>
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<td>6,736</td>
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<td>11/2/2023</td>
<td>4,433</td>
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<td>2,017</td>
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<td>6,450</td>
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<td>11/3/2023</td>
<td>4,320</td>
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<tr>
<td>11/4/2023</td>
<td>4,023</td>
<td>60%</td>
<td>2,697</td>
<td>40%</td>
<td>6,720</td>
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<td><strong>Total</strong></td>
<td><strong>74,365</strong></td>
<td><strong>66%</strong></td>
<td><strong>38,076</strong></td>
<td><strong>34%</strong></td>
<td><strong>112,441</strong></td>
</tr>
</tbody>
</table>
Comparison of Generation

Solar Noon at 11:45 AM, PST

* MegaPack powering micro-grid. Generators will start when battery falls below 50% state of charge
The solar array produced 264 MWhrs or 40% of the micro-grid’s output.

Reduced generator diesel fuel use by some 68,000 gallons equaling a cost savings of $200,000.

Tesla MegaPack charging in November and December was 247 MWhrs going into the battery and 237 MWhrs coming back out onto the micro-grid.

The system is running near 90% efficient with about half of the power loss attributable to the DC solar to AC conversion, which matches Solon’s designed de-rating from 885 KVDC to 840 KVAC, then another 4-5% loss from the MegaPack through the Zig-Zag transformer and then through the step-up to 20.8 KV transformer as the power exits the fence line.
Summary - Next Steps – Major Take Aways

- Work on optimizing system to minimize fuel consumption
- Monitor system performance over 1 year period per DOE
- Increase load on micro-grid to reduce PV curtailment through grid expansion and/or by deploying EV charging (*working with NREL on this question*)

- Battery resolved a significant technical problem – battery absorbs costly excessive VAR produced by micro-grid
- With proper support from tribal leadership, other tribes can duplicate this success.
- Retain qualified personnel: HTUA Generation Manager is a 4-year degreed electric utility and communications engineer.
- Be sure to adequately budget for the replacement of the main battery. Battery should be replaced in about 10 years.
Questions? Thank you for your time!

Roger Wright
Manager of Generation
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928-279-6192

Water Rights celebration, 8/30/2023

Kevin Davidson
Planning & Econ Dev Director
Kevin.Davidson@Hualapai-nsn.gov
(928) 769-1310

Sandia National Labs visit, 6/16/2023
COMMUNICATIONS & CONTACT

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