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Innovation in Finance, Technology & Policy

CleanEnergy States Alliance

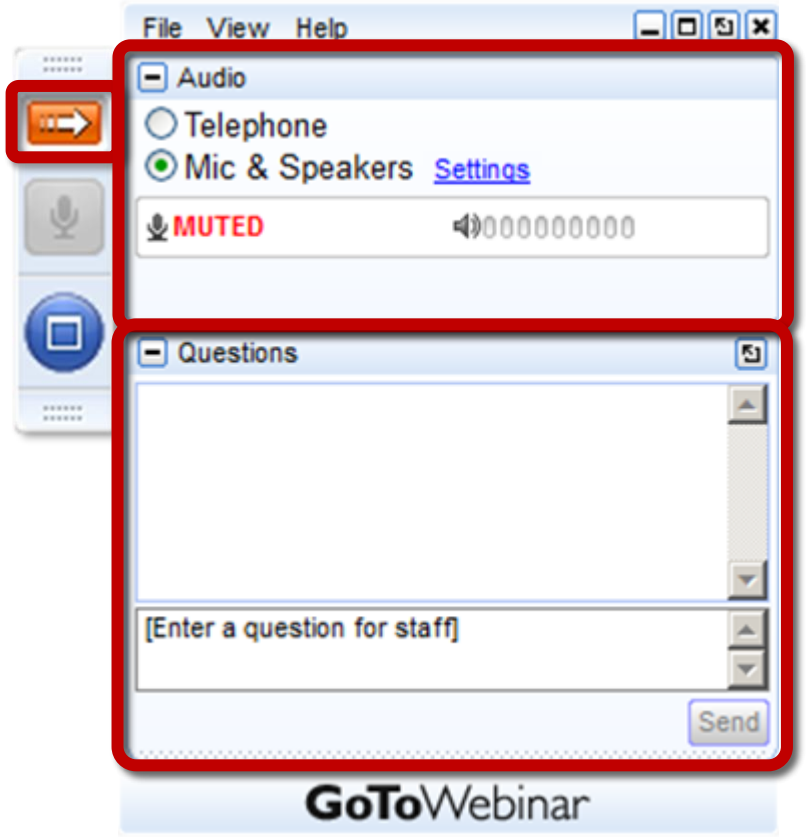
The Bad River Band Microgrid: Solar+Storage as a Tool for Tribal Energy Sovereignty and Resilience

July 22, 2021

U.S. DEPARTMENT OF ENERGY

Sandia National Laboratories

WEBINAR LOGISTICS



Join audio:

- Choose Mic & Speakers to use VoIP
- Choose Telephone and dial using the information provided

Use the orange arrow to open and close your control panel

Submit questions and comments via the Questions panel

This webinar is being recorded. We will email you a webinar recording within 48 hours. CEG's webinars are archived at www.cleanegroup.org/webinars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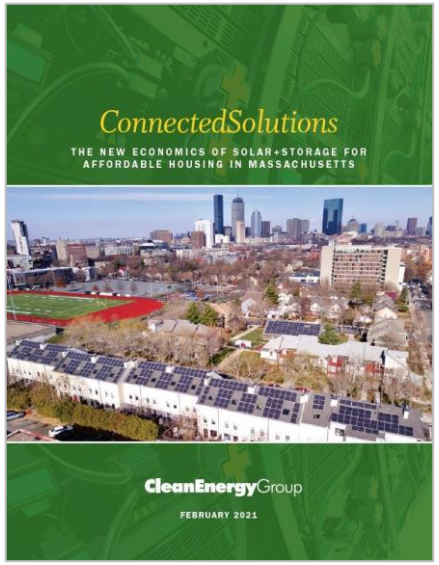
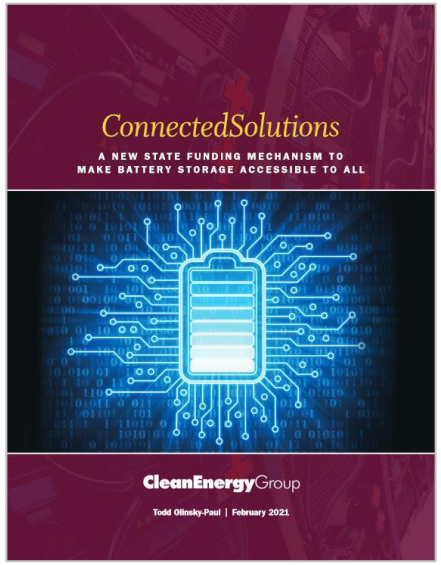
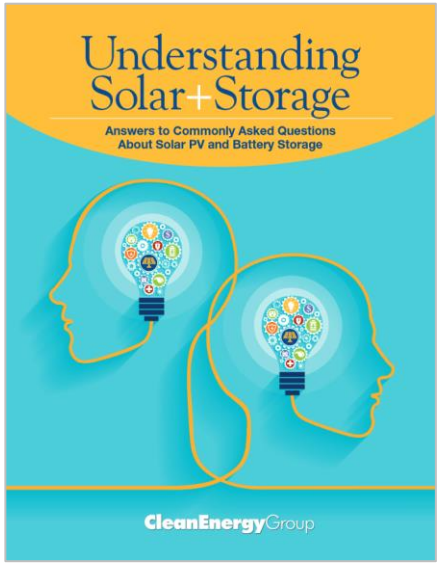
THE RESILIENT POWER PROJECT

- Increase public/private investment in clean, resilient power systems (solar+storage)
- Protect low-income and vulnerable communities, with a focus on affordable housing and critical public facilities
- Engage city, state and federal policy makers to develop supportive policies and programs
- Visit www.resilient-power.org for more information and resources







SUPPORTING 250+ PROJECTS ACROSS THE COUNTRY

Boulder: Nonprofit transportation center serving elderly and disabled residents

Boston: Multiple housing properties representing 1,000+ units of senior and affordable housing

DC: First solar+storage resilience center at affordable housing in DC

Puerto Rico: Supporting the installation of solar+storage at multiple community medical clinics

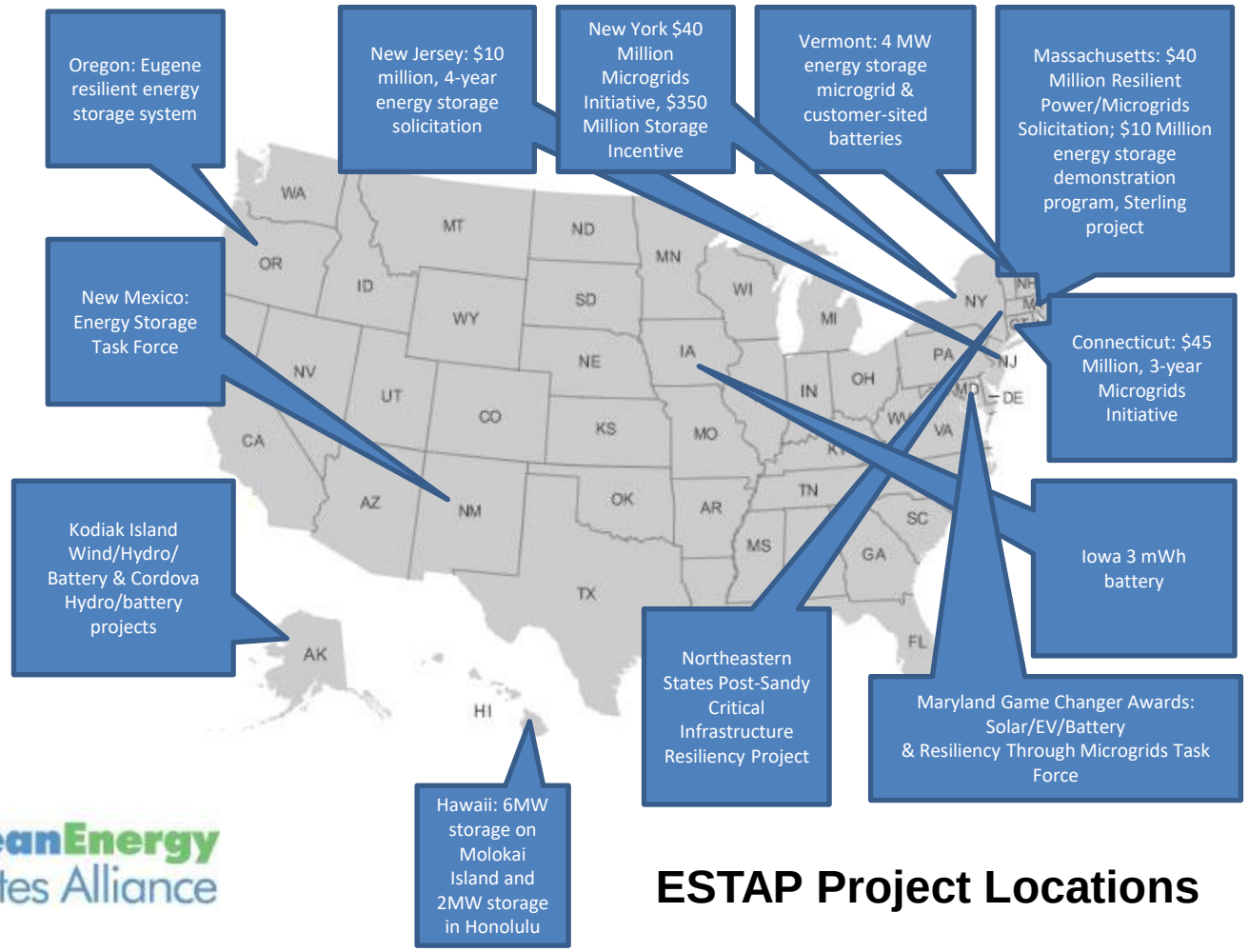
New Mexico: Added resilience for remote wildfire operations command center

DOE-OE Energy Storage Technology Advancement Partnership

The Energy Storage Technology Advancement Partnership (ESTAP) is a US DOE-OE funded federal/state partnership project conducted under contract with Sandia National Laboratories.

ESTAP Key Activities:

1. Facilitate public/private partnerships to support joint federal/state energy storage demonstration project deployment
2. Disseminate information to stakeholders
   - ESTAP listserv >5,000 members
   - Webinars, conferences, information updates, surveys.
3. Support state energy storage efforts with technical, policy and program assistance



ESTAP Project Locations

U.S. DEPARTMENT OF ENERGY

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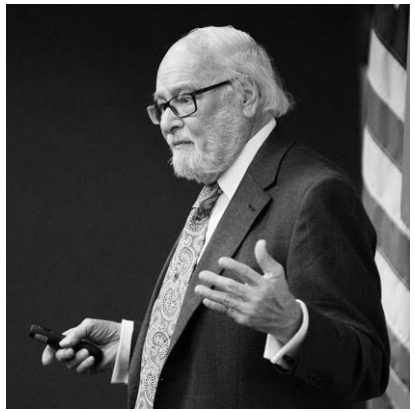
CleanEnergy States Alliance

Thank You!



Dr. Imre Gyuk
Director, Energy Storage Research,
U.S. Department of Energy

Dan Borneo
Engineering Project/Program Lead,
Sandia National Laboratories

WEBINAR SPEAKERS






- **Dr. Imre Gyuk**, Director of Energy Storage Research, Office of Electricity, US Department of Energy
- **Bill Bailey**, President, Cheq Bay Renewables
- **Dan Wiggins**, Tribal Energy Manager for the Bad River Band of Lake Superior Chippewa
- **Amy Simpkins**, Chief Executive Officer, muGrid Analytics
- **Tim Zdrazil**, Application/System Engineer, Faith Technologies
- **Shelley Robbins**, Project Director, Clean Energy Group (moderator)

Energy Storage for Resiliency, Equity and Energy Sovereignty: Tribal Projects

IMRE GYUK, DIRECTOR,
ENERGY STORAGE RESEARCH, DOE-OE

Global Warming is Real!

FLOODS!

Florida, Harvey, 2017

DROUGHTS!

Worst in 400 years

Floods and Droughts,
but also
Wildfires, Ice Storms,
Earthquakes, and Volcanoes!

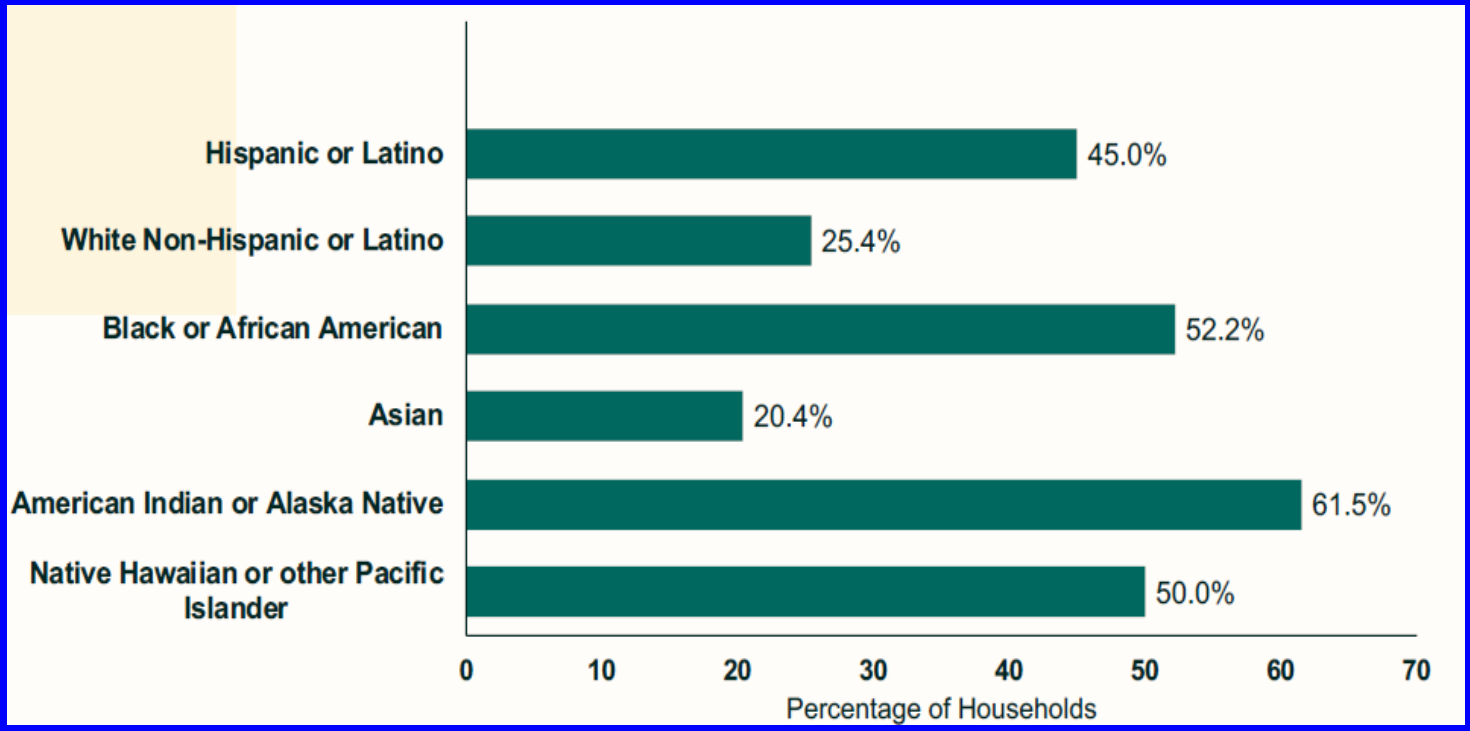
For Local Resilience we need
Renewable Energy and Storage!

But Resources are not
Distributed Evenly!

The Cost of Electricity has been
rising much faster than
the Cost of Living
during the last Decade!

Outages have happened
more frequently.
Particularly at grid edge!

Households Experiencing Energy Insecurity



From: S. Baker/Yale

Lower income households are disproportionally non-white

We need to avoid creating an “Energy Divide”

We need to consider Social Equity for Urban, Rural, and Tribal Communities!

Sterling, MA: Microgrid/Storage

$1.5M Grant from MA. Additional DOE Funding, Sandia Analytics

Sterling, MA, Oct. 2016, NEC, Li-Ion

Dec. 2016, 2MW/2hr Storage, 3MW PV

2016 Dec. till **2017** Nov.
Actual Savings:

• Arbitrage	$11,731
• Monthly Peaks	$143,447
• Annual Peak	$240,660
• Total	$395,839

Sean Hamilton

Carina Kaainoa

Capital Cost: $2.7M

April 2019: 1 million $ Avoided Cost!

Cordova, Alaska, Municipal System

Cordoba, Grid Isolated

6MW Run of RiverHydro Power

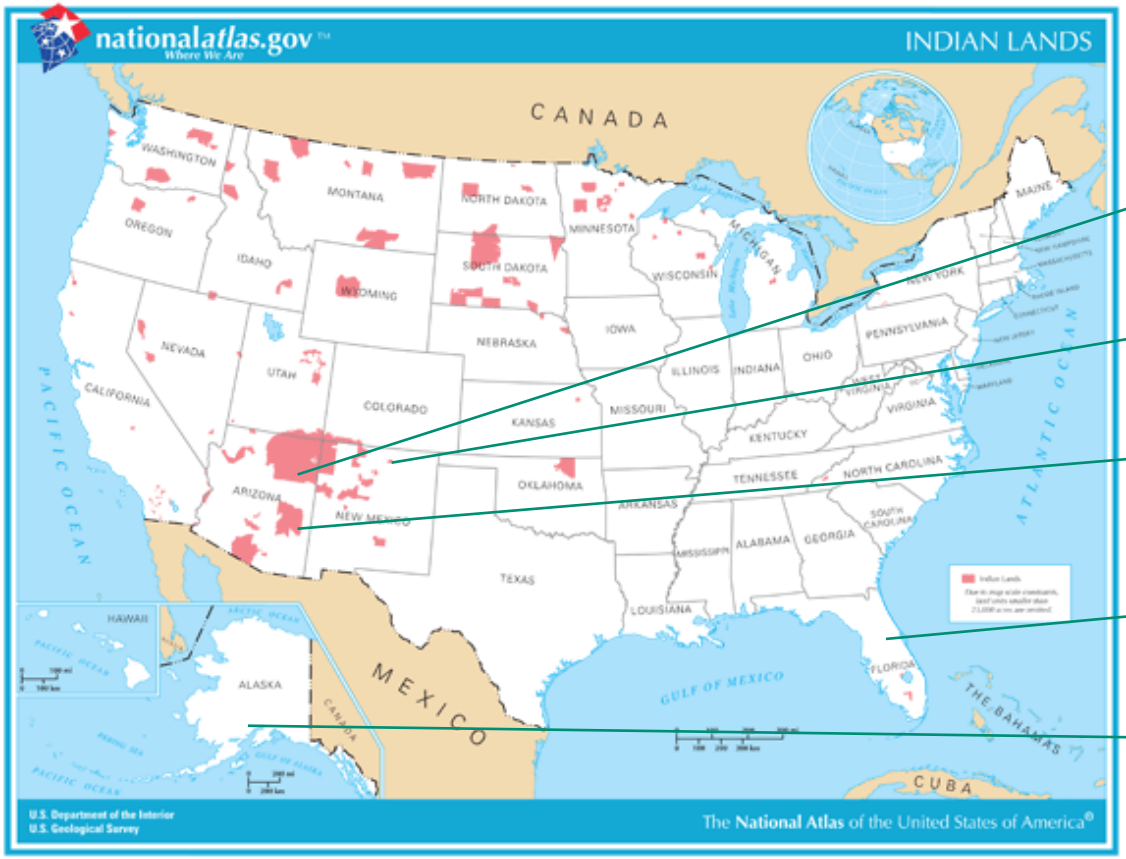
Total Capacity: 7.25MW Hydro; 2x 1MW Diesel

0.5MW Deflected as Spinning Reserve

Hydro: $0.06/kW; Diesel: $0.60/kW

1MW/1hour Battery, Commissioned June 7, 2019

OE Energy Storage Program
Tribal Energy Projects



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

Navajo Nation: 18,000 at Remote Locations. MnO_2 better than L/A

Picuris Pueblo: High cost of Electricity from neighboring Utility, Energy Sovereignty!

San Carlos Apache: Over 100 Outages per year! Cost Benefit Analysis. Storage Sizing.

Seminoles: Grid Instability. Help with RFP, Vendor Selection, Commissioning

Levelok Alaska (Aleut, Inuit) 234kW diesel at 85c/kWh. Baseline Analysis. Fuel Savings, O&M Reduction, Generator Life.

Bad River Band of Lake Superior Chippewa in Wisconsin (DOE Indian Energy)

July 2016 Flood caused
Multiday Power Outage

Energy Sovereignty: $2M Microgrid

- Admin. Building
- Wastewater Treatment Plant
- Health & Wellness Center

May 2021: 500 kW Solar
500kW/1 MWh Storage

Resiliency, Sustainability, Predictable Budget

Bad River Band of Lake Superior Chippewa in Wisconsin

A DOE Indian Energy Office Project

500 kW Solar

500kW / 2hr Storage

Energy Sovereignty!

CHEQ BAY RENEWABLES (CBR)

Making renewables energy more accessible

Bad River Microgrids

CONCEPTUAL PLAN

FORMED TEAM

CBR'S ROLE

Microgrid Conceptual Plan

- **Needed to move beyond net-metering**
  - Had a *financial* motivation (14 cents all-in cost of electricity/kWh)
    - Battery storage kept more energy behind the meter
  - Had a *resilience* motivation (2016 flood and no power for a week)
    - Battery storage works well with solar and existing backup generator to extend power during an outage (sum is greater than the parts)
  - *Tribal Sovereignty* and energy independence were long-standing goals

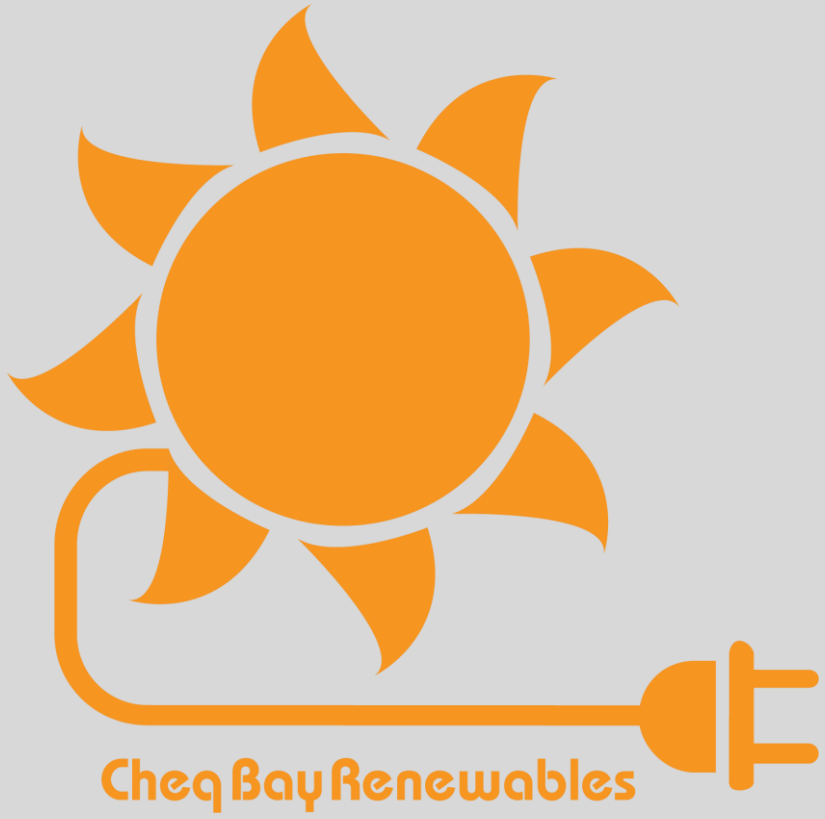
Putting Team Together

- muGrid Analytics – technical expertise
- Madison Solar Consulting – project development
- Cheq Bay Renewables – local presence

Cheq Bay Renewables' Role

- Conceptual Plan
- Non-technical grant writing
- Connection to and understanding local utility
- Business background
  - Management
  - Financial

www.cheqbayrenewables.org



Ishkonige Nawadide Solar Microgrid Project

BAD RIVER BAND OF LAKE SUPERIOR TRIBE OF CHIPPEWA INDIANS

2021 Clean Energy Webinar : Tool for Tribal Energy Sovereignty and Resilience

July 22,, 2021

Daniel Wiggins Jr, Air Quality Technician & Project lead

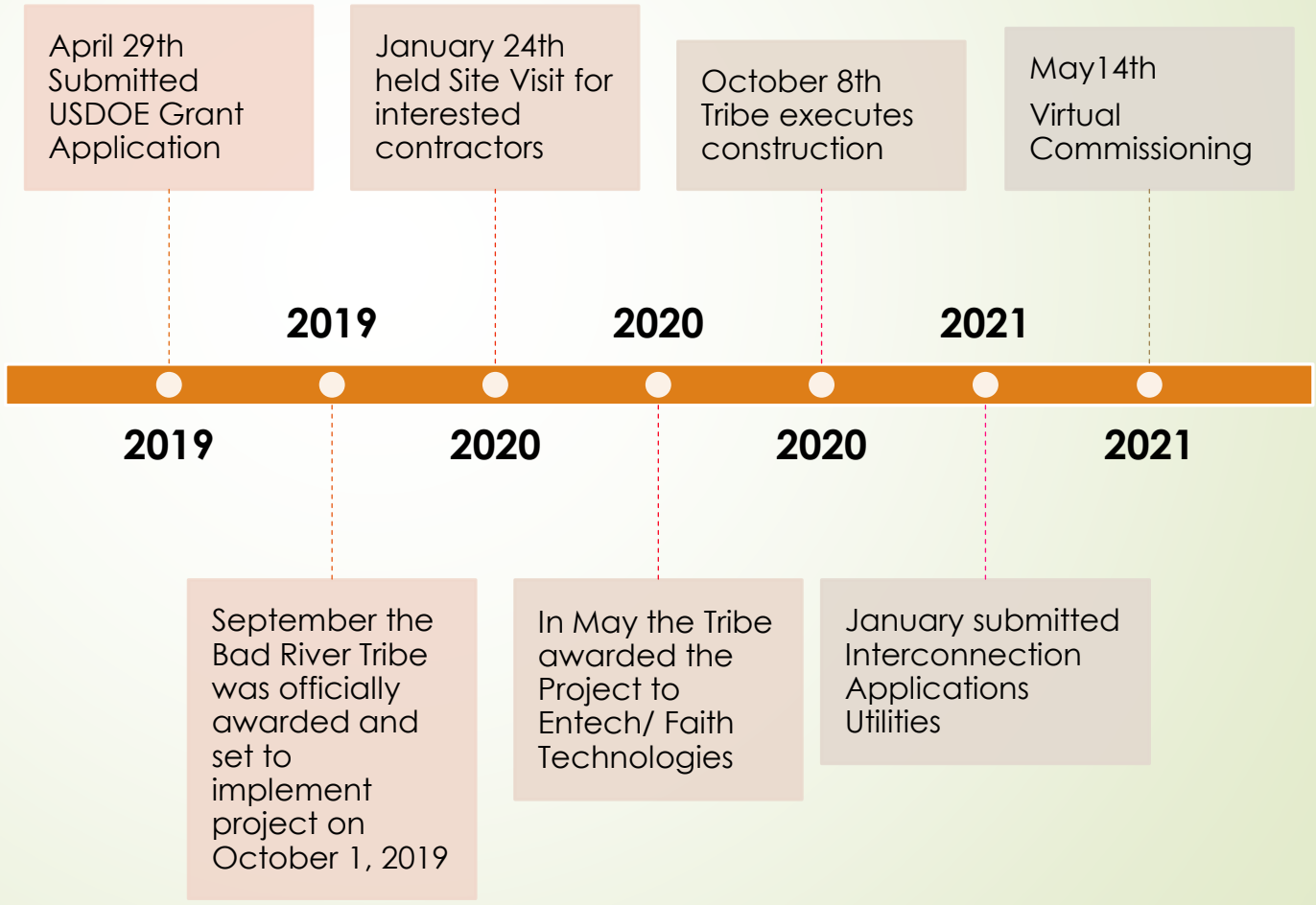
Overview

- Ishkonige Nawadide
  - Objectives
  - Timeline
  - Project Details
  - Planning & Development
  - Execution of Project
  - Challenges
  - Next Steps
- Questions

Ishkonige Nawadide Objectives

- The Bad River Tribe was awarded a USDOE Grant in 2019 for the Ishkonige Nawadide (It Catches Fire) Solar Microgrid Project.
  - Over 2.2 Million Dollar Project
  - 1.8 Million USDOE Contribution
  - Remainder funded through investor and developer
- Focused on resiliency after the 2016 Flood and while experiencing electrical outages at crucial facilities, such as the Health & Wellness Center, the Tribe's community Clinic.
- Tribe is installing over 500 kW of solar with over 1000 kWh of battery storage at three tribal facilities located in the Odanah Community:
  - The Chief Blackbird Administration Building
  - Wastewater Treatment Plant (WWTP)
  - Health & Wellness Center (H&WC)
- Systems at the H&WC and the WWTP will offset facility electrical loads and offer assisted level of resiliency if power goes out that can last projected days if not weeks.

Project Timeline



Project Details

Why “Go Solar”

REASON 1	REASON 2	REASON 3
Emission reduction	**Economic benefit**	**Increased resiliency**
Solar generates clean energy	Reduces utility bills	Prolongs power supply when the grid is down
Necessary to tackle climate change	Locks in savings as electricity prices increase	Solar, batteries & backup generator – the three sisters

Emission Reduction

Three systems will generate 630,000 kWh annually
Same electric use of 74 average WI households
Avoids 500 tons of CO2 emissions/year
*Would fill 812 average size homes by volume
*Would take 547 acres of trees to sequester
*Equivalent emissions from 50,000 gallons of gasoline

Source: EPA Greenhouse Gas Emissions Calculator

Economic Benefit

Three systems will reduce electric bills by $58,000 /year

Savings go up as inflation raises utility prices

Solar PV system should last 40-50 years

Savings can be used for other Tribal programs

Increased Resilience

Each systems can operate with or without the grid
Solar, batteries and backup generation work together
Without the batteries the solar shuts down during a power outage
The HWC & WWTP can operate for extended periods without the grid, especially during the spring, summer and fall
HWC can operate, on average, about 300 hours without the grid (12 ½ days)
Solar + Batteries extend operating without the grid by an average of 200 hours vs. generator alone per outage

Why Add Batteries?

-Smooths out intermittency of solar

-Increases emissions reduction

-Increases economic benefits

-Increases resiliency

-Allows solar to work without the grid

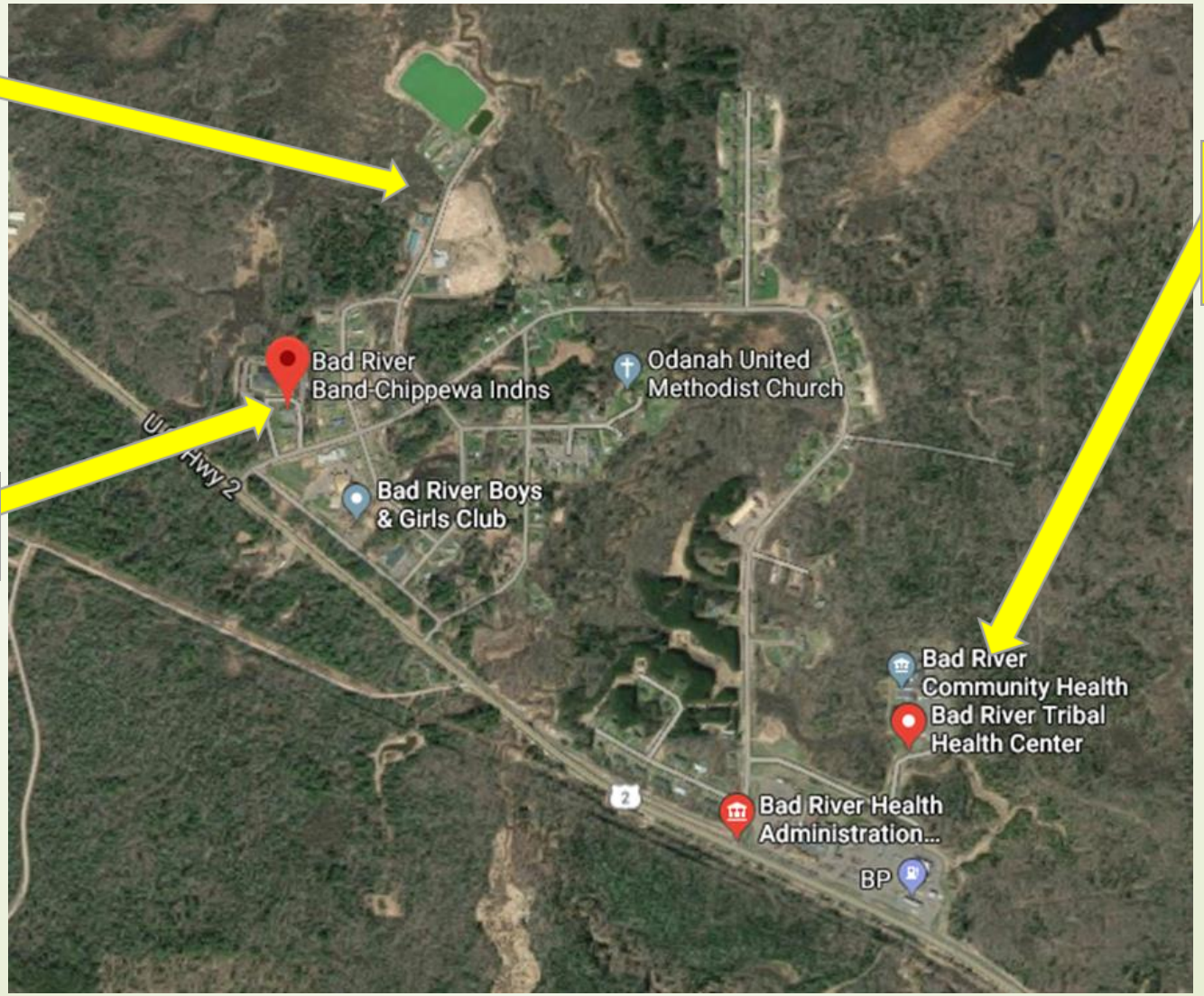
Energy Tracking

- Moment-by-moment tracking for:
  - Building usage
  - Solar generation
  - Battery state-of-charge
- Tracking enables system to be optimized for best economic outcome
- Tracking confirms the system is performing as designed
- muGrid and EnTech will independently track data and meet quarterly with the Tribe to discuss systems' optimization

Odanah Community

Waste Water Treatment Plant

Administration



Health & Wellness Center

Administration

- 24kW DC Solar panel generation – Rooftop installation
- 20.4kW AC Inverter
- Battery Storage 10kW, 22kWh
- Pushes excess energy back to building
- Grid forming capabilities in the event of a utility outage
- Batteries charge on excess solar

Admin Pics

Wastewater Treatment Plant

- 200kW DC Solar panel generation – Ground mount installation
- 250kW AC Inverter
- Battery Storage 200kW, 426kWh
- Pushes excess energy back to the building/grid
- Does not form a grid in the event of a utility outage
- Batteries charge on excess solar

WWTP Pics

Health & Wellness Center

- 301kW DC Solar panel generation – Ground mount installation
- 250kW AC Inverter
- Battery Storage 200kW, 568kWh
- Pushes excess energy back to the building/grid
- Grid forming capabilities in the event of a utility outage
- Batteries charge on excess solar

H&WC Pics

Battery Pictures


ISHKONIGE NAWADIDE
Microgrid Facility Monitori
[MICROGRID 1]
Wastewater Treatment Plant
202.4 kW
SOLAR
110.1 kW
UTILITY
-48.8 kW
BATTERY
0.0 kW
GENERATOR
25.6 kW
BUILDING LOAD
[MICROGRID 2]
Health and Wellness Center
310.4 kW
SOLAR
0.0 kW
UTILITY
-193.2 kW
BATTERY
0.0 kW
GENERATOR
96.7 kW
BUILDING LOAD
[MICROGRID 3]
Chief Blackbird Administrative Building
4.4 kW
SOLAR
3.6 kW
UTILITY
0.6 kW
BATTERY
0.0 kW
GENERATOR
...
PANEL LOAD
ENTECH SOLUTIONS
FAITH TECHNOLOGIES

Ishkonige Nawadide
Planning & Development

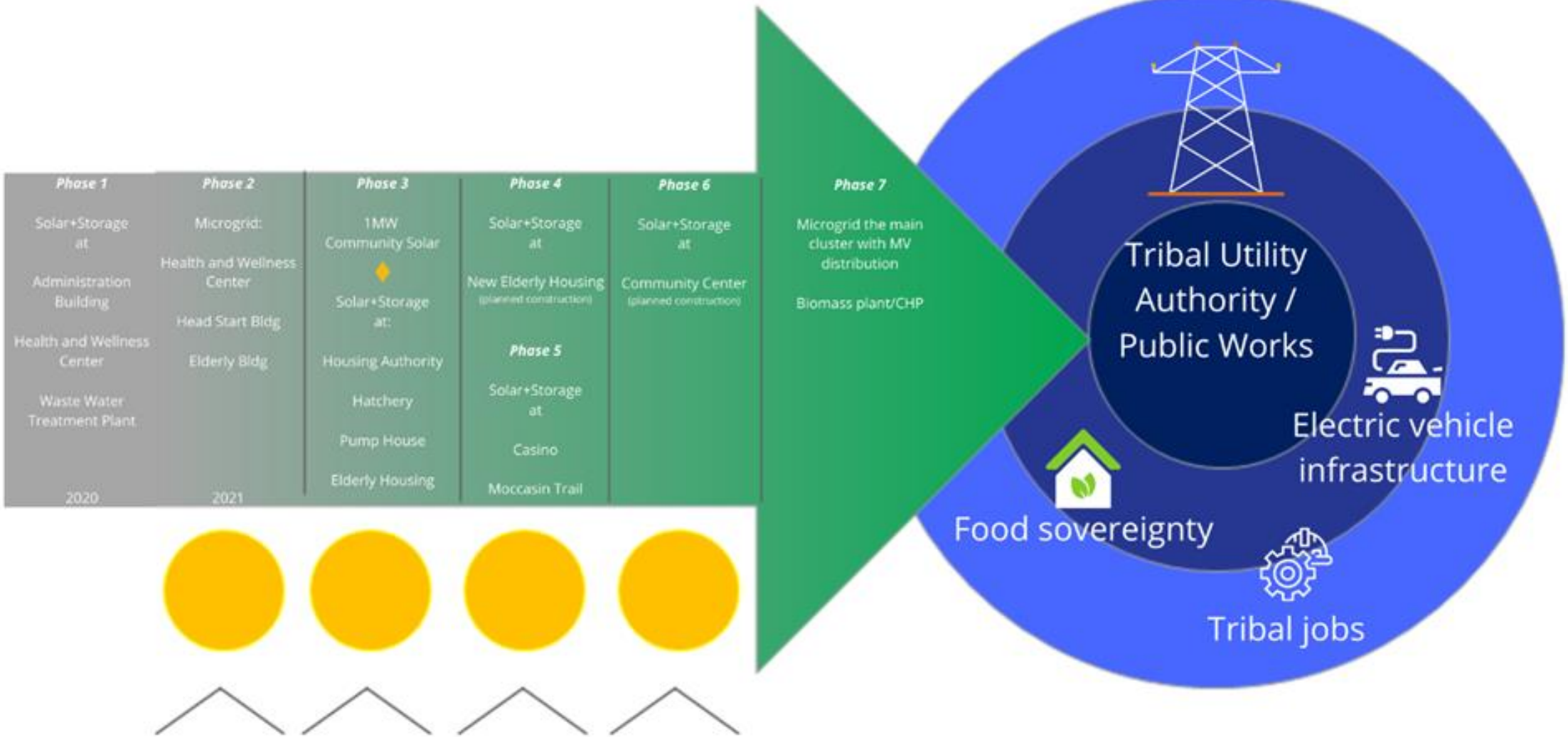
- The Ishkonige Nawadide Project was guided with both Strategic Energy Planning done in 2012 and 2017.
- The Tribe used the newly adopted 2018 Emergency Preparedness Plan (EPP) to identify critical infrastructure that was affected by power outages and the 2016 Flood.
- Several buildings and scenarios were identified for possible solar projects
  - Many other buildings but were not in great condition
  - Looked at some Housing Authority Homes and Buildings
- The 2018 EPP identify the Health & Wellness Center, Wastewater Treatment Plant, and the Chief Blackbird Administration Building as critical infrastructure.

Ishkonige Nawadide
Execution of Project

- Request For Proposals were concluded in May of 2020 and awarded Faith Technologies/ Entech
- Developed Long Term Stategic Plan identifying phased plan
- Began Construction in October of 2020
- Virtual Commissioning occurred in May of 2021
- Quarterly Reporting and Progress Update Meeting(s)

Bad River Band

Phased Energy Plan



Ishkonige Nawadide Challenges

- COVID-19
  - Tribe issued *Declaration of Public Health Emergency with Respects to the 2020 COVID-19 Pandemic* in March of 2020 along with Safer at Home orders once COVID begun to hit the community in June
  - Made meetings difficult
    - Decision making by leadership
    - Utility Task Force Meetings
    - Overall Team Meetings
    - Virtual Meetings have created a great level of communication
  - Construction
    - Limited building access and extra precautions
    - Contractors coming from out of town
    - Required all contractors to have strict COVID-19 policies

Ishkonige Nawadide Challenges

- Community Acceptance
  - Replacing land with solar or any infrastructure is not always accepted by elders and environmentalists.
    - " I don't know how I'll feel about it until I see the panels…. The trees were nice." Community Elder

Ishkonige Nawadide
Next Steps

- Execute Long-term Phased Energy Plan
  - Phase 2 directly ties in the new Head Start and existing Elderly Building into the Health & Wellness Center's existing Solar Microgrid.
  - Phase 3 looks at 1MW of Solar with residential housing
  - Work with Utility(s)!

Ishkonige Nawadide
Next Steps

Training and Workforce Development

- Tribal staff knowledgeable about how systems operate and what to do when there are technical issues
  - Working with existing Facility Staff
    - Siaki, Tony, and Marcus
  - High level training is being considered for Tribal Electricians into the Faith Tech "Itian" Program
- Facility Managers will need to identify staff to work with Faith Technology Staff or (Itians) in order to develop skills to understand the microgrids.

Ishkonige Nawadide Partners

- Bad River Tribe Utility Task Force Team
- Cheq Bay Renewables
- Madison Solar Consulting
- muGrid Analytics
- Faith Technologies

Chi Miigwech!
Thank You!

Daniel Wiggins Jr

Air Quality Technician

Mashkiiziibii Natural Resources Department

Ph: 715-979-1486

Email: Air1@badriver-nsn.gov

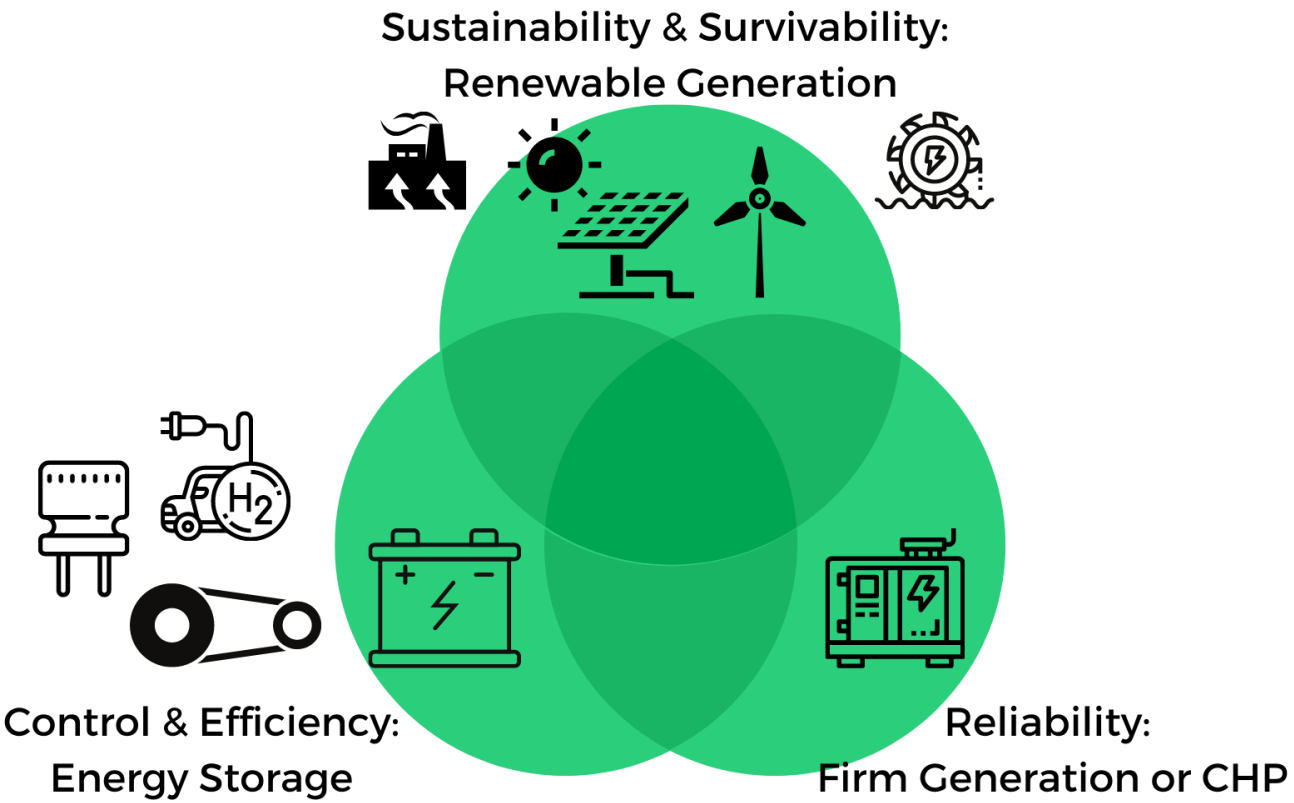
Bad River Resilience Modeling

22 July 2021

Amy Simpkins

muGrid Analytics

Resilient Grid-Connected Microgrids



- Provide utility savings during normal operation
- Extend survivability during outages at no net cost
- Provide redundant sources of backup power to reduce risk
- Meet sustainability / green energy goals
- Increase operational efficiency

muGrid Analytics

Resilience is…

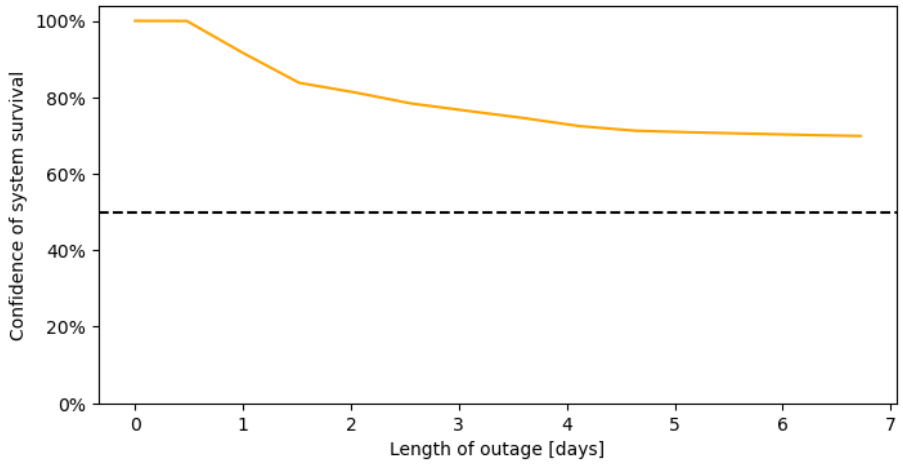
- a top priority for the Bad River Tribe
- a powerful differentiator in the DOE grant process

- hard to define
- hard to value

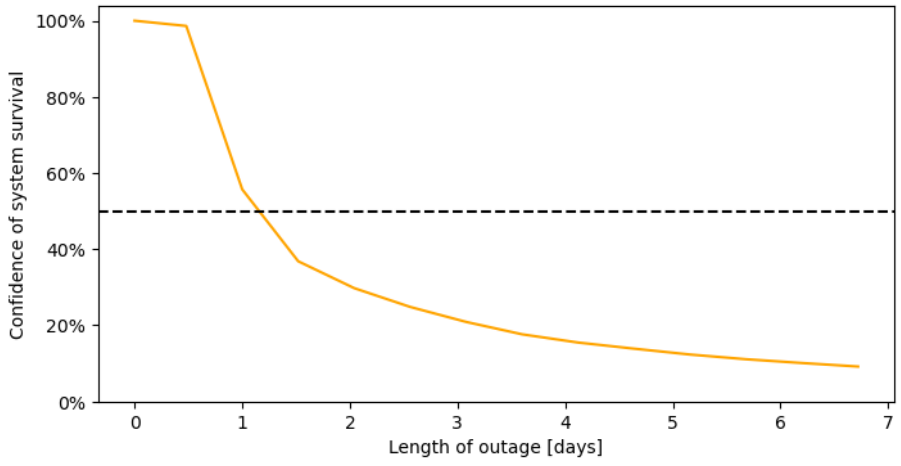
muGrid Analytics

Stochastic Resilience

- Resilience duration is defined as the amount of time the system can support the building before failing
- Resilience performance is dependent on time of day, seasonality, load conditions at the building, etc. and therefore duration varies
- The following evaluations are for solar plus storage only; resilience may be supplemented by fuel-based generation



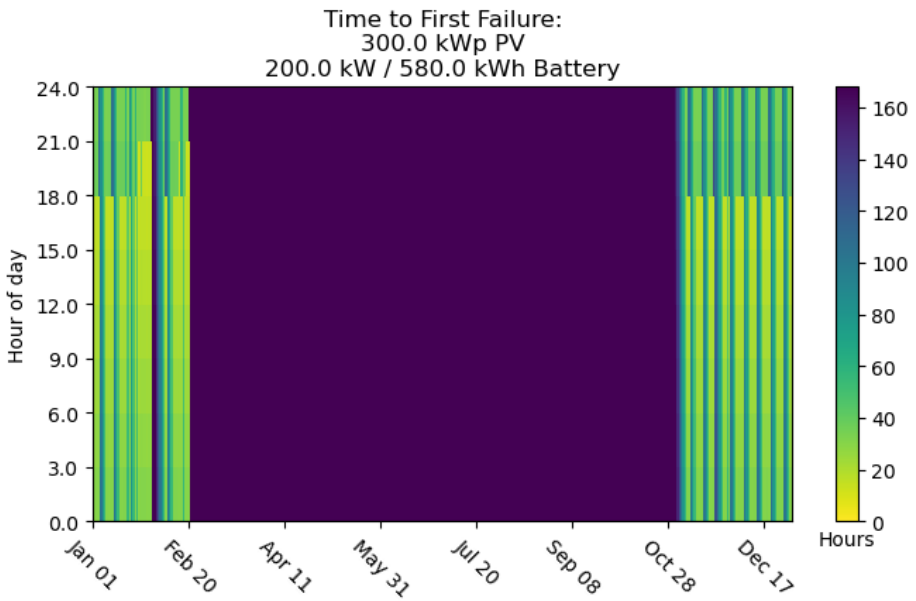
HWC



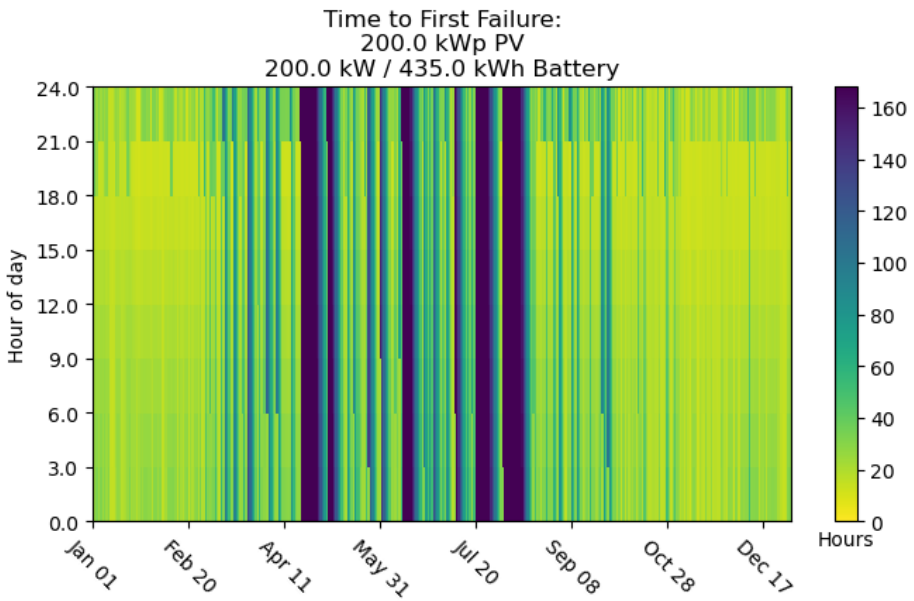
WWTP

muGrid Analytics

Resilience Seasonality



HWC



WWTP

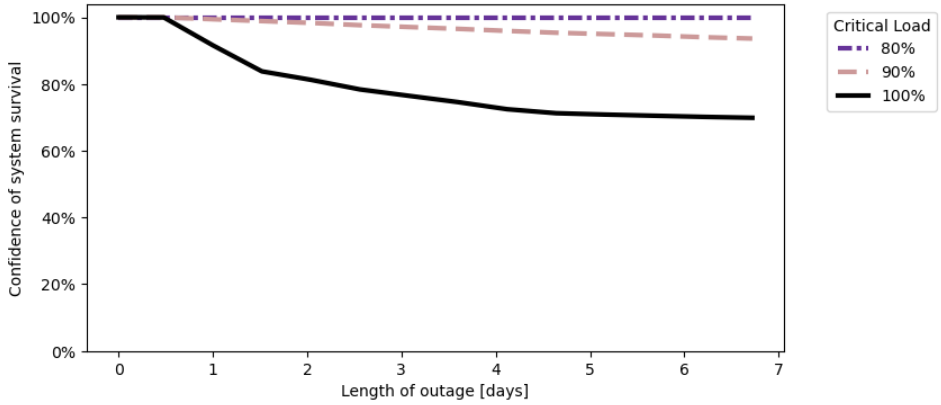
- At the HWC, solar production creates sufficient generation to provide near indefinite resilience from March to November. During winter months, resilience may be supplemented by fuel-based generation
- At the WWTP, due to flatter load, resilience durations provided by solar plus storage alone cover most nominal grid outages, while fuel-based generation supplements for longer durations.

muGrid Analytics

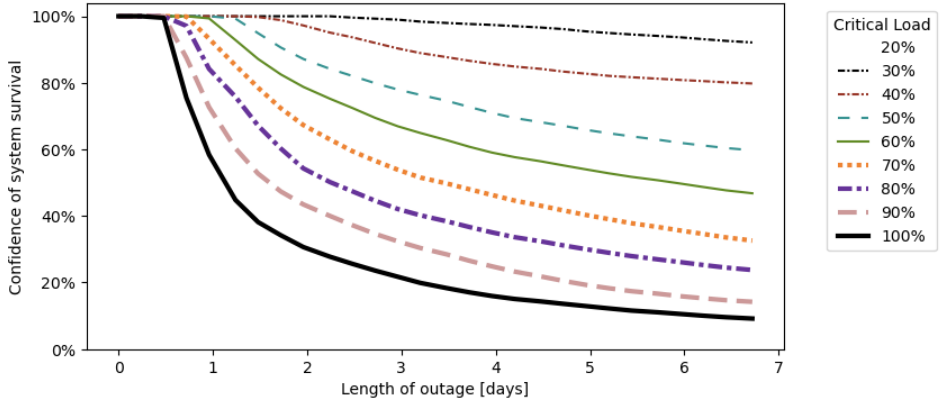
Load Reduction

- We assumed 100% critical load at both facilities
- If load is able to be reduced, resilience performance improves

HWC



WWTP



muGrid Analytics

Upcoming Webinars

Justice in 100% Clean Energy Policies: A Scorecard for Equity and Lessons from Washington State

Wednesday, July 28, 2-3pm ET

The LA100 Study: Lessons for State 100% Clean Energy Planning

Wednesday, August 25, 3-4pm ET

Read more and register at: www.cleanegroup.org/webinars

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