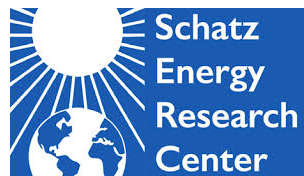

Energy Paths for the Yurok People





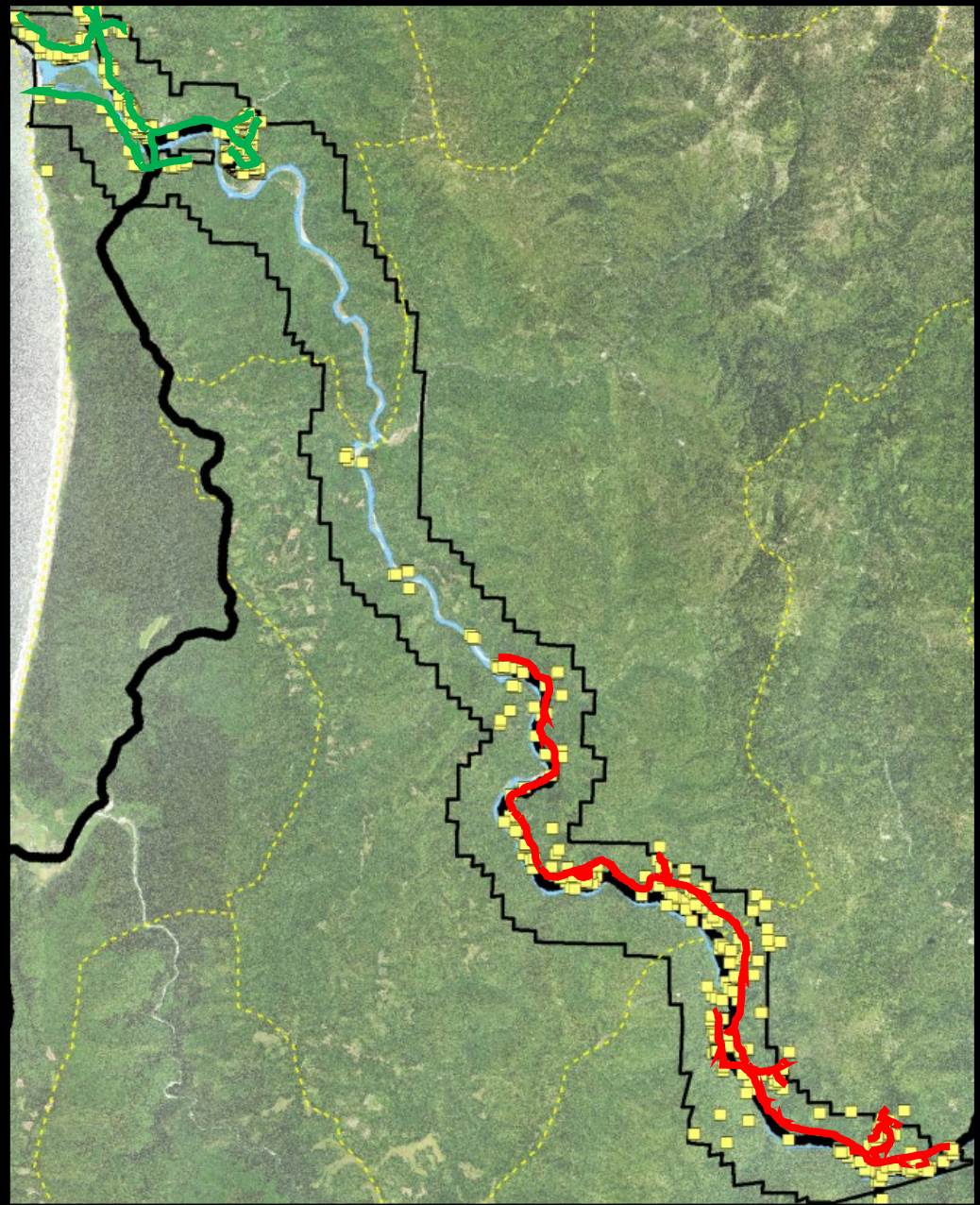
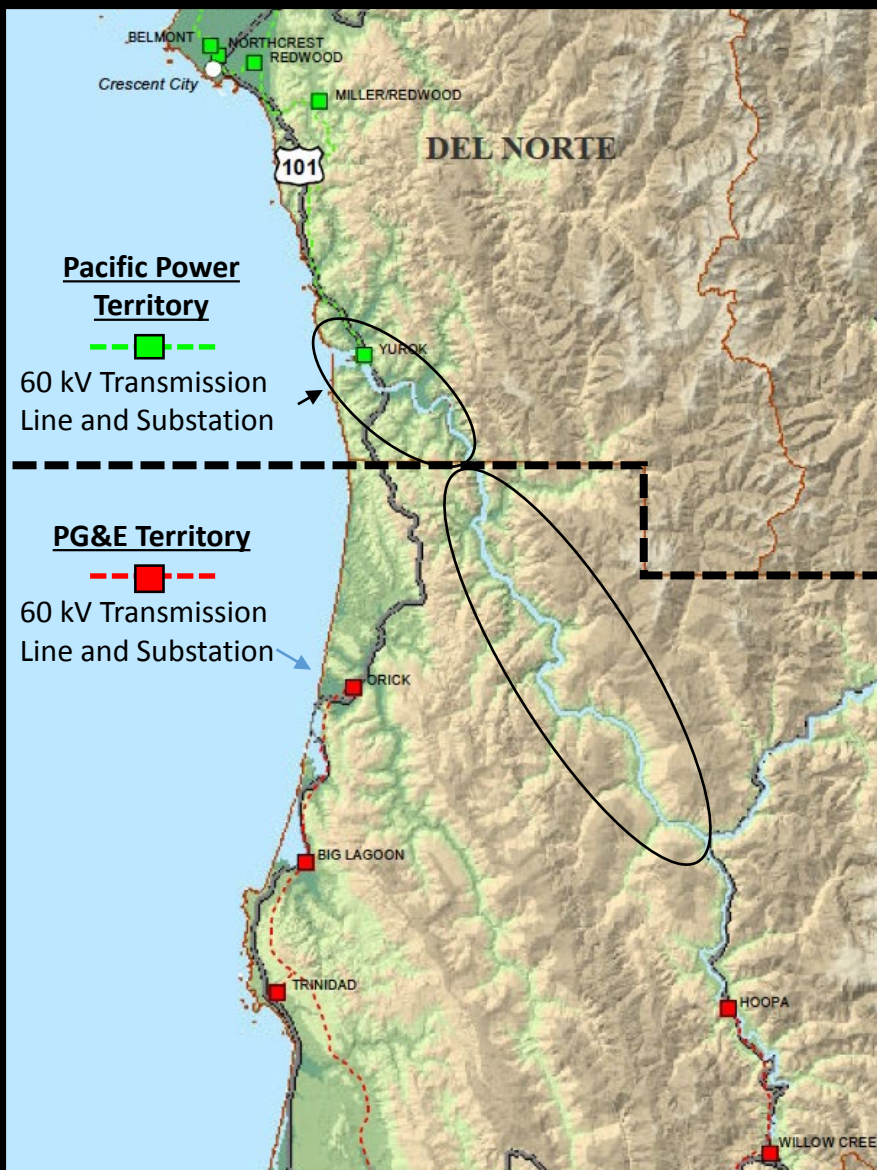
Yurok Country



- Yurok Tribe organized as a government in 1991
- The reservation is roughly 56,000 acres
- Largest Tribe in California with 6,232 members
- Employees roughly 500 people



Energy Landscape



Roughly 50% of homes on and adjacent to the Upper Yurok Reservation do not have access to grid electricity.

(The Present)

Start of the Energy Paths for the Yurok People Project

- Objective: To create a Strategic Energy Action Plan, complete with an implementation Strategy and a prioritized list of energy projects.
 - Increase energy efficiency/ decrease energy costs
 - Develop renewable energy
 - Meet the energy needs of the Yurok People



The Future (Fulfilling Our Vision)

To make sure all Tribal members on the Reservation have access to reliable, affordable, modern, cost-effective energy services. In addition, the Tribe seeks an energy program that promotes energy self-sufficiency, environmental sustainability, use of local renewable resources, and job creation and economic opportunity for Tribal members.



Project Overview

- Review past Yurok energy studies and projects
- Load analysis
- Demand reduction assessment
- Resource assessment

- Infrastructure analysis
- Community engagement process
- Energy options analysis
- Yurok Strategic Energy Action Plan



Review past Yurok energy studies and projects

Partial List of Studies Reviewed

- Numerous small hydroelectric studies (Pecwan, Achelth, Ke'pel, Miners, & Pine Creeks; 1997-2011)
- Sandia/WAPA Energy Options Assessment (2000)
- Biomass utilization preliminary feasibility study (2003)
- Tribal utility feasibility (included inventory of renewable energy resources; 2007)



- Human capacity building (2007)
- Wind & hydro feasibility (2011)

Load Analysis

Approach:

- Primary focus on Tribal facility energy use
- Compile data & ID biggest users
- ID usage by geographic region

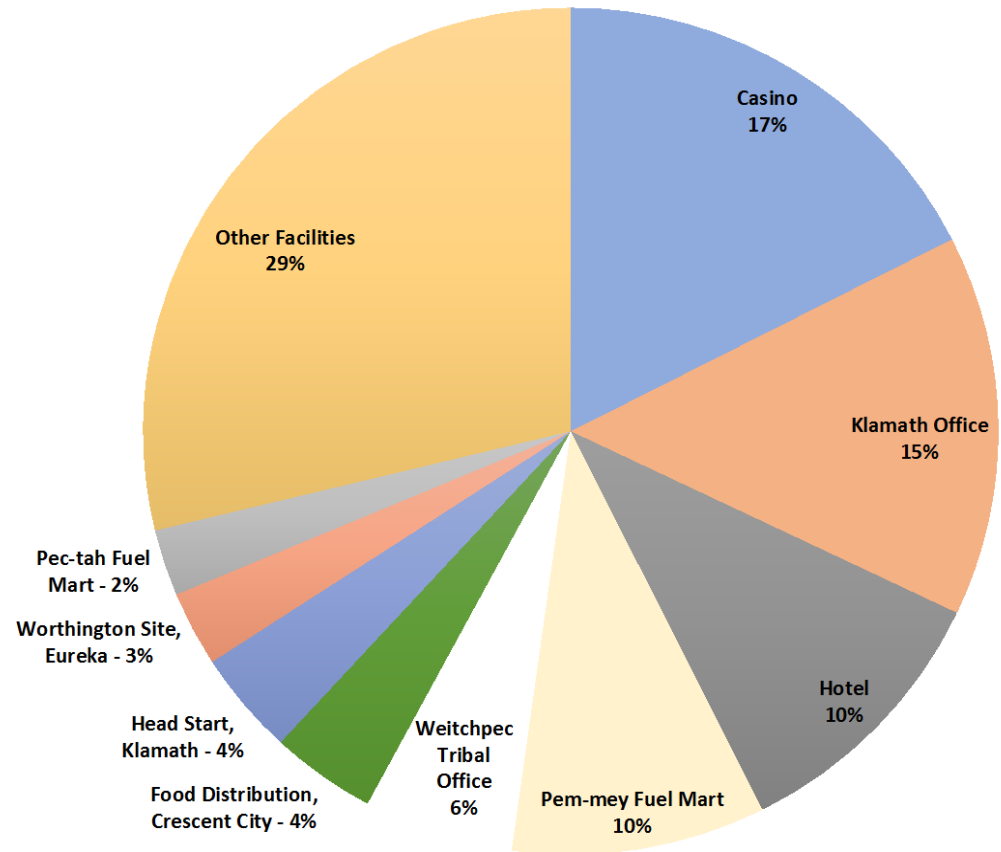
Results:

- 9 facilities account for majority of costs (71%)
- These facilities are key focus in demand reduction assessment
- Determined electrical load by geographic area, using to match resource availability to load
- >85% of Tribal facility electrical load & cost is in Klamath

Including the residential sector:

- 70% of total cost & 80% of total load is in Klamath
- Residential sector accounts for >70% of total load & cost

Energy Cost Breakdown - Tribal Facilities



Demand Reduction Assessment

Approach:

- Examine big users
- Calculate Energy Use Intensities (EUIs) and compare w/ national median for building type
- Engage w/ local utilities and assess programmatic opportunities

Results:

- Most EUIs are higher than national median
- Expected to be lower due to mild climate and in some cases built to CA energy code
- Many utility program opportunities identified

Facility	Location	Year Built	Fuels	Site EUI (GJ/m ²)	National Median EUI (GJ/m ²)	Difference (%)	Area (ft ²)
Casino	Klamath	2014	electricity	0.56	0.45	24%	35,750
Hotel	Klamath	2014	electricity	0.98	0.87	13%	11,770
Klamath Office	Klamath	2002	electricity & propane	0.89	0.66	35%	28,983
Pem-mey Gas Station/ Convenience Store	Klamath	2005	electricity	3.32	2.4	38%	3,496
Pec-tah Gas Station/ Convenience Store	Weitchpec		electricity	1.58	2.4	-34%	4,562
Weitchpec Tribal Office	Weitchpec	1999	electricity & propane	1.22	0.6	103%	5,519

Energy & Cost Savings Opportunities

Residential

Direct install programs:

- Energy Savings Assistance Program (ESA) & Weatherization services
- Moderate Income Direct Install (MIDI) Program
- Plan community level deployment

Reduced rates:

- California Alternate Rates for Energy Program (CARE)
- Medical baseline
- LIHEAP assistance

Business

- No-cost, interest free loans via on-bill financing
- Direct install program, full service starting with free energy assessment
- Special focus on lighting and refrigeration
- Energy management and custom analysis services → target high EUI facilities for retrocommissioning activities
- Contractor deployment for multiple facilities at once

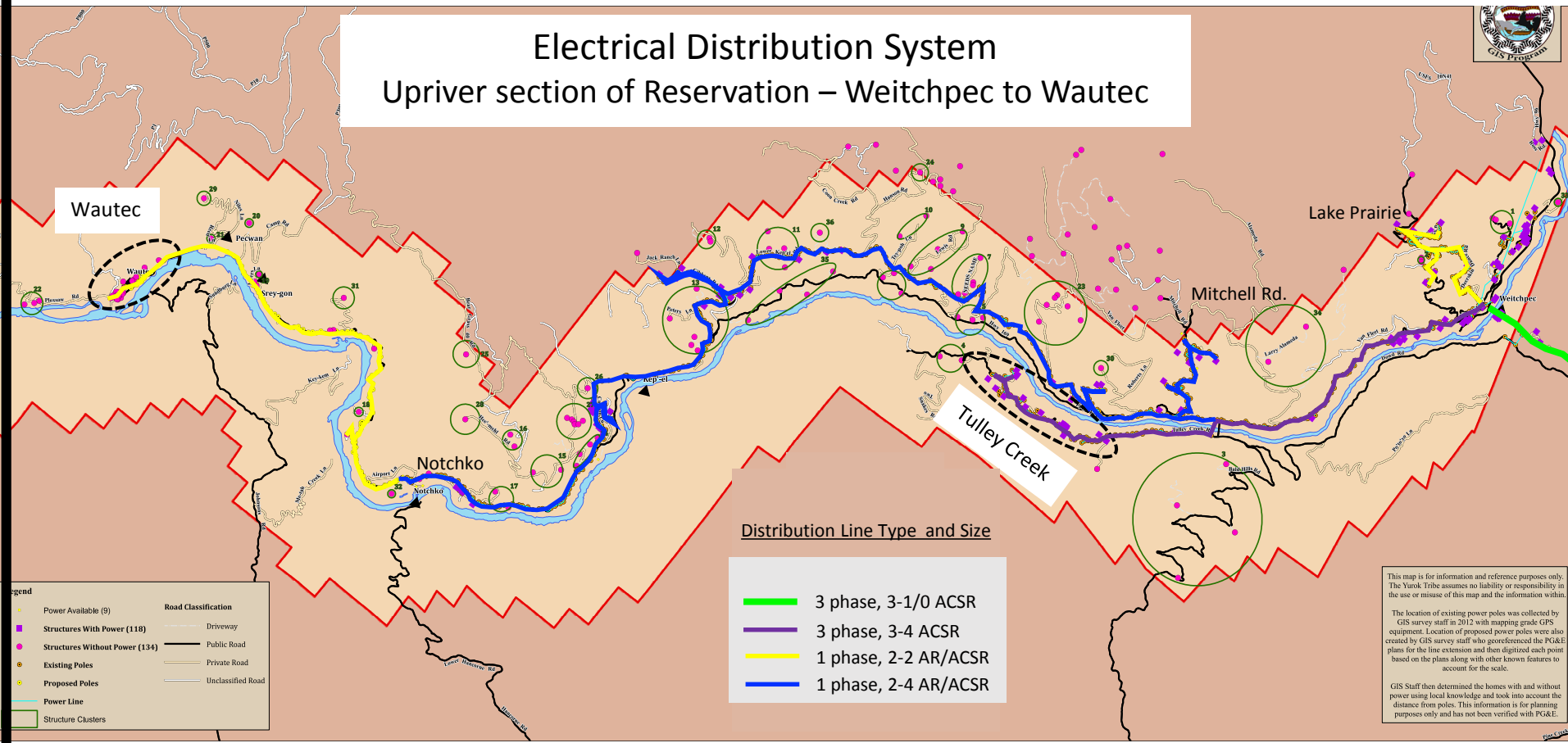


Infrastructure Analysis

Approach:

- Compile available data (statewide maps, utility data, Yurok Tribe line extension data)
- Assess capacity of distribution circuits & capability to support distributed generation resources

Electrical Distribution System Upriver section of Reservation – Weitchpec to Wautec



Note: As of August 2018 the line extension has been completed all the way to the village of Wautec. Many of the Wautec homes shown as structures without power on this map now have power.

Infrastructure Analysis

- PG&E provides guidance on the potential capacity of distributed energy resources (DER) that can be connected to the distribution grid.
- Available data only cover Weitchpec to Tulley Creek. No data are available for the rest of PG&E territory or Pacific Power territory.

HOOPA 1101 Location: Tulley Creek, End of Line

1 of 1

Asset Info DER Capacity

Disclaimers:

- DG installers should reference the "Uniform Generation" fields at this time.
- DCFC installers should reference the "Uniform Load" fields at this time.
- DER capacity values last updated in 2015 and is planned to be updated in 2018.
- DER Capacity values are mutually exclusive and should not be added together.

Feeder name: HOOPA 1101 Zone Id:192401101.022

DER	Zone DER Capacities (kW)		Substation DER Capacities (kW)	
	Minimal Impacts	Possible Impacts	Feeder Limit	Substation Bank Limit
Uniform Generation (Inverter)	177	191	1,004	1,004
Uniform Generation (Machine)	72	77	737	737
Uniform Load	177	191	1,150	1,150
PV	177	191	1,519	1,519
PV with Storage	177	191	1,651	1,651
PV with Tracker	177	191	1,233	1,233
Storage - Peak Shaving	177	191	1,220	1,220
EV - Residential (EV Rate)	177	191	2,514	2,514
EV - Residential (TOU Rate)	177	191	1,606	1,606
EV - Workplace	177	191	1,712	1,712

Next Steps:

- For potential deployment of distributed generation, apply for interconnection with local distribution utility
- This will provide accurate information regarding how much generation capacity can be interconnected and what the associated upgrade costs might be (if any)

Resource Assessment

Approach:

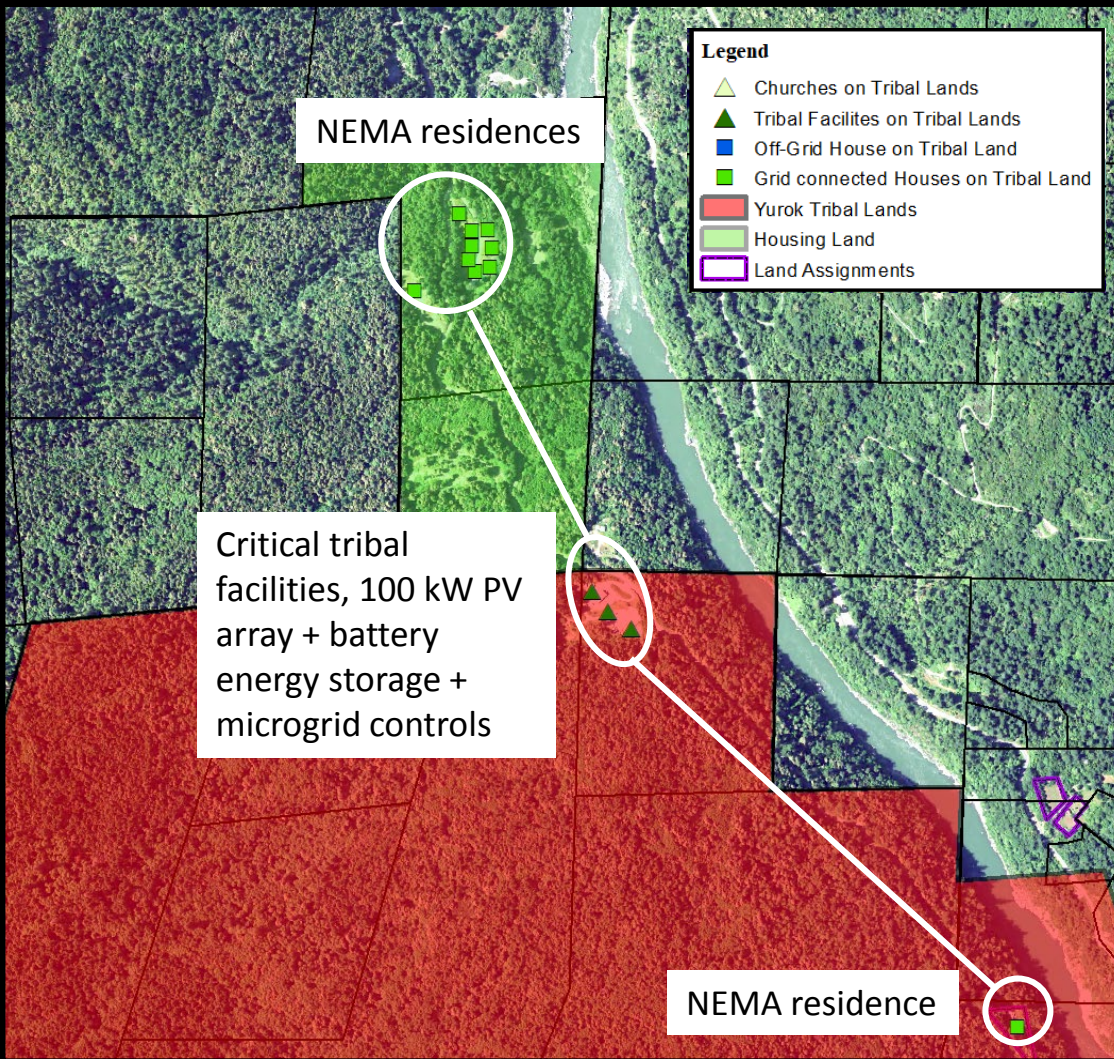
- Considering broad array of resources (wind, hydro, biomass, solar)
- Examine resource potential
- Match resource to load (offsetting retail load is best value)
- Consider distribution system constraints
- Consider opportunities for energy storage and microgrids

Results:

- Initial assessment focused on solar electricity (PV)
- Favorable resource, space available, numerous opportunities exist
- Planning for aggregate net metering arrangement

Location	Klamath	Tulley Creek	Wautec
Area available	2.8 acres	525 m ²	0.28 acres
PV array parameters	800 kW _{DC} , ground mount, south @ 30° tilt	103 kW _{DC} , roof mount, 135° azimuth @ 15° tilt	93 kW _{DC} , roof & ground mount, south facing @ 15° tilt (roof) & 30° tilt (ground)
Rough cost estimate	\$2.4M	\$309k	\$279k
Estimated array output	1,130 MWh/yr, 58% of load for 33 Tribal facilities	135 MWh/yr, 96% of load for 3 Tribal facilities & 10 residences	129 MWh/yr, 99% of load for 2 Tribal facilities & 13 residences

Possible Tulley Creek Aggregate Net Metering (NEMA) System



- 100 kW_{DC} PV system at Tulley Creek
- Convert 3 separate Tribal facility electric accounts into 1 primary voltage account with 1 point of common coupling.
- Add behind-the-meter battery energy storage and microgrid controls.
- Provide resilience for critical cluster of Tribal facilities in the Upriver section of the Reservation.
- PV system will be oversized for serving primary voltage account. Aggregate w/ 10 residential load accounts under PG&E NEMA tariff.
- Meet nearly 100% of the NEMA aggregate load.

Activities to be completed

- Community engagement process
- Energy options analysis
- Yurok Strategic Energy Action Plan



Future Plans

- Develop NEMA Projects
- Extend electrical lines to nearby residences.
- Provide renewable energy systems to residences far from the grid.
- Further explore hydro and biomass resources for sale to the grid.



Special thanks to



U.S. DEPARTMENT OF
ENERGY

Office of
Indian Energy

