



Wind & Hydro Energy Feasibility Study for the Yurok Tribe



DOE Tribal Energy Program Review Meeting
Award #DE-FG36-07GO17078
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Jim Zoellick, Schatz Energy Research Center**

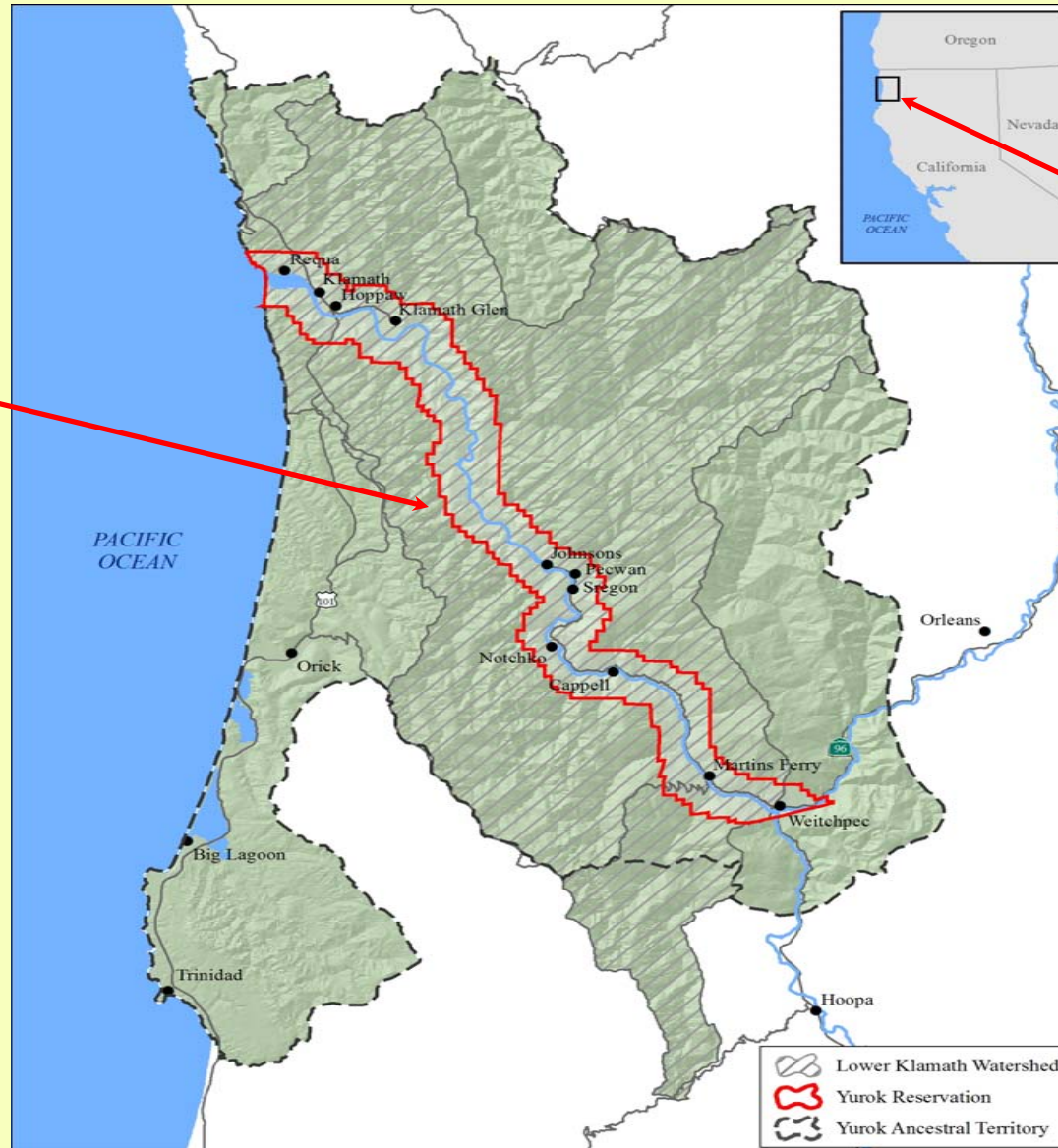




Background/Locati on



**Yurok
Reservation**
Straddles the
lower stem of the
Klamath
River, 2 miles
wide and
44 miles long)

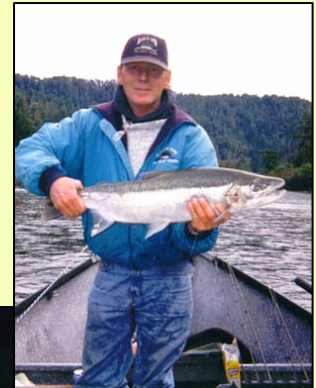


Located in
northwest
corner of
California



Background

- Largest Indian Tribe in California
- Traditional livelihood on the Yurok Reservation is based upon subsistence harvest of salmon on the Klamath River





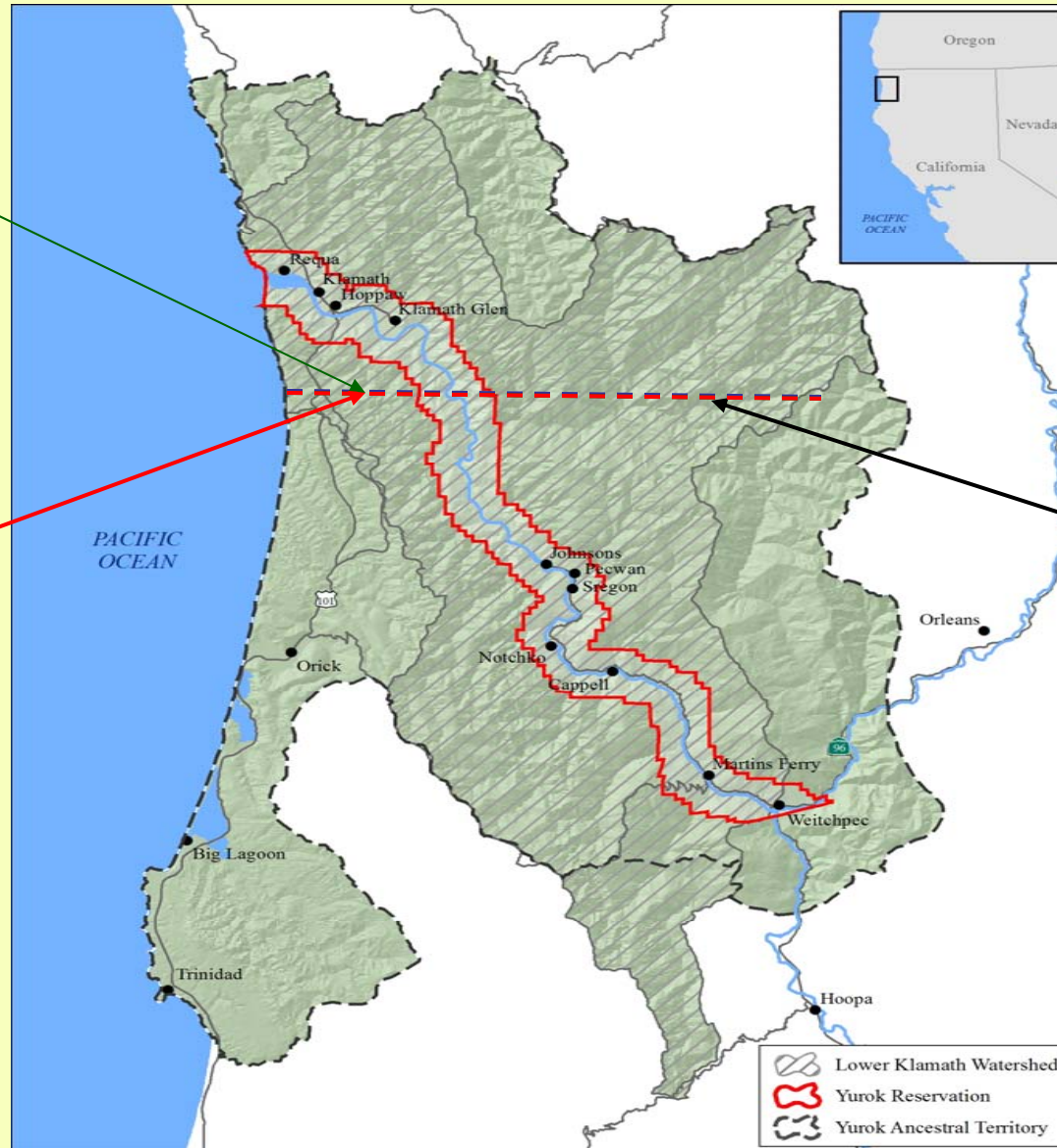
Background/Locati on



PG&E/
PP&L
Service
Territory
Boundary

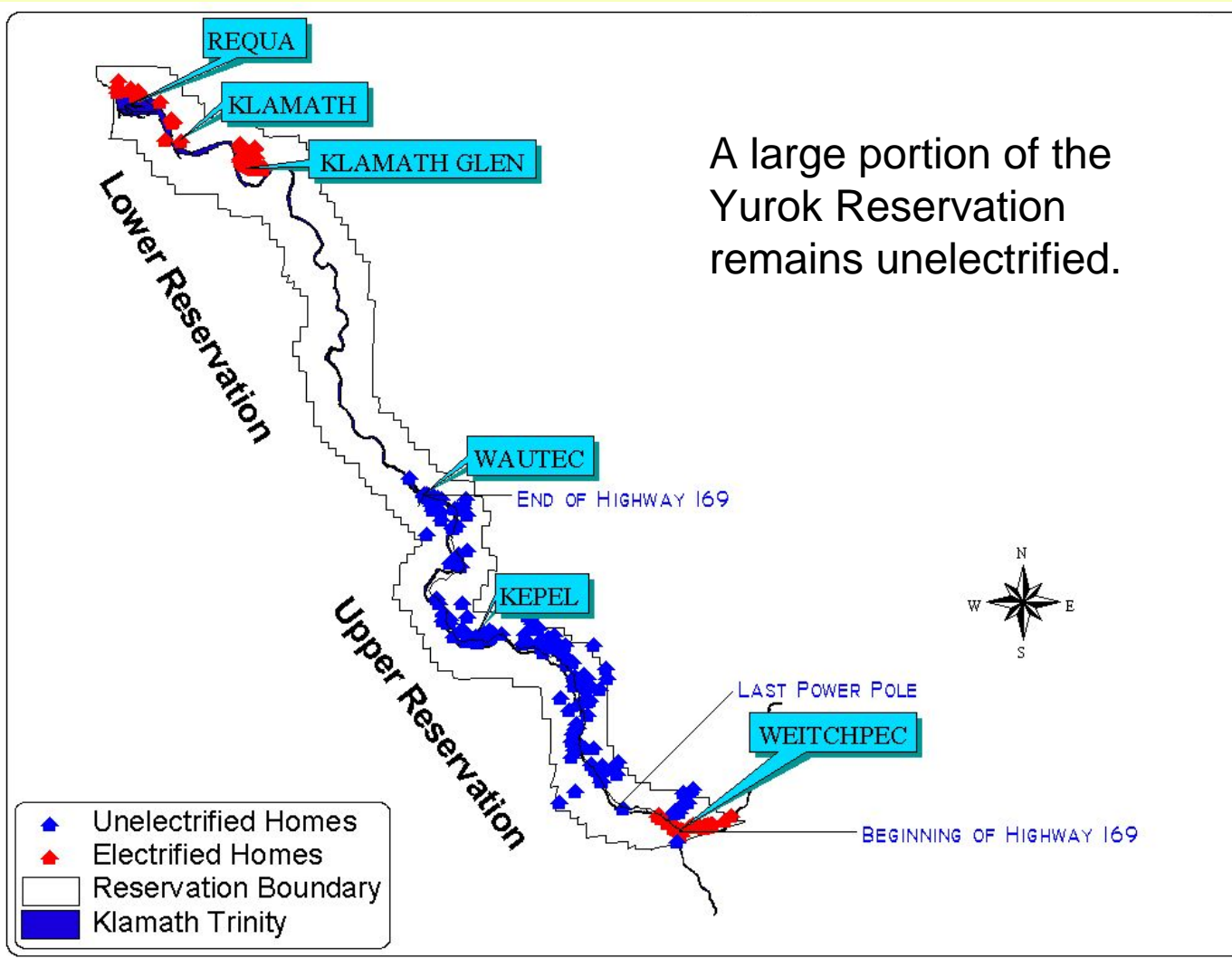
Redwood
Community
Action
Agency/ Del
Norte
Senior
Center
Service
Territory
Boundary

Humboldt/
Del Norte
County
Line





Background





Background

- A high percentage of residents on the Yurok Reservation **lack convenient access to power or phone.**
- Yurok Tribe members suffer from high energy cost to income ratios: a recent survey indicates **~40% of residents' income is spent on energy.**
- Because the Reservation straddles two counties and is located in the most remote corners of two large utility companies' service areas, **energy service programs are not readily accessible.**
- **Renewable energy systems** have been installed in the past that have not endured due to **lack of proper use and maintenance.**
- There are **additional renewable energy resources** on the Reservation that **can be developed.**





Project Overview

Goals & Objectives:

- Assess the feasibility of developing hydro and wind energy resources on the Yurok Reservation
- Assess two hydro sites and one wind site
- Provide detailed, site specific information and comprehensive business plan sufficient to implement a favorable project
- Two-year project: collect data during year one, conduct analysis during year two

Project Team:

- Yurok Tribe (Planning, Environmental, and Fisheries Departments)
- Schatz Energy Research Center
- Humboldt State University (Engineering, Biology, & Economics Departments)





Previous Activities

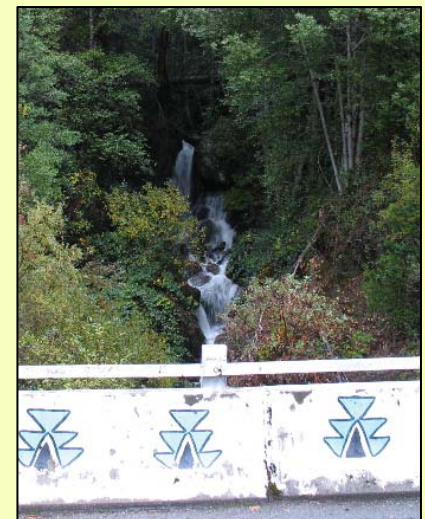
- **1997-1999** Work with Native American Renewable Energy Education Project (NAREEP) and associates
- **2000** - Renewable energy options analysis conducted by team from Sandia National Labs
- **2003** Strategic Energy Plan developed with help from Council of Energy Resource Tribes (CERT)
- **2003-present** USDA Rural Utility Service grant, electric utility line extension
- **2003-2007** DOE First Steps projects (Tribal Utility Feasibility Study, Human Capacity Building)
- Proposals offered up by various private firms





Current Research Needs

- “have multiple consultant’s reports that are confusing”
“delaying the implementation of any development”
“wanted specific recommendations, not a ‘shopping list’”
(Sandia Labs energy options report, 2000)
- Need for detailed investigation for specific projects
- Resource assessment recently conducted identified wind, hydro, biomass and solar as the primary renewable energy resource options available to the Yurok Tribe
- The Wind and Hydro Energy Feasibility Study will serve to investigate specific project opportunities for wind and hydro resources





Preliminary Resource Assessment - Hydro

- Yurok Reservation occupies the lowermost 44 miles of the Klamath River, once the 3rd largest producer of salmon on the West Coast
- Due to critical declines of the Klamath River salmon populations, Tribe is not interested in any hydro development that would impound or divert water on the mainstem of the river
- Nearly 50 creeks enter Klamath River within Reservation boundaries
- Offer some prime hydropower development, range 20-kW to >1-MW, could serve remote off-grid village or be sold to the grid
- Key issues regarding development on tributary streams includes:
 - hydropower potential (flow and head)
 - potential impacts to anadromous fish populations (shorter steeper drainages with natural fish barriers preferred)
 - impacts to cultural or sacred sites
 - proximity to electric grid or remote village
 - land ownership

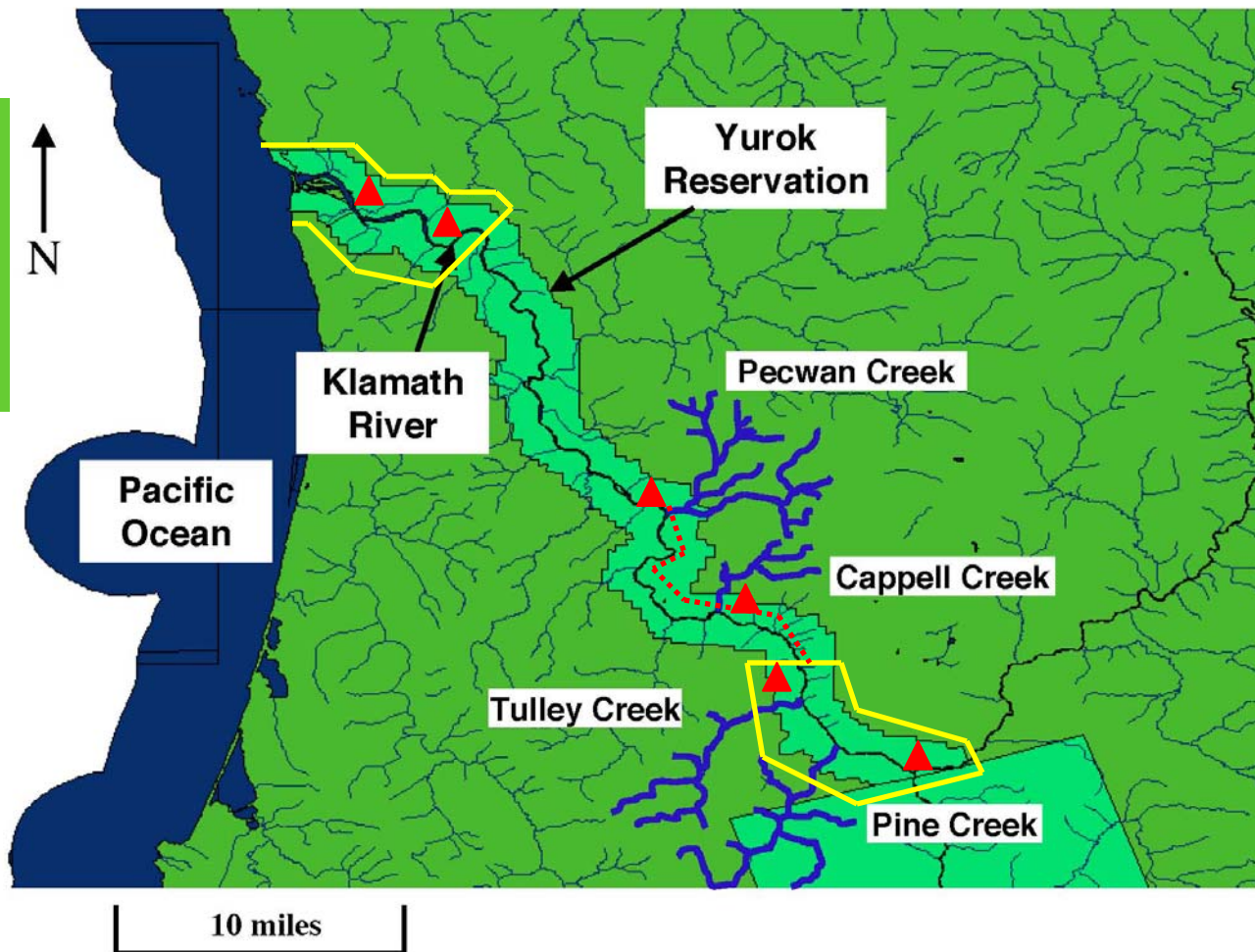
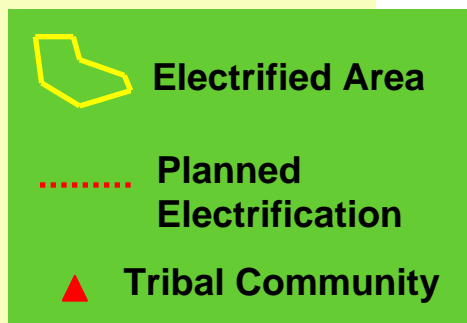




Preliminary Resource Assessment - Hydro



Locations of Candidate Streams for Yurok Hydroelectric Study





Preliminary Resource Assessment - Hydro



Pecwan Creek

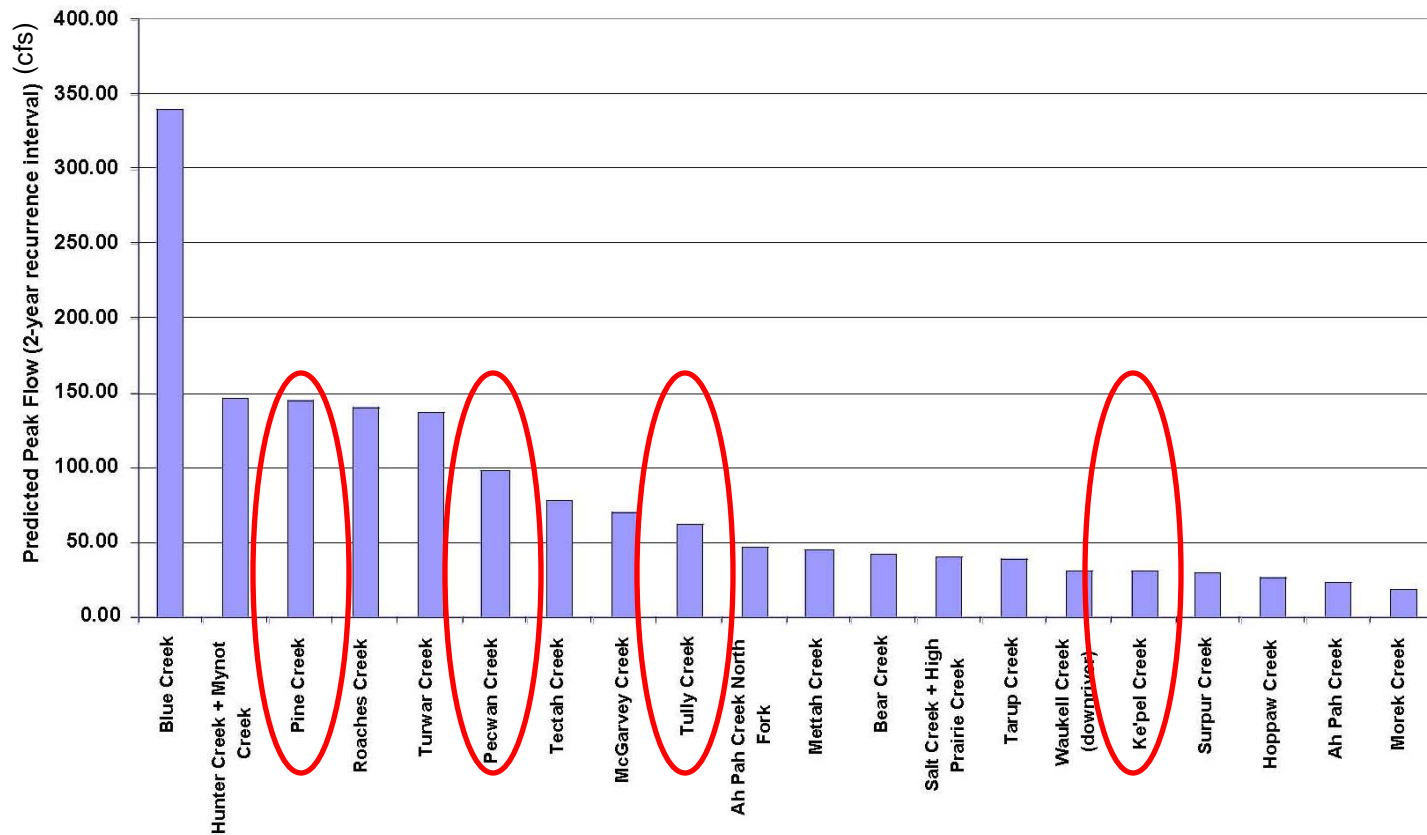
Tully Creek





Preliminary Resource Assessment - Hydro

Yurok Creeks Ranked by Peak Flow
(20 highest peak flows shown)



Note: Peak flows estimated using Waananen and Crippen hydrologic model.





Preliminary Resource Assessment - Wind



- CA Energy Commission (CEC) and NREL data characterize the area surrounding the Yurok Reservation with class 1 to 4 wind power ratings (“poor” to “good” on a 7-point scale)
- The CEC Wind Atlas (1985) reports a 13.2 mph mean wind speed for School House Peak located approximately 5 miles from the Reservation
- Not likely to be tremendous resource available for development, but there may be select sites that display favorable conditions to support medium scale wind development (hundreds of kW up to ~1 MW)
- Wind power is highly intermittent, best suited for sale to grid
- Key issues regarding wind power development:
 - adequate resource, economically viable
 - access to the electric grid
 - environmental & cultural impacts
 - land ownership



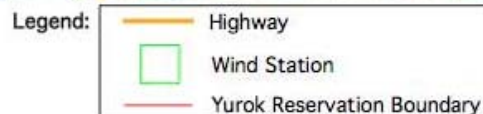
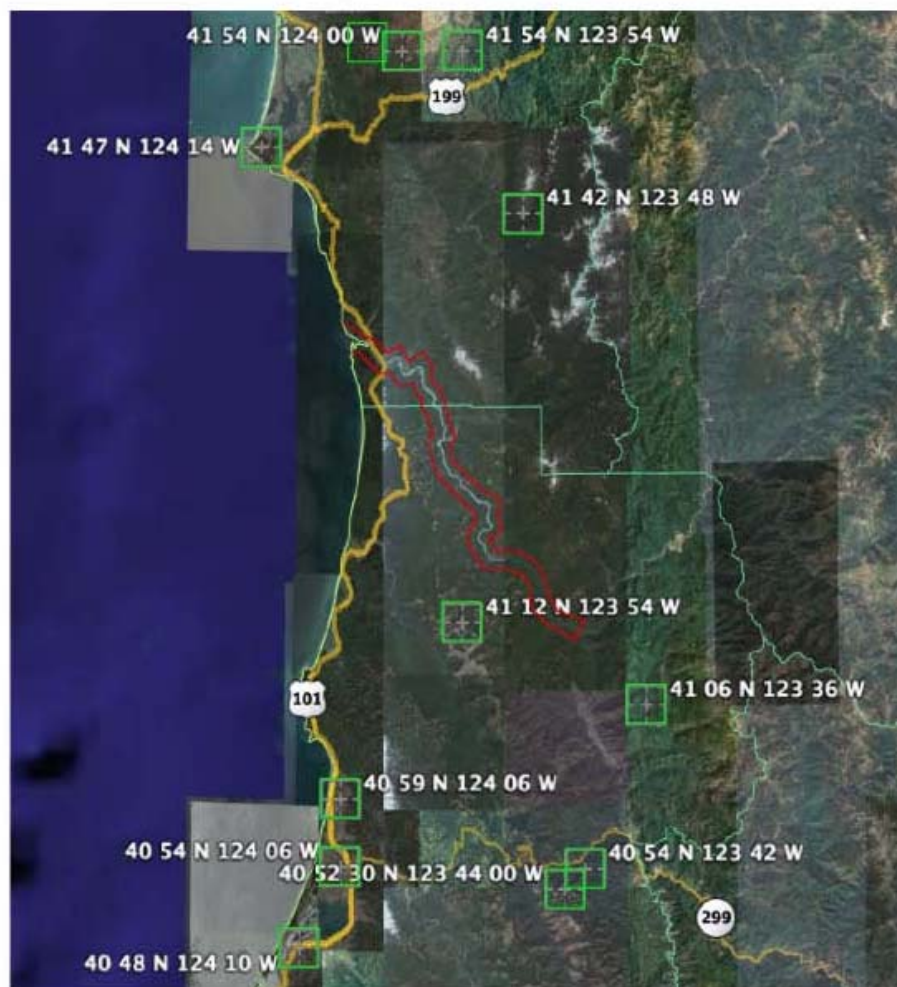
NREL



Preliminary Resource Assessment - Wind



Wind monitoring stations in the vicinity of the Yurok Reservation (current and historical)

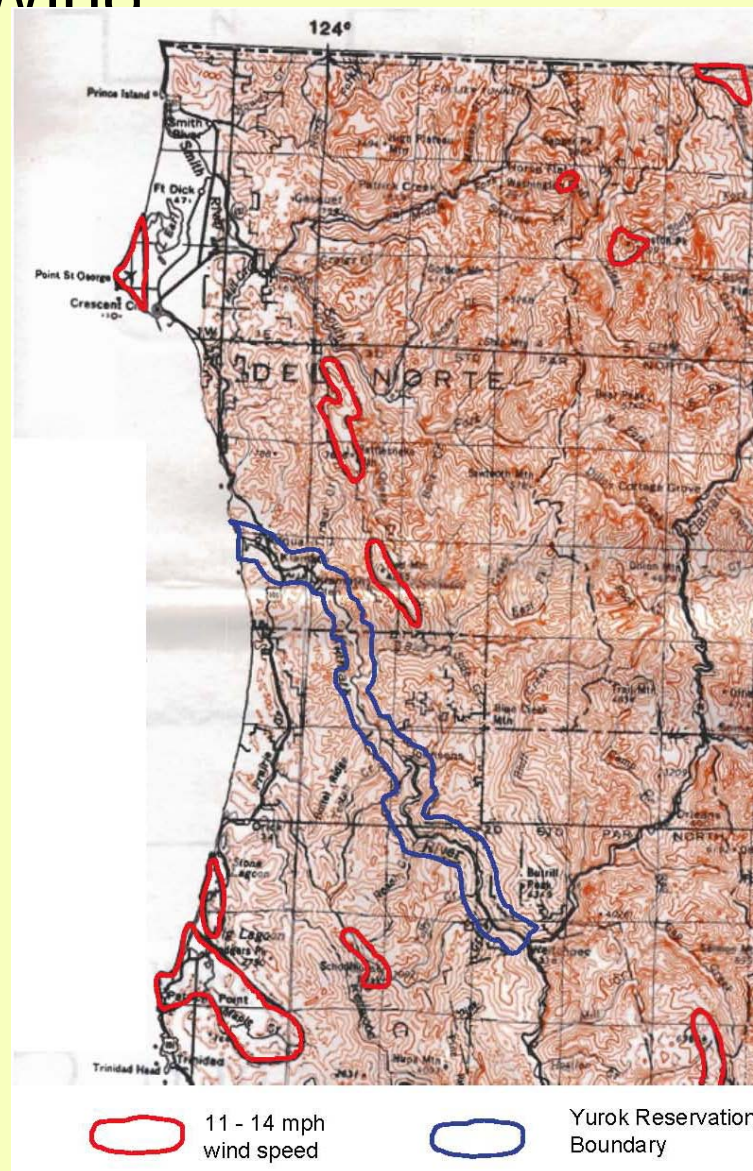




Preliminary Resource Assessment - Wind



Wind Energy Potential Map (CEC Wind Atlas, 1985)

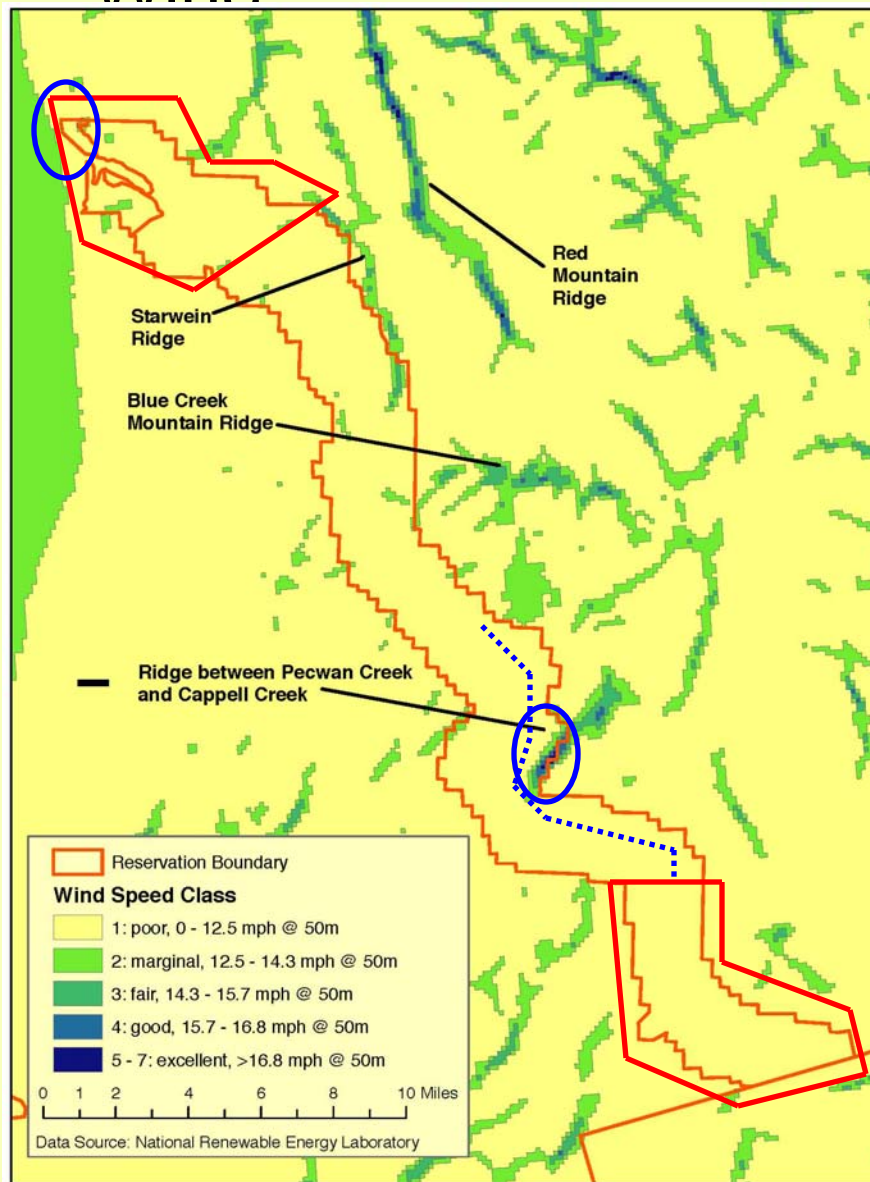
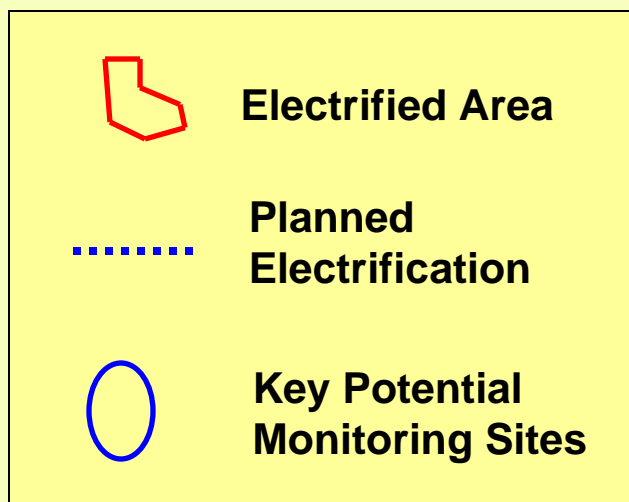




Preliminary Resource Assessment - Wind



Wind Speed Classes in the Vicinity of the Yurok Reservation





Preliminary Resource Assessment - Wind



**Potential Requa Hill Wind Site
Old WWII US Air Force Installation**





Project Tasks

1. Select project sites
2. Install data monitoring equipment and collect data
3. Assess availability of appropriate energy conversion technologies
4. Analyze data, determine energy production potential
5. Assess on-Reservation loads that could be served
6. Assess off-Reservation sales opportunities
7. Assess electrical grid access
8. Develop preliminary design specifications
9. Conduct economic analysis
10. Identify preferred alternatives
11. Conduct preliminary environmental assessment
12. Assess permitting requirements
13. Conduct stakeholder analysis
14. Develop preliminary O&M plan
15. Outline a community education plan
16. Develop business plan and financing options
17. Provide training/professional development to Tribal staff & government





Two Year Project Timeline

Year One - Site selection & data collection

Yurok Wind and Hydro Energy Feasibility Study GANTT Chart

Task	Description	Month																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	Site Selection	X																							
2	Data Collection		X	X	X	X	X	X	X	X	X	X	X	X	X	X									
3	Technology Assessment																X	X							
4	Data Analysis / Resource Assessment									X	X				X	X	X	X							
5	Load Assessment													X	X										
6	Market Assessment															X	X	X							
7	Electrical Grid Assessment													X	X										
8	Preliminary Design Specifications															X	X	X	X						
9	Economic Analysis																	X	X						
10	Identification of Preferred Alternatives																		X						
11	Preliminary Environmental Review																		X	X	X				
12	Permitting Requirements																			X	X	X			
13	Stakeholder Analysis																	X	X	X	X	X			
14	Preliminary O&M Plan																					X	X		
15	Plan to Develop Community Support																					X	X		
16	Business Plan																			X	X	X	X		
17	Professional Development Training																							X	
18	Reporting			X			X			X			X			X		X				X	X	X	X

Year Two - Feasibility analysis & business plan





Near-Term Tasks

- Complete the DOE Environmental Checklist
- Obtain wind monitoring equipment from NREL
- Purchase data monitoring equipment for hydro assessment
- Select data monitoring sites
- Install monitoring equipment
- Begin collecting data
- Conduct preliminary data analysis (start-up and shake-down for monitoring stations)





Yurok Tribe Real-Time Monitoring Program

Includes:

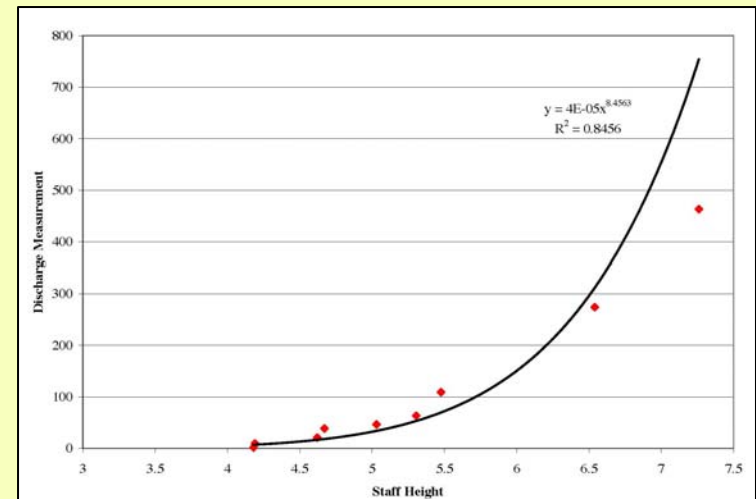
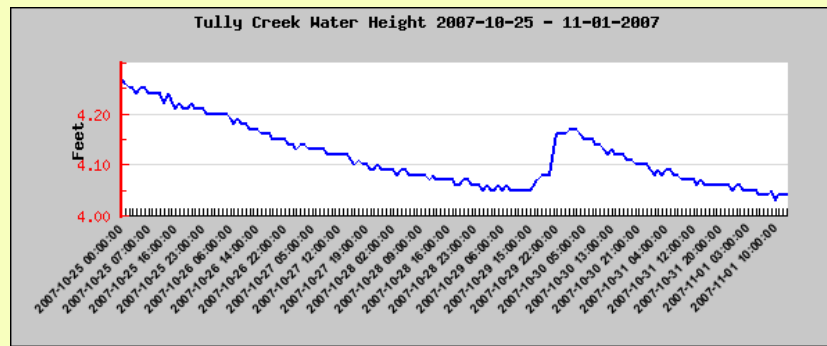
- 5 stream gauging stations
- 3 meteorological stations
- Real-time monitoring via satellite
- EPA approved Quality Assurance Program Plan





Hydro Monitoring Equipment

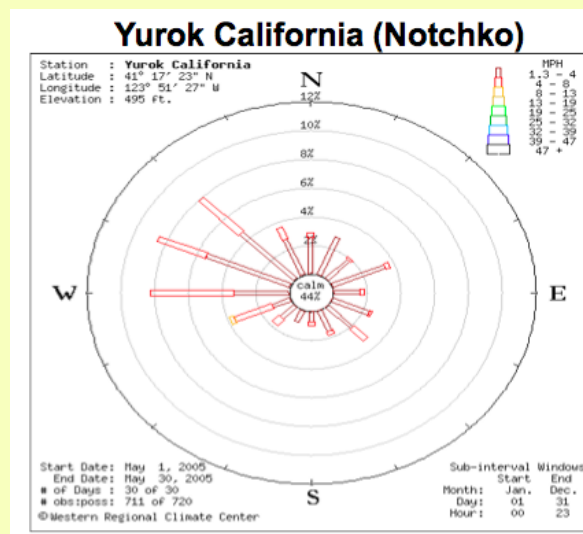
- Set up two stand-alone gauging stations
- Measure stream stage at 30-minute intervals
- Flow data collected throughout range of stage heights and weather events
- Develop stage-discharge rating curves
- Data uploaded to Tribe's computer information system
- Installation and operation of gauging stations will follow USGS prescribed methods





Wind Monitoring Equipment

- Obtaining a 40-meter anemometer tower and data monitoring equipment via NREL's Native American Anemometer Loan Program
- Outfitted with four anemometers (to measure wind speed) and two wind vanes (to measure wind direction)
- Monitoring equipment located at 20 meters and 40 meters
- Data stored as 10-minute averages on data cards
- Data cards replaced monthly, data uploaded to Tribe's computer system





Selecting Data Monitoring Sites

- Select two hydro and one wind site
- Use information gathered in previous resource assessment studies to help identify best potential sites
- Work with Tribal Council and staff to select final sites
- Selection criteria will include:
 - expected energy resource potential
 - site accessibility and suitability
 - proximity to electric grid or off-grid village sites
 - proximity to Yurok cultural sites
 - potential environmental impacts (fisheries, raptors, etc.)
 - expected support from Tribal community
 - Tribal government's willingness to develop site





Thank You

