Microgrid Implementation on Tribal Lands

Sandra Begay-Campbell
Tribal Energy Lead
and
Chelsea Chee, Intern

DOE IE Tribal Energy Systems:
Climate Preparedness & Resiliency
March 4, 2015

Exceptional service in the national interest

Sandia National Laboratories

Source: Agunwah (2010)

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Abstract

The 131 year old United States electrical power grid is currently facing challenges. Age, maintenance, grid expansion, permitting, inclusion of variable energy resources, vulnerability, and water use are some challenges of utilizing the electrical grid.

U.S. Tribes face these some of the following infrastructure challenges:

- Some tribal members do not have access to electricity because of their rural locations, costly grid expansion, permitting issues, water concerns, and the renewable resources which can provide variable energy.
- Microgrids could be one solution for tribes to increase energy access to their communities. Microgrids could be cost comparable to grid expansion and upgrades; integrate local variable energy resources (which some tribes have); and conserve water use (depending on the energy resources used).

As examples of tribal economic development projects, the Ramona Band of Cahuilla Indians have implemented a microgrid for their eco-tourism facility and the Hualapai Tribe are planning to implement a microgrid for the Grand Canyon West facilities.

Introduction

Sandia National Laboratories

- Tribal Energy Program
  - Financial & technical assistance for energy reduction & renewable energy development on tribal lands
- Energy Surety
  - Safety – reduce safety hazards
  - Security – resiliency to threats
  - Reliability – sufficient power
  - Sustainability – support power that doesn't compromise future demands
  - Cost effectiveness
- Energy Surety Microgrid
  - Grid tied or islanded
  - Computer modeling of distributed energy resources
  - Risk assessment – critical needs

Background

- Power Electrical Grid
  - Components
    - Generation
    - Transmission
    - Distribution
    - Load
  - Challenges
    - Aging infrastructure
    - Expansion
    - Variable energy resources
    - Vulnerability
    - Water use

- Microgrid
  - Group of interconnected local loads & distributed energy resources with clear electrical boundaries & acts as single controllable entity
  - Grid tied or islanded
  - Build on existing or new infrastructure
  - Energy security for critical loads
  - Sustainable energy business model

Ramona Band - EcoResort

- 560 acres near Anza, CA
- Complications
  - 7-9 miles from grid
  - Various landowners
  - Environmental effects
  - Cost
- Eco-Resort Microgrid
  - 10500 W solar array
  - 20 kW propane generator
  - 48 batteries
  - Inverter
  - Underground lines
- Lessons
  - Cost & funding
  - Community participation
  - Education
- Economic Development
  - Independence
  - Money stays on nation
  - Sustainability plan

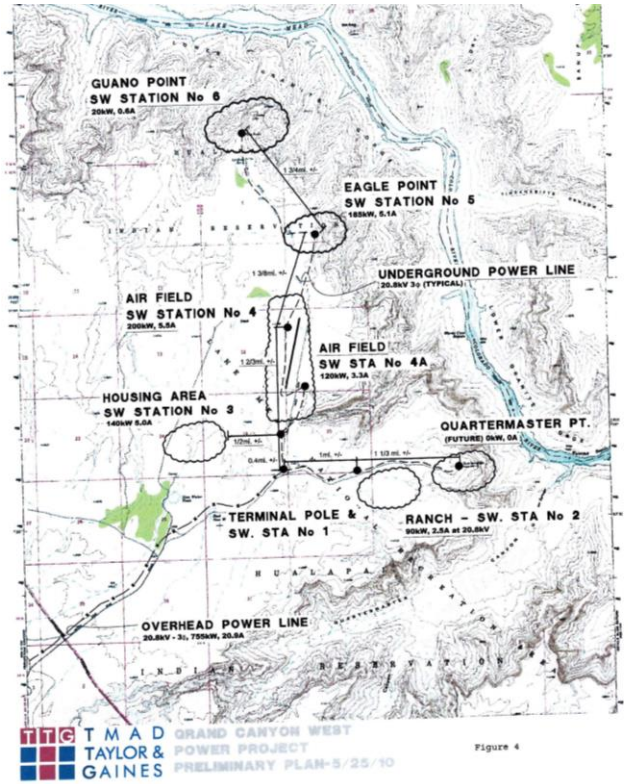
Hualapai – Grand Canyon West

Sandia National Laboratories

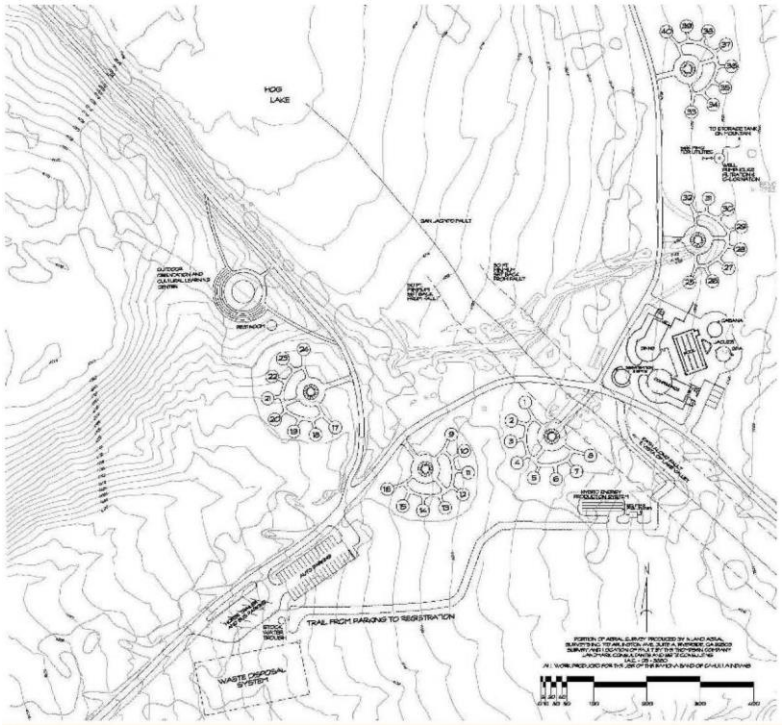
- 992,000 acres in Arizona
- ~53 miles of Grand Canyon
- GCW
  - Visitor's Center
  - 3 attraction points
  - Bus & air terminals
  - 775,000 visitors in 2012
  - 21 miles from grid
  - Individual load center generation
- Microgrid (projected)
  - Centralized 20.8 KV
  - 3 diesel generators
  - 2 solar arrays
  - 7.6 miles of underground lines
  - Future grid tie

Conclusions

- Context dependent
- Planning ahead
- Energy security



- Economic development
- Capacity building
- Tribal sovereignty



Source: Schmitt & Davidson (2013)

References

Agunwah, R. (2010). *Ramona Band of Cahuilla* [PowerPoint Slides].

American Society of Civil Engineering. (2013). 2013 Report Card for America's Infrastructure – Energy. Retrieved from http://www.infrastructurereportcard.org/a/#p/energy/overview

Glenwright, T. (2012). *Introduction to microgrids* [PowerPoint Slides]. Retrieved from http://www.smartgrid-live.com/wp-content/uploads/2012/12/Introduction-to-Microgrids-by-Tristan-Glenwright.pdf

Jensen, R., M. Baca, B. Schenkman, and J. Brainard. (2013). *Veneite, Alaska Energy Assessment*.

Laird, D. (2013). *Eng 505-enery surety and systems: Water, offshore wind, marine hydrokinetics, conventional hydro, energy-water nexus* [PowerPoint Slides]. Retrieved from https://sharepoint.sandia.gov/sites/ESI/_layouts/PowerPoint.aspx?PowerPointView=ReadingView&PresentationId=/sites/ESI/Presentations/Week%207%20Water_Offshore%20Wind/Laird_Water_2013.pptx&Source=https%3A%2F%2Fsharepoint%2Esandia%2Egov%2Fsites%2FESI%2FPresentations%2FForms%2FAllItems%2Easpx%3FRootFolder%3D%252Fsites%252FESI%252FPresentations%252FWeek%25207%2520Water%255FOffshore%2520Wind%26FolderCTID%3D0x012000EE10A9168EF5AD4584BBDB149700762A%26View%3D%7BE90A0296%2D8063%2D41EC%2D8D64%2DD6E30F04660C%7D&DefaultItemOpen=1

Lasseter, B. (2011). *Microgrids: U.S. Department of Energy Electricity Advisory Committee* [PowerPoint Slides]. Retrieved from http://energy.gov/sites/prod/files/EAC%20Presentation%20-%20Microgrids%202011%20-%20Lasseter.pdf

Massachusetts Institute of Technology. (2011). MIT Study on the Future of the Electric Grid.

Ramona Band. (2008). *Ramona tribal history*. Retrieved from http://www.ramonaband.com/history.html

TTG Engineers, Inc. (NA). Hualapai Mini Grid.

Schmitt, L. A. and K. A. Davidson. (2013). *Design considerations and rationale behind the Grand Canyon West 20.8 KV micro-grid*.

U.S. Energy Information Administration. (2013). Frequently asked questions. Retrieved from http://www.eia.gov/tools/faqs/faq.cfm?id=427&t=3

U.S. Department of Energy. (2012). Distributed Energy Resource Basics. Retrieved from http://www1.eere.energy.gov/femp/technologies/derchp_derbasics.html