

USING RENEWABLE ENERGY ON NATIVE AMERICAN LANDS

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ABSTRACT

A natural connection has existed for centuries between **Native Americans** and **renewable energy**. Sustainable Native American communities have utilized the naturally occurring energy in sunshine, flowing water, and the wind. Since renewable energy is generally *clean* energy, it complements Native Americans' respect for the environment and their concern for future generations (the "seventh-generation" viewpoint). Recently a number of tribes have actively pursued development of their renewable energy resources, with a view to energy self-sufficiency as well as economic development. Some of the recent efforts are described in this paper.

1.0 INTRODUCTION

During the last decade, many tribes have investigated a variety of renewable energy technologies to meet their specific needs. These activities have included photovoltaics (PV), wind, biomass, hydroelectric, and solar building technologies, as well as integrated resource planning and vertical integration of energy production. Thirteen new renewable energy projects have been initiated recently on tribal lands. Eight of these projects involve remote applications of renewable energy technologies on Native American lands, and were funded under a Department of Energy solicitation in 1999. These are described in

Sections 2.0 through 9.0, and their locations are shown on Figure 1. The other five projects, funded under the DOE Federal Energy Management Program, are described in Sections 10.0 through 14.0.

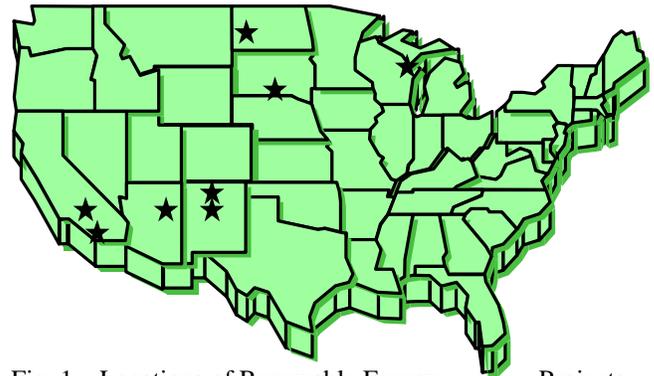


Fig. 1. Locations of Renewable Energy Projects Associated with Remote Applications of Renewable Energy Technologies on Native American lands

2.0 THREE AFFILIATED TRIBES OF NORTH DAKOTA - WIND TURBINE DEMONSTRATION PROJECT

On a plateau above the shores of Lake Sakakawea, a 100 kW wind turbine will supply power to a tribally-owned facility in New Town, North Dakota. The reconditioned

turbine to be located on the Fort Berthold Indian Reservation will demonstrate wind energy technology while providing valuable knowledge and operating experience.

Through this project, the Tribes intend to gain hands-on experience in the procurement, installation, commissioning, operation, and maintenance of a utility-scale wind turbine. The demonstration turbine will also serve as a learning platform and a focal point for a number of educational and outreach activities intended to increase public awareness of the viability of wind energy in North Dakota.

The Tribes will contract with wind energy experts to assist in the procurement, installation, and utility hookup of a high-quality, utility-scale, reconditioned wind turbine and to arrange for training at established wind farms by experienced windsmiths. Tribal personnel will be trained to operate and maintain the wind turbine, performing routine maintenance and monitoring the turbine on a daily basis.

A local energy research facility with experience in wind energy will be involved in the project to assist with data collection and reporting requirements and to provide technical backup to the tribe in case of personnel turnover or in case of unscheduled maintenance problems. The Office of Intergovernmental Assistance, State of North Dakota (State Energy Office) will sponsor annual windsmith training sessions to be conducted on reservations in North Dakota.

3.0 ROSEBUD SIOUX TRIBE - INSTALLATION AND OPERATION OF A UTILITY-GRADE WIND TURBINE

The Rosebud Sioux Tribe in South Dakota is siting and installing a 750 kW utility-grade wind turbine to supply the electrical needs of the Rosebud Casino & Convention Center. The wind resource measured on the reservation over an 18-month period indicates an annual mean wind speed of 17.9 miles per hour. Continuing anemometer measurements will be pursued as part of this project. The retail electricity rate currently paid by the Casino & Convention Center will continue until the project costs are recovered.

Two electrical meters will be installed: one at the turbine to measure specific output and one at the casino. These two meters will provide accurate measurement of electricity produced and any line losses between the two meters. In addition to the electricity produced, the project will provide training of tribal members in the operation and maintenance of the project, as well as provide useful operational information for this and future projects.

4.0 NAVAJO NATION - ELECTRIFICATION OF RESIDENCES PROJECT

Arizona, with its windswept mesas and sculpted canyons, is Indian Country. In the south-central part of the Navajo Reservation, between Window rock (the Navajo capital) and Flagstaff, south of the Hopi reservation and North of Winslow, Arizona, are the Dilkon and Teesto Chapters of the Navajo Nation.

Within this largely undeveloped land is a large population of families with no access to electricity. Native American Photovoltaics, Incorporated (NAPV), a not-for-profit joint venture between the Dilkon and Teesto Chapters of the Navajo Nation and Energy Photovoltaics, Incorporated (EPV), plan to install stand-alone PV power systems for 20 residences on the Navajo Reservation in Arizona.

The 1 kW or 2 kW systems with battery storage will be assembled, installed and serviced by the first NAPV Systems Group, located in Dilkon and Teesto Chapters. NAPV will establish local facilities to assemble, install, and service PV systems. These facilities will include training of staff, and education and marketing for local customers. By providing local service and maintenance, NAPV hopes to eliminate a major shortcoming of existing remote PV systems -many of which do not function after a year or two.

5.0 JICARILLA APACHE TRIBE - PHOTOVOLTAIC DEMONSTRATION PROJECT

The Jicarilla Apache Tribal Utility Authority (JATUA) will install a photovoltaic (PV) demonstration project at its offices in Dulce, New Mexico; collect data on system performance over a three-year period; and conduct a PV information dissemination program for reservation residents and other New Mexico Indian tribes.

The PV hardware project will be linked with an innovative outreach effort aimed at Jicarilla members and other New Mexico tribes and pueblos that will help them better understand the energy use that occurs on their respective reservations (and its attendant environmental impacts), and to better understand how even simple buildings can be designed to utilize renewable resources and energy efficient technologies

6.0 MANZANITA BAND OF MISSION INDIANS - WIND & SOLAR HYBRID SYSTEM DEMONSTRATION

This project is a joint effort between the Manzanita Band of

Mission Indians ("the band"), Northern Power Systems (NPS), and the Native American Renewable Energy Education Project (NAREEP). A hybrid PV/wind power system will be installed to provide power to one of the community buildings on the Manzanita Reservation, located in southeastern San Diego County (Figure 2).

The band has long recognized that the Reservation has abundant wind and solar resources that could be commercially utilized to its benefit. In 1995, the band established the Manzanita Alternative Energy Office, and the band expects to further measure and develop their wind resource potential under the current project. This experience will help them make informed decisions when considering the benefits and risks of encouraging large-scale wind power development on their lands.

Northern Power Systems is an engineering-oriented company that has worked on remote power projects since 1974. The company specializes in hybrid design solutions integrating renewable and conventional energy resources.

Established in 1995, The Native American Renewable Energy Education Project (NAREEP), managed by the University of California at Berkeley, is an education, technical assistance, and research program whose mission is to enhance the ability of Native Americans to assess and carry out renewable energy and energy efficiency projects on tribal lands.



Fig. 2 - Manzanita Tribal Office Building from Potential Wind Turbine/ Photovoltaic Power System Site

7.0 RAMONA BAND OF MISSION INDIANS - ECOTOURISM PROJECT

The Ramona Band of Mission Indians, Domestic Technology International, Inc. (DTI), Kupcha and Associates (KKA--a Native American-owned company), and TERO, a Native American construction trades training

institution, will jointly implement this project. A HUD Community Development Block Grant provides funding for tribal housing, well water pumping and storage, infrastructure development, and an ecotourism facility.

Additional funding is being provided by the Department of Energy for the additional renewable energy power capacity needed to operate the ecotourism lodge. The DOE grant also covers design and engineering services for the entire renewable energy system, education and training module development, training of trainers, and monitoring and evaluation of system performance. A schematic of an "Eco-Tent" unit for the Ramona ecotourism facility is shown in Figure 3.

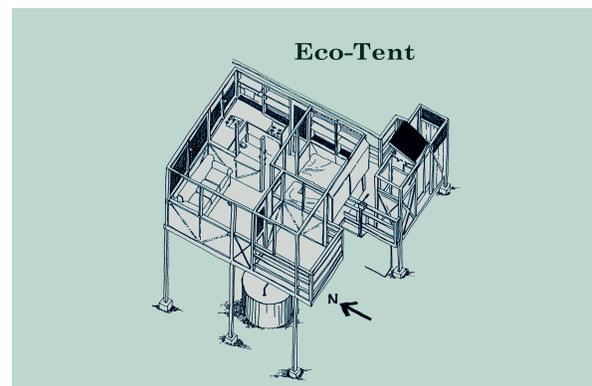


Fig. 3: Eco-Tent Concept for Native American EcoTourism Project at the Ramona Reservation

8.0 ONEIDA TRIBE OF WISCONSIN - ONEIDA NATION'S WISCONSIN SOLAR PROJECT

Near Green Bay, Wisconsin, the Oneida Nation is increasing their use of renewable energy through the installation of solar hot water and photovoltaic systems. Through the Oneida Solar Energy Project, 80 tribal homes will use renewable energy technology to meet electricity or hot water needs.

The specific system design features of both the solar hot water and the photovoltaic systems will be developed through a technical advisory committee comprised of regional solar energy contractors. The photovoltaic systems will be positioned on a pole or tracking system if roof access is not available, with solar panel arrays being a combination of fixed panel mounts or stationed on a passive solar tracker. The passive solar tracking system will be a design feature as it increases energy production by up to 40%.

Systems will include the standard package of an inverter, charge control, batteries sufficient to meet system voltage, and a battery capacity meter. Systems will be sized to meet 100% of summer demand or yearly average loads, and will not be sized to meet winter shortfalls (the grid system will satisfy this demand). Anticipated size is a 6 panel array for the standard system.

Solar hot water systems will have a flat plate solar collector installed on the roof, and will be supported by angle brackets. A storage tank, expansion tank, heat exchanger, and insulated fluid lines will also be system components. The systems will have two 4 x 8 ft. collectors. The circulation pumps will be powered by photovoltaic panels.

As part of the project, education and training programs will be pursued to include public educational campaigns, tribal trades people training for the installation and maintenance of both the photovoltaic systems and the solar hot water systems, and construction of a mobile solar educational trailer. Solar education programs have already been established with the Oneida Nation Schools. These will be supplemented with presentations at the Oneida Turtle Elementary School and an educational project promoting occupational skills and mechanical knowledge at the Oneida Nation High School

Inter-tribal programs and workshops will also be used to promulgate information. The Oneida Solar Energy Project involves collaborations between the Oneida Environmental Resource Board, Environmental Health and Safety Department, Oneida Plumbing Department, Oneida Housing Authority, registered tribal electricians, Midwest Renewable Energy Association, Menominee Sustainable Development Institute, Hopi NativeSUN, and Wisconsin Public Service Corporation.

9.0 PUEBLO OF LAGUNA - OFF-GRID RENEWABLE ENERGY PROJECT

The Pueblo of Laguna's renewable energy program is to establish the Majors Ranch, a Laguna-owned operation, as a self contained community with its own source of electrical power utilizing its solar and wind resources. The Majors Ranch facilities, located at least 10 miles off the closest utility grid, are currently used and operated by the Laguna Service Center, an operating division of the Pueblo of Laguna, for the purposes of running a Youth Program and Retreat.

Under this project, the Pueblo of Laguna will design, install, operate, and maintain, the following renewable energy

systems: 1) one 10 kW wind turbine with battery storage; 2) two photovoltaic arrays (1 kW and 1.8 kW) with battery storage; 3) two 1.2 kW photovoltaic powered water pumps; and 4) two 100 gallon active solar hot water heater systems.

The renewable energy systems are being designed to meet the entire electrical and hot water loads of the buildings.

10.0 BIA /SHERMAN INDIAN SCHOOL - PHOTOVOLTAIC SYSTEM PROJECT

A grant was awarded to the Bureau of Indian Affairs /Sherman Indian School to install a photovoltaic system that can supply 30 kilowatts of power; the system will be connected to the existing power distribution grid on the school's campus, thus providing electricity to the grid as well as to nearby facilities. Native Americans employed at the facility will be trained to operate and maintain the photovoltaic system and to assist in transferring these skills to others. The project will also serve as an educational resource for high school science classes.

11.0 BIA - HAVASUPAI INDIAN RESERVATION - PHOTOVOLTAIC SYSTEM PROJECT

A grant was awarded to the Bureau of Indian Affairs/ Truxton Canon Agency to install three photovoltaic systems at Federal facilities on the Havasupai Indian Reservation. This project will provide electricity to such facilities as the Havasupai school and the apartment building that provides housing for school teachers and police officers. Native Americans associated with this project will receive training in the maintenance and operation of the energy systems. The cost savings for utilities and maintenance can be redirected to new community and economic development activities.

12.0 BIA /SEBA DALKAI SCHOOL - PHOTOVOLTAIC SYSTEM PROJECT

A grant was awarded to the Bureau of Indian Affairs/Seba Dalkai School for a photovoltaic system for a school that will be completed in 2001. The new school building will serve as both an outdoor classroom and a hands-on laboratory for training in the use of building-integrated photovoltaic energy systems. The 13-kilowatt (peak) photovoltaic system will help to prevent the blackouts and brownouts that have caused so many problems in the school's computer-based curriculum. DINE, Inc., will work with other groups in the Navajo Nation to provide training in the use of solar electric systems.

13.0 FORT APACHE TRIBE - WIND TURBINE PROJECT

A grant to the Bureau of Indian Affairs/Fort Apache Agency will provide for installation of five new wind turbines. The Fort Apache Indian Reservation contains approximately 1.7 million acres of remote forest land in the White Mountains of Arizona.

Five fire-lookout towers are scattered across the forest for surveillance and radio communications purposes, and solar electric systems have been the only source of power. During heavy usage periods or very poor atmospheric conditions, power supplies can be uncertain; adding new wind turbines will ensure a reliable supply of electric power. Native Americans will conduct the maintenance and operation activities associated with these turbines.

14.0 ALASKA NATIVE MEDICAL CENTER - GROUNDWATER COOLING SYSTEM

The Indian Health Service and the Alaska Native Medical Center, Anchorage, received funding for a groundwater cooling system. This project will use groundwater pumped through a heat exchanger to remove heat from a closed-loop, chilled-water system in the medical center; the chilled-water system will save energy and money by replacing three conventional electric chillers. System design, management, operation, and maintenance will be provided by Alaskan Natives

15.0 CONCLUSIONS

Native American tribes are now beginning to look much more closely at their renewable energy resources as new revenue generators. Investments in such areas as ecotourism, biomass power plants, and wind farms have the potential for producing economic development and jobs for tribal members. In addition, tribes are looking at the potential for renewable resources to improve their quality of life. This is especially true where there are homes with no current electricity supply. In addition, the environmental advantages of renewable energy are significant. The development of renewable resources holds great promise for Native Americans across the land.