GENI Global Energy Network Institute

Renewable Energy on Tribal Lands

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Introduction

Tribal lands contain enormous potential for renewable energy. In fact, according to the Intertribal Council on Utility Policy, the wind resources on Tribal lands in the Great Planes alone could power over 50 million homes.[1] When a Tribe or nation develops their resources of fossil fuels, whether coal, oil or natural gas, the resources are limited and will run out. However, if a Tribe or nation develops clean, renewable sources of energy, such as its wind, solar, hydro, or geothermal potential, no matter how long or how much energy is produced, the resources will still be as plentiful as when they were first harnessed. Developing renewable energy gives Native American Tribes a massive resource that could provide them with steady revenue and drive the development of the tribal infrastructure necessary for the Tribes to complete large projects.

Energy is an exceptionally valuable commodity in the modern world and is unlikely to decrease in value or demand. In fact, according to the Energy Information Administration (EIA), energy is expected to increase in both value and demand.[2] Therefore an economy based on the production of energy is fairly stable. It is even more stable if it is based on inexhaustible sources of clean energy such as wind or solar power. It is also possible for a Tribe to reinvest the capital gained from the sale of energy or the leasing of land used to produce renewable energy into projects that allow the Tribe to further diversify their economy. The Campo Band of the Kumeyaay Indians in San Diego County, CA, for example, is reinvesting its income from a 50 MW wind farm completed in 2005 into projects, such as an overnight rest stop, to stimulate the economy of the Tribe. In most cases this reinvesting of capital will lower unemployment and raise the standard of living for the Tribe.

Renewables are almost pollution free, so there is no loss of air or water quality as a result of increasing the amount of energy available to the Tribe. In this respect, renewables are compatible with tribal beliefs, such as living in harmony with nature: no mountains are torn apart to mine coal; no polluting gases are spewed into the atmosphere; and no green house gases are created to increase global warming. In a few cases, there have been concerns about the development of renewables coexisting with tribal beliefs; however, these concerns typically disappear when the technology is understood. For example, when the Hopi Nation first began to use photovoltaic panels, many of the tribal members where worried that the solar panels were stealing from the sun. After years of education on solar energy, that approaches the problem from the point of view of the Hopi people, the sentiment has diminished and photovoltaic panels are now extensively used in the Hopi Nation.[3]

[1] http://intertribalcoup.org/mission/index.html#Page:%204
[2] http://www.eia.doe.gov/oiaf/aeo/pdf/trend_2.pdf
[3] http://apps1.eere.energy.gov/tribalenergy/pdfs/nativesun0601.pdf

The development of renewables by a Tribe creates a substantial increase in the standard of living for many tribal members. Solar panels and small wind turbines can allow for rural electrification, bringing power to the most remote parts of a reservation. Large wind farms produce not only a valuable commodity, but they also produce large number of high quality jobs, such as electrical engineers, wind turbine mechanics, and other similar vocations. This provides an opportunity for a Tribe to increase its employment rate, provide electricity to members far from the electric grid and increase the Tribe's revenue.

Types of Renewables

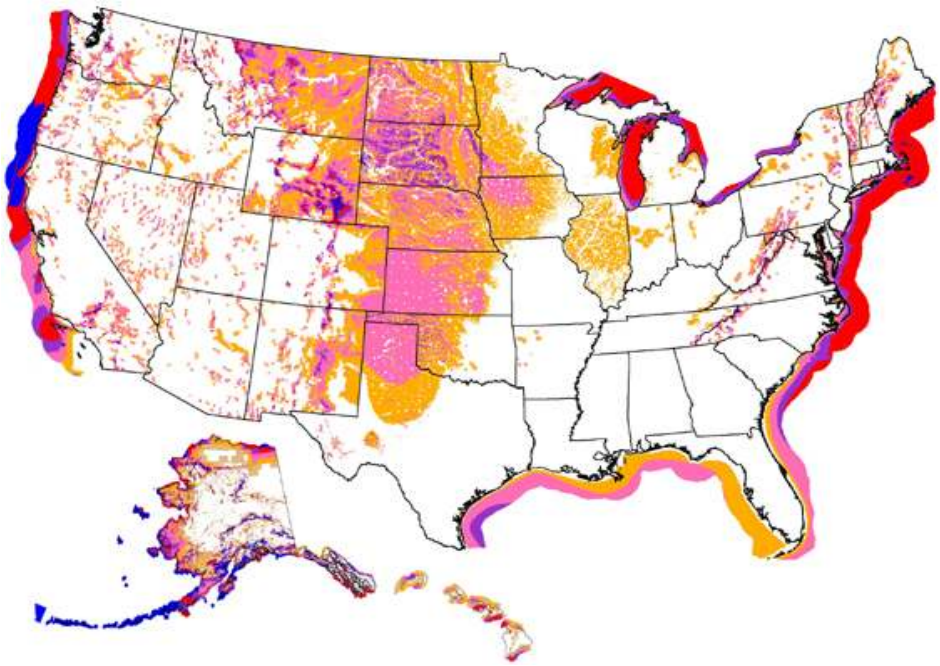
There are many different sources of renewable energy. The two types of renewables that have had considerable success on Native American reservations, are wind and solar, which have been used with positive results for several years. Other sources of renewable energy include biomass, hydroelectric and geothermal. Of these resources, geothermal and hydroelectric are not easily applied to tribal lands, but may have potential on a few Native American reservations. Biomass is not as clean as wind or solar but in many cases is the least expensive renewable resource for a Tribe.[4]

[4] http://www.eia.doe.gov/cneaf/solar.renewables/ilands/chapter4.html

Wind Power

Wind is the most common renewable resource used on Native American Lands. It has great potential on many Indian Reservations. Wind is cheaper to produce in bulk, so it is typically used to produce energy on a utility scale. By percentage, wind is the fastest growing form of energy in the US, as it comprised 30% of new energy capacity brought online in 2007, up from 1% in 2002.[5] Wind is also the cleanest form of energy as it produces no emissions and takes up relatively little land.

Fig. 1, a wind map of the U.S. showing average wind resources by wind power class. Source: National Renewable Energy Laboratory.



Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m^3	Wind Speed at 50 m m/s	Wind Speed at 50 m mph
3	Fair	300-400	6.4-7.0	14.3-15.7
4	Good	400-500	7.0-7.5	15.7-16.8
5	Excellent	500-600	7.5-8.0	16.8-17.9
6	Outstanding	600-800	8.0-8.8	17.9-19.7
7	Superb	800-1600	8.8-11.1	19.7-24.8

[5] http://www.awea.org/pubs/documents/Outlook_2008

As demonstrated by Fig. 1, wind resources are widespread and plentiful in America. The Tribes of the Great Plains have access to the greatest wind resources.[6] In addition to the Great Plains, pockets of strong wind resources are scattered across the rest of the United States, and a great number of Tribes have a large potential wind resource. It is advisable for a Tribe to test for wind resources if they are in a place identified as having a class three or higher wind resource. The Tribal Energy Program has wind maps of most western reservations on their web site. [7]

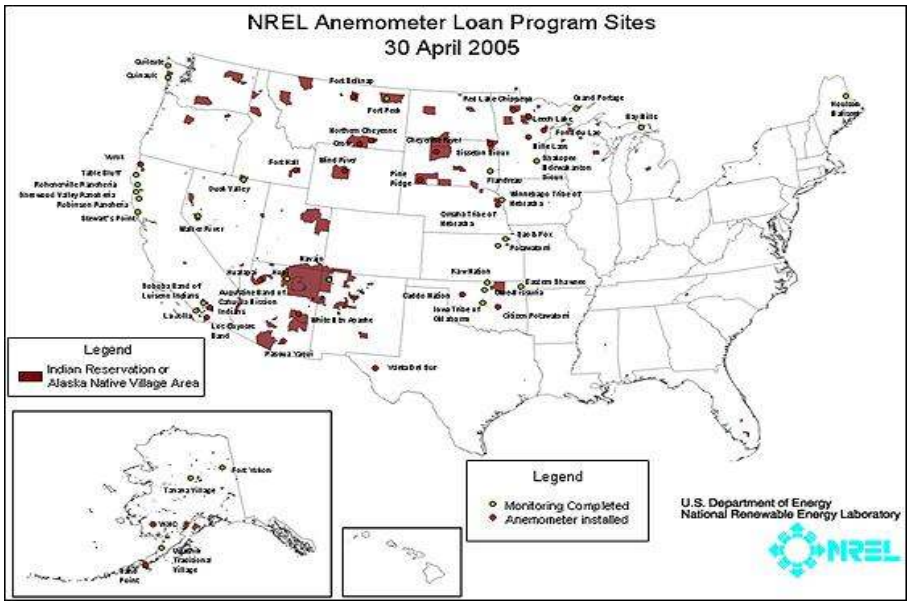
Wind Anemometer Loan Program

A wind resource is measured by installing a wind anemometer, a wind measuring instrument placed on the top of a tower that records wind speed and directions over long periods of time. The DOE has a Tribal Anemometer Loan Program that loans anemometers to Tribes that are seriously considering installing wind turbines. To qualify for the loan the Tribe must:[8]

-be able to correctly install, maintain and take down the anemometer
-have a realistic project planned
-agree to swap the data cards in the anemometer on a monthly basis.

The Tribe must also identify a combination of the factors necessary to make the project successful. These factors include road access, existing transmission in the area, a reliable wind resource and tribal ownership of lands. According to Tony Jimenez – the current head of the Anemometer loan program – over forty Tribes have received anemometers.

Fig 2, a map of tribes who have received an Anemometer Loan. Source National Renewable Energy Laboratories



[6] http://www.windpoweringamerica.gov/filter_detail.asp?itemid=764
[7] http://www1.eere.energy.gov/tribalenergy
[8] http://www.windpoweringamerica.gov/na_anemometer_loan.asp

Solar Power

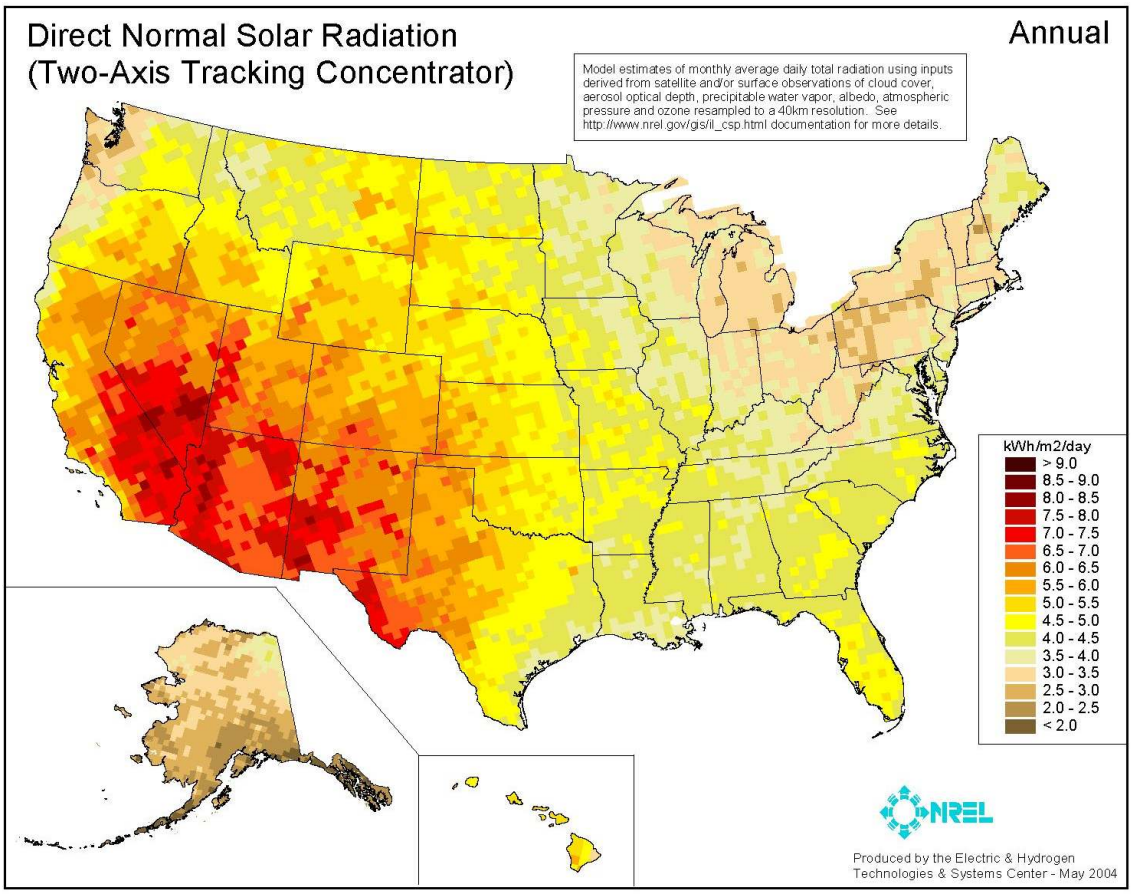
Solar power is both abundant and limitless. However, it is highly dependent on weather and only produces electricity during the day. Unlike wind power, most individual solar power generation is only cost effective when it is used directly where it is produced, such as in a home with rooftop solar PV. In contrast, utility scale concentrated solar power, that uses a molten salt tower or parabolic troughs are capable of producing electricity on a utility scale. These are fairly new technologies which have never been developed on Tribal lands, but may have future potential on reservations located in the Southwest. Most solar generation today incorporates photovoltaic (PV) panels which generate electricity directly from solar energy. Solar PV is primarily used on reservations for rural electrification where it is far cheaper than extending power lines which can cost approximately $60,000 per mile in mountainous terrain.[9]

Fig 3, a concentrated solar power plant using parabolic troughs. Source: www.usnews.com.

As shown by Fig. 4, solar energy is abundant in almost all parts of the U.S., but is highly dependent upon area because small variances in the resource can determine whether solar power is cost effective when compared with other energy sources. As demonstrated by Fig. 4, solar energy is abundant in the Southwestern United States. Tribes in Nevada, New Mexico and Arizona are likely to have large potential of solar energy.

[9] http://apps1.eere.energy.gov/states/alternatives/power_line_extension.cfm

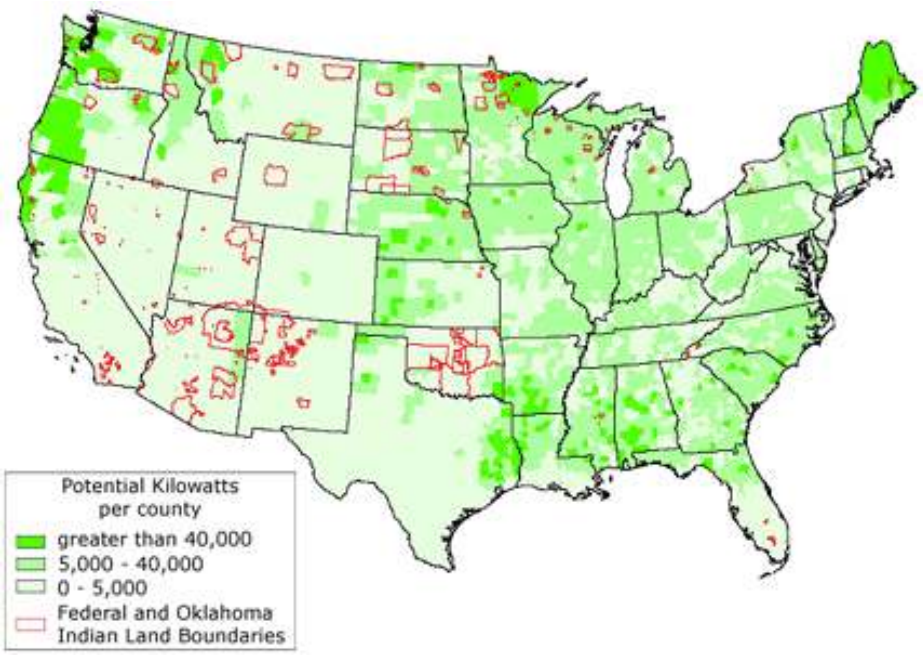
Fig 4, a map of solar resource in the U.S. Source: National Renewable Energy Laboratory.



Biomass

Biomass is strongly dependent on its location, so potential is determined site-by-site. There are two main categories of biomass energy resources. The first are residue sources – waste products from the processing of biomass – such as using animal waste to produce methane or burning scraps from agricultural or forestry waste. The second category of biomass is comprised of fuel crops – plants such as corn or soybeans-grown specifically to produce fuel. Biomass can also be used in conjunction with already existing coal power plants in a process called 'co-firing' which adds burnable waste from sawmills or farms to the coal burned in the plant.[10] Biomass is not as clean as wind and solar because it is burned which produces air pollution. However, it is one of the cheapest forms of renewable energy available on most Indian Reservations.[11]

Fig 5, a map of biomass resources in U.S. Source:
http://www.nationalatlas.gov/articles/people/a_energy.html



[10] http://www.eia.doe.gov/oiaf/analysispaper/biomass/
[11] http://www.eia.doe.gov/cneaf/solar.renewables/ilands/ilands_sum.html

Hydroelectric Power

Hydroelectric power is the most commonly used renewable resource in America, as it has been extensively developed for the last sixty years and currently supplies approximately 10% of the U.S.'s power.[12] Hydroelectric power is primarily produced by the damming of rivers to create lakes which provide water pressure used to spin turbines that generate electricity in large quantities. This process creates huge lakes, upsets natural habitats and can even displace entire towns. In contrast, small scale hydroelectric plants, (100 kW to 30 MW) such as the one pictured in Fig 5, only use small dams or divert only part of the river, and so decrease the damage done on the local ecosystem. It is also far easer to secure the construction permits for small scale hydroelectric plant, making them considerably easier to develop. On a side note, it is possible for Tribes to buy power wholesale from the massive government-owned hydroelectric dams.[13]

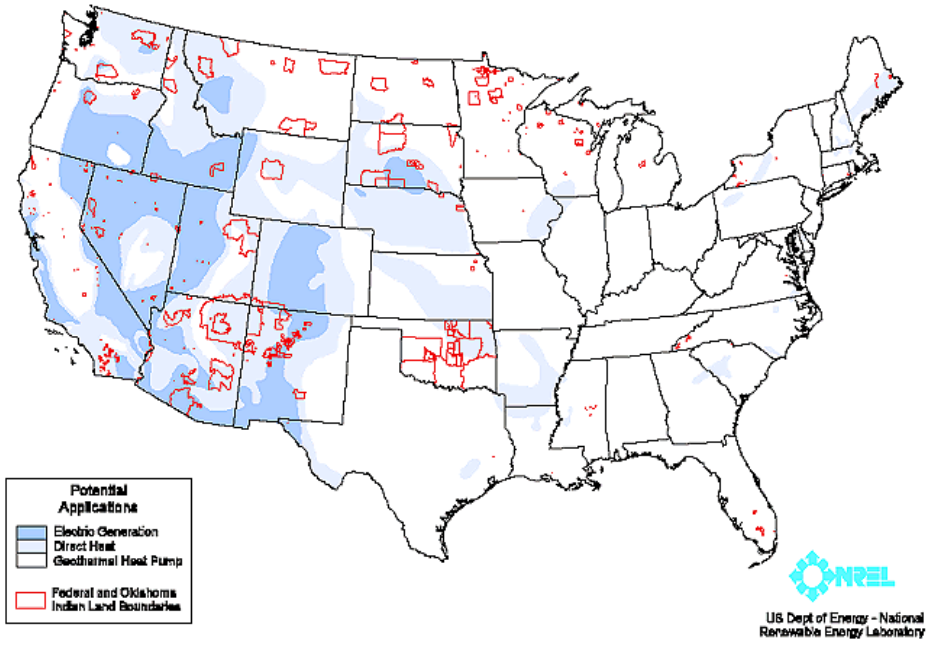
Fig 6, an 800-kW run-of-river hydropower plant provides electricity to the 700 residents of King Cove, Alaska. Source: http://www1.eere.energy.gov/tribalenergy/guide/hydroelectric_power.html (Photo: Duane Hippe)

[12] http://www.usbr.gov/power/edu/pamphlet.pdf
[13] http://www1.eere.energy.gov/tribalenergy/guide/hydroelectric_power.html

Geothermal Power

Geothermal power can either be used directly for heating or cooling homes, drying crops, warming fish farms and heating greenhouses, or it can be used to power utility scale power plants.[14] It is difficult to use geothermal power to produce electricity except on a utility scale, and it requires industrial scale faculties to produce electricity.[15] Because of this, there are few cases where geothermal has been developed for the production of electricity on a typical Native American reservation. However, the direct-use applications listed above, and many more, could be used on reservations with geothermal resources.

Fig 7, Map of Geothermal Resource in the U.S. Source: US DOE-National Renewable Laboratory qtd in http://www.bl-a.com/ECB/GreenGreen/fig15.gif



Analyzing geothermal potential requires site-by-site analyses, although the presence of hot springs more than 50 degrees Celsius is a hopeful sign when assessing geothermal resource potential.[16]

[14] http://www1.eere.energy.gov/geothermal/geothermal_basics.html
[15] http://www1.eere.energy.gov/geothermal/pdfs/conversion.pdf
[16] http://www1.eere.energy.gov/geothermal/pdfs/conversion.pdf

Beginning a Project

It can be very difficult for a Tribe to begin the process of developing their renewable potential. However, there are many resources for a Tribe starting this process. For example the DOE's Tribal Energy Program has an in-depth guide which is designed to instruct Tribes that are considering development their renewable resource. The guide has extensive information on the steps a Tribe must take to successfully complete a renewable energy project, and is a valuable resource to any Tribe planning such a project. The Tribal Energy Program works directly with Tribes to connect them to companies or organizations that can help them reach their goals. The Tribal Energy Program's Website is http://apps1.eere.energy.gov/tribalenergy/.

It is also effective for Tribes to form groups to work together on their projects, rather than attempting a difficult project independently. By joining together, Tribes can achieve projects that are beyond their individual abilities. An example of such a group of Tribes who have worked cooperatively is the Intertribal Council on Utility Policy.[17] (COUP) This organization represents nine Tribes from the states of North Dakota, South Dakota, and Nebraska that have the ambitious goal of installing utility scale wind farms on each of their reservations. Intertribal COUP has participated in the successful development and construction of a 750 kW wind turbine on one if its member reservations and is working to install 80 MW spread over six member reservations. COUP also does policy analysis and recommendations for Tribes around the country.[18]

Mentoring

There is also the chance that a Tribe beginning the process of developing renewable energy may be able to find another Native American Tribe that has successfully completed a similar project and is willing to mentor the inexperienced Tribe on the technicalities of developing renewables on tribal lands. A mentoring Tribe would help an inexperienced Tribe determine what steps they need to take in order to achieve their goals and then provide advice on each step based on their experience. The advantage of tribal mentors comes from the fact that many of the difficulties faced by Tribes developing renewables are unique to tribal lands. Tribes that have successfully completed a project understand problems faced by Native American Tribes, whereas an outside consulting company might not. A Native American Tribe may have a greater understanding and respect for the tribal culture of the Tribe attempting a project. This allows for easier communication and can result in the Tribe developing the project being able to learn faster and more effectively. For these reasons, any Tribe planning to develop their renewable energy resource should learn as much as possible from other successful Native American Tribes who have developed their own renewable energy resources either from studying what they did, or more directly by being mentored by members of an experienced Tribe.

[17] Intertribal COUP
[18] http://www.windpoweringamerica.gov/filter_detail.asp?itemid=677

Developing a Project

There are key aspects that Tribes which have completed projects developing renewables have in common. One of the most important factors in a successful project is the Tribe having a clear idea of their goals. These goals will vary considerably from Tribe to Tribe, and only the Tribe can determine what they are.[19] Common tribal goals often include: more jobs on the reservation, an increase in income for the people on the reservation, the ability to be more self-sufficient, a diversified source of income, the ability to manage their own utility rather than depend on non-tribal utilities for their grid power, and a better standard of living for members of the Tribe. Given the diversity of these goals, it is important for a Tribe planning a project to begin the project with a clear understanding of their desired results and which types of projects produce those results. For example, a rural electrification program will not provide a Tribe with a source of income like a utility scale facility that sells energy off the reservation, and a utility scale facility would not provide energy to people far from the grid, like a rural electrification program.

Once a Tribe has a clear idea of their goals, they need to determine how to reach those goals. What options are available to the Tribe? These may be obvious: if a Tribe is located in a desert, solar power is defiantly an option. Completing an integrated resource plan is an effective way for a Tribe to start planning an energy project. An integrated resource plan does the following:

- Considers the Tribe's current and future energy needs
- Looks at current sources of energy
- Looks at potential sources of energy
- And then organizes them to examine ways to provide reliable sources of energy at the best possible cost, both financially and environmentally.

If a Tribe plans to receive bulk electricity from the Western Area Power Authority, it may already need to complete an intergraded resource plan.[20] However, it is beneficial for any Tribe planning to install renewable energy on their land to complete an integrated resource plan, because it is a valuable tool for analyzing all of a Tribe's options for reaching their goals. More detailed information about integrated resource plans can be found on the Tribal Energy Program's website. (http://www1.eere.energy.gov/tribalenergy/guide)

If a Tribe plans to export its electricity, there are several aspects of producing and selling energy that need to be addressed. Some of the most important factors in producing energy are the rules and regulations surrounding power transmission. Electricity is transported by interconnected grids of transmission lines that can span across the country.

[19] http://www1.eere.energy.gov/tribalenergy/guide/
[20] http://www.wapa.gov/powerm/pmirp.htm

These grids are operated by utilities which can be private or public companies, government or tribal organizations, or co-ops run by the people receiving the electricity. Within the grid, each utility controls the area under its jurisdiction and interacts with the utilities surrounding it. Utilities usually have a set of standards, such as standards for quality of electricity, standards for the equipment used, and rates that are charged for energy that a Tribe would have to meet before connecting a power plant to the grid. Therefore, a Tribe planning to sell energy should carefully research the neighboring utilities' standards for connecting to the gird.

It is important for a Tribe planning to export electricity to secure Power Purchase Agreements with their buyers. Power Purchase Agreements are contracts that utilities or other major consumers of electricity sign that say they will buy a specific quantity energy at a set price. Often the cost of energy under the power purchase agreement will vary depending on when the energy is produced, because electricity's value changes depending on the time of day.[21] It is important for a Tribe to obtain power purchase agreements early in developing their project, because without them, there is no guarantee that there will be a buyer for the electricity.

The appropriate use of technology is always important to the development of a successful project involving the development of renewable energy. The technology chosen should reflect what the Tribe's integrated resource plan states as the best natural resource. The technology chosen should also reflect the Tribe's goals. For example, if a Tribe's goal is to become energy independent, and its resource is abundant solar power, then it would be sensible for that Tribe to install multiple photovoltaic panels where the energy is consumed. However, if the Tribe's goal is to create and sell energy to the surrounding utilities, a better option may be to create one large solar plant. Finally the technology chosen should reflect the financial resources available. For example, while it is cheaper to build a single, 2 MW turbine than it is to build four 500 kW turbines, the Tribe may not be able to find the funds for the larger investment, so they should build a single 500 kW turbine rather than attempting a project that is far beyond what the Tribe can support. These considerations are essential when selecting which type of technology is applicable to the Tribe and should be thoroughly researched.

[21] http://www1.eere.energy.gov/tribalenergy/guide/

Types of Projects

Projects involving renewable energy have a considerable range in scale and application. This variety allows Tribes to design and build projects that match the Tribe's needs and goals, whether it is an increase in jobs, an increase in capital, or an increase in independence. These projects usually fall into several main categories. The most common way of organizing these projects is the land-lease agreement in which a company from outside the Tribe leases a section of land from the Tribe and builds a large wind or solar farm.

Another common way in which large scale renewable energy facilities are developed on Native American Lands is for the Tribe to both supply most of the capital required and manage the project themselves. There has also been considerable development of small scale renewable projects that are used for rural electrification rather than the export of large amounts of export power. These different types of projects require approaches that are as diverse as the projects.

Figs 8 & 9, a small scale rural electrification plant, and a 50 MW wind farm owned by Native Americans. Sources: www.sacredpower.com, & http://www.daylife.com/photo/00hVePU1P04LC

Contracting Out/Land-Lease

Fig 10, a 50 megawatt wind farm on the Campo band of Kumeyaay Indians' reservation. Source: www.daylife.com

Contracting out to one main company that leases land from a Native American Tribe and then finances, builds, and maintains a utility scale renewable energy generation project is a common way in which renewables are developed on Tribal lands. From the Tribe's perspective this structure of management has the advantage of not requiring a significant financial risk. This method also has the advantage of not requiring the Tribe to have the level of expertise and personnel resources required to manage and control the many factors that go into the construction of a utility scale renewable generation facility.[22] An additional advantage that Tribes receive from contracting out is that current tax incentives do not apply to Native Americans, because Tribes are sovereign nations and, therefore, are not taxable entities. However, while the government can not tax Tribes or tribal members on their reservation, they can tax non-members on tribal lands such as a businesses operating on tribal lands or a business contracting with the tribal leadership.[23] This means that the Tribe can still take advantage of the Production Tax Credits (PTC) included in the TARP passed in 2008 through their contractors, which can mean the difference between a profitable project and an unprofitable project.

The disadvantage for the Tribe with this structure of management is that the Tribe forfeits much of the ownership of the project, with the extreme case being, for example, the Tribe leases land to a company for a flat rate and receives a share of the company's

[22] http://www1.eere.energy.gov/tribalenergy/guide/
[23] http://www.intertribalcoup.org

gross income from the sale of energy.[24] This creates a situation where the Tribe has very little control of the project, something that most Native American Tribes are understandably uncomfortable with.

Even in a land-lease structure, it is possible for Tribes to increase their control over their project, if particular attention is given to several aspects. One of the most important factors is the way in which dispute resolution between the Tribes and the company occurs. It needs to be decided whether disputes will be worked out in tribal courts, in state courts, or through another outside mediation service. It is also important for the Tribe to spell out their expectations in regard to the company training and hiring tribal members as part of the construction and continued operation of the project. Also, the Tribe should pick companies that match their standards of ethics and respect their Tribal culture.[25] Attention to these matters allows a Tribe a greater level influence in the project.

Tribally Owned Project

For a Tribe installing large scale renewables, another option is for the Tribe to take responsibility for the project and have complete ownership. Completing a large renewable project, such as a wind farm, is a difficult challenge for most Tribes, according to Michal Connelly, one time council member for the Campo Band of Kumeyaay Indians. Not only does a tribally owned project produce a larger amount of income for the Tribe than the traditional land-lease method, but it also gives the Tribe valuable experience in running a major project that can then be applied to other developments to raise the standard of living for the Tribe, such as building schools, or other business developments, such as farms and other energy projects.[26] This path requires a considerable amount of capital and infrastructure in the Tribe to manage the projects.

Fig 11, the construction of the Rosebud Sioux 750 Kilowatt turbine. Source: http://www.wapa.gov/ES/pubs/esb/2003/03oct/esb102.htm

[24] http://www1.eere.energy.gov/tribalenergy/guide/
[25] http://www1.eere.energy.gov/tribalenergy/guide/
[26] http://www.intertribalcoup.org/

The Rosebud Sioux Tribe of South Dakota is an excellent example of a Tribe completing its own renewable project. According to Robert Gough of the Intertribal Council on Utility Policy,[27] the Rosebud Sioux Tribe started on the road to building a wind turbine by completing an integrated resource plan that was required to receive energy from a federal hydroelectric dam. The Tribe discovered an ample wind resource and decided to pursue the possibility of building a wind turbine. Then, the Tribe began the project by collecting wind data for 18 months, discovering that their average wind speed was approximately 18 miles per hour. Having a high wind speed backed by actual data gave the Rosebud Tribe an advantage in applying for grants. They then received a grant for 50% of the total cost of installation of the wind turbine from the Department of Energy. This grant was matched with a loan from the USDA Rural Electrical Service and the sale of green tags. They then secured a Power Purchase Agreement from the Basin Electric Power Cooperative and installed the wind turbine.[28] The Rosebud Sioux Tribe has now successfully run the turbine for over three years and, with the experience gained from their first turbine, is now in the process of building a 30 MW wind farm.

The Flip Structure

The Flip Structure combines the best of both contracting out and tribal ownership. The need for the flip structure comes from the fact that Tribes are not taxable entities and, therefore, the production tax credits (PTC) which make wind power affordable do not easily apply to Tribes developing wind. While complex, a flip arrangement manages to both preserve tribal ownership and allow the Tribe to take advantage of whatever tax credits are available.

To start the process, a Tribe, combined with other investors, loans a company money to build a large wind or solar farm. The Tribe also leases the land required for the project to the company. For the next ten years, the company builds and operates the project, during which they hold 90% of the ownership of the project with the Tribe retaining 10%. This allows the project to take advantage of the ten year long PTCs, because the company which has ownership of the project is a taxable entity. During the first ten years, the Tribe receives payments of interest on the loan and on the land-lease. After the first ten years, the company makes a balloon payment for the value of the original lease. At the same time, the Tribe buys the wind or solar farm from the company for the value of the original lease. This creates a "flip" in ownership so the Tribe then holds 90% of the ownership and the company holds 10% of the ownership of the facility.[29] This creates a debt free facility that has all of the advantages of a tribally owned project while taking advantage of any tax incentives.

[27] http://www.windpoweringamerica.gov/filter_detail.asp?itemid=764
[28] http://www1.eere.energy.gov/tribalenergy/guide/cs_utility_scale.html
[29] http://apps1.eere.energy.gov/tribalenergy/pdfs/course_biz0710_maccourt.pdf

Rural Electricity

A third way to develop renewables on tribal lands is to use them for rural electrification. Many reservations do not have the same access to electricity that most American communities have. In fact, according to the Energy Information Administration, 14% of households on Native American reservations have no access to electricity, compared to 1.4% nationally.[30] Energy can also cost as much as 10% above national average on reservations. This creates a high need for rural electrification. One way rural electrification systems are developed is by linking a small scale generator, such as solar panels, small turbines, or a propane generator to a bank of batteries that then store the charge until it is needed. One of these systems can provide power to a household and is fairly inexpensive compared to the enormous cost of bringing traditional utility distribution lines to remote locations at a cost of as much as $60,000 a mile. While rural electrification systems like this can not provide the same quality of energy as a utility, requiring the households that use these systems to be conservative in their use of electricity, they can provide a substantial increase in the basic standard of living for households far from the electric grid

Fig 12, rural electrification in the Navajo Nation. Source: www.sacredpower.com

The use of solar panels attached to banks of batteries to supply energy to homes far from the grid was pioneered by the Hopi Nation in which several villages did not have access to the local energy grid.[31] The Hopi Tribe formed the Hopi Solar Enterprise which sold small scale solar systems to Native Americans and trained them to maintain their generation systems.[32]

[30] ftp://ftp.eia.doe.gov/pub/pdf/renewables/ilands.pdf
[31] http://apps1.eere.energy.gov/tribalenergy/pdfs/nativesun0601.pdf
[32] http://www.sandia.gov/news-center/news-releases/2005/renew-energy-batt/tewa.html.

The Navajo Tribal Utility Authority (NTUA) uses this system of solar panels combined with batteries in their attempt to bring electricity to the estimated 10,000 to 30,000 Navajo tribal members who live without electricity.[33] Many of the residents living on the Navajo reservation can not pay for these systems in one lump sum. The Navajo Tribal Utility Authority has a payment method whereby they require regular affordable payments of $75 to $95 per month over a 15 year period. During this time the NTUA performs the necessary maintenance on the systems and trains the customers to maintain their systems. At the end of the 15 years, the utility transfers both the ownership and the responsibility for maintenance to the customer. This system has proven to be effective, and the NTUA is now in the process of installing over 200 such systems. [34]

[33] http://www.sandia.gov/media/NewsRel/NR2000/navajos.htm
[34] http://www.ntua.com/

Infrastructure

Completing a major project with renewable energy requires a great deal of infrastructure on the Tribe's part. There are many factors that go into the success of a project. These include the quality of resource, the location and strength of existing transmission lines, the current tax laws, access to the site, and the organization and capability of the tribal government. Because installing renewables is a complex, multi-year process requiring long-term commitment, the tribal government requires an organizational commitment to manage the bureaucratic issues, such as signing contracts and hiring the necessary staff and contractors to complete the project. Therefore the organizational structure of the tribal leadership plays a major role in determining the success of the project. Projects such as the construction of a utility scale wind farm take a long time to complete, often up to eight years. Frequent changes in tribal leadership result in delays during the construction and can create inconsistencies in the project. [35]

Fig 13, a small part of the vast U.S. transmission grid. Source: www.eere.energy.gov.

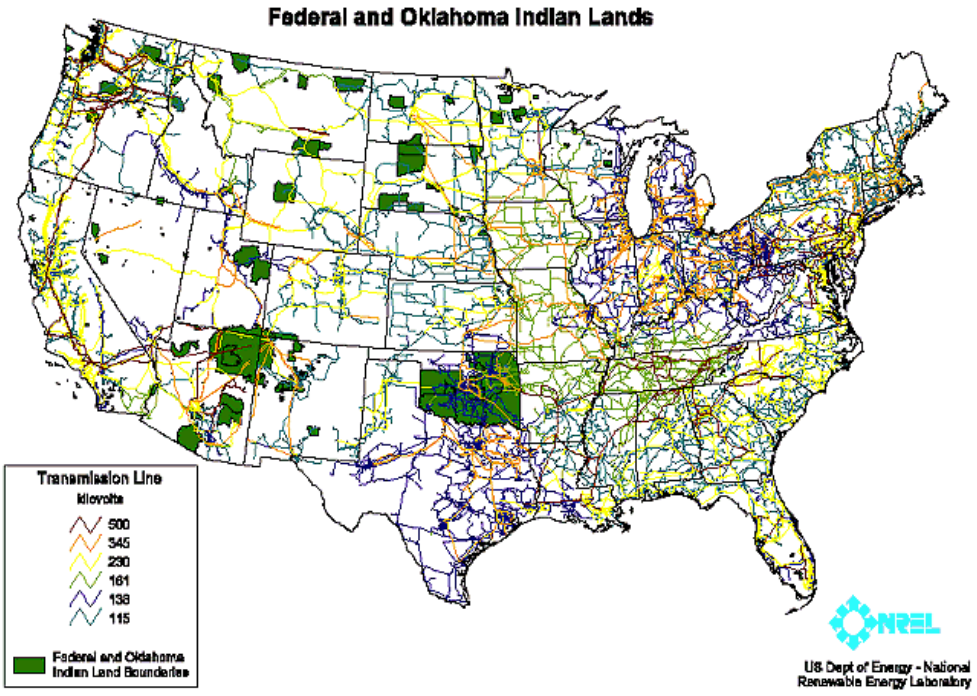
[35] http://www1.eere.energy.gov/tribalenergy/guide/

Transmission

Power transmission is essential to the development of any large scale renewable resource, because in most cases renewable energy resources are found far from load centers, requiring high voltage power transmission lines to move the electricity from were it is being produced to load centers. Therefore, transmission is an essential aspect of whether or not any utility scale development of renewable energy is financially feasible. On the more positive side the current presidential administration is planning to extend and upgrade the current electric grid so projects that where not feasible due to financial reasons may become so in the next few years.

Another important aspect of power transmission is the leasing of energy Right-of-Ways (ROW) on tribal lands. An energy ROW is an area of land that is leased in order to allow the construction of electrical line, or gas and oil pipelines. Historically, Tribes have not been properly reimbursed for energy ROWs on their land,[36] however, as a result of Section 1813 of the Energy Policy Act of 2005 many unreasonable ROWs are being renegotiated to allow these Tribes a fair compensation for use of their land.

Fig 14, a map of the U.S. power grids overlaid with the Native American Reservations and Oklahoma Indian Land Boundaries. Source: National Renewable Energy laboratory



[36] http://www.oe.energy.gov/DocumentsandMedia/EPAct_1813_Final.pdf

Roads

The location of roads in relationship to the site of the renewable resource can be a major factor in the cost of the project.[37] The construction of almost all large scale renewable projects requires heavy machinery to be transported to the site. So the existence of roads near the location can allow for an ease of transportation to the site that decreases the cost of construction by not requiring the construction of new roads for site access.

Tribal Champions

The most common and successful way to keep consistency and momentum throughout the course of the project is for the Tribe to select a tribal champion who drives the project forward. The tribal champion is the one who keeps things moving and figures out what the next step is and then takes it. When selecting a tribal energy champion, it is important for the Tribe to look for the following characteristics in the people being considered for the position: passion for the project (it is always important for the champion to care about what he is doing) and patience (tribal champions need a large amount of patience when dealing with the problems that will inevitably turn up).[38] The tribal champion also needs a lot of persistence to see a project through to completion, especially when the project takes more than a half decade to complete. It is important to remember when selecting a tribal champion that often they will come forward on their own as the project begins to take shape.[39]

Methods of Organization

After a Tribe identifies a champion, they must decide how they are going to organize their project. A major concern of developing renewables on a tribal reservation is that the tribal counsel can change halfway through the completion of a multi year project. This often creates a problem of inconsistent leadership which can result in a project falling. This problem has been dealt with in many ways. The most common is the creation of either a Tribal utility or a tribally owned corporate body that is separate from the tribal council, but still under their basic jurisdiction. These methods of organization allow a Tribe to create stability in the project while keeping it under the control of the Tribe.[40]

A tribal utility acts like a regular utility in that it controls the area under its jurisdiction and interacts with the utilities surrounding it. An excellent example of a tribal utility is the Navajo Tribal Utility Authority which, from its formation in 1958, has worked to bring electricity, natural gas, water, wastewater treatment, and photovoltaic energy to the residents of the 26,000 square mile Navajo Nation.[41] This tribal utility

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[37] .http://www.windpoweringamerica.gov/filter_detail.asp?itemid=764
[38] http://www1.eere.energy.gov/tribalenergy/guide/human_resources.html
[39] http://www1.eere.energy.gov/tribalenergy/guide/human_resources.html
[40] http://www1.eere.energy.gov/tribalenergy/guide/organizational_development.html
[41] http://www.ntua.com

provides many services, including a project to install photovoltaic panels to service rural households that are too far away from the grid to receive electricity.[42] This project is an example of how a tribal utility can provide the infrastructure needed to control and manage a project with renewable energy that directly increases the Tribe's standard of living.

Another way to organize the development of renewables is to create a for-profit company owned by the Tribe. An example of this is the Hopi Solar Electric Enterprise which began as a non-profit that sold stand-alone photovoltaic systems to rural households in the Hopi Reservation.[43] They used a creative payment method that allowed people who received the systems to pay for them over a 15 year lease in increments similar to the amount they would have paid if they were receiving electricity from the grid. During the period of the loan, the company maintained the photovoltaic system and trained the customer to maintain the system. At the end of the 15 year loan, both the ownership and the responsibility to maintain the system transferred to the customer. The Hopi Solar Electric Enterprise did quite well and installed over 300 photovoltaic systems. In 2000, it became the for-profit company, NativeSUN LLC.[44] Their achievements demonstrate how a Tribe can create a company to effectively achieve a goal of developing renewable energy.

Fig 15, one of the Hopi Solar Installations. Source:

http://www.smartcommunities.ncat.org/success/native_sun.shtml

[42] http://www.sandia.gov/media/NewsRel/NR2000/navajos.htm
[43] http://www.sandia.gov/news-center/news-releases/2005/renew-energy-batt/tewa.html
[44] http://apps1.eere.energy.gov/tribalenergy/pdfs/course_solar_tewa.pdf

Financing

The primary drawback to the installation of renewables is their cost. Many large scale installations cost millions of dollars, and even smaller projects can cost several thousand dollars. This means that Tribes usually can not front the investment of capital necessary to complete a renewable energy generation faculty. However, many creative payment methods exist to help Tribes pursue large renewable projects.

Land-Lease Arrangement

The most common method of financing a project is for the Tribe to lease a section of land to a company that installs a utility scale renewable generation facility on the land, fronts the capital for building the project, and depending on the contract, pays part of the gross income they receive from the sale of electricity.[45] This method is one of the least expensive methods of financing a major project, but it typically produces less revenue for the Tribe, and many Tribes are understandably uncomfortable with not having complete ownership of everything on their lands. For these reasons, many Tribes choose to finance their projects in ways that allow tribal ownership of the project.

Grants

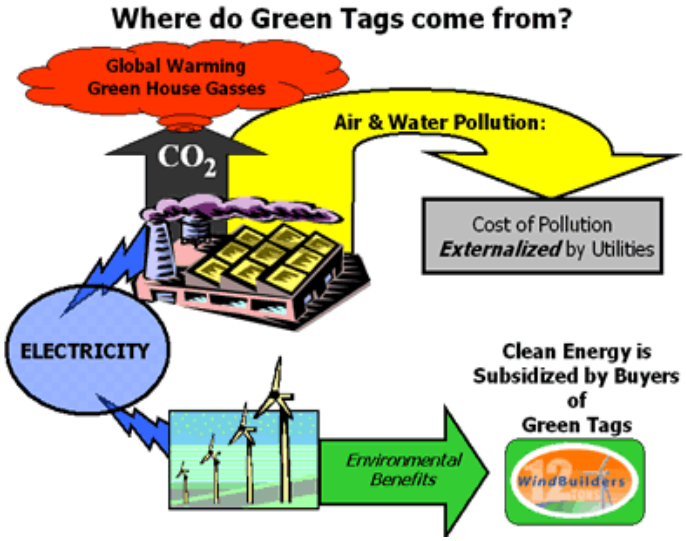
There are many sources of financial support for Tribes considering a large renewable project. One of the most common sources of money are grants from the Department of Energy.[46] The DOE gives grants to Tribes that have clear, practical plans for the completion of their project, a large and well documented resource of the renewable of choice and enough organization to successfully complete the project.[47] There are also many other sources of grants form private foundations to other government agencies.

[45] http://www.nrel.gov/docs/fy07osti/41746.pdf
[46] http://www1.eere.energy.gov/tribalenergy
[47] http://www.windpoweringamerica.gov/filter_detail.asp?itemid=764

Green Tags

Besides grants from the Department of Energy and other government agencies, another source of funds for renewable projects is the sale of green tags or carbon offset bonds. Green tags represent the amount of carbon dioxide that a renewable energy project would produce if it had been a fossil fuel plant. Basically, green tags represent the amount of carbon dioxide not released into the environment because of the construction of the renewable facility. These green tags are sold to business or individuals who wish to become carbon neutral by offsetting their carbon production with an equal amount of green tags.

Fig 16, a diagram of how green tags work, Source: www.intertribalcoup.org



It is important for any developer of renewable energy to remember that if they sell green tags on the carbon dioxide that would have been produced had they been using fossil fuels to produce energy rather than renewables; it is unethical to market the energy as green energy, because they have already sold the "green" part of the energy.[48]. An example of a Tribe that benefited from the sale of green tags is the Rosebud Sioux Tribe which partially financed their first turbine with the wholesale of green tags to Native Wind which then resold them to business and individuals. [49]

[48] http://www.epa.gov/oaintrnt/documents/greentags.pdf
[49] http://www.nativewind.org/html/projects.html

Conclusion

Fig 17, a picture of the 30 MW wind farm on the campo band of Kumeyaay Indians. Source http://cache.gettyimages.com

There are substantial amounts of renewable resources, such as wind, solar and biomass on tribal lands. If fully developed, the wind blowing across Indian Reservations in the Great Plains alone would supply approximately 534 Billion kWh/yr[50] or 13% of the total energy usage of the USA, which was approximately 4,055 Billion kWh in 2006.[51] The tribal lands in the Mojave Desert located in Southwestern U.S. contain a limitless supply of solar power which has the potential to supply local Tribes with clean, inexpensive power.

Developing renewables on Native American Lands presents many challenges. In many cases, finding the capital for the project presents a challenge for a Tribe considering the development of renewables. Another challenge is that many Tribes do not have the infrastructure and organizational capacity to manage a major project. This combined with the problem that current PTCs and other government incentives are not easy applied to Native American Lands creates a challenging situation.

Overcoming these problems can be difficult, but there are ways in which they can be met. Financial requirements can be supplied through grants, loans, and the sale of green tags. Infrastructure and organizational problems can be dealt with through multiple tribal efforts such as groups of Tribes working together or an experienced Tribe mentoring an inexperienced Tribe. Creative financing mechanisms such as the flip structure allow Tribes to take advantage of elusive PTCs and other government incentives.

[50] http://www.nativewind.org/html/wind_potential.html
[51] http://www.eia.doe.gov/cneaf/electricity/epa/epa_sum.html#figes1

The positive results of the development of renewables on tribal lands make these difficulties worth overcoming. The development can provide a valuable export of electricity and create jobs for tribal members. Renewable energy can also be used to provide energy for tribal homes unattached to a standard utility grid for less cost than extending utility lines out to the remote corners of a reservation. Other benefits of the development of renewables include giving the Tribe increased independence and the ability to provide its members with clean, local energy.

These benefits make installing renewables on tribal lands worth the effort. The increase in jobs and a valuable unlimited resource to export can have substantial impact on the standard of living for many Native Americans on Indian reservations over time. The addition of high-quality jobs would decrease the unemployment rate on Indian lands. The extra tribal revenue from the sale of energy would allow the tribal governments to reinvest in either infrastructure such as schools, roads, and medial centers, or in other energy projects such as wind turbines or a geothermal plant.

Projects developing renewables on Tribal Lands raise the living standard for the tribal members and provide a more dependable and sustainable economy for the Tribe.