

**RENEWABLE ENERGY:  
PLANNING FOR SUSTAINABILITY & SELF-DETERMINATION  
FOR THE NAVAJO NATION**



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**ABSTRACT**

In general Native American tribes, like other developing nations are exploring the possibility of developing renewable energy projects as a means of economic development and a more sustainable way of producing energy. In fact, tribes are in a very good position to develop renewable energy projects on tribal lands because they have the natural resources and they exist as sovereign nations which have the right to develop their lands as they see fit. This paper will explore energy, particularly renewable energy, development both large- and small-scale for the Navajo Nation. The purpose of this paper is to propose a plan for investigating how renewable energy systems can be an avenue for sustainability and self determination for the Navajo Nation. Specifically, this paper will—

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<sup>1</sup> Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

- Examine the relevance of renewable energy systems to the Navajo Nation;
- Discuss the methodology for studying renewable energy and sustainability on the Navajo reservation;
- Explain renewable energy systems – what they are and how they are used;
- Discuss how a plan for renewable energy systems can be deployed on the Navajo reservation;
- Discuss time and money resources required; and
- Discuss how success should be evaluated.

## INTRODUCTION



The world is changing. There is no denying this reality because we come face to face with it every day—every time we swipe our debit cards at the grocery store or at the gasoline pump and especially as we sit back in the comfort and confines of our homes and watch the evening news in a state of constant apprehension. As the world

transforms before our eyes, global trepidation over climate change and our energy use grows. Many studies have been conducted that unanimously attribute climate change to consumption. Energy consumption is of particular concern because energy supports our economies and lifestyles; we need energy to enjoy all the benefits and conveniences of modern life especially in developed nations. Everything we consume and produce requires energy. The more we consume and the more people we produce to consume undoubtedly puts a huge strain on available energy supplies.

At the same time the question of sustainability steadily increases as we begin to agree climate change is in fact a global emergency.<sup>2</sup> Outside the planning community, one might inquire exactly what sustainability is. The American Planning Association (APA) broadly defines sustainability as, “whether the Earth’s resources will be able to meet the demands of a growing human population that has rising aspirations for consumption and quality of life, while maintaining the rich diversity of the natural environment or biosphere.”<sup>3</sup>

In reality, sustainability is an umbrella concept for examining the relationship between human activity and the environment that encompasses a host of environmental, economic, social, and cultural issues. To a great extent, sustainability is indefinable; it means different things to different people and, ultimately, depends on context.<sup>4</sup>

Sustainability is not just a fancy planning word used only when academics gather in a classroom or some other mainstream setting. Sustainability also applies to, and is a concern of, the most unlikely group of people—Native Americans. As one Wisconsin Utility Authority stated when addressing the Rosebud Tribal Utility Commission, “You are either at the table, or you are on the menu.”<sup>5</sup> Consequently, more and more tribes are not only making reservations for a seat at the table, but are beginning to take a more proactive stance in deciding what gets put on that menu. This paper explores energy, particularly renewable energy, as a means of planning for sustainability and practicing greater self-determination for the people of the Navajo Nation.

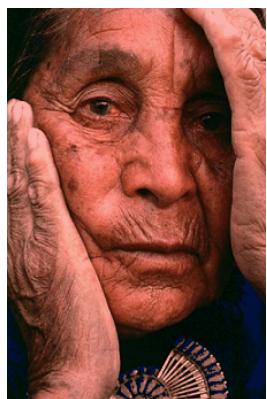
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<sup>2</sup> Walsh, Bryan, Kristin Kloberdanz, Massimo Calabresi, Mark Thompson, Adam Zagorin. “Why Green Is the New Red, White And Blue”. *Time*, April 28, 2008.

<sup>3</sup> *Policy Guide on Planning for Sustainability*. American Planning Association. <http://www.planning.org>.

<sup>4</sup> For more information, contact Paul Templet, Project Coordinator, People First, Developing Sustainable Communities at the Institute for Environmental Studies. 42 Atkinson Hall Louisiana State University. Baton Rouge, Louisiana 70803.

<sup>5</sup> LaDuke, Winona. “Wind Powering Native America”. *The Native Voice*. March 21, 2003. 5C.



The people of the Navajo Nation live on 26,000 square miles of reservation land in the Four Corners region of the southwestern United States. The Navajo Reservation spans northeast Arizona, northwest New Mexico, and southeast Utah. Historically, the people have been known to be resilient and have constantly adapted to the ever-changing world.<sup>6</sup> Unfortunately, the area is also known to suffer from a lack of basic infrastructure and utilities. Specifically, an estimated 18,000 households, or about one-third of the population, currently live without electricity.<sup>7</sup> Life without electricity has posed many hardships for the Navajo people including health and safety risks especially for those living in the most remote areas of the reservation.

<sup>6</sup> Underhill, Ruth M. *The Navajos*. Norman: University of Oklahoma Press. 1956. Page 25.

<sup>7</sup> Energy Information Administration, "Energy Consumption and Renewable Energy Development Potential on Indian Lands." April 2000.

In response, the Navajo Tribal Utility Authority (NTUA) developed a renewable energy program to meet the electricity needs of the people by using solar and wind energy as alternatives to connecting to a utility grid which would require installing miles of transmission and distribution



lines, some into areas with limited or no roads. The program began in 1993. First generation systems were composed of a photovoltaic (PV) array that produced a mere 240/260 Watts of power providing customers with direct current (DC) lighting and one alternating current (AC) outlet. This pilot project evolved into a second generation of PV systems that produced 640 Watts of power and allowed customers to power more household appliances than the 240 Watt systems allowed.<sup>8</sup> The latest generation of systems includes a hybrid system composed of an 880-Watt PV array coupled with a small wind turbine working in combination to power a battery bank that is connected to an inverter that converts DC power to AC power sending it inside the home.

Although the Department of Energy (DOE) has provided \$2 million to assist the program, it is not enough to provide electricity to all those who need it because the hybrid systems provided by the NTUA cost approximately \$18,000 each. In comparison, running power lines to individual homes is estimated to cost \$30,000 per mile. Furthermore, the success and feasibility of the renewable energy program depends largely on a family's ability to manage their energy loads efficiently because the NTUA units produce about 2 kW a day.

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<sup>8</sup> SAND 2004-5104P. "Navajo Tribal Utility Authority: Photovoltaic Hybrid Operation and Maintenance Process For a Sustainable Program."

## METHODOLOGY



Because overconsumption of energy is one of the leading contributors to global climate change, which is a very real indicator of unsustainable practices worldwide, there have been countless studies conducted examining unsustainable use of resources all over the world. In the United States, the range of entities that study energy use and sustainability range from non-profit organizations to designated departments under the federal government, such as DOE's Energy Information Administration (EIA). To date, however, there have been few studies done for and/or by tribal entities. Although studies have been conducted on and for different tribes, they are limited in scope and usually not very in-depth. Other limitations to using currently existing studies stem from the fact that every tribe is unique. One tribe's issues will differ drastically from another, regardless of location.



The studies done by non-government, usually non-profit, entities are the most accessible because they are usually published as and public media freely available on the internet. Scientific studies by different professional and scientific institutions can be found in scientific journals maintained by their

respective institutions and are made accessible, usually for free, by universities all over the country. Studies done by governmental entities are somewhat harder to access; they require considerable time and effort to identify and then obtain access to the published results.

With respect to the Navajo Nation, there are no readily accessible research/studies on how using renewable energy can foster sustainability on the Navajo reservation. As such, the goal of investigating renewable energy and sustainability on the Navajo reservation is taken with an interdisciplinary approach drawing on data and research on the social and economic situation of the Navajo and the technical research of renewable energy as well as first-hand information gathered from various field visits over the course of the Tribal Energy Program student internship. This paper investigates three primary aspects of sustainability: environment, social, and economic.

The first question to be examined is *“What kind of renewable energy sources are most feasible for use on the Navajo Reservation?”* To answer this question requires investigating the nature of renewable energy (*i.e.*, what it is and how it can be used). With a basic understanding of renewable energy, the question can be further examined through the lens of existing reports and feasibility studies such as the wind feasibility study currently being conducted by the NTUA on renewable energy development on tribal lands as well as maps created in ArcGIS using data from the National Renewable Energy Laboratory (NREL).

The second question is *“How do renewable energy sources help foster sustainability for the Navajo Nation?”* Answering this question will require defining ‘sustainability’ in the context of the Navajo Nation. This definition will serve as a guide for examining the economic, social, environmental, and cultural issues of the Navajo Nation and, ultimately, establishing a link between sustainability and renewable energy for the Navajo people. A discussion of ‘sustainability strength’ and an examination of case studies and field information gathered on

other tribes who have explored, implemented, and benefitted from renewable energy systems will also be included.



The third question asks *“How does sustainability define self-determination for the Navajo Nation?”*

An investigation of this question will include diving into the Navajo people’s history of dependency and self-sufficiency issues as they relate to the federal

government. This investigation will also examine what it means to be or not be connected to the grid by examining health, safety, and quality-of-life issues for the Navajo people.

The fourth question asks *“How can renewable energy systems be deployed on the Navajo Reservation?”* This paper will attempt to answer this question by evaluating a proposal that discusses how to plan for deploying renewable energy on the Reservation and by considering how planning can effectively include the elements of sustainability planning and tenets of indigenous planning. These questions will also be examined by investigating proposed participatory planning methods and existing funding sources for renewable energy projects.

## RENEWABLE ENERGY & THE NAVAJO NATION



Currently the United States, like other developed nations, relies heavily on the burning of fossil fuels, namely coal, to produce energy. In fact, the Architecture 2030 Project reports 45 percent of the energy produced in the U.S. is derived from burning coal.<sup>9</sup> Fossil fuels are nonrenewable resources and will eventually run out. Depletion will make them extremely expensive and they will eventually be considered too damaging to the environment to continue to use. In contrast, renewable resources such as wind and solar energy are constantly available in the natural environment and will not run out.<sup>10</sup>

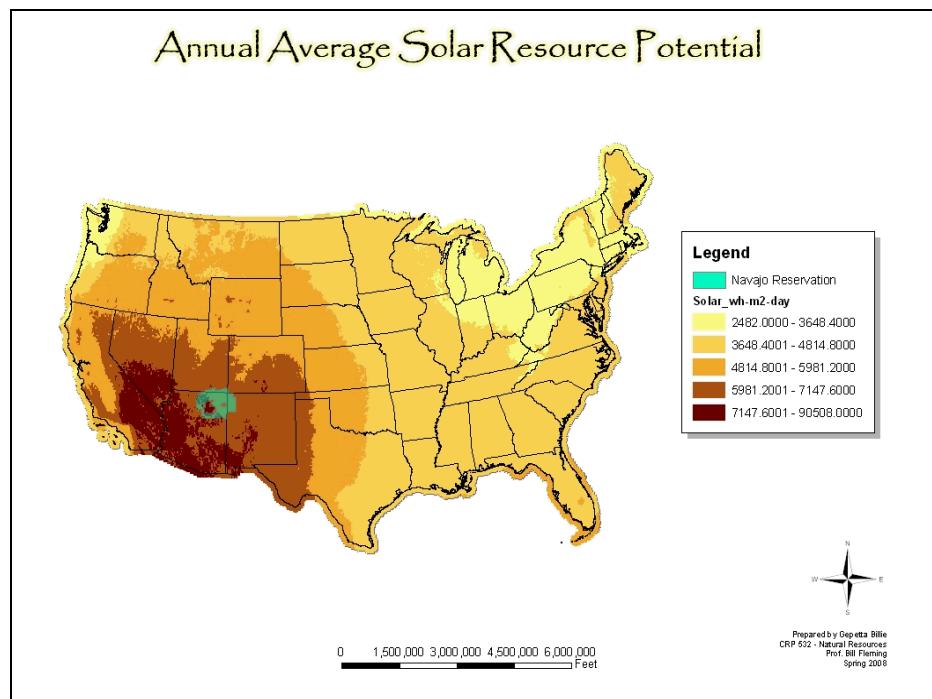
NREL identifies seven forms of renewable energy that have been developed to produce energy for our use. Based on data taken from NREL and an analysis of the data in a geographic information system (GIS), the Navajo reservation appears to be located in an area that has great potential for wind and solar resources as shown in the maps below. Consequently, the following information on available renewable energy technologies for the Navajo Nation focuses on solar and wind energy.

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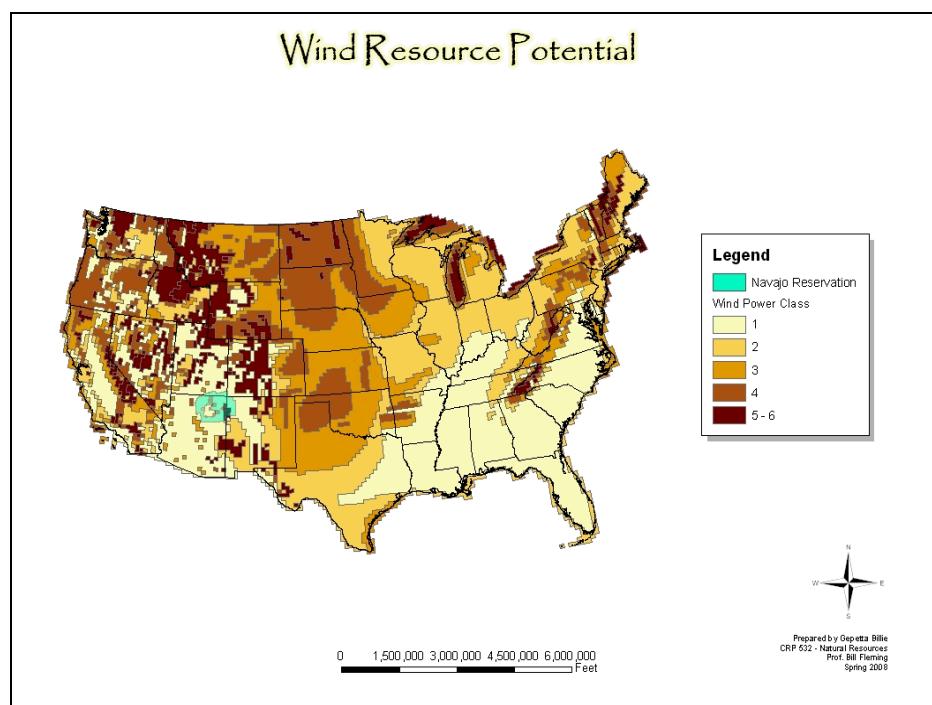
<sup>9</sup> Architecture 2030. <http://www.architecture2030.org/home.html>.

<sup>10</sup> National Renewable Energy Laboratory. Learning about Renewable Energy. [http://www.nrel.gov/learning/re\\_basics.html](http://www.nrel.gov/learning/re_basics.html).

## Annual Average Solar Resource Potential



## Wind Resource Potential



Other forms of renewable energy, as defined by, NREL include:

- a) Biomass – harnessing the energy from plants and plant-derived materials for fuel, power production, and products that would otherwise come from fossil fuels. Biomass-derived energy has the potential to greatly reduce greenhouse gas emissions, reduce dependence on foreign oil, and support U.S. agricultural and forest-product industries;
- b) Hydrogen – harnessing the energy of hydrogen gas through fuel cell technology. Fuel cells produce electricity by electrochemically combining hydrogen and oxygen. This technology is still in the developmental stages since hydrogen by itself is not readily available for use like wind and solar. There are also issues with storage and production;
- c) Geothermal – harnessing the earth’s internal heat for a variety of uses such as electric power production and heating and cooling of buildings. The sources of geothermal resources vary from geothermal reservoirs located near the earth’s surface to hot water and steam reservoirs deep in the earth. They also allow for use on both large and small scales;
- d) Ocean – harnessing mechanical energy from the tides and waves and thermal energy from the sun reflecting off the surface;<sup>11</sup> and
- e) Hydropower – harnessing the kinetic energy of flowing water to produce electricity. In this system, turbines and generators act like wind turbines to convert kinetic energy into electricity that is fed into the grid and used to power homes and other buildings.<sup>12</sup>

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<sup>11</sup> U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. Exploring Ways to Use Ocean Energy. [http://www.eere.energy.gov/consumer/renewable\\_energy/ocean/index.cfm/mytopic=50007](http://www.eere.energy.gov/consumer/renewable_energy/ocean/index.cfm/mytopic=50007).

<sup>12</sup> U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. Hydropower Basics. Wind & Hydropower Technologies Program. [http://www1.eere.energy.gov/windandhydro/hydro\\_basics.html](http://www1.eere.energy.gov/windandhydro/hydro_basics.html)

## ***Solar***



The most common and most abundant source of renewable energy comes, directly or indirectly, from the sun. The sun's heat and light provide a massive amount of energy that is used in different technologies. Solar energy can be used as passive solar heating and daytime lighting for the buildings we inhabit and use, for generating electricity with PV systems, and for hot water heating, solar cooling, and various other commercial and industrial uses.

With respect to passive solar heating and lighting, both are being practiced in unique ways at a



couple of sites at the Ramona Tribal headquarters and preschool in California. There, they are making use of the sun's light to light an office and preschool through solar tube skylighting, a relatively new technology that captures sunlight with a lens installed in a roof. Reflective material inside a tube that runs from the lens to the ceiling of

a room reflects and evenly disperses the collected white light into the room without overheating it.<sup>13</sup> Ramona is also using solar heating technology in an 'earth ship' that is used as office space.



Solar power can be used and developed on both a large and small scale. In large-scale applications, solar power can be concentrated in

<sup>13</sup> Solatube website. <http://www.solatube.com/homeowner/Introduction.php>

solar fields to produce electricity and thus provide a “green” alternative to utility customers. Examples of concentrating solar power technologies include parabolic trough systems, solar power towers, and dish stirling systems. All three types of concentrating solar power are being developed at Sandia National Laboratories.<sup>14</sup>

Small-scale applications include installing of PV systems at individual home sites.<sup>15</sup> In a residential setting, PV systems can be installed as stand-alone systems that can be mounted on a



tracking system that enables the PV array to track the sun as it moves across the sky to capture maximum solar power or on a non-tracking mount with a set angle and direction. PV systems can also be mounted directly on a house or building, usually on the roof positioned toward the south to gain maximum southern exposure. An example of a tracking PV and roof-mounted PV system being used on tribal lands

would be the one installed at Mr. Willie Moore’s residence at Hopi in northern Arizona. Mr. Moore and his family live totally off-grid with no connections to any utilities. Their message is that choosing to live off-grid and depending on renewable energy sources for power does not mean a lower quality of life but, rather, increases your resources by making use of what is provided free and abundantly while taking care of the environment and, ultimately, your family.

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<sup>14</sup> U.S. Department of Energy Office of Energy Efficiency & Renewable Energy. Tribal Energy Program. Guide to Tribal Energy Development: Concentrating Solar Power Systems.

[http://www1.eere.energy.gov/tribalenergy/guide/solar\\_concentrators.html](http://www1.eere.energy.gov/tribalenergy/guide/solar_concentrators.html).

<sup>15</sup> National Renewable Energy Laboratory. Learning about Renewable Energy.  
[http://www.nrel.gov/learning/re\\_basics.html](http://www.nrel.gov/learning/re_basics.html).

## Wind



Energy from the sun is used indirectly through wind energy because it is the sun that drives the winds. Wind energy is not a new concept. Wind energy is captured with wind turbines to produce electricity in the same fashion that windmills are used to pump water or grind grain. Wind turbines, like windmills, are mounted on towers high above the ground to capture faster

and less turbulent winds. A turbine is composed of blades, usually two or three, that turn a rotor which then spins a generator to produce electricity.<sup>16</sup>

Like solar energy systems, wind systems can be developed and used on both a large and small



scale. Large-scale applications include connecting a large number of turbines together to form wind farms that essentially act as power plants to provide electricity. Power generation at this scale is usually

distributed to utilities that then sell the power to their customers. One tribal entity involved in this type of power generation is the Campo band of the Kumeyaay Nation in southern California. Twenty-five 2-megawatt wind turbines line a ridge opposite Campo's Golden Acorn casino, just off Interstate 10. While Campo does not own the wind farm itself, Campo does collect a land lease fee.<sup>17</sup> Small-scale applications include stand-alone systems that can power individual homes, usually in combination with a PV system, to form a hybrid system.<sup>18</sup>

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<sup>16</sup> U.S. Department of Energy Office of Energy Efficiency & Renewable Energy. Tribal Energy Program. Guide to Tribal Energy Development: Wind Turbines. [http://www1.eere.energy.gov/tribalenergy/guide/wind\\_turbines.html](http://www1.eere.energy.gov/tribalenergy/guide/wind_turbines.html).

<sup>17</sup> Mills, Andrew D. *Wind Energy in Indian Country: Turning to the Seventh Generation*. 2006. Master's thesis, University of California, Berkeley.

<sup>18</sup> National Renewable Energy Laboratory. Learning about Renewable Energy. [http://www.nrel.gov/learning/re\\_basics.html](http://www.nrel.gov/learning/re_basics.html).

## SUSTAINABILITY



In addition to the APA's definition of sustainability (described above) two other definitions of sustainability are considered. The first is from the Environmental Protection Agency (EPA) where sustainability is defined as, "Social and environmental practices that protect and enhance the human and natural resources needed by future generations to enjoy a quality of life equal to or greater than our own." The second definition is taken from the Biological Resources Discipline (BRD) of the U.S. Geological Survey. The BRD defines sustainability as, "Economic development that takes full account of the environmental consequences of economic activity and is based on the use of resources that can be replaced or renewed and therefore are not depleted."<sup>19</sup>



These two definitions are important because they encompass the social, environmental, and economic aspects of sustainability. The first definition talks about protecting and enhancing the human and natural resources that our children will need to enjoy the same quality of life we do now, or better. It is important that we not only protect what we have now, but build on our current resources and improve the way we use them. It is also important from a social standpoint that we do so for the sake of our children because if we continue our unsustainable practices, we will not be leaving any kind of legacy for our children and their children. Why should our children suffer for our the mistakes?

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<sup>19</sup> U.S. Geological Survey. Biological Resources Discipline. <http://biology.usgs.gov/s+t/SNT/noframe/zy198.htm>.

The common perception of sustainability is usually centered on protecting the environment or on our use of resources, especially natural resources. The second definition is appropriate because it addresses economic development, which is something that is not normally considered in sustainability discussions even though the almighty dollar can be a mighty dictator. The second definition speaks not just to economic development, but to *responsible* economic development and clear accountability. Accountability is important because it ensures that a degree of responsibility is taken when considering sustainable renewable energy technologies as a source of economic development.<sup>20</sup>

As for sustainability strength, measuring strength is a matter of choice between continuing our



current practices and the alternative—more sustainable use of resources. Right now, the Navajo reservation is home to two coal-fired power plants: the Navajo Generating Station near Page, Arizona, and the Four Corners Power Plant near Farmington, New Mexico; a

third proposed plant has been proposed for Desert Rock, New Mexico. Together, the two existing power plants produce enough energy to power over 600,000 homes in New Mexico, Utah, Nevada, Arizona, and California.<sup>21</sup> Surprisingly, none of this power goes directly to the Navajo reservation even though Navajo coal is sold to these generating stations. Instead, this power is sold to power companies like the Public Service Company of New Mexico (PNM), Arizona Public Service (APS), and Tucson Electric Power. The power is then sold back to

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<sup>20</sup> Curley, Andrew. "Renewable Energy Best Choice for Diné". *Navajo Times*. Jan 24, 2008.

<sup>21</sup> Friends of Lake Powell. <http://www.lakepowell.org/>.

NTUA from these companies and finally sold to the Navajo people.<sup>22</sup> Even though Desert Rock will be built with the Navajo Nation as a partner and the supplier of the coal that would fuel the plant, the power that would be generated at Desert Rock would also not go directly to the Navajo people. All of the power generated at Desert Rock would be exported out from the reservation to serve urban areas.<sup>23</sup>

Navajos who are connected to power lines are those who live in established communities, usually concentrated around Navajo chapter houses. The density of people in these areas is enough to make running power lines to individual homes economically feasible. Based on the power lines map from NTUA's website, it looks like the power lines generally run along major roadways. The people who are not connected are those who live in the most remote areas of the reservation. NTUA claims it is not economically feasible to run power lines to these homes because it would cost about \$30,000 per mile.

Developing renewable energy offers a sustainable alternative for providing power to the Navajo Nation. From an environmental standpoint, renewable energy is clean; both pollution and resource consumption are reduced. Both the Four Corners Power Plant and the Navajo Generating Station are listed on the U.S.'s top 50 dirtiest power plants<sup>24</sup> and the Navajo Generating Station is on the World's top 50 dirtiest power plants.<sup>25</sup> According to the Environmental Integrity Project report, "The top 50 power plants generate as little as 14 percent

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<sup>22</sup> Terry Battiest and Wally Chief. Navajo Tribal Utility Authority Presentation. NTUA Headquarters, Fort Defiance, Arizona. June 9, 2008.

<sup>23</sup> Desert Rock Blog. <http://www.desert-rock-blog.com/>.

<sup>24</sup> "50 Dirtiest U.S. Power Plants Named." Environment News Service. <http://www.ens-newswire.com/ens/jul2007/2007-07-26-05.asp>.

<sup>25</sup> Carbon Monitoring for Action. <http://carma.org/>.

of the nation's electricity but account for a disproportionate share of pollution in the four categories.” Altogether, coal-fired power plants emit over 27 tons of carbon dioxides, 202 pounds of nitrogen oxides and about 350 pounds of sulfur dioxides every year.<sup>26</sup> Such statistics beg the question of whether it is really worth it to continue to build and rely on such plants for power.



With respect to resource consumption, coal-fired power plants need two natural resources to operate: coal and precious water. According to data from the National Atlas, the Navajo reservation lies in an area with abundant coal reserves. Because the Navajo Nation is

rich in coal, the power industry is drawn to the area. The problem with mining coal is in how it is done. Strip mining is usually the common practice for extracting this resource and usually ends in physical destruction of the land and, consequently in habitat loss that inevitably leads to imbalances in local ecosystems. Mills estimates over 600,000 billion btu of coal are exported from the Navajo reservation every year.<sup>27</sup> The Navajo Nation receives approximately 85% of its revenue from coal sales. It is also estimated that renewable energy would save 43 tons of coal from being mined every year.<sup>28</sup>

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<sup>26</sup> Thomas, Michael G., Connie Brooks & Gabriela Cisneros. SAND 2001-3863P. “The Solar Way”. 2001. Sandia National Laboratories.

<sup>27</sup> Mills, Andrew D. *Wind Energy in Indian Country: Turning to the Seventh Generation*. 2006. Master’s thesis, University of California, Berkeley.

<sup>28</sup> Thomas Thomas, Michael G., Connie Brooks & Gabriela Cisneros. SAND 2001-3863P. “The Solar Way”. 2001. Sandia National Laboratories.

Water is also consumed in the process not only to get the coal to the plants through slurry lines, but also in the actual power making process. At the plant, water is used for cooling. Every year, more than one million gallons of water are drawn to support coal-fired power plants.<sup>29</sup> Drawing water in huge amounts is unsustainable, especially for the southwest where water is already a precious and highly sought after commodity. Depleting natural resources at current rates is not responsible, especially when the potential for sustainable renewable technologies for the Navajo Nation is so vast.<sup>30</sup>



From a cultural standpoint, renewable energy falls in line with the Navajo philosophy of *Hozhó*. Like sustainability, *hozhó* means different things to different people and often depends on context. In general, *hozhó* represents the many complex layers of living right in an ideal environment. It is about balancing human activity with nature. *Hozhó* means harmony and happiness, beauty and order, and truth and rightness all at the same time. Not only does *hozhó* mesh with Leopold's ideas of integrity, stability, and beauty, but *hozhó* highlights the truths of Leopold's concept of a land ethic.<sup>31</sup> *Hozhó* makes sure the Navajo people do what is right for the land by maintaining balance at all levels of activity. This obligation is the same obligation Flader talked about when she illustrated how Leopold's ethics were a kind of community instinct where obligation to the whole takes precedence over individual rights.<sup>32</sup> By doing what is right for the land, the Navajo

<sup>29</sup> Thomas Thomas, Michael G., Connie Brooks & Gabriela Cisneros. SAND 2001-3863P. "The Solar Way". 2001. Sandia National Laboratories.

<sup>30</sup> Curley, Andrew. "Renewable Energy Best Choice for Diné". *Navajo Times*. Jan 24, 2008.

<sup>31</sup> Leopold, Aldo. *A Sand County Almanac*. 1949.

<sup>32</sup> Flader, Susan. "Aldo Leopold and the Evolution of the Land Ethic" in *Aldo Leopold: The Man and His Legacy*. Edited by Thomas Tanner. 1995. Soil Conservation Society of America.

people do the same kind of right that Leopold talked about when he said, “A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.”<sup>33</sup>

From an economic standpoint, an investment in renewable energy opens avenues of economic development on both a small and large scale. One report finds, “developing clean energy would create 80 percent more construction jobs and five times as many long-term operations and maintenance jobs compared to employment figures for Desert Rock.”<sup>34</sup> On a small scale, local people can be employed and trained to install and maintain small hybrid systems (a combination of a solar panel and small wind turbine that work in combination to power batteries that store and provide power to a household load). On a large scale, many more people will potentially be employed to construct and maintain wind farms and solar fields thereby diversifying the economy and Navajo workforce. This diversification would be an avenue for poverty alleviation by providing the unemployed with greater access, assets, and information so they can compete in the marketplace.<sup>35</sup> Furthermore, various studies and reports indicate local economies benefit from utility-scale wind projects through the creation of jobs, increased tax revenues, and land lease payments.<sup>36</sup> The Navajo Nation would also be charged with producing and selling the power to be used on the reservation and possibly sold to outside sources as well.

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<sup>33</sup> Leopold, Aldo. *A Sand County Almanac*. 1949.

<sup>34</sup> Desert Rock Blog. <http://www.desert-rock-blog.com/>.

<sup>35</sup> Mills, Andrew D. *Wind Energy in Indian Country: Turning to the Seventh Generation*. 2006. Master’s thesis, University of California, Berkeley.

<sup>36</sup> Mills, Andrew D. *Wind Energy in Indian Country: Turning to the Seventh Generation*. 2006. Master’s thesis, University of California, Berkeley.

Finally, from a social standpoint renewable energy systems would encourage community participation first at the small scale of individual chapters to the larger scale of the entire Navajo reservation given that local people will have the opportunity to learn about the systems and their maintenance as well as teach each other so that everybody becomes an expert. This kind of community learning would pave the way for strengthening Navajo identity because planning for the environment requires higher levels of participation.<sup>37</sup> The highest level of participation would have to come from the community members learning from and teaching each other. This kind of community participation is evident in the Hopi village of Hotevilla where solar power is used to power the village. Specifically, a Hopi-owned PV company, NativeSUN, successfully “created a legacy of end-users who fully understand how to operate and maintain their solar systems.”<sup>38</sup> The success of the business, the community involvement, and the preference for solar power can be attributed in large part to NativeSUN’s policy of incorporating tenets of sustainability into their business plan and operation.

## **SELF-DETERMINATION**



The term “self-determination” embodies the shift in federal policy toward Native Americans that occurred in the 1970’s. Throughout the 1950’s and 1960’s, federal Indian policy was geared toward terminating the trust responsibility of the federal government over tribal lands. According to Indian Law scholar Charles Wilkinson, tribal activists fought against the federal government trying to end their responsibility by demanding and

<sup>37</sup> Arnstein, Sherry R. "A Ladder of Citizen Participation," *JAIP*. Vol. 35, No. 4. July 1969. Pages 216-224.

<sup>38</sup> SAND 2006-1508P. “NativeSUN: A Model for Sustainable Solar Electric Systems on Indian Lands.”

acquiring more tribal responsibility over their own land. The establishment of the Office of Economic Opportunity (OEO) programs laid the groundwork for tribes practicing self-determination in the 1960's. The success of the OEO programs made tribes taking responsibility for and practicing control and leadership over their projects possible.<sup>39</sup> Then in 1975, self-determination was formalized with the Indian Self-Determination and Education Assistance Act. Self-determination would finally allow tribes to address the needs of their people in accordance with their own goals instead of federally imposed goals.<sup>40</sup>

With this idea in mind, planning for renewable energy generation on the Navajo reservation will serve as an avenue for the Navajo people to facilitate self-determination on their land. First of all, self-determination is facilitated by the tribe taking a proactive and necessary step to provide infrastructure, economic opportunities, cultural recognition, and overall well-being for the Navajo people. Secondly, self-determination is facilitated by the Navajo people once they define their own goals and vision for the community. In fact, one of the basic tenets of indigenous planning contends, “People have the basic right to determine their own future.”<sup>41</sup> By addressing the needs of the Navajo people, the Navajo tribe will be in the position to make its own decisions, where those decisions are based on the pre-defined goals of the Navajo people without the influence of the federal government. This will make planning for such a venture totally unique to the Navajo people and an exercise of the right to determine a Navajo future for the Navajo people by the Navajo people.

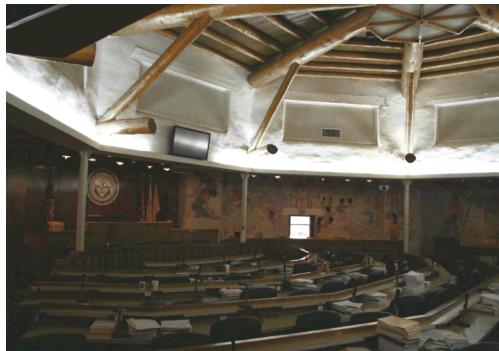
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<sup>39</sup> Wilkinson, Charles. *Blood Struggle: The Rise of Modern Indian Nations*. 2005. New York: Norton.

<sup>40</sup> Ambler, Marjane. *Breaking the Iron Bonds: Indian Control of Energy Development*. 1990. Lawrence, Kansas: University Press of Kansas.

<sup>41</sup> Jojola, Theodore. *Indigenous Planning and Resource Management*. In *Trusteeship in Change: Toward Tribal Autonomy in Resource Management*. Richmond L. Clow & Imre Sutton, editors. 2001. Boulder, Colorado: University Press of Colorado. Pages 303-314.

## DEPLOYMENT



Planning for implementing renewable energy systems on Navajo land must take an approach different from the “business as usual” and must incorporate the basic tenets of strategic energy planning. According to Wheeler, “Plans are only effective if they are implemented,

inspire action, or otherwise help bring about changes in the world.”<sup>42</sup> In this case, the most effective and constructive planning approach is sustainable planning where all parties involved will be able to conceptualize problems differently and address the true challenges of planning for the Navajo people. Wheeler identifies the following five elements to differentiate sustainability planning from “business as usual” planning: 1) a long-term perspective, 2) a holistic outlook, 3) acceptance of limits, 4) a focus on place, and 5) active involvement in problem-solving.

A long-term perspective considers an expanded time horizon where the goal is to see the Navajo nation thrive well into the future, not just exist. Considering an expanded time horizon is not only implicit to the concept of sustainability, but also corresponds with the Seven Generations philosophy. The lesson behind the Seven Generations philosophy “is to care for the earth and the people on it, care about future generations, and live as sovereign people for seven generations to come.”<sup>43</sup> By looking to the seventh generation, an assessment of how short- or near-term actions can guide long-term goals can be made. One way to make such an assessment would be to define sustainability indicators such as meeting the goal of reduced emissions by a certain percentage

<sup>42</sup> Wheeler, Stephen M. “Theory of Sustainability Planning”. In *Planning for Sustainability: Creating Livable, Equitable, and Ecological Communities*. 2004. Routledge, New York. Pages 193-204.

<sup>43</sup> Begay-Campbell, Sandra. “Making Decisions for Seven Generations: Native Americans bring traditional perspectives to technical solutions.” Sandia National Laboratories. <http://photovoltaics.sandia.gov/docs/PDF/MakingDecisions.pdf>.

by a certain year or to have a certain percentage of Navajo people working as certified renewable energy technicians by a certain year. However, a long-term perspective is not just about looking to the future; this perspective also means revisiting the past to understand the history and evolution of the Navajo environment to gain a more comprehensive understanding of current problems.



A holistic outlook embodies an ecological understanding of the world by seeing the relationships between everything.<sup>44</sup> One way to do this is to integrate different scales of planning. In this case, a holistic outlook on the planning process would integrate community-based planning at the chapter level with planning at the agency level and then planning at the reservation level. This would mean linking activities from the 110 existing chapters to develop a regional plan that would then inform a comprehensive energy plan, which the Navajo Nation currently does not have. To link the different scales of planning, the three goals of planning, or the “Three E’s,” would need to be merged to be sustainable.<sup>45</sup> This means weaving environmental, economic, and equity issues together so that global issues such as climate change and energy consumption are connected with local issues surrounding power plant pollution and Navajo respiratory problems. In fact, Curley asserts that “working in partnership with the world community on climate change would strengthen Navajo sovereignty and preserve culture far more than saying ‘yes’ to a coal-

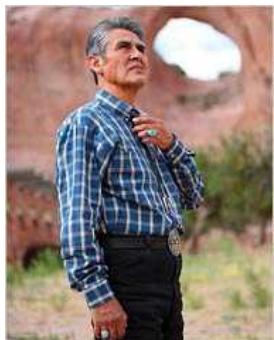
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<sup>44</sup> Wheeler, Stephen M. “Theory of Sustainability Planning”. In *Planning for Sustainability: Creating Livable, Equitable, and Ecological Communities*. 2004. Routledge, New York. Pages 193-204.

<sup>45</sup> Wheeler, Stephen M. “Theory of Sustainability Planning”. In *Planning for Sustainability: Creating Livable, Equitable, and Ecological Communities*. 2004. Routledge, New York. Pages 193-204.

fired power plant ever could.”<sup>46</sup> Another way of embodying a holistic outlook would be to conduct an energy audit of existing infrastructure and identifying possibilities for the future.

Acceptance of limits recognizes the revolutionary notion of limiting growth. In a world where progress is equated to virtually endless quantitative growth in production and consumption, there are several ways of applying “limits to growth” to planning.<sup>47</sup> For the Navajo, one possibility of applying this concept would be in the arena of economic development. The concept would stress that economic development should ultimately be about improving the quality of life for the Navajo, not just about increasing the number of jobs on the reservation to reduce the unemployment rate. Acceptance of limits also means recognizing the fact that resources are limited.<sup>48</sup> Planning for renewable energy development provides an opportunity for the Navajo people and surrounding communities to conserve and manage existing natural resources such as water and coal more sustainably.



A focus on place means fostering the health and uniqueness of specific geographical locations.<sup>49</sup> For urban, or even suburban, environments this means planning to avoid building another “Anywhere, USA.” For the Navajo Nation, “focusing on place” means creating and maintaining a sense of place for the reservation so that the reservation does not become just another place to stick a wind farm or solar field. The goal is to make sure that the reservation

<sup>46</sup> Curley, Andrew. “Renewable Energy Best Choice for Diné”. *Navajo Times*. Jan 24, 2008.

<sup>47</sup> Wheeler, Stephen M. “Theory of Sustainability Planning”. In *Planning for Sustainability: Creating Livable, Equitable, and Ecological Communities*. 2004. Routledge, New York. Pages 193-204.

<sup>48</sup> Wheeler, Stephen M. “Theory of Sustainability Planning”. In *Planning for Sustainability: Creating Livable, Equitable, and Ecological Communities*. 2004. Routledge, New York. Pages 193-204.

<sup>49</sup> Wheeler, Stephen M. “Theory of Sustainability Planning”. In *Planning for Sustainability: Creating Livable, Equitable, and Ecological Communities*. 2004. Routledge, New York. Pages 193-204.

reserves its scenic beauty and distinct cultural atmosphere and that Navajo people are not displaced in any part of the process. By focusing on place, the reservation would effectively be given the opportunity to heal, especially since it is already home to two of the nation's worst polluting power plants and natural resources are being extracted and consumed faster than they can be replaced. Furthermore, sense of place is already an important component of traditional Navajo ideology. For example, the traditional practice of burying a newborn's umbilical cord in a meaningful place ties that baby to that place. It is said that doing so ensures children grow up with meaning and guidance in their lives so they do not wander through life trying to find their place. They will know where they come from, thus where they are going.



Active involvement in problem-solving is important because sustainable development will only occur through the hard work of many dedicated people who actively and constructively participate in the problem-solving process.<sup>50</sup> In rural settings, such as the Navajo reservation, there are many advantages to seeking the involvement of many different people from all different walks of life. Chambers identifies the following as the basic principles and practices of taking such a multidisciplinary approach:

- 1) Optimizing tradeoffs in the information that is collected and learned and, most importantly, recognizing when enough information is known and not trying to get any more information than is needed;

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<sup>50</sup> Wheeler, Stephen M. "Theory of Sustainability Planning". In *Planning for Sustainability: Creating Livable, Equitable, and Ecological Communities*. 2004. Routledge, New York. Pages 193-204.

- 2) Offsetting biases, acting unhurriedly and deliberately, having a balanced representative view;
- 3) Triangulating different research methods to get the same result;
- 4) Learning directly from and with rural people to obtain valuable face-to-face information from local “experts”; and
- 5) Learning rapidly and progressively to allow for conscious exploration, judgment and decision-making, and adaptive learning.<sup>51</sup>

Active involvement also paves the way for defining and articulating a vision for the plan for and by the Navajo people. Having a vision ensures that the plan addresses the needs and concerns of the past and present as well as providing a vision for the future as voiced by the Navajo people. The vision provides the means of measuring how well the plan represents the people for which it was developed. Such measures can best be realized through community participation. As Daniels *et al.* describe, “Good public involvement depends on opportunities and encouragement.”<sup>52</sup> Opportunity and encouragement from the Navajo community can be maximized through participatory planning methods that include the following:

- 1) Focus groups – or meetings with small groups of people (ideally 7 to 9) that focus on a single topic, usually led by an outside facilitator;
- 2) Establishment of advisory committees – committees of renewable energy experts, community and tribal leaders;

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<sup>51</sup> Chambers, Robert. “Shortcut and Participatory Methods for Gaining Social Information for Projects”. In *Putting People First: Sociological Variables in Rural Development*. Michael M. Cernea, editor. 1985. London: Oxford University Press. Pages 515-537.

<sup>52</sup> Daniels, Thomas L., *et al.* *The Small Town Planning Handbook, Third Edition*. 2007. Chicago, Illinois: Planners Press, American Planning Association.

- 3) Public meetings – meetings held in public settings with as many people as possible attending. These meetings should be well advertised to ensure maximum participation and local leaders should all be invited. A great outlet for advertisement would be the local radio station (KTNN) and newspaper (The Navajo Times);
- 4) Design charettes – small meetings of community members gathered to share ideas of creativity and visions for the planning project usually facilitated by a design professional;
- 5) Surveys – surveys conducted to gather information not otherwise noted at the focus groups or public meetings and designed to gather individual information people might not be comfortable giving in public. The Pueblo of Laguna Utility Authority recently surveyed tribal members in an effort to gain an understanding of how much people knew about renewable energy systems and how much they supported the development of renewable energy projects on Laguna lands. With the survey the Utility Authority was able to gain valuable information and insight on what tribal members thought and was able to gain a better understanding of what projects were feasible and had support; and
- 6) GIS – Using geographic information systems to map possible locations for development, locations of support, and demographic information.

These methods will foster community learning and facilitate public participation at the local level so that planning becomes culturally and socially relevant to the Navajo people. Incorporating these methods into the planning process will also encourage buy-in from the

community thus ensuring that the plan is something the Navajo people want to do for themselves. Without community buy-in, planning renewable energy development projects becomes us pushing technology on them.

## **TIME & MONEY RESOURCES**

The community planning process begins with the decision to plan and a commitment of resources.<sup>53</sup> Time and money are needed to get any plan off the ground. In this case, time should be sufficiently allocated for inventory, participation, and assessment activities. An inventory will gather the following information:

- Which homes do not have electricity;
- Household incomes of homes without electricity;
- Proximity to power lines for homes without electricity; and
- Current power sources for homes without electricity.

Participation activities include those outlined in the previous section. An assessment of the following information will help determine feasibility of the project:

- Employment opportunities;
- Financial risks for the Navajo Nation;
- Environmental and health impacts;
- Profitability for all parties; and
- Cost-benefit analysis vs. cost-effective analysis.

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<sup>53</sup> Daniels, Thomas L., *et al.* *The Small Town Planning Handbook, Third Edition.* 2007. Chicago, Illinois: Planners Press, American Planning Association.

This is what a time-table for the project would look like if it were to be completed in one year:

Project	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Interviews												
Focus groups												
Planning workshop												
Action planning workshop												
Plan & report writing												
Follow-up workshop												

Project development of this scope requires tapping into a variety of funding sources. The following is a list of funding opportunities available to the Navajo Nation:<sup>54</sup>

- Grants – mostly from federal government entities such as the Tribal Energy Program, the Department of Energy, Department of Interior, Department of Agriculture, Department of Commerce, Environmental Protection Agency, Department of Housing and Urban Development, and Low-income energy assistance programs. Applications are submitted through Grants.gov and require registration.

For example, the Rural Development office of the USDA offers grant money to rural communities through its High Energy Cost Grant Program. This program offers grant funds “for improving and providing energy generation, transmission and distribution facilities serving communities with average home energy costs exceeding 275% of the national average.”<sup>55</sup> The Navajo Nation itself might be eligible for this grant because grant funds may also be used for off/on-grid renewable energy projects, energy efficiency, and energy conservation projects.

<sup>54</sup> U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. [http://www.eere.energy.gov/tribalenergy/project\\_financing.cfm](http://www.eere.energy.gov/tribalenergy/project_financing.cfm).

<sup>55</sup> U.S. Department of Agriculture. Rural Development, High Energy Cost Program, <http://www.usda.gov/rus/electric/hecgp/index.htm>.

Although grant money usually supports the initiation of projects, it may be worthwhile for the tribe to consider all other possible funding opportunities, rather than wait for grant money to become available. The application process for grant money can be highly competitive with no guarantee of the tribe receiving grant funding. Furthermore, waiting for grant money to become available might be a costly risk the tribe might not want to take as the project costs may increase over time and delaying a project may cause it to exceed approved funding limits or project estimates. More information on government grants can be found at—

[http://www.eere.energy.gov/tribalenergy/government\\_grants.cfm](http://www.eere.energy.gov/tribalenergy/government_grants.cfm).

- Project financing – involves raising money typically through loans from the Department of Agriculture, the Bureau of Indian Affairs (BIA), and the Department of Housing and Urban Development (HUD); investment financing from a wide variety of financial institutions including the Native American Bank and the First Nations Oweesta Corporation. More information can be found at—

[http://www.eere.energy.gov/tribalenergy/financial\\_institutions.cfm](http://www.eere.energy.gov/tribalenergy/financial_institutions.cfm).

- Renewable energy certificates - the Navajo Nation can buy “green tags” to quantify and market the environmental benefits of using solar and wind energy to produce electricity. For example, the Rosebud Sioux partly paid for a large 750-kilowatt wind turbine with a major green tags purchase. The Rosebud Sioux received \$200,000 in return for the purchase of green tags generation. More information can be found at—

<http://www.eere.energy.gov/tribalenergy/certificates.cfm>.

- Program services from the Navajo Nation Capital Improvement Office – the Navajo Nation can provide internal funding for services, including project management, cultural

resource inventories, project planning and research, and technical assistance, through its Capital Improvement Office. More information can be found at—  
<http://www.nndcd.org/content.asp?CustComKey=292855&CategoryKey=300610&pn=FrameLink&DomName=nndcd.org>.

## EVALUATING SUCCESS

Evaluation is important for gauging the overall quality, nature and success of a project.<sup>56</sup> By evaluating project success, its strengths and weaknesses can be identified and modifications can be made to the existing plan as well as future planning projects.

One way to evaluate the success of this project is by using the SWOT technique.<sup>57</sup> This technique evaluates the following:

- Strengths – to determine successes of the project that should be reinforced;
- Weaknesses – to determine areas that need improvement or definition;
- Opportunities – to determine other areas of interest to the Navajo people and avenues of sustainability and/or empowerment; and
- Threats – to determine issues that might halt the project during implementation or even before it begins.

Another way of evaluating project success is through benchmarking or establishing measurable targets.<sup>58</sup> By establishing measurable targets, benchmarking exposes a plan's strengths and

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<sup>56</sup> Butterfoss, Frances Dunn, *et al.* “The Plan Quality Index: An Empowerment Evaluation Tool for Measuring and Improving the Quality of Plans”. In *Empowerment Evaluation: Knowledge and Tools for Self-Assessment and Accountability*. Fetterman, Kaftarian and Wandersman, editors. 1996. Sage Publications.

<sup>57</sup> Daniels, Thomas L., *et al.* *The Small Town Planning Handbook, Third Edition*. 2007. Chicago, Illinois: Planners Press, American Planning Association.

weaknesses because it becomes obvious which goals were and were not reached. An example of a benchmark might be to have 20 percent of those households without electricity hooked up to a hybrid system in 6 months. With a concrete list in hand, benchmarking becomes a way for people to define measures of success. It gives people goals to work toward so that plans are successful and in line with the Navajo people's vision.

Evaluating success through benchmarking and/or establishing measurable targets also provides a means of establishing accountability. Reaching certain benchmarks and targets provides quantifiable evidence of which goals were met, how funds were spent, and whether or not the funds were spent as intended. Nevertheless, this kind of accountability can only be established if the cost of each component is attached to the benchmarks and targets. The planning body can then be held accountable for what was spent and how and for ensuring that the plan implemented the community's vision in a meaningful way.

Finally, empowerment evaluation would also be an effective tool for evaluating the success of the plan. Empowerment evaluation allows *people* to drive the evaluation process and become the experts.<sup>59</sup> By allowing the people to evaluate the plan for themselves, they would learn not only about the planning process and the associated technologies, but they would also take more responsibility for and ownership over the project. For example, a local chapter was put in charge of evaluating the success of the local senior center. Because the local people knew the elders that used the center, they made sure their senior center was maintained and offered appropriate

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<sup>58</sup> Daniels, Thomas L., *et al.* *The Small Town Planning Handbook, Third Edition*. 2007. Chicago, Illinois: Planners Press, American Planning Association.

<sup>59</sup> Butterfoss, Frances Dunn, *et al.* "The Plan Quality Index: An Empowerment Evaluation Tool for Measuring and Improving the Quality of Plans". In *Empowerment Evaluation: Knowledge and Tools for Self-Assessment and Accountability*. Fetterman, Kaftarian and Wandersman, editors. 1996. Sapge Publications.

services and activities. At the same time, the evaluators felt a greater sense of responsibility for the people and the center.

## CONCLUSION



For the methods and technical jargon to make sense to the Navajo people, there must also be a discussion about the ethical and economic issues on the reservation. It is only ethical to address the fact that the Navajo reservation, like many other tribal lands, has been equated to a “Cancer Alley.”<sup>60</sup> For the Navajo people to trust and agree with wind and solar projects on their lands, they have to know the issues—health and safety are important too. Their issues and concerns have to be addressed because otherwise there will be no incentive for them to participate; they think no one cares about them anyway. The methods outlined above seek to break the planning process down enough to empower the local people and put planning within their reach. By empowering the people with the project planning, they will also be empowered to do something about their economic situation. The Navajo people are a people plagued with high poverty and unemployment rates. The Navajo, like many other Native Americans are poor.<sup>61</sup> The location of the reservation, however, puts renewable energy technologies in their corner of the ring and provides them with the opportunity to turn things around on the reservation through sustainable economic development. In the end, this is what *hozhó* is really about.

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<sup>60</sup> Norrell, Brenda. “South Africa: Indian Country USA, defined as New Cancer Alley”. *Indian Country Today*. 2001.

<sup>61</sup> Gilbreath, K. *Red Capitalism: An Analysis of the Navajo Economy*. 1973. Norman, Oklahoma University Press.

## REFLECTIONS

First, I would like to thank my fellow interns – Amanda, Carson, and Suzanne – for making this summer a fun, educational, worthwhile, and memorable one. I would also like to thank my supervisor – Sandra Begay-Campbell – for not only being a great boss, but for being a truly influential individual who has taught me to think way outside the box and to always consider possibilities of great potential. Thank you!

To say this internship was a great learning experience would be an understatement. The work I have done, the places I have seen, and the people I have had the opportunity to meet and interact with over the past summer have dramatically changed the way I think about energy planning, development, and consumption on tribal lands. Through this internship I have learned through first-hand observation and participation how tribal communities at scales from the eight-member Ramona band of the Cahuilla to the ever-expanding Navajo Nation are trying to develop renewable energy projects on tribal lands in an effort to create more sustainable environments to meet the basic needs of their people.

The people who drive these efforts are amazing and I hope one day I can make a contribution of the same magnitude. Every single person we met along our journey through this internship has a great story and an enduring lesson to share.

At Navajo, I learned that access to electricity is not something to which we are entitled or something that everybody must have. For some people on the Navajo reservation, electricity is a luxury they simply cannot afford. To assume that everybody must have electricity is

presumptuous. Electrification of the Navajo Nation is about giving people the choice to access to power and work must start at the community level (*i.e.*, from the bottom, up) to find out what the people want and need, not from the top, down by telling them what they want and need. At Hopi, I learned how living off the grid does not automatically mean a downgrade in quality of life. Living off-grid means making a conscious effort to minimize your impact on the environment and the natural resources you use in your daily activities. At Ramona, I learned how community development is important even for a community that is composed of eight tribal members. Planning for development is not always about making a quick buck, but about making sure development is in sync with a vision of the community that ensures that the community's sense of place remains intact physically, socially, economically, and culturally.

Planning for energy development on tribal lands is not a straightforward task where cookie-cutter programs can be applied. Planning for energy development on tribal lands is multi-dimensional where a people's culture, tradition, and history have to be carefully considered so that planning activities are ultimately sustainable.