ANALYSIS OF THE BARRIERS TO RENEWABLE ENERGY DEVELOPMENT ON TRIBAL LANDS

by

Thomas Elisha Jones

A Dissertation Submitted to the Faculty of the

SCHOOL OF NATURAL RESOURCES AND THE ENVIRONMENT

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

WITH A MAJOR IN NATURAL RESOURCES

THE UNIVERSITY OF ARIZONA

2016

THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE AND LIFE SCIENCES

As members of the Dissertation Committee, we certify that we have read the dissertation prepared by Thomas Elisha Jones, titled Analysis of the Barriers to Renewable Energy Development on Tribal Lands and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

_____ Date: (05/02/2016)
Benedict J. Colombi

_____ Date: (05/02/2016)
Howard R. Gimblett

_____ Date: (05/02/2016)
Ronald L. Trosper

_____ Date: (05/02/2016)
Manley A. Begay, Jr.

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copies of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

_____ Date: (05/02/2016)
Dissertation Chair: Benedict J. Colombi

_____ Date: (05/02/2016)
Dissertation Chair: Howard R. Gimblett

STATEMENT BY AUTHOR

This dissertation has been submitted in partial fulfillment of the requirements for an advanced degree at the University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this dissertation are allowable without special permission, provided that an accurate acknowledgment of the source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department of the Dean of the Graduate College when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

SIGNED: Thomas Elisha Jones

ACKNOWLEDGEMENTS

I would first like to acknowledge Dr. Ben Colombi for bringing me on as a student at the University of Arizona. Your patience, expertise and friendship is invaluable to my work. I look forward to maintaining our friendship and working together well into the future. I would like to also acknowledge my dissertation committee members Dr. Randy Gimblett, Dr. Ron Trosper, and Dr. Manley Begay for countless hours of support and expertise to further my understanding.

Sandra Begay-Campbell is a treasure for advancing Native Americans in the field of STEM. Bringing me on at Sandia National Laboratories in the Tribal Energy Program internship that you created and perfected has been life changing. Thank you for everything you have done for me and I am honored to have you as a friend.

Len Necefer, thank you for helping me to become a better researcher and being a great friend and co-author. Having a friend that is passionate about the same field and understands that working together can make a difference for Indian country is not something I take for granted.

I would also like to acknowledge co-authors Dr. Mike Pasqualetti and Dr. Chris Scott for the collaborative work we did. Thank you for bringing me on board and I am thankful for the opportunity to work with two researchers as experienced as you both.

DEDICATION

This work is dedicated to my parents Bob and Sandra Jones. You have been instrumental in my achievements through your endless support, love, and prayers. Thank you, I cannot thank you enough. –TuTones

Table of Contents

List of Tables

Abstract

Native American lands have significant renewable energy resource potential that could serve to ensure energy security and a low carbon energy future for the benefit of tribes as well as the United States. Economic and energy development needs in Native American communities match the energy potential. A disproportionate amount of Native American households have no access to electricity, which is correlated with high poverty and unemployment rates. Despite the vast resources and need for energy, the potential for renewable energy development has not fully materialized. This research explores this subject through three separate articles: 1) a case study of the Navajo Nation that suggests economic viability is not the only significant factor for low adoption of renewable energy on Navajo lands; 2) an expert elicitation of tribal renewable energy experts of what they view as barriers to renewable energy development on tribal lands; and 3) a reevaluation of Native Nation Building Theory to include external forces and the role that inter-tribal collaboration plays with renewable energy development by Native nations. Major findings from this research suggests that 1) many Native nations lack the technical and legal capacity to develop renewable energy; 2) inter-tribal collaboration can provide opportunities for sharing resources and building technical, legal, and political capacity; and 3) financing and funding remains a considerable barrier to renewable energy development on tribal lands.

Introduction

Native American lands have significant renewable energy resource potential that could serve to ensure energy security and a low carbon energy future for the benefit of tribes as well as the United States. Economic and energy development needs in Native American communities match the energy potential. A disproportionate amount of Native American households have no access to electricity, which is correlated with high poverty and unemployment rates. Despite the vast resources and need for energy, the potential for renewable energy development has not fully materialized. This research explores this subject through three separate articles: 1) a case study of the Navajo Nation that suggests economic viability is not the only significant factor for low adoption of renewable energy on Navajo lands; 2) an expert elicitation of tribal renewable energy experts of what they view as barriers to renewable energy development on tribal lands; and 3) a reevaluation of Native Nation Building Theory to include external forces and the role that inter-tribal collaboration plays with renewable energy development by Native nations.

Major findings from this research suggests that:

- Many Native nations lack the technical and legal capacity to develop renewable energy;
- Inter-tribal collaboration can provide opportunities for sharing resources and building technical, legal, and political capacity; and
- Financing and funding is a considerable barrier to renewable energy development on tribal lands.

Addressing the host of barriers that exist for renewable energy development on tribal lands will take a concerted effort among Native nations that includes tackling internal and external factors. Many factors involving federal and state policies play critical roles in renewable energy development feasibility on tribal lands.

Chapter 1. A Paradox of Plenty: Renewable Energy on Navajo Nation Lands

The chapter has been published by a peer reviewed journal:

Pasqualetti, M. J., Jones, T. E., Necefer, L., Scott, C. A., & Colombi, B. J. (2016). A Paradox of Plenty: Renewable Energy on Navajo Nation Lands. *Society & Natural Resources*, 1-15.

Abstract

A persistent paradox in the global boom of renewable energy revolves around how little of its vast potential has been developed on Native American lands. For economic and environmental reasons, attempts to reverse this pattern are on the rise. Such plans will encounter many unique conditions, particularly those related to tribal norms, customs, and histories. This article examines the prospect of renewable energy (RE) development on the Navajo Nation of the American Southwest. We examine its potential in light of past energy projects, current jurisdictions and control, and the cultural and social heritage of the Navajo Nation. We find that robust RE development on Navajo Nation lands will remain hindered without accounting for Navajo values, intratribal and tribal–nontribal politics, and their relationship to a multifaceted set of regulatory procedures. Without due consideration of these factors, RE development on Navajo and other Native American lands will continue to be slow and disappointing.

Introduction

A persistent paradox of the global boom in renewable energy (RE) development is its scarcity on tribal lands in the southwestern United States. RE development is a continuing temptation for Tribes and other decision makers with an eye toward meeting legal mandates for carbon-free sources of power, bolstering economic development amid chronic poverty, or simply providing reliable energy to tribal citizens. Why is RE adoption so low, especially for the Tribe with the greatest RE potential in the United States, the Navajo Nation? Is it possible that the economics are not favorable? Could it be that the Navajo tribal citizens and their leaders have not accepted RE as a reliable energy resource (Burningham, Barnett, and Walker 2015)? We believe the explanation is significantly more complex. Despite the appeal that RE development holds for the Navajo Nation government, as well as for private investors and developers and electric utilities, its benefits and drawbacks are many times informed more by cultural and social influences than by accessibility or need. This means that while people often have held high hopes and bold plans to reap the rewards of RE resources specifically on Navajo Nation lands, there is scant evidence of significant development or associated benefits. As we show, however, developing RE on Navajo Nation lands poses several unique challenges. Identifying if not reducing these challenges is our principal aim here.

Conceptually, we view solar and wind energy not simply as material resources or opportunities for economic development; they also reflect essential values for human quality of life, and function as key ecosystem processes. Their spatial distribution across landscapes touches the very core of place-based human values and priority settings. RE development is in everyone's backyard. And yet, equal access to large-scale RE is only notional, because it is mediated by technology and investment, with a profit logic that responds to financial interests that are often

external to local communities. RE has come to be considered not primarily for the electricity it can supply, or for the carbon abatement it may offer. Instead, RE is eminently about place-based choices and priorities, about winners and losers. A spiritual dimension informs the relationship and interaction between humans and natural forces for many Navajo people. We explore contested RE development in light of these values, plus the broader context of the paradox of plenty: abundant renewable energy resources ripe for development, juxtaposed with the drawbacks of energy poverty; alluring prospects for economic improvements, juxtaposed with delays, suspicions, and infighting over costs that might accompany such improvements. Conventional understanding of low adoption (e.g., economic viability) offer only a partial explanation. We propose other factors that are important:

- Navajo spiritual perceptions of the landscape (physical, institutional, cultural).
- Spiritual/cultural teachings about acceptable forms of economic development and environmental management.
- Navajo–nonnative control and other legacy effects, especially the pervasive environmental damages of current and past energy development (coal and uranium mining, hydropower).
- Perceived intratribal inequities.
- Protracted regulatory procedures.

We believe obstacles to energy and economic development will persist unless the conventional model of RE development is reworked. That is, how will Navajo people and other stakeholders be engaged by Navajo Nation leadership? The challenges are clear: how to remedy chronic energy poverty, how to regain the trust lost in implementation of past energy projects, and how

to catalyze social and cultural awareness of Navajo RE development. In the end, the most vexing challenge is how to reap the benefits of RE development without compromising Navajo values.

We address these questions as follows. First, in the preceding, we set the stage for an understanding of RE development that considers material resources, human values, and ecosystem processes as we try to make sense of the paradox of plenty. Next, we assess resource distribution, summarize sociodemographic characteristics of the Navajo Nation, and review legacy effects of past and current energy development. We do this to explain persistent distrust by Navajo people of external, nontribal interests, including developers, investors, and regulators. Third, we seek to draw connections between Navajo spiritual values, concerns for intergenerational equity, and perceptions of intratribal decision making.

Fourth, we synthesize our assessment of RE development opportunities in the regulatory context of the federal, state, and Navajo Nation institutions, as well as nongovernmental organizations, in order to better understand opportunities and limits to addressing energy poverty through RE development. Finally, we conclude with findings with relevance beyond the Navajo Nation.

The Navajo Nation and its Energy Resources

The Navajo Nation—roughly the size of the Republic of Ireland or the state of West Virginia—covers 27,425 square miles (71,000km2) in Arizona, New Mexico, and Utah, where the three states meet. Several characteristics make it ideal for a consideration of RE. For example, it has (1) a greater area than any other Tribal land holding in the United States; (2) the largest Tribal population in the United States, complete with diverse intratribal opinions; (3) the greatest untapped RE resources of any Tribe in the country; (4) a history of prior energy development; (5) proximity to several quickly growing electricity load centers; and (6) a location, largely within

Arizona, mandated with the highest target for the reduction of greenhouse gases (U.S. Environmental Protection Agency [EPA] 2014).

Divided into 110 chapters, the Navajo Nation includes local governing units, plus five separate agencies as administrative districts. The Navajo Nation has over 300,000 enrolled members, approximately 84% of whom are "full-blooded," the highest proportion in the United States (U.S. Census 2010). Approximately 170,000 of the total Navajo population live within the Navajo Nation's boundaries (U.S. Census 2010), mostly within Arizona. Gender distribution is evenly divided between male and female, while those under 18 years constitute more than one-third of the Navajo Nation's population. Unemployment remains a major concern; currently the rate is 43%, contributing to a low annual per-capita income of about $6,000 (Smith 2007). Taken together, these factors drive the need for economic development, including the creation of more local jobs. The ample energy resources of the Navajo Nation would seem to be an obvious foundation for such development.

Fossil Fuels

For the past several decades, the highest value economic activity on the Navajo Nation has been the mining, transport, and combustion of coal. Each of these three steps in the fuel cycle has produced its own controversy. From 1965 to 2005, coal was sent as a slurry, using fossil water pumped from the overexploited Navajo aquifer, to the Mojave Generating Station 273 miles away in Laughlin, NV (Kelley and Francis 1993). This use, about 3 million gallons per day, was cited as dramatically reducing water levels in sacred springs and streams near surrounding communities (Hall 1992). The plant and slurry line shut down because of mandated Best Available Retrofit Technology (BART) upgrades, uncertainty of obtaining coal from Black Mesa, and concerns about water impacts (Tsosie 2009)

The nearby Kayenta Mine continues to operate, producing about 7.8 million tons per year of low-sulfur, subbituminous coal for Navajo Generating Station (NGS) near Page, AZ. A 2012 Arizona State University study, commissioned by Salt River Project (managers of NGS), estimated that it and the Kayenta Mine together stand to contribute nearly $13 billion to the Navajo Nation economy through sustained jobs and wages, if NGS stays operational until 2044 (Croucher, Evans, and James 2012). While this estimate illustrates the importance of energy development can have on Tribal life, past financial agreements between the developers and the Tribe have come under intense scrutiny as unfair (Voggesser 2010).

Such experiences are invoking greater caution in negotiations, and have even led the Tribe to involve itself more directly in energy development (McPherson and Wolff 1997). For example, starting in 2013, the Navajo Nation shifted from leasing its coal-rich land to outside mining companies, to owning and operating one of its coal mines itself. Reflecting the diversity within this far-flung and diverse Nation, however, not everyone considered this a positive move. "[T]he $85-million purchase of the Navajo coalmine has caused deep concern among critics who fear it saddles the Tribe with the twin burdens of a polluted past and an unsustainable future" (Anonymous 2014, 104). The past has caught up with the future: Scarce water used to slurry coal, low per-ton payments to the Tribe, changes in Navajo culture stemming from overreliance on coal-mining revenues, and forced relocation of Native Americans have all nurtured growing distrust (Schoepfle, Burton, and Begishe 1984; Tsosie 2009; Martin 2011).

When the Tribe considered taking more direct control over its energy resources, attention recently shifted away from mining coal to burning it. Within the past decade, the now defunct Diné Power Authority (DPA), a commercial enterprise of the Navajo Nation, entered into a project agreement with Sithe Global to build the 1500-MW Desert Rock Power Plant, near

Burnham, NM (Powell 2010; Powell and Long 2010). After much debate, in July 2008 the U.S. EPA issued an Air Quality permit for Desert Rock. Nonetheless, not a year later, the permit was reviewed and rescinded due to Tribal and DPA concerns about increased air pollution.

The history of this project underscored that the Navajo Nation is not monolithic. Indeed, Desert Rock exposed intratribal tensions among Navajo chapters and government, plus between the Tribe and the New Mexico state government. In addition, environmental groups and communities expressed concerns about the increase in air pollution from the prospect of a third coal power plant just 20 miles south of the Four Corners and San Juan generating stations (Tsosie 2009). Additionally, communities surrounding the proposed sites expressed concern about the larger environmental impacts such as increased water pollution and the effect on cultural resources in the region (Powell and Curley 2008). More significantly, individuals in the northern agency of the Navajo Nation expressed frustration with the process of proposing and developing the plant, with some individuals holding that the Navajo Nation government did not properly consult the affected communities when the Desert Rock Power Plant was proposed (Powell and Curley 2008). This suspicion culminated with community members making human blockades of the proposed Desert Rock site and denying access to DPA officials or other entities.

Uranium

Preceding fossil fuels by several decades, uranium mining and milling set the stage for enmity between energy developers and the Tribe. These negative sensibilities mostly focused on outside companies and the federal government. Concern centered on the unpredicted and unseen effects on worker health and safety (Eichstaedt 1994; Brugge, Benally, and Yazzie-Lewis 2006). From the 1950s poor mine safety, especially inadequate ventilation, plagued miners and surrounding residents (Brugge, deLemos, and Bui 2007; Bunnell et al. 2010). Many contaminated sites

remain (Arnold 2014). Estimated cancer rates among Navajo teenagers living near mine tailings are 17 times the national average (Smith 2007), and accidental spills have put many Tribal members at risk (Graf 1990; Brugge, deLemos, and Bui 2007). Again illustrating intratribal disagreements, some factions within the Navajo Nation continue discussing uranium exploration as a viable economic development tool, despite this history of environmental contamination and health miseries (Navajo Nation Council 2014).

A significant motivation for the Navajo Nation to sustain or even expand coal operations is the royalties and lease payments that accrue to the tribal treasury. While motivations of economic development can lead to permission by leaders within the Navajo Nation, they are not necessarily compelling arguments for the Navajo Nation public as a body; concerns about protecting land, water, and cultural resources may force aside promises of employment and revenue (Piña and Covington 1993; Shirley 2005, 2009; Necefer et al. 2015).

Renewable Energy Resources

Native holdings west of the Mississippi River hold a substantial percentage of the RE resources in the United States. Of these lands, the Navajo Nation has more developable solar energy than any Tribe, amounting to 100 times the installed capacity of California, the leading state. In addition, the Navajo Nation has an estimated wind generating capacity as large as the installed capacity of Texas, the leading state for wind development (Table 1).

Table 1. Solar and wind potential on the Navajo Nation

Concentrated solar potential (MW	Concentrated solar annual potential generation (MWh)	Solar photovoltaic potential (MW)	Solar photovoltaic potential annual generation (MWh)	Wind generation potential (MW, at 50m hub height)	Wind generating potential (MW, at 70m hub height)
830,000	2.8 billion	1,087,316	2.5 billion	4,562	11,806

Note. Sources: U.S. Department of Energy, Office of Indian Energy (2013) and Brummels (2010)

These Navajo RE resources are attracting attention, even off Tribal lands. For example, the California Public Utility Commission, in February 2013, approved redirecting funds from the sale of sulfur dioxide credits held by Southern California Edison's share of the retired Mohave Generating Station to fund the development of renewable energy projects on tribal lands for sale to the California market (Umberger and Ramo 2013).

Before this recent spurt of interest, however, the ample RE resources on the Navajo Nation remained underdeveloped, despite about 18,000 homes on the Navajo Nation that have no access to electricity (Tarasi et al. 2011). Indeed, the RE potential itself—even when coupled with need, technical acumen, and economic reward—may not be enough to guarantee success for developers (Pasqualetti 2011a, 2011b). Many other factors, especially those resting in perceptual and cultural history, are important in realizing the rewards RE resources can offer.

One factor is that the Navajo Nation was not included in significant pushes of the Rural Electrification Act in the 1935. Rather, a majority of the allocated funding was directed at non-Native cooperatives and associations (Glaser 2009). Second, the Navajo–Hopi Land Settlement Act of 1974 passed by Congress—also known as the "Bennett Freeze"—stopped development of basic infrastructure on partitioned Hopi Tribe and Navajo Nation land until it was repealed in 2010 (Moore 1993; Tarasi et al. 2011). Third, many of the residents without electricity are located in remote locations, miles from existing distribution lines, and often are isolated from other homes, frequently because of spiritual and ancestral connections to the land that they live on (Tarasi et al. 2011).

Solar is slowly advancing in the Nation, most recently through deployment of small-scale solar installations (less than 1100 W), offered through the Navajo Tribal Utility Authority (NTUA) (Energy Information Administration [EIA] 2000; Navajo Tribal Utility Authority (NTUA) n.d.;

Tarasi et al. 2011). These small-scale solar installations are more cost effective than line extensions, as many homes are more than 5 miles from an existing distribution line, and connections costs exceed $50,000/mile, compared to $20,000/remote unit (Energy Information Administration [EIA] 2000; Tarasi et al. 2011). Families who receive these units sign 20-year lease agreements with NTUA, paying around $75 per month. Despite efforts to make these systems affordable, the $75 per month payment can be a significant burden, especially given the high rates of unemployment and poverty across the reservation. To date only around 300 homes are leasing these units from NTUA across the Navajo Nation, raising serious questions about financing and deployment in poor rural communities.

Larger scale RE projects on Navajo Nation land have been limited to systems less than 200 kW. NTUA currently owns and operates seven 35-kW solar photovoltaic (PV) installations that serve to partially power Tribal offices across the Navajo Nation and serve as a public demonstration and opportunity for education (Yurth 2011). Lastly, the Department of Energy's Uranium Mill Tailings Remedial Action Superfund site near Tuba City, AZ, placed a 200-kW solar PV array on a former uranium-milling site to offset energy demands from onsite loads related to reclamation (Gil, Shafer, and Elmer 2012).

Influences on RE Potential

Spiritual and Social Values

For RE development on Navajo Nation lands, the most salient manifestations of spiritual and social values are often those of intergenerational environmental impacts. On the Navajo Nation, such impacts are likely to play a strong role in forming the viewpoints of stakeholder within the context of both resource longevity and the effects of its use. Concerns about the impacts on

future generations are rooted in a concern for culturally defined ethics surrounding appropriate human–environmental interaction. Within the Navajo knowledge system, K'é is a term that describes the interconnected and interdependent realm of human–environment relationships, the desire to restore peace and harmony. Achieving K'é is a prerequisite for successful RE development.

Likewise, the future has origins in the present. Given the concern over sustainably maintaining a society and culture for future generations, Hozhó recognizes the importance of preserving the environment today (Farella 1990; Piña and Covington 1993). More significantly, social relations and cultural identities are, in part, established, reaffirmed, and validated through productive interactions with the environment (Stevenson 1996). Such codes of ethics and relationships inform beliefs about emotional and physical well-being, customary social values, cultural practices, and spiritual creed (Piña and Covington 1993; Stevenson 1996).

Necefer et al. (2015) showed that Navajo people place high importance toward preserving clean air, water, and natural resources not just as a responsibility for future generations, but as a "duty": that is, a duty to preserve culture and identity that will sustain ethics of environmental stewardship hundreds of years in the future. This was not an isolated finding; rather, it was identified across stakeholder groups, including coal miners, oil and gas workers, nongovernmental organizations (NGOs), and government officials. It should be expected to extend to RE workers as well. Indeed, future costs to land, air, and water are likely to play a larger role in shaping stakeholder opinions than the promise of employment or monetary windfall. For some stakeholders, the goal of employment and revenue from energy development could directly conflict with cultural values (Schoepfle, Burton, and Begishe 1984; Necefer et al. 2015).

These values—K'é and Hozhó—in part inform some Navajo stakeholders' beliefs about preserving ties to the land and its stewardship (Farella 1990; Necefer et al. 2015). Many of the unelectrified homes on the Navajo Nation are located in rural and isolated locations, and the associated land leases and grazing rights are often passed down matrilineally (Farella 1990). Small-scale RE installations, such as those promoted by NTUA, could allow these individuals to maintain these spiritual connections to land while providing a source of sustainable electricity. For these reasons, despite several recognized advantages, commercial renewable energy has been slow to gain traction on reservation land. RE development cannot succeed without full appreciation of intergenerational environmental consequences.

Exposure of these concerns also highlights the varied energy futures possible on Navajo Nation land, a variety that makes clear the need to develop a coherent vision of the Navajo Nation's energy future. Stakeholders should avoid considering social issues simply as nuisances, but take them seriously or else risk driving wedges among those who might benefit, including private companies and the Tribal government. Given that the Navajo Nation has much more autonomy over resource decisions than does any other jurisdiction, it will be of critical importance to cast the net widely to capture a wide assortment of opinions before beginning.

Equity

Adding renewable energy to the portfolio of prospective power sources widens the range of potential equity concerns. It was for this reason that public resistance to renewable energy matched the upswing of interest in its potential (Pasqualetti 2011a, 2011b). For example, hundreds of public groups have materialized just to oppose wind projects. They have been targeting issues that are largely unique, such as twirling movement, intermittent noise, and ice throws. There has also been rising opposition to solar projects, again for unique reasons, such as

glint and large land commitments (Pasqualetti 2011a; Ho, Sims, and Christian 2014). For both wind and solar energy, concern about Native American equity has also been conspicuous.

For the Navajo Nation, resistance to renewable energy development, to the degree that it occurs, originates from a combination of factors, including entrenched political and institutional commitments to coal revenues combined with well-funded advertising campaigns by coal interests to protect "business as usual." Some of these conflicts are within Navajo Nation boundaries, while others are between the Navajo public and those of the non-Native community (Williams and Hardison 2013). Co-learning and co-production processes do not guarantee fairness or equal standing, or address power asymmetries (Hill et al. expertise between academia and broader society, have been underexamined specifically in the ways that the larger cultural, legal, economic, and governance contexts influence them.

In this context, it would be incorrect to assume tribal homogeneity. Conflicts are likely to increase as to whether to develop RE, how to develop RE, and who might benefit from such developments. These conflicts also may pose a threat to Navajo Nation government ability to hold the trust of the public, thereby thwarting efforts to promote resource development in the future (Colombi and Smith 2012).

Renewable Energy Regulations and Codes

Renewable energy proposals on Navajo Nation lands will encounter regulations and codes of several organizations and possibly intervention from environmental NGOs. Typically, tribal lands fall into three categories:

- Land held in trust by the Bureau of Indian Affairs (BIA), including individually allotted lands held by individual members.

- Tribal trust lands held by the respective Tribal Nation governments.
- Privately owned parcels that individuals or Tribal Nations may purchase in the open market.

Each category holds its own implications and restrictions for RE development (Wilkins and Lomawaima 2001).

Federal. The federal government can play an important role in approving RE projects. Any use of public lands or federal funding may invoke the National Environmental Policy Act, including a demanding compliance process (Brookshire and Kaza 2013). Public comments may surface from members of the respective Tribe and any other U.S. citizen. Such involvement, while often helpful in mitigating impacts, can also cause delays, added expense, and even project abandonment.

Federal regulations that extend to reservation land can include laws pertaining to air pollution and critical habitat for endangered species. With approval from the U.S. EPA, regulations may be met by a tribal government through advanced tribal management and conservation plans. In essence, the Tribe may take charge of management in lieu of the federal government. Such regulations and the necessary planning must be part of the development considerations for RE projects.

State. States lack regulatory authority over individually allotted lands or Tribal Trust lands. However, fee-simple lands held by individual Native Americans or Tribal Nations are subject to state regulatory authority because the BIA does not hold them in trust. Additionally, projects that may affect or use state lands are subject to state or county approval.

Off-reservation development by the Navajo Nation often proves difficult and protracted. One example of such difficulties comes from a proposed 85-MW wind farm slated for construction on Big Boquillas Ranch in Arizona. The Navajo Nation owns roughly half of this ranch of 730,000 acres. The remainder is in Arizona state trust lands and leased by the Navajo Nation. Many elements for the wind development were in place, including transmission infrastructure. Most permitting and approvals were obtained from Tribal and federal authorities, and a 25-year power purchase agreement with a local utility was in discussion. However, local oppositions and permits have prevented the project from breaking ground. The proposed Boquillas site was additionally subject to state and local authority because it is on private property owned by the Tribe in fee title and not held in trust.

While states do not regulate Tribal lands, their renewable portfolio standards (RPS) can create markets for renewable power that will indirectly affect projects proposed for Tribal lands. For examples, Arizona has a 15% RPS standard by 2025 for investor-owned utilities, rural electric cooperatives, retail, and suppliers. Additionally, for distributed generation there is a 30% "carve out" of the required yearly RPS level in 2012 and thereafter (4.5% of sales in 2025). Half of this must be from residential installations and half from nonresidential, nonutility installations. This requirement might, de facto, be enlarged under the new rule proposed by the U.S. EPA in June 2014 (U.S. EPA 2014), which in its draft form would require a 52% reduction in greenhouse gas emissions from Arizona power plants below 2005 levels. The U.S. EPA, in October 2014, issued a related proposed rule specifically addressing emissions from power plants on Native lands (U.S. EPA 2014). In both cases, achieving the final reductions will likely come in part from RE development.

Tribal. Tribal codes may also exist to further protect respective Tribal resources. Codes can help express the cultural sentiments of a community through written law. Tribal codes also work to guide decision making that can help maintain continuity with changing Tribal governing administrations and staff.

The Navajo Nation Code (NNC) can use several of its provisions to regulate RE development activities (Navajo Nation Department of Economic Development [NNDED] 2009). Codifications that relate to agriculture and livestock, environment, commerce and trade, descendant estates, health and welfare, land, mines and minerals, water, and conservation and wildlife can all add specifications that guide and sometimes restrict development. Navigating effectively and transparently within the code is critical to project implementation and, importantly, social acceptance.

The NNC delegates much of the decision-making power to Tribal agencies such as the Navajo Nation (NN) EPA. Much like the U.S. EPA, the NN EPA works to protect the natural environment, plus the health and the wellbeing of the Navajo people. Therefore, permitting and environmental clearance must meet NN EPA standards and NNC goals in order to gain approval.

Many local chapter governments hold approval rights. Such approval is not always guaranteed. Local chapter governments are responsible for managing grazing rights leases within their jurisdiction. Large land transformations will inevitably impact grazing rights holders and likely create significant tension. The Navajo Nation government rarely uses eminent domain—a common tool on off-reservation land—because it often conflicts with individuals' claims to ceremonial sites and historic grazing lands.

Title V of the Energy Policy Act of 2005 established the Tribal Energy Resource Agreement (TERA) granting authority to Tribal Nations. TERA grants Tribal decision-making authority for leasing and business agreements for energy projects. To date, no Tribe has utilized TERA authority. Permitting measures are also implemented throughout several Navajo Nation jurisdictional levels. Permitting can be made through the Tribal government and local chapters. Local chapters particularly play a role in decision making that affects the associated land base.

The growing body of policy is matched by rising interest in Navajo RE. For example, in 2013 the Navajo Nation passed a comprehensive energy policy that outlined decision-making power surrounding large- and small-scale energy development on tribal land (Navajo Nation Energy Policy [NNEP] 2013). Prior to this policy, no clear guidelines existed on how energy development should proceed, or what authority local governments had over these matters. As a result, development companies sought support and approval from whichever chapter governments seemed to have jurisdiction over the land under consideration (M. Henry personal communication, July 5, 2014). As was commonly the case, these governments possessed neither the technical knowledge nor the financial resources required for projects. In other instances, commercial interests would approach tribal councils, or their members, and if support was not forthcoming, the executive branch would be approached with the same proposal.

A major policy push is to have the Navajo Nation, specifically business entities within the Tribe, take leadership over the management and development of its resources, eschewing the traditional pattern of outsiders taking charge. Additionally, the Navajo Nation has sought to increase the level of engagement and education of local communities that could be impacted by RE development—a departure from past development that failed to engage local interests.

Environmental NGOs. Regardless of the category of landholding, any project is subject to attention from nongovernmental organizations (NGOs). This is especially true for projects considered particularly risky to public health, cultural norms, artifacts, or endangered species. NGOs such as the Sierra Club have rallied people against proposed projects and current development on the Navajo Nation that affect the environment and the health of nearby populations.

Environmental NGOs are not always exogenous. Navajo NGOs—such as Diné CARE, Black Mesa Water Coalition, Eastern Navajo Diné Against Uranium Mining, and "Dooda"

("No") Desert Rock—are well-organized, highly influential organizations capable of swaying Navajo decision making (Powell 2010; Powell and Long 2010). A recent survey of Navajo citizens revealed that NGOs, specifically Navajo-based NGOs, were held in a favorable light by the public, but simultaneously considered a nuisance by the Navajo Nation government. Anyone interested in developing renewable energy on Nation land should be aware of not only jurisdictional distinctions, but also tribal and nontribal NGOs.

Discussion—RE Pros and Cons

RE proposals on Navajo Nation land hold attractions and drawbacks. Project developers must recognize, assess, and integrate both views in any successful plan for future use of these resources. First, development plans must consider the inherent characteristics of the resource themselves. For example, solar insolation is very similar across the entirety of tribal lands, whereas wind energy is site specific. This means that while the wind resource is already generally mapped, specific installations of wind-generating equipment will require documented

monitoring for at least a year. In contrast, solar development, which is usually less intrusive, can be installed quickly and yield acceptable results.

Second, resource characteristics must comport with some of the more generalized characteristics of the Navajo Nation. Solar energy, especially PV, is quiet and relatively maintenance free. Installation is not technically difficult. The most likely equipment failure will be the inverter, but it can be removed and replaced easily with relatively simple skills.

Installing and operating wind turbines, even those of small size, are more complicated in several ways than installing and operating solar modules. Moreover, wind turbines spin, rotate, stop and start, and produce noise that is especially noticeable on these quiet lands.

Third, installing and operating solar and wind equipment on tribal lands may hold additional challenges because of their impacts to wildlife, landscapes, and culture. For example, sacred landscapes and viewsheds (Abbott 2010) are likely to be affected by the installation of large-scale energy resource projects. In addition to landscape impacts, disturbances to habitats and access to medicinal-herb and traditional food gathering locations may severely disrupt ceremonial practices already threatened by climate change (Lynn et al. 2013; Voggesser et al. 2013; Maldonado, Colombi, and Pandya 2014).

Fourth, decisions must consider scale. While RE resources hold many advantages, these will vary among the options of distributed, community, and commercial scale. As the scale increases, so too does the potential for outside interventions to intrude on Navajo cultural norms, even as they increase the potential for economic development, job creation, and the Tribal revenue generation. At the largest scale of deployment, revenues could be substantial and totally under the control of the Navajo Nation. However, it will be critically important for the Navajo Nation

and other tribes to weigh the potential costs to the environment and cultural traditions from these large-scale installations with the potential revenue and employment. For the Navajo people, spiritual connections to land play a significant role in the public's perception of land transformations from any energy resource, including RE. These relationships are likely to be encountered to various degrees in other Native communities outside the Navajo Nation.

Electrification efforts across the Navajo Nation have implications for other tribes as they aim to meet internal electricity demand at affordable prices given remote locations. According to the U.S. Department of Energy (DOE), American Indians consume about 20% less electricity per person but pay around 15–20% more for electricity, often due to increased transmission costs. As seen with the NTUA's efforts, part of this demand could be met by small RE installations at tribal customers' homes. Providing access to electricity in impoverished Navajo communities and ensuring financial solvency of programs that provide these systems have presented significant challenges for NTUA. Relying on flat-rate monthly payments to maintain this system is daunting especially in contexts of high poverty and unemployment common across Indian country. Despite the challenges of financing, small and distributed RE systems could play a significant role in maintaining spiritual relationships to land and historic practices of land tenure. Such systems could allow individuals and communities to live in remote locations while being able to benefit from electrification.

Conclusions

We situated this article within the overarching paradox of plenty; while the Navajo Nation holds substantial energy resources, there nevertheless exists persistent energy poverty and slow

economic growth from RE. We draw three specific conclusions for the Navajo Nation, posed here as reflections on specific questions:

Question 1—How do Past and Current Experiences Inform Future Developments?

Development of conventional energy resources of the past have left a strong environmental legacy of suspicion and misgivings that carries over to future RE proposals. While the promise of lower environmental impacts that accompany RE is attractive, the legacy of negligent business practices is interfering with acceptability; many Navajo citizens are skeptical of the motivations of non-Navajo companies and investors, as well as of the motivations of the Navajo Nation government that has collaborated with these entities.

To erase or at least begin to mitigate such suspicion, those promoting RE development should be clear-eyed about the prominence of perceived intergenerational impacts that will emerge in response to new proposals. Future development must ensure that proposals fit into existing strategic plans of Tribal government and other Navajo interest groups, including social and cultural benefits for the community beyond per-capita payments and other capital rewards.

There must be a recognition that strategic visions of the Navajo Nation and of local Navajo communities do not always align, and an important step in any development process will be to ensure that there is a consistent view of how RE proposals match with the interests of all stakeholder groups.

Question 2—How do Social and Cultural Differences Influence Future Development?

Identifying significantly different perspectives of future stakeholders must avoid the trap of viewing social issues simply as challenges to overcome. While most people might welcome the promise of economic gains from such activities, projects embraced by Navajo leadership may not

be supported by the Navajo public as a body. Ensuring that these values are explicitly included and guide decision making can increase public buy-in and support for RE projects.

Protecting environmental and cultural resources may be more compelling than enhancing employment opportunities and revenue. Ensuring that cultural and spiritual values for the environment guide decisions on energy resources may prove to be more significant than promises of employment or increased tribal revenue. RE on Tribal lands will depend on traditional environmental knowledge, appreciation for ecosystem conservation, and a high a degree of Tribal control over resources. Concerns such as high unemploymentand the need for revenue generation, while important, may not be considered the most pressing by Navajo people in light of larger environmental impacts. Many Navajos are primarily concerned with the long-term environmental impacts, sociocultural costs, and the sustainability of the Navajo society. Proposed RE projects that aim to place these outcomes ahead of revenue generation and employment have a greater chance of success and long-term viability.

Question 3—How Does Addressing the Social Issues of RE Development on Navajo Nation Lands fit Within the Larger Context of RE Potential on All Native American Lands?

First, RE proposals on the Navajo Nation help outline a scenario of promise throughout Indian Country, a promise that accounts for tribal cultural, social, and political concerns. Second, RE development on the Navajo Nation can illustrate how RE development in Native communities can remedy chronic energy poverty, gain increased energy security, and develop low-carbon energy sources more broadly.

In specific terms, Navajo distrust of energy development is aimed not only toward outside entities, but also toward Tribal decision makers. For RE development to grow, only meaningful

on-the-ground collaboration has a chance to gain trust between Navajo Nation tribal members and Tribal decision makers. We argue that such collaboration stems from ascertaining the needs and recommendations of tribal citizens by Tribal decision makers and then decision makers creating and executing a vision that meets and delivers those needs.

Renewable energy development by the Navajo Nation government provides an opportunity to regain the trust of Navajo Nation people by learning from past practices and by making social and environmental concerns primary, elevating them above economic growth and revenue generation. The process of Tribal decision makers and developers ensuring stakeholder buy-in and community support will take significantly more time and effort than is customary elsewhere. Without such sensitivity, any RE proposal is likely to face significant opposition and disappointing progress.

Funding

Partial funding for this research was provided by National Science Foundation (NSF) grant DEB-1010495.

References

1. Abbott, J. A. (2010). The localized and scaled discourse of conservation for wind power in Kittitas County, Washington. *Society & Natural Resources* 23 (10):969–85. doi:10.1080/08941920802438634

2. Anonymous. (2014). Tribe at a crossroads: The Navajo nation purchases a coal mine. *Environmental Health Perspectives* 122 (4):104–7.

3. Arnold, C. (2014). Once upon a mine: The legacy of uranium on the Navajo Nation. *Environmental Health Perspectives* 122 (2):44–49. doi:10.1289/ehp.122-a44

4. Brookshire, D., and N. Kaza. (2013). Planning for seven generations: Energy planning of American Indian tribes. *Energy Policy* 62:1506–14. doi:10.1016/j.enpol.2013.07.021

5. Brugge, D., T. Benally, and E. Yazzie-Lewis. (2006). *The Navajo people and uranium mining*. Albuquerque, NM: University of New Mexico Press.

6. Brugge, D., J. L. deLemos, and C. Bui. (2007). The Sequoyah Corporation fuels release and the Church Rock spill: Unpublicized nuclear releases in American Indian communities. *American Journal of Public Health* 97 (9):1595–600. doi:10.2105/ajph.2006.103044

7. Brummels, G. (2010). Wind energy mapping using geographic information systems. MA thesis, Northern Arizona University, Department of Geography, Planning, and Recreation, Flagstaff, AZ.

8. Bunnell, J. E., L. V. Garcia, J. M. Furst, H. Lerch, R. A. Olea, S. E. Suitt, and A. Kolker. (2010). coal combustion and respiratory health near Shiprock, New Mexico. *Journal of Environmental Public Health* 2010:1–14. doi:10.1155/2010/260525

9. Burningham, K., J. Barnett, and G. Walker. (2015). An array of deficits: Unpacking NIMBY discourses in wind energy developers' conceptualizations of their local opponents. *Society & Natural Resources* 28 (3):246–60. doi:10.1080/08941920.2014.933923

10. Colombi, B. J., and C. L. Smith. (2012). Adaptive capacity as cultural practice. *Ecology and Society* 17 (4):13. doi:10.5751/es-05242-170413

11. Croucher, M., A. Evans, and T. James. (2012). *Navajo Generating Station and Kayenta Mine: An economic impact study*. Tempe, AZ: Arizona State University, L. William Seidman Research Institute, W. P. Carey School of Business. http://www.ngspower.com/pdfx/SRPASUNGS.pdf (accessed December 10, 2014).

12. Eichstaedt, P. H. (1994). *If you poison us: Uranium and Native Americans*. Santa Fe, NM: Red Crane Books.

13. Energy Information Administration. (2000). *Energy consumption and renewable energy development potential on Indian lands*. Washington, DC: U.S. Department of Energy.

14. Farella, J. R. (1990). *The main stalk: A synthesis of Navajo philosophy*. Tucson, AZ: University of Arizona Press.

15. Gil, A., D. Shafer, and J. Elmer. (2012). U.S. Department of Energy Office of Legacy Management's Tribal Interactions–12513. WM Symposia, Tempe, AZ. http://www.wmsym.org/archives/2012/ papers/12513.pdf

16. Glaser, L. S. (2009). *Electrifying the rural American West: Stories of power, people, and place*. Norman, OK: University of Nebraska Press.

17. Graf, W. L. (1990). Fluvial dynamics of thorium-230 in the Church Rock Event, Puerco River, New Mexico. *Annals of the Association of American Geographers* 80:327–42. doi:10.1111/j.1467-8306.1990.tb00300.x

18. Hall, K. (1992). Changing woman, Tukunavi and coal: Impacts of the energy industry on the Navajo and Hopi reservations. *Capitalism Nature Socialism* 3 (1):49–78. doi:10.1080/10455759209358473

19. Hill, R., C. Grant, M. George, C. J. Robinson, S. Jackson, and N. Abel. (2012). A typology of indigenous engagement in Australian environmental management: Implications for knowledge integration and social-ecological system sustainability. *Ecology and Society* 17 (1):23. doi:10.5751/es-04587-170123

20. Ho, C. K., C. A. Sims, and J. M. Christian. (2014). Evaluation of glare at the Ivanpah solar electric generating system. SAND2014–15847, Sandia National Laboratory Report.

21. Kelley, K., and H. Francis. (1993). Places important to Navajo people. *American Indian Quarterly* 17 (2):151–69. doi:10.2307/1185525

22. Lynn, K., J. Daigle, J. Joffman, F. Lake, N. Michelle, D. Ranco, and P. Williams. (2013). The impacts of climate change on tribal traditional foods. *Climatic Change* 120(3):545–56.

23. Maldonado, J. K., B. J. Colombi, and R. Pandya. (2014). *Climate change and indigenous peoples in the United States: Impacts, experiences, and actions*. New York, NY: Springer Press.

24. Martin, J. A. (2011). Significant traditional cultural properties of the Navajo people. Traditional Culture Program, Navajo Nation Historic Preservation Department, Window Rock, AZ.

25. McPherson, R., and A. Wolff. (1997). The Utah Navajo and the poverty, politics, and petroleum: Aneth oil field. *American Indian Quarterly* 21 (3):451–70.

26. Moore, J. D. (1993). Justice too long delayed on the Navajo reservation: The Bennett freeze as a case study in government treatment of Native Americans. *Harvard Human Rights Journal* 6:222–29.

27. Navajo Nation Council. (2014). *Council blocks proposed uranium recovery project*. Window Rock, AZ: The Navajo Nation Council. http://www.navajonsn.gov/News%20Releases/NNCouncil/2014/july/FOR%20IMMEDIATE%20RELEASE%20%20Navajo%20Nation%20Council%20blocks%20proposed%20in%20situ%20uranium%20recovery%20project.pdf (accessed January 20, 2016).

28. Navajo Nation Department of Economic Development. (2009). 2009–2010 comprehensive economic development strategy: The Navajo Nation. http://www.navajobusiness.com/pdf/CEDS/CED_NN_Final_09_10.pdf (accessed January 20, 2016).

29. Navajo Nation Energy Policy. (2013). 0276–13. http://www.navajonsn.gov/News%20Releases/Other/2013/0276-13WebsiteFile.pdf (accessed July 2014).

30. Navajo Tribal Utility Authority. (n.d.). NTUA solar program FAQ's. http://www.ntua.com/solar/ FAQs.html (accessed April 23, 2015).

31. Necefer, L., G. Wong-Parodi, P. Jaramillo, and M. J. Small. (2015). Energy development and Native Americans: Values and beliefs about energy from the Navajo Nation. *Energy Research & Social Science* 7:1–11. doi:10.1016/j.erss.2015.02.007

32. Pasqualetti, M. J. (2011a). Opposing wind energy landscapes: A search for common cause. *Annals of Association of American Geographers* 101 (4):907–17. doi:10.1080/00045608.2011.568879

33. Pasqualetti, M. J. (2011b). Social barriers to renewable energy landscapes. *Geographical Review* 101 (2):201–23. doi:10.1111/j.1931-0846.2011.00087.x

34. Piña, V. Y., and W. W. Covington. (1993). Conservation biology, restoration ecology, and a Navajo view of nature. General Technical Report RM-247, USDA Forest Service. http://library.eri.nau.edu/gsdl/collect/erilibra/import/YazzieEtAl_1993_SustainableEcological.pdf (accessed January 20, 2016).

35. Powell, D. E. (2010). Landscapes of power: An ethnography of energy development on the Navajo Nation. PhD dissertation, Department of Anthropology, University of North Carolina-Chapel Hill, Chapel Hill, NC.

36. Powell, D. E., and A. Curley. (2008). K'e, Hozhó, and non-governmental politics on the Navajo Nation: Ontologies of difference manifest in environmental activism. *Anthropological Quarterly* 81:17–58.

37. Powell, D. E., and D. J. Long. (2010). Landscapes of power: Renewable energy activism in Diné Bikéyah. In *Indians and energy: Exploitation and opportunity in the American Southwest*, ed. S. Smith and B. Frehner 231–62. Santa Fe, NM: School for Advanced Research Press.

38. Schoepfle, M., M. Burton, and K. Begishe. (1984). Navajo attitudes toward development and change: A unified ethnographic and survey approach to an understanding of their future. *American Anthropologist* 86 (4):885–904. doi:10.1525/aa.1984.86.4.02a00040

39. Shirley, J. (2005). *Desert rock energy project will help Navajo Nation regain its economic independence*. The Navajo Nation, Office of the President. http://www.navajo-nsn.gov/images/pdf%20releases/George%20Hardeen/march07/Desert%20Rock%20Energy%20Project%20Will%20Help%20Navajo%20Nation%20Regain%20Its%20Economic%20Independence_March.pdf (accessed January 20,2016).

40. Shirley, J. (2009). *Navajo President Joe Shirley, Jr. places Desert Rock project into international perspective during State of Nation address*. The Navajo Nation, Office of the President and Vice President. http://www.navajo-nsn.gov/News%20Releases/George%20Hardeen/Apr09/090422pres_Navajo%20president%20puts%20Desert%20Rock%20into%20international%20perspective.pdf (accessed January 20, 2016).

41. Smith, K. (2007). Pollution of the Navajo Nation lands. Paper presented at the United Nations' International Expert Group Meeting on Indigenous Peoples and Protection of the Environment, Khabarovsk, Russian Federation, August.

42. Stevenson, M. G. (1996). Indigenous knowledge in environmental assessment. *Arctic* 49 (3):278–91. doi:10.14430/arctic1203

43. Tarasi, D., C. Alexander, J. Nania, and B. Gregory. (2011). 18,000 Americans without electricity: Illuminating and solving the Navajo energy crisis. *Colorado Journal of Environmental Law and Policy* 22 (2):263.

44. Tsosie, R. (2009). Climate change, sustainability, and globalization: Charting the future of indigenous environmental self-determination. *Environmental & Energy Law & Policy Journal* 4 (2):188–255.

45. Umberger, A., and A. Ramo. (2013). California Public Utilities Commission applies utility's acid rain program credit sale proceeds to renewable energy projects on Native American lands. http://ggucuel.org/california-public-utilities-commission-applies-utility's-acid-rain-program-credit-saleproceeds-to-renewable-energy-projects-on-native-american-lands (accessed April 22, 2015).

46. U. S. Department of Energy, Office of Indian Energy. (2013). Developing clean energy projects on tribal lands: Data and resources for Tribes. http://www.nrel.gov/docs/fy13osti/57748.pdf (accessed November 1, 2014).

47. U. S. Environmental Protection Agency. (2014). Carbon pollution emission guidelines for existing stationary sources: Electric utility generating units. https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electricutility-generating (accessed December 16, 2014).

48. Voggesser, G. (2010). The evolution of federal energy policy for tribal lands and the renewable energy future. In *Indians and energy: Exploitation and opportunity in the American Southwest*, ed. S. Smith and B. Frehner 55–88. Santa Fe, NM: School for Advanced Research Press.

49. Voggesser, G., K. Lynn, J. Daigle, F. K. Lake, and D. Ranco. (2013). Cultural impacts to Tribes from climate change influences on forests. *Climatic Change* 120(3):615–26.

50. Wilkins, D. E., and K. T. Lomawaima. (2001). *Uneven ground: American Indian sovereignty and federal law*. Norman, OK: University of Oklahoma Press.

51. Williams, T., and P. Hardison. (2013). Culture, law, risk and governance: Contexts of traditional knowledge in climate change adaptation. *Climatic Change* 120(3):531–44.

52. Yurth, C. (2011). LEEDing by example: NTUA goes green with new Chinle facility. http://navajotimes.com/news/2011/0711/072311green.php#.VThoL61Viko (accessed April 19, 2015).

Chapter 2. Identifying Barriers and Pathways to Success for Renewable Energy Development on American Indian Lands

Thomas E. Jones and Len E. Necefer

This paper has been approved for dissemination by Sandia National Laboratories: SAND2016-3113 J.

Abstract

American Indian tribes possess lands rich with renewable energy (RE) resources. Tribes have great potential and need to develop these resources, yet face a host of barriers that continue to impede development. Understanding these challenges as well as the pathways that can be taken to overcome them may facilitate more economic development to meet community needs and better position tribes to play a role in securing a low-carbon energy future for the United States. This paper presents the results of an expert elicitation of 24 tribal energy experts from federal, tribal, academic, and private industry backgrounds to identify barriers and opportunities for federally recognized tribes in the lower 48 states. Experts identified a number of unique challenges facing tribes including financing and funding, infrastructure, tribal leadership and staff, state-level influence, and partnerships. Cultural factors were seen only to be of concern with large-scale development. Tribal sovereignty is a significant motivation for RE development and has yet to be fully realized. Cultural considerations are critical to the success of future projects; smaller residential and community-scale projects may be a better fit. Improving partnerships between tribes and the private sector can increase RE deployment and overcome historical distrust. States can have a double-ended influence on projects within tribal lands through taxation.

Introduction

American Indian lands have significant energy resource potential both from non-renewable and renewable resources that could serve to ensure energy security and a low carbon energy future for the benefit of tribes as well as the United States. American Indian lands alone comprise roughly 5% of the land base of the United States yet they are estimated to contain 10% of the country's energy resources including roughly 40% of uranium, 30% low sulfur coal, and 4% oil and gas (EIA, 2000; Cornell, 1988; MacCourt & Wynne, 2010). The National Renewable Energy Laboratory (NREL) estimates that there is 17,600 billion kWh/year of solar energy potential and 535 billion kWh/year of wind energy potential on Indian Lands in the lower 48 states. This is enough to power millions of homes (Doris, et al., 2013; MacCourt & Wynne, 2010). Economic and energy development needs in American Indian communities match the energy potential. A disproportionate number of American Indian households live in energy poverty (Adamson, 2003; Snipp, 1986). The Energy Information Administration (2000) reported that 14.2% of all Native American households have no access to electricity, which is more than ten times the national average. Of the 14.2% that are without electricity, the Navajo Nation in the Southwestern U.S. accounts for roughly 75% (EIA Report, 2000). Despite the vast resources and need for energy, the potential for development has not fully materialized.

Historically, energy resource development on tribal lands has been a rocky road to economic development and while renewable energy holds promise for tribes, there remain significant barriers and misconceptions about them. Decades of developing coal, uranium, petroleum and hydropower have provided significant employment and revenue while also negatively impacting the environment, cultural resources, and human health (Adamson, 2003; Brugge & Goble, 2002; deLemos et al., 2009; USEPA, 2007). Almost all development occurring on tribal land has been

operated and managed by non-tribal entities (Adamson, 2003; Grossman, 2005; Krepps, 1991; LaDuke, 1994; Snipp, 1986; Rosser, 2008; Trosper, 2009). As a result of these arrangements, requisite knowledge and capacity for future energy development within tribal governments and communities is lacking (Royster, 2009). The 567 American Indian tribes contend with similar yet different circumstances when choosing to pursue the development of energy resources.

Previously published research identifies many challenges to developing renewable energy that are not specific to tribal lands. These studies have identified challenges including uncertainty regarding state and federal financial incentives, federal policy, securing financing and funding for projects, high costs of infrastructure, impacts on wildlife and the environment, and public opposition (Abbott, 2010; Amin & Gellings, 2006; Bird et al., 2005; Erickson et al., 2005; Kimmell & Stalenhoef, 2011; Kronk, 2009; Greenhowe, 2013; Regan, 2013). Specific to tribes, Brookshire and Kaza (2013) and Kronk (2009) found that federal incentives and advisory services were key to developing capacity and thus energy planning and resource development. Tribes that have formalized energy plans or visions are more likely to develop their energy resources than those that do not (Brookshire & Kaza, 2013; Middlemiss & Parrish, 2010; Tano, 2006). Many tribes are located in rural and remote regions where high costs of infrastructure are a significant challenge (Kronk, 2009; Unger, 2009). Regan (2013) argues that energy development and thus economic development have been stifled by federal policies toward American Indians, trust-responsibility agreements, and the federal bureaucratic processes that govern parts of tribal energy resource development. Federal policy has played a significant role vís-a-vís energy development on tribal lands. In fact, federal departments with influence and legal power over tribal resources - such as the Department of the Interior - have been

instrumental in pushing certain forms of energy resource development such as coal, petroleum, uranium, and hydropower (Adamson, 2003; Royster, 2009; Snipp, 1986).

To date, minimal research has engaged decision-makers and experts in Indian energy on what they understand to be the barriers to renewable energy development on tribal land and the appropriate pathways for addressing them. In this article we present the results of an expert elicitation to elucidate the current state of challenges facing American Indian tribes in the lower 48 states in developing renewable energy and also potential policy pathways for addressing these challenges. We limit this focus to the tribes in the lower 48 continental United States as the legal frameworks of Alaska Native Villages and corporations as well as Hawaiian natives are significantly different, which indicates that the barriers in those contexts are unique. Experts were selected based upon their work in areas related to energy development in Indian Country. They hold positions in federal and tribal governments, academia, and private industry.

Methods

This research relied on an expert elicitation to present a snapshot of tribal energy development barriers by persons working directly within the field of Indian energy. We employed the Delphi method, which relies on multiple interactions with experts in order to reach a consensus (Koontz & O'Donnell, 1976; Linestone & Turoff, 1975). In the first round, experts' opinions are synthesized into a single set of findings that are then returned to experts for feedback. If an expert disagrees with a particular finding they are asked to provide an explanation for their disagreement (Koontz & O'Donnell, 1976; Linestone & Turoff, 1975). We selected this method due to the geographic separation between identified experts as well as political constraints making it untenable to convene them. The possibility for a spurious consensus to result from the

iterative questionnaires is one potential drawback of this approach. This drawback can be mitigated through the careful and comprehensive selection of experts to ensure that there is a wide range of expertise and backgrounds (Dalkey, 1972; Linestone & Turoff, 1975).

The first round of expert elicitation involved a questionnaire covering a set of topics identified from previous scholarship on renewable energy on tribal lands (Brookshire & Kaza, 2013; GAO, 2015; Greenhowe, 2013; Kronk, 2009; MacCourt & Wynne, 2010; Meison & Eberich, 2009; Middlemiss & Parrish, 2010; Miles, 2005; Regan, 2013; Tano, 2006; Unger 2009)(Appendix A). We developed a protocol that used open-ended and non-directive questions on the following topics: (1) First we asked experts to describe their involvement with renewable energy on tribal lands; (2) Next we asked experts what direction they saw renewable energy development on tribal land taking in the next five to ten years; (3) We then asked experts to rank barriers in order of importance (Appendix A) and explain their choices; (4) We then asked experts to explain how the most significant of these barriers would be addressed in the next decade; Questions (5-9) are focused on five areas of Native Nation Building Theory (Jorgenson, 2007) which includes: Role of sovereignty (5), capable governing institutions (6), cultural factors (7), strategic planning (8), and leadership (9). Lastly, we asked about the role of federal programs (10). Federal programs is not considered a part of Native Nation Building Theory, however, previous scholarship by Brookshire and Kaza (2013) has identified this area as significant to energy development on tribal lands.

We identified experts in the field of Indian energy by the following criteria: (1) Individuals who have worked in federal or tribal governments, national laboratories, private industry, or academia; (2) Individuals within this group who have, or currently work, directly on issues related to Indian energy; and finally (3) a minimum of five years work experience in tribal

energy issues. The names, positions, and direct work affiliations of the experts we interviewed remained confidential. We provided confidentiality to the experts to elicit insight uninhibited by concerns of potential repercussions for disclosing personal opinions regarding challenges to energy development on tribal lands. We contacted experts using a snowball sampling method between July 2014 and September 2015. The surveys were conducted in-person, over the telephone, or participants could fill out written responses to each of the questions. Nine interviews were conducted over the phone, seven were conducted in-person, and eight were returned as a written document. Twenty-four experts total were interviewed, representing federal agencies such as the Department of Energy (DOE) and the Department of Interior (DOI) (9), academia (3), private industry – legal, RE developers, etc. (2), and experts from tribes located in: Arizona & New Mexico (4), Alaska (1), California (3), Oregon (1) and Washington (1). We then performed a content analysis of the questionnaires and interviews using an open-coding method in which both researchers worked independently to identify patterns within each of the responses[1]. We then provided the results of this analysis back to experts for feedback and comment on agreement or disagreement with the results.

Results

Barriers to RE development and how they will be addressed

The most significant barriers identified by experts were financing and funding (18 mentions – 63% Experts); infrastructure (15 mentions – 50% Experts); tribal leadership and staff (13 mentions – 54% Experts); customer (12 mentions – 38% Experts); partnerships (9 mentions –

[1] This process assigns a word or phrase (i.e. a code) to an individual response. After one round of coding a "master" coding list was identified and was used to recode the interviews (Appendix 2). Participants could mention codes more than once due to the open-ended protocol.

25% Experts); community vision, stakeholder buy-in and cultural acceptance (8 mentions – 21% Experts); depends on regulation, incentives, and energy market (7 mentions – 29% Experts); strategic energy planning (6 mentions – 21% Experts); permitting (6 mentions – 25% Experts); and federal policy and programs (6 mentions – 21% Experts); (Table 2.).

Table 2: Experts were asked to describe what they believe are the most significant barriers to renewable energy development on tribal lands. Numerical values are mentions by experts whom expressed this view, number of experts who mentioned the code and percentage of experts whom expressed this view.

Most Significant Barrier	# Mentions	# Experts	% Experts
Financing / Funding	18	15	63%
Infrastructure	15	12	50%
Tribal Leadership / Staff	13	13	54%
Customer	12	9	38%
Partnerships	9	6	25%
Community vision & Stakeholder buy-in & Cultural acceptance	8	5	21%
Depends on Regulation, Incentives, Energy Market	7	7	29%
Permitting	6	6	25%
Strategic Energy Planning	6	5	21%
Federal policy & programs	6	5	21%

Additionally experts were asked about what they saw as the least significant barriers to renewable energy development on tribal lands currently are.The least significant barriers identified by the experts were non-tribal governments and public opinion (11 mentions – 46% Experts); tribal sovereignty (11 mentions – 46% Experts); community vision and stakeholder buy-in and cultural acceptance (6 mentions – 25% Experts); planning and project development (6 mentions – 25% Experts); customer (5 mentions – 21% Experts); depends on regulation, incentives, and energy market (5 mentions – 21% Experts); partnerships (5 mentions – 21% Experts); financing and funding (5 mentions – 21% Experts); infrastructure (4 mentions – 17% Experts); and permitting (4 mentions – 17% Experts); (Table 3.).

Table 3: Experts were asked to describe what they consider to be the least significant barriers to renewable energy development on tribal lands. Numerical values are mentions by experts whom expressed this view, number of experts who mentioned the code and percentage of experts whom expressed this view.

Least Significant Barrier	# Mentions	# Experts	% Experts
Non-tribal governments / public opinion	11	11	46%
Tribal Sovereignty	11	11	46%
Community vision & Stakeholder buy-in & Cultural acceptance	6	6	25%
Planning & Project development	6	6	25%
Customer	5	5	21%
Depends on Regulation, Incentives, Energy Market	5	5	21%
Partnerships	5	5	21%
Financing / Funding	5	5	21%
Infrastructure	4	4	17%
Permitting	4	4	17%

Experts discussed how these barriers to renewable energy development could be addressed by mentioning: Depends on regulation, incentives, energy market (14 mentions – 54% Experts); federal policy and programs (8 mentions – 29% Experts); education and capacity building (7 mentions – 29% Experts); intertribal collaboration (6 mentions – 25% Experts); community vision and stakeholder buy-in and cultural acceptance (4 mentions – 13% Experts); climate change impacts and critical for Alaska (3 mentions – 13% Experts); infrastructure (3 mentions – 13% Experts); capable institutions present (2 mentions – 8% Experts); partnerships (2 mentions – 8% Experts);and strategic energy planning (2 mentions – 8% Experts) (Table 4.).

Table 4: Experts were asked how renewable energy barriers would be addressed in the next five to ten years. Numerical values are mentions by experts whom expressed this view, number of experts who mentioned the code and percentage of experts whom expressed this view.

Addressing Barriers	# Mentions	# Experts	% Experts
Depends on Regulation, Incentives, Energy Market	14	13	54%
Federal policy & programs	8	7	29%
Education & Capacity building	7	7	29%
Intertribal collaboration	6	6	25%
Community vision & Stakeholder buy-in & Cultural acceptance	4	3	13%
Climate Change impacts & Critical for Alaska	3	3	13%
Infrastructure	3	3	13%
Capable institutions present	2	2	8%
Partnerships	2	2	8%
Strategic Energy Planning	2	2	8%

Future of RE development on tribal lands

On the topic of the direction of future energy development on tribal lands, the most frequently coded responses are the development of more small-scale projects (28 mentions – 100% Experts); depends on regulation, incentives, and the larger energy market (20 mentions – 62% Experts); more large-scale projects (13 mentions – 42% Experts); federal policy and programs (10 mentions – 33% Experts); financing and funding (9 mentions – 33% Experts); energy independence: tribally managed projects, utilities (8 mentions – 33% Experts); education and capacity building (8 mentions – 29% Experts); partnerships (8 mentions – 25% Experts); climate change impacts and critical for Alaska (6 mentions – 25% Experts); and, finally, infrastructure (6 mentions – 21% Experts) (Table 5.).

Table 5: Experts were asked what direction they saw the future of renewable energy development on tribal lands taking in the next decade. Shown in numerical form are mentions by experts whom expressed this view, number of experts who mentioned the code and percentage of experts whom expressed this view.

Future of RE Development on Tribal Lands	# Mentions	# Experts	% Experts
More small-scale projects	28	24	100%
Depends on Regulation, Incentives, Energy Market	20	15	63%
More large-scale projects	13	10	42%
Federal policy & programs	10	8	33%
Financing / Funding	9	8	33%
Energy independence: Tribally managed projects, utilities	8	8	33%
Education & Capacity building	8	7	29%
Partnerships	8	6	25%
Climate Change impacts & Critical for Alaska	6	6	25%
Infrastructure	6	5	21%

Role of Tribal Leadership, Staff, and Governance in RE Development

Experts closely identified tribal leadership and staff with lacking capacity (21 mentions – 54% Experts); education and capacity building (19 mentions – 54% Experts); detrimental to development (14 mentions – 38% Experts); important for success (9 mentions – 33% Experts); time constraints (9 mentions – 25% Experts); champions and leadership (8 mentions – 25% Experts); tribes not taking risk (7 mentions – 21% Experts); community vision and stakeholder buy-in and cultural acceptance (6 mentions – 21% Experts); capable institutions present (5 mentions – 21% Experts); and federal policy and programs (5 mentions – 13% Experts) (Table 6.).

Table 6: Experts were asked about the role of tribal leadership and staff with renewable energy development on tribal lands. Numerical values are mentions by experts whom expressed this view, number of experts who mentioned the code and percentage of experts whom expressed this view.

Tribal Leadership / Staff	# Mentions	# Experts	% Experts
Lacking capacity	21	13	54%
Education & Capacity building	19	13	54%
Detrimental to development	14	9	38%
Important for success	9	8	33%
Time constraints	9	6	25%
Champions / Leadership	8	6	25%
Tribes not taking risk	7	5	21%
Community vision & Stakeholder buy-in & Cultural acceptance	6	5	21%
Capable institutions present	5	5	21%
Federal policy & programs	5	3	13%

Experts mentioned that the role of tribal governance in renewable energy development was most closely identified with separation of business and governance (17 mentions – 58% Experts); capable institutions present (10 mentions – 38% Experts); detrimental to development (9 mentions – 25% Experts); continuity and term-limits (7 mentions – 25% Experts); tribal policy and regulation (6 mentions – 21% Experts); important for success (4 mentions – 13% Experts); education and capacity building (3 mentions – 13% Experts); time constraints (3 mentions – 13% Experts); community vision and stakeholder buy-in and cultural acceptance (2 mentions – 8% Experts); and each tribe is unique (2 mentions – 8% Experts) (Table 7.).

Table 7: Experts were asked about the role of governance with renewable energy development on tribal lands. Numerical values are mentions by experts whom expressed this view, number of experts who mentioned the code and percentage of experts whom expressed this view.

Governance	# Mentions	# Experts	% Experts
Separation of business and governance	17	14	58%
Capable institutions present	10	9	38%
Detrimental to development	9	6	25%
Continuity & Term-limits	7	6	25%
Tribal policy and regulation	6	5	21%
Important for success	4	3	13%
Education & Capacity building	3	3	13%
Time constraints	3	3	13%
Community vision & Stakeholder buy-in & Cultural acceptance	2	2	8%
Each tribe is unique	2	2	8%

Strategic Energy Planning

When asked about strategic energy planning within tribal governments experts mentioned community vision and stakeholder buy-in and cultural acceptance (21 mentions – 46% Experts); important for success (16 mentions – 58% Experts); can help overcome institutional barriers (8 mentions – 29% Experts); other community issues significant (6 mentions – 25% Experts); financing and funding (6 mentions – 21% Experts); land use impacts (landscapes and transformation) (3 mentions – 13% Experts); education and capacity building (3 mentions – 13% Experts); planning and project development (2 mentions – 8% Experts); partnerships (2 mentions – 8% Experts); and capable institutions present (2 mentions – 8% Experts) (Table 8.).

Table 8: Experts were asked about the role of strategic energy planning with renewable energy development on tribal lands. Numerical values are mentions by experts whom expressed this view, number of experts who mentioned code and percentage of experts whom expressed this view.

Strategic Energy Planning	# Mentions	# Experts	% Experts
Community vision & Stakeholder buy-in & Cultural acceptance	21	11	46%
Important for success	16	14	58%
Can help overcome institutional barriers	8	7	29%
Other community issues significant	6	6	25%
Financing / Funding	6	5	21%
Land use impacts (landscapes & transformation)	3	3	13%
Education & Capacity building	3	3	13%
Planning & project development	2	2	8%
Partnerships	2	2	8%
Capable institutions present	2	2	8%

Partnerships

Commonly coded with partnerships is mistrust (10 mentions – 17% Experts); depends on regulation, incentives, and energy market (2 mentions – 8% Experts); energy independence: tribally managed projects, utilities (2 mentions – 8% Experts); more large-scale projects (2 mentions – 8% Experts); financing and funding (2 mentions – 4% Experts); detrimental to development (1 mentions – 4% Experts); education and capacity building (1 mentions – 4% Experts); limited waivers of sovereign immunity common (1 mentions – 4% Experts); and, finally, non-tribal governments and public opinion (1 mentions – 4% Experts) (Table 9.).

Table 9: Commonly coded relationships for total coding of partnerships. Numerical values are mentions by experts whom expressed this view, number of experts who mentioned code and percentage of experts whom expressed this view.

Partnerships	# Mentions	# Experts	% Experts
Mistrust	10	4	17%
Depends on Regulation, Incentives, Energy Market	2	2	8%
Energy independence: Tribally managed projects, utilities	2	2	8%
More large-scale projects	2	2	8%
Financing / Funding	2	1	4%
Detrimental to development	1	1	4%
Education & Capacity building	1	1	4%
Limited waivers of sovereignty common	1	1	4%
Non-tribal governments / public opinion	1	1	4%

Role of culture in RE development

On the topic of the role of culture on renewable energy development experts mentioned support for renewable energy (11 mentions – 33% Experts); land use impacts (landscapes and transformation) (10 mentions – 38% Experts); each tribe is unique (8 mentions – 33% Experts); scale of project significant (8 mentions – 33% Experts); detrimental to development (7 mentions – 29% Experts); community vision and stakeholder buy-in and cultural acceptance (4 mentions – 17% Experts); education and capacity building (3 mentions – 13% Experts); environmental protection low priority (2 mentions – 8% Experts); important for success (2 mentions – 8% Experts); strategic energy planning (2 mentions – 8% Experts) (Table 10.).

Table 10: Experts were asked what role they saw culture playing in renewable energy development on tribal lands. Numerical values are mentions by experts whom expressed this view, number of experts who mentioned code and percentage of experts whom expressed this view.

Culture	# Mentions	# Experts	% Experts
Support renewable energy	11	8	33%
Land use impacts (landscapes & transformation)	10	9	38%
Each tribe is unique	8	8	33%
Scale of project significant	8	8	33%
Detrimental to development	7	7	29%
Community vision & Stakeholder buy-in & Cultural acceptance	4	4	17%
Education & Capacity building	3	3	13%
Environmental protection low priority	2	2	8%
Important for success	2	2	8%
Strategic Energy Planning	2	2	8%

Role of tribal sovereignty in RE development

Experts do not identify tribal sovereignty as a significant barrier to development. The most common associations with tribal sovereignty are that limited waivers of sovereign immunity are common (18 mentions – 71% Experts); energy independence: tribally managed projects, utilities (9 mentions – 25% Experts); detrimental to development (6 mentions – 25% Experts); partnerships (6 mentions – 25% Experts); tribal policy and regulation (5 mentions – 21% Experts); capable institutions present (4 mentions – 17% Experts); community vision and stakeholder buy-in and cultural acceptance (4 mentions – 13% Experts); education and capacity building (3 mentions – 13% Experts); important for success (3 mentions – 13% Experts); depends on regulations, incentives, and energy market (2 mentions – 8% Experts) (Table 11.).

Table 11: Experts were asked what role tribal sovereignty plays in renewable energy development. Numerical values are mentions by experts whom expressed this view, number of experts who mentioned code and percentage of experts whom expressed this view.

Tribal Sovereignty	# Mentions	# Experts	% Experts
Limited waivers of sovereignty common	18	17	71%
Energy Independence: Tribally managed projects, utilities	9	6	25%
Detrimental to development	6	6	25%
Partnerships	6	6	25%
Tribal policy and regulation	5	5	21%
Capable institutions present	4	4	17%
Community vision & Stakeholder buy-in & Cultural acceptance	4	3	13%
Education & Capacity building	3	3	13%
Important for success	3	3	13%
Depends on Regulation, Incentives, Energy Market	2	2	8%

Federal Programs

Federal programs are identified as important for education and capacity building (21 mentions – 79% Experts); important for success (16 mentions – 67% Experts); financing and funding (13 mentions – 54% Experts); detrimental to development (3 mentions – 13% Experts); federal policy and programs (2 mentions – 8% Experts); partnerships (2 mentions – 8% Experts); champions and leadership (1 mentions – 4% Experts); climate change impacts and critical for Alaska (1 mentions – 4% Experts); and intertribal collaboration (1 mentions – 4% Experts) (Table 12.).

Table 12: Experts were asked to describe the role that federal programs such as the DOE Office of Indian Energy Policy and Programs play in renewable energy development in tribal lands. Numerical values are mentions by experts whom expressed this view, number of experts who mentioned code and percentage of experts whom expressed this view.

Federal Programs	# Mentions	# Experts	% Experts
Education & Capacity building	21	19	79%
Important for success	16	16	67%
Financing / Funding	13	13	54%
Detrimental to development	3	3	13%
Federal policy & programs	2	2	8%
Partnerships	2	2	8%
Champions / Leadership	1	1	4%
Climate change impacts & Critical for Alaska	1	1	4%
Intertribal collaboration	1	1	4%
Lacking capacity	1	1	4%

Discussion

Federal and states' double-edged influence on tribal renewable energy projects

Experts identified federal policy and programs and other federal actions including permitting, regulation, incentives and energy markets as both significant barriers and less significant barriers to renewable energy development. Federal guidelines and permitting including FERC compliance, NEPA compliance, and financing requirements for large-scale projects were mentioned as difficult and time consuming for tribes. However, a majority of experts did not see federal policies, programs, and actions as being as significant as other barriers to renewable energy development; nearly all experts stated that there is a continued need for expansion of existing federal technical assistance programs for tribes. A number of experts mentioned that future federal technical assistance should address education and capacity building regarding risk assessment as well as technical decision tools for renewable energy development.

Non-tribal and non-federal governments, such as state or county governments, were perceived to be the least significant barrier to renewable energy development. States and counties generally do not have regulatory authority over individually allotted lands or tribal trust lands; they do have authority over fee simple lands (Leeds, 2006). However, when there is a right of way held by a utility or county, regulatory authority may be shifted from the tribe to the state, county, and federal authority. Fee simple lands are lands bought either by individuals or the tribe in the open market (Leeds, 2006). They are held by individual American Indians or tribal governments and are subject to state regulatory authority (Leeds, 2006). Additionally, projects that may impact or use state lands are subject to state or county approval (Leeds 2006).

Despite the political separation of tribal governments and states, tribal economic development also translates to economic development for states and local governments. States have been able to levy various taxes on projects that occur on tribal lands (Connolly, 2008; Cowan, 2005; Fletcher, 2005; Redhorse and Smith, 1982). Taxation methods vary from state to state and even from county to county (Stahl et al., 2009). Equipment leased by Native nations such as slot machines and wind turbines are assessed a one-time sales tax and property taxes, by the state, until they are wholly transferred to tribal ownership or other revenue sharing agreements are in place (Contreras, 2001; Connolly, 2008). In case of the Campo Kumeyaay's wind development near San Diego, San Diego County received more revenue from taxing the tribes' lessee partner than the tribe received from lease payments (Connolly, 2008).

State and federal renewable energy portfolio standards can benefit tribal renewable energy development by directing utilities to purchase additional renewable energy resources. The general requirement of utilities to acquire more renewable energy can promote tribal competiveness in the open market for power purchase agreements. Renewable energy portfolio

standards also benefit tribes that are in areas where renewable energy sources are competing against other forms of energy that are cheaper for utilities to purchase. Federal power purchase agreements including preferential agreements for tribes were suggested by several experts as one way of alleviating this barrier. Federal power purchase agreements are significant as many tribes in the west are located near federal facilities such as national laboratories, military bases, and national parks (Nangle, 2013).

Tribal sovereignty not a significant barrier but rather pathway for success

A majority of experts identified tribal sovereignty not as a significant barrier, but rather as a motivation and catalyst for future renewable energy development. They explained that tribal sovereignty motivates renewable energy development through promoting goals of energy self-sufficiency and independence, environmental sustainability, economic development, and community resiliency. Steps toward these goals include the development of tribally-owned and managed projects, the development of tribal energy regulations, and the formation of tribal utilities. Some experts mentioned that waivers of tribes' sovereign immunity can impede the development of *large-scale* renewable energy projects as significant outside financing and partnerships are usually required[2].

Many tribes have the ability to finance, install, and operate community and facility scale renewable energy projects. These smaller-scale projects require significantly less upfront financing and funding and less institutional capacity. They incur fewer cultural impacts, have identified customers, and generally have fewer barriers to leasing and permitting, which makes

[2] Experts mentioned that one reason for this is tribal governments' reluctance to lose the ability to resolve conflicts within their tribal courts. Waivers of sovereign immunity can move a dispute over a project or financing into state or federal courts rather than tribal courts. By doing this, experts mentioned that outside entities are more confident that investments can be recouped.

them more attractive than larger-scale installations. Small-scale projects can be seen as steps toward building capacity and achieving goals of energy self-sufficiency and independence, environmental sustainability, economic development, and community resiliency. While these small-scale projects often do not require a tribal utility, several tribes currently own and operate their own utilities that have the capability to install and operate community or facility-scale renewable energy projects.

Tribal utilities can be formed as a tribal corporation under tribal law, a Section 17 corporation under federal law, or a corporation or limited liability company formed under state law (Clark-Deschene, 2011; Nilles et al., 2011). To date, there are around ten tribal utilities developed with various forms of implementation. Several utilities were developed by the BIA and are now managed by tribes, several were developed during casino development, several were built from the ground up; a few are virtual utilities and, finally, several tribes have acquired existing utility infrastructure and are now operating utility services (Schaff and Doan, 2002). Startup costs are high for developing a utility from the ground up but capital is typically recovered over time through generated revenue (Gold, 2012). It is important to note that revenue generated from users of tribal utilities does not funnel to outside entities but rather get recycled back into the tribal authority, thus reinvesting in the community (Clark-Deschene, 2011). However, the starting point for a tribal utility can fall in line anywhere in the process from generation to end-use reception. With a virtual utility the tribe does not own or operate infrastructure but rather administers the administrative needs of existing distributors (Awerbuch & Preston, 2012; Drag & Kimelberg, 2014). Additionally, tribes have the potential to add renewable energy into the grid and capture state and federal tax incentives, which can be distributed among the end-users (Drag & Kimelberg, 2014).

Financing and securing tax credits remains a significant challenge for large scale RE on tribal lands

Financing and funding were considered to be the most significant barriers to development by a majority of experts. This is comparable with findings that are well known through much of the literature on Indian energy (Royster, 2009; Unger, 2009; Brookshire and Kaza, 2013). Experts mentioned various economic factors in identifying financing and funding as significant barriers including: small-scale projects not being economically feasible as an alternative to grid connection, large-scale projects often require significant outside capital, high infrastructure costs are necessary to reach remote locations, and there is a dearth of tribal financial resources available to dedicate to energy development or grant matching. A smaller number of experts from tribal and federal backgrounds saw financing as a less significant barrier specifically in situations where there is significant potential and the project is economically viable. Specifically, this implies tribes or projects that are located near transmission infrastructure or near large metropolitan demands that could potentially make finding an off-taker less challenging.

A number of experts suggested that financing and funding challenges for some tribes are in part due to risk aversion about debt financing due to internal financial challenges or simply being uncomfortable with assuming financial risks. For example, experts mentioned that financing projects through debt is complicated by a tribe's own credit history and the requirement for limited waivers of sovereign immunity. Many tribes are economically depressed and unable to afford large risks that may result in failure, which hinders their ability to take on long-term or capital-intensive projects (Begay, 1991; Pasqualetti et al., 2016). Tribes that are willing to take on some level of debt may be unable to do so due to lack of internal capital to match funds or provide sufficient collateral and in some instances secure favorable terms on outside financing.

Conversely, some may be unwilling to take on large debt for renewable projects considering them to be uncertain economic ventures, a degradation of sovereignty due to limited waivers associated with outside debt, and an undesirable financial risk to the tribe. Tribes must also consider the opportunity cost of dedicating limited financial resources to large-scale renewable projects when other non-energy development options may be more lucrative.

Experts explained that the current legal framework for providing financial incentives does not adequately provide these incentives to tribal governments and consequently can provide significant challenges to realizing financial benefits from RE development for tribes. Under current federal law, tribal governments are considered sovereign, non-taxable entities and cannot use RE financial incentives (MacCourt, 2010). Experts mentioned that, in order to employ these incentives, tribes often pursue inverted lease structures with non-tribal partners, or simply lease the land for the duration of the project to an outside developer. Leasing land instead of directly holding equity in a renewable energy project may come at the expense of reduced revenue for the tribe.

Addressing these barriers requires multifaceted approaches. Experts suggested that market forces including renewable energy requirements would increase the availability of financial resources and incentives for development. Experts also mentioned that federal policy and programs promoting renewable energy development including specific grants, loans, rebates, and tax incentives would encourage development if made available to tribes.

Ensuring proper governance and building capacity internally for tribal leadership and staff

Leadership, internal capacity, and education of tribal leadership and staff on energy issues was identified by experts both as an indispensable factor for the success of future energy projects and

a significant barrier to future renewable energy development. Tribal staff was often mentioned by experts as "champions" for development as they often remain in their positions through leadership changes and are thus able to provide the necessary capacity to shepherd projects through from start to finish. An important caveat is that many, but not all, tribal governments lack the technical and institutional capacity to make informed decisions regarding energy resource management (Royster, 2009). Therefore, increasing capacity at the staff level could ensure that there is a buffer to larger issues of governance within tribal governments that might thwart energy development. Capacity building should go beyond the staff level. Experts also mentioned the importance of tribal leadership having an understanding of the larger energy market and the process for developing renewable energy projects in order to facilitate informed decision-making.

Experts emphasized the importance of separating business and governance for project development. Separating business and politics is generally accepted as beneficial to economic development as it helps eliminate free-riding or ill-intentioned actions (Cornell and Kalt, 1992, 1998; Jorgensen, 2007; Jorgensen and Taylor, 2000). In addition, many experts mentioned that certain governance structures such as general council (e.g. projects being placed to a vote by the entire tribal membership), and one or two-year term limits for elected officials have been detrimental to projects in that significant lead-time is required for this processes. Experts stated that internal politics have the potential to destroy a tribe's energy potential. Coupled with federal, state and local politics, this particular amalgamation can prove fatal for project development.

Tribal leadership operates within a historical context of forced political reorganization, cultural removal, and economic devastation (Begay, 1997). Working within short time-frames to address legislative, social, economic, and cultural rights affecting their nations, tribal leaders are faced

with job demands that may be more complex and difficult than their non-tribal counterparts (Begay, 1997). Given the backdrop of issues that uniquely face Indian Country, tribal leaders are often operating in a constant state of triage – stopping the bleeding and attempting not to do more harm. Elected leadership can play a critical role in educating communities. However, championing and leading renewable energy development is not solely a role held by tribal council members or business leaders. Department heads, supervisors, hired staff, community members and youth can all play a role in the future of energy development on tribal lands as each can add their current capacity and potential for further capacity development. Stakeholder involvement and education of each of these groups will only help to see a project through to completion. Acknowledging that community collaboration and, in turn, intertribal collaboration can build capacity for development is critical for current tribal leadership.

Building productive partnerships with tribes

Partnerships were not covered explicitly within the questionnaire protocol yet experts mentioned the issue in talking about the sense of mutual distrust that often exists between tribal governments and outside companies. Tribes' mistrust of outside companies is well founded. Historically tribes have dealt with imbalanced business deals, environmental damage caused by outside companies, and in some instances a general disregard of communities' values when dealing with energy resources (Adamson, 2003; Pearson, 2000; Zaferatos, 2006; Pasqualetti, et al., 2016). In addition, many companies often do not fully understand the implications of tribal sovereign immunity and are averse to placing significant capital within tribal lands without some waiver of this immunity to ensure that their investment can be recouped (Vetter, 1994; McLish, 1988). Having effective institutions and tribal codes in place can reduce uncertainty and bring stability into partnerships (Cornell, 2001).

Many experts discussed the difficulty tribes have in finding purchasers and developing partnerships with utilities that have the ability to purchase renewable electricity generated on tribal land. This is partly an issue of the remote location of many tribal lands and distance from existing infrastructure (Kronk, 2009; Unger 2009). Moreover, many tribes do not have the technical expertise, required internal capacity, financial resources, or ability to capture tax credits to build out RE projects on their own and require partnerships with other tribes or non-tribal partners to meet these needs. Experts mentioned that in some instances developers, including tribes who could provide technical and financial resources, and tribes with the energy resource might share very different goals when pursuing development. For example, some tribes have wanted to include provisions within energy development agreements to pay for cleanup and dismantling projects at the end of their useful life, discounted electricity from the project, and employment for tribal members. In these instances, partnering companies have found these terms to be unattractive due to increased costs or other unique challenges that may arise from a tribe's request. Another misalignment of goals mentioned by experts was the selection of equipment in inverted lease-ownership agreements between tribes and outside companies. In these situations, experts mentioned that companies may be inclined to purchase lower-cost panels that could have a shorter service life in order to reduce payback periods or make the produced power cost competitive for potential customers. Tribes may view these agreements as an opportunity to own a renewable energy installation at the end of the lease agreement with the partnering company. Such a misalignment could mean that tribes obtain the panels at or near the expected service-life of the installed equipment. These types of incongruences within partnerships could sour future development and potentially deepen tribes' mistrust of outside companies.

Improved understanding and shared knowledge between tribes, development partners, state governments, utilities, and the federal government is needed for continued renewable energy growth across Indian Country. This can begin with tribes having a community vision for their energy futures and an environment with capable institutions in place to promote development. A community vision can also aid in the identification of areas in which a tribe lacks needed capacity for energy development. Shared knowledge and capacity for development between tribes is a valuable opportunity that should be explored as a pathway for addressing identified deficits.

Intertribal collaboration can address these concerns by helping tribes identify solutions so they can become better informed and capable of pursuing development. Sharing resources and knowledge regarding partnerships can begin to address mistrust and misalignment of goals. Additionally, inter-tribal collaboration could serve to further alleviate challenges associated with capacity gaps such as legal expertise and technical knowledge.

Strategic planning – a pathway for ensuring a cultural fit for future development

Experts mentioned that cultural acceptance is contingent upon the scale of a project and that larger projects would likely face more opposition from within the community. Renewable energy was seen by experts to be consistent with many tribes' cultural values toward preservation and protection of the environment. It should be noted that each of the 567 federally recognized tribes are unique and thus express, interpret and protect culture differently. With that understanding, generalizations can still be made with reasonable variation regarding renewable energy and culture for tribes. Arguably because of general cultural compatibility, numerous scholars have concluded that renewable energy development on tribal lands holds promise (Clary, 2011; Dreveskracht, 2011; Tsosie, 1997). In addition, previous literature has in part attributed the

success of economic development project to the extent to which they were compatible with cultural values (Cornell & Kalt, 1992; Necefer et al. 2015, Ruffing, 1978, Reno, 1981). Energy development that has no cultural match has had numerous negative consequences for tribes (Turner-Ruffing, 1978; Reno, 1981; Adamson, 2003).

While significant resource potential exists on tribal lands, previous literature has not considered whether utility-scale (e.g. large-scale) renewable development is a cultural match for all tribes. Indeed, large-scale projects have a higher potential to negatively impact cultural resources, sacred sites, landscapes, view sheds, and plants and wildlife that are considered sacred or have significance to a tribal community (Redsteer, et al. 2012; Necefer, et al., 2015; Schloepfe, et al, 1984). Mitigating impacts on these cultural resources from renewable energy development does not ensure a cultural match (Pasqualetti, et al., 2016). Large-scale projects could also raise conflicts about participation in global financial markets as many projects would require debt-financing.

Some tribes may also have apprehensions about participating in larger capital markets and global financial systems and thus assuming values that, in their view, conflict with traditional cultural norms (Necefer, et al., 2015; Turner-Ruffing, 1978; Reno, 1981). Focusing upon solely economic outcomes of energy resource management within these contexts may not address all communities' concerns and could be secondary to cultural and spiritual impacts (Jett, 1992; Pemberton, 1985; Necefer, et al., 2015; Pasqualetti et al., 2016). Some communities may be opposed to certain types of renewable energy development or even electrification due to concerns about cultural change. Energy resources, in the eyes of some communities and individuals, may hold cultural significance beyond their economic potential (Pemberton, 1985; Campbell, 1987; Jett, 1992; Stoffle, et al., 1988). These concerns are significant; scholars within

development economics have noted that structural economic changes can have significant impacts and changes in social and political institutions (Barsch, 1992; Reno, 1981). How people make a living impacts culture, the distribution of power, and the nature of leadership (Barsch, 1992; Reno, 1981). These types of changes have the potential to result in conflict (Basrch, 1992). Culture has significant influence on individual and community preferences, perceptions of risk, and preferences surrounding energy development (Triandis, 1995; Douglas and Wildavsky, 1983; Slovic, 1987; Kahan, et al., 2007). More significantly, it can inform what acceptable forms of energy development are for a community (Stephenson et al., 2010). It is important that these concerns are given consideration as their neglect from decision making could result in distrust or significant opposition to projects (Cornell and Kalt, 2001; Necefer, et al., 2015).

The significant resource potential of tribal lands has been discussed as a means of alleviating poverty in American Indian communities (Greenhowe, 2013; Regan, 2009). Renewable energy development could provide a means of increasing revenue for both tribal governments and communities that could then foster greater economic independence. Experts saw future renewable energy development being focused on smaller-scale projects at the community or residential scale as they are commensurate with community concerns of self-sufficiency, energy sovereignty, and reduction of environmental impacts. It is vitally important that consideration is given to whether efforts to increase economic sovereignty are a cultural fit. Mismatched economic strategies could be viewed as illegitimate and thus undermined or blocked entirely by communities (Graham, 2004; Cornell and Kalt, 1992).

The development of a comprehensive strategic energy plan that engages tribal citizens and includes cultural values into a larger, long-term energy vision can identify appropriate pathways for renewable energy development on a tribe's land. Strategic plans offer a proactive opportunity

for tribes to access the sentiments of the community regarding how energy should play a role in the tribe's future. Many experts cited the absence of strategic planning specific to energy as a significant barrier to RE development. Previous research has found that tribes that create strategic energy plans are more likely to develop energy resources in a manner consistent with their cultural values (Brookshire and Kaza, 2013). While the absence of a strategic plan could provide a barrier to future renewable development, a plan that does not consider the cultural fit could prove equally fatal (Graham, 2004; Cornell and Kalt, 1992). The inclusion of culturally informed values and preferences in decision making and planning can increase the chances of successful project development by increasing trust and understanding of the decisions made (Lynam, et al., 2007; Ramirez, 1999; Brookshire & Kaza, 2013). Such plans could be used as a statement of cultural values for a tribe and also as a basis for evaluating whether projects proposed on tribal lands fit into the larger vision of energy resource management (Pasqualetti et al., 2016). Strategic planning can serve as a basis for the development of tribal policy that promotes appropriate forms of renewable energy development. A comprehensive land use map that includes community stakeholder input can ensure future development is congruent with community expectations, such as the protection of culturally sensitive areas.

Limitations of this study

There are several shortcomings of this expert elicitation. First, we did not explicitly consider the challenges specific to Alaska Native communities and corporations developing renewable energy. Alaska Native communities fall into a complex web of land designations and regional and local decision-making established through the Alaska Native Claims Settlement Act (1971). They also face unique environmental conditions. These complexities warrant their own study. Second, our protocol did not explicitly consider the difference in challenges between different

scales of projects nor the role a tribe's own history with energy development plays in influencing future decisions. Lastly, our geographic distribution of tribal energy experts did not include tribes from the eastern United States.

Conclusion and Policy Implications

American Indians possess lands with natural resources that are sustainable, renewable, and plentiful. In-depth understanding and careful consideration of culture, economics, and politics must be used to effectively facilitate the most beneficial use of these natural resources for tribes, the Nation, and to ensure a low carbon energy future. While vast potential and great need for renewable energy development exists, there are a host of barriers that are continuing to impede development that benefits tribes. Developing a greater understanding of these barriers and how they might be addressed will lead to more economic development, energy security, and sustainable energy. Some barriers are unique to certain tribes and others are common to most tribes. When these challenges are addressed, tribes will undoubtedly play an indispensable role in securing a low-carbon energy future for the United States. Several policy implications have emerged from this research.

Finding 1: Tribal sovereignty – a motivation for RE

Exerting sovereign power over resources and governance is the focus of many tribes. Practical sovereignty or tribal self-rule varies dramatically from outside decision-making over tribal affairs. Historically, tribes have relied on or were forced into outside decision-making systems including the Indian Reorganization Act of 1934 model of limited constitutions (Jorgensen, 2007). Federal policy has changed over time to support more self-governance. Practical

sovereignty puts decision-making in tribal hands so a tribe can better reflect the interests of their own local communities.

Renewable energy development on tribal lands has the potential to foster greater degrees of economic sovereignty and thus self-determination as tribes will be empowered to make decisions consistent with their own values. The energy resource potential on tribal lands provides a significant opportunity to develop projects in tribal communities that foster goals of energy independence, the development of tribally-owned and managed projects, tribal regulation of energy development, and the development of tribal utilities. Tribal authority over land and resources that is motivated by a policy of self-determination can increase the likelihood of sustained economic development (O'Brien, 1993; Graham, 2004). This is if it is clear who renewable energy development will primarily benefit and who will develop it. Tribes have historically been treated as resource colonies by the United States; in some instances, energy development has come at the expense of tribal sovereignty and also the well being of tribal communities (USCCR, 1975).

Tribal governments have the ability to play a positive role in regulating renewable energy and influencing electricity markets within reservations to ensure beneficial development. Tribally developed renewable energy portfolio standards and incentives are one pathway for doing this that can create markets for renewable energy on tribal lands (LeBeau, 2001). Despite this opportunity, the development, implementation, and enforcement of these regulations and incentives on tribal land may exceed the internal capacity of an individual tribal government. To address this gap, tribes should create cooperative agreements to implement such standards with states and public utilities, which is an expression of de facto tribal sovereignty (Graham, 2004).

There are significant financial challenges to securing renewable energy incentives and bringing cost competitive energy to market for many tribes. However, addressing all of these factors might not result in more projects – many tribes are risk adverse about financial risks associated with energy development. For tribes that are economically depressed, the failure of large renewable projects could hinder other long-term or capital-intensive projects (Begay, 1991; Necefer et al., 2015, Pasqualetti et al., 2016). Tribes must also weigh the opportunity costs dedicating resources and capacity when other non-energy development may be more lucrative

The pursuit of greater economic sovereignty and thus self-determination through renewable energy development should not be limited to only reservation trust lands. Exploring opportunities in other regions of the United States and globally could provide more substantial projects for economic development for a tribe. Exploring projects in this arena will significantly increase competition with larger, more experienced, entities yet this should not be viewed as an insurmountable obstacle.

Finding 2: Cultural fit is critical and dependent upon scale

Renewable energy also holds promise as it can be developed in a way that is consistent with many tribes' cultural values. While development projects that occur consistent with these values are much more likely to be successful, the picture of cultural acceptance is more nuanced. The type and scale of renewable energy development are significant; simply minimizing impacts from large-scale projects may not ensure a cultural fit. Large-scale projects, specifically debt financing, could raise internal conflicts over cultural values within a tribe about the degree of participation in global financial markets – namely the perceived difference in values around a cash economy and the potential for unwanted cultural changes. Economic benefits to a tribe and

its members that can accompany large-scale energy development may not fully alleviate other concerns about cultural and spiritual impacts.

Strategic energy planning is critical for tribes' success as it increases chances of creating a more favorable environment for development to proceed in a manner consistent with cultural values and a larger community vision. Planning can help provide guidance toward overcoming institutional barriers by providing a roadmap for financing, funding, and capacity building opportunities. Assessing the various economic, environmental, and social risks of energy resource development within strategic planning for tribes is a significant opportunity for future research. Developing tools and strategies with tribes to assess the risks of energy resource development could address the risk aversion within tribal governments that many experts saw impeding the development of projects. Quantifying and assessing the risks posed to tribes from energy development though the use of technical tools can provide meaningful information for tribal policy makers in situations where difficult tradeoffs must be made.

Finding 3: Improving partnerships with private industry can increase deployment of RE

Developing renewable energy projects is a significant undertaking. Many tribes will need to continue working with outside partners to fill capacity, attract capital, and garner necessary resources and incentives. The challenges of doing this are compounded by the lack of internal capacity and a multitude of internal issues that direct necessary internal capacity to more pressing needs within the community. It is important to note that gaps in capacity are reflective of larger systemic issues of education within many reservations. There are few educational tracks that can cultivate tribal leadership within legislative, legal, technical, and economic arenas. In this space it is critical that champions (e.g. those who advocate internally) for renewable energy projects are supported in their efforts to bring meaningful change from within their communities.

The gap in internal tribal capacity could explain in part why Tribal Energy Resource Agreements (TERAs) from the Energy Policy Act of 2005 have yet to be implemented (Royster, 2009). It will be vitally important that tribes and outside partners work towards mutually shared goals and also ensure that projects further tribal sovereignty. Renewable energy projects present an opportunity to improve upon business relations with tribes that have been soured by past development projects. Intertribal collaboration could provide a pathway for developing strong, productive partnerships for renewable energy development. Such collaboration could also serve as a means of facilitating agreements between tribes such as financing, project management, TERAs, right-of-way, leasing, and partnership agreements. This coordination of efforts could ensure that the "big picture" benefits of collaboration are realized for each tribe.

Federally facilitated partnership agreements can also provide greater risk management for tribes that are exploring capital intensive projects. Program terms regulating the BIA Loan Guarantee Program offer increased assurances toward loan repayment, qualified lending and tribally beneficial and focused development. Provisions that protect investments, resources and ensure community benefits that are focused on renewable energy development can help mitigate investment risks for tribes.

Finding 4: State level regulation can have a double-edged influence on projects within tribal lands

State legislation and regulation of renewable energy can have a number of positive impacts for tribal projects. State portfolio standards and financial incentives can provide markets for renewable electricity and significantly lower barriers to finding non-tribal off-takers. For example, the largest wind installation on tribal lands, a 50MW installation on the Campo Kumeyaay reservation, provides renewable electricity to help meet California portfolio standards

(Connolly, 2008). In the near future, state-level plans to reduce carbon pollution for compliance with the EPA's Clean Power Plan could provide significant markets for renewable energy produced on tribal lands. In January 2015, the state of Arizona enacted SB 1007 with specific measures to comply with the clean power plan's state-level goals (EPA, 2014). More significantly, this bill authorizes the state to participate in regional and multi-jurisdictional agreements that include Arizona's tribes.

The future of RE on American Indian lands

Tribal lands possess significant renewable potential and opportunities for culturally appropriate development while ensuring a sustainable energy future. Tribes and their partners can work together to develop all scales of renewable energy both on and off reservation lands. In addition, these partnerships and collaborations will enable tribes to build and fill capacity within their communities. Partnerships and collaboration could place tribes in a position to compete on a larger scale in the energy market and ensure that tribes consistently have a seat at the table in the development of future energy policy. Developing these projects could secure greater tribal and economic sovereignty through energy independence and economic development that benefits tribal communities while remaining consistent with cultural values.

References

1. Abbott, J.A., (2010). The localized and scaled discourse of conservation for wind power in Kittitas County, Washington. Society & Natural Resources: An International Journal, 23:10, 969-985, doi: 10.1080/08941920802438634.

2. Adamson, R. (2003). Land Rich, Dirt Poor: The Story of Indian Assets. *Native Americas Journal*, 26–37. Retrieved from http://www.nrfc.org/ln/documents/Adamson_LandRich_jb3.pdf

3. Allen, M. (1989). Native American Control of Tribal Natural Resource Development in the Context of the Federal Trust and Tribal Self-Determination. *Boston College Environmental Affairs Law Review*, *16*(4).

4. Amin, S. M., & Gellings, C. W. (2006). The North American power delivery system: balancing market restructuring and environmental economics with infrastructure security. Energy, 31(6), 967-999.

5. Awerbuch, S. & Preston, A. (Eds.) (2012). The virtual utility: Accounting, technology & competive aspects of the emerging industry (Vol. 26). Springer Science & Business Media.

6. Barsh, R. L. (1992). Democratization and Development. *Hum. Rts. Q.*, *14*, 120.

7. Berkhofer Jr, R. F. (1978). Native Americans. Ethnic leadership in America, 119-149.

8. Billy, C., Heydt, G., Langness, P., Laughter, A., Mann, B., Rice, M., & Winslow, L. (2007). Sustainable Electric Power Options with Attention to Native American Communities. *IEEE*, *00*, 177–182.

9. Connolly, M. L. (2008). Commercial Scale Wind Industry on the Campo Indian Reservation. *Nat. Resources & Env't*, *23*, 25.

10. Bird, L., Bolinger, M., Gagliano, T., Wiser, R., Brown, M., & Parsons, B. (2005). Policies and market factors driving wind power development in the United States. *Energy Policy*, *33*(11), 1397-1407.

11. Brookshire, D., and Kaza, N., (2013). Planning for seven generations: Energy planning of American Indian Tribes. Energy Policy 62: 1506-1514.

12. Brugge, D., & Goble, R. (2002). The history of uranium mining and the Navajo people. *American Journal of Public Health*, *92*(9), 1410–9. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3222290&tool=pmcentrez&rendertype=abstract

13. Campbell, G. R. (1987). Northern Cheyenne Ethnicity, Religion, and Coal Energy Development. The Plains Anthropologist, 378-388.

14. Clary, D. M. (2011). Commercial-Scale Renewable Energy Projects on Tribal Lands. *Natural Resources & Environment*, *25*, 19–23.

15. Cornell, S. (1998). Strategic Analysis: A Practical Tool for Building Indian Nations. Harvard Project on American Indian Economic Development. Retrieved September 30, 2014, from http://fngovernance.org/resources_docs/Strategic_Analysis_for_Economic_Development.pdf.

16. Cornell, S. (2001). Enhancing Rural Leadership and Institutions: What Can We Learn from American Indian Nations?. International Regional Science Review, 24(1), 84-102.

17. Cornell, S. E., & Kalt, J. P. (Eds.). (1992). *What can tribes do?: Strategies and institutions in American Indian economic development*. Los Angeles, CA: American Indian Studies Center, University of California, Los Angeles.

18. Dalkey, N. C. (1967). *Delphi*. Santa Monica, CA: The RAND Corporation.

19. deLemos, J. L., Brugge, D., Cajero, M., Downs, M., Durant, J. L., George, C. M., … Lewis, J. (2009). Development of risk maps to minimize uranium exposures in the Navajo Churchrock mining district. *Environmental Health : A Global Access Science Source*, *8*, 29. doi:10.1186/1476-069X-8-29

20. Doris, E., Lopez, A., & Beckley, D. (2013). *Geospatial Analysis of Renewable Energy Technical Potential on Tribal Lands*. Washington, DC.

21. Douglas, M., & Wildavsky, A. (1983). Risk and culture: An essay on the selection of technological and environmental dangers. Univ of California Press.

22. Doyle, J. T., Redsteer, M. H., & Eggers, M. J. (2013). Exploring effects of climate change on Northern Plains American Indian health. *Climatic change*,*120*(3), 643-655.

23. Drag, E. & Kimelberg, M. (2014). Seneca Nation – 2014 Project Retrived February, 02, 2016, from http://apps1.eere.energy.gov/tribalenergy/projects_detail.cfm/project_id=223

24. Dreveskracht, R. D. (2011). Economic Development , Native Nations , and Solar Projects. *The Journal of Energy and Development*, *34*(2).

25. EIA. (2000). *Energy Consumption and Renewable Energy Development Potential on Indian Lands*. Washington, DC.

26. Erickson, W. P., Johnson, G. D., & Young Jr, D. P. (2005). A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions. *USDA Forest Service General Technical Report PSW-GTR-191*, 1029-1042.

27. Garcia, R. W. N. (2010). Who Is Hawaiian, What Begets Federal Recognition, and How Much Blood Matters. Asian-Pacific Law & Policy, Journal, 11, 85.

28. Graham, L. (2002). Securing Economic Sovereignty Through Agreement. *New Eng. L. Rev.*, *37*, 523.

29. Graham, L. M. (2004). Interdisciplinary Approach to American Indian Economic Development, An. *NDL Rev.*, *80*, 597.

30. Greenhowe, J. S. (2013). Reservations Please! Could Energy Development on Native American Land Be America's Most Valuable Resource? *Journal of Environmental and Public Health*, *7*(2), 279–304. doi:10.5195/pjephl.2013.51

31. Grossman, Z. (2005). Unlikely alliances: treaty conflicts and environmental cooperation between Native American and rural white communities. American Indian culture and research journal, 29(4), 21-43.

32. Jett, S. C. (1992). An introduction to Navajo sacred places. Journal of Cultural Geography, 13(1), 29-39.

33. Jorgensen, M. (Ed.). (2007). Rebuilding native nations: Strategies for governance and development. University of Arizona Press.

34. Kahan, D. M., Braman, D., Gastil, J., Slovic, P., & Mertz, C. K. (2007). Culture and identity-protective cognition: Explaining the white-male effect in risk perception. Journal of Empirical Legal Studies, 4(3), 465-505.

35. Kahneman, D. (2011) *Thinking, fast, and slow*. Macmillan

36. Kimmell, K., and Stalenhoef, D.S. (2011). The Cape Wind offshore wind energy project: A case study of the difficult transition to renewable energy. Golden Gate University Environmental Law Journal 5(1): 209-211.

37. Koontz, H., & O'Donnell, C. (1976). Management: A systems and contingency analysis of managerial functions (6th ed.). New York: McGraw-Hill.

38. Krepps, M. B. (1991). Can tribes manage their own resources?: a study of American Indian forestry and the 638 Program. Malcolm Wiener Center for Social Policy, John F. Kennedy School of Government, Harvard University.

39. Kronk, E. A. (2009). Alternative Energy Development in Indian Country: Lighting the Way for the Seventh Generation. *Idaho L. Rev.*, *46*, 449.

40. LeBeau, T. A. (2001). Reclaiming Reservation Infrastructure: Regulatory and Economic Opportunities for Tribal Development. Stan. L. & Pol'y Rev., 12, 237.

41. Linstone, H. A., & Turoff, M. (1975). The Delphi method: Techniques and applications. Reading, Massachusetts: Addison-Wesley Publishing Company

42. Lynam, T., De Jong, W., Sheil, D., Kusumanto, T., & Evans, K. (2007). A review of tools for incorporating community knowledge, preferences, and values into decision making in natural resources management. Ecology and society, 12(1), 5.

43. MacCourt, D., & Wynne, A. (2010). Renewable Energy Development in Indian Country : A Handbook for Tribes A Project for the National Renewable Energy Laboratory (NREL). *Contract*, (June).

44. McLish, T. P. (1988). Tribal Sovereign Immunity: Searching for Sensible Limits. *Columbia Law Review*, 173-193.

45. Meisen, P., & Erberich, T. (2009). Renewable Energy on Tribal Lands. *Global Energy Network Institute (GEN), www. geni.org/Trevor. erberich@gmail.com*.

46. Middlemiss, L., & Parrish, B.D. (2010). Building capacity for low-carbon communities: The role of grassroots initiatives. *Energy Policy, 38*(12), 7559-7566.

47. Nangle, J. (2013). Military Base Off-taker Opportunities for Tribal Renewabel Energy Projects. US Department of Energy, Office of Indian Energy

48. Navajo Tribal Utility Authority (NTUA) (2006). *Final Report: Navajo Electrification Demonstration Program*.

49. Necefer, L., Wong-Parodi, G., Jaramillo, P., & Small, M. J. (2015). Energy development and Native Americans: Values and beliefs about energy from the Navajo Nation. Energy Research & Social Science, 7, 1-11.

50. Nelkin, D. (1981). Native Americans and Nuclear Power. *Science, Technology & Human Values*, *6*(35), 2–13.

51. O'Brien, S. (1993). *American Indian tribal governments* (Vol. 192). University of Oklahoma Press

52. Pasqualetti, M., Jones, T., Necefer, L., Scott, C., Colombi, B. (2016). A Paradox of Plenty: Renewable Energy on Native Lands. Society and Natural Resources.

53. Pearson, E. (2000). "We Have Almost Forogtten How To Hope": The Hualapai, The Navajo, And the Fight for the Central Arizona Project 1944-1968. *Western Historical Quarterly*, *31*(Autumn), 297–316.

54. Pemberton Jr, R. (1985). I Saw That It Was Holy: The Black Hills and the Concept of Sacred Land. Law & Ineq., 3, 287.

55. Ramirez, R. (1999). Value co-production: intellectual origins and implications for practice and research. Strategic Management Journal, 20(1), 49-65.

56. Redsteer, M. H., Kelley, K. B., Francis, H., & Block, D. (2013). Increasing vulnerability of the Navajo people to drought and climate change in the southwestern United States: Accounts from Tribal Elders. *Special report on indigenous people, marginalized populations and climate change. Cambridge University Press, Cambridge*.

57. Reno, P. (1981). Mother Earth, Father Sky, and economic development: Navajo resources and their use (No. 3). University of New Mexico Press.

58. Rosser, E. (2008). This Land is My Land, This Land Is Your Land: Markets and Institutions for Economic Development on Native American Land. *Arizona Law Review*, *47*(245).

59. Royster, J. (2008). Practical Sovereignty, Political Sovereignty, and the Indian Tribal Energy Development and Self-Determination Act. Lewis & Clark Law Review, 12, 1065.

60. Ruffing, L. T. (1978). Navajo mineral development. Am. Indian J., 4, 31.

61. Schoepfle, M., Burton, M., & Begishe, K. (1984). Navajo attitudes toward development and change: A unified ethnographic and survey approach to an understanding of their future. American Anthropologist, 86(4), 885-904.

62. Slovic, P. (1987). Perception of risk. Science, 236(4799), 280-285.

63. Snipp, M. C. (1986). American Indians and Natural Resource Development: Indigenous Peoples' Land, Now Sought after, Has Produced New Indian-White Problems. *American Journal of Economics and Sociology*, *45*(4), 457–474.

64. Stoffle, R. W., & Evans, M. J. (1988). American Indians and nuclear waste storage: the debate at Yucca Mountain, Nevada. Policy Studies Journal, 16(4), 751-767.

65. Tano, M. L. (2006). Developing Agile Tribal Leaders and Agile Tribal Institutions to Adaptively Manage and Mitigate the Impacts of Global Climate Change in Indian Country. *Report to International Institute for Indigenous Resource Management. Denver, CO*.

66. Tiller, V.E.V. (2005). Tiller's guide to Indian Country. Albuquerque, NM: BowArrow Publishing.

67. Triandis, H. C. (1995). Individualism & collectivism. Westview press.

68. Tribal Energy Program Website. http://apps1.eere.energy.gov/tribalenergy/index.cfm

69. Trosper, R. (2009). Resilience, reciprocity and ecological economics: Northwest Coast sustainability. Routledge.

70. Tsosie, R. (1997). Tribal Environmental Policy In An Era of Self-Determination: The Role of Ethics, Economics, and Traditional Ecological Knowledge. *Vermont Law Review*, *21*(225), 225–333.

71. Unger, K. R. (2009). Change is in the Wind : Self-Determination and Wind Power through Tribal Energy Resource Agreements. *Earth*, *43*.

72. United States Energy Information Administration. (2000). Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Consumption and Renewable Energy Development Potential on Indian Lands, Department of Energy, Washington, DC.

73. United States Environmental Protection Agency. (2007). *Abandonded Uranium Mines And The Navajo Nation - Navajo Nation AUM Screening Assessment Report and Atlas with Geospatial Data*. San Francisco, CA. Retrieved from http://www.epa.gov/region9/superfund/navajo-nation/abandoned-uranium.html

74. United States Government Accounting Office. (2015). Indian Energy Development: Poor management by BIA has hindered energy development on Indian lands. (GAO Publication No. 15-502). Washington, D.C.: U.S. Government Printing Office.

75. Vetter, W. V. (1994). Doing Business with Indians and the Three" S" es: Secretarial Approval, Sovereign Immunity, and Subject Matter Jurisdiction. *Ariz. L. Rev.*, *36*, 169.

76. Western Area Power Administration, W. U.-T. (2010). Tribal Authority Process, Case Studies: The Conversion of On-reservation Electric Utilities to Tribal Ownership and Operation.

77. Zaferatos, N. C. (2006). Environmental justice in Indian country: dumpsite remediation on the Swinomish Indian reservation. Environmental Management, 38(6), 896–909. doi:10.1007/s00267-004-. *Environmental Management*, *38*(6), 896–909. doi:10.1007/s00267-004-0103-0

Supplementary information 1: Expert Elicitation Interview & Questionnaire Protocol

Introduction:

We are conducting a series of expert elicitation interviews to better understand barriers to renewable energy development on American Indian and Alaskan Native lands. We developed the questions based upon a literature review and series of conversations with persons affiliated with energy on tribal lands. The results of these interviews will allow for a much more comprehensive view of renewable energy development in Indian Country.

Your responses to the questions will remain anonymous and we will not use your name nor refer to your position in the subsequent paper that we will develop from all respondents.

We will also be interviewing other tribal leaders and experts on Indian energy.

This interview should take between 20-30 minutes.

Do you have any questions before we begin?

Questions

1. Can you tell me about your involvement with renewable energy on tribal lands?
2. What direction do you think renewable energy projects on tribal land will take in the next 10 years?
3. So now we are going to ask you to rank in order of importance the following challenges to preventing renewable energy development within your tribe/other tribes?

    1 = most significant and 10 = least significant

    - Renewable energy tax credits
    - Financing/funding for a project
    - Infrastructure [electrical transmission, roads,etc]
    - Partnerships [utility or developer]
    - Tribal sovereignty
    - Permitting
    - Finding a customer
    - Cultural acceptance
    - Leadership
    - Non-tribal governments / public
    - Planning
    - Other not included in this list

    Can you explain your ranking?

4. How likely do you think it is that these barriers will be removed or lessened in the next 5 years? 10 years?

Next we want to cover questions relating to Nation Building Theory. The theory suggests that successful tribal development can typically be associated with five areas including 1) tribes exerting sovereignty, 2) capable governing institutions are in place, 3) cultural match is considered with development, 4) the tribe has strategic and long term planning and 5) capable tribal leaders or mobilizers within the community are present.

5. What role does tribal sovereignty play in renewable energy?
    a. Could you tell me what your thoughts on waivers of sovereign immunity?
    b. Follow up question about alternatives
6. How does the governance structure of your Native Nation/of Native Nations influence renewable energy development?
7. How does the culture of the Native Nation's people influence renewable energy development?
8. Can you tell me about the role of a tribe's energy planning on development?
9. How important are federal programs to developing renewable energy
10. Tell me how tribal Leadership or tribal staff can play a role in renewable energy development.

That's the end of our interview. We very much appreciate your time in completing this survey.

Is there anything else you would like to add?

If you would like to contact with follow up inputs, questions, or suggestions feel free to contact us:

Mr. Tommy Jones - Ph.D. Student University of Arizona

ThomasJones@email.arizona.edu (405) 818-3753

Len Necefer - Ph.D. Candidate Carnegie Mellon University

LNecefer@andrew.cmu.edu (401) 935-8074

Supplementary Information 2: List of codes and definitions

Category & Code	Application
Future Energy Development	
Climate Change Impacts & Critical for Alaska	Future RE development being forced by climate impacts and their importance for Alaska
More large scale projects	Larger projects for commercial sales off a reservation
More small scale projects	Small projects aimed toward facility or community scale power consumption
Intertribal collaboration	Collaboration between tribes
Depends on Regulation, Incentives, Energy Market	RE development on tribal lands being dependent upon federal/state regulations, incentives, or larger energy market
Barriers & Addressing	
Community vision & Stakeholder buy-in & Cultural Acceptance	Views of the community about RE, community support, and it's consistency with a tribes' values
Customer	Finding a customer to purchase energy from a tribe
Financing / Funding	Securing financing or funding for a RE project
Infrastructure	Transmission and distribution infrastructure
Non-tribal governments / public opinion	State, county, or other non-tribal entity's influence
Partnerships	Partnerships with a tribe
Permitting	Federal, state, or tribal permitting for an Re project
Governance	
Capable Institutions Present	Tribal institutions capable of handling RE development
Continuity & Term-limits	Political continuity and imposed term-limits of elected officials
Separation of business and governance	Separation of tribal business and governance
Tribal Leadership / Staff	
Champions / Leadership	Individuals within a tribe that advocate for renewable energy
Lacking capacity	Internal capacity of tribes to manage and/or develop renewable projects
Time constraints	Cultural differences in time constraints between tribes and non-tribes
Tribes not taking risk	Mentions of tribal staff or leadership being risk adverse
Planning & project development	Specific mentions of specific project development or planning
Education & Capacity Building	Education being important for success of RE project and the need for capacity building within tribes
Partnerships	
Mistrust	Specific mention of tribes or companies lacking trust for each other

Culture	
Each tribe is unique	Statements which state that each tribe has a unique culture and/or must be considered
Land use impacts (Landscapes & transformation)	Specific mentions of sacredness of land or land transformations
Environmental protection low priority	Mention of cultural values placing a lower importance on the environment
Scale of project significant	Mentions of large scale projects having impacts on cultural resources or facing more opposition
Support renewable energy	Renewable energy being consistent with cultural values
Tribal Sovereignty	
Energy Independence: Tribally managed projects, utilities	Projects that are under full control of the tribe for the purpose of energy independence
Limited waivers of sovereignty common	Mentions of limited waivers as common business transaction with tribes
Tribal policy and regulation	Policies and regulations created by the tribes within their jurisdiction
Other community issues significant	Non-energy issues within the tribe are more significant
Federal Programs	
Federal policy & programs	Mentioning of a federal policy or programs that affect tribes
Strategic Energy Planning	Strategic Energy Planning was mentioned as a service by the federal government

Chapter 3. Examining External Forces and the Role of Intertribal Collaboration in Renewable Energy Development on Tribal Lands

Thomas E. Jones and Len E. Necefer

Abstract

Within the context of renewable energy this research explored the efficacy of reevaluating Native Nation Building Theory to include a greater emphasis on addressing external forces that impact energy development and the role that inter-tribal collaboration has with development. We studied Native nations in terms of evolutionary history of group interaction and inter-tribal collaboration through a lens of Elinor Ostrom's common pool resource design principles. We recommend that that strategic orientation and long-term planning by Native nations include an early process with which to address external forces. Energy development and sale is nested in various enterprises, which require Native nations to systematically ensure participation. We also recommend a sixth development element that uses inter-tribal collaboration as a means for capacity building. Inter-tribal collaboration provides opportunities for sharing resources and building technical, legal, and political capacity.

Introduction

Legacies of federal paternalism toward American Indian Tribes (Native nations hereafter) has led to underdeveloped governing institutions and leaders ill prepared for leading sovereign communities (Begay, 1997; Hensen et al., 2008). Historically, Native nations have relied on or were forced into outside decision making from the federal government based off of the reservation system and limited constitutions from the Indian Reorganization Act of 1934 (Jorgensen, 2007). Gradually, federal policy has changed over time to support more self-governance and greater self-determination has been pursued by Native nations. Since the 1970's and the enactment of the Indian Self-Determination and Educational Assistance Act (IESDA) there has been progress made for many Native nations. The Act allowed Native nations to take over and manage programs (contracts) that the federal government had administered on reservations (Hensen et al., 2008; S.1017). The contracts initially were limited to Bureau of Indian Affairs (BIA) and Indian Health Service (IHS) programs, however, in 1994 the possibility for contracting expanded to all non-BIA Department of Interior (DOI) programs (Hensen et al.; 2008; H.R. 2623; Sunoo and Falkner, 1999). The negotiations for amending the IESDA involved 63 committee members (48 representing Native nations and tribal organizations; 15 representing more than 10 federal agencies) each with full veto power (Sunoo and Falkner, 1999). The process used full consensus for all decisions and created a benchmark for future negotiations not only between Native nations and the DOI and DHHS but also with other federal agencies.

Assuming control of individual contracts has been additionally backed by the Tribal Self-Governance Act of 1994, which allocates lump sums of money as a "compact" to be used for governing functions at a respective Native nation's discretion. Policy that supports practical sovereignty puts decision-making in tribal hands so a Native nation can better reflect interests of

their own local communities. Transitioning from outside decision making to greater self-rule has been and arduous reality for many Native nations yet progress is still widely seen across most tribal communities.

The Harvard Project on American Indian Economic Development's and Native Nations Institute's Native Nation Building Theory (NNBT) has furthered traction on improved practical sovereignty. Native Nation Building Theory refers to the "processes by which a Native nation enhances its own foundational capacity for effective self-governance and for self-determined community and economic development" (Jorgensen, 2007). Native Nation Building Theory uses case studies that support how to build effective, sovereign governments, develop vigorous economies that fit respective Native nations circumstances and cultures, how to solve difficult social problems, how Native nations can achieve their own objectives in interaction with other governments, how Native nations can manage their environment and natural resources and how to balance change and cultural continuity (Cornell and Kalt, 1995; Cornell et al., 2002; Kalt, 1995; Jorgensen, 2007).

Native Nation Building Theory is typically applied to economic development ventures for capital gain that can improve societal conditions for a respective Native Nation (Cornell & Kalt, 1992; Cornell & Kalt, 1995; Cornell & Kalt, 1998; Cornell & Kalt, 2000; Kalt, 1995, Jorgensen & Taylor, 2000). Posited by this theory is that successful economic development ventures by Native nations in the United States are typically associated with five key elements: 1) Native Nations Exert Their Sovereignty and Decision-Making Power Over Their Resources; 2) Sovereignty is Backed by Capable Governing Institutions; 3) Cultural Match is Considered with Development and Governing Institutions; 4) Strategic Orientation and Long-Term Planning

Occurs; and 5) Motivated Leadership, Staff, or Community Members are Present (Jorgensen, 2007).

Within in the context of renewable energy development, NNBT has not fully explored the potential of renewable energy development as a form of economic development and meeting community needs. Historically Native nations have participated in energy resource development, such as coal mining and power generation, uranium mining, petroleum, and hydropower on their lands as a form of economic development (LaDuke, 1994; Royster, 2008; Trosper, 2009; Unger, 2009). Yet despite decades of development on tribal lands the success of these projects are questionable, nearly all of these projects have been operated and managed by non-tribal entities leaving little vested capacity for tribal led development and a significant portion of American Indian households still lack electricity access (Adamson, 2003; Grossman, 2005; Krepps, 1991; LaDuke, 1994; Snipp 1986; Rosser, 2008; Royster, 2008; Trosper, 2009; EIA, 2000). While there has been extensive development of non-renewable energy resources, there has been notably lower levels of renewable energy development on tribal lands despite significant resource potential and need that exists (Doris, Lopez, & Beckley, 2013; Jones & Necefer, *in review*; MacCourt, 2010; Adamson, 2003; Snipp, 1986). Large-scale projects in particular are limited on tribal lands and of those that exist very few are owned and operated by the respective Native nation. Jones and Necefer (*in review*), found that significant barriers to renewable energy development on tribal lands were attributed to financing and funding projects, lacking required infrastructure, tribal leadership and staff acceptance and capacity for renewable energy projects, finding a customer or off-taker for energy generated while competing with other companies and negotiations with utilities, partnerships for project development, community vision - stakeholder buy in and cultural acceptance, dependent upon regulation - tax incentives, and energy market,

strategic energy planning, permitting, and federal policy and programs. Notably, many of the barriers that Native nations face found by Jones and Necefer (in review) are from external forces that NNBT does not adequately address.

Native nations that develop renewable energy will interface with electrical transmission infrastructures - which has been considered in terms of a common pool resource with components of stock, flow, and renewability (Backman, 2011; Kunneke and Finger, 2009; Wolsink, 2012). Native nations that wish to develop energy resources are adding to these common pool aspects of energy transmission and it is important to systematically ensure participation. As infrastructures increase in size and complexity renewable energy can play an important role toward meeting energy needs, particularly with advances towards a "smart-grid", supporting digital operation, distributed generation, and the increased incorporation of storage and intermittent generation (Farhangi, 2010). Much of the development focus of a "smart-grid" has focused upon the technical challenges yet the influence of social construction and embedded institutional roles are critical for the operation of the future electrical grid (Wolsink, 2012). Much of the requisite institutional and technical capacity to make informed decisions in the context of this common pool resource is historically lacking within Indian country.

Analyzing expansion of renewable energy among Native nations, particularly in terms of energy resources and transmission in terms of common pool resources, must include non-tribal influences. This paper aims to address gaps in NNBT pertaining specifically to renewable energy development by Native nations. We suggest that previous literature by Elinor Ostrom offers principles regarding common pool resources that can better prepare Native nations for clean energy futures that incorporate both internal and external principles.

Common pool resource theory and evolutionary principles applicable to tribal renewable energy development

The Tragedy of the Commons published in 1968 by Garrett Hardin detailed the plight of common pool resources by resource users. In his analysis he describes that subtraction of common pool resources is exacerbated by individuals with individual interests and benefits. Each user subtracts from the common resource, which leads to unchecked depletion of the resources. To address this plight, effective group activity to manage common pool resources was suggested by Elinor Ostrom in *Governing the Commons: The Evolution of Institutions for Collective Action* (1990). Ostrom (1990:90) suggested that successful group organization that created robust, long lasting, institutional arrangements for managing common pool resources were characterized by eight design principles:

Principle 1: *Clearly defined boundaries.* Individuals or households who have rights to withdraw resource units from the common pool resources must be clearly defined, as must the boundaries of the common pool resource itself.

Principle 2: *Congruence between appropriation and provision rules and local conditions*. Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions and to provision rules requiring labor, material, and/or money.

Principle 3: *Collective-choice arrangements*. Most individuals affected by the operational rules can participate in modifying the operation rules.

Principle 4: *Monitoring*. Monitors, who actively audit the common pool resource conditions and appropriator behavior, are accountable to the appropriators or are the appropriators.

Principle 5: *Graduated sanctions*. Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offense), by other appropriators, by officials accountable to the appropriators, or by both.

Principle 6: *Conflict-resolution mechanisms*. Appropriators and their officials have rapid access to low cost local arenas to resolve conflicts among appropriators or between appropriators, or by both.

Principle 7: *Minimum recognition of rights to organize*. The rights of the appropriators to devise their own institutions are not challenged by external governmental authorities.

Principle 8: *Nested enterprises*. Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

The design principles are able to reduce uncertainty in complex and uncertain environments without privatization or top-down regulation (Wilson et al., 2013; Ostrom, 1990). Through this process, collective action may result from foundations of sustained trust and reciprocity that are developed through implementation of the design principles (Cox et al., 2010).

Of particular interest to tribal renewable energy development are principles seven and eight. Principal seven focuses on external government agencies challenging the institutions created by local users (Ostrom, 1990; Cox et al., 2010). External enforcement (i.e. central government enforcement) decisions have shown collapses in local decision making institutions (Cox et al., 2010; Pagdee et al., 2006; Turner, 1999; Scott, 1998 and Hayek, 1945 in Cox et al., 2010:11). Rules and enforcement that are not congruent with local conditions are particularly burdensome on community application (Hayek, 1945 and Scott, 1998 in Cox et al., 2010). Pagdee et al.

(2006), found that community forest management institutions were significantly influenced by tenure security, clear ownership, congruence between biophysical and socioeconomic boundaries of the resources, effective enforcement of rules and regulations, monitoring, sanctioning, strong leadership with capable local organization, expectation of benefits, common interests among community members, and *local authority*.

Principle eight focuses on the nested enterprises, which discuss cross-scale institutional factors. This notion emphasized how user and resource boundaries may extend to several different institutional boundaries. Social systems that cross physical relationships incorporate various levels of decision-making and stakeholder input. Cross-scale cooperation may be needed to effectively manage resource decisions or to maintain institutional functionality (Cox et al., 2010; Lane and Scoones, 1993; & Niamir-Fuller, 1998 in Cox et al., 2010). There are horizontal linkages as well as vertical linkages in which groups exist (Cox et al., 2010). Groups can interact among other groups (horizontal linkage) or they can be part of a larger governmental jurisdiction (vertical linkage) (Cox et al., 2010).

A critique of the eight principles stressed the importance of external factors, particularly economic factors impacting local decision making and resource use outcomes (Cox et al., 2010). Market integration is suggested as removing control of a resource from a user group through altering incentives (Cox et al., 2010). Additionally, it was noted that when users of a resource are not dependent on the resource, their welfare is not as strongly tied to their cooperative behavior (Cox et al., 2010). Cox et al. (2010), argues that in an increasingly interconnected world the local and external socio-economic factors that exist must be considered. When considering the extrapolation of resource use to a global scale and through a large scale or global/international

market, local-level resource management becomes highly impacted (Cox et al., 2010). Cox et al. (2010) suggested that the eight principles have to factor the size of the respective user group, heterogeneity differences between user groups, and government regime involved.=

Principle 7: Minimum recognition of rights to organize: Tribal authority over renewable energy development

Federal

The nature of the relationship between Native nations and the federal government inherently influences local decision making authority. Native nations are often referred to as "domestic dependent nations" with the United States maintaining eminent domain over land and Congress maintaining plenary power as defined in federal law (Cherokee Nation v. Georgia, 1831; United States v. Kagama, 1886; U.S. Constitution art 2 & 8). Federal policy and actions such as permitting (i.e. air permits), regulation (i.e. critical habitat for endangered species), Federal Energy Regulatory Commission (FERC) compliance, and National Environmental Policy Act (NEPA) compliance can all apply to tribal renewable energy development (Jones & Necefer, *in review;* Pasqualetti et al., 2016). Federal policies such as these are in place to manage common pool resources such as air quality and transmission infrastructure. An important aspect of federal influence stems from most tribal energy projects receiving federal funding at some point during development (Jones and Necefer, *in review*; Brookshire and Kaza, 2013). Federal funding elicits NEPA compliance, which requires that public comment solicitation occur, and detailed environmental permitting and analysis. The process to conduct environmental assessments (EA) and environmental impact statements (EIS) can be lengthy and take multiple years to achieve. Therefore, constructing large-scale renewable energy projects by nature will require long term planning to account for the required federal permitting process.

Greater local authority was provided in language of the Indian Tribal Energy Development and Self-Determination Act of 2005 (ITEDSDA). The Act allowed Native nations to develop energy projects on tribal lands using Tribal Energy Resource Agreements (TERA) in lieu of NEPA requirements. TERA requirements are very similar to NEPA requirements and obligate Native nations to consider a wide range of potential impacts both environmentally and socially. To date, there have been no TERAs approved or utilized. Efforts to streamline the TERA process are currently underway as the TERAs are considered too complex and burdensome for Native nations to complete (Kronk, 2011).

State and Local Governments

State and county government policies or decision making can impact fee simple lands, established right of ways, and approval of projects if state lands can be impacted by development (Jones & Necefer, *in review*; Leeds, 2006). States can also levy taxes that occur on tribal lands that vary from state to state and even county to county (Connolly, 2008; Cowan, 2005; Fletcher, 2005; Redhorse & Smith, 1982; Stahl et al., 2009). Examples of this are states placing sales taxes, property taxes, and revenue sharing demands on projects developed on tribal lands (Contreras, 2001; Connolly, 2008). These arrangements have been shown to create more revenue for the state through taxation than revenue received by a Native nation for renewable energy developments on tribal land (Connolly, 2008).

States have also levied taxes on oil and gas production and extraction on tribal lands (Sullivan, 2010)[3]. Oil and gas production and extraction by the Three Affiliated Tribes is subject to an 11.5% maximum state tax rate (typically lower) on both trust lands and non-trust lands in North

[3] See Cotton Petroleum Corporation v. New Mexico

Dakota[4]. More taxation on projects theoretically lowers the financial incentives of developing and thus reduces the attractiveness of developing on tribal lands. Taxation concerns can be further exacerbated by a potential double taxing of both state and tribal taxes (Cowan, 2005). The Supreme Court in Washington v. Confederated Tribes of the Colville Indian Reservation (1980) held that a state may tax non-Indians operating in Indian country despite any tribal taxation that is in place. Taxation by one entity does not exempt taxation from the other.

Principle 8: Nested enterprises: Renewable energy developments on tribal lands are influenced by external forces

Native nations that are interested in pursuing renewable electricity sales off reservation are faced with a host of nested enterprises. As previously described there are horizontal and vertical linkages that groups exist. Renewable energy development on tribal lands is not shielded from external policy, market forces and decision-making and there are considerable barriers to bringing this energy to market and to the benefit of Native nations (Jones & Necefer, *in review*).

Many Native nations lack requisite infrastructure on their lands to transmit electricity generated on their land from renewable resources. The reasons behind this gap are due to geography (remote and isolated communities), legislative (Bennett freeze & exclusion from Rural Electrification Act of 1935), and simply lacking large-scale transmission infrastructure. In addition, while a number of Native nations may have large scale transmission lines running across their lands, access and capacity on these lines may be limited thus presenting a considerable barrier for projects on many tribal lands (Jones & Necefer, *in review*). Reaching customers and meeting community needs while having historically underdeveloped transmission

[4] See Three Affiliated Oil and Gas Tax Agreement here:
https://www.nd.gov/tax/data/upfiles/media/oilgastaxagreement.pdf?20151229140456

and infrastructure throughout Indian Country requires considerable tribal, private, state, and federal investment.

Nested Market Forces

Market forces are influenced by state and federal policies including emissions regulations, renewable energy portfolio standards, tax incentives, and fossil fuel energy resource availability. Multiple common pool resources are thus influenced by regulation around energy. These policies and competing energy sources impact financial viability and finding a customer for development renewable energy. The Clean Power Plan (CPP) and carbon emission regulations influence current fossil fuel energy resource use and increases demand for renewable energy development. Existing power purchase agreements and competing tribal and non-tribal enterprises may also dictate development viability. Having access to existing infrastructure also plays a deciding factor on off loading energy (Jones & Necefer, *in review*). Using existing infrastructure to sell generated power off tribal lands typically triggers wheeling charges, particularly when state boundaries are crossed. Wheeling is a process for adding electric generation to existing transmission infrastructure and selling it to another user. Dependent by state, many investor owned utility companies are effectually monopolies with ownership and operation of generation, transmission, and end service (Delmas & Tokat, 2005). These arrangements give exclusive rights to their transmission lines with associated regulations and charges for wheeling.

Native nations have many factors to consider when generating energy and sending if off tribal lands. Aspects of federal, state, and private ownership regarding energy affects the bigger picture of commodity prices such as purchase prices for renewable energy. Participation in the energy market thrusts Native nations into an environment of many nested enterprises that span several common pool resources that overlap. Nested market forces may work against Native

nations in a microcosm but in reality are national and global issues that all competing interests must address.

Partnerships

Partnerships influence Native nations with both principles seven and eight of Ostrom's design principles. Renewable energy business models on tribal lands are replicating the same business structures of past energy development and as a result opens Native nations to significant influence from partnerships and outside market forces. Although many of the capacities to develop or push renewable energy require these partnerships to move forward in some way this will require a compromise on Native nation's part.

Renewable energy development on tribal lands largely still follows a business model of relying upon land leasing agreements similar to what has occurred with non-renewable resources. Inverted leases are a common business structure for these operations. A company will own a project and will depreciate the cost of a project then after a negotiated amount of years they will flip the ownership to the Native nation. This process does not explicitly build capacity for future or current energy developments. There may be programs factored into the leasing agreement to hire tribal employees or train community members but decision making is still typically vested in the developer. Adding provisions for tribal capacity building may not be favorable to developers and consequently are a tradeoff for Native nations deciding to partner.

An example of this trade-off is seen with the Campo Kumeyaay Nation, located near San Diego, CA. On their reservation is a 50MW wind farm currently operating through a land-lease agreement – the largest currently in Indian Country and Alaska (Clary, 2011; Connolly, 2008). The agreement with developers included community improvement initiatives in addition to

financial payments (Connolly, 2008). The Campo Kumeyaay Nation partnered with an outside entity that was able to receive renewable energy tax credits. The trade-off for the Native nation is decision-making authority over the development. By leasing the land the Campo Kumeyaay Nation does not gain capacity for ownership and operation of a large-scale renewable energy project yet still receive the desired revenue from lease payments.

Partnerships with non-native entities can benefit Native nations in several ways. Partnerships can add needed equity for project development, can fill capacity gaps ranging from planning, development, legal expertise and technical knowledge. Native nations can also act as an investor in such arrangements although partnerships with a Native nation being majority owner are limited. Working to improve relationships between outside companies, investors, and developers and Native nations can ensure higher degrees of success with greater understanding of tribal sovereignty and the role that culture plays in development (Jones and Necefer, *in review*).

Financing and funding was found to be the most significant barriers to development of renewable energy on tribal by a recent study (Jones & Necefer, in review). Many Native nations lack the equity to dedicate to energy development or grant matching or have other ventures and priorities for existing financial resources. Outside investors, developers, and state and federal grants often play a critical role for renewable energy development, particularly large-scale developments, on tribal lands. The federal taxation incentives that are available for renewable energy are not available to Native nations as they are considered sovereign, non-taxable entities (Jones & Necefer, *in review*; MacCourt, 2010). Partnering with non-tribal entities allow for Native nations to capture these incentives although partnerships are mostly associated with inverted lease structures as previously mentioned (Jones & Necefer, *in review*).

Collaboration to Address Common Pool Resources

Wilson et al. (2013), suggests that understanding the design principles from an evolutionary perspective sheds light on how cooperation among groups can lead to achieving shared goals. Wilson et al. (2013) generalized Ostrom's design principles into two respects: first, the authors detailed how the nature of evolutionary dynamics of cooperation among species is guided by the same principles. Wilson and Wilson (2007), suggested that the tradeoff for increasing group fitness does not have to be at a severe consequence to the individual fitness. A group (i.e. Native nation) that contributes more resources to between group interactions (i.e. intertribal collaboration) would be an example of this. More dedicated resources by an individual nation such as human or financial capital may reduce the "fitness" of that respective nation, but would increase fitness or strength of the intertribal group as a whole.

An example of this in Indian Country is with the NCAI member nations. To ensure equity of membership to this entity, each member nation must pay a sliding scale membership fee based on tribal revenue earnings. Although several nations will invariably pay more than other nations, the strength and overall funding of NCAI increases their likelihood of benefitting all Native nations, including those that pay higher dues, through policy work. Another example discussed later is the Indian Country Energy and Infrastructure Working Group (ICEIWG). The group is comprised of member nations that work on behalf of Indian Country to address policy and programmatic topics pertaining to energy development and federal program work. The dedicated resource in this scenario is time and human capital that is required to be active in the working group. Not all topics discussed within the group meetings are useful to each member nation yet; working on all issues collaboratively can begin to help each respective nation and Indian Country broadly.

Second, Wilson et al. (2013) determined that the design principles are relevant to and useful to any situation that requires cooperation and coordination by groups to achieve shared goals. Native nations that find success or progress through NNBT principles are exhibiting traits that are based in evolutionary principles. The fitness or capacity of a Native nation is increased by group advantageous traits (i.e. NNBT principles). Additionally, the traits can be selectively neutral or disadvantageous within groups, or correlated with the uniqueness of Native nations, and how they choose to express progress (Wilson & Wilson, 2007). However, common-pool resource users are more likely to develop effective institutions when there are homogenous interests (Ostrom, 2008). Qualities that are beneficial for an entire group (i.e. Native nation) are seldom selectively advantageous for individuals within that group (Wilson et al., 2013). Rather, qualities that are good for a group require group-level selection and interaction to continue and spread (Williams, 2008).

This conceptualization would suggest that a particular trait or quality that is beneficial for the good of one Native nation would need to be compared to a similar trait or quality at a separate Native nation to continue to evolve socially. By this notion, faster social evolutionary changes or increased societal-well-being can stem from within-nation trait selection and between-nation (inter-tribal collaboration) selection.

Single traits can exist despite being disadvantageous such as free riding due to lack of effective governing institutions or lack of decision-making power over resources due to nested relationships among more powerful institutions. However, interaction between groups can counteract these disadvantages such as a requirement of clearly defined rules and boundaries for collaboration among groups and multiple Native nations exerting political unity to influence cross-scale institutional decision-making (Ostrom, 1990; Wilson & Wilson, 2007). Between-

group selection has been shown to trump within-group selection as groups cooperating can result in higher-level forces or organisms (Frank, 2012a; Frank 2012b; Wilson et al., 2013; Wilson and Wilson, 2007). Within this context, inter-tribal collaboration or group interaction can increase societal well being by limiting disadvantageous traits while seeking group advantageous goals based on homogenous interests.

Collaborations are not without tradeoffs as such arrangements can replace perceived absolute decision-making authority among individual groups with a collaborative decision-making approach shared among groups. It should be noted that Native nations are nested in multiple cross-scale institutions. This includes as a respective federally recognized sovereign nation that interacts directly with the federal government and collectively as "Indian Country" and "Alaska". Collectively, Congress and federal agencies make decisions that can impact and have immediate influence on all of Indian Country and Alaska. Therefore, correlated inter-tribal collaboration inherently seems appropriate for negotiations between Native nations and Congress and federal agencies. Additionally, other groups are vying for special interests within these same cross-institutional boundaries that can compete with inter-tribal interests. Effective inter-tribal institutions are therefore essential for advocating for competing interests.

Native nations that lead by example can offer another evolutionary principle of replication to other Native nations through blind imitation, operant conditioning, or conscious thought (Wilson et al., 2013). The human capacity for cooperation through cultural transmission and learned information can lead to greater within and between-group evolution (Wilson et al., 2013). Replication is already part of the NNBT literature as abundant case studies are available showcasing Native nations that accomplished goals while exhibiting theory principles.

Tying intertribal collaboration & evolutionary principles to renewable energy development on tribal lands

The concept of group interaction or inter-tribal collaboration is supported through evolutionary history and recognized in Ostrom's design principles. NNBT does recognize that exerting sovereignty is important and the first step of nation building. However, what happens when sovereignty is asserted and not recognized? Inter-tribal collaboration is our suggestion for continuing tribal progress and amending NNBT.

An option that is currently being explored is Native nations investing in other Native nations for energy development. Nations that have readily available financial equity can partner with Nations that have resource potential for development. Also, pooling financial resources through a shared capital system focused on renewable energy development should be explored by Native nations with shared goals that are unable to develop on their own. Native nations could also partner to compete for public lands and private lands for large-scale development.

Intertribal working groups would undoubtedly facilitate greater capacity building among tribal governments. Additionally, inter-tribal collaboration could serve to further alleviate challenges associated with capacity gaps such as legal expertise and technical knowledge acknowledged by Jones and Necefer (*in review*). There are many inter-tribal organizations that have successfully worked together to achieve group benefits. There are also informal inter-tribal collaborations that have existed for specific purposes that address federal and state policy.

Inter-tribal groups work many times to address external forces that are associated with principles seven and eight of Ostrom's design principles. External polices, market forces, and resource competition may be formidable entities with which Native nations must compete. The following

are several examples with which Native nations or Native focused organizations have come together to address these external forces.

Endangered Species Act Enforcement on Tribal Lands

One inter-tribal effort was to address the concerns of the enforcement of the Endangered Species Act of 1973 (ESA) on tribal lands. Although many or most of the environmental impacts were created by non-Indian development there was considerable regulatory pressure regarding areas such as timber harvesting, building construction, water development, and wildlife harvesting (Wilkinson, 1997). The reach of the ESA to tribal lands was directly counter to tribal sovereignty over resource management practices (Wilkinson, 1997).

The issue was addressed beginning with a group of largely tribal resource managers and tribal lawyers from multiple tribally affiliated organizations and Native nations. The main objective was to contemplate with a unified tribal position on how to address ESA. The group decided to hold a national meeting and invited other Native nations and tribal organizations to attend. From the workshop, several themes emerged beginning with how single species management is poorly designed in comparison to the holistic management that has historically sustained generations. Many Native nations additionally have natural resources agencies or departments and actively manage resources while balancing cultural resources, economic resources, and environmental quality. The workshop attendees agreed that "the ESA does not and should not apply to Indian tribes" but rather Tribal rights to manage their resources in accordance with their own beliefs and values must be protected (Wilkinson, 1997). "Additionally, the workshop findings discussed how "tribes are now being asked or required to shoulder and unfair and disproportionate responsibility for conservation to make up for past and continuing degradation of the

environment resulting from non-Indian development." "The ESA deals with existence thresholds for individual species. Trust responsibilities require the restoration of resources productivity to where resources are capable of sustaining tribal utilization." Since the issues from the ESA dealt specifically with the trust relationship and protection of that trust and tribal sovereignty, there was a consensus that action was needed. The participants organized a working group to examine legislative and administrative alternatives to ESA species-by-species enforcement.

The Endangered Species Act and subsequent Secretarial Order No. 3206 American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act clarifies the responsibilities of the federal government and government-to-government consultations. The latter Act was meant to ensure that a disproportionate burden for the conservation of listed species did not fall onto Native nations (Nie, 2008). Many provisions were suggested and adopted in the final legislation that stemmed from direct tribal-federal consultation. The Order allows for cooperative assistance, consultation, sharing of information, and creation of government-to-government partnerships to promote health ecosystems. Important provisions also include intergovernmental agreements that focus on "land and resources management, multijurisdictional partnerships, cooperative law enforcement, and guidelines to accommodate Indian access to, and traditional uses of, natural products (Nie, 2008; S.O. 3206). These types of arrangements are considered useful in mitigated trust responsibilities and species conservation concerns (Nie, 2008; Zellmer, 2000). In the Order it is stated:

> *In developing reasonable and prudent alternatives, the Services shall give full consideration to all comments and information received from any affected tribe, and shall strive to ensure that any alternative selected does not discriminate against such tribe(s)* (Stern, 2009; S.O. 3206)

National Congress of American Indians

The National Congress of American Indians (NCAI), formed in 1944 in response to termination and assimilation policies of the federal government. A major focus of NCAI is to protect and enhance treaty and sovereign rights. This is carried out mostly through ensuring that recommendations from Native nations are known to Congress and the White House. NCAI represents roughly 70% of all federally recognized Native nations, however, the work they do represents and is meant to positively impact all federally recognized nations. It is widely considered the most representative American Indian and Alaska Native focused organization.

National Indian Health Board

The National Indian Health Board (NIHB) is a nonprofit tribal organization focused on representing tribal governments that administer their own health services through contracting and compacting and those that utilize Indian Health Service. The organization works on advocacy, policy formation and analysis, legislative and regulatory tracking, direct communication with Native nations, and research on AI/AN health issues, program development and assessment, training and technical assistance programs, and project management . The organization is the only of its kind.

United South and Eastern Tribes, Inc.

The United South and Eastern Tribes, Inc. is an inter-tribal non-profit that represents twenty six Native nations at a regional and national level. The slogan for the organization represents the essence of inter-tribal collaboration: Because there is Strength in Unity. The group works towards the exchange of ideas amongst Native nations, agencies, and governments with a focus

on health, education, social services, housing, economic development, transportation, and justice opportunities for its member nations.

National Indian Gaming Association

The National Indian Gaming Association (NIGA) is comprised of 184 Native nations in addition to other organizations, Native nations, and business involved with tribal gaming. NIGA is a non-profit whose focus is to advance the lives of Indian peoples economically, socially, and politically by working with the federal government and congress regarding policies that impact gaming. The organization lobbies on behalf of protecting tribal sovereignty and self-sufficiency.

Indian Country Energy and Infrastructure Working Group

Specific to energy, organizations such as the Council on Energy Resources Tribes (CERT), Coalition of Large Tribes (COLT) and NCAI have made efforts to promote all forms of energy development on tribal lands. While CERT, COLT, and NCAI have all worked on energy issues through shared knowledge, lobbying and crafting policy, there is another group working towards progressive energy developments throughout Indian Country.

An additional intertribal collaborative that focuses specifically on energy is the Indian Country Energy and Infrastructure Working Group (ICEIWG); an informal working group comprised of representatives from 14 separate Native nations. The working group is informal rather than a full advisory committee in order to have more flexibility in structure, membership, and guiding of business (ICEIWG, 2011)[5]. Full advisory committees must operate according to the Federal

[5] All ICEIWG meeting documents can be found here: http://www.energy.gov/indianenergy/listings/iceiwg-meeting-agendas-and-summaries

Advisory Committee Act and follow strict rules and regulations (ICEIWG, 2011). Former Secretary of Energy Steven Chu established the working group in 2011 to fulfill statutory requirements from Title V of the Energy Policy Act of 2005. The member nations and individuals represent both the lower 48 and Alaska and provide advice and recommendations to the Director of the Office of Indian Energy Policy & Programs (OIE) and the Secretary of Energy and also engage with the White House Council on Native American Affairs Energy Subgroup. The OIE Director appoints the members and members must be elected officials of tribal governments or employees designated to act on their behalf of federally recognized Native nation with energy activities.

The focus of their work is to assist the OIE with strategic planning and implementation with energy resource decision-making, energy business and energy infrastructure development[6]. The working group is also cooperatively supported by the National Conference of State Legislatures (NCSL), which allows for Tribal, Federal, and State representation. ICEIWG is meant to assist in surveys, analysis, and recommendations to program implementation and policy initiatives that stem from DOE statutory authorizations and requirements established in Title V of the Energy Policy Act of 2005. The goal is to get on-the-ground recommendations from energy resource Native nations on what obstacles and opportunities exist related to energy development, which varies by meeting date. The Working Group is also meant as a liaison between other Native nations and the OIE on energy resource programs. The group contributes to the OIE's missions of facilitating and supporting tribal energy development in its various forms, including commercial and community-scale projects; fostering increased and appropriately developed electrical infrastructure development on Indian lands; and promoting the delivery of reliable and

[6] View the ICEIWG charter here: http://www.energy.gov/sites/prod/files/ICEIWG%20Charter_FINAL-012612.pdf

affordable energy to tribal communities. ICEIWG does not and will not establish OIE programmatic or working-level policy but will respond to the OIE Director or Secretarial requests for recommendations on DOE policy and programs.

Many Native nations have found difficulty in finding a customer to sell power generated from a large-scale project on tribal lands (Jones and Necefer, *in review*). There have been discussions in ICEIWG meetings that have suggested selling power to the US Department of Defense. This is relevant as many Native nations are located near or adjacent to federal lands and facilities. The response from IE was that conversations are taking place regarding this, however ground way had not been made (ICEIWG, 2013). The desire from IE was to get face time with those who are setting DoD policies and contribute to DoD energy purchase decisions. An important component to this is the DoD has a 25% renewable energy procurement priority to achieve by 2025 (Schwartz et al., 2012). A joint DOE-IE study of tribal lands near military installations was conducted and 15 Native nations/projects were identified as preferred development zones (ICEIWG, 2013). To date, there has not been any agreement between Native nations and military installations stem from this discussion. Department of Energy, however, has an established tribal renewable energy product and by product purchase preference enforced by Secretary Chu through EPAct of 2005 authority.

External federal support for a sustainable inter-tribal energy groups represents the minimum recognition of rights to organize suggested in principle seven of Ostrom's design principles and simultaneously promotes activities that are layered in nested institutions identified in principle eight. Additionally, principle 2 of Ostrom's design principles mentioned previously is the congruence between appropriation and provision rules and local conditions.

Utility Approach

Most tribal reservations are serviced by for profit or cooperative non-tribal utilities. Growing tribal economies and communities require correlated growth in electrical transmission and infrastructure. Meeting the needs for this growth on tribal lands is often not met by utility services or existing energy providers.

Tribal utilities can be formed as a tribal corporation under tribal law, a Section 17 corporation under federal law, or a corporation or limited liability company formed under state law (Clark-Deschene, 2011; Nilles et al., 2011). To date, there are around ten tribal utilities developed with various forms of implementation. Several utilities were developed by the BIA and are now managed by Native nations, several were developed during casino development, several were built from the ground up, there are a few that are virtual utilities, and finally, there are several Native nations that have acquired existing utility infrastructure and are now operating utility services (Schaff and Doan, 2002).

Electrical utilities must generate or acquire electrical power, send this power through transmission facilities lines to substations that can step up or step down power, then distribute on power lines to distribution transformers, then directly to serving customer meters. Most tribal utility authorities obtain either a percent ownership in a generating plant or purchase power from a third party (Gold, 2012). While many Native nation governments cannot meet the technical capacity expertise from within the community; it is common to hire staff that is not from the respective Native nation. In addition to these aspects, land use planning and cultural consultations must take place for placement of an energy producer, the substations, and right of

ways for power lines. As with all electrical service providers, federal regulation compliance for utilities is administered through the Federal Energy Regulatory Commission (FERC).

Navajo Tribal Utility Authority (NTUA) is the oldest tribal utility in the United States and has renewable energy projects in various sizes and purposes. Among NTUA's electrical services are non-permanent small-scale solar and wind units leased to individual homes. NTUA also has larger photovoltaic units that are currently offsetting building energy loads and funneling into the power grid. Navajo Nation also now requires that any projects that is developed on tribal lands to have Navajo majority ownership. It is important to note that while NTUA may be one of the most advanced tribal utilities and is located on tribal land it is also entrenched in market and nested enterprises as NTUA purchases nearly 80% of its power to supply to users from off reservation sources.

However, the starting point for a tribal utility does not have to start at generation, it can fall in line anywhere in the process from generation to end use reception. Native nations can opt for virtual utilities as a way to service communities. With a virtual utility the Native nation does not own or operate infrastructure but rather administers the administrative needs of existing distributors. The virtual utility means that bills are handled by the tribal entity, which is typically a Section 17 Corporation. Additionally, Native nations have the potential to add renewable energy into the grid and capture state and federal tax incentives, which can be distributed among the end users. For example, the Seneca Nation in New York experienced high costs for energy and decided to develop Seneca Energy, LLC to take over as a virtual utility for their community. Next, Seneca Energy installed a 1.8MW grid tied wind turbine on tribal lands. The tax incentive benefits gained from the wind turbine were spread evenly among the tribal end source users and

lowered subsequent energy bills[7]. Virtual utilities also have the ability to span multiple Native nations. Although this opportunity has never been discussed, it has great potential for collaborative success. Several Native nations that are regionally close and share a same utility could explore this option. The member nations of this partnership could contribute grid tied renewable energy where available. A similar inter-tribal collaborative effort is the nonprofit Northwest Intertribal Court System (NICS). NICS formed to pool resource and human capital from member Native nations so that each could have an effective court system.

Another option available to Native nations is acquiring or condemning assets that are already serving a respective Native community. There are several mechanisms for acquiring existing utility infrastructure (WAPA, 2010). Acquisitions are typically made from existing utility infrastructure (i.e. Arizona Public Service owned infrastructure) or BIA owned infrastructure. Native nations that acquire infrastructure can begin to provide service to their communities and better determine expansion options. Energy is still typically purchased from outside generation sources, however, there is potential for Native nations to tie into the grid with renewable energy developments.

Both virtual utilities and infrastructure acquisition provide opportunities specifically for Native nations with small land bases or disaggregated land bases to assume utility control. Both options provide opportunities for improved user service, reduced energy costs, renewable energy purchase preference, and renewable energy development integration. Assuming these roles also builds and develops institutions that can expand services and development.

NNBT lacks in the discussion of intertribal connections that can address the various capacity

[7] More on the development here:
http://apps1.eere.energy.gov/tribalenergy/pdfs/2013_program_review/48_seneca_elizabth_drag.pdf

needs of renewable energy development and the contending markets forces and external policy that can impact successful energy development. It is critical for economic development and thus large scale renewable energy in particular to consider both principles seven and eight of Ostrom's design principles.

Discussion

Principle seven of Ostrom's design principle suggests the pitfalls that may occur if the rights to organize are not recognized or are superseded. Native nations are not shielded from external rules and authorities with energy development. Many times tribal decision making and institutions regarding energy resource developments are challenged by federal, state and market forces. Additionally, within the same context of external forces is principle eight of Ostrom's design principles acknowledging nested enterprises. Indeed, Native nations are nested in multiple enterprises that can prove fatal to project development or dictate development possibilities altogether. Federal, state and local polies, market forces and competing interest are all nested enterprises that are both horizontally linked or vertically linked to Native nations. An example of how a Native nation is nested is the desire to build a commercial scale energy farm must take into consideration federal regulations such as NEPA or endangered species critical habitat, then work with the local utility for transmission of produced energy which may be dictated by state or federal emissions standards or renewable energy portfolio standards, then a customer for the energy that is generated must be identified, all while competing with other developers for power purchase agreements.

Thus, in order to compete in the energy market external forces and enterprises must be taken into consideration early on in the planning process. Native Nation Building Theory does not adequately address the role of external forces including rules, polices and nested enterprises on

successful economic or social progress. Native Nation Building Theory is typically associated with internal factors that set the ground work for successful economic development. However, when participating in the larger energy market for economic development it is equally important to consider the external factors that are barriers to development.

Our suggestion is to reformat the successful elements to development offered by NNBT to:

1) Native Nations Exert Their Sovereignty and Decision-Making Power over Their Resources;

2) Sovereignty is backed by Capable Governing Institutions;

3) Cultural Match is considered with Development and Governing Institutions;

4) Strategic Orientation and Long-Term Planning Occurs;

- ***Native Nations address external forces***

5) Motivated Leadership, Staff, or Community Members are Present.

6) Development Capacity met through Inter-tribal collaboration.

Native Nations Address External Forces

Strategic planning within NNBT is largely a visioning of where do respective Native nations want to see their communities in the future and planning the steps it takes to reach that goal. The authors of *Rebuilding Native Nations* (Jorgensen, 2007) suggest that strategic planning is: proactive thinking rather than reactive thinking; long term planning rather than short term planning; shifting from opportunistic goals towards larger long term goals; focusing on broader cultural, social, political and economic health rather than a narrow focus of problem resolution. Within this context a heavy focus must be placed on addressing external forces.

Development Capacity met Through Inter-Tribal Collaboration

Partnerships among Native nations can result in beneficial progress with respect to renewable energy development. Native nations investing in other Native nations such as a capital rich nation investing in a resource rich nation deserves a harder look. Also, Inter-tribal collaborations with shared goals offer the potential of a host of benefits including pooled resources, lobbying power, greater capacity building opportunities in both legal and technical regards, and cooperation towards formation of tribal utilities and competing energy business entities. Additionally, Inter-tribal can work towards influencing policy through lobbying, identifying energy markets, finding customers, and how to address the historically underdeveloped transmission and infrastructure throughout Indian Country. Addressing barriers identified by Jones and Necefer (*in review*) including education and capacity building should be the focus of a sustained inter-tribal collaboration.

Native Nation Building Theory has a significant internal emphasis that eschews from reliance on other institutions and external capacity. However, consideration towards the necessity to build renewable energy capacity respectively should be examined. Using renewable energy as specifically an economic development venture may not merit institutional capacity development for renewable energy development and operation. There may be other areas of governance that are more pressing than building long term capacity for energy development and operation. Large-scale renewable energy projects require institutional and legal capacity for long term planning and project development that is maintained for the functional life of the system and decommission. Each Native nation will be unique in desire to build this capacity and vision for their energy future. Notably, the United States provides an example of acquiring capacity rather than building capacity through contracting federal work or functions to individuals or employers.

Columbia River Tribal Fisheries Commission

Perhaps the best example of the benefits of Inter-tribal collaboration to achieve shared goals is the Columbia River Tribal Fisheries Commission (CRITFC). CRITFC is a collaboration of four Columbia River treaty nations that all share a common interest protecting and harvesting salmon in the Columbia River. A long history of protest, lawsuits, and a previous management institution for salmon existed prior to development of CRITFC that focused on upholding treaty rights and the well-being of the associated tribal members (Diver in Colombi & Brooks, 2012). Recognition of fishing rights outlined in their treaty was secured through court ruling. From this foundation CRITFC member nations have progressed into an organization that can promote culturally appropriate decision making for a region. CRITFC was created as a technical and coordinating agency that hired their own policy, legal, and scientists to represent the member nations (Diver in Colombi & Brooks, 2012). CRITFC is essentially built on the understanding that legal and technical capacity is needed to address cultural resources that are influenced by external policies and nested enterprises with which the member nations exist.

By being official recognized by the member nations CRITFC was able to qualify for components of Self-Determination policy such as funding and taking over management of certain programs. Additionally, as the capacity growth continued in technical, legal and political arenas CRITFC began to be a larger player in nested enterprises. The organization now has capacities to work on new policies that emerge and address current policies that are nested in larger enterprises such as state, federal, and international arenas.

The formation of a policy and technical inter-tribal organization such as CRITFC was recently promoted for tribal energy through a federal funding announcement opportunity. The funding

supports two or more Native nations or tribal organizations that wish to collaborate to achieve shared energy goals. Formation of energy goals, energy policy, and technical capacity to have a seat at the energy in larger energy nested enterprises is the focus of the grant opportunity. Perhaps soon an inter-tribal energy organization will emerge that is as successful at CRITFC in addressing shared interests.

Conclusion

The vision of the future for renewable energy development by Native nations is one that includes better partnerships and collaborations on large and small-scale projects. Native nations have the adaptive capacity to addresses sociopolitical changes with culturally informed decision making that considers indigenous knowledge systems, exertions of inherent and legal sovereignty and is guided by strong leadership (Colombi, 2012; Colombi & Smith, 2012; Colombi & Smith, 2014).

Inter-tribal partnerships may help address external forces and fill capacity gaps while working towards common goals of economic development and societal wellbeing. Culturally appropriate adaptation that better positions Native nations to meet community energy needs and succeed in energy based economic development is supported through the evidence and progression of Native nations over time. The endurance of Native nations to withstand physical and cultural genocide, forced removal, assimilation, and termination and begin a new chapter of self-determination is a testament to the resiliency and adaptive potential of Native peoples.

Collaborating may give Native nations greater potential to compete within energy markets regionally, nationally and globally. By doing so, greater economic sovereignty will be realized through energy independence and economic development consistent with cultural values. Moving forward with energy development and meeting community needs will take resilience,

organization, and collaboration. Inter-tribal collaborations that operate like CRITFC may better prepare Natives nations to address external influences and nested enterprises in the 21st century.

Additional research should focus on the need for specific technical and legal capacities in the context of renewable energy developments. There may be better arrangements specifically for renewable energy development such as shared capacities among partnerships. Case studies should also be evaluated for NNBT's expanded elements that account for the role of external forces and inter-tribal collaboration efficacy in other fields of study.

References

1. Adamson, R. (2003). Land Rich, Dirt Poor: The Story of Indian Assets. *Native Americas Journal*, 26–37. Retrieved from http://www.nrfc.org/ln/documents/Adamson_LandRich_jb3.pdf

2. Bäckman, A. (2011). The Nordic electricity system as a common-pool resource.

3. Begay, M. A. (1997). *Leading by choice, not chance: Leadership education for native chief executives of American Indian nations* (Doctoral dissertation, Harvard Graduate School of Education).

4. Brookshire, D., and Kaza, N., (2013). Planning for seven generations: Energy planning of American Indian Tribes. Energy Policy 62: 1506-1514.

5. The Cherokee Nation v. The State of Georgia. 30 U.S. 1. Supreme Court. (1831).

6. Civic Impulse. (2015). H.R. 2623 — 104th Congress: To amend the Indian Self-Determination and Education Assistance Act to make the provisions and benefits. Retrieved from https://www.govtrack.us/congress/bills/104/hr2623.

7. Clark-Deschene, C. (2011). Tribal Utility Overview: Tribal Renewable Energy Business Development and Financing. Presented at Tribal Renewable Energy Business Development and Financing Conference, National Renewable Energy Laboratory. Boulder, Colorado

8. Clary, D. M. (2011). Commercial-Scale Renewable Energy Projects on Tribal Lands. *Natural Resources & Environment*, *25*, 19–23.

9. Colombi, B. J. (2012). Salmon and the adaptive capacity of Nimiipuu (Nez Perce) culture to cope with change. The American Indian Quarterly, 36(1), 75-97.

10. Colombi, B. J., & Brooks, J. (Eds.). (2012). Keystone nations: indigenous peoples and salmon across the north Pacific. School for Advanced Research Press.

11. Colombi, B. J., & Smith, C. L. (2012). Adaptive capacity as cultural practice. Ecol Soc, 17(4), 13.

12. Colombi, B. J., & Smith, C. L. (2014). Insights on Adaptive Capacity: Three Indigenous Pacific Northwest Historical Narratives. Journal of Northwest Anthropology, 48(2).

13. Committee member. (08.25.2011). Comments made during Indian Country Energy and Infrastructure Working Group (ICEIWG) meeting. Retrieved from http://energy.gov/sites/prod/files/2013/07/f2/ICEIWG_MeetingSummary_Denver_Aug2011.pdf

14. Committee member. (03.14.2013). Comments made during Indian Country Energy and Infrastructure Working Group (ICEIWG) meeting. Retrieved from http://energy.gov/sites/prod/files/2013/07/f2/ICEIWG_MeetingSummary_LasVegas_Mar2013.pdf

15. Connolly, M. L. (2008). Commercial Scale Wind Industry on the Campo Indian Reservation. *Nat. Resources & Env't*, *23*, 25.

16. Contreras, G. (2001). Exclusivity Agreements in Tribal-State Compacts: Mutual Benefit Revenue-Sharing or Illegal State Taxation. *J. Gender Race & Just.*, *5*, 487.

17. Cornell, S. E., & Kalt, J. P. (1992). *Reloading the dice: Improving the chances for economic development on American Indian reservations* (Vol. 59). Malcolm Wiener Center for Social Policy, John F. Kennedy School of Government, Harvard University.

18. Cornell, S., & Kalt, J. P. (1995). Where does economic development really come from? Constitutional rule among the contemporary Sioux and Apache. *Economic Inquiry*, *33*(3), 402-426.

19. Cornell, S., & Kalt, J. P. (1998). Sovereignty and nation-building: The development challenge in Indian country today. American Indian Culture and Research Journal, 22(3), 187-214.

20. Cornell, S., & Kalt, J. P. (2000). Where's the glue? Institutional and cultural foundations of American Indian economic development. *The Journal of Socio-Economics*, *29*(5), 443-470.

21. Cornell, S., Jorgensen, M., & Kalt, J. P. (2002). The First Nations Governance Act: Implications of research findings from the United States and Canada. *Udall Center for Studies in Public Policy-The University of Arizona*.

22. Cowan, M. J. (2005). Double taxation in Indian country: Unpacking the problem and analyzing the role of the federal government in protecting tribal governmental revenues. *Pittsburgh Tax Review*, *2*(2).

23. Cox, M., Arnold, G., & Tomás, S. V. (2010). A review of design principles for community-based natural resource management. *Ecology and Society*, *15*(4), 38.

24. Delmas, M., & Tokat, Y. (2005). Deregulation, governance structures, and efficiency: the US electric utility sector. *Strategic Management Journal*, *26*(5), 441-460.

25. Doris, E., Lopez, A., & Beckley, D. (2013). Geospatial Analysis of Renewable Energy Technical Potential on Tribal Lands. US Department of Energy, Office of Indian Energy.

26. EIA. (2000). *Energy Consumption and Renewable Energy Development Potential on Indian Lands*. Washington, DC.

27. Farhangi, H. (2010). The path of the smart grid. *Power and Energy Magazine, IEEE*, *8*(1), 18-28.

28. Fletcher, M. L. (2005). In Pursuit of Tribal Economic Development as a Substitute for Reservation Tax Revenue. *North Dakota Law Review*, *80*.

29. Frank, S. A. (2012a). Natural selection. III. Selection versus transmission and the levels of selection*. *Journal of evolutionary biology*, *25*(2), 227-243.

30. Frank, S. A. (2012b). Natural selection. IV. The Price equation*. *Journal of evolutionary biology*, *25*(6), 1002-1019.

31. Gold, L. S. (2012). Establishing a Tribal Utility Authority Handbook: 2012 Edition. Prepared for the U.S. Department of the Interior Indian Energy and Economic Development.

32. Grossman, Z. (2005). Unlikely alliances: treaty conflicts and environmental cooperation between Native American and rural white communities. American Indian culture and research journal, 29(4), 21-43.

33. Hardin, G. (1968). The tragedy of the commons. *science*, *162*(3859), 1243-1248.

34. Hayek, F. A. (1945). The use of knowledge in society.

35. Henson, E. C., Taylor, J. B., Curtis, C., Cornell, S., Grant, K. W., Jorgensen, M., ... & Lee, A. J. (2008). *The state of the Native nations: conditions under US policies of self-determination*. New York: Oxford University Press.

36. Jones, T. and Necefer, L. In Review. Identifying Barriers and Predictors for Success for Renewable Energy Development on Tribal Lands.

37. Jorgensen, M. (Ed.). (2007). *Rebuilding native nations: Strategies for governance and development*. University of Arizona Press.

38. Jorgensen, M., & Taylor, J. B. (2000). What Determines Indian Economic Success?: Evidence from Tribal and Individual Indian Enterprises. Cambridge, MA: Harvard University.

39. Kalt, J. P. (1995). Successful Economic Development and Heterogeneity of Governmental Form on American Indian Reservations.

40. Krepps, M. B. (1991). Can tribes manage their own resources?: a study of American Indian forestry and the 638 Program. Malcolm Wiener Center for Social Policy, John F. Kennedy School of Government, Harvard University.

41. Kronk, E. A. (2011). Tribal Energy Resource Agreements: The Unintended Great Mischief for Indian Energy Development and the Resulting Need for Reform. Pace Envtl. L. Rev., 29, iv.

42. Künneke, R., & Finger, M. (2009). The governance of infrastructures as common pool resources. In *Workshop on the Workshop* (Vol. 4, pp. 3-6).

43. LaDuke, W. (1994). Traditional Ecological Knowledge and Environmental Futures. Colo. J. Int'l Envtl. L. & Pol'y, 5, 127.

44. Lane, C., & Scoones, I. (1993). Barabaig natural resource management. *MAN AND THE BIOSPHERE SERIES*, *12*, 93-93.

45. Leeds, S. L. (2006). Moving toward exclusive tribal autonomy over lands and natural resources. Nat. Resources J., 46, 439.

46. MacCourt, D. C. (2010). *Renewable Energy Development in Indian Country: A Handbook for Tribes*. National Renewable Energy Laboratory.

47. Niamir-Fuller, M. (1998). The resilience of pastoral herding in Sahelian Africa. *Linking social and ecological systems: Management practices and social mechanisms for building resilience*, 250-284.

48. Nie, M. (2008). Use of Co-Management and Protected Land-Use Designations to Protect Tribal Cultural Resources and Reserved Treaty Rights on Federal Lands, The. *Nat. Resources J.*, *48*, 585.

49. Nilles, Kathleen M., Lawrence, Frank, Saunders, Allyson. (2011). Tribal Business Formation - Legal and Structural Options. Presented at Tribal Renewable Energy Business Development and Financing Conference, National Renewable Energy Laboratory. Boulder, Colorado.

50. Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge university press.

51. Ostrom, E. (2008). Tragedy of the commons. *The New Palgrave Dictionary of Economics*, 3573-3576.

52. Pasqualetti, M. J., Jones, T. E., Necefer, L., Scott, C. A., & Colombi, B. J. (2016). A Paradox of Plenty: Renewable Energy on Navajo Nation Lands. *Society & Natural Resources*, 1-15.

53. Pagdee, A., Kim, Y. S., & Daugherty, P. J. (2006). What makes community forest management successful: a meta-study from community forests throughout the world. *Society and Natural Resources*, *19*(1), 33-52.

54. Redhorse, D., & Smith, T. R. (1982). American Indian tribal taxation of energy resources. *Nat. Resources J.*, *22*, 659.

55. Rosser, E. (2008). This Land is My Land, This Land Is Your Land: Markets and Institutions for Economic Development on Native American Land. *Arizona Law Review*, *47*(245).

56. Royster, J. (2008). Practical Sovereignty, Political Sovereignty, and the Indian Tribal Energy Development and Self-Determination Act. Lewis & Clark Law Review, 12, 1065.

57. S. 1017. 93rd Congress. Indian Self-Determination and Education Assistance Act of 1975. Public Law 93-638.

58. Schaff, Margaret M. and Doan, Ron. (2002). Case Study on the Formation of Umpqua Indian Utility Cooperative A Tribal Utility Formed by the Cow Creek Band of Umpqua Tribe of Indians. Prepared for The Affiliated Tribes of Northwest Indians Economic Development Corporation.

59. Schwartz, M., Blakeley, K., & O'Rourke, R. (2012) Department of Defense energy initiatives: background and issues for Congress. Library of Congress. Washington, DC. Congressional Research Service.

60. Snipp, M. C. (1986). American Indians and Natural Resource Development: Indigenous Peoples' Land, Now Sought after, Has Produced New Indian-White Problems. *American Journal of Economics and Sociology*, *45*(4), 457–474.

61. Scott, J. C. (1998). *Seeing like a state: How certain schemes to improve the human condition have failed*. Yale University Press.

62. Secretarial Order No. 3206. 1997. American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act.

63. Stahl, B., Chavarria, L., & Nydegger, J. D. (2009). Wind energy laws and incentives: a survey of selected state rules. *Washburn LJ*, *49*, 99.

64. Stern, Walter. 2009. Development Energy Projects on Federal Lands: Tribal Rights, Roles, Consultation, and Other Interests (a Developers Perspective). Rocky Mountain Mineral Law Foundation-Inst., No.3, Paper No. 15A.

65. Sullivan, B. C. (2010). Changing Winds: Reconfiguring the Legal Framework for Renewable-Energy Development in Indian Country. *Ariz. L. Rev.*, *52*, 823.

66. Sunoo, J. J. M., & Falkner, J. A. (1999). Regulatory negotiations: the Native American experience. *The Consensus Building Handbook*, 901-922.

67. Trosper, R. (2009). Resilience, reciprocity and ecological economics: Northwest Coast sustainability. Routledge.

68. Turner, M. D. (1999). Conflict, environmental change, and social institutions in dryland Africa: Limitations of the community resource management approach. *Society & Natural Resources*, *12*(7), 643-657.

69. Unger, K. R. (2009). Change is in the Wind : Self-Determination and Wind Power through Tribal Energy Resource Agreements. *Earth*, *43*.

70. United States v. Kagama. 118 U.S. 375. Supreme Court. (1886).

71. U.S. Const. art. 2 & 8.

72. Western Area Power Administration, W. U.-T. (2010). Tribal Authority Process, Case Studies: The Conversion of On-reservation Electric Utilities to Tribal Ownership and Operation.

73. Wilkinson, C. (1997). Role of Bilateralism in Fulfilling the Federal-Tribal Relationship: The Tribal Rights-Endangered Species Secretarial Order, The. *Wash. L. Rev.*, *72*, 1063.

74. Williams, G. C. (2008). *Adaptation and Natural Selection: A Critique of Some Current Evolutionary Thought: A Critique of Some Current Evolutionary Thought*. Princeton University Press.

75. Wilson, D. S., & Wilson, E. O. (2007). Rethinking the theoretical foundation of sociobiology. *The Quarterly review of biology*, *82*(4), 327-348.

76. Wilson, D. S., Ostrom, E., & Cox, M. E. (2013). Generalizing the core design principles for the efficacy of groups. *Journal of Economic Behavior & Organization*, *90*, S21-S32.

77. Wolsink, M. (2012). The research agenda on social acceptance of distributed generation in smart grids: Renewable as common pool resources. *Renewable and Sustainable Energy Reviews*, *16*(1), 822-835.

78. Zellmer, S. B. (2000). Conserving Ecosystems Through the Secretarial Order on Tribal Rights. *Natural Resources & Environment*, 162-214.

Conclusion

There is great potential for renewable energy throughout Indian country and considerable need. Although there are a host of internal barriers including development capacity that must be addressed on an individual Native nation or inter-tribal collaboration level, there are several areas of external federal and state barriers that should also be addressed.

Federal actions that uphold treaty rights and supports or strengthen tribal sovereignty are essential for continued progress in tribal communities. Supreme Court decisions, Congressional actions and federal executive branch actions that strengthen or erode tribal sovereignty can have cascading positive or negative influences on tribal governance and thus tribal energy development. Greater practical tribal sovereignty, self-governance, and self-determination can help transform communities into vigorous economies that are capable of greater societal wellbeing. Greater political and economic sovereignty can lead to less financial dependence on federal government programs and promote localized and informed decision making.

On an individual Native nation or inter-tribal collaboration level, waiving sovereign immunity for renewable energy project development should not be considered in the same context as federal decisions and actions that erode sovereignty. Waiving sovereignty is a common business action that is not specific to tribal governments. An action that a Native nation is not forced into but rather makes the conscience choice to participate in is in fact sovereignty in practice; including waiving sovereignty for economic development. The U.S. government also waives sovereign immunity with contracts to individuals or employers to keep separation of powers objective.

Federal tax reform needs to occur regarding energy development on tribal lands to promote greater energy development opportunities and tribal revenue. State taxes that vary from state to state and county to country can be leveraged that can prove fatal to renewable energy development on tribal lands. Several areas of concern arise with state taxation on tribal lands. First, states are not granted general authority to tax Native nations and often have ad-hoc areas of taxation that has mostly been decided by court rulings. State taxation for property, depletion, revenue sharing and sales tax are an affront to the tribal sovereignty granted by federal law. Limitations on state taxation influence on renewable energy developments needs to be explored to incentivize renewable energy development on tribal lands.

Second, when taxes are levied against Native nations there is not certainty that the taxes are going towards improving the tribal communities with which they came. If state taxation on tribal lands remains, a correlated requirement that the taxation revenue go towards community improvements seems inherently reasonable. Additionally, many tribal governments levy their own taxes on businesses on tribal lands. A double taxation of state and tribal can make developments less attractive financially and greater clarification on which taxation supersedes the other needs to be determined.

Lastly, reform concerning the exclusion of Native nations from receiving renewable energy tax incentives should be considered. Currently, Native nations or native organizations can partner with outside entities to capture these credits for development. However, this process inherently forces shared ownership and thus can reduce revenue for a Native nation or inter-tribal group. Native nation inclusion in receiving tax incentives can place greater decision-making authority on appropriate development consistent with their community's respective values.

The historic lack or degraded infrastructure that spans many parts of Indian country should be a priority for federal investment. Native nations have the potential to play a major role in a clean energy future for the United States. Tribal energy development can add to a smart grid and help meet federal and state emission standards and energy portfolios. Lacking the appropriate infrastructure limits the potential for contributing to regional and national energy needs and limits meeting localized community electrification.

Federal action that focuses on these areas can begin to better fuel renewable energy development on tribal lands. With greater energy development on tribal lands greater economic sovereignty and opportunities for societal improvements can emerge. Investing in Indian country *is* investing in the United States. Meeting tribal community needs and being an integral part of energy infrastructure and supply in the United States is the future of Indian Energy.

References

1. Abbott, J. A. (2010). The localized and scaled discourse of conservation for wind power in Kittitas County, Washington. *Society & Natural Resources* 23 (10):969–85. doi:10.1080/08941920802438634
2. Adamson, R. (2003). Land Rich, Dirt Poor: The Story of Indian Assets. *Native Americas Journal*, 26–37. Retrieved from http://www.nrfc.org/ln/documents/Adamson_LandRich_jb3.pdf
3. Allen, M. (1989). Native American Control of Tribal Natural Resource Development in the Context of the Federal Trust and Tribal Self-Determination. *Boston College Environmental Affairs Law Review*, *16*(4).
4. Amin, S. M., & Gellings, C. W. (2006). The North American power delivery system: balancing market restructuring and environmental economics with infrastructure security. Energy, 31(6), 967-999.
5. Anonymous. (2014). Tribe at a crossroads: The Navajo nation purchases a coal mine. *Environmental Health Perspectives* 122 (4):104–7.
6. Arnold, C. (2014). Once upon a mine: The legacy of uranium on the Navajo Nation. *Environmental Health Perspectives* 122 (2):44–49. doi:10.1289/ehp.122-a44
7. Awerbuch, S. & Preston, A. (Eds.) (2012). The virtual utility: Accounting, technology & competive aspects of the emerging industry (Vol. 26). Springer Science & Business Media.
8. Bäckman, A. (2011). The Nordic electricity system as a common-pool resource.
9. Barsh, R. L. (1992). Democratization and Development. *Hum. Rts. Q.*, *14*, 120.
10. Begay, M. A. (1997). *Leading by choice, not chance: Leadership education for native chief executives of American Indian nations* (Doctoral dissertation, Harvard Graduate School of Education).
11. Berkhofer Jr, R. F. (1978). Native Americans. Ethnic leadership in America, 119-149.
12. Billy, C., Heydt, G., Langness, P., Laughter, A., Mann, B., Rice, M., & Winslow, L. (2007). Sustainable Electric Power Options with Attention to Native American Communities. *IEEE*, *00*, 177–182.

13. Bird, L., Bolinger, M., Gagliano, T., Wiser, R., Brown, M., & Parsons, B. (2005). Policies and market factors driving wind power development in the United States. *Energy Policy*, *33*(11), 1397-1407.
14. Brookshire, D., and N. Kaza. (2013). Planning for seven generations: Energy planning of American Indian tribes. *Energy Policy* 62:1506–14.
15. Brugge, D., & Goble, R. (2002). The history of uranium mining and the Navajo people. *American Journal of Public Health*, *92*(9), 1410–9. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3222290&tool=pmcentrez&rendertype=abstract
16. Brugge, D., J. L. deLemos, and C. Bui. (2007). The Sequoyah Corporation fuels release and the Church Rock spill: Unpublicized nuclear releases in American Indian communities. *American Journal of Public Health* 97 (9):1595–600. doi:10.2105/ajph.2006.103044
17. Brugge, D., T. Benally, and E. Yazzie-Lewis. (2006). *The Navajo people and uranium mining*. Albuquerque, NM: University of New Mexico Press.
18. Brummels, G. (2010). Wind energy mapping using geographic information systems. MA thesis, Northern Arizona University, Department of Geography, Planning, and Recreation, Flagstaff, AZ.
19. Bunnell, J. E., L. V. Garcia, J. M. Furst, H. Lerch, R. A. Olea, S. E. Suitt, and A. Kolker. (2010). coal combustion and respiratory health near Shiprock, New Mexico. *Journal of Environmental Public Health* 2010:1–14. doi:10.1155/2010/260525
20. Burningham, K., J. Barnett, and G. Walker. (2015). An array of deficits: Unpacking NIMBY discourses in wind energy developers' conceptualizations of their local opponents. *Society & Natural Resources* 28 (3):246–60. doi:10.1080/08941920.2014.933923
21. Campbell, G. R. (1987). Northern Cheyenne Ethnicity, Religion, and Coal Energy Development. The Plains Anthropologist, 378-388.
22. Civic Impulse. (2015). H.R. 2623 — 104th Congress: To amend the Indian Self-Determination and Education Assistance Act to make the provisions and benefits. Retrieved from https://www.govtrack.us/congress/bills/104/hr2623.

23. Clark-Deschene, C. (2011). Tribal Utility Overview: Tribal Renewable Energy Business Development and Financing. Presented at Tribal Renewable Energy Business Development and Financing Conference, National Renewable Energy Laboratory. Boulder, Colorado
24. Clary, D. M. (2011). Commercial-Scale Renewable Energy Projects on Tribal Lands. *Natural Resources & Environment*, *25*, 19–23.
25. Colombi, B. J. (2012). Salmon and the adaptive capacity of Nimiipuu (Nez Perce) culture to cope with change. The American Indian Quarterly, 36(1), 75-97.
26. Colombi, B. J., & Brooks, J. (Eds.). (2012). Keystone nations: indigenous peoples and salmon across the north Pacific. School for Advanced Research Press.
27. Colombi, B. J., & Smith, C. L. (2012). Adaptive capacity as cultural practice. Ecol Soc, 17(4), 13.
28. Colombi, B. J., & Smith, C. L. (2014). Insights on Adaptive Capacity: Three Indigenous Pacific Northwest Historical Narratives. Journal of Northwest Anthropology, 48(2).
29. Committee member. (03.14.2013). Comments made during Indian Country Energy and Infrastructure Working Group (ICEIWG) meeting. Retrieved from http://energy.gov/sites/prod/files/2013/07/f2/ICEIWG_MeetingSummary_LasVegas_Mar2013.pdf
30. Committee member. (08.25.2011). Comments made during Indian Country Energy and Infrastructure Working Group (ICEIWG) meeting. Retrieved from http://energy.gov/sites/prod/files/2013/07/f2/ICEIWG_MeetingSummary_Denver_Aug2011.pdf
31. Connolly, M. L. (2008). Commercial Scale Wind Industry on the Campo Indian Reservation. *Nat. Resources & Env't*, *23*, 25.
32. Contreras, G. (2001). Exclusivity Agreements in Tribal-State Compacts: Mutual Benefit Revenue-Sharing or Illegal State Taxation. *J. Gender Race & Just.*, *5*, 487.
33. Cornell, S. (1998). Strategic Analysis: A Practical Tool for Building Indian Nations. Harvard Project on American Indian Economic Development. Retrieved September 30, 2014, from http://fngovernance.org/resources_docs/Strategic_Analysis_for_Economic_Development.pdf.

34. Cornell, S. (2001). Enhancing Rural Leadership and Institutions: What Can We Learn from American Indian Nations?. International Regional Science Review, 24(1), 84-102.
35. Cornell, S. E., & Kalt, J. P. (1992). *Reloading the dice: Improving the chances for economic development on American Indian reservations* (Vol. 59). Malcolm Wiener Center for Social Policy, John F. Kennedy School of Government, Harvard University.
36. Cornell, S. E., & Kalt, J. P. (Eds.). (1992). *What can tribes do?: Strategies and institutions in American Indian economic development*. Los Angeles, CA: American Indian Studies Center, University of California, Los Angeles.
37. Cornell, S., & Kalt, J. P. (1995). Where does economic development really come from? Constitutional rule among the contemporary Sioux and Apache. *Economic Inquiry*, *33*(3), 402-426.
38. Cornell, S., & Kalt, J. P. (1998). Sovereignty and nation-building: The development challenge in Indian country today. American Indian Culture and Research Journal, 22(3), 187-214.
39. Cornell, S., & Kalt, J. P. (2000). Where's the glue? Institutional and cultural foundations of American Indian economic development. *The Journal of Socio-Economics*, *29*(5), 443-470.
40. Cornell, S., Jorgensen, M., & Kalt, J. P. (2002). The First Nations Governance Act: Implications of research findings from the United States and Canada. *Udall Center for Studies in Public Policy-The University of Arizona*.
41. Cowan, M. J. (2005). Double taxation in Indian country: Unpacking the problem and analyzing the role of the federal government in protecting tribal governmental revenues. *Pittsburgh Tax Review*, *2*(2).
42. Cox, M., Arnold, G., & Tomás, S. V. (2010). A review of design principles for community-based natural resource management. *Ecology and Society*, *15*(4), 38.
43. Croucher, M., A. Evans, and T. James. 2012. *Navajo Generating Station and Kayenta Mine: An economic impact study*. Tempe, AZ: Arizona State University, L. William Seidman Research Institute, W. P. Carey School of Business. http://www.ngspower.com/pdfx/SRPASUNGS.pdf (accessed December 10, 2014).
44. Dalkey, N. C. (1967). *Delphi*. Santa Monica, CA: The RAND Corporation.

45. deLemos, J. L., Brugge, D., Cajero, M., Downs, M., Durant, J. L., George, C. M., … Lewis, J. (2009). Development of risk maps to minimize uranium exposures in the Navajo Churchrock mining district. *Environmental Health : A Global Access Science Source*, *8*, 29. doi:10.1186/1476-069X-8-29
46. Delmas, M., & Tokat, Y. (2005). Deregulation, governance structures, and efficiency: the US electric utility sector. *Strategic Management Journal*, *26*(5), 441-460.
47. Doris, E., Lopez, A., & Beckley, D. (2013). Geospatial Analysis of Renewable Energy Technical Potential on Tribal Lands. US Department of Energy, Office of Indian Energy.
48. Douglas, M., & Wildavsky, A. (1983). Risk and culture: An essay on the selection of technological and environmental dangers. Univ of California Press.
49. Doyle, J. T., Redsteer, M. H., & Eggers, M. J. (2013). Exploring effects of climate change on Northern Plains American Indian health. *Climatic change*,*120*(3), 643-655.
50. Drag, E. & Kimelberg, M. (2014) Seneca Nation – 2014 Project Retrived February, 02, 2016, from http://apps1.eere.energy.gov/tribalenergy/projects_detail.cfm/project_id=223
51. Dreveskracht, R. D. (2011). Economic Development, Native Nations, and Solar Projects. *The Journal of Energy and Development*, *34*(2).
52. Eichstaedt, P. H. 1994. *If you poison us: Uranium and Native Americans*. Santa Fe, NM: Red Crane Books.
53. Energy Information Administration. 2000. *Energy consumption and renewable energy development potential on Indian lands*. Washington, DC: U.S. Department of Energy.
54. Erickson, W. P., Johnson, G. D., & Young Jr, D. P. (2005). A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions. *USDA Forest Service General Technical Report PSW-GTR-191*, 1029-1042.
55. Farella, J. R. 1990. *The main stalk: A synthesis of Navajo philosophy*. Tucson, AZ: University of Arizona Press.
56. Farhangi, H. (2010). The path of the smart grid. *Power and Energy Magazine, IEEE*, *8*(1), 18-28.
57. Fletcher, M. L. (2005). In Pursuit of Tribal Economic Development as a Substitute for Reservation Tax Revenue. *North Dakota Law Review*, *80*.
58. Frank, S. A. (2012a). Natural selection. III. Selection versus transmission and the levels of selection*. *Journal of evolutionary biology*, *25*(2), 227-243.

59. Frank, S. A. (2012b). Natural selection. IV. The Price equation*. *Journal of evolutionary biology*, *25*(6), 1002-1019.
60. Garcia, R. W. N. (2010). Who Is Hawaiian, What Begets Federal Recognition, and How Much Blood Matters. Asian-Pacific Law & Policy, Journal, 11, 85.
61. Gil, A., D. Shafer, and J. Elmer. 2012. U.S. Department of Energy Office of Legacy Management's Tribal Interactions–12513. WM Symposia, Tempe, AZ. http://www.wmsym.org/archives/2012/ papers/12513.pdf
62. Glaser, L. S. 2009. *Electrifying the rural American West: Stories of power, people, and place*. Norman, OK: University of Nebraska Press.
63. Gold, L. S. (2012). Establishing a Tribal Utility Authority Handbook: 2012 Edition. Prepared for the U.S. Department of the Interior Indian Energy and Economic Development.
64. Graf, W. L. 1990. Fluvial dynamics of thorium-230 in the Church Rock Event, Puerco River, New Mexico. *Annals of the Association of American Geographers* 80:327–42. doi:10.1111/j.1467-8306.1990.tb00300.x
65. Graham, L. (2002). Securing Economic Sovereignty through Agreement. *New Eng. L. Rev.*, *37*, 523.
66. Graham, L. M. (2004). Interdisciplinary Approach to American Indian Economic Development, An. *NDL Rev.*, *80*, 597.
67. Greenhowe, J. S. (2013). Reservations Please! Could Energy Development on Native American Land Be America's Most Valuable Resource? *Journal of Environmental and Public Health*, *7*(2), 279–304. doi:10.5195/pjephl.2013.51
68. Grossman, Z. (2005). Unlikely alliances: treaty conflicts and environmental cooperation between Native American and rural white communities. American Indian culture and research journal, 29(4), 21-43.
69. Hall, K. 1992. Changing woman, Tukunavi and coal: Impacts of the energy industry on the Navajo and Hopi reservations. *Capitalism Nature Socialism* 3 (1):49–78. doi:10.1080/10455759209358473
70. Hardin, G. (1968). The tragedy of the commons. *science*, *162*(3859), 1243-1248.
71. Hayek, F. A. (1945). The use of knowledge in society.

72. Henson, E. C., Taylor, J. B., Curtis, C., Cornell, S., Grant, K. W., Jorgensen, M., ... & Lee, A. J. (2008). *The state of the Native nations: conditions under US policies of self-determination*. New York: Oxford University Press.
73. Hill, R., C. Grant, M. George, C. J. Robinson, S. Jackson, and N. Abel. 2012. A typology of indigenous engagement in Australian environmental management: Implications for knowledge integration and social-ecological system sustainability. *Ecology and Society* 17 (1):23. doi:10.5751/es-04587-170123
74. Ho, C. K., C. A. Sims, and J. M. Christian. 2014. Evaluation of glare at the Ivanpah solar electric generating system. SAND2014–15847, Sandia National Laboratory Report.
75. Jett, S. C. (1992). An introduction to Navajo sacred places. Journal of Cultural Geography, 13(1), 29-39.
76. Jones, T. and Necefer, L. In Review. Identifying Barriers and Predictors for Success for Renewable Energy Development on Tribal Lands.
77. Jorgensen, M. (Ed.). (2007). Rebuilding native nations: Strategies for governance and development. University of Arizona Press.
78. Jorgensen, M., & Taylor, J. B. (2000). What Determines Indian Economic Success?: Evidence from Tribal and Individual Indian Enterprises. Cambridge, MA: Harvard University.
79. Kahan, D. M., Braman, D., Gastil, J., Slovic, P., & Mertz, C. K. (2007). Culture and identity-protective cognition: Explaining the white-male effect in risk perception. Journal of Empirical Legal Studies, 4(3), 465-505.
80. Kahneman, D. (2011) *Thinking, fast, and slow*. Macmillan
81. Kalt, J. P. (1995). Successful Economic Development and Heterogeneity of Governmental Form on American Indian Reservations.
82. Kelley, K., and H. Francis. 1993. Places important to Navajo people. *American Indian Quarterly* 17 (2):151–69. doi:10.2307/1185525
83. Kimmell, K., and Stalenhoef, D.S., 2011. The Cape Wind offshore wind energy project: A case study of the difficult transition to renewable energy. Golden Gate University Environmental Law Journal 5(1): 209-211.
84. Koontz, H., & O'Donnell, C. (1976). Management: A systems and contingency analysis of managerial functions (6th ed.). New York: McGraw-Hill.

85. Krepps, M. B. (1991). Can tribes manage their own resources?: a study of American Indian forestry and the 638 Program. Malcolm Wiener Center for Social Policy, John F. Kennedy School of Government, Harvard University.
86. Kronk, E. A. (2009). Alternative Energy Development in Indian Country: Lighting the Way for the Seventh Generation. *Idaho L. Rev.*, *46*, 449.
87. Kronk, E. A. (2011). Tribal Energy Resource Agreements: The Unintended Great Mischief for Indian Energy Development and the Resulting Need for Reform. Pace Envtl. L. Rev., 29, iv.
88. Künneke, R., & Finger, M. (2009). The governance of infrastructures as common pool resources. In *Workshop on the Workshop* (Vol. 4, pp. 3-6).
89. LaDuke, W. (1994). Traditional Ecological Knowledge and Environmental Futures. Colo. J. Int'l Envtl. L. & Pol'y, 5, 127.
90. Lane, C., & Scoones, I. (1993). Barabaig natural resource management. *Man and the BIOSPHERE Series*, *12*, 93-93.
91. LeBeau, T. A. (2001). Reclaiming Reservation Infrastructure: Regulatory and Economic Opportunities for Tribal Development. Stan. L. & Pol'y Rev., 12, 237.
92. Leeds, S. L. (2006). Moving toward exclusive tribal autonomy over lands and natural resources. Nat. Resources J., 46, 439.
93. Linstone, H. A., & Turoff, M. (1975). The Delphi method: Techniques and applications. Reading, Massachusetts: Addison-Wesley Publishing Company
94. Lynam, T., De Jong, W., Sheil, D., Kusumanto, T., & Evans, K. (2007). A review of tools for incorporating community knowledge, preferences, and values into decision making in natural resources management. Ecology and society, 12(1), 5.
95. Lynn, K., J. Daigle, J. Joffman, F. Lake, N. Michelle, D. Ranco, and P. Williams. 2013. The impacts of climate change on tribal traditional foods. *Climatic Change* 120(3):545–56.
96. MacCourt, D. C. (2010). *Renewable Energy Development in Indian Country: A Handbook for Tribes*. National Renewable Energy Laboratory.
97. Maldonado, J. K., B. J. Colombi, and R. Pandya. 2014. *Climate change and indigenous peoples in the United States: Impacts, experiences, and actions*. New York, NY: Springer Press.

98. Martin, J. A. 2011. Significant traditional cultural properties of the Navajo people. Traditional Culture Program, Navajo Nation Historic Preservation Department, Window Rock, AZ.
99. McLish, T. P. (1988). Tribal Sovereign Immunity: Searching for Sensible Limits. *Columbia Law Review*, 173-193.
100. McPherson, R., and A. Wolff. 1997. The Utah Navajo and the poverty, politics, and petroleum: Aneth oil field. *American Indian Quarterly* 21 (3):451–70.
101. Meisen, P., & Erberich, T. (2009). Renewable Energy on Tribal Lands. *Global Energy Network Institute (GEN), www. geni.org/Trevor. erberich@gmail.com*.
102. Middlemiss, L., & Parrish, B.D. (2010). Building capacity for low-carbon communities: The role of grassroots initiatives. *Energy Policy, 38*(12), 7559-7566.
103. Moore, J. D. 1993. Justice too long delayed on the Navajo reservation: The Bennett freeze as a case study in government treatment of Native Americans. *Harvard Human Rights Journal* 6:222–29.
104. Nangle, J. (2013). Military Base Off-taker Opportunities for Tribal Renewabel Energy Projects. US Department of Energy, Office of Indian Energy
105. Navajo Nation Council. 2014. *Council blocks proposed uranium recovery project*. Window Rock, AZ: The Navajo Nation Council. http://www.navajonsn.gov/News%20Releases/NNCouncil/2014/july/FOR%20IMMEDIATE%20RELEASE%20%20Navajo%20Nation%20Council%20blocks%20proposed%20in%20situ%20uranium%20recovery%20project.pdf (accessed January 20, 2016).
106. Navajo Nation Department of Economic Development. 2009. 2009–2010 comprehensive economic development strategy: The Navajo Nation. http://www.navajobusiness.com/pdf/CEDS/CED_NN_Final_09_10.pdf (accessed January 20, 2016).
107. Navajo Nation Energy Policy. 2013. 0276–13. http://www.navajonsn.gov/News%20Releases/Other/2013/0276-13WebsiteFile.pdf (accessed July 2014).
108. Navajo Tribal Utility Authority (NTUA) (2006). *Final Report: Navajo Electrification Demonstration Program*.

109. Navajo Tribal Utility Authority. (n.d.). NTUA solar program FAQ's. http://www.ntua.com/solar/ FAQs.html (accessed April 23, 2015).
110. Necefer, L., Wong-Parodi, G., Jaramillo, P., & Small, M. J. (2015). Energy development and Native Americans: Values and beliefs about energy from the Navajo Nation. Energy Research & Social Science, 7, 1-11.
111. Nelkin, D. (1981). Native Americans and Nuclear Power. *Science, Technology & Human Values*, *6*(35), 2–13.
112. Niamir-Fuller, M. (1998). The resilience of pastoral herding in Sahelian Africa. *Linking social and ecological systems: Management practices and social mechanisms for building resilience*, 250-284.
113. Nie, M. (2008). Use of Co-Management and Protected Land-Use Designations to Protect Tribal Cultural Resources and Reserved Treaty Rights on Federal Lands, The. *Nat. Resources J.*, *48*, 585.
114. Nilles, Kathleen M., Lawrence, Frank, Saunders, Allyson. (2011). Tribal Business Formation - Legal and Structural Options. Presented at Tribal Renewable Energy Business Development and Financing Conference, National Renewable Energy Laboratory. Boulder, Colorado.
115. O'Brien, S. (1993). *American Indian tribal governments* (Vol. 192). University of Oklahoma Press
116. Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge university press.
117. Ostrom, E. (2008). Tragedy of the commons. *The New Palgrave Dictionary of Economics*, 3573-3576.
118. Pagdee, A., Kim, Y. S., & Daugherty, P. J. (2006). What makes community forest management successful: a meta-study from community forests throughout the world. *Society and Natural Resources*, *19*(1), 33-52.
119. Pasqualetti, M. J. 2011a. Opposing wind energy landscapes: A search for common cause. *Annals of Association of American Geographers* 101 (4):907–17. doi:10.1080/00045608.2011.568879
120. Pasqualetti, M. J. 2011b. Social barriers to renewable energy landscapes. *Geographical Review* 101 (2):201–23. doi:10.1111/j.1931-0846.2011.00087.x

121. Pasqualetti, M. J., Jones, T. E., Necefer, L., Scott, C. A., & Colombi, B. J. (2016). A Paradox of Plenty: Renewable Energy on Navajo Nation Lands. *Society & Natural Resources*, 1-15.
122. Pearson, E. (2000). "We Have Almost Forogtten How To Hope": The Hualapai, The Navajo, And the Fight for the Central Arizona Project 1944-1968. *Western Historical Quarterly*, *31*(Autumn), 297–316.
123. Pemberton Jr, R. (1985). I Saw That It Was Holy: The Black Hills and the Concept of Sacred Land. Law & Ineq., 3, 287.
124. Piña, V. Y., and W. W. Covington. 1993. Conservation biology, restoration ecology, and a Navajo view of nature. General Technical Report RM-247, USDA Forest Service. http://library.eri.nau.edu/gsdl/collect/erilibra/import/YazzieEtAl_1993_SustainableEcological.pdf (accessed January 20, 2016).
125. Powell, D. E. 2010. Landscapes of power: An ethnography of energy development on the Navajo Nation. PhD dissertation, Department of Anthropology, University of North Carolina-Chapel Hill, Chapel Hill, NC.
126. Powell, D. E., and A. Curley. 2008. K'e, Hozhó, and non-governmental politics on the Navajo Nation: Ontologies of difference manifest in environmental activism. *Anthropological Quarterly* 81:17–58.
127. Powell, D. E., and D. J. Long. 2010. Landscapes of power: Renewable energy activism in Diné Bikéyah. In *Indians and energy: Exploitation and opportunity in the American Southwest*, ed. S. Smith and B. Frehner 231–62. Santa Fe, NM: School for Advanced Research Press.
128. Ramirez, R. (1999). Value co-production: intellectual origins and implications for practice and research. Strategic Management Journal, 20(1), 49-65.
129. Redhorse, D., & Smith, T. R. (1982). American Indian tribal taxation of energy resources. *Nat. Resources J.*, *22*, 659.
130. Redsteer, M. H., Kelley, K. B., Francis, H., & Block, D. (2013). Increasing vulnerability of the Navajo people to drought and climate change in the southwestern United States: Accounts from Tribal Elders. *Special report on indigenous people, marginalized populations and climate change. Cambridge University Press, Cambridge*.

131. Reno, P. (1981). Mother Earth, Father Sky, and economic development: Navajo resources and their use (No. 3). University of New Mexico Press.
132. Rosser, E. (2008). This Land is My Land, This Land Is Your Land: Markets and Institutions for Economic Development on Native American Land. *Arizona Law Review*, *47*(245).
133. Royster, J. (2008). Practical Sovereignty, Political Sovereignty, and the Indian Tribal Energy Development and Self-Determination Act. Lewis & Clark Law Review, 12, 1065.
134. Ruffing, L. T. (1978). Navajo mineral development. Am. Indian J., 4, 31.
135. S. 1017. 93rd Congress. Indian Self-Determination and Education Assistance Act of 1975. Public Law 93-638.
136. Schaff, Margaret M. and Doan, Ron. (2002). Case Study on the Formation of Umpqua Indian Utility Cooperative A Tribal Utility Formed by the Cow Creek Band of Umpqua Tribe of Indians. Prepared for The Affiliated Tribes of Northwest Indians Economic Development Corporation.
137. Schoepfle, M., Burton, M., & Begishe, K. (1984). Navajo attitudes toward development and change: A unified ethnographic and survey approach to an understanding of their future. American Anthropologist, 86(4), 885-904.
138. Schwartz, M., Blakeley, K., & O'Rourke, R. (2012) Department of Defense energy initiatives: background and issues for Congress. Library of Congress. Washington, DC Congressional Research Service.
139. Scott, J. C. (1998). *Seeing like a state: How certain schemes to improve the human condition have failed*. Yale University Press.
140. Secretarial Order No. 3206. 1997. American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act.
141. Shirley, J. 2005. *Desert rock energy project will help Navajo Nation regain its economic independence*. The Navajo Nation, Office of the President. http://www.navajo-nsn.gov/images/pdf%20releases/George%20Hardeen/march07/Desert%20Rock%20Energy%20Project%20Will%20Help%20Navajo%20Nation%20Regain%20Its%20Economic%20Independence_March.pdf (accessed January 20,2016).
142. Shirley, J. 2009. *Navajo President Joe Shirley, Jr. places Desert Rock project into international perspective during State of Nation address*. The Navajo Nation, Office of

the President and Vice President. http://www.navajo-nsn.gov/News%20Releases/George%20Hardeen/Apr09/090422pres_Navajo%20president%20puts%20Desert%20Rock%20into%20international%20perspective.pdf (accessed January 20, 2016).

143. Slovic, P. (1987). Perception of risk. Science, 236(4799), 280-285.
144. Smith, K. 2007. Pollution of the Navajo Nation lands. Paper presented at the United Nations' International Expert Group Meeting on Indigenous Peoples and Protection of the Environment, Khabarovsk, Russian Federation, August.
145. Snipp, M. C. (1986). American Indians and Natural Resource Development: Indigenous Peoples' Land, Now Sought after, Has Produced New Indian-White Problems. *American Journal of Economics and Sociology*, *45*(4), 457–474.
146. Stahl, B., Chavarria, L., & Nydegger, J. D. (2009). Wind energy laws and incentives: a survey of selected state rules. *Washburn LJ*, *49*, 99.
147. Stern, Walter. 2009. Development Energy Projects on Federal Lands: Tribal Rights, Roles, Consultation, and Other Interests (a Developers Perspective). Rocky Mountain Mineral Law Foundation-Inst., No.3, Paper No. 15A.
148. Stevenson, M. G. 1996. Indigenous knowledge in environmental assessment. *Arctic* 49 (3):278–91. doi:10.14430/arctic1203
149. Stoffle, R. W., & Evans, M. J. (1988). American Indians and nuclear waste storage: the debate at Yucca Mountain, Nevada. Policy Studies Journal, 16(4), 751-767.
150. Sullivan, B. C. (2010). Changing Winds: Reconfiguring the Legal Framework for Renewable-Energy Development in Indian Country. *Ariz. L. Rev.*, *52*, 823.
151. Sunoo, J. J. M., & Falkner, J. A. (1999). Regulatory negotiations: the Native American experience. *The Consensus Building Handbook*, 901-922.
152. Tano, M. L. (2006). Developing Agile Tribal Leaders and Agile Tribal Institutions to Adaptively Manage and Mitigate the Impacts of Global Climate Change in Indian Country. *Report to International Institute for Indigenous Resource Management. Denver, CO*
153. Tarasi, D., C. Alexander, J. Nania, and B. Gregory. 2011. 18,000 Americans without electricity: Illuminating and solving the Navajo energy crisis. *Colorado Journal of Environmental Law and Policy* 22 (2):263.

154. The Cherokee Nation v. The State of Georgia. 30 U.S. 1. Supreme Court. (1831).
155. Tiller, V.E.V. (2005). Tiller's guide to Indian Country. Albuquerque, NM: BowArrow Publishing.
156. Triandis, H. C. (1995). Individualism & collectivism. Westview press.
157. Tribal Energy Program Website. http://apps1.eere.energy.gov/tribalenergy/index.cfm
158. Trosper, R. (2009). Resilience, reciprocity and ecological economics: Northwest Coast sustainability. Routledge.
159. Tsosie, R. (1997). Tribal Environmental Policy In An Era of Self-Determination: The Role of Ethics, Economics, and Traditional Ecological Knowledge. *Vermont Law Review*, *21*(225), 225–333.
160. Tsosie, R. 2009. Climate change, sustainability, and globalization: Charting the future of indigenous environmental self-determination. *Environmental & Energy Law & Policy Journal* 4 (2):188–255.
161. Turner, M. D. (1999). Conflict, environmental change, and social institutions in dryland Africa: Limitations of the community resource management approach. *Society & Natural Resources*, *12*(7), 643-657.
162. U. S. Department of Energy, Office of Indian Energy. 2013. Developing clean energy projects on tribal lands: Data and resources for Tribes. http://www.nrel.gov/docs/fy13osti/57748.pdf (accessed November 1, 2014).
163. U. S. Environmental Protection Agency. 2014. Carbon pollution emission guidelines for existing stationary sources: Electric utility generating units. https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electricutility-generating (accessed December 16, 2014).
164. U.S. Const. art. 2 & 8.
165. Umberger, A., and A. Ramo. 2013. California Public Utilities Commission applies utility's acid rain program credit sale proceeds to renewable energy projects on Native American lands. http://ggucuel.org/california-public-utilities-commission-applies-utility's-acid-rain-program-credit-saleproceeds-to-renewable-energy-projects-on-native-american-lands (accessed April 22, 2015).

166. Unger, K. R. (2009). Change is in the Wind : Self-Determination and Wind Power through Tribal Energy Resource Agreements. *Earth*, *43*.
167. United States Energy Information Administration. (2000). Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Consumption and Renewable Energy Development Potential on Indian Lands, Department of Energy, Washington, DC.
168. United States Environmental Protection Agency. (2007). *Abandonded Uranium Mines And The Navajo Nation - Navajo Nation AUM Screening Assessment Report and Atlas with Geospatial Data*. San Francisco, CA. Retrieved from http://www.epa.gov/region9/superfund/navajo-nation/abandoned-uranium.html
169. United States Government Accounting Office. (2015). Indian Energy Development: Poor management by BIA has hindered energy development on Indian lands. (GAO Publication No. 15-502). Washington, D.C.: U.S. Government Printing Office.
170. United States v. Kagama. 118 U.S. 375. Supreme Court. (1886).
171. Vetter, W. V. (1994). Doing Business with Indians and the Three" S" es: Secretarial Approval, Sovereign Immunity, and Subject Matter Jurisdiction. *Ariz. L. Rev.*, *36*, 169.
172. Voggesser, G. 2010. The evolution of federal energy policy for tribal lands and the renewable energy future. In *Indians and energy: Exploitation and opportunity in the American Southwest*, ed. S. Smith and B. Frehner 55–88. Santa Fe, NM: School for Advanced Research Press.
173. Voggesser, G., K. Lynn, J. Daigle, F. K. Lake, and D. Ranco. 2013. Cultural impacts to Tribes from climate change influences on forests. *Climatic Change* 120(3):615–26.
174. Western Area Power Administration, W. U.-T. (2010). Tribal Authority Process, Case Studies: The Conversion of On-reservation Electric Utilities to Tribal Ownership and Operation.
175. Wilkins, D. E., and K. T. Lomawaima. 2001. *Uneven ground: American Indian sovereignty and federal law*. Norman, OK: University of Oklahoma Press.
176. Wilkinson, C. (1997). Role of Bilateralism in Fulfilling the Federal-Tribal Relationship: The Tribal Rights-Endangered Species Secretarial Order, The. *Wash. L. Rev.*, *72*, 1063.
177. Williams, G. C. (2008). *Adaptation and Natural Selection: A Critique of Some Current Evolutionary Thought: A Critique of Some Current Evolutionary Thought*. Princeton University Press.

178. Williams, T., and P. Hardison. (2013). Culture, law, risk and governance: Contexts of traditional knowledge in climate change adaptation. *Climatic Change* 120(3):531–44.
179. Wilson, D. S., & Wilson, E. O. (2007). Rethinking the theoretical foundation of sociobiology. *The Quarterly review of biology*, *82*(4), 327-348.
180. Wilson, D. S., Ostrom, E., & Cox, M. E. (2013). Generalizing the core design principles for the efficacy of groups. *Journal of Economic Behavior & Organization*, *90*, S21-S32.
181. Wolsink, M. (2012). The research agenda on social acceptance of distributed generation in smart grids: Renewable as common pool resources. *Renewable and Sustainable Energy Reviews*, *16*(1), 822-835.
182. Yurth, C. 2011. LEEDing by example: NTUA goes green with new Chinle facility. http://navajotimes.com/news/2011/0711/072311green.php#.VThoL61Viko (accessed April 19, 2015).
183. Zaferatos, N. C. (2006). Environmental justice in Indian country: dumpsite remediation on the Swinomish Indian reservation. Environmental Management, 38(6), 896–909. doi:10.1007/s00267-004-. *Environmental Management*, *38*(6), 896–909. doi:10.1007/s00267-004-0103-0
184. Zellmer, S. B. (2000). Conserving Ecosystems Through the Secretarial Order on Tribal Rights. *Natural Resources & Environment*, 162-214.