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Identifying Barriers and Pathways for Success for Renewable Energy Development on American Indian Lands

Dr. Thomas Elisha Jones
Dr. Len Edward Necefer

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550

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Dr. Thomas Elisha Jones
Dr. Len Edward Necefer
Sandia National Laboratories
P.O. Box 5800, MS-0734
Albuquerque, New Mexico 87185-0734

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.

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1. 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, 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, 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.

External as well as internal factors can play significant roles with energy development on tribal lands. Necefer et al. (2015), describes a public elicitation related to energy development on Navajo Nation. Their study suggested that despite high poverty and unemployment on the reservation, economic gains through resource development is limited in part by environmental impact concerns. Environmental preservation was found to be tied to culture, identity, and viable stewardship that supports future generations (Necefer et al., 2015). Similarly, Pasqualetti et al. (2016) found on tribal lands that tribal norms, customs, and histories play significant roles in renewable energy resource development acceptance. The research suggested accounting for tribal values, intratribal and tribal-nontribal politics, and nested policies was suggested as essential for continued renewable energy resource development on tribal lands.

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.

2. 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. In the second round, the initial set of findings are returned to the initial 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 and discussions identified through webinars, workshops and conferences (Brookshire & Kaza, 2013; DOE IE 2014; GAO, 2015; Greenhowe, 2013; Kronk, 2009; MacCourt, 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. Participants were additionally asked if there were barriers not mentioned in the survey that they considered relevant. Incorporating open discussion on barriers not listed is meant to eliminate any perceived bias towards particular barriers. We did not distinguish between the different types or scales of renewable energy development that a respective tribe could pursue. Rather, our results reflect the perceptions of individuals regarding tribal renewable energy development in general as each type of energy development assuredly has unique challenges. We additionally pretested the survey with five individuals prior to contacting participants. No changes were made to the survey after pretesting and pretest participants were not included in the final survey participant pool.

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. Experts were additionally identified through their prominence in working within tribal energy (e.g. published work on tribal energy, tribal energy directors). 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. We had a response rate of 51% with 24 recipients completing a survey out of 47 contacted. Of the 47 contacted 14 were female and 33 were male. Of the 24 respondents 7 were female and 17 were male. The experts interviewed represented 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.

[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.

3. 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 – 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 1.).

Table 1: 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 2.).

Table 2: 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 3.).

Table 3: 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 4.).

Table 4: 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 5.).

Table 5: 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 6.).

Table 6: 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 7.).

Table 7: 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 between tribes and outside entities

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 8.).

Table 8: 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 renewable energy 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 9.).

Table 9: 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 10.).

Table 10: 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 11.).

Table 11: 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%

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 the 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). Notably the 50MW Campo Kumayaay installation is the largest wind installation on tribal lands.

State and federal legislation and regulation of renewable energy can have a number of positive impacts for tribal projects. Renewable portfolio standards and financial incentives can provide markets for renewable electricity and significantly lower barriers to finding non-tribal off-takers. Energy portfolio standards can also 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. For example, the 50MW installation on the Campo Kumeyaay reservation provides renewable electricity demands created by California portfolio standards. 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). 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.

Tribal governments also have the ability to regulating renewable energy and 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 could create cooperative agreements to implement such standards with states and public utilities, which is an expression of de facto tribal sovereignty (Graham, 2004).

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. Exerting sovereign power over resources and governance is the focus of many tribes. Experts explained that tribal sovereignty motivates renewable energy development through promoting goals of energy self-sufficiency and independence, environmental sustainability, economic development, and community resiliency. 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. 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). 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.

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. 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 Bureau of Indian Affairs 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).

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. 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. Many view this as an unneeded aspect of energy development although it is a common business transaction. However, waiving sovereign immunity is not a tribal government specific clause. Governments all across the globe have clauses for waving sovereign immunity, including the United States. The Tucker Act (1887) waives sovereign immunity for contracts with the United States involving debts incurred for salaries of government employees, tax refunds that have not been sent, commercial contract, and any other provision that specifically mentions waiving immunity. Interestingly, one expert mentioned that "any decision a tribe makes that they are not forced into is in fact expressing sovereignty, including waiving sovereignty".

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; Necefer et al., 2015, 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; Meisen & Erberich, 2009). 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, tax incentives and federal power purchase agreements would encourage development if made available to tribes.

Also, many tribes may 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 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.

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. 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).

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 also 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. 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.

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 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 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) 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 or type of energy resource to be developed. Third, we did not consider the role a tribe's own history with energy development plays in influencing future decisions. Fourth, we did not compare response results from the different categories of experts (e.g. tribal or academia). Variances in opinion may exist that could emerge upon further study with more experts. Lastly, our geographic distribution of tribal energy experts did not include tribes from the eastern United States.

5. CONCLUSIONS AND FUTURE WORK

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. 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.

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

12. Campbell, G. R. (1987). Northern Cheyenne Ethnicity, Religion, and Coal Energy Development. The Plains Anthropologist, 378-388.
13. Clary, D. M. (2011). Commercial-Scale Renewable Energy Projects on Tribal Lands. *Natural Resources & Environment*, *25*, 19–23.
14. Connolly, M. L. (2008). Commercial Scale Wind Industry on the Campo Indian Reservation. *Nat. Resources & Env't*, *23*, 25.
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. Department of Energy, Office of Indian Energy Policy and Programs. (2014). *Education and Training*. http://www.energy.gov/indianenergy/resources/education-and-training
21. Doris, E., Lopez, A., & Beckley, D. (2013). *Geospatial Analysis of Renewable Energy Technical Potential on Tribal Lands*. Washington, DC.
22. Douglas, M., & Wildavsky, A. (1983). Risk and culture: An essay on the selection of technological and environmental dangers. Univ of California Press.
23. 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.
24. Drag, E. & Kimelberg, M. (2014) Seneca Nation – 2014 Project Retrieved February, 02, 2016, from http://apps1.eere.energy.gov/tribalenergy/projects_detail.cfm/project_id=223

25. Dreveskracht, R. D. (2011). Economic Development, Native Nations, and Solar Projects. *The Journal of Energy and Development*, *34*(2).
26. EIA. (2000). *Energy Consumption and Renewable Energy Development Potential on Indian Lands*. Washington, DC.
27. 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.
28. Garcia, R. W. N. (2010). Who Is Hawaiian, What Begets Federal Recognition, and How Much Blood Matters. Asian-Pacific Law & Policy, Journal, 11, 85.
29. Graham, L. (2002). Securing Economic Sovereignty Through Agreement. *New Eng. L. Rev.*, *37*, 523.
30. Graham, L. M. (2004). Interdisciplinary Approach to American Indian Economic Development, An. *NDL Rev.*, *80*, 597.
31. 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
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. Jett, S. C. (1992). An introduction to Navajo sacred places. Journal of Cultural Geography, 13(1), 29-39.
34. Jorgensen, M. (Ed.). (2007). Rebuilding Native Nations: Strategies for governance and development. University of Arizona Press.
35. 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.
36. Kahneman, D. (2011) *Thinking, fast, and slow*. Macmillan
37. 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.

38. Koontz, H., & O'Donnell, C. (1976). Management: A systems and contingency analysis of managerial functions (6th ed.). New York: McGraw-Hill.
39. 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.
40. Kronk, E. A. (2009). Alternative Energy Development in Indian Country: Lighting the Way for the Seventh Generation. *Idaho L. Rev.*, *46*, 449.
41. LeBeau, T. A. (2001). Reclaiming Reservation Infrastructure: Regulatory and Economic Opportunities for Tribal Development. Stan. L. & Pol'y Rev., 12, 237.
42. Linstone, H. A., & Turoff, M. (1975). The Delphi method: Techniques and applications. Reading, Massachusetts: Addison-Wesley Publishing Company
43. 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.
44. MacCourt, D. (2010). Renewable Energy Development in Indian Country : A Handbook for Tribes A Project for the National Renewable Energy Laboratory (NREL). *Contract*, (June).
45. McLish, T. P. (1988). Tribal Sovereign Immunity: Searching for Sensible Limits. *Columbia Law Review*, 173-193.
46. Meisen, P., & Erberich, T. (2009). Renewable Energy on Tribal Lands. *Global Energy Network Institute (GEN), www. geni.org/Trevor. erberich@gmail.com*.
47. Middlemiss, L., & Parrish, B.D. (2010). Building capacity for low-carbon communities: The role of grassroots initiatives. *Energy Policy*, *38*(12), 7559-7566.
48. Nangle, J. (2013). Military Base Off-taker Opportunities for Tribal Renewable Energy Projects. US Department of Energy, Office of Indian Energy
49. Navajo Tribal Utility Authority (NTUA) (2006). *Final Report: Navajo Electrification Demonstration Program*.
50. 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.

51. Nelkin, D. (1981). Native Americans and Nuclear Power. *Science, Technology & Human Values*, *6*(35), 2–13.
52. O'Brien, S. (1993). *American Indian tribal governments* (Vol. 192). University of Oklahoma Press
53. Pasqualetti, M., Jones, T., Necefer, L., Scott, C., Colombi, B. (2016). A Paradox of Plenty: Renewable Energy on Native Lands. Society and Natural Resources.
54. Pearson, E. (2000). "We Have Almost Forgotten How To Hope": The Hualapai, The Navajo, And the Fight for the Central Arizona Project 1944-1968. *Western Historical Quarterly*, *31*(Autumn), 297–316.
55. Pemberton Jr, R. (1985). I Saw That It Was Holy: The Black Hills and the Concept of Sacred Land. Law & Ineq., 3, 287.
56. Ramirez, R. (1999). Value co-production: intellectual origins and implications for practice and research. Strategic Management Journal, 20(1), 49-65.
57. 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*.
58. Reno, P. (1981). Mother Earth, Father Sky, and economic development: Navajo resources and their use (No. 3). University of New Mexico Press.
59. 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).
60. Royster, J. (2008). Practical Sovereignty, Political Sovereignty, and the Indian Tribal Energy Development and Self-Determination Act. Lewis & Clark Law Review, 12, 1065.
61. Ruffing, L. T. (1978). Navajo mineral development. Am. Indian J., 4, 31.
62. 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.
63. Slovic, P. (1987). Perception of risk. Science, 236(4799), 280-285.

64. 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.
65. 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.
66. 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*.
67. Tiller, V.E.V. (2005). Tiller's guide to Indian Country. Albuquerque, NM: BowArrow Publishing.
68. Triandis, H. C. (1995). Individualism & collectivism. Westview press.
69. Tribal Energy Program Website. http://apps1.eere.energy.gov/tribalenergy/index.cfm
70. Trosper, R. (2009). Resilience, reciprocity and ecological economics: Northwest Coast sustainability. Routledge.
71. 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.
72. Unger, K. R. (2009). Change is in the Wind : Self-Determination and Wind Power through Tribal Energy Resource Agreements. *Earth*, *43*.
73. 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.
74. United States Environmental Protection Agency. (2007). *Abandoned 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
75. 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.

76. 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.
77. 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.
78. 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

APPENDIX A: EXPERT ELICITATION INTERIVEW & QUESTIONAIRE 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

DISTRIBUTION

3 Department of Energy, Office of Indian Energy Policy & Programs
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