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SUSTAINABLE RED POWER: TRIBAL ENERGY SOVEREIGNTY AND THE WAY FORWARD

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“Tribes are not vestiges of the past, but laboratories of the future.”

Vine Deloria Jr.¹

This article will examine how tribes can synthesize Indigenous ingenuity and federal self-determination policy to strengthen their cultural and political institutions by developing sophisticated solar-based microgrids and leveraging blockchain technology. This article acknowledges that climate change is here to stay and seeks to provide indigenous peoples in the US with innovative community solutions that work toward tribal energy sovereignty (ES) by marrying Indigenous sciences and cultural knowledge with innovative technologies. This article examines some of the creative renewable energy and blockchain systems that Indigenous communities have been using and encourages tribal leaders to consider how such technologies can support one another to strengthen ES. By pragmatically leveraging inherent sovereignty, federal programs, and principles from international law, tribes can exert tribal energy sovereignty

* J.D. & M.P.S. Candidate, University of Arizona James E. Rogers College of Law, Indigenous Peoples Law and Policy Program, Class of 2022. This article is dedicated to the author’s two sons—Leonardo and Raphael. The author acknowledges that he (and his older generations) merely borrow the land from them (and their younger generations). The author also expresses his deep love and appreciation for his wife, Tania. The author apologizes for inevitably bringing all of their very limited, COVID-era, dinner discussions with friends to blockchain and microgrids—hah! Tania’s countless hours, tireless dedication, and keen intellect were of paramount importance in conceptualizing and refining the ideas in this article. The author also expresses his deepest appreciation, respect, and admiration to the indigenous luminaries that paved the way for this article including Professors Rebecca Tsosie, Rob Williams, Dr. Lawrence Gross, and the late great Vine Deloria Jr.. We—as human beings—have sacred obligations to our future generations that require us to restore ecological balance, decrease carbon emissions, and advance indigenous scientific knowledge. We must do what we can with what we have to protect all of our relations; including our children, loved ones, mother earth, and non-human kin.

¹ Elizabeth Ann Kronk Warner, *Tribes As Innovative Environmental "Laboratories"*, 86 U. Colo. L. Rev. 789, 836 (2015).

by building resilient systems to protect their cultures and economies from the ravages of climate change.

Section I clarifies the cultural context of this article and explores the immense importance of traditional cultural values. More specifically, Section I explores traditional Cowlitz practices, my identity as a Cowlitz man as an integral element of this article, and the connections between Cultural Sovereignty² and ES³. Section II examines the political and economic realities facing Indian communities seeking to develop renewable energy by briefly exploring Federal Indian Law, the UN Declaration on the Rights of Indigenous Peoples, Native nation-building, and the benefits of decentralizing Indian affairs by moving from centralized federal management to decentralized tribal governance. Section III explores solar energy and microgrids generally and briefly explores three remarkable tribal case studies. Section IV explores some of the specific ways that tribes can work toward solar and microgrid-based ES by leveraging cultural values, tribal programs, federal self-determination policy, and NGOs. Section V considers blockchain technologies generally and looks at some innovative ways Indigenous peoples in the US use them. Section VI considers how blockchain can support ES by allowing tribes to develop peer-to-peer (p2p), decentralized, community-energy systems. Section VII shares final conclusions on recommendations.

I. Context, Cultural Sovereignty, and Energy Sovereignty	42
A. Professional and Cultural Context	42
1. Cultural Sovereignty	44
2. Energy Sovereignty	45
II. Building Strong Autonomous Native Nations	46
A. Federal Indian Law and Self-Determination Policy	46
B. International Law and Interest Convergence	47
C. Decentralization and Native Nation-Building	49
III. Renewable Energy Technology Basics	50
A. Solar Energy	50
B. Energy Storage – Microgrids and Batteries	51
C. Energy Landscape in Indian Country	54
IV. Renewable Excellence in Indian Country – Case Studies	54
A. Blue Lake Rancheria	54
B. Spokane Tribe	55
C. Navajo Tribal Utility Authority	56
D. Case Study Observations	57
V. The Way Forward – Blockchain and Energy Sovereignty	57
A. Sovereignty and Indigenous Blockchain Projects in the U.S.	57

² The term Cultural Sovereignty was developed by Professor Rebecca Tsosie and Wallace Coffey and is explored at length later in this Note.

³ See Chelsea Shelly, et. al, *Energy Policy for Energy Sovereignty: Can Policy Tools Enhance Energy Sovereignty?*, *Solar Energy* 205 (2020): 109-112. (defining Energy Sovereignty as “an emerging concept that attempts to redefine the priorities for decision making regarding energy systems. Rather than promoting energy security (typically defined in terms of security of the supply of carbon intensive fuel sources for a nation, an understanding anchored in the geopolitics of past crises) or prioritizing decarbonization (the goal for most policy work emphasizing climate change action as the primary motivation for energy system transitions), energy sovereignty centers the rights of communities and individuals to make their own choices regarding the forms, scales, and sources of energy as well as the patterning and organization of energy usage.” (internal citations omitted).

B. Blockchain Fundamentals – It's More Than Just Cryptocurrency	59
VI. P2P Energy Trading	60
A. Blockchain Evolves – From Currency to Contracts	60
1. Brooklyn Microgrid	61
2. To Decentralize or Not to Decentralize – Ethereum's Current Limitations	62
3. Decentralized p2p Energy Markets	63
VII. Conclusion and Recommendations	64

I. Context, Cultural Sovereignty, and Energy Sovereignty

A. Professional and Cultural Context

This article is not an objective review of the law but a labor of love born out of my lived experience. Before entering the legal world, I worked on three different reservations in California for an Indian housing non-profit, a tribal housing department, and a tribal gaming facility. I witnessed first-hand the impacts of climate change on tribal communities at the ends of powerlines as they struggled to support residential and economic operations in the face of rolling blackouts. The impacts to the lives and livelihood of Indian people were significant and, compared to the rest of the population, outsized. Anecdotally, I personally saw blackouts on reservations last longer than those in more densely populated areas because tribes tended to be located at the ends of power lines. In centralized power generation and transmission systems, end of line communities are thus especially at-risk during power outages because they are the first to lose power and the last to regain.

The wildfires in California routinely make national news because of their ferocity. It is widely acknowledged that powerlines, high winds, and drought have collectively caused numerous fires.⁴ Utility-caused powerlines have led to significant environmental, human, and financial losses in California.⁵ To make matters worse, colonial fear of fire radically changed the California landscape and created vast tinderboxes by the accumulation of detritus and tightly packed forests. Traditional Native culture prescribed burning practices, and forest management will play a critical role in California.⁶ Indeed, the global community is beginning to recognize the considerable value of traditional ecological knowledge.⁷ Many utilities have begun cutting power at the sign of strong

⁴ See generally Steve Gorman, *Probe Finds PG&E Power Lines Sparked Deadly 2017 California Wildfires*, Reuters (June 18, 2018), <https://www.reuters.com/article/us-california-fire-idUSKCN1J501C>; see also Russel Gold, et al., *PG&E Sparked at Least 1,500 California Fires. Now the Utility Faces Collapse.*, WALL ST. J. (Jan. 13, 2019), <https://www.wsj.com/articles/pg-e-sparked-at-least-1-500-california-fires-now-the-utility-faces-collapse-11547410768>; see also Cal. Dep't Forestry and Fire Prot., *CAL Fire Investigators Determine Cause of Four Wildfires in Butte and Nevada Counties*, CAL Fire News Release (May 25, 2018), <https://files.constantcontact.com/fac05d5d601/84b67f87-60c5-489b-ac2c-bc1c33dfd067.pdf>; see also Matt Kraus, *CalFire Concludes PG&E Violations Caused 2017 Wildfires*, Elec. Contractor, (May 31, 2018), <https://www.ecmag.com/section/systems/calfire-concludes-pge-violations-caused-2017-wildfires>.

⁵ *Id.*

⁶ See e.g. Maanvi Singh, *'The fire moved around it': success story in Oregon fuels calls for prescribed burns*, The Guardian (Aug. 8, 2021), <https://www.theguardian.com/world/2021/aug/12/the-fire-moved-around-it-success-story-in-oregon-fuels-calls-for-prescribed-burns>.

⁷ See Richard P. Allan, et. al, *Climate Change 2021 The Physical Science Basis*, IPCC (August 7, 2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf; see also Climate Change,

winds to minimize fire risk.⁸ While this practice is sensible, it also causes significant disruption to tribal communities and economic development operations—many of which are at the end of the lines and thus go without power for extended periods.

Severe weather events are devastating Indian and non-Indian communities alike. Indeed, climate change has long been linked with catastrophic power outages.⁹ Such risks will likely increase as severe weather becomes more frequent and extreme. Anecdotally, one relative of mine was without power for 16 days in the wake of Texas's 2020 polar vortex freeze. Similarly, Hurricane Ida resulted in considerable power outages in New Orleans. I, therefore, hope to leverage my academic training to create work with value, integrity, and substance for Indigenous peoples so that we may prepare for what is coming.

Professor Lawrence Gross writes candidly and convincingly about his decision to surrender the scholarly goal of supposed objectivity for a larger goal of academic precision.¹⁰ Professor Gross explains his decision to refer to himself in the first person while referring to his people because the Anishinaabe experience is inseparably his own experience.¹¹ Here, supposed academic objectivity must also be surrendered for precision because the Cowlitz experience is inseparably my experience.

I am a Cowlitz man, and we pride ourselves on being forever people.¹² As forever people, we are on a continual spiritual quest to honor our ancestors by striving toward a better world for future generations so that we may live in perpetuity. Indeed, the very word Cowlitz—a name which we share with our most important river—means seeker in a spiritual sense.¹³ Traditionally, our young would leave the community to engage in ceremony in the hopes of finding their *Tamanawas* through vision quests.¹⁴ If successful, our young people would come back to the community with a new purpose and spiritual power in life, which would strengthen the entire community.¹⁵ Those who found their *Tamanawas* were blessed with connections to powerful beings which gave them spirit powers, strengths, and determined communal roles and responsibilities. As a Cowlitz scholar, I can't separate my cultural identity from my work because my work springs forth from my being Cowlitz. Indeed, as Vine Deloria Jr. once wrote, "every society needs educated people, but the primary responsibility of educated people is to bring

UN DEP'T OF ECON. AND SOC. AFF. INDIGENOUS PEOPLES (last visited Dec. 4, 2021), (<https://www.un.org/development/desa/indigenouspeoples/climate-change.html>).

⁸ See e.g., Rebecca Heilweil, *The US Power Grid isn't Ready for Climate Change*, Recode, (July 3, 2021), <https://www.vox.com/recode/2021/7/3/22560691/power-grid-climate-change-heat-wave>.

⁹ See generally Alyson Kenward & Urooj Raja, *Blackout: Extreme Weather, Climate Change and Power Outages*, Climate Central (2014); see also Stephane Hallegatte, Jun Rentschler & Julie Rozenberg, *Lifelines: The Resilient Infrastructure Opportunity*, The World Bank (2019); see also Kamia Handayani, Tatiana Filatova & Yoram Krozer, *The Vulnerability of the Power Sector to Climate Variability and Change: Evidence from Indonesia*, 12 *Energies* 3640 (2019).

¹⁰ See Lawrence Gross, *The Comic Vision of Anishinaabe Culture and Religion*, 26 *American Indian Q.*, no. 3, 2002 at 436.

¹¹ *Id.*

¹² See generally Cultural Res. Dep't, Cowlitz Indian Tribe Cultural Resources Department, https://www.cowlitz.org/index.php?option=com_content&view=category&id=27&Itemid=245 (last visited Mar. 14, 2021); see also *Cowlitz Indian Tribe dot the i's on ilani casino resort*, Casinoreview, <https://www.casino-review.co/cowlitz-indian-tribe-ilani/> (last visited Mar. 14, 2021); see also Stevie Mathieu, *Cowlitz Tribe Celebrates Homecoming: Casino*, *Columbian*, (Mar. 14, 2021), <https://www.columbian.com/news/2016/feb/14/cowlitz-tribe-celebrates-homecoming-casino/>.

¹³ See Judith Irwin, *The Dispossessed I*, 1 (2014).

¹⁴ *Id.*, at 146.

¹⁵ *Id.* at 146-7.

wisdom back into the community and make it available to others so that the lives they are leading make sense.”¹⁶ Thus, this article sacrifices supposed academic objectivity for a more profound truth by melding ancestral wisdom with today’s technologies to create a more balanced and loving world for all people.

This article also sacrifices academic objectivity by unrepentantly advancing Indigenous perspectives and solutions to contemporary colonial oppression. Rather than applying insincere political neutrality, this article contends that traditional Native knowledge is a critical element of many of the planet’s most crucial Indigenous-led resistance movements to extractive industries and climate change. One of the most famous encapsulations of traditional Native knowledge is Chief Seattle’s words published in 1887 by Henry Smith in the *Seattle Sunday Star*. Chief Seattle connected Native people and the land when he explained that “to us the ashes of our ancestors are sacred and their resting place is hallowed ground. . . . Our religion is the traditions of our ancestors — the dreams of our old men, given them in solemn hours of the night by the Great Spirit; and the visions of our sachems, and is written in the hearts of our people. . . . Every part of this soil is sacred in the estimation of my people. Every hillside, every valley, every plain and grove, has been hallowed by some sad or happy event in days long vanished.”¹⁷

More contemporary Native leaders such as Chief Arvol Looking Horse, Oren Lyons, and Vine Deloria Jr. have also commented forcefully on the deep cultural and spiritual connections that we as Native people share with our lands.¹⁸ These foundational traditional teachings have spurred Native communities to protect our land and waters through resistance to numerous resource extraction projects such as the Dakota Access Pipeline, Lines 3 and 5, Keystone XL Pipeline, and Oak Flat. Indeed, a recent groundbreaking report by the Indigenous Environmental Network has determined that Indigenous resistance against carbon has kept an estimated 25 percent of CO2 emissions on the earth.¹⁹ Thus, tradition is at the heart of Indigenous actions to protect our land and way of life for the sake of future generations.

1. Cultural Sovereignty

Contrary to popular western belief, tradition does not lock us in the past but enables us to plan more effectively for the future. As such, our traditions and traditional forms of knowledge must be central in charting a path beyond the looming climate catastrophe. In their groundbreaking Stanford Law and Policy Review article, *Rethinking the Tribal Sovereignty Doctrine: Cultural Sovereignty and the Collective Future of Indian Nations*, Wallace Coffey and Professor Rebecca Tsosie argue that we must reorient our understanding of sovereignty based on Native cultural values.²⁰ Mr. Coffey and Professor Tsosie contend that we can only “truly understand the

¹⁶ See generally Corey Still, *Title VII: A Path to Education Equity*, Education Week (Dec. 3, 2013), <https://www.edweek.org/policy-politics/opinion-title-vii-a-path-to-education-equity/2013/12>.

¹⁷ Henry A. Smith, *Scraps From a Diary—Chief Seattle—A Gentleman by Instinct—His Native Eloquence*, *Seattle Sunday Star* (October 29, 1887) (quoting Chief Seattle).

¹⁸ See generally Oren Lyons, *Oren Lyons: On The Indigenous View of the World*, RATIONAL (Sept. 16, 2016), https://www.ratical.org/many_worlds/6Nations/OrenLyons-IndigenousWorldView.html; see also Chief Arvol Looking Horse, *Important Message from Keeper of Sacred White Buffalo Calf Pipe*, Indigenous Environmental Network (Aug. 26, 2016), <https://www.ienearth.org/important-message-from-keeper-of-sacred-white-buffalo-calf-pipe/>; see also Vine Deloria Jr., *God Is Red* (2003).

¹⁹ Dallas Goldtooth et al., *Indigenous Resistance Against Carbon*, Indigenous Environmental Network (2021), <https://www.ienearth.org/indigenous-resistance-against-carbon/>.

²⁰ Wallace Coffey & Rebecca Tsosie, *Rethinking the Tribal Sovereignty Doctrine: Cultural Sovereignty and the Collective Future of Indian Nations*, 12 STAN. L. & P. REV. 191 (2001).

significance of our communities as they are currently constituted, appreciating both the strengths and continuities that exist, as well as the pathologies that destroy community” by “delving into the inquiry of how our Ancestors saw the world.”²¹ Drawing on Vine and Robert Allen Warrior, they posit that “tradition is not a set of prescribed activities, but rather is a set of processes” that “provide the critical constructive material upon which a community rebuilds itself.”²² They conclude by discussing the importance of achieving cultural sovereignty and noting that “our focus in the future must be on nation-building, on institutional development that starts within tribal communities, builds upon our traditional forms of governance, and responds to the contemporary needs of our communities.”²³ Thus, culture and tradition form the basis for how we as Native people comport ourselves in the present and project our people’s values into the future through pragmatic and culturally informed planning.

2. Energy Sovereignty

“Energy sovereignty” is a term that is growing in popularity which combines notions of cultural sovereignty, political sovereignty, and renewable energy. The European Union contends that ES “has become popular among organizations and movements globally, especially after 2000, as a response to multiple forms of extractivism, energy poverty, corporate oligopoly, patriarchy, privatization and trade agreements, wars and crimes to secure provision of fossil fuels.”²⁴ While some scholars have noted that the US energy policy may limit ES, it remains clear that tribal nations are increasingly focused on ES²⁵ Tribes are likely becoming more interested in energy sovereignty because it “applies to community control over the myriad environmental, economic and psychosocial externalities associated with energy production and transportation . . . [and] is linked to both the supply of energy for legitimate needs (whatever the community would take those to be) as well as the implications of the associated externalities.”²⁶

Although US policy may indeed generally limit tribal aspirations for ES, numerous tribes have successfully leveraged federal and private programs in their work to achieve ES²⁷ Moreover, the 2020 Presidential election and subsequent agency nominations may well signal a significant positive change in federal-tribal relations and a more enthusiastic embrace of tribal ES Some tribes have supported President Biden’s commitment to strengthening Indigenous rights and land management efforts to conserve biodiversity under the increasingly popular global ‘30x30 plan,’ which aims to conserve 30 percent of the world’s land by 2030.²⁸ A federal government that is

²¹ *Id.* at 199 (quoting Robert Allen Warrior, TRIBAL SECRETS 87 (1995) (internal quotations removed)).

²² *Id.*

²³ *Id.* at 210 (citing Panel remarks of Joseph Flies-Away, Judge for the Hualapai Tribal Court and the Ft. Mojave Court of Appeals, The Future of Tribal Courts at ASU College of Law (April 21, 2000)).

²⁴ Newsletter for the European Union, *Energy Sovereignty*, Eur. Union (Mar. 25, 2019), <http://www.newslettereuropean.eu/energy-sovereignty/>.

²⁵ See Chelsea Shelly, et. al, *Energy policy for energy sovereignty: Can policy tools enhance energy sovereignty?*, *Solar Energy*, 205 at 109 (2020).

²⁶ *Id.*

²⁷ See tribal renewable excellence case studies *infra* note Section IV.

²⁸ See Native News Online Staff, *Tribal Leaders Endorse Biden Administration’s 30x30 Proposed Policy*, Native News Online (Sep. 17, 2021), <https://nativenewsonline.net/currents/tribal-leaders-endorse-biden-administration-s-30x30-proposed-policy>; I.C.T. Opinion, *Tribal leaders: ‘Support the “30 by 30 initiative” to protect 30 percent of US lands and waters’*, Indian Country Today (Sep. 17, 2021), <https://indiancountrytoday.com/opinion/tribal-leaders-support-the-30-by-30-initiative-to-protect-30-percent-of-us-lands-and-waters>; see also Ashley Hemmers, *Tribal sovereignty a key principle in Biden Administration’s ‘America the Beautiful’*, Indian Country Today (Sep. 17,

supportive of tribal land conservation and renewable energy efforts will be important for tribes interested in achieving ES.

Whether the federal government is outwardly supportive of tribal ES, tribes possess significant inherent authority to work toward their goals. In particular, the development of tribal energy utilities can play a crucial role in achieving ES because it vests tribal entities with energy regulation authority. Tribes working toward energy sovereignty might face pushback from state agencies and utility commissions in the absence of tribal energy utilities. Tribes, however, can clarify their regulatory authority by establishing tribal utilities.²⁹ Indeed, Tribal utilities are rather common throughout Indian Country, and many tribes have developed tribal utilities with support from various federal agencies.³⁰ When considering the development of tribal utilities, Tribes must consider the jurisdictional status of the tribal utility authority, the corporate form of the utility, the contractual relationships with the incumbent utility, and power purchase contracts.³¹ Furthermore, tribal energy utilities can likely help tribes achieve ES by removing administrative duties, responsibilities, and power for communal energy systems from the electoral system.

II. Building Strong Autonomous Native Nations

A. Federal Indian Law and Self-Determination Policy

Indian people in the US are on the precipice of finally leaving behind antiquated relationships with the federal government built on the doctrine of discovery and embodied in the self-determination era and the guardian-ward relationship. The US government has committed countless atrocities on Indian people. Among the most damaging was developing the trust relationship that sought to extend centralized control over all Indian affairs under the federal government. The Supreme Court in the 1886 case, *US v. Kagama*, premised its trust responsibility on the supposed weakness and helplessness of the Indians who required the benevolent protection of the federal government because they were but “remnants of a race once powerful, now weak and diminished in numbers.”³² The trust doctrine is highly convenient and lucrative for the federal government. It provides a handy mechanism by which the federal government could legally steal hundreds of millions of acres of Indian land and countless thousands of Indian children under the auspices of protecting the helpless Indians. With so much to gain through the trust relationship, it quickly became apparent that the federal government had a strong interest in maintaining weakness and helplessness among the Indians so that they could continue ‘protecting’ us. Even still, there are encouraging signs that Indian people are purposefully moving away from the antiquated trust relationship.

In 1970, President Nixon ushered in the era of self-determination and “stressed the continuing importance of the trust relationship between the federal government and the tribes. . . [and] urged a program of legislation to permit the tribes to manage their affairs with a maximum

2021), <https://indiancountrytoday.com/opinion/tribal-sovereignty-a-key-principle-in-biden-administrations-america-the-beautiful>.

²⁹ See Pilar M. Thomas, *Tribal Utility Development Energy Development and Services on Tribal Land*, Ariz. Att'y (April 2019).

³⁰ *Id.* at n. 5; see also, Leonard S. Gold, *Establishing a Tribal Utility Authority Handbook*, Bureau of Indian Affs. (2012), https://www.bia.gov/sites/bia_prod.opengov.ibmcloud.com/files/assets/as-ia/ieed/ieed/pdf/tribalutility_handbook.pdf; see also Office of Indian Energy Policy and Programs, *Tribal Energy Project Funding History*, <https://www.energy.gov/indianenergy/projects/tribal-energy-project-funding-history>.

³¹ Thomas, *supra* note 29, at 26, 28.

³² *US v. Kagama*, 118 US 375, 384 (1886).

degree of autonomy.”³³ Congressional and executive Federal Indian policy have fluctuated somewhat since 1970 but are nevertheless still “based on a model of continuing pluralism; it recognizes that the tribes are here to stay for the indefinite future, and seeks to strengthen them. The assimilationist viewpoint, which has intermittently predominated in the past, is not now in favor.”³⁴ The self-determination policy, after years of federal micromanagement, effectively put tribes in the driver’s seat so they could “develop tribal natural resources and promote reservation economic development according to their own policies and values. For example, many Indian nations have contracted with the federal government to conduct forestry programs on their reservations, often leading to improved management of their timber resources.”³⁵

The current federal policy era of self-determination aligns closely with developing energy independence in Indian Country. Indeed, the United States Department of Energy (DOE) has worked closely with Tribes to develop numerous microgrid projects.³⁶ Nevertheless, there are many valid critiques of the current era of federal self-determination policy. Chronic underfunding remains a tremendous problem, and the federal government has largely neglected its trust obligations by not allocating enough funding to support self-determination or self-governance. However, while certainly related to Federal Indian policy stances, ES rests squarely on the shoulders of Indian people and is based in inherent tribal sovereignty rather than federal policy.

Tribes have possessed inherent sovereignty since time immemorial.³⁷ Tribal inherent sovereignty allows Tribes to enact innovative ES-based regulatory frameworks because they are pre-constitutional sovereigns. Inherent tribal sovereignty, unless explicitly divested by statute or treaty or implicitly divested through historical circumstances, enables tribes to regulate Indian activity on Indian lands.³⁸ Tribes may even, in some instances, exert sovereign authority over non-Indian activity and over non-Indian lands.³⁹ Elizabeth Kronk Warner, a leading Federal Indian Law scholar, has characterized tribes as “regulatory laboratories.”⁴⁰ Furthermore, Kronk Warner explains that inherent tribal sovereignty—in the context of environmental law—allows “tribes the opportunity to innovate where the federal government has not precluded innovation through its own federal environmental statutes.”⁴¹ Professor Kronk Warner further argues that tribes are exercising inherent authority to fill the void left by federal inaction, especially on climate change issues.⁴² Thus, Tribes should strongly consider developing ES-based regulations as an extension of their inherent sovereignty.

B. International Law and Interest Convergence

The UN Declaration on the Rights of Indigenous Peoples (“The Declaration”) presents a seismic shift on international and domestic law. Indigenous leaders worldwide achieved a

³³ William Canby Jr., *American Indian Law in a Nutshell*, 31-33 (5th ed. 2019).

³⁴ *Id.* at 34.

³⁵ Rebecca Tsosie, *Tribal Environmental Policy in an Era of Self-Determination: The Role of Ethics, Economics, and Traditional Ecological Knowledge*, 21 Vt. L. Rev. 225, 231 (1996).

³⁶ See generally *Tribal Energy Project Successes*, US DEPARTMENT OF ENERGY, <https://www.energy.gov/indianenergy/tribal-energy-project-successes> (last visited Dec. 4, 2021).

³⁷ See *Santa Clara Pueblo v. Martinez*, 436 US 49, 56 (1978); see also *Talton v. Mayes*, 163 US 376 (1896); see also *United States v. Wheeler*, 435 US 313 (1978), see also *Merrion v. Jicarilla Apache Tribe*, 455 US 130 (1982).

³⁸ See *Wheeler*, 435 US 313 (1978).

³⁹ See *Montana v. United States*, 450 US 544 (1981).

⁴⁰ Kronk Warner *supra* note 1, at 836.

⁴¹ *Id.*

⁴² Kronk Warner *supra* note 1, at 838.

tremendous victory in 2007, after over two decades of work, with the signing of “The Declaration.”⁴³ Notably, Canada, Australia, New Zealand, and the United States were not signatories, though all have since signed onto The Declaration.⁴⁴ Leading Indian Law scholars Professors Carpenter and Riley have argued that “the world is witnessing a jurisgenerative moment in indigenous peoples’ human rights” because of The Declaration.⁴⁵ While scholars note that The Declaration creates legal obligations for all signatories, it is not considered legally binding on the US.⁴⁶ Nevertheless, other scholars have argued that the absence of any formal opposition to The Declaration strengthens its legal status and effect.⁴⁷

Although many scholars and lawyers in the US are unfamiliar with international law or fail to see its importance, The Declaration provides a valuable framework for Indian decolonization efforts.⁴⁸ Notably, Article 23 of The Declaration provides that

Indigenous peoples have the right to determine and develop priorities and strategies for exercising their right to development. In particular, indigenous peoples have the right to be actively involved in developing and determining health, housing and other economic and social programs affecting them and, as far as possible, to administer such programs through their own institutions.⁴⁹

The Declaration can thus support Indian efforts to build strong, autonomous Indian nations because it inherently rejects the doctrine of discovery and eschews the guardian-ward relationship. The Declaration is an indigenous-drafted template for relations between Indians and the federal government, which presents mutually beneficial reasons for nation-to-nation partnerships and relations.

This moment is also ripe for incorporating The Declaration into US domestic law because there is a convergence of interests between Indians and the white federal government, indicating a mutual desire to dissolve the racist trust model. Professor Derrick Bell’s Interest Convergence Theory provides that “the interest of blacks in achieving racial equality will be accommodated only when it converges with the interests of whites.”⁵⁰ While his theory was initially formulated as an analytical framework for understanding *Brown v. Board of Education*, it has since become a tenant of the Critical Race Theory (CRT).⁵¹ Critical race theorists have applied the same principle

⁴³ United Nations Declaration on the Rights of Indigenous Peoples, G.A. Res. 61/295, Annex, UN Doc. A/RES/61/295 (Sept. 13, 2007), available at <https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html> (hereinafter “The Declaration”).

⁴⁴ *Id.*

⁴⁵ Kristen A. Carpenter & Angela R. Riley, *Indigenous Peoples and the Jurisgenerative Moment in Human Rights*, 102 Cal. L. Rev. 173, 178 (2014).

⁴⁶ See Summer Blaze Aubrey, *Violence Against the Earth Begets Violence Against Women: An Analysis of the Correlation Between Large Extraction Projects and Missing and Murdered Indigenous Women, and the Laws That Permit the Phenomenon Through an Int*, 10 Ariz. J. Envtl. L. & Pol’y 34, 64 (2019).

⁴⁷ See Paul Joffe, *UN Declaration on the Rights of Indigenous Peoples Not Merely “Aspirational”* (Jun. 25, 2015), https://www.afn.ca/uploads/files/2015_usb_documents/un_decl_-_not_merely_aspirational_-_joffe_-_final_-_jun_25_15-1.pdf.

⁴⁸ Carpenter, *supra* note 45, at 204.

⁴⁹ See The Declaration.

⁵⁰ Derrick A. Bell, Jr., *Brown v. Board of Education and the Interest-Convergence Dilemma*, 93 Harv. L. Rev. 518, 523 (1980).

⁵¹ H. Richard Milner IV, *Critical Race Theory and Interest Convergence as Analytic Tools in Teacher Education Policies and Practices*, J. OF TCHR. EDUC., Sept. 2008 at 333.

elaborated in Professor Bell's theory to other communities of color, including Indians. Indeed, Professor Rob Williams—a leading Lumbee Indigenous human rights and Federal Indian Law scholar—was among the Harvard Law students who developed the model that would eventually become CRT.⁵²

Since entering the self-determination era, the US government—as evidenced by the recent *Cobell* settlement—has sought to disregard, diminish, and dismantle its trust obligations to Indian people wherever possible.⁵³ In the landmark tribal trust fund mismanagement case, *Cobell v. Salazar*, Eloise Cobell argued powerfully that the federal government mismanaged \$100 billion in oil, gas, timber, mineral, and grazing proceeds from Indian trust lands.⁵⁴ Despite the extremely compelling evidence of federal mismanagement of Indian trust proceeds, the case settled out of court after years of litigation for a mere \$3.4 billion.⁵⁵ The Cobell litigation and settlement clearly illustrate the government's waning interest in the trust model. Federal and tribal interests likely converge here because the federal government is no longer interested in maintaining its costly and centralized trust system. At the same time, Indian nations have the will and ability to maintain their affairs fully. The Declaration provides a proven alternative that might appeal to both the federal government and Indigenous peoples.⁵⁶

C. Decentralization and Native Nation-building

Tribes can both reap and provide benefits by embracing decentralization and Native nation-building best practices. Professor Wenona Singel has argued that decentralized tribal governance “has allowed Native leaders to apply their knowledge of local context to produce policies that are often more successful than centralized management under federal control.”⁵⁷ Singel pointed powerfully to the positive connection between decentralized tribal governmental structures and community-based climate change solutions.⁵⁸ The notion that decentralized and direct tribal governance is superior to centralized federal control has supported prominent Native Nations timber-based economic development studies.⁵⁹ Studies on tribally run salmon restoration and management programs have also shown the ecological and economic benefits of combining decentralized resource protection and management programs with traditional tribal culture.⁶⁰

⁵² Intersectionality Matters!: 39, *The Insurgent Origins of Critical Race Theory on Apple Podcasts*, <https://podcasts.apple.com/us/podcast/39-the-insurgent-origins-of-critical-race-theory/id1441348908?i=1000534153352>.

⁵³ See Linda Chiem, *\$3.4B Tribal Land Settlement Won't Get Supreme Court Review*, LAW360 (Oct. 29, 2012), <https://www.law360.com/articles/390315/-3-4b-tribal-land-settlement-won-t-get-supreme-court-review>.

⁵⁴ *Id.*

⁵⁵ *Id.*

⁵⁶ It must be noted here however that a small handful of tribal nations have benefitted immensely from the current trust framework—namely those with successful tribal gaming operations. Many of these gaming tribes may oppose a move away from the trust relationship and toward The Declaration. Nevertheless, such a move would likely be in their favor because it would replace an inherently racist relationship with the federal government with a true partnership based on respect and reciprocity.

⁵⁷ Wenona T. Singel, *The First Federalists*, 62 Drake L. Rev. 775, 840 (2014).

⁵⁸ *Id.* at 841.

⁵⁹ See Matthew Krepps, *Can Tribes Manage Their Own Resources? A Study of American Indian Forestry and the 638 Program*, Malcolm Weiner Center for Social Policy (Nov. 1991); see also Matthew Krepps B. & Richard E. Caves, *Bureaucrats and Indians: Principal-Agent Relations and Efficient Management of Tribal Forest Resources* *Journal of Economic Behavior and Organization*, J. Econ. Behav. & Org. (1994).

⁶⁰ See *The Nez Perce Tribal Fishery Honoring Nations Program*, Harvard Project on Am. Indian Econ. Dev. (2015).

Stephen Cornell and Joseph Kalt argue convincingly in their seminal work *Two Approaches to the Development of Native Nations One Works, the Other Doesn't* that successful development occurs under the nation-building model when “(1) Native nations comprehensively assert decision-making power (practical sovereignty, or self-rule); (2) nations back up decision-making power with effective governing institutions; (3) their governing institutions match their own political cultures; (4) decision making is strategic; and (5) leaders serve as nation builders and mobilizers.”⁶¹ Dr. Cornell and Professor Kalt’s research focused primarily on the factors that led to successful tribal economic development. Still, their findings are widely applicable and support the contentions put forth by Mr. Coffey and Professor Tsosie that Native nations must be in charge of their own identity.

III. Renewable Energy Technology Basics

A. Solar Energy

With particular emphasis on photovoltaic (PV), solar capabilities will be crucial for achieving ES. Generally speaking, there are two categories of solar—the well-known silicon-based PV and the less well-known concentrating solar power (CSP) systems.⁶² Solar PV systems harness “the photovoltaic effect exhibited by semiconductors and thus directly converts solar irradiation into electricity.”⁶³ PV systems are the ubiquitous blue or black panels seen on building roofs and in parking lots. On the other hand, CSP systems “use mirrors to focus sunlight onto a receiver in which a fluid (e.g., thermo oil or molten salt) is heated up to several hundred degrees Celsius. In a heat engine (e.g., a steam turbine), this thermal energy is then converted into electricity.”⁶⁴ CSP technology also is the basis upon which the increasingly popular, non-electric solar cookers⁶⁵ and solar water heating systems are based.⁶⁶ While CSP technology is popular among utilities as an alternative to coal-fired power plants and can help through solar cookers and water-heaters, this article focuses primarily on the opportunities presented by PV systems through residential and community-scale electric generation.

Solar PV systems align nicely with traditional tribal values because they reduce greenhouse gas emissions and are highly versatile. ES proponents have noted that solar “has long been promoted as a means of enhancing Tribal Nation sovereignty as it provides a means of sustainable and self-determined economic development for Tribal Nations.” The DOE has noted that each kilowatt-hour (kWh) of solar significantly reduces dangerous pollutants, greenhouse gas

⁶¹ Stephen Cornell & Joseph P. Kalt, *Two Approaches to Economic Development on American Indian Reservations: One Works, the Other Doesn't*, *Rebuilding Native Nations: Strategies for Governance and Development* (2007).

⁶² Michael Peters et al., *Shedding light on solar technologies—A techno-economic assessment and its policy implications*, *Energy Pol'y*, 6422 (2011).

⁶³ *Id.* at 6243.

⁶⁴ *Id.*

⁶⁵ Solar cookers concentrate solar rays through mirrors to cook food. There are a wide variety of solar cookers, they are widely available, relatively affordable, and can provide a relatively effective option to traditional cooking methods. As such, despite not generating electricity directly, solar cookers can help in the shift toward energy sovereignty by empowering Indian people to cook without the need for traditional fuel sources such as wood, gas, propane, or electricity.

⁶⁶ Solar water heating systems use heat from the sun to heat water rather than conventional water heating systems. Similar to solar ovens, these systems can reduce the need for infrastructure and can reduce tribal reliance on fuels traditionally used to heat water.

emissions, water consumption, and water withdrawal.⁶⁷ Thus, solar's political and environmental benefits make it a strong match in Indian Country which values ecological stewardship and connection with the natural world. The DOE has also noted that "most states in the United States have good-to-excellent solar resource. Even places with relatively low solar resources, such as the Pacific Northwest and Alaska, can experience cost savings, and have similar solar resources to countries that have widely developed solar PV, like Germany."⁶⁸

PV also helps tribal economic development by presenting a cost-effective form of energy and asset development. A 2015 Berkeley Labs study of 22,000 US home sales found that solar increases the value of home sales.⁶⁹ Further, the DOE reports that solar is "opportunity for anyone who is looking to reduce monthly utility bills and make a long-term, low-risk investment." A recent study by the International Energy Agency has found that PV systems are now the cheapest energy in history.⁷⁰ Many tribes are located on the ends of existing powerlines, and others have almost no electricity in their communities. The affordability of solar makes it a much simpler and more economical option than extending existing energy infrastructure. Thus, solar PV energy generation systems will play a key role in achieving ES because of their affordability and synergy with tribal values.

B. Energy Storage—Microgrids and Batteries

Microgrids are widely considered critical in developing a dynamic and resilient electric system in the US. According to the DOE, microgrids are local energy grids that are capable of "disconnect[ing] from the traditional grid and operat[ing] autonomously."⁷¹ Microgrids are self-contained energy systems comprised of energy generation, storage, and users.⁷² Microgrids are typically controlled by a centralized load management software and may or may not interact with a larger utility grid.⁷³ At least as far back as 2012, the DOE Smart Grid R&D Program "established microgrid R&D as a key focus area" and identified microgrids as "a key building block" of building a dynamic smart grid.⁷⁴ The National Association of Regulatory Utility Commissioners (NARUC) and National Association of State Energy Officials (NASEO) recently identified microgrids as "a key component of a holistic reliance strategy" in response to increasingly severe weather events.⁷⁵ Notably, the California Public Utilities Commission (CPUC) issued a Decision on June 11, 2020, requiring investor-owned utilities to minimize the impact of wildfire-induced

⁶⁷ Energy Saver, *Benefits of Residential Solar Electricity*, <https://www.energy.gov/energysaver/benefits-residential-solar-electricity> (last visited Mar. 14, 2021).

⁶⁸ *Id.*

⁶⁹ *Berkeley Lab Illuminates Price Premiums for US Solar Home Sales*, Berkeley Lab Electricity Markets & Policy (Jan. 1, 2015), <https://emp.lbl.gov/news/berkeley-lab-illuminates>; see also *SunShot Programs Bring Solar Energy Basics to Real Estate Pros*, Office of Energy Efficiency & Renewable Energy (Jul. 26, 2016), <https://www.energy.gov/eere/articles/sunshot-programs-bring-solar-energy-basics-real-estate-pros>.

⁷⁰ Simon Evans & Josh Gabbatiss, *Solar is now 'cheapest electricity in history', confirms IEA* (Oct. 13, 2020), <https://www.carbonbrief.org/solar-is-now-cheapest-electricity-in-history-confirms-iea>.

⁷¹ US Dep't of Energy, *How Microgrids Work* (June 17, 2014), <https://energy.gov/articles/how-microgrids-work>.

⁷² *Id.*

⁷³ *Id.*

⁷⁴ Dan Ton and Merrill A. Smith, *The US Department of Energy's Microgrid Initiative* (Sept. 13, 2020, 6:47 PM), <https://www.energy.gov/sites/prod/files/2016/06/f32/The%20US%20Department%20of%20Energy's%20Microgrid%20Initiative.pdf>.

⁷⁵ *NASEO NARUC Microgrids State Working Group: Microgrid Planning and Deployment for Community Resilience* (May 20, 2020, 3:30 PM), <https://naseo.org/event?EventID=7192>.

power outages by speeding up microgrid deployment.⁷⁶ Thus, the energy sector has acknowledged the importance of microgrids in creating energy resilience in the face of severe weather events.

Battery storage systems are plagued by many issues but remain crucial elements of microgrid development because they allow for the local storage of locally generated energy. Lithium-ion batteries are the most ubiquitous battery on the planet, powering most smartphones, vapes, laptops, and electric vehicles.⁷⁷ Indeed, the rapid proliferation of smartphones can likely be attributed directly to lithium-ion batteries' development and growth.⁷⁸ Lithium-ion battery prices have fallen almost 90% since 2010, and the technology continues to improve.⁷⁹ Indeed, "the lithium ion battery industry is expected to grow from 100 gigawatt hours of annual production in 2017 to almost 800 gigawatt hours in 2027."⁸⁰ Other lithium-based chemistries have also emerged on the consumer market—namely the Lithium Nickel Manganese Cobalt chemistry seen in the Tesla Powerwall—a grid-tied home battery intended for whole-home power storage to be paired with rooftop solar.⁸¹

Despite the current and future upside to lithium-based batteries, this chemistry is plagued by some significant issues. Nations are currently racing to control the global lithium market, and China currently controls the vast majority of the current global market despite only accounting for 9.7 percent of the world's lithium reserves.⁸² The US has also been accused of backing a coup against Evo Morales' socialist and pro-indigenous government in Bolivia to access their lithium reserves.⁸³ Bolivia possesses significant lithium reserves, which some claimed account for half of the world's entire lithium reserve.⁸⁴ Elon Musk—the American oligarch and CEO of Tesla—has been accused by Evo Morales of encouraging the Bolivian coup so Tesla could have a steady

⁷⁶ Cal. Pub. Util. Comm'n, *CPUC Orders Deployment of Microgrids and Resiliency Strategies to Support Communities and Infrastructure Threatened by Power Outages* (Sept. 13, 2020 at 2:27 PM), <https://yubanet.com/california/cpuc-orders-deployment-of-microgrids-and-resiliency-strategies-to-support-communities-and-infrastructure-threatened-by-power-outages/>.

⁷⁷ Bill Roberson, *The Clock Is Ticking On Electric Car Batteries - And How Long They Will Last* (Sept. 30, 2019), FORBES, <https://www.forbes.com/sites/billroberson/2019/09/30/the-clock-is-ticking-on-electric-car-batteries-and-how-long-they-will-last/?sh=4f23a7f421d9>.

⁷⁸ *Id.*

⁷⁹ David Stringer, *The Secret to a Greener, Longer-Lasting Battery Is Blue*, Bloomberg Businessweek (Sept. 22, 2020), <https://www.bloomberg.com/news/articles/2020-09-22/sodium-ion-batteries-emerge-as-cheaper-alternative-to-lithium>.

⁸⁰ Inst. for Energy Rsch., *The Environmental Impact of Lithium Batteries* (Nov. 12, 2020), <https://www.instituteforenergyresearch.org/renewable/the-environmental-impact-of-lithium-batteries/>.

⁸¹ See Jason Svarc, *Tesla Powerwall Review*, Clean Energy Reviews (Jan. 20, 2021), <https://www.cleanenergyreviews.info/blog/tesla-powerwall-2-solar-battery-review>; see also Tesla Powerwall, <https://www.tesla.com/powerwall>.

⁸² See Inst. for Energy Rsch., <https://www.instituteforenergyresearch.org/renewable/china-dominates-the-global-lithium-battery-market/> (Sept. 9, 2020); see also BloombergNEF, <https://about.bnef.com/blog/china-dominates-the-lithium-ion-battery-supply-chain-but-europe-is-on-the-rise/> (Sept. 16, 2020); see also Robert Rapier, Forbes, <https://www.forbes.com/sites/rpapier/2020/12/13/the-worlds-top-lithium-producers/?sh=36dcab3a5bc6> (Dec. 13, 2020).

⁸³ See Aizar Raldes & Pablo Cozzaglio, *The world needs lithium. Can Bolivia's new president deliver it?*, Grist (Nov. 12, 2020), <https://grist.org/energy/the-world-needs-lithium-can-bolivias-new-president-deliver-it/>; see also Lawrence Wright, *Lithium Dreams*, THE NEW YORKER (Mar. 15, 2010), <https://www.newyorker.com/magazine/2010/03/22/lithium-dreams>.

⁸⁴ See Council on Hemispheric Aff., *Lucky Bolivia and the Future of Lithium in the World Economy* (Feb. 19, 2009), <https://www.coha.org/lucky-bolivia-and-the-future-of-lithium-in-the-world-economy/>.

and cheap supply of the invaluable material.⁸⁵ Indeed, Elon Musk himself tweeted in reference to the Bolivian coup that “we [the US] will coup whoever we want!”⁸⁶ Before the coup, Morales was credited with having dreams of turning Bolivia into an Indigenous-led world lithium powerhouse and the ‘Saudi Arabia of the electric-car era.’⁸⁷ Disturbingly, the Organization of American States (OAS) has also been accused of instigating the coup by spreading now-discredited election statistics and alleging fraud in the Bolivian election just before the coup.⁸⁸ In addition to numerous imperialistic supply chain issues, lithium batteries also degrade over time and lose storage capacity, which presents engineering and ecological problems.⁸⁹

Battery technology is continually improving and is now relatively affordable and accessible, thanks in part to enhancements in efficiency, recycling, and innovative non-lithium-based battery chemistries. New lithium-based chemistries are emerging with purported increases in efficiency, safety, and even potential reductions in adverse environmental and social impacts.⁹⁰ Existing lithium batteries are also being recycled and given new life by do-it-yourself, off-grid energy enthusiasts.⁹¹ Large companies such as Li-Cycle Corp, a recycler of lithium batteries, and Nissan manage significant lithium recycling and upcycling businesses.⁹² Indeed, Nissan is converting older lithium batteries from their line of electric cars into home batteries.⁹³ Recently, Jack Goodenough, the creator of the now-ubiquitous lithium-ion chemistry, developed a sodium-based battery chemistry that can hold three times the energy as lithium-ion batteries.⁹⁴ A polymer-

⁸⁵ See Vijay Prashad & Alejandro Bejarano, *Elon Musk and the Overthrow of Democracy in Bolivia*, Socialist Project The Bullet (Jul. 31, 2020), <https://socialistproject.ca/2020/07/elon-musk-overthrow-of-democracy-in-bolivia/>.

⁸⁶ See Renato Mota, *'Let's hit whoever we want': Musk's tweet sparks controversy*, Olhar Digital (Jul. 27, 2020), <https://olhardigital.com.br/en/2020/07/27/news/let%27s-hit-whoever-we-want-musk-tweet-generates-controversy/>; see also Vijay Prashad & Alejandro Bejarano, *Elon Musk and the Overthrow of Democracy in Bolivia*, LA Progressive (Jul. 28, 2020), <https://www.laprogressive.com/overthrow-of-democracy-in-bolivia>.

⁸⁷ See Wright, *supra* note 83.

⁸⁸ See Mark Weisbrot, *Silence reigns on the US-backed coup against Evo Morales in Bolivia*, The Guardian (Sep. 18, 2020), <https://www.theguardian.com/commentisfree/2020/sep/18/silence-us-backed-coup-evo-morales-bolivia-american-states>; see also Daniel Berehulak, *A Bitter Election. Accusations of Fraud. And Now Second Thoughts.*, The New York Times (Jun. 7, 2020), <https://www.nytimes.com/2020/06/07/world/americas/bolivia-election-evo-morales.html>.

⁸⁹ See John Wenz, *Scientists May Have Found What Makes Batteries Degrade Over Time*, Popular Mechanics (Sep. 17, 2018), <https://www.popularmechanics.com/science/energy/a23135177/lithium-ion-battery-degradation-study-nature/>.

⁹⁰ See Young-hye Na, *Free of Heavy Metals, New Battery Design Could Alleviate Environmental Concerns*, IBM (Dec. 18, 2019), <https://www.ibm.com/blogs/research/2019/12/heavy-metal-free-battery/>; see also Prachi Patel, *Entrepreneur rethinks lithium-ion batteries with an eye toward storing renewable energy*, Chemical & Engineering News (Jul. 16, 2018), <https://cen.acs.org/materials/energy-storage/Entrepreneur-rethinks-lithium-ion-batteries/96/i29>.

⁹¹ See Jason Deign, *These DIY Powerwall Hobbyists Are Building Their Own Home Battery Systems*, GREEN TECH MEDIA (Sep. 15, 2015), <https://www.greentechmedia.com/articles/read/the-diy-hobbyists-building-their-own-home-battery-systems>.

⁹² See Jennifer Sensiba, *Lithium-Ion Recycling Company Is Going Public*, CLEANTECHNICA (Feb. 27, 2021), <https://cleantechnica.com/2021/02/27/lithium-ion-recycling-company-is-going-public/>; see also Joshua Franklin, *EXCLUSIVE-Battery recycler Li-Cycle nears SPAC deal to go public – sources*, NASDAQ (Feb. 15, 2021) <https://www.nasdaq.com/articles/exclusive-battery-recycler-li-cycle-nears-spac-deal-to-go-public-sources-2021-02-15>.

⁹³ *Id.*

⁹⁴ James Conca, *Energy's Future - Battery and Storage Technologies*, FORBES (Aug. 26, 2019) <https://www.forbes.com/sites/jamesconca/2019/08/26/energys-future-battery-and-storage->

based battery has also emerged even more recently, which is said to have better storage and charging capacity than lithium batteries.⁹⁵ Which battery technologies will ultimately be the best economic and cultural choices for Tribes will invariably change over time. As such, Tribes should consider the various kinds of emerging battery technologies to determine which might best support their ES efforts.

C. Energy Landscape in Indian Country

Indian Country has an incredible unmet need for energy despite having outsized energy generation potential. Indian Country has “the highest rates of un-electrified homes—more than half of a million homes.”⁹⁶ Despite the widespread lack of electricity, however, Tribal lands have huge potential for renewable generation and have even been referred to as the ‘Saudi of renewables’ for their renewable energy potential.⁹⁷ Indeed, “[w]hile American Indian land comprises ~2% of the total US land base, it represents an estimated 5% of the total US renewable energy generation potential. The total generation potential for renewable energy generation on tribal lands is 21 billion megawatt-hours (MWh).”⁹⁸ However, traditional utilities are often unable or unwilling to meet these unfilled needs due to the cost-prohibitiveness of developing energy transmission infrastructure for rural Indian communities.⁹⁹ Lack of adequate funding combined with the inability to access capital and regulatory barriers often completely prevent tribes from developing utility-scale energy projects.¹⁰⁰ Thus, despite the tremendous need for energy in Indian Country, many tribal communities have the renewable resources necessary to generate enough electricity to meet their needs.

IV. Renewable Excellence in Indian Country—Case Studies

A. Blue Lake Rancheria

The Blue Lake Rancheria Microgrid (BLRM) went online in 2017 and was built with support from the California Energy Commission, Humboldt State University’s Schatz Energy Research Center, and Siemens.¹⁰¹ The BLRM is controlled by an automated Siemens Spectrum Power Microgrid Management System (SP MGMS) system and generates .5MW of solar which it

technologies/?sh=67a46f7244cf; see also Jack Goodenough et. al, *Energy and Environmental Science, Alternative strategy for a safe rechargeable battery* (Dec. 2016).

⁹⁵ See St. Petersburg State University, *A new type of battery that can charge ten times faster than a lithium-ion battery created* (Apr. 6, 2021), https://www.eurekalert.org/pub_releases/2021-04/spsu-ant040621.php.

⁹⁶ US Dep’t of Energy, *President’s Quadrennial energy Review, Summary for Policymakers* (Jan. 2017), https://energy.gov/sites/prod/files/2017/01/f34/Summary%20for%20Policymakers_1.PDF.

⁹⁷ See Andrew Ricci, *Henry Red Cloud: ‘Native Communities Are the Saudi Arabia of Solar’*, NATIVE BUS. MAG. (Sep. 13, 2020, 12:15 PM), <https://www.nativebusinessmag.com/henry-red-cloud-native-communities-are-the-saudi-arabia-of-solar/>; see also *Solar power brings electricity and jobs to remote Southwest tribal lands*, Inst. for Energy Econ. & Fin. Analysis (Sep. 13, 2020, 12:18 PM), <https://ieefa.org/solar-power-brings-electricity-and-jobs-to-remote-southwest-tribal-lands/>.

⁹⁸ US Dep’t of Energy, *Indian Country Energy & Infrastructure Working Group* (Oct. 2016), https://www.ncsl.org/Portals/1/Documents/energy/Tribal_Energy/ICEIWG_North_Dakota_%20Chris_Deschene_Oct.pdf.

⁹⁹ Nicholas M. Ravotti, *Access to Energy in Indian Country: The Difficulties of Self-Determination in Renewable Energy Development*, 41 Am. Indian L. Rev. 279, 291 (2017).

¹⁰⁰ Michael Maruca, *From Exploitation to Equity: Building Native-Owned Renewable Energy Generation in Indian Country*, 43 Wm. & Mary Envtl. L. & Pol’y Rev. 391 (2019).

¹⁰¹ Cara Gorman, *Case Study: Blue Lake Rancheria Microgrid*, MICROGRID KNOWLEDGE (May 24, 2016), <https://microgridknowledge.com/blue-lake-rancheria-microgrid/>.

feeds into 950 kWh of Tesla battery storage.¹⁰² The BLRM has won numerous awards and recognition from the White House, the Federal Emergency Management Agency (FEMA), the Microgrid Greater Goods Award, and the DistribuTECH conference.¹⁰³ Blue Lake Rancheria, a small tribe in Northern California, was motivated to develop its microgrid by the 2011 tsunami in Japan, which caused the Fukushima Daiichi explosion.¹⁰⁴ The tsunami in Japan prompted the Tribe to consider how its community might be impacted by severe weather disasters and made the Tribe realize that it would need to provide electricity in the face of those disasters.¹⁰⁵

The Tribe's foresight paid off in 2019 when the local utility cut power to the community during a wildfire.¹⁰⁶ In addition to providing power for the tribal community, the BLRM has been credited with saving at least four lives during the wildfire-induced electric shutdown when the Tribe welcomed electricity-dependent hospital patients into its hotel.¹⁰⁷ Furthermore, the Tribe's microgrid also allowed for continued casino and gas station operations and ensured that the Tribe was one of the county's only businesses with power throughout the prolonged blackout.¹⁰⁸ BLRM shows that innovative microgrid projects can insulate tribal communities and businesses from the dangers of severe weather incidents while providing security to the community at large.

B. Spokane Tribe

The Spokane Tribe built a fantastic project in collaboration with the Spokane Tribal Housing Authority, Grid Alternatives, a non-profit solar installer, and Sovereign Power, a tribal member-run energy marketing company. Like BLRM, Spokane began thinking seriously about ES in response to an environmental calamity—the 2016 Cayuse Mountain Fire.¹⁰⁹ Unlike BLRM, however, Spokane was directly impacted by the ecological disaster and lost 14 homes and tens of thousands of acres of tribal land.¹¹⁰ Spokane funded its project with a clever combination of state and federal incentives through the DOE, US Forest Service, and the Department of Interior and investment from Grid Alternatives Tribal Accelerator Fund.¹¹¹

¹⁰² *Id.*; see also Lisa Cohn, *California Microgrids Flex Their Skills During Blackouts*, MICROGRID KNOWLEDGE (Aug. 25, 2020), <https://microgridknowledge.com/california-blackouts-microgrids-flexible-load/>.

¹⁰³ *Id.*, see also *Blue Lake microgrid*, Schatz Energy Research Center, <https://schatzcenter.org/blrmicrogrid/> (last visited Mar. 15, 2021); see also Peter Maloney, *Life Won Thanks to the Blue Lake Rancheria Microgrid* MICROGRID KNOWLEDGE (Nov. 11, 2019), <https://microgridknowledge.com/blue-lake-rancheria-microgrid-outages/>.

¹⁰⁴ Steve Hanley, *Native American Tribe Leads The Microgrid Revolution In California*, CleanTechnica (Jan. 4, 2020), <https://cleantechnica.com/2020/01/04/native-american-tribe-leads-the-microgrid-revolution-in-california/>.

¹⁰⁵ Scott Wilson, *Blue Lake Rancheria tribe's microgrid helped neighboring communities during PG&E shut-offs*, The Press Democrat (Jan. 2, 2020), <https://www.pressdemocrat.com/article/news/blue-lake-rancheria-tribes-microgrid-helped-neighboring-communities-during/>.

¹⁰⁶ See Scott Wilson, *Amid shut-off woes, a beacon of energy*, The Washington Post (Sept. 13, 2020, 1:43 PM), <https://www.washingtonpost.com/climate-solutions/2020/01/01/amid-shut-off-woes-beacon-energy/>.

¹⁰⁷ *Id.*; see also *A Power island in the storm*, Siemens (Sept. 13, 2020, 1:37 PM),

<https://new.siemens.com/global/en/company/stories/infrastructure/blue-lake-rancheria-energy-resilience.html>; see also Erik Neumann, *California Reservation's Solar Microgrid Provides Power During Utility Shutoffs*, NATIONAL PUBLIC RADIO (Jan. 11, 2020), <https://www.npr.org/2020/01/11/795248921/california-reservations-solar-microgrid-provides-power-during-utility-shutoffs>.

¹⁰⁸ Neumann, *supra* note 107.

¹⁰⁹ *Solar born of fire*, GRID ALTERNATIVES (Feb. 21, 2020), <https://gridalternatives.org/headquarters/news/solar-born-of-fire>.

¹¹⁰ *Id.*

¹¹¹ *Id.*; see also Agnes Portalewska, *Building Sovereign Power: How One Tribal Nation is Becoming Energy Independent*, CULTURAL SURVIVAL (March, 2017), <https://www.culturalsurvival.org/publications/cultural-survival-quarterly/building-sovereign-power-how-one-tribal-nation-becoming>.

Spokane's innovative partnerships and disbursed solar installations provide a compelling model for how tribes can leverage connections and existing infrastructure to build solar. Spokane installed 650 kilowatts of solar energy on 32 buildings, including 23 tribal homes, eight community buildings, and the tribal fish hatchery.¹¹² Community members and tribal government employees have reported up to 80-90 percent savings on their monthly utility bills.¹¹³ Spokane doesn't have a microgrid or battery backup system, but such systems can often be added to or built upon as new systems emerge. Spokane's remarkable installations make meaningful differences in tribal members' and employees' lives and operations.

C. Navajo Tribal Utility Authority

The Navajo Tribal Utility Authority (NTUA) is a tribal utility that serves the Navajo Nation by providing "electricity, water, sewer (wastewater), natural gas and solar electricity throughout the 27,000 square mile Navajo reservation."¹¹⁴ The Navajo Nation is approximately the same size as West Virginia, and throughout much of it, the NTUA is the only service provider.¹¹⁵ The NTUA has worked collaboratively with the tribal and federal government to bring innovative energy solutions to members without grid access.¹¹⁶ The NTUA has long led the way forward toward distributed energy generation and storage and has developed "the largest off-grid residential PV program in the nation."¹¹⁷ Indeed, "the Solar Program consists of almost 300 PV systems . . . available in two offerings: 640-watt systems and 880-watt systems enhanced with small wind turbines. The PV systems owned by the NTUA are designed as stand-alone systems; as such they do not interfere with the electricity utility grid."¹¹⁸

The NTUA's innovative projects develop expertise and economic opportunity for community members. Since 2010, the NTUA electrified an estimated 18,000 homes through its smart grid and renewable projects.¹¹⁹ The NTUA has also received invaluable technical assistance from the Sandia National Laboratories' Tribal Technical Assistance program since the 1990s on a variety of innovative projects aimed at providing electricity to homes that lacked service.¹²⁰ While up to 40 percent of the reservation still lacks electricity, there have been significant ancillary benefits from the NTUA's programs and partnerships.¹²¹ The NTUA has developed educational workforce training programs in collaboration with the DOE.¹²²

¹¹² Grid Alternatives, *supra* note 109.

¹¹³ *Id.*; see also Steve Dubb, *Building Economic Sovereignty: A Model for Renewable Energy Emerges in the Spokane Nation*, NON-PROFIT Q. (Jan. 22, 2021), <https://nonprofitquarterly.org/building-economic-sovereignty-a-model-for-renewable-energy-emerges-in-the-spokane-nation/>.

¹¹⁴ See Terry Battiest, Jeffery Nelson, & Sandra Begay-Campbell, *Navajo Tribal Utility Authority Solar Program System Data and O&M Initiative for DOE Solar Technologies Database*, UNIV. OF COLORADO-BOULDER & SANDIA NAT'L LABORATORIES (Dec. 2007) at 2.

¹¹⁵ *Id.* at 3; see also *Solar Power Makes Electricity More Accessible On Navajo Reservation*, NPR (April 21, 2015), <https://www.npr.org/2015/04/21/401000427/solar-power-makes-electricity-more-accessible-on-navajo-reservation>.

¹¹⁶ *Id.*

¹¹⁷ *Id.* at 5.

¹¹⁸ *Id.*

¹¹⁹ *Id.*

¹²⁰ See Battiest *supra* note 114 at 1.

¹²¹ See NPR *supra* note 115; *Navajo Tribal Utility Authority: Smart Grid Workforce Training*, US DEP'T OF ENERGY (Dec. 2010).

¹²² *Id.*

D. Case Study Observations

Tribes pursuing ES must look both inwards and outwards to achieve their ambitions. The tribes in these case studies drew inspiration from cultural and community values to provide energy and security to their communities. They engaged with a wide range of public and private partners: public, private, state, federal, non-profit, and corporate. Moreover, tribes successfully leveraged intergovernmental planning and funding and thus provided great models for tribes interested in ES. Indeed, the DOE has approved approximately \$15.3 million in microgrid projects since 2018.¹²³ In addition to federal partners, state and local partners were also indirect but significant beneficiaries of tribal energy projects. Tribal success leveraging intergovernmental partnerships will likely continue to be a fruitful model for tribes pursuing ES absent new legislation or substantial changes to Federal Indian policy. Tribes in these studies were also successful in garnering private support from tribally-owned and non-profit businesses.

V. The Way Forward—Blockchain and Energy Sovereignty

A. Sovereignty and Indigenous Blockchain Projects in the US

Cryptocurrency is likely to significantly impact Native communities in the coming years by allowing them to exert virtual sovereignty through digital currencies and decentralized blockchain systems. Indeed, a small but growing number of Indigenous blockchain projects are attempting to address critical community issues. Indigenous cryptocurrencies, like Mazacoin and Aloha Coin, demonstrate that Native communities quickly understood the value of cryptocurrency to develop national currencies. Tribal business enterprise blockchain projects, like NativeCoin, demonstrate that there is also an appetite for other sorts of Indigenous economic development use cases.

Likely the first tribal blockchain project in the US, Mazacoin (MZC), was officially launched in 2014 to become a sovereign digital currency for tribes.¹²⁴ The Northern Cheyenne developer, Payu Harris, intended the coin specifically to benefit his Lakota relatives, the Oglala Lakota of the Pine Ridge Indian Reservation, by creating a digital currency and blockchain system to support tribal sovereignty.¹²⁵ While the project is still active, according to the team's Twitter and Telegram pages, it's unclear how actively the project is being developed based on how old the most recent public coding updates are.¹²⁶ Concerningly, it was widely reported that the Oglala

¹²³ See *Energy Department to Invest More Than \$5 Million in Tribal Energy Infrastructure Deployment Projects*, OFFICE OF INDIAN ENERGY POL'Y AND PROGRAMS (May 5, 2020), <https://www.energy.gov/indianenergy/articles/energy-department-invest-more-5-million-tribal-energy-infrastructure>; see also *DOE Announces \$16 Million for 14 Tribal Energy Infrastructure Deployment Projects*, OFFICE OF INDIAN ENERGY POL'Y AND PROGRAMS (Jul. 23, 2019), <https://www.energy.gov/articles/doe-announces-16-million-14-tribal-energy-infrastructure-deployment-projects>; see also *Department of Energy to Fund 15 Tribal Energy Infrastructure Deployment Projects*, OFFICE OF INDIAN ENERGY POL'Y AND PROGRAMS (Aug. 15, 2018), <https://www.energy.gov/articles/department-energy-fund-15-tribal-energy-infrastructure-deployment-projects>.

¹²⁴ See Cindy Tekobbe & John C. McKnight, *Indigenous cryptocurrency: Affective capitalism and rhetorics of sovereignty*, FIRST MONDAY (Oct. 2016).

¹²⁵ See generally Alysa Landry, *9 Questions Surrounding MazaCoin, the Lakota CryptoCurrency: Answered*, INDIAN COUNTRY TODAY (Sep. 12, 2018), <https://indiancountrytoday.com/archive/9-questions-surrounding-mazacoin-the-lakota-cryptocurrency-answered>.

¹²⁶ See Twitter, Maza, <https://twitter.com/mazacoin> (last visited Nov. 10, 2021) (posting on Feb. 2, 2021 that the project was still active); see also Telegram, MAZATribe, <https://t.me/mazatribe> (last visited Nov. 10, 2021)

Lakota Tribe adopted Mazacoin as their 'national currency' though such claims have been disputed.¹²⁷ Technologically, Mazacoin still uses the energy-intensive POW consensus mining model developed by Bitcoin.¹²⁸ Thus, while certain questions remain unresolved about the sovereign character of MazaCoin and its environmental impact, the idea of tribally controlled digital currencies has begun to take off.

The Nation of Hawaii¹²⁹ has been experimenting with a cryptocurrency called Aloha Coin for use as a national currency.¹³⁰ Aloha Coin was signed into being in 2015 through Nation of Hawaii executive order to develop "[a] National Monetary system for the Nation, specifically, an online cryptocurrency economic vault and storage system, and; [to adopt] The "Aloha Coin", as the Nation of Hawai'i's, National Currency."¹³¹ Aloha Coin is being developed by a Japanese development team in coordination with the Nation of Hawaii to be used as a currency by Japanese tourists when visiting the Nation.¹³² Aloha Coin's youtube channel appears to have removed their marketing video, so this ambitious project's current development status is unclear.¹³³ Nevertheless, the Nation of Hawaii's work is remarkable because Native Hawaiians never ceded their sovereignty and are not federally recognized.¹³⁴ The Nation of Hawaii thus demonstrates beautifully that federal recognition isn't necessary to merge inherent sovereignty with emerging technology for the betterment of Indigenous peoples in the US

While Mazacoin and Aloha Coin both focus on crypto as currency, NativeCoin has sought to apply blockchain technology to tribal-gaming. NativeCoin is a tribal gaming-oriented blockchain developed by a team of Natives specifically for tribal gaming enterprises.¹³⁵ NativeCoin, born in 2019, is being built on the Ethereum blockchain and is geared toward providing an online betting option for tribal gaming enterprises.¹³⁶ NativeCoin presents a potentially strong use case of blockchain for federally recognized gaming tribes. Cierra White speculates in her groundbreaking article *Betting on Blockchain* that "the use of blockchain technology as a foundation for internet casinos would (1) improve the reliability of casino licenses

(demonstrating continual discussion about the project); *but see* MazaCoin, GITHUB (last visited Nov. 10, 2021) <https://github.com/MazaCoin> (showing that the last significant updates were in 2016).

¹²⁷ See James Vincent, *Mazacoin: Native American Tribe Adopts Bitcoin Derivative as 'National Currency'*, THE INDEPENDENT (Mar. 3, 2014), <https://www.independent.co.uk/life-style/gadgets-and-tech/mazacoin-native-american-tribe-adopts-bitcoin-derivative-national-currency-9165314.html>; *see also* Mashable, *MazaCoin: The First Native American Cryptocurrency*, YOUTUBE (Sep. 18, 2014), <https://www.youtube.com/watch?v=3BoQGkCuFk>; *but see also* Mina Down, *The Rise and Fall of a Tribal Cryptocurrency*, HACKERNOON (Sep. 6, 2020), <https://hackernoon.com/the-rise-and-fall-of-a-tribal-cryptocurrency-ykn3wex>; *see also* Bianca Consunji, *One Man's Lonely Quest to Build 'Bitcoin for Native Americans'*, MASHABLE (Sep. 14, 2014), <https://mashable.com/archive/mazacoin-bitcoin-native-americans>.

¹²⁸ See MazaCoin Github.

¹²⁹ One of a number of Native Hawaiian Nations actively working to exert their inherent sovereignty for the betterment of their people.

¹³⁰ Exec. Order No. 95-004, OFFICE OF THE HEAD OF STATE (2015), <https://www.hawaii-nation.org/alohacoin.html>.

¹³¹ *Id.*

¹³² See *Aloha Coin Japan アロハコインとは*, VIMEO (last visited Nov. 11, 2021), <https://vimeo.com/162812463>.

¹³³ *Id.*

¹³⁴ See *Rice v. Cayetano*, 528 US 495 (2000). Note, however, that Native Hawaiians do receive some limited federal assistance for housing and other programs. Moreover, there have been discussions about the prospect of federal recognition for Native Hawaiians but it remains unclear whether Native Hawaiian groups would ever accept such offers.

¹³⁵ See NATIVECOIN, <https://native-coin.com/nativecoin-about/#vision> (last visited Apr. 19, 2021).

¹³⁶ See NATIVECOIN, <https://native-coin.com/whitepaper/> (last visited Apr. 19, 2021).

and regulations, (2) better protect players while providing a more efficient overall experience, and (3) benefit tribes and states by lowering costs and generating more business due to an increased customer base and public trust in casinos.”¹³⁷ Thus, while the Native blockchain space is still in its infancy, many Indigenous people in the US have seen the immense value that blockchain technology might have for their communities after it mysteriously emerged in 2008.

B. Blockchain Fundamentals—It’s More Than Just Cryptocurrency

Blockchain technology is still in its early stages, but it is projected to be one of the most disruptive technologies of the 21st century, which is likely to have significant impacts on renewable energy generation and distribution. Indeed, leading blockchain and renewable energy experts predict that “nearly every electric power regulator, consumer advocate, utility executive, and grid operator will, in the next few years, be asked to evaluate and make decisions about blockchain-related projects.”¹³⁸ But what is blockchain? IBM has defined blockchain as “a shared, immutable ledger for recording transactions, tracking assets, and building trust.”¹³⁹ Blockchain was the culmination of years’ worth of work to develop a decentralized, virtual currency that was brought to fruition in 2008 by the anonymous creator(s) of the cryptocurrency Bitcoin, Satoshi Nakamoto, when they published their groundbreaking whitepaper, *Bitcoin: A Peer to Peer Electronic Cash System*.¹⁴⁰ Bitcoin was originally designed to be a “purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution.”¹⁴¹

Blockchain technology is built on three fundamental characteristics: immutability, public/private key cryptography, and distributed consensus.¹⁴² Blockchain immutability means that nothing on the chain can be changed once it has been entered into the chain.¹⁴³ Immutability on the blockchain is achieved with hashes - mathematical functions that can take in any data and turn output a fixed fingerprint representation of that data—and blocks—which contain both the current transactions as well as hashes of previous blocks.¹⁴⁴ Public/private key cryptography builds upon the cryptographic principle of a trapdoor function, a mathematical problem that is very easy to solve in one direction but practically impossible to reverse engineer.¹⁴⁵ Public and private keys can be analogized to email addresses and email passwords; the former can be seen and used publicly, where the latter is only in the hands of the account owner and allows the owner to access the messages sent to the publicly visible email address.¹⁴⁶

¹³⁷ Cierra White, *Betting on Blockchain*, 17 Colo. Tech. L.J. 421, 441 (2019).

¹³⁸ Claire Henly, Sam Hartnett, Sam Mardell, Buck Endemann, Ben Tejblum, Daniel S. & Cohen, *Energizing the Future with Blockchain*, 39 Energy L.J. 197, 201 (2018).

¹³⁹ *What is blockchain technology?*, IBM (Oct. 4, 2020, 4:56 PM), <https://www.ibm.com/blockchain/what-is-blockchain>.

¹⁴⁰ *Id.*; see also Bernard Marr, *A Very Brief History of Blockchain Technology Everyone Should Read*, FORBES (Feb. 16, 2018), <https://www.forbes.com/sites/bernardmarr/2018/02/16/a-very-brief-history-of-blockchain-technology-everyone-should-read/#5f60b6b77bc4>.

¹⁴¹ Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System* (2008).

¹⁴² Henly et. al, *supra* note 138, at 201.

¹⁴³ Antony Lewis, *A Gentle Introduction to Immutability of Blockchain*, BITS ON BLOCKS (Feb. 29, 2016), <https://bitsonblocks.net/2016/02/29/a-gentle-introduction-to-immortality-of-blockchains/>.

¹⁴⁴ *Id.*

¹⁴⁵ See *What Are Public Keys and Private Keys?*, LEDGER ACADEMY (Oct. 23, 2019), <https://www.ledger.com/academy/blockchain/what-are-public-keys-and-private-keys>.

¹⁴⁶ *Id.*

If one blockchain user wants to send a message to another through the blockchain the information is first encrypted with the sender's private key and the recipient's public key, sent onto the blockchain network, and then decrypted by the recipient when they verify the transaction with their private key.¹⁴⁷ The final essential ingredient for blockchain is distributed consensus, which is what decentralizes blockchains.¹⁴⁸ The purpose of distributed consensus is to ensure a single version of the distributed ledger across all participants in the network.¹⁴⁹ Distributed consensus can be achieved through a variety of different mechanisms, but virtually all distributed consensus models are built on economically incentivizing network participants to maintain network integrity through rewards and disincentivizing participants from diminishing network integrity through punishments.¹⁵⁰

VI. p2p Energy Trading

A. Blockchain Evolves—From Currency to Contracts

Blockchain technology—which was initially developed to facilitate trustless p2p digital currency transactions—grew immensely with the advent of smart contracts on the Ethereum platform. Smart contracts can be most simply defined as an automatically executing agreement.¹⁵¹ However, the term ‘smart contract’ was coined by the cryptographer Nick Szabo in the early 1990s.¹⁵² Szabo defined smart contracts as “combin[ing] protocols with user interfaces to formalize and secure relationships over computer networks.”¹⁵³ Szabo also described vending machines as “the primitive ancestor of smart contracts” because they are “contract[s] . . . [in which] anybody with coins can participate in an exchange with the vendor.”¹⁵⁴ Vitalik Buterin brought new life to the idea of smart contracts when he wrote the Ethereum Whitepaper in which he described smart contracts as “[digital] cryptographic boxes that contain value and only unlock it if certain conditions are met.”¹⁵⁵

In the context of blockchain, smart contracts have also been described as simple if/then statements that allow people to program “decentralized agreements . . . [which are then] stored on a blockchain.”¹⁵⁶ However, unlike traditional contracts—which have traditionally been enforced through courts—smart contracts are automatically enforced by the decentralized network upon completing the programmed conditions.¹⁵⁷ Suffice it to say that smart contracts can be defined in numerous ways. However, for this article, it is only important to understand that smart contracts are the basis upon which decentralized agreements may be made and executed on the blockchain. Automatically executing decentralized contracts are the building blocks upon which p2p energy

¹⁴⁷ *Id.*

¹⁴⁸ Henly et. al, *supra* note 138, at 202.

¹⁴⁹ See *What Is a Blockchain Consensus Algorithm?*, BINANCE ACADEMY (Jul., 2020), <https://academy.binance.com/en/articles/what-is-a-blockchain-consensus-algorithm>

¹⁵⁰ Henly et al., *supra* note 138, at 202.

¹⁵¹ Max Raskin, *The Law and Legality of Smart Contracts*, 1 Geo. L. Tech. Rev. 305, 309 (2017).

¹⁵² Camila Russo, *The Infinite Machine: How an Army of Crypto-hackers Is Building the Next Internet with Ethereum* (2020).

¹⁵³ Nick Szabo, *Formalizing and Securing Relationships on Public Networks*, FIRST MONDAY (Sept. 1, 1997), <https://journals.uic.edu/ojs/index.php/fm/article/view/548/469>.

¹⁵⁴ *Id.*

¹⁵⁵ Vitalik Buterin, *Ethereum Whitepaper*, ETHEREUM (last visited Mar. 4, 2021), <https://ethereum.org/en/whitepaper/> (internal quotations omitted).

¹⁵⁶ Jeremy M. Sklaroff, *Smart Contracts and the Cost of Inflexibility*, 166 U. Pa. L. Rev. 263 (2017).

¹⁵⁷ Raskin, *supra* note 151, at 308.

trading rests and form the basis for the shift toward the widescale use of blockchain-based energy systems.

1. Brooklyn Microgrid

Blockchain technology has the potential to disrupt the energy sector and radically change the dominant manner of energy production and distribution by allowing for the sale and purchase of renewable energy between peers. There are now numerous companies offering blockchain and microgrid-based p2p energy trading services.¹⁵⁸ Brooklyn Microgrid (BMG), developed by LO3 Energy (LO3) in 2016, emerged as one of the first renewable energy peer-to-peer trading systems which leveraged blockchain and microgrid technologies.¹⁵⁹ BMG has developed a marketplace which “[p]rosumers”¹⁶⁰ with “consumers”¹⁶¹ through a mobile app.¹⁶² BMG’s app allows “[p]rosumers sell their excess solar energy to the marketplace where consumers purchase the available solar via auction.”¹⁶³ BMG’s first energy sale was transacted on the Ethereum network though the project now uses LO3’s proprietary software “Exergy.”¹⁶⁴

Despite the initial successful use of Ethereum, New York State regulations—which allowed only utilities and retail service providers to sell energy—hampered BMG’s vision of creating decentralized energy marketplaces.¹⁶⁵ In 2019 however, LO3 Energy secured a 12-month regulatory sandbox pilot program for BMG, which exempted them from local regulations and allowed LO3 to begin selling and purchasing of electricity.¹⁶⁶ Unfortunately, the private and proprietary nature of Exergy raises serious questions about whether the project could even fairly be considered blockchain technology.¹⁶⁷ Exergy lacks the distinctive characteristics of a public chain: immutability, public/private keys, and distributed consensus.¹⁶⁸ BMG remains a useful reference for tribes considering energy trading markets because it was one of the US’s first p2p energy trading market.

Despite BMG’s movement toward a proprietary product, a recent study shows that Ethereum remains the most prominent platform across energy blockchain initiatives.¹⁶⁹ Moreover, the study concludes that “real-world energy blockchains are growing exponentially year-on-

¹⁵⁸ See *What is Peer-to-Peer Energy Trading?*, Infinite Energy (Mar. 1, 2020), <https://www.infiniteenergy.com.au/peer-to-peer-energy-trading/>.

¹⁵⁹ BROOKLYN MICROGRID (Oct. 4, 2020, 5:37 PM), <https://www.brooklyn.energy/>.

¹⁶⁰ People in NYC who own solar arrays.

¹⁶¹ People who want to purchase local solar energy.

¹⁶² *Id.*

¹⁶³ *Id.*

¹⁶⁴ See Clinton Nguyen, *Brooklyn’s ‘Microgrid’ Did Its First Solar Energy Sale*, VICE NEWS (Apr. 12, 2016), <https://www.vice.com/en/article/d7y7n7/transactive-grid-ethereum-brooklyn-microgrid>; see also *From the Brooklyn Microgrid to EXERGY – A Conversation with Lawrence Orsini, CEO of LO3 Energy*, Cleantech Group (Jan. 17, 2018), <https://www.cleantech.com/from-the-brooklyn-microgrid-to-exergy-a-conversation-with-lawrence-orsini-ceo-of-lo3-energy/>.

¹⁶⁵ See *Brooklyn Microgrid Moves Ahead with Pilot Regulatory Sandbox for Program*, Microgrid Knowledge (Dec. 30, 2019), <https://microgridknowledge.com/brooklyn-microgrid-regulatory-sandbox-approved/>.

¹⁶⁶ *Id.*

¹⁶⁷ *Infra* Part II.a.

¹⁶⁸ *Id.*

¹⁶⁹ Peter O’Donovan & Dominic O’Sullivan, *A Systematic Analysis of Real-World Energy Blockchain Initiatives*, 11 FUTURE INTERNET 174, 184.

year.”¹⁷⁰ Thus, while energy blockchain technology is still in the early stages, tribes would do well to track the technology and develop systems and regulations that allow for upgrading to blockchain technology when it becomes feasible. In addition to potential regulatory issues, blockchain energy technology is still relatively young. Although promising in many ways, “the blockchain technology application in the electrical power sector still poses big challenges to technicians. Innovation and experimentation are required essentially across technology and application.”¹⁷¹

2. To Decentralize or Not to Decentralize—Ethereum’s Current Limitations

Important questions remain for tribes in the form of persistent network issues that are currently being upgraded. Despite being the most robust blockchain network, Ethereum remains technologically young and limited in ways that could complicate tribal use. Lawrence Orsini, the CEO of LO3, explained that the company used Ethereum for its first transactions because blockchain could be used “not as a currency, but as a communications platform, as a way to efficiently organize grid edge device control or at least provide prices as a proxy for control at the grid edge.”¹⁷² Orsini remarked, however, that they started building their proprietary chain when it “became clear that Ethereum wasn’t going to scale.”¹⁷³ The private nature of LO3’s product calls into question whether it is true blockchain technology. As a centralized system, however, it could be argued that it LO3’s product could never be truly trustless or immutable.¹⁷⁴ In spite of this, however, LO3 is working on some exciting projects that would undoubtedly be of considerable value in Indian Country for tribes looking for a more streamlined p2p energy trading system.¹⁷⁵

Indeed, Orsini’s concerns proved well-founded during Ethereum’s infamous CryptoKitties Congestion Crisis. CryptoKitties, a Neopets-esque Ethereum-based game, exploded in popularity and brought down the whole network by consuming the chain’s entire transaction capacity.¹⁷⁶ Several leading Ethereum development teams banded together to effectively save the network by working with the CryptoKitties team to design and implement optimizations and plans to avoid this issue in the future.¹⁷⁷ More recently, increasing network demand has led to skyrocketing gas fees on the Ethereum network, making transacting on the chain significantly more expensive.¹⁷⁸

Despite these substantial hurdles, Ethereum remains the most promising blockchain project because of the clear roadmap toward network scaling and transaction efficiencies. The Ethereum network development environment was relatively young when Orsini first started working on LO3 in 2013.¹⁷⁹ Indeed, Ethereum officially launched its upgraded Beacon Chain on December 1, 2020

¹⁷⁰ *Id.* at 13.

¹⁷¹ Maria Luisa Di Silvestre, et. al, *Blockchain for power systems: Current trends and future application*, 119 RENEWABLE AND SUSTAINABLE ENERGY REV., Mar. 2020 at 15.

¹⁷² See CLEANTECH GROUP, *supra* note 164.

¹⁷³ *Id.*

¹⁷⁴ See IBM *supra* note 139 (explaining the decentralization is a critical component of trustlessness and immutability).

¹⁷⁵ See LO3 ENERGY (last visited Apr. 19, 2021 at 9:06pm), <https://lo3energy.com/press/>.

¹⁷⁶ See CONSENSYS, *The Inside Story of the CryptoKitties Congestion Crisis* (Feb. 20, 2018), <https://consensys.net/blog/news/the-inside-story-of-the-cryptokitties-congestion-crisis/>.

¹⁷⁷ *Id.*

¹⁷⁸ See Michael Garbade, *High Gas Fees Prevent Ethereum From Being Ethereum*, COINDESK (Oct. 14, 2020), <https://www.coindesk.com/high-gas-fees-prevent-ethereum-from-being-ethereum/>.

¹⁷⁹ See Cleantech Group, *supra* note 156.

which is the first in “a set of upgrades that improve the scalability, security, and sustainability of Ethereum.”¹⁸⁰ Ethereum is moving toward a more or less complete makeover commonly referred to as Ethereum 2.0.¹⁸¹ Ethereum’s upgrade will address gas issues and the now infamously wasteful energy use of the Proof of Work consensus model in favor of a much more efficient Proof of Stake model.¹⁸² Moreover, while Orsini’s concerns were also well-founded regarding blockchain communication with off-chain data systems, projects such as Chainlink are actively solving this problem with decentralized oracle networks that connect chains and off-chain systems.¹⁸³ Decentralized oracles will likely be key part of any workable decentralized tribal p2p energy markets. Thus, although there are still substantial technological issues for fully Ethereum-based decentralized competitors in the p2p energy market space, the conditions are nevertheless ripe for Tribes to develop their own decentralized alternatives.

3. Decentralized p2p Energy Markets

Decentralized p2p energy trading markets can strengthen ES by giving tribal people more economic and electric power while also reducing tribal reliance on expensive and dangerous centralized power lines. Notably, a 2019 study found that p2p energy markets can democratize energy by developing new business models that challenge centralized energy markets.¹⁸⁴ The study notes that p2p markets can be a solution for the lack of competition in the retail market. Critically, for tribal purposes, the study notes that “grid operators can benefit from such [p2p] markets by deferring grid investments in new lines and equipment. One of the strengths is the increase in resilience and security, which creates an opportunity to solve grid problems by all market participants rather than reinforcing the grid.”¹⁸⁵ Tribes thus have economic and ecological incentives to develop decentralized p2p markets.

Unlike BMG, which offers a highly centralized form of a p2p market, tribes can develop tribal p2p energy markets by developing their own blockchain applications and softwares using decentralized technologies. Smart contracts are the key mechanism that will facilitate “the property transfer of any digitally identifiable good from one person to another. In p2p electricity transactions as an example, the smart contract allows the transfer of tokens from one party to another and ‘certifies’ the activation of a local resource at the premises of one of the two parties while acquiring registrations of the consumptions and injections.”¹⁸⁶ Blockchain-based p2p energy systems can provide “a secure and trusted digital transaction platform where consumers

¹⁸⁰ See ETHEREUM, *Upgrading Ethereum to radical new heights* (last visited Apr. 19, 2021 at 9:10pm), <https://ethereum.org/en/eth2/>.

¹⁸¹ *Id.*

¹⁸² See Harald Vranken, *Sustainability of bitcoin and blockchains*, CURRENT OP. IN ENVIRON. SUSTAINABILITY, Oct. 2017, at 1; See also Moritz Platt et. al., *Energy Footprint of Blockchain Consensus Mechanisms Beyond Proof-of-Work*, UCL CENTRE FOR BLOCKCHAIN TECHNOLOGIES at 1, 3 (2021), http://blockchain.cs.ucl.ac.uk/wp-content/uploads/2021/09/UCL_CBT_DPS_Q32021_updated-1.pdf.

¹⁸³ See, e.g., Lorenz Breidenbach et al., *Chainlink 2.0: Next Steps in the Evolution of Decentralized Oracle Networks* at 6 (Apr. 15, 2021), <https://research.chain.link/whitepaper-v2.pdf>.

¹⁸⁴ Tiago Sousa et. al, *Peer-to-peer and community-based markets: A comprehensive review*, 104 ELSEVIER RENEWABLE AND SUSTAINABLE ENERGY REV. 376, 373 (2019), <http://pierrepinson.com/wp-content/uploads/2020/04/Sousaetal2019.pdf>.

¹⁸⁵ *Id.*

¹⁸⁶ Maria Luisa Di Silvestre, et. al, RENEWABLE AND SUSTAINABLE ENERGY REVS., *Blockchain for power systems: Current trends and future applications* at 3 (2020).

can directly participate in the energy market.”¹⁸⁷ Thus, these qualities make blockchain-based p2p energy systems a promising opportunity for tribes seeking to realize their ES ambitions.

VII. Conclusion and Recommendations

Tribes are turning to renewable energy technology to overcome colonialism’s negative legacy and the threat posed by climate change. Many tribes have thus, for practical and cultural reasons, embraced ES as a way to protect their people. Indeed, tribal ES is perhaps the truest expression of Indian cultural identity; it is a pragmatic model that uses renewable technology to create the energy systems necessary to protect community members while reducing negative environmental footprints. The ES model aligns closely with traditional tribal practices and beliefs regarding the environment and traditional environmental stewardship responsibilities.

The most promising efforts toward achieving ES rely heavily on solar and microgrids. While battery technology remains a troublesome bottleneck, there are promising innovations on the horizon that will hopefully minimize destructive environmental practices. Moreover, the number of tribal solar installations and microgrids is increasing and likely will continue to grow. While this growth occurs, tribes provide one another with innovative models that can be studied and understood to inspire future ES developments. Tribes interested in achieving ES should look to the examples discussed in this article and be creative about leveraging every possible program and partnership. In particular, tribes can learn a lot from the examples embodied by the Spokane Tribe, NTUA, and Blue Lake Rancheria’s successful leveraging of intergovernmental and non-profit relationships.

Tribes are also well-positioned to harness the power of emerging blockchain technology to enhance ES operations with p2p energy systems. While blockchain energy projects are generally still in early stages, p2p energy trading is a fast-growing and promising field. This technology shows particular promise for tribal communities because the emphasis on decentralization aligns closely with tribal values and Native nation-building and economic development models. Moreover, this technology can make tribal ES systems significantly more dynamic and resilient. Thus, tribes should continue developing their solar and microgrid systems while tracking and regulating the development of indigenous blockchain systems.

¹⁸⁷ Asma Khatoon et. al, *Blockchain in Energy Efficiency: Potential Applications and Benefits*, ENERGIES, Aug. 2019 at 12.