

# Window of Opportunity: Navajo Solar

## A Fast-Track Community-Driven Development Approach



**Institute for Energy Economics  
and Financial Analysis**  
IEEFA.org

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**Brett Isaac and Tony Skrelunas, DINÉHózhó, with support from  
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**Karl Cates, Seth Feaster, and David Schlissel, IEEFA**

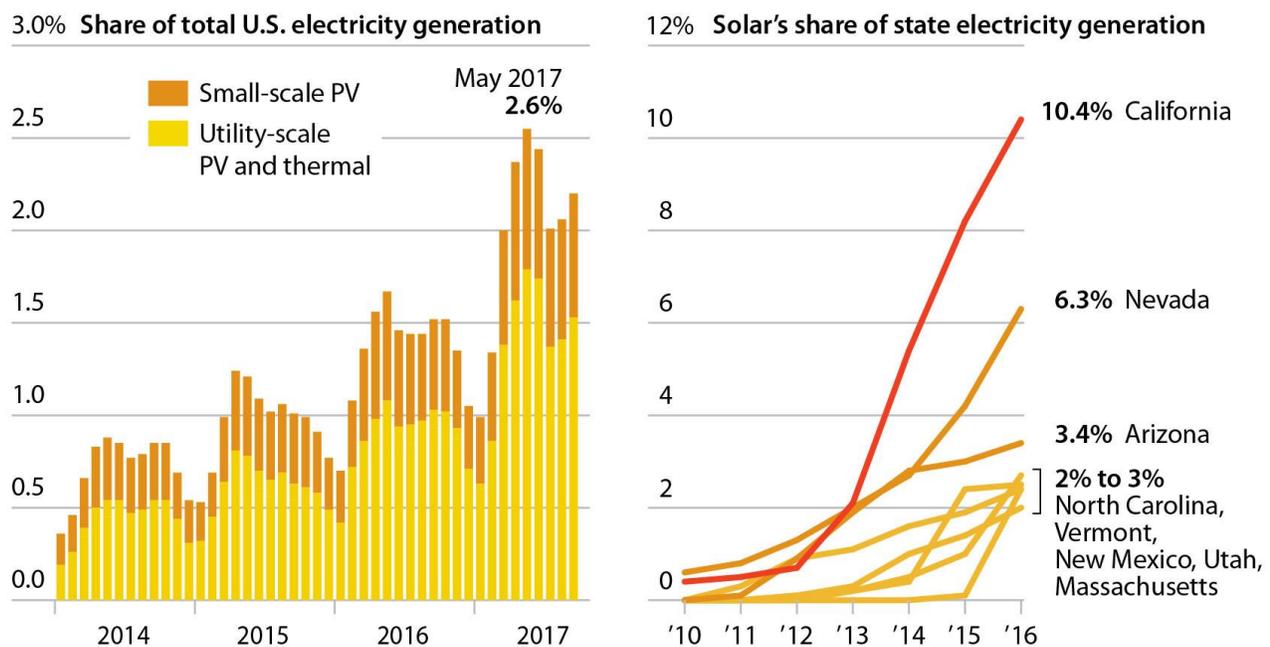
# Executive Summary

Rich in culture, land, and solar resources, Navajo Nation tribal-chapter communities are poised today to participate in a renewable-energy revolution that can help lift neighborhood and regional economies that have historically been left behind.

Located in the center of the American Sun Belt and situated near major electricity-transmission lines, these communities are increasingly being sought out by outside interests. These developers are often seeking deals crafted to meeting growing demand from utility companies that are switching from fossil-fuel powered electricity to renewables. This transition creates an urgent opportunity in which powerline capacity is open now for new forms of generation.

The Navajo Nation, in fact, is at the center of a region that stands to become a major source of solar-powered generation as part of a trend in which solar is capturing a growing piece of U.S. power-generation markets. Solar-driven electricity power has grown four-fold in just three years, and the Southwest stands apart for its contribution to this trend. The uptake of solar is hardly a regional phenomenon, however. Eight states now meet a significant portion of their electricity demand with solar.

**Figure 1: Uptake of U.S. Solar (Energy Information Administration, IEEFA)**



Market momentum favors solar. The U.S. Energy Information Administration sees sun-powered generation providing the greatest portion of new electricity-generation additions nationally—ahead of any other form of generation.

As the solar-industry footprint expands, Navajo communities are being courted by outside interests to participate in fast-moving development deals. The Navajo Nation, only 67 years old and built from a history of trauma, is not well-equipped to assess these opportunities, but

tribal-chapter communities can get up to speed with proper advice and consultation.

This brief, in addition to presenting a **U.S. Solar Industry Overview**, outlines an approach for how to make informed, locally beneficial decisions that can be implemented as fast-track solar development arrives.

- **Pathways to Tribal Community Solar-Ownership Success:** Suitable assessments include **predevelopment** protocols that are in place in many cases already and **development** procedures that create partnerships that ensure tribal-chapter ownership equity in perpetuity.
- **Revenue-Maximization Mechanisms:** As with predevelopment requirements, many of these mechanisms exist now and can serve as foundations by which fair and just shared-ownership models can be put into place. Tribal-chapter development corporations can serve a key equity-ownership role. Models to avoid include the ones that currently support the failing Navajo Generating Station and Kayenta Mine.
- **Negotiating and Protecting Local Tribal-Community Benefits:** Assertive and informed negotiation is crucial to ensuring that solar-development projects are built in ways that benefit, protect, and profit local communities. Reasonable stipulations include earmarked revenue for scholarship funds, employment assistance, stand-alone funding for the thousands of Navajo households that do not have electricity, and set-asides for veterans' assistance, healthcare, and senior services.
- **Potential Locations and Partnership Requirements:** Strong candidates for community-owned utility-scale solar developments in Arizona include Black Mesa, Cameron, Coalmine, Dilkon, Hard Rock, Kayenta, LeChee, Leupp, Shonto, and Tuba City. Partnership requirements for these communities and others like them should include **proven track records, liability protections, strong financing and cultural compatibility.**
- **Utility-Scale Solar Development Timeline Expectations:** Solar-energy electricity generation can be brought online much faster than historically conventional power generation, including coal-fired, gas-fired and nuclear plants. In most cases, predevelopment, development and commissioning can occur in less than two years.

While a “seize-the-day” mind-set will serve Navajo chapter-house community leaders as utility-scale solar generation takes root across the Southwest U.S., it should be tailored to meet the long-term interests of local populations that continue to be underserved and overlooked. Solar energy is a natural fit for Navajo communities, and it can help diversify an economy that can and should be developed not at the expense of its people but to their benefit. Public policy, corporate and consumer preferences, technology advances and comparative costs are creating a combined effect that is driving the uptake of solar, which is highly likely to continue regardless of national partisan political difference.<sup>1</sup>

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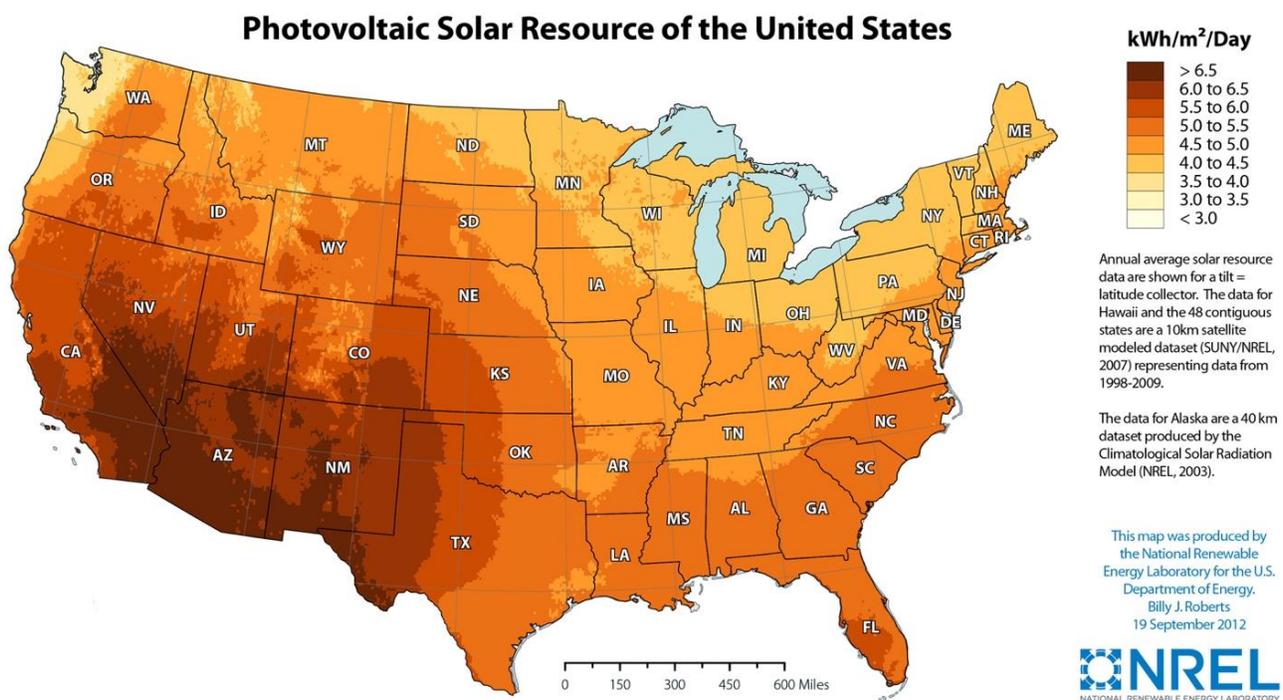
<sup>1</sup> Washington Post: Solar power is forging ahead, even if Trump doesn't talk about it  
[https://www.washingtonpost.com/news/powerpost/paloma/the-energy-202/2017/12/18/the-energy-202-solar-power-is-forging-ahead-even-if-trump-doesn-t-talk-about-it/5a36f67730fb0469e883fc31/?utm\\_term=.3941e6201f39](https://www.washingtonpost.com/news/powerpost/paloma/the-energy-202/2017/12/18/the-energy-202-solar-power-is-forging-ahead-even-if-trump-doesn-t-talk-about-it/5a36f67730fb0469e883fc31/?utm_term=.3941e6201f39)

# U.S. Solar Industry Overview

In March 2017, renewable energy for the first time in history accounted for 10 percent of U.S. electricity generation,<sup>2</sup> and the national renewable-energy footprint continues to grow.

Wind-powered generation has made up the bulk of this trend, accounting for substantial percentages of electricity generation in several regions. Eight U.S. states generated more than 15 percent of their electricity in 2016 with wind, and three of them, Iowa, South Dakota, and Oklahoma, generated more than 30 percent. Wind has provided more than 50 percent of power in some instances in Texas and in the Southwest Power Pool (which stretches from Oklahoma to Canada).

Figure 2: U.S. Solar Footprint (National Renewable Energy Laboratory)



The wind boom occurring across the American heartland portends a similar phenomenon for solar-powered electricity. If the Plains states and the Midwest are the “Saudi Arabia of wind,”<sup>3,4</sup> then the Southwestern U.S., anchored by rich resources in Arizona, Southern California, Nevada and New Mexico, is the Saudi Arabia of solar (Figure 2). Analysts see utility-scale solar generation pulling more and more market share from traditional electricity-generation models in a continuation of a trend that has taken deep root already. Over

<sup>2</sup> EIA Today in Energy <https://www.eia.gov/todayinenergy/detail.php?id=31632>

<sup>3</sup> IEEFA Update: Wind Is Blowing Away Fossil-Generated Power in Middle America <http://ieefa.org/ieefa-update-wind-blowing-away-fossil-generated-power-middle-america/>

<sup>4</sup> IEEFA: Wind in the Wires, and More on the Way <http://ieefa.org/ieefa-update-wind-wires-way/>

certain stretches of 2017, solar provided 40 percent of power generation in California,<sup>5</sup> for instance.

As recently as 2007, U.S. utility-scale solar generation totalled only 76,000 megawatt-hours of electricity production, according to the Energy Information Administration (the average U.S. household consumes roughly 1 megawatt-hour (1,000 kilowatt-hours) per month). By 2016, U.S. utility scale solar power generation totalled 32 million megawatt-hours,<sup>6</sup> a 4,200 percent increase over 10 years (and enough electricity to power 32 million homes).

This trend is gaining momentum, driven by falling costs<sup>7</sup> in utility-scale solar, by public policy that favors renewable energy, and by consumer demand for cheap, cleanly sourced electricity.

In its latest annual electricity market outlook, the EIA sees solar accounting for the biggest share of new electricity-generation additions nationally, outpacing wind, natural gas, oil, nuclear and coal-fired generation.<sup>8</sup> Price is by far the biggest driver of this phenomenon. Installation costs for utility-scale solar projects have fallen by two-thirds over the past 10 years,<sup>9</sup> and while small-scale distributed solar projects installations costs have fallen as well,<sup>10</sup> the majority of solar capacity today is in utility scale projects. In 2016, 72 percent of all new solar additions nationally were utility scale.<sup>11</sup>

While solar energy production has grown fastest in the southwest and mid-Atlantic U.S., it is spreading rapidly now into the southeast and the northwest, opening new markets (Figure 1, Page 2). Performance of new wind and solar facilities has improved simultaneously, a trend that has supported lower power purchase agreement (PPA) prices, which have dropped sharply in recent years. Average levelized solar PPA prices declined by 75 percent from 2009 through 2016 to about \$35 per megawatt hour (MWh). Further declines in PPA prices are likely as installation prices continue to fall. Some investors expect that solar installation costs to decline so much that PPA prices will remain low even after solar investment tax credits are phased out, with unsubsidized PPA prices of \$30-\$40 per MWh for solar by the early 2020s. These prices would be well below the marginal operating costs of most traditional electricity-fired generation, including coal-fired generation.

As much as 100 GW of new renewable energy will come online by 2022, according to S&P Global Market Intelligence.<sup>12</sup> Studies by regional independent system operators, or ISOs, the organizations that manage the electricity grid, show that, with upgrades, the grid can handle substantially more renewable resource than it now has.

Solar-generated electricity is already at least as cheap as coal-fired electricity in the U.S., and its costs will probably drop an additional 66 percent by 2040, according to research by

<sup>5</sup> EIA Today in Energy <https://www.eia.gov/todayinenergy/detail.php?id=30692>

<sup>6</sup> EIA Electric Power Monthly [https://www.eia.gov/electricity/monthly/epm\\_table\\_grapher.php?t=epmt\\_1\\_01\\_a](https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_1_01_a)

<sup>7</sup> IEEFA Update: Even Without Tax Credits, Prices for U.S. Wind and Solar Are on a Downward Slope <http://ieefa.org/ieefa-update-tax-credits-without-prices-u-s-wind-solar-downward-slope/>

<sup>8</sup> EIA Energy Outlook 2017 [https://www.eia.gov/pressroom/presentations/sieminski\\_01052017.pdf](https://www.eia.gov/pressroom/presentations/sieminski_01052017.pdf)

<sup>9</sup> Utility-Scale Solar 2016, Lawrence Berkeley National Laboratory [https://emp.lbl.gov/sites/default/files/utility-scale\\_solar\\_2016\\_slides.pdf](https://emp.lbl.gov/sites/default/files/utility-scale_solar_2016_slides.pdf)

<sup>10</sup> Ibid

<sup>11</sup> Ibid

<sup>12</sup> S&P Global Market Intelligence: Growth of Renewable Energy Continues amidst Political Climate: <https://www.prnewswire.com/news-releases/growth-of-renewable-energy-continues-amidst-political-climate-300522866.html>

Bloomberg New Energy Finance. Renewables—solar included—will account for most of the \$10.2 trillion expected to be invested globally in power-generating projects through 2040.<sup>13</sup>

Solar is in a strong position to gain market share also as a result of “steel for fuel” policies<sup>14,15</sup> adopted by a growing number of utilities and merchant generators. Underpinning this shift is a growing realization that solar and wind are “deflationary,” that is, their up-front costs are drastically offset over time by zero fuel costs. The Solar Energy Industries Association sees solar-generated electricity capacity, driven by uptake of utility-scale solar, more than doubling over the next five years.<sup>16</sup>

Meantime, corporate behemoths are demanding more renewable-sourced electricity. Household-name companies like Amazon, Google, Facebook, Mars, Nestle and Walmart are aiming to achieve near-complete reliance on renewables.<sup>17</sup> Direct corporate purchase of renewables by corporations outside traditional utility resource procurement channels will grow to between 10 gigawatts and 50 gigawatts over the next five to seven years (a gigawatt is 1,000 megawatts).<sup>18</sup>

The U.S. solar industry is expanding in the context of a global transition.<sup>19</sup> Across Europe, lower wholesale electricity prices driven by the uptake of renewables have created significant disruption and have shown how late-arriving major utilities are at risk of financial loss by not seizing the renewable-energy mantle quickly enough. In the U.S., NextEra sees renewables as a means to create sustained shareholder value providing power at low prices. In China,<sup>20</sup> CEIC – the merged China Shenhua and China Guodian—is now the world’s largest power company by installed capacity. India logged a historic milestone in 2017 when solar costs came in lower than the cost of power generated from existing coal-fired capacity of the main national utility, NTPC, which has taken a lead role in that country’s electricity-generation transition.<sup>21</sup> In the U.K., renewable energy is seen increasingly as a reliable and economically sensible replacement for coal-fired generation, which for more than a century has been the driver of industrialization.<sup>22</sup> Similar trends are occurring also now in “frontier

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<sup>13</sup> BNEF New Energy Outlook 2017 <https://about.bnef.com/new-energy-outlook/>

<sup>14</sup> Utility Dive: ‘Steel for fuel’: Xcel CEO Ben Fowke on his utility’s move to a renewable-centric grid <https://www.utilitydive.com/news/steel-for-fuel-xcel-ceo-ben-fowke-on-his-utility-s-move-to-a-renewable-c/446791/>

<sup>15</sup> GreenTech Media: American Electric Power Plans to Spend \$1.8 Billion on Wind and Solar <https://www.greentechmedia.com/articles/read/aep-future-coal-power-very-limited#gs.0jOMDjA>

<sup>16</sup> SEIA/GTM Research <https://www.seia.org/solar-industry-data>

<sup>17</sup> Wall Street Journal: How Companies Are Pushing Ahead on Climate-Change Targets <https://www.wsj.com/articles/how-companies-are-pushing-ahead-on-climate-change-targets-1510790610>

<sup>18</sup> Utility-Scale Solar 2016, Lawrence Berkeley National Laboratory [https://emp.lbl.gov/sites/default/files/utility-scale\\_solar\\_2016\\_slides.pdf](https://emp.lbl.gov/sites/default/files/utility-scale_solar_2016_slides.pdf)

<sup>19</sup> IEEFA Report: Winners and Losers Among Big Utilities as Renewables Disrupt Markets Across Asia, Europe, the U.S., and Africa <http://ieefa.org/ieefa-report-winners-losers-global-electricity-market-renewables-disrupt-markets-across-asia-europe-u-s-africa/>

<sup>20</sup> China on Pace for Record Solar-Power Installations <https://www.bloomberg.com/amp/news/articles/2017-11-20/china-on-pace-for-record-solar-installations-as-forecasts-jump>

<sup>21</sup> IEEFA Report: State-Owned Utility NTPC Takes a Lead Role in India’s Electricity Transition <http://ieefa.org/ieefa-report-state-owned-utility-ntpc-takes-lead-role-indias-electricity-transition/>

<sup>22</sup> IEEFA Report: As U.K. Sheds Coal by 2025, Renewables and Reliable Generation Can Fill the Gap <http://ieefa.org/ieefa-report-u-k-sheds-coal-2025-renewables-reliable-generation-can-fill-gap%E2%80%A8/>

economies" in Africa and Asia.<sup>23</sup> Solar is seen also as a crucial component in the recovery of the hurricane-shattered economy of the U.S. commonwealth of Puerto Rico.<sup>24</sup>

The national politics of the moment are seen as unlikely to slow the fast growth of renewable energy in the U.S.<sup>25,26</sup> Indeed, renewables make up an energy sector that enjoys the rare distinction of having broad bipartisan support.<sup>27</sup>

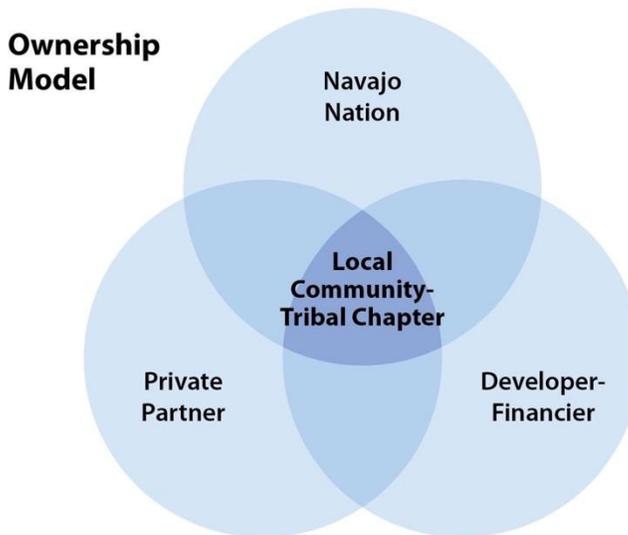
## Pathways to Tribal Community Solar-Ownership Success

Fair and just solar development requires a significant community-ownership stake, nurtured and guarded through predevelopment and development.

Past energy development on tribal lands has rarely had these elements.

Central to fair and just community-ownership projections are partnerships that place local interests at the center of cooperative deals that include participation by the tribal government, private investors and developers or financiers.

**Figure 3: Mutually Beneficial Equity**



<sup>23</sup> Bloomberg New Energy Finance: 5 Distributed Energy Trends in Emerging Markets

<https://about.bnef.com/blog/distributed-energy-trends-emerging-markets/>

<sup>24</sup> Washington Post: Bernie Sanders to unveil a \$146 billion 'Marshall Plan' for Puerto Rico

[https://www.washingtonpost.com/news/wonk/wp/2017/11/28/bernie-sanders-to-unveil-a-146-billion-marshall-plan-for-puerto-rico/?utm\\_term=.5882d876e8f6](https://www.washingtonpost.com/news/wonk/wp/2017/11/28/bernie-sanders-to-unveil-a-146-billion-marshall-plan-for-puerto-rico/?utm_term=.5882d876e8f6)

<sup>25</sup> S&P Global Market Intelligence: Growth of Renewable Energy Continues amidst Political Climate:

<https://www.prnewswire.com/news-releases/growth-of-renewable-energy-continues-amidst-political-climate-300522866.html>

<sup>26</sup> IEEFA Update: The Global Energy Transformation Remains on Track <http://ieefa.org/ieefa-update-global-energy-transformation-remains-track/>

<sup>27</sup> New York Times: Tax Bill Largely Preserves Incentives for Wind and Solar Power

[https://www.nytimes.com/2017/12/16/climate/tax-bill-wind-solar.html?\\_r=1](https://www.nytimes.com/2017/12/16/climate/tax-bill-wind-solar.html?_r=1)

# Predevelopment

Everything that goes into a project in the run-up to construction is part of the predevelopment stage. Predevelopment in essence is the process by which a business plan is formulated.

Predevelopment includes jurisdictional permissions, environmental assessments, feasibility studies, resource (sun and wind) analysis, transmission-infrastructure appraisals, cost and revenue research, and power-purchase agreements.

Proximity to transmission lines is obviously crucial, and potential regulatory roadblocks must be considered and cleared.

Navajo communities have a built-in predevelopment advantage in that many tribal lands have been studied already for project feasibility. Solar assessments exist already, as do environmental, topography, and transmission analyses. This advantage is crucial in the current marketplace, in which electricity-transmission is available now as power-line infrastructure is being made available with the likely closure of the Navajo Generating Station, which is scheduled to occur by the end of 2019. Utilities are prepared to buy power now from new utility-scale solar on tribal lands.

# Development

Development proceeds after ownership has been determined and after clearances have been acquired, both regionally and locally

Prudent development of solar resources will be built around partnerships that include the Navajo Nation tribal government, non-profit or private interests that hold a management stake in the project, and developers or financiers who hold an equity stake.

Key to just and fair development of solar-generation on tribal lands is a measure of community tribal-chapter ownership (Figure 3) that occurs simultaneously and in perpetuity with the equity held by other parties.

# Revenue-Maximization Mechanisms

Mechanisms exist now by which fair and just shared-ownership models can be put into place. These models can benefit investors, developers, the central tribal government, and local tribal community chapters alike.

Utility-scale solar development can occur, for instance, with financing from "impact investors" who seek to own equity in projects that can generate financial returns while hewing to core environmental, social, and governance (ESG) criteria; such investors seek equity in projects that aim to do well and do good.

Large banks have legal obligations to invest in projects that benefit underserved populations like those on tribal lands. Many investment houses, private equity groups and hedge funds are motivated by mission to do so. Federal-government-sanctioned and taxpayer-supported

entities like community-development financial institutions (CDFIs) exist for the partial purpose of investing in projects and business that guarantee local inclusion. Enormously competitive financing can be generated also on the strength of the Navajo Nation's strong credit rating.

And local chapter-house tribal development corporations exist now, offering a framework by which mutually-beneficial partnerships can be formed.

**The models to avoid** are the ones that have been used to develop energy resources on tribal lands like the Navajo Generating Station and Kayenta Mine, both of which generate tribal revenue based largely on royalty agreements and neither of which include true Navajo ownership.

## Negotiating and Protecting Local Tribal-Community Benefits

As demand for solar-generated electricity soars, interest from outside parties seeking to capitalize on the moment increases, along with speed-of-deal consummation. While these trends create risk they also bring opportunity.

Assertive and informed negotiation is crucial to ensuring that solar-development projects on tribal lands are built in ways that benefit, protect, and profit local communities. Tribal-community chapters will do well to remember that utility-scale solar development is a give-and-take proposition that should benefit all parties.

### **Among the many points open for predevelopment discussion including the following:**

- Earmarks for certain percentages of revenue to scholarship funds;
- Line-item revenues for local employment assistance;
- Dedicated revenues for stand-alone solar-electricity systems in Navajo homes that are too remote to be on the grid and extension of grid-linked electricity to residents in proximity to the grid;
- Revenue set-asides to public services that include veterans' assistance, healthcare, and senior services.

Central to community success in solar-energy development: Ironclad contracts that require and ensure benefits like those mentioned above.

# Potential Locations and Partnership Requirements

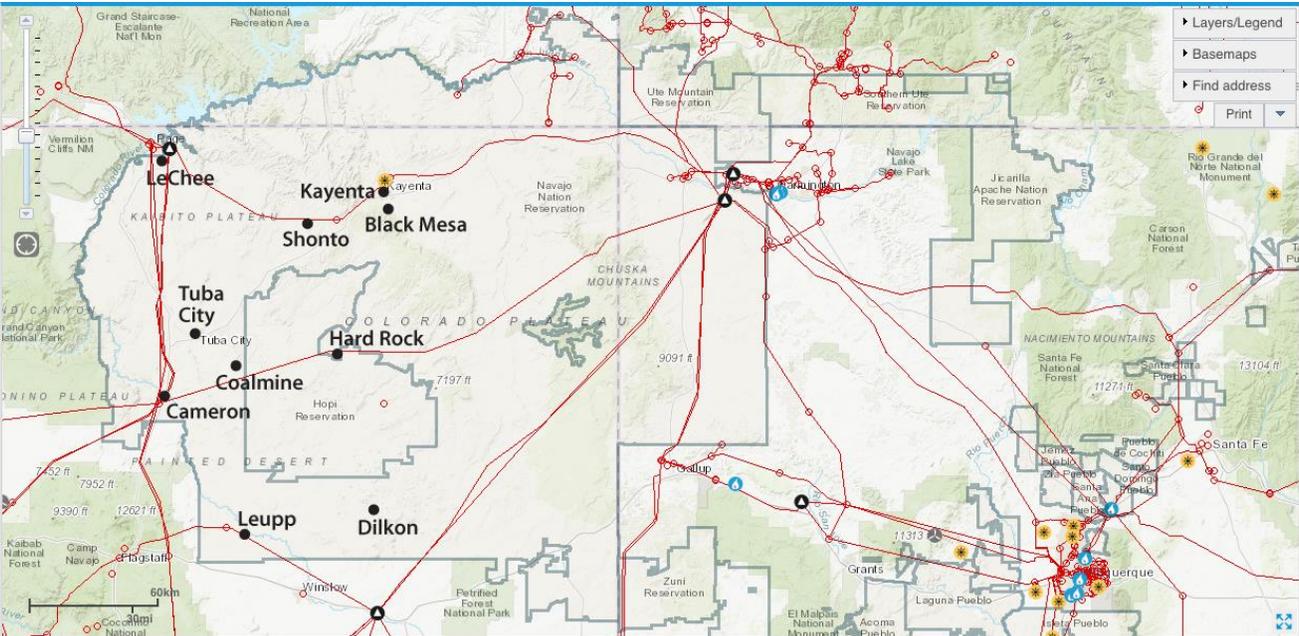
In the heart of the Sun Belt of the U.S., the Navajo Nation is in close, strategic proximity also to major electricity-transmission lines that send power to surrounding markets.

Combined with advantages that include existing predevelopment completions such as environmental and topographic assessments, these communities can move quickly to proceed with locally beneficial projects that can generate long-term revenues.

## Locations

Because of their proximity to transmission lines—and because of national momentum and growing demand for solar power—many Navajo communities are well positioned to take advantage of the rapid uptake of solar-powered electricity generation.

**Figure 4: Several communities in northeast Arizona (black dots) are prime candidates for utility-scale solar development. Red lines here show existing power-transmission lines. Triangles coal-fired plants that historically have supported electricity generation. Starbursts are solar plants. The main boundaries here, marking Navajo tribal lines, cross state lines.**



Native communities in Arizona that are ripe now for fast-track solar-development built around locally beneficial deals informed by proper due diligence emphasizing tribal-chapter

benefits and protections include: Black Mesa, Cameron, Coalmine, Dilkon, Hard Rock, Kayenta, LeChee, Leupp, Shonto, and Tuba City.

All of these communities, and many like them, have a land base that has already cleared important predevelopment hurdles.

## Partnership Requirements

Tribal-community solar-development deals with outside partners should be shaped by requirements that—in addition to ensuring clearly articulated community benefits (see Page 6, Negotiating and Protecting Local Tribal-Community Benefits)—are in the best interest of tribal chapters.

### Among them:

- A substantial and proven track record with transparent economic modeling that earmarks revenue-sharing and protects local interests from liability.
- Strong financing that is open to community scrutiny and can withstand due-diligence review.
- Cultural compatibility that includes suitable presentations, straightforward communication, ability to work with others, and a willingness to listen to chapter-level representatives and engage in necessary modifications and annual reviews.

## Utility-Scale Solar Development: Short Project Timelines

Solar energy of all types—microgrid community projects, stand-alone off-grid installations, and utility-scale developments—can come online quickly.

Development can occur within a matter of months or even weeks. Because of the many interests involved in development on tribal lands, however, a reasonable completion timeline for a utility-scale project is probably somewhere between one and two years. Solar-powered electricity development is far faster than that required of historically-conventional power-generation plants involving nuclear, coal-, or gas-fired plants.

Figure 5: Utility-Scale Solar Project Calendar

## Timeline: Two Years or Less



Many conventional electricity-generation power plant projects also carry risks that tie them to the past: coal-fired power plants are being phased out; nuclear generation typically is encumbered by cost overruns, regulatory tangles, and technology failures; gas-powered electricity plants take many years to be built and brought online. Development and construction of solar-powered electricity generation, by comparison, come online with few or no glitches and with much greater speed than other electricity-generation plants with the exception perhaps of wind farms.

## About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) conducts research and analyses on financial and economic issues related to energy and the environment. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy.

## About DinéHózhó

Diné Innovative Networks of Economies in Hózhó, L3C (DinéHózhó) is the first Low-Profit Limited Liability Company (L3C) incorporated within the Navajo Nation with a mission to integrate Diné culture, sustainability, conservation, and local knowledge to a locally developed economy.

## About the Authors

Tony Skrelunas is vice-president of DinéHózhó L3c.com, board chairman of Blackwater Mesa Water Coalition, and director of Native America Programs at Grand Canyon Trust.

Brett Isaac is a member of DinéHózhó L3c.com, where he specializes in off-grid solar energy development.

Karl Cates is IEEFA's lead editor and a former editor for Bloomberg LP and the New York Times.

Seth Feaster is an IEEFA data analyst and a former data-analyst expert for the New York Times and the Federal Reserve of New York.

David Schlissel is IEEFA's director of resource planning analysis and a long-time consultant, expert witness, and attorney on engineering and economic issues related to energy.