Developing Utility-Scale Renewable Electricity

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This analysis is a starting point for additional research and consideration of investment or policy options. Other factors that can inform decision-making are not considered here. The analysis results are not intended to be the sole basis of investment, policy, or regulatory decisions. The analysis does not constitute a comprehensive treatment of the issues discussed or a specific advisory recommendation to the jurisdiction(s) considered.

The data, results, conclusions, and interpretations presented herein have not been reviewed by technical experts outside NREL.

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Preface: What is Utility-Scale?

For purposes of this presentation, utility-scale refers to projects that are multi-megawatt (e.g., 50 MW), grid-connected, and selling power to third parties.

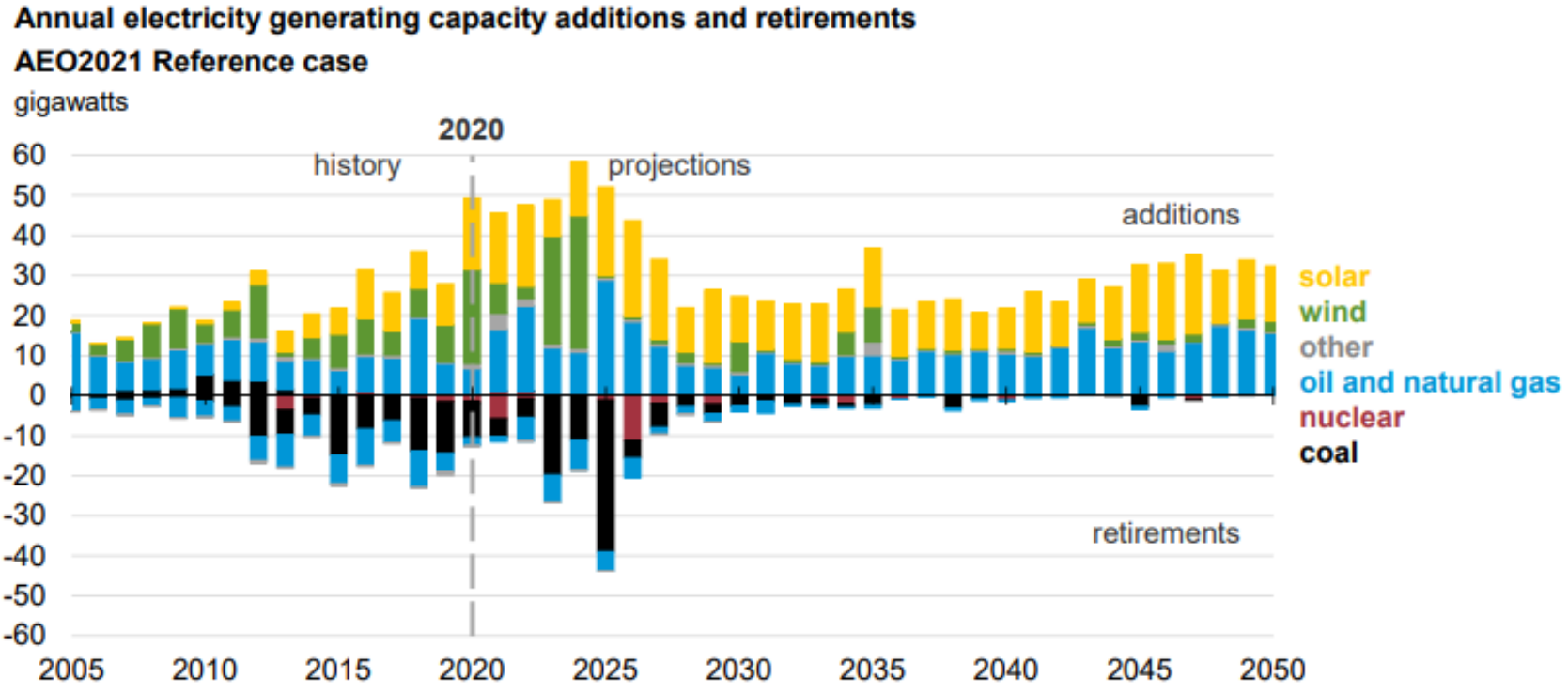
THIS …

Utility-Scale Solar PV Project at the Moapa River Indian Reservation, Clark County Nevada
Source: Las Vegas Review-Journal, 3/17/2017

NOT THIS …

Commercial-Scale Solar PV Project at the Indian Pueblo Cultural Center, Albuquerque, New Mexico
Source: Sandia National Laboratories

Forecast Electricity Generating Changes to 2050



Source: U.S. Energy Information Administration, Annual Energy Outlook 2021

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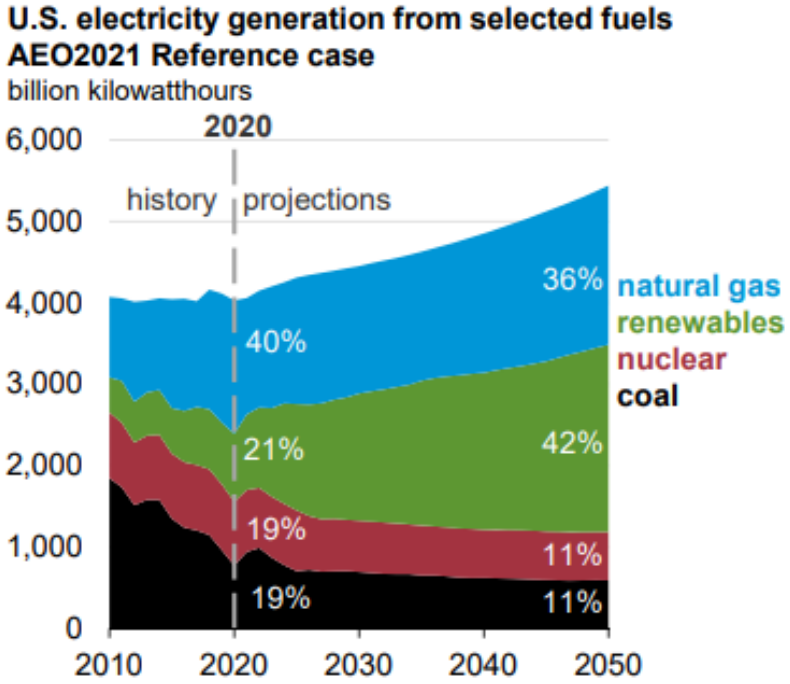
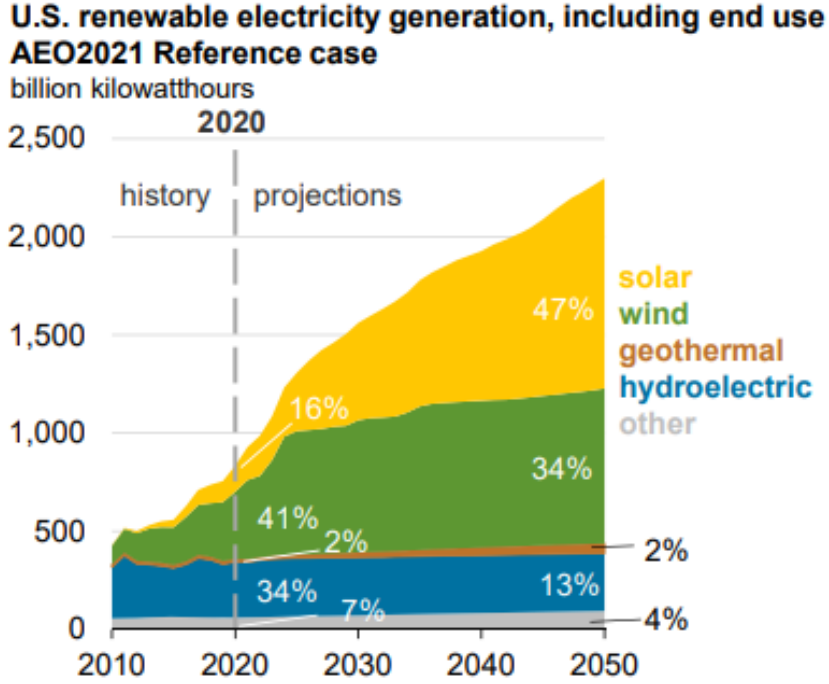




Source: U.S. Energy Information Administration, Annual Energy Outlook 2021

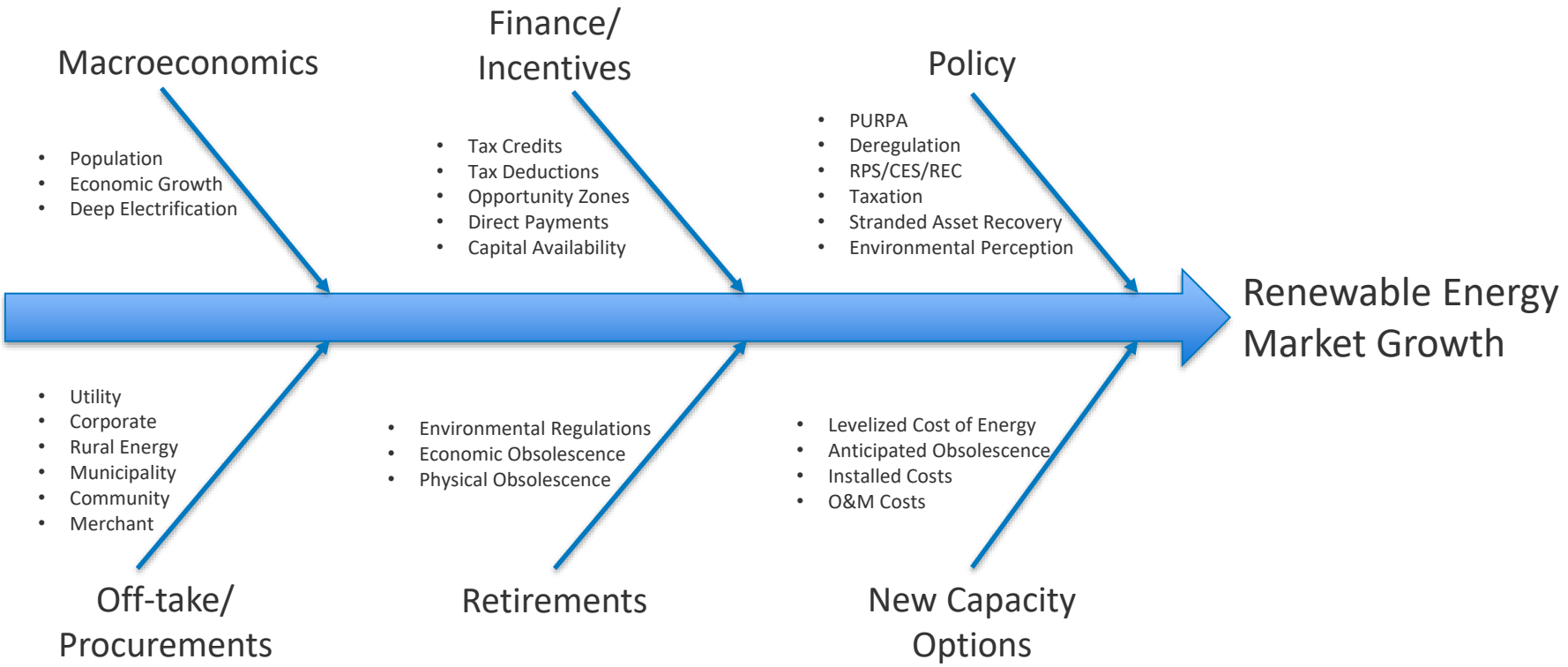
Purpose is Foundational to Success

Why Renewable Energy?

Multiple factors are driving the growth of renewable energy:

- Favorable tax policy
- Declining prices
- Energy storage
- Renewable mandates
- Corporate investment
- Community interest
- Coal fleet retirements

Market Drivers



Source: Settle et al, NREL, September 2019

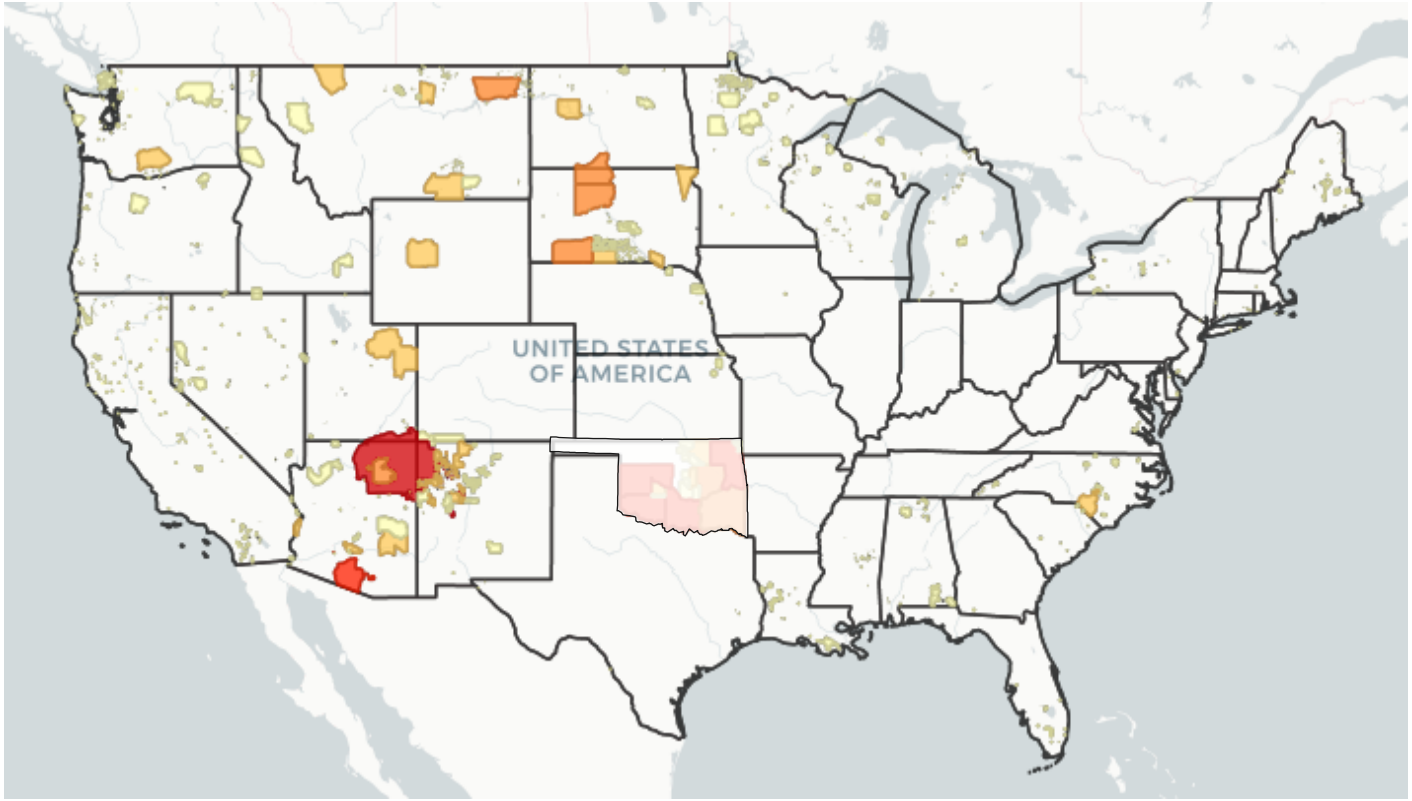
Purpose is Foundational to Success

Why Tribal Energy?

Alignment of Renewable Energy with Tribal Goals:

- Sustainable Use of Resources
- Income Base Expansion
- Construction Jobs
- Operations Jobs
- Capacity Building
- Infrastructure Upgrades
- Other Community Benefits

Solar PV Potential on Tribal Land



Technical exclusions:

- Slopes > 5%
- Minimum Contiguous Area of 1 km^2
- Incompatible Land Use
- Protected Areas

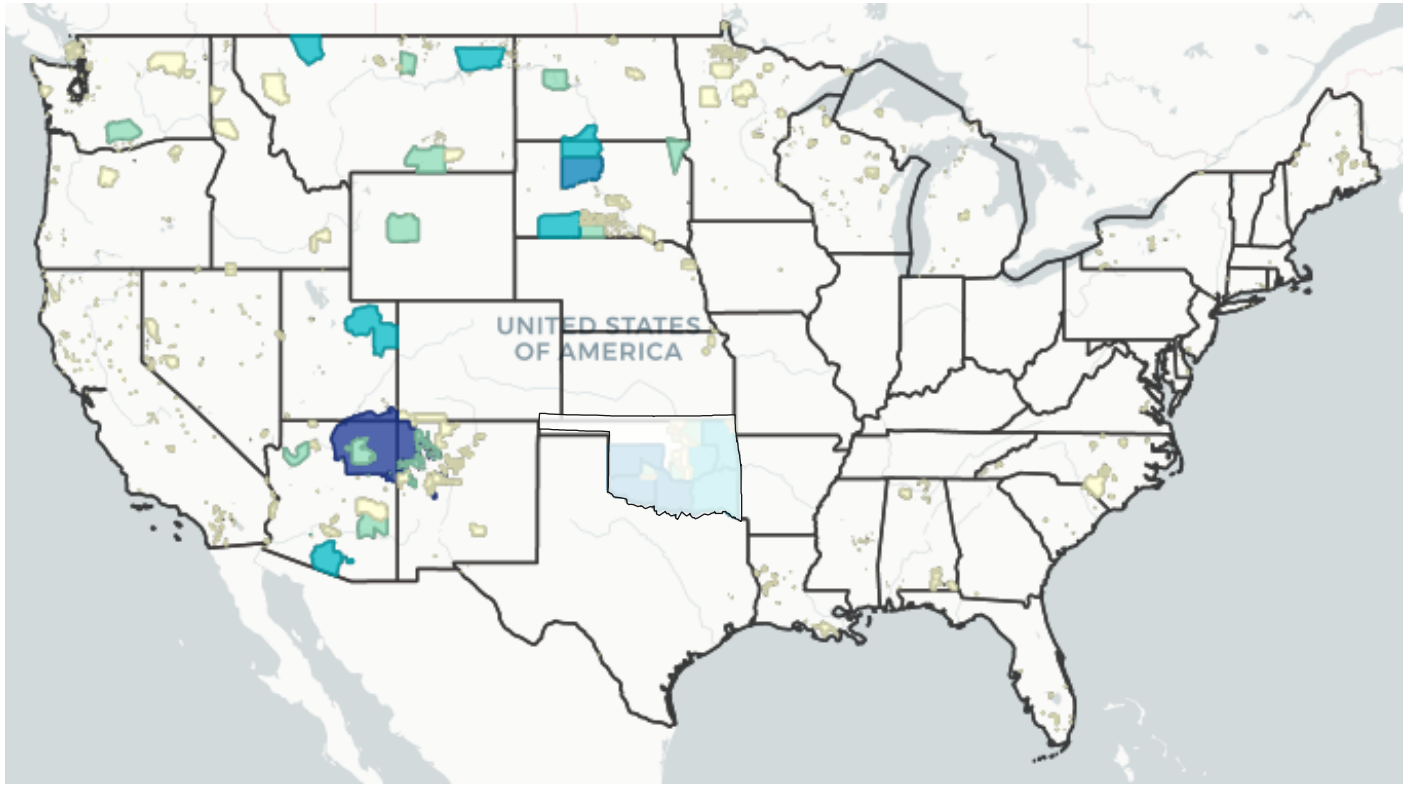
See Milbrandt, et. al., "Techno-Economic Renewable Energy Potential on Tribal Lands", NREL, July 2018

Utility-Scale PV (within tribes) (Megawatt Hour (MWh))

- 0 - 50,000,000
- 50,000,000 - 200,000,000
- 200,000,000 - 400,000,000
- 400,000,000 - 1,000,000,000
- 1,000,000,000 - 2,500,000,000

Note: Oklahoma tribal land in the Tribal Energy Atlas refers to Oklahoma Tribal Statistical Areas. Most of these lands are not fully under tribal control and therefore were not included in the critical planning study at this time.
Source: Tribal Energy Atlas, Utility-Scale Wind on Tribal Lands, October 2019

Wind Potential on Tribal Land



Technical exclusions:

- Slopes > 20%
- Incompatible Land Use
- Protected Areas

See Milbrandt, et. al., "Techno-Economic Renewable Energy Potential on Tribal Lands", NREL, July 2018

Utility-Scale Wind (within tribes) (Megawatt Hour (MWh))

- 0 - 15,000,000
- 15,000,000 - 50,000,000
- 50,000,000 - 100,000,000
- 100,000,000 - 200,000,000
- 200,000,000 - 400,000,000

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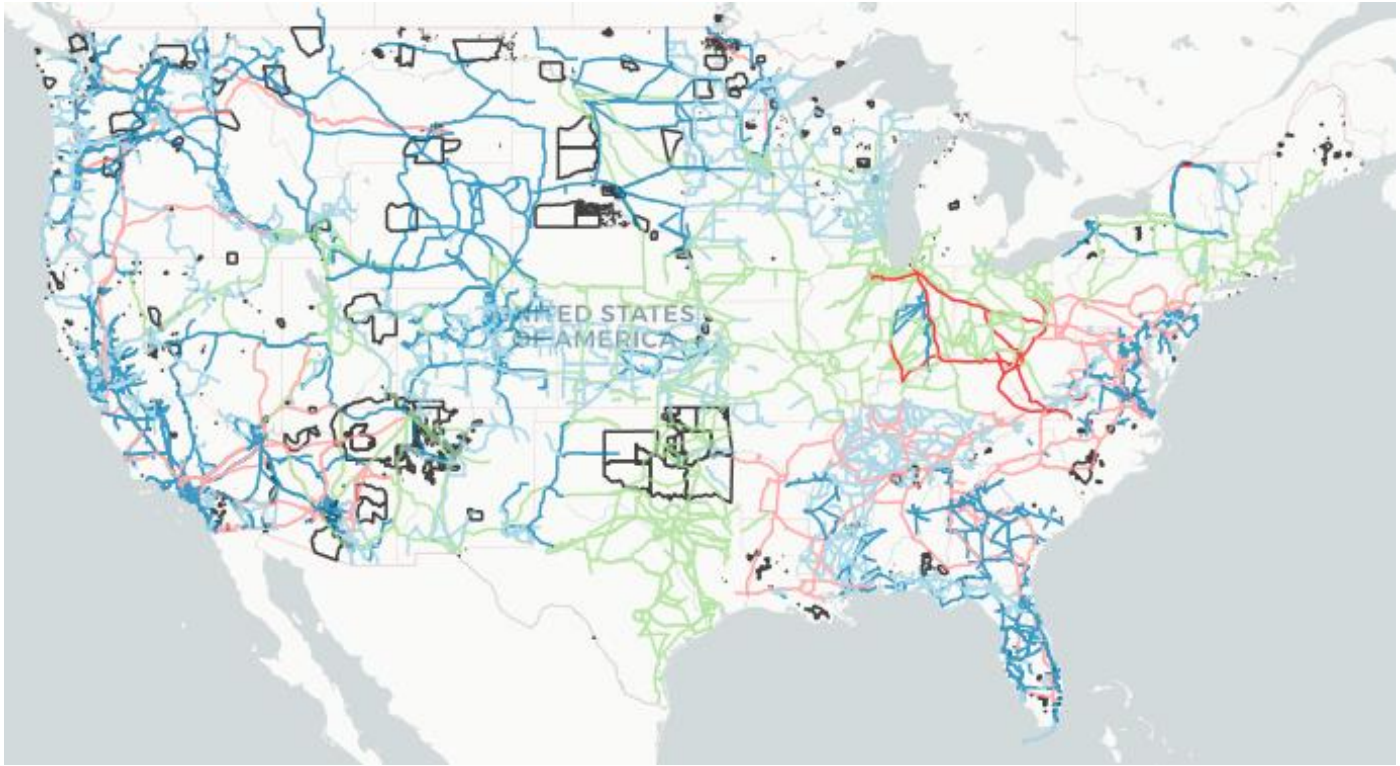
Transmission on Tribal Land



This study used a refined high voltage dataset from ABB Energy Velocity Suite using the following ranges for substations and transmission lines:

- 34.5 – 120 kV
- 130 – 287 kV
- >=300 kV

Transmission Lines (kV)

- 100-161
- 230-287
- 345
- 500
- 735 AND ABOVE

Source: Tribal Energy Atlas, Utility-Scale Wind on Tribal Lands, October 2019

Community Benefits of Renewable Energy Development

Economic Opportunity

Renewable energy development creates multiple economic benefits to communities, including:

- Job creation (construction & permanent)
- Indirect impacts (employee spending at local businesses)

Workforce Development

- Developers can agree to prioritize local, qualified labor for construction.
- Operations and maintenance work can often be carried out by locals.

Land Lease Payments

- Land leases are a significant revenue stream for the life of the project.

Community Funds

- Community funds are typically provided by the project developer and administered by an independent authority.
- Such funds may support energy efficiency, fire departments, schools, reduced electricity rates for low-income residents, etc.[1]

Property Taxes, Infrastructure Upgrades

- Depending on local and county tax rates, RE development can also provide additional public funding.
- Delivery of machinery and equipment to the site can entail upgrades to public roads covered by the developer

1.Rynne, S., et al. (2011). Planning for Wind Energy. American Planning Association. Report Number 566. Accessed May 14, 2018. Available at www.planning.org/ research/wind/index.htm

Example of Community Benefits – Perrin Ranch Wind

WORKFORCE/ECONOMIC

- Development Consultants
- Construction, Direct and Subcontract
- Suppliers
- Operators

EDUCATION

- NAU Partnership, Curriculum, Training

DONATIONS

- Multiple Local Organizations

ONGOING BENEFITS

- Firehouse, EMT Training, Equipment
- Tax Payments to School District
- Road Rebuilding
- Chambers of Commerce
- Landowner Payments

Williams News, Photo/Bob Freson

An Approach to Maximizing Community Benefits

CAUTION: If the project is not competitive, there are no community benefits.

Competitive RFQ/RFP Process

DEVELOPMENT

- De-risk the project site and establish development value
- Compete the development offering through formal RFQ/RFP process

CONSTRUCTION

- Secure Tribal jobs
- Engage Tribal businesses

OPERATION

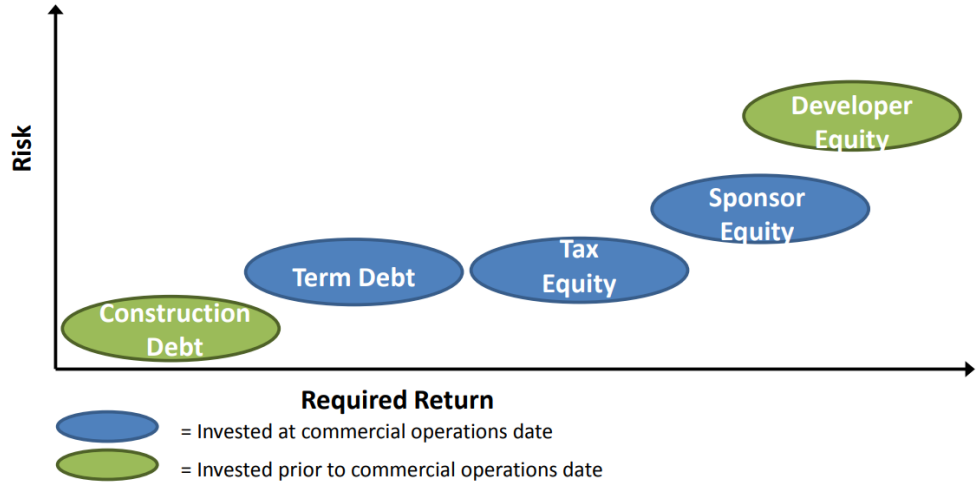
- Secure Tribal jobs
- Engage Tribal businesses
- Provide education and job training
- Long-term land lease and reinvestment
- Consider profits interest/equity stake and reinvestment

POST-PPA

- Evaluate takeover options
- Salvage, repower, transfer to tribal utility

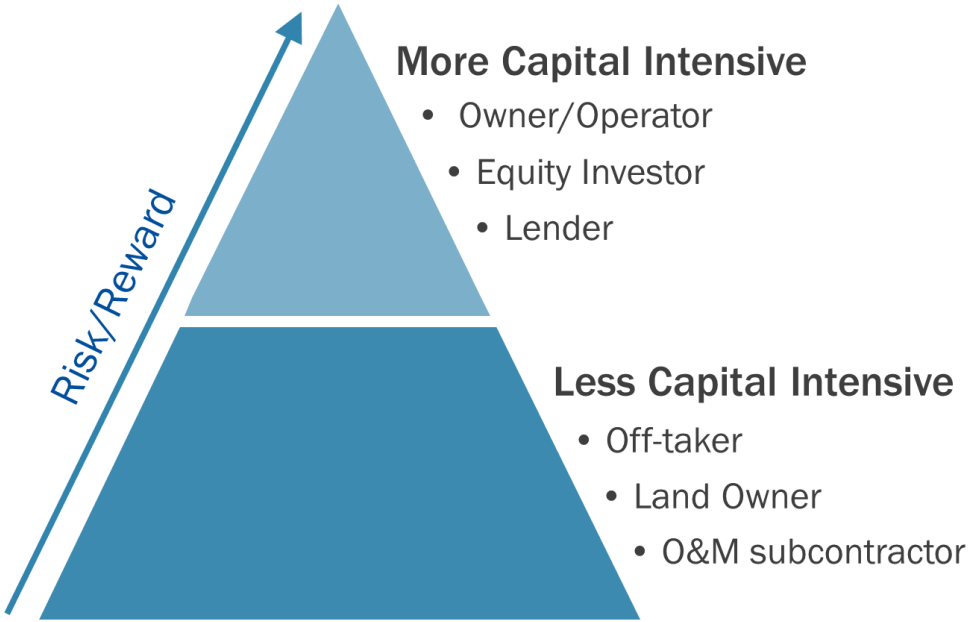
Development Risk

The risk and required return for renewable energy financing are not constant over the life of the project.



Paul Schwabe, David Feldman, Jason Fields, Edward Settle. 2017. *Wind Energy Finance in the United States: Current Practice and Opportunities*. NREL/TP-6A20-68227. https://www.nrel.gov/docs/fy17osti/68227.pdf.

Project Roles



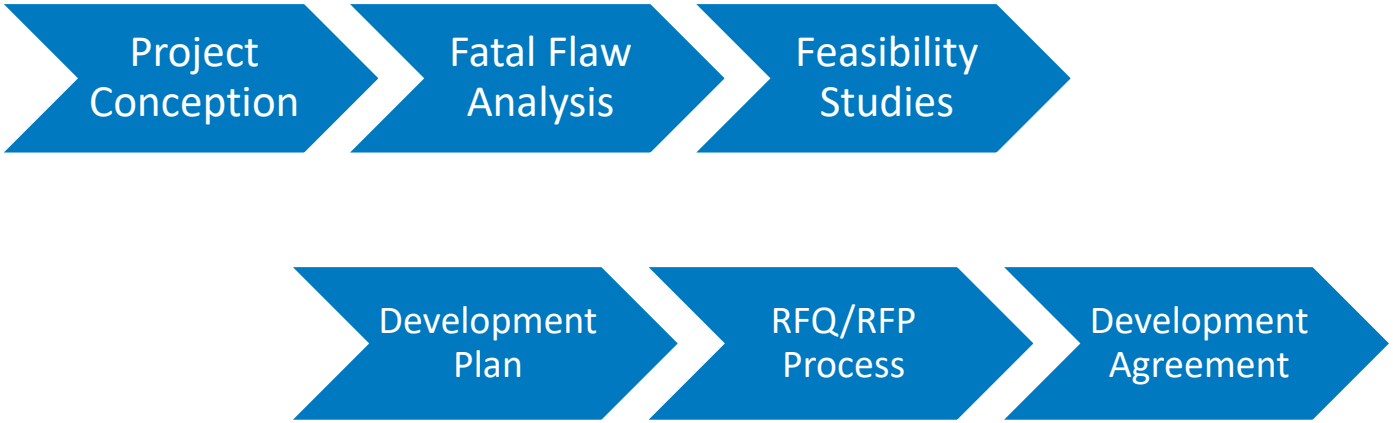
Tribal Roles

Role	Opportunity	Constraints	Comments
Resource/ Landowner	Land rent/royalty, taxes. Low risk, known reward, consistent income.	Limited project control. Must provide site access.	Limited upside potential, limited risk
Off-Taker/ Energy User	Tribe purchases and uses all power on-site. Electricity price security/hedge value.	Limited investment, economic development for on-site projects	Must have demand to use power; still requires utility interconnection agreement (if on the grid). Limited/Med risk.
Project Operator/ O&M	Greater involvement; Job/skills development opportunity. Modest source of revenue	Investors require experience May not be very labor intensive Might not be practical for a single project	Depending on technology, can be complex. Risk profile higher given O&M responsibilities.

Tribal Roles

Role	Opportunity	Constraints	Comments
Lender/ Debt Provider	Participate financially in project with lower risk. Interest income.	Requires ready capital May be cost-prohibitive to document and manage a single debt transaction (multiple more cost-effective)	Med-risk, more complex Requires lending experience Option for Tribes with limited lands, available $
Equity Investor	Invest cash into project development. Profit opportunity. Less capital required than commercial scale.	Higher risk than debt lending. Requires ready capital, or unique source of capital that provides market advantage (like NMTC). Implications for tax credits	High risk, more complex Competes with other investments Option for Tribes with limited lands, available $
Project Developer and Owner	Self-determination of project; potential for profits (and losses) is highest. Tribes with its own resource may not need investors.	Capital intensive and complex Tribes investing money may not want this high risk/return investment Might forfeit tax benefits	High risk Likely Tribe has gained experience over time in other roles A project portfolio mitigates some risks

Energy Project Development Process



Development Plan outlines the entitlement pathway, transmission/interconnection studies, and potential power purchasers.

Development Agreement is the contract with a well-qualified developer to fully develop the project, including the land lease agreement and other benefits.

Four Pillars of Success

Photo Credit: Edward Settle, NREL –
Kayenta Solar II, Navajo Tribal Utility Authority

- **Resource**
- **Site Control**
- **Buyer**
- **Transmission**

Four Pillars of Success

Resource – A chosen project location must have a strong natural resource. Whether solar, wind or other, the strength of the resource directly relates to the performance of the project.

Site Control – The developer and the financier(s) will not expend much development capital without effective ownership or control of the project site.

Buyer – The capital necessary to build and operate a project usually requires a long-term contract with a buyer for the product (electricity). This is often referred to as the off-take agreement or power purchase agreement. Buyers may include utilities, cooperatives, municipalities, or corporations.

Transmission – If there is a resource on an approved project site and a buyer for the power, the ability to interconnect and transmit power between the project and the buyer is required.

Utility Scale Solar PV – Four Pillars and Assumptions

CAUTION: Figures are subject to change at any moment.

LAND

6 to 8 acres per megawatt
$300 to $600 (or more) per acre rent, fixed 25-year plus
Site control, access, and entitlements – including linear corridors

RESOURCE

Verified sunny

BUYER

Need a long-term (20 year plus) power purchase agreement
Recent Price: ~~$24.99 per MWh, 20 years~~ $23.76 per MWh, 25 years

DELIVERY

Adequate transmission between site and buyer
Ability to interconnect

Hypothetical 100 MW:

Capital Cost: Around $1,000,000 per MW
Construction Labor: 150 to 250 workers, 6 to 9 months
Operating Labor: 2 to 3 FTEs
Incentives: 26% Investment Tax Credit, Accelerated Depreciation
Tax/Fee Structure: Competitive


Thank you
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