

# ***DOE Office of Indian Energy, Tribal Energy Webinar*** ***--Presented by NREL***

***“Understanding the Renewable Energy Development Process – and an overview of the related contracts”***

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Source: NREL

# Outline

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- Goals of each party
- Wind Development Process
  - Market
  - Wind Resource
  - Land
- Contract Overview
  - Land Leases
  - ROWs
  - Interconnection
  - Power Purchase Agreement (PPA)
- Wind Development Picture Summary

# Typical Goals of each party

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- Developer:
  - Secure land agreements and complete due diligence of multiple project sites within a market to determine which has the best wind, interconnection, permitting profile
  - Speed/efficiency at completing the above tasks
  - Complete above tasks to demonstrate a mature project allowing for marketing to off-takers
  - Prefers no “one-off” contracts
- Landowner (Tribal Trust):
  - Generate a long-term revenue stream – hedge against Ag volatility
  - Minimize environmental and cultural impact
  - Minimize disruption to land—continue Ag related activities
  - For developer to meet their goals and execute a PPA ASAP
  - Open communication with developer – “Team Approach”
- Off-Taker:
  - Run efficient RFP processes that separate mature from immature projects
  - Secure clean low-cost power via a Power Purchase Agreement or Build Transfer Agreement

# Wind Development Process

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***Awareness for the landowners...***

## Overview of Renewable Energy Development



# Market

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## Identify Customers

- Who has purchased renewable energy in the past?
  - Utility buyers
  - Corporate buyers.

## Understand Drivers:

- Wholesale market price comparisons
- Regulatory/Policies: Example: National Targets = an appetite to buy wind.

## Research Transmission Availability:

- Interconnection Studies/process
- Transmission Studies/process
- Long Term transmission plans (integrated resource plan [IRP])
  - *Where will transmission be built in the future?*

## *...poll question*

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- **Question 1:** Corporate buyers, like Amazon and Google have been large purchasers in recent years (versus the utility). What percentage of wind energy PPAs are being signed by corporate buyers in the U.S.? In 2019
  - 10%
  - 20%
  - 30%
  - 40%

# Market

## Developer's need to understand Customers

- Power Marketing is a "contact sport." What does this mean?

## Demand For Wind Power Reaches New Heights

Utilities and corporate customers announced a record **8,726 MW** of power purchase agreements (PPAs) in 2019. Corporate buyers accounted for 40 percent of the new PPAs signed in 2019. In fact, Walmart and AT&T were two of top three wind buyers last year. Meanwhile utilities signed **5,085 MW** of wind contracts last year, the second highest amount on record for this group.



**Utilities and businesses bought a record 8.7 GW of wind power in 2019.**

Source: AWEA 2019 Annual Report

## **Transmission task:**

- Developers need to sign an Interconnection Agreement which can take 2+ years to complete studies. Typically they need to demonstrate to utility:
  - Certain amount of land control (i.e. lease at interconnection point)
  - This is another puzzle piece that demonstrates a mature project to future off-takers



# Wind Resource

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## **Landowner awareness...**

### **Developer's Objective:**

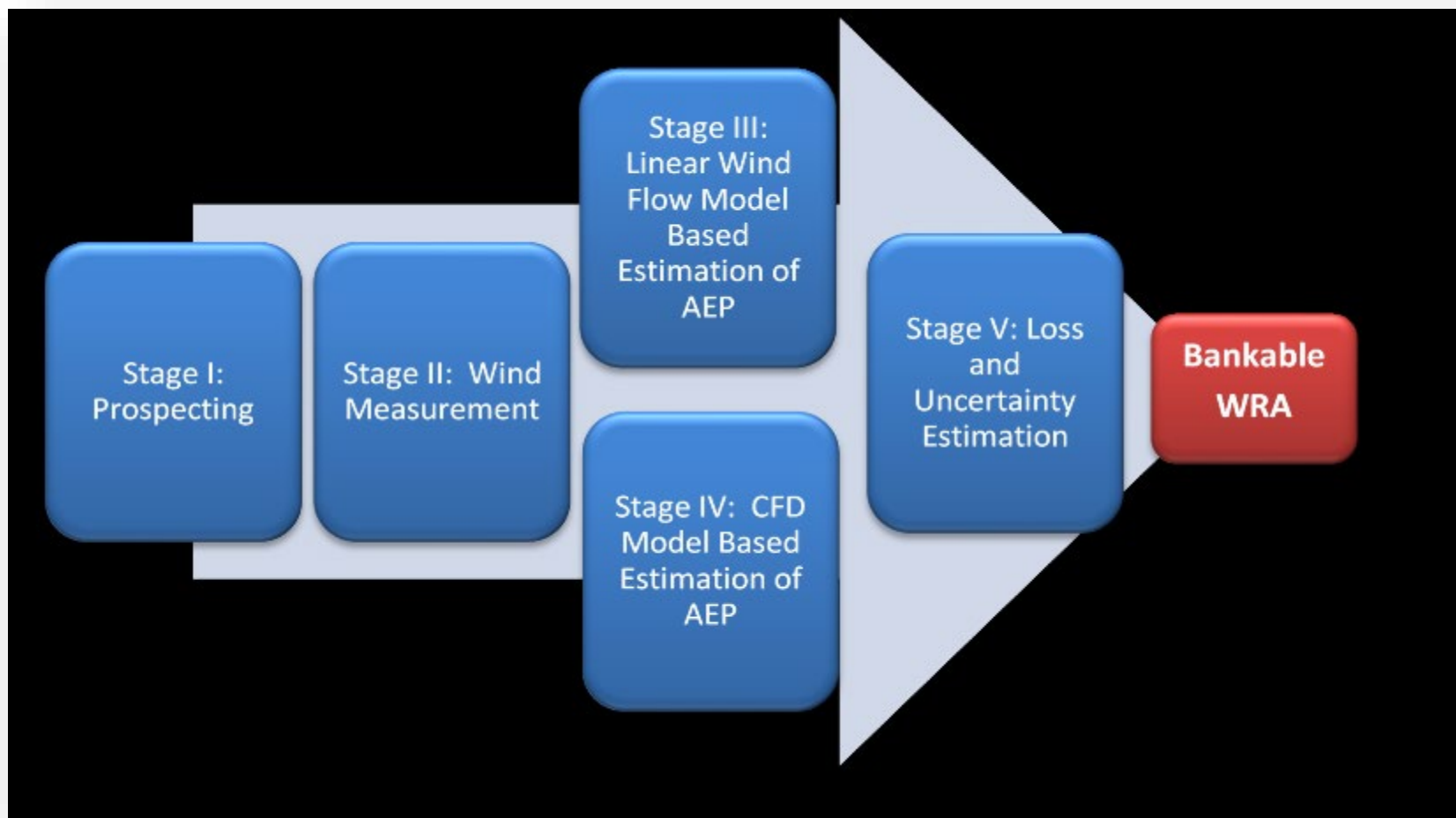
Net capacity factor  
estimate for pricing:

- MET towers installs to validate the resource
- *Land contract will have an option period that will allow for Wind measurement and permitting activities*



Source: Harness Energy

# Wind Resource Assessments



**AEP = Annual Energy Production; CFD = Computational Fluid Dynamics; WRA = Wind Resource Assessment**

Source: Jain, Pramod 2019, Wind Energy Engineering; NY: McGraw-Hill

# Land

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## Land ownership profile:

- Tribal (Trust and Fee)
- Private
- Public
- Usage profile

## Wildlife/avian habitat:

- Threatened and endangered species habitat in or near project?

## Permitting requirements

- Tribal, Federal, state, and local
- Zoning ordinances
- Application requirements and schedule
- Public hearings
- Study requirements (environmental, noise, and so on).

## Legal Contracts

# Land Requirements: Spread Out Turbine Layout to Reduce the Wake Effect



Source: NREL

# Development/Prospecting Tools

- **RE Data Explorer** (<https://www.re-explorer.org/>)
  - How the RE Data Explorer supports wind development for investors and developers:
  - Visualization capability, access to data, reduced project prospecting time
  - Easy to use (manage/evaluate multiple layers of information to support decisions).
- **Wind Farmer** (<https://www.dnvgl.com/software/software-services/windfarmer-analyst-features.html>)
  - Site/layout map, measurement campaign, wind shear analysis
  - Wake and energy modeling
  - Wind farm optimization.
- **Openwind** (<https://www.ul.com/apps/openwind>)
  - Cost of Energy Optimization Module – Understand the impact that each turbine has on the bottom line; determine the best layout to balance energy output with construction costs
  - Deep Array Wake Module – Estimate wake losses for utility-scale wind farms;
  - A GIS interface that enables you to create and modify gridded turbine layouts
  - Tools to analyze multiple turbine layouts for cost effectiveness, including different hub heights and turbine types
  - Time series energy capture, directional curtailment, inflow angle, and turbulence.

# Land: Acquisition Strategy

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- Manage expectations on timing—expect 2-3 years to complete
- Develop and train team (*2-10 people depending on project size*)
- Develop marketing tools
  - Promote through visualizations how small the amount of land is taken out of agriculture production
  - Show the turbine equipment and how it will be transported
  - Pay landowners fairly
- Hold community meetings:
  - Consider a community or smaller good neighbor annual payment for “non-hosting” landowners.

# Land: Acquisition Strategy

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- Meet with Tribal Leaders and other key landowners
- Develop handouts/leave-behinds that describe four key items:
  - Personal Economics: compare how much they will make compared to agricultural income on same land;
  - Displacement of Land: show pictures and easy to understand calculations of how little land is used for actual equipment placement;
  - Tribe and tribal community: show how much the community will benefit

## *...Poll question*

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- **Question 2:** For a typical utility-scale wind project of 20MW to 100MW, what percentage of land is permanently displaced by the turbine pad, roads and substation?
- 1 %
- 5%
- 10%
- 15%
- 20%



# Land Displacement Prop (*for Landowner and Community Leaders Discussion*)

NOTE: Range of 0.3 to 0.5 acres per turbine is permanently displaced.

Example: Wind Project Land Use/Displacement							
Project Profile			Land Used/Displaced (acres)				
Project Size (MW)	# of Turbines (2.5 MW each)	Size (acres)	Turbine Foundation & Apron/pad	Turbine road	Project substation	Total Land	% of Displaced Land
20	8	2,000	1.3	2.8	20	24.0	1.2%
50	20	5,000	3.2	6.9	25	35.1	0.7%
75	30	7,500	4.8	10.3	25	40.1	0.5%

# Landowner Payment Template

Payments are divided into three components:

- Development
- Construction
- Operations.

Typical Landowner Payments:		
Phase:	Payment	Period
Development Payment	\$1-5/acre	3-5 years
Construction Payment	\$100/acre	one time
Operations Payment	2-4% of gross; or \$3000-\$5000/MW	25-50 years

# Landowner Economics Worksheet

Net Profit for Current Agriculture Use:	Profit for Wind Energy:
<b>A:</b> # Turbines ____ X 0.5 acre/Turb. = ____acres displaced	
Gross Revenue per Acre: \$____	Total Gross Revenue \$ ____
Itemized Costs per Acre: \$____	Development \$ ____
Seed \$____	Construction \$ ____
Fertilizer \$____	Operations \$ ____
Water/pumping \$____	Costs: \$ 0
Labor \$____	Profit: \$ ____
Equipment \$____	Displaced Acres: <b>A</b> = ____
Transportation \$____	
Tax 1 \$____	
Tax 2 \$____	
Misc. \$____	
NET Ag PROFIT per Acre: \$____ X <b>A</b> = \$____ per displaced acres	NET Wind Profit per acre (Profit/ <b>A</b> ): \$____per acre
Total Ag Profit of displaced Acres \$ ____	Total Wind Profit of displaced Acres = \$____

# Community/Stakeholder Engagement

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Educational outreach and social acceptance:

- Unbiased information for tribal, local, state, and federal decision makers
- State and regional wind working group network
- Educational programs, monthly recorded webinars, e-newsletter on deployment issues, and workshops
- Information portals
- International Energy Agency task – international research on wind impacts.



Source: NREL

# Tribal/Comm. Economics Worksheet

## Project Economics for Project A:

	One-time:	Annual:
P.I.L.T (pmt. in lieu of taxes) =	_____	_____
Option Payment =	_____	_____
Operations/Royalty Payment =	_____	_____
Total income for Tribe: \$	_____	_____

Direct jobs generated:

- Development = \_\_\_\_\_
- Construction = 120 - 200 per 100-MW project
- Operations = 8 - 10 per 100 MW

Indirect jobs (ex: engineering, hotels, restaurants, hardware stores) = 100 - 200

# Land Lease - components

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- Ownership Parties
- Purpose and Use
- Land description
- Payment description
  1. Option agreement (3-5 yrs.)
  2. Operations Payment (20-25 yrs.)
    - Either described by % of Gross Revenue or \$/Megawatt (MW)
  3. Restoration Payment – for damaged crops or range land (used anytime)

# Land Lease – components (cont'd)

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- Lessor's Covenants
  - Taxes and insurance
  - Obstructions
  - Uses
  - Communications
- Lessee's Covenants
  - Access Roads, Culverts, Fencing
  - Taxes
  - Compensation for damages
  - Reclamation
  - Topsoil

# Land Lease – components (cont'd)

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- Mutual Covenants
  - Transmission easements
  - Removal of equipment
  - Discharge of encumbrances
  - Assignments
- Dispute Resolution
  - Authority/Governing Law
  - Cure process
- Misc.:
  - Confidentiality
  - Amendments, Notices
  - Schedules:
    - Surveys
    - Detailed Land description
    - Sketch of temporary workspace



# Land Lease considerations

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- Best Practices
- How to evaluate your developer before you sign
- What to include in the agreement
  - Performance guarantees during the development option period
- Always have an attorney review
- Consider discussing concerns with a neighboring community County Commissioner (that has a fully permitted and operating project) and separate truth from myth and/or relative emphasis of concern

# Right of Way (ROW)

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- Similar to a lease agreement but less detailed
- Includes:
  - Parties
  - Uses can be:
    - Underground electric lines
    - Overhead electric lines
    - ...or simply transportation access across property during construction
  - Payment Structure:
    - One time
    - Annual
    - Restoration (anytime)
  - Term
  - Survey, Land description

# Interconnection Agreement

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- Signed between Developer (project owner) and Utility (T-line owner) – *needed for PPA and project financing*
- Steps:
  - Developer selects a site (completes prel. due diligence)
  - Signs land lease(s) at interconnection point
  - Signs study agreement with utility:
    - Feasibility Study & System Impact Study
    - Facility Study
    - ...if positive results, move on to IA negotiation
  - Execute Interconnection Agreement (IA or LGIA)
    - Designates amount (MWs) of power that can be connected to system at a specific location
    - Designates all equipment needed to interconnect (X-MWs) and who is responsible which equipment (network vs. developer).
    - Designates construction schedule
    - Designates payment schedule and cost
- Describe difference between an IA (interconnection) vs. TSA (transmission)

# Power Purchase Agreement (high level summary)

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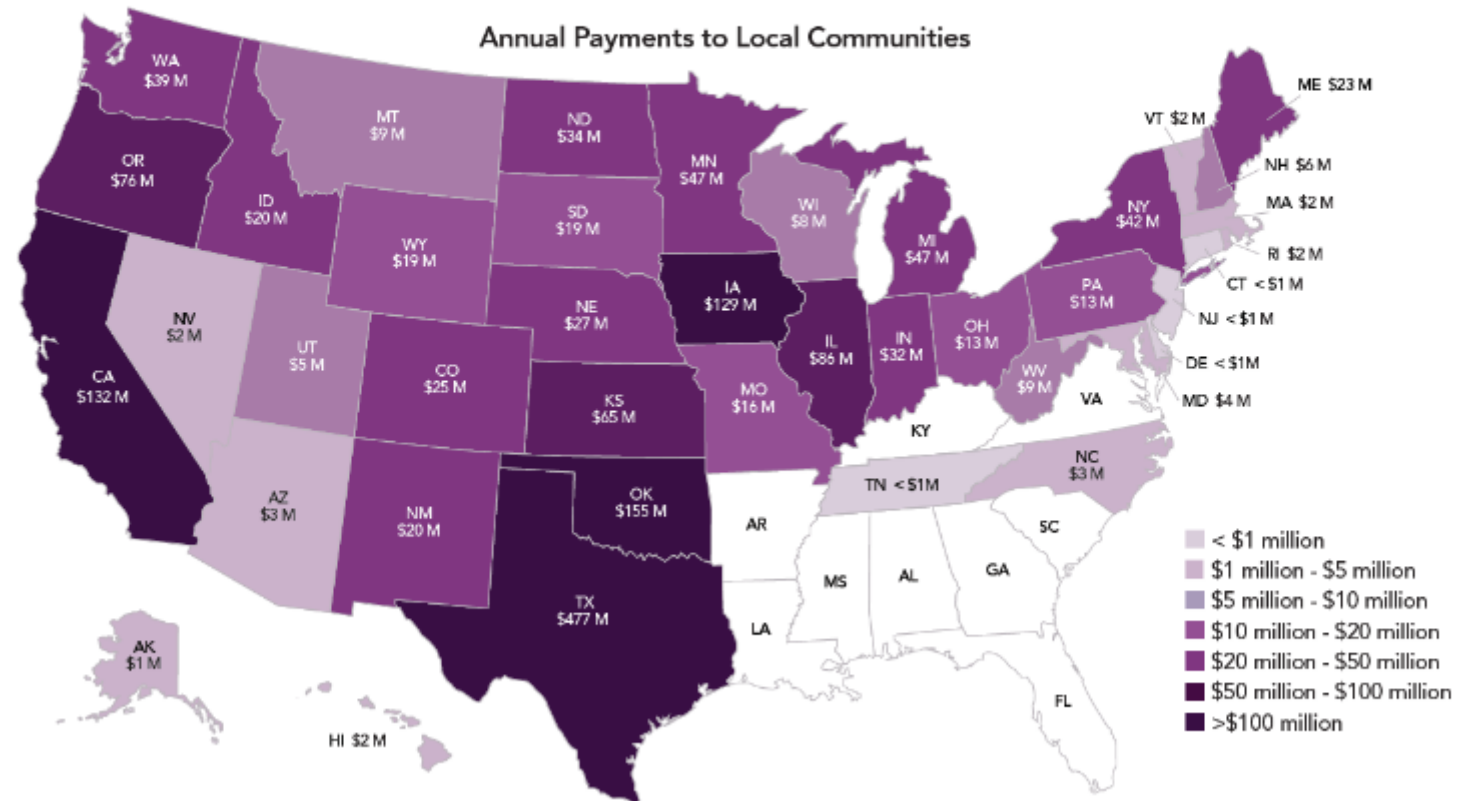
- Importance:

- Usually standardized agreement for financing
- Executed with Developer that has a fully mature project
- Project cannot obtain financing without a signed PPA
  - Project cannot be built without financing
- Includes:
  - Parties
  - Price (\$/MWH)
  - Take or pay options...and Force Majeure description
  - Availability guarantees
  - Minimum power guarantees....and replacement power guarantees
  - Equipment description
  - Interconnection description
  - Wind Resource assessments (independent)
  - Schedules: Project maps, construction plan/schedule, land leases, completed permits, equip., maps
  - Development plan (any remaining items)

# Promote the Benefits to Landowners and Community

## Wind Supports Local Communities

The U.S. wind industry is a major economic development driver, especially in rural areas. The industry invested **\$14 billion** in new wind projects in 2019. Every year, wind projects pay over **\$1.6 billion** to state and local governments and private landowners, including **\$912 million** in state and local tax payments and **\$706 million** in landowner lease payments.



Source: AWEA 2019 Annual Report

# Summarizing the Wind Development Process

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1. Desktop analysis: market, wind resource, land uses (environmental exclusion / ownership)
2. Find overlap: strongest wind resource, potential customers, proximity to transmission lines:
  - Evaluate Land Uses:
    - Ownership (tribal, private, state, or federal lands in large or small parcels),
    - Proximity to sacred sites/cultural resources, homes, schools, churches and businesses, parks, wildlife refuges, T&E species habitat, forests
3. Visit the area: landowner meetings and permitting representative meetings
4. Site selection:
  - Evaluate available transmission and submit interconnection application
  - Initiate land leasing
  - Install MET towers
5. Permitting (understand Tribal and federal processes/timelines):
  - Aviation
  - Wildlife

# Wind Development (continued):

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6. Permitting (Tribal, State and local)
  - Sound study
  - Flicker study
  - Wildlife impact studies (birds and threatened and endangered species)
  - Historical preservation agencies
  - Jobs and tax benefits to community identification
  - Environmental benefits to community (water conservation and reduced emissions)
  - Comm search (microwave tower study—communities' emergency communication)
  - If yes, then:
7. Develop pricing tools to see if proposed wind farm competes well with existing costs of “new” energy needs
8. Develop pricing tools to see if proposed wind farm competes well with existing costs of “new” energy needs
9. Market the power of “proposed” wind farm:
  - Respond to requests for proposals
  - Negotiate bilateral contracts
10. Complete power contract negotiations with buyer:
  - Utilities: Purchased Power Agreements; Build Transfer Agreements
  - Corporations (Purchased Power Agreements).
11. Complete Financing
12. Build and Operate the wind farm.

# Pro Forma

Megawatts		20	50	100	
Number of Turbines		5	19	25	
		Project Size			NOTES/Assumptions:
		20 MW (2MW-4MW/turbine)	50MW (2MW-4MW/turbine)	100MW (2MW-4MW/turbine)	
Turbine Configuration		4xM-150 @ 120mHH	4xM-150 @ 120mHH	4xM-150 @ 120mHH	HH equals hub height
costs	Turbines	\$ 2,900,000	\$ 2,700,000	\$ 2,500,000	WTG, Commissioning, Aviation Lights, Elevator, CMS, PMTA on site
	transportation	\$ 500,000	\$ 500,000	\$ 500,000	Intl + local. Assumed no port or road modifications required. Escort
	customs	\$ 29,000	\$ 27,000	\$ 25,000	
	INSTALLATION(BOP):				
	Civil	\$ 675,000	\$ 459,615	\$ 455,000	BOP+ foundation + O&M on 50&100mw projects only
	Civil 2	\$ 300,000	\$ 300,000	\$ 300,000	Placeholder space for improved roads to site
	Electrical	\$ 375,000	\$ 275,000	\$ 250,000	assumed collection system homerun to project substation is minimal
	Erection	\$ 415,000	\$ 305,769	\$ 303,000	Same cost/wtg erection with decreasing mob/demob cost effect on v
	Contingency	\$ 176,500	\$ 134,038	\$ 130,800	assume 10%
	Installed Turbine subtotal	\$ 5,194,000	\$ 4,567,385	\$ 4,333,000	per turbine
	INSTALLED COST	\$ 25,970,000	\$ 59,376,000	\$ 108,325,000	per project
	INTERCONNECTION:				
	IPC studies	\$ 100,000	\$ 100,000	\$ 100,000	Assumed no benefit for project size in studies
	Station Equipment/installed	\$ 500,000	\$ 1,300,000	\$ 2,500,000	\$25000/mw to \$40,000/mw
	Generation tie-line	\$ 250,000	\$ 500,000	\$ 1,000,000	\$500,000 per mile
	Network upgrades	\$ 400,000	\$ 1,040,000	\$ 2,000,000	\$20,000/mw
	subtotal	\$ 1,250,000	\$ 2,940,000	\$ 5,600,000	per project
	DEVELOPMENT:				
	Management FEE	\$ 750,000	\$ 1,500,000	\$ 3,000,000	
	Land Payments	\$ 50,000	\$ 130,000	\$ 250,000	\$10,000/wTG
	Engineering Manager	\$ 259,700	\$ 593,760	\$ 1,083,250	1% of CapEx
	Geotech	\$ 25,000	\$ 65,000	\$ 125,000	\$5000/wTG
	Community payments	\$ 25,000	\$ 65,000	\$ 125,000	\$5000/wTG ... country/community specific
	Wind Assessments/studies	\$ 60,000	\$ 150,000	\$ 300,000	Large project as MET small has only LIDAR
	Environmental studies	\$ 50,000	\$ 150,000	\$ 150,000	Assumed no benefit for project size in studies
	Permitting	\$ 50,000	\$ 150,000	\$ 150,000	Assumed no benefit for project size in studies
	Other consulting	\$ 100,000	\$ 100,000	\$ 100,000	Assumed no benefit for project size in studies
	Legal 1-General	\$ 100,000	\$ 100,000	\$ 100,000	Assumed no benefit for project size in studies
	subtotal	\$ 719,700	\$ 1,503,760	\$ 5,383,250	
	FINANCING:				
	Independent Wind report	\$ 100,000	\$ 100,000	\$ 100,000	Assumed no benefit for project size in studies
	Construction Manager/				
	Owner's Engineer	\$ 100,000	\$ 200,000	\$ 200,000	
	Legal 2 -- PPA/Financing	\$ 100,000	\$ 200,000	\$ 200,000	Assumed no benefit for project size in studies
	Insurance	\$ 2,597,000	\$ 5,937,600	\$ 10,832,500	10% of CapEx
	OC/Performance Bond(s)	\$ 591,370	\$ 607,114	\$ 2,166,500	2% of subtotal
	subtotal	\$ 3,488,370	\$ 7,044,714	\$ 13,493,000	
	Fin-Dev-Int SUBTOTAL:	\$ 5,458,070	\$ 11,488,474	\$ 24,482,250	
	PROJECT COST:	\$ 31,428,070	\$ 70,864,474	\$ 132,807,250	
		\$ 1,571.40	\$ 1,362.78	\$ 1,328.07	Per KW



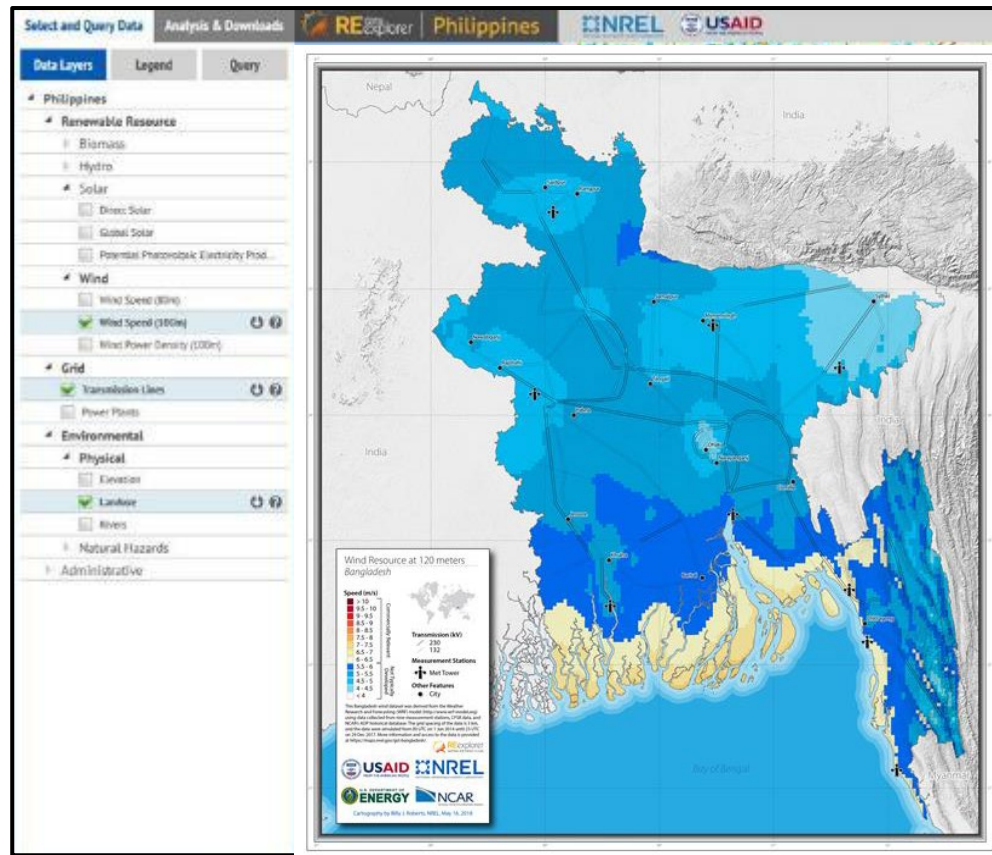
# Summary

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*....in Pictures*

# Prospect and Find the Best Sites

## Renewable Energy Data Explorer tool



<https://www.re-explorer.org/>

# Landowner—(a.k.a. “kitchen-table”) Meetings

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Source: Wayfair



Source: U.S. DOE

# Complete Wildlife and Archeological Studies

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Source: Nick Cote NYT



Source: NREL



# Public Engagement and Permitting

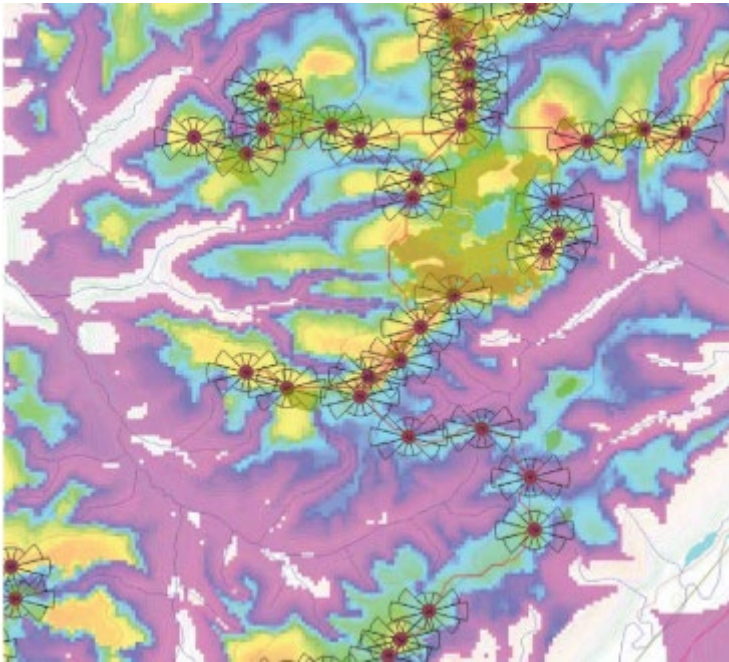


Source: NREL



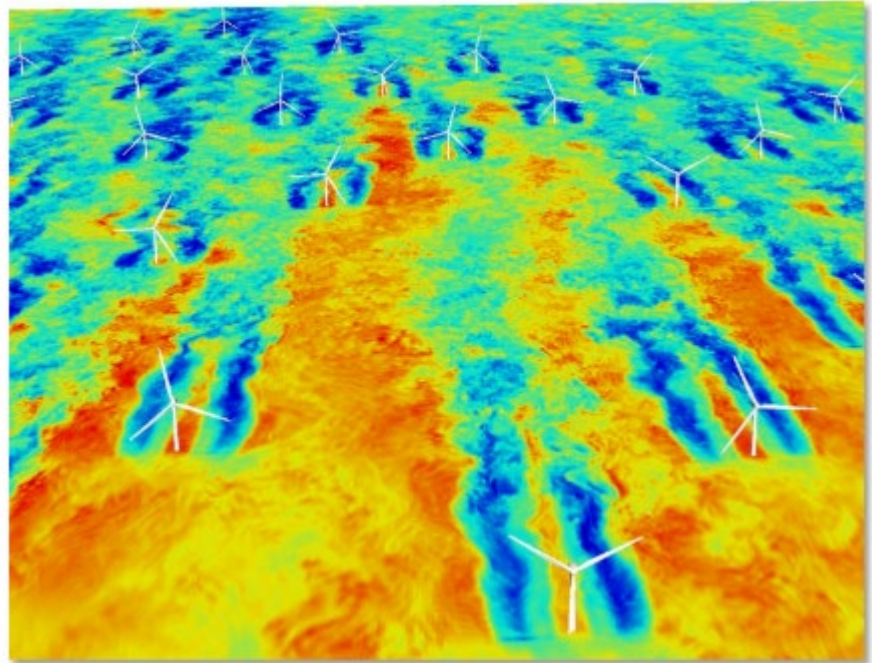
Source: U.S. DOE

# Finish Layout Siting and Modeling



**Developing a layout**

(Source: UL and Windographer)



**Contours of simulated instantaneous flow at Lilligrund wind farm** (Source: NREL)

# Contracts and Financing complete!

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Source: gtreview



# Pour Foundations



Source: dglobe.com



# Transport Turbine Components



Source: bennington-banner



Source: Port of San Diego Waterfront



Source: bigge.com

# Fly Up Rotor Assemblies





# Operations mode: Landowner's Collect their Royalty Checks

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# Maintenance of Wind Farm

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Source: NREL

# Questions?

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