

DOE OFFICE OF INDIAN ENERGY

The Five-Step Development Process

Step 1: Identify Project Potential

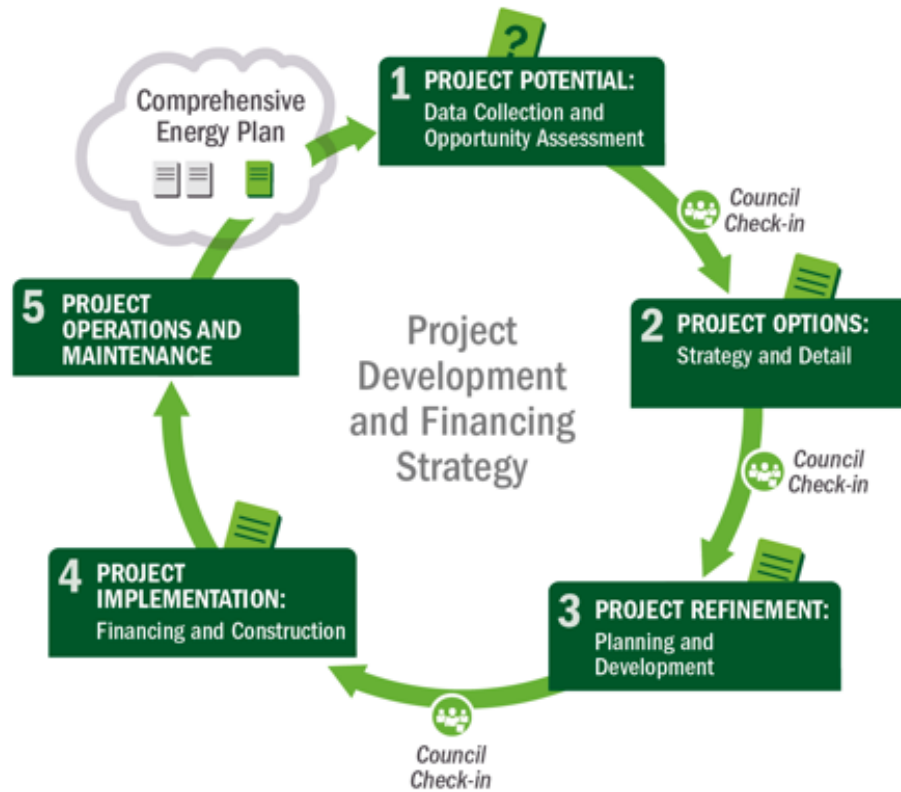


U.S. DEPARTMENT OF
ENERGY

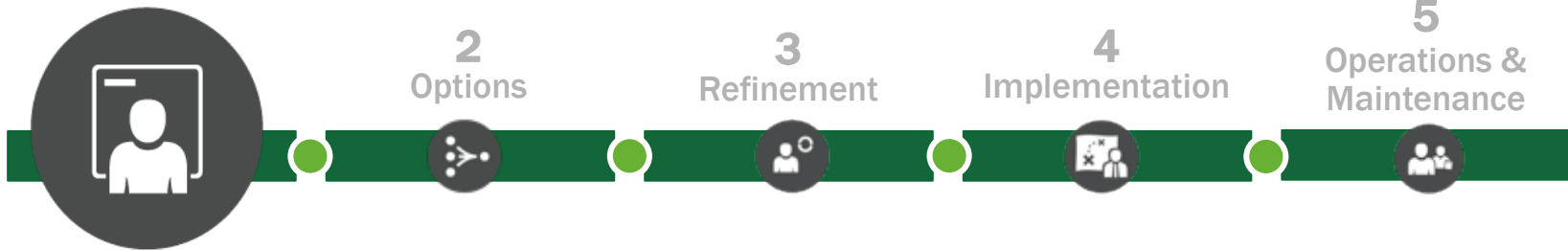
Office of
Indian Energy

Presentation Agenda

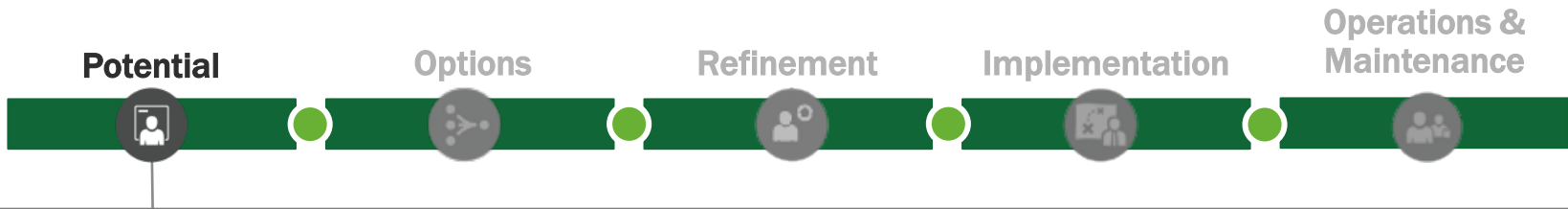
- Brief Review of Day 1
- Step 1: Identifying Project Potential
 - Community Market Potential
 - Resource Potential
 - Initial Site Considerations
- Tools and Resources
- Small Group Exercise/Discussion



1 Potential



Step 1: Site, Scale, Resource, and Community Market Potential



Purpose: Determine whether basic elements for a successful project are in place

Tasks:

1. Identify possible **sites** for project locations
2. Determine the **energy load/demand** for these sites using past electric bills for these facilities
3. Confirm renewable energy **resource**
4. Review tribal facility electric cost data, regulations, and transmission and interconnection requirements
5. Evaluate community market potential for renewable sales. **Your community is the marketplace/energy user**
6. Assemble or communicate with the right team—those in positions or with knowledge to facilitate, approve, and champion the project

Understanding Community Market Potential

- **Who is your market?**
 - Tribal community
- **What do you need to know?**
 - Current energy loads and demand
 - Expected future energy loads and demand of the system
 - Condition of buildings and availability of roof space and land
 - Consider energy efficiency/weatherization first (typically the most cost-effective)

	2015	2016	2017
Energy (kWh)			
Demand (avg kW)			

Sizing Your Renewable Energy System

Current Load

- Use your past monthly energy bills to determine the demand. Start with your strategic energy plan
- Consider your scale: residential, commercial, or industrial
- Consider the current tariff structure (how the energy is metered and billed)

Future Load

- At which energy scale does your community expect the most growth in energy demand?
- How much will you need?

Other Limiting Factors

- Interconnection
- Net metering cap
- Rebate limits

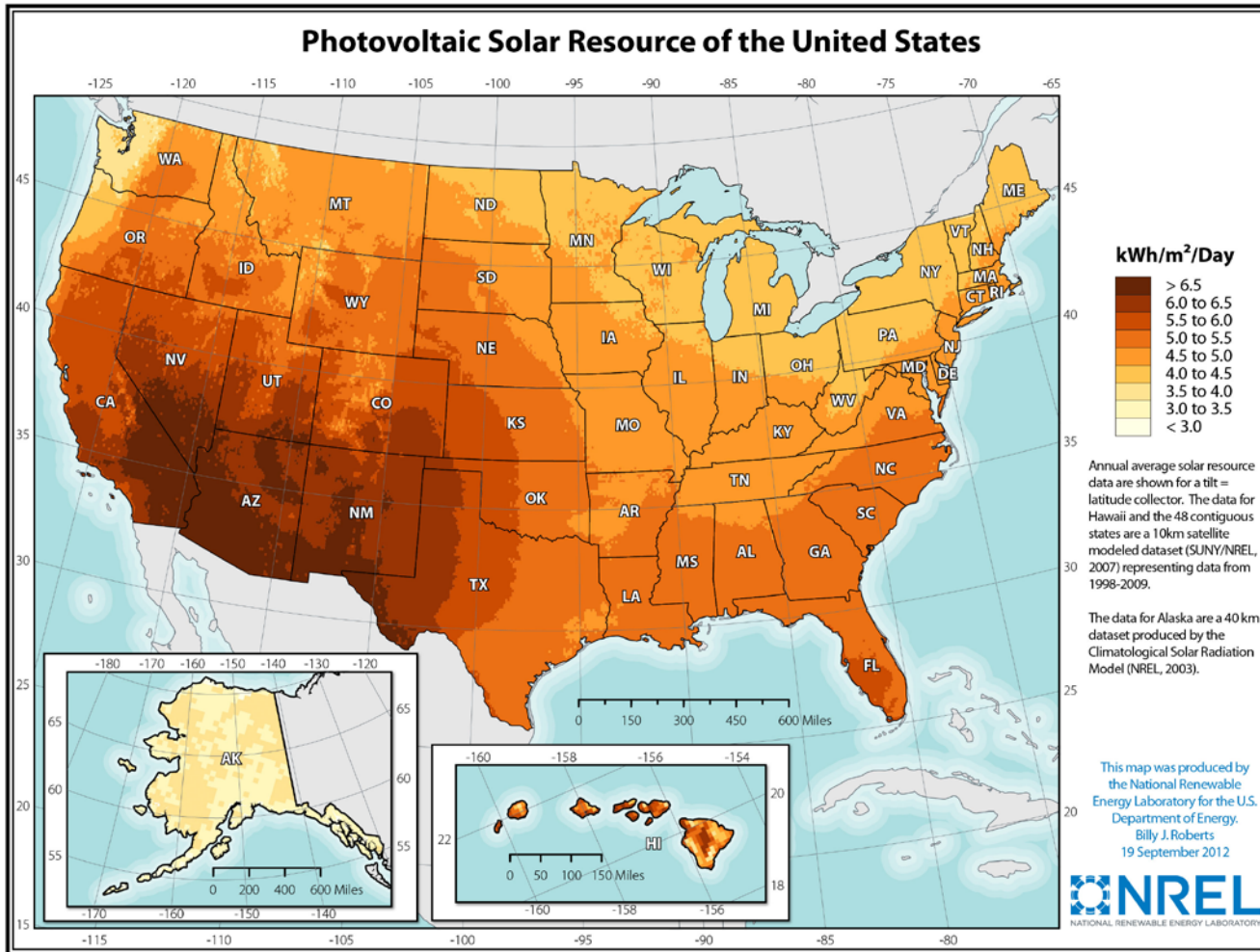
	2015	2017	2019
Energy (kWh)	xyz	xyz	xyz
Demand (avg kW)	xyz	xyz	xyz

Resource, Production & Savings

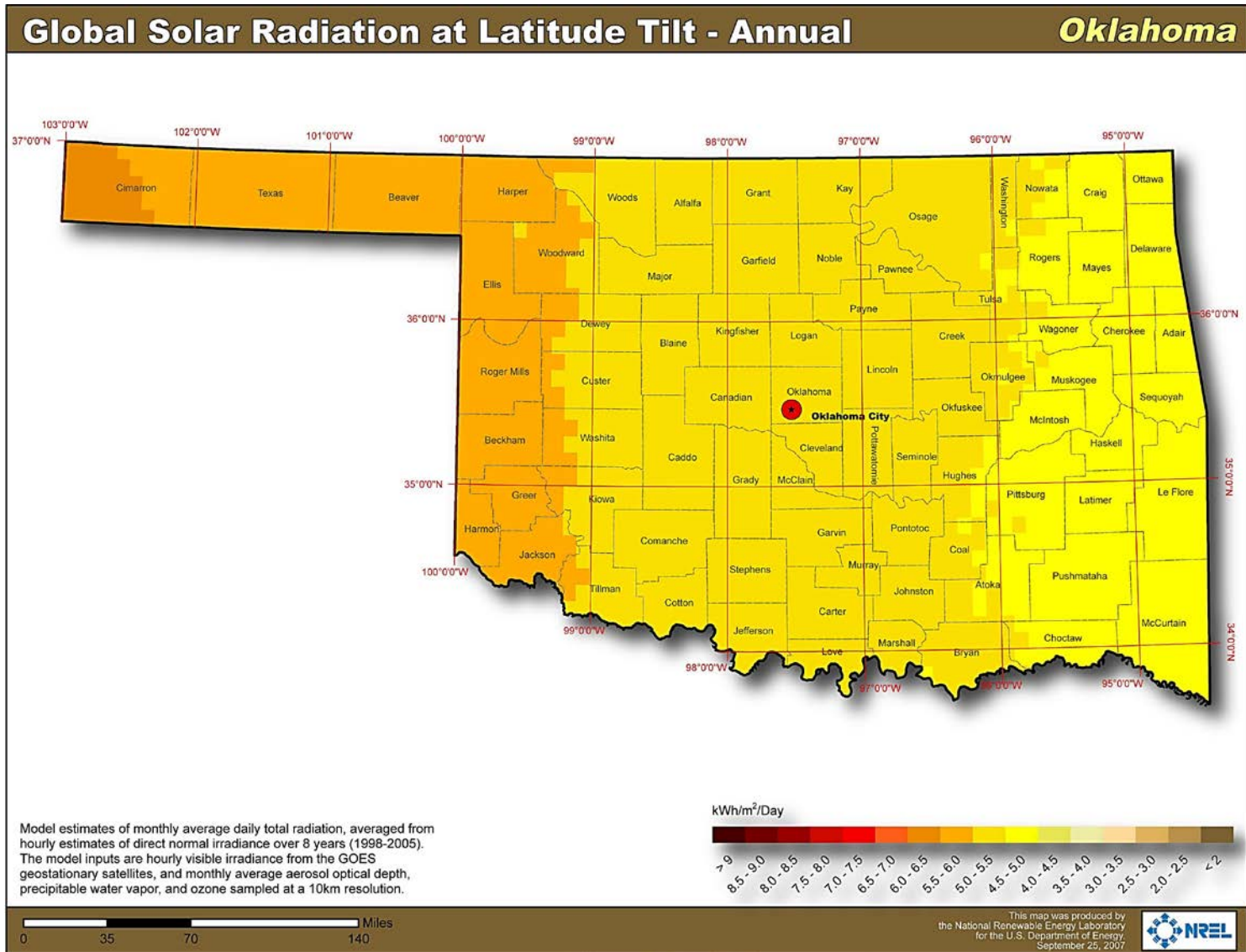
Assess available local energy resources

- Production
 - Online tools (PV Watts)
 - Field based measuring equipment
 - Resource maps

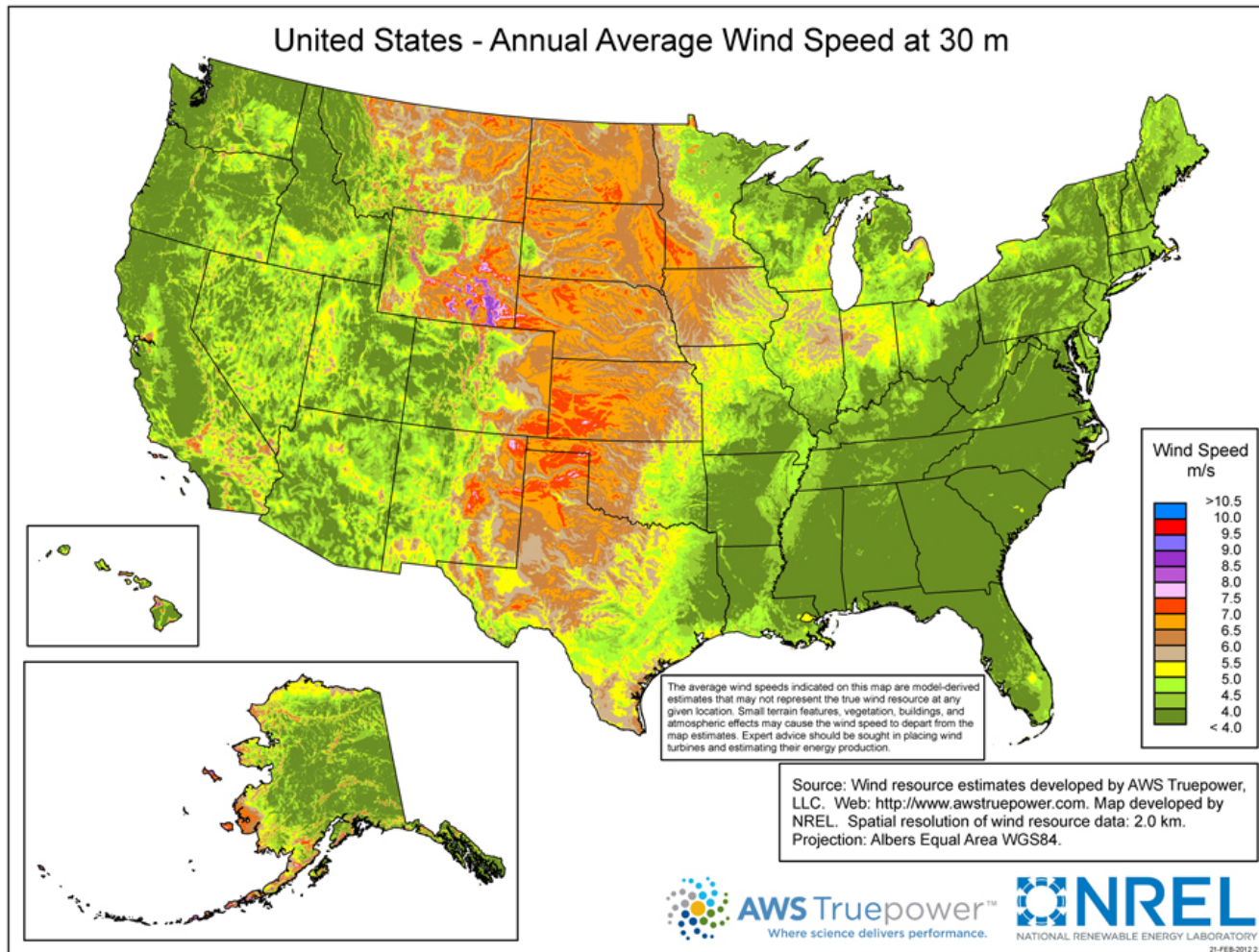
Solar PV Energy Resource Mapping



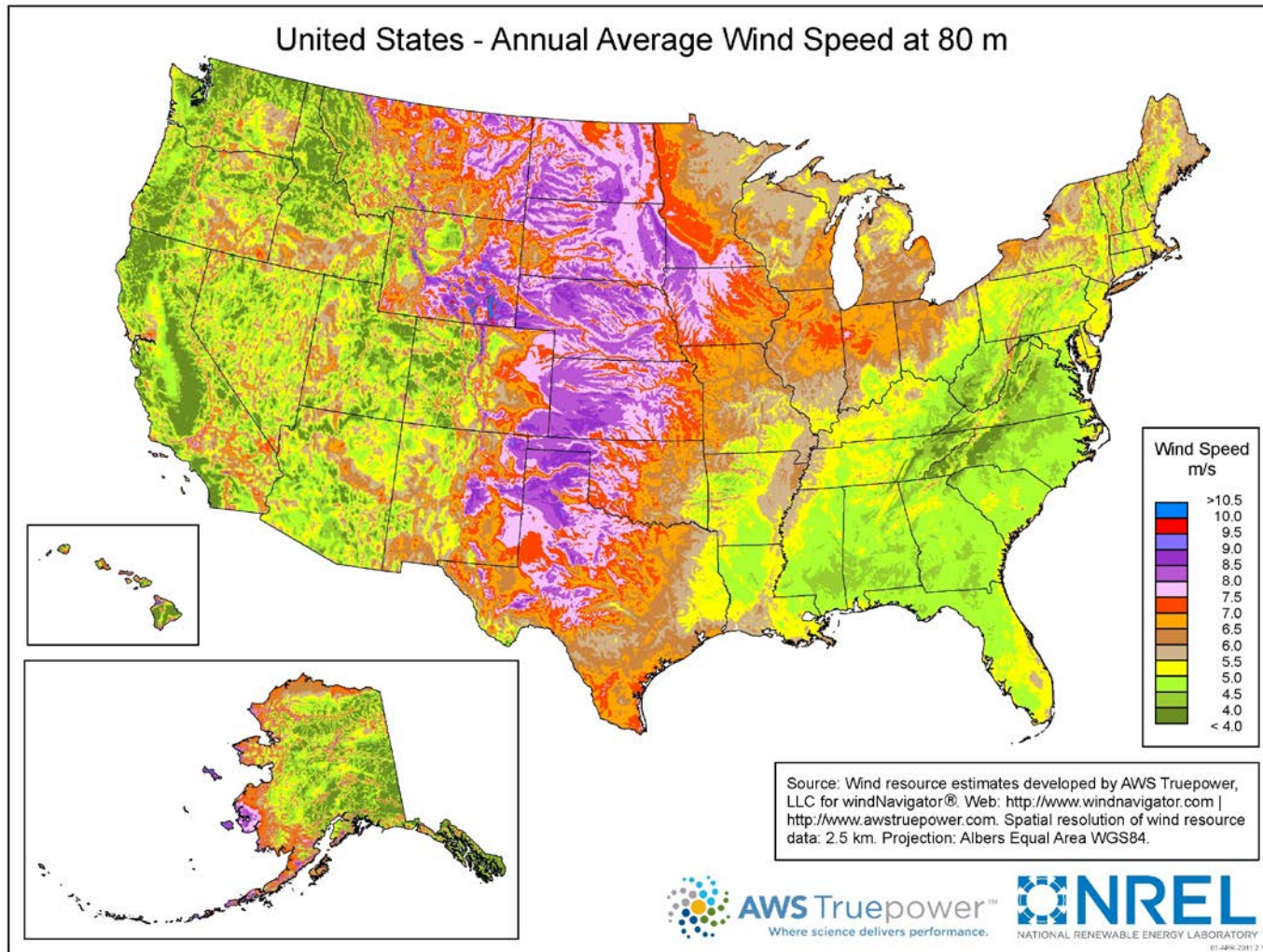
Solar Resources in Oklahoma



Wind Energy Resource Mapping: 30 Meter (m)



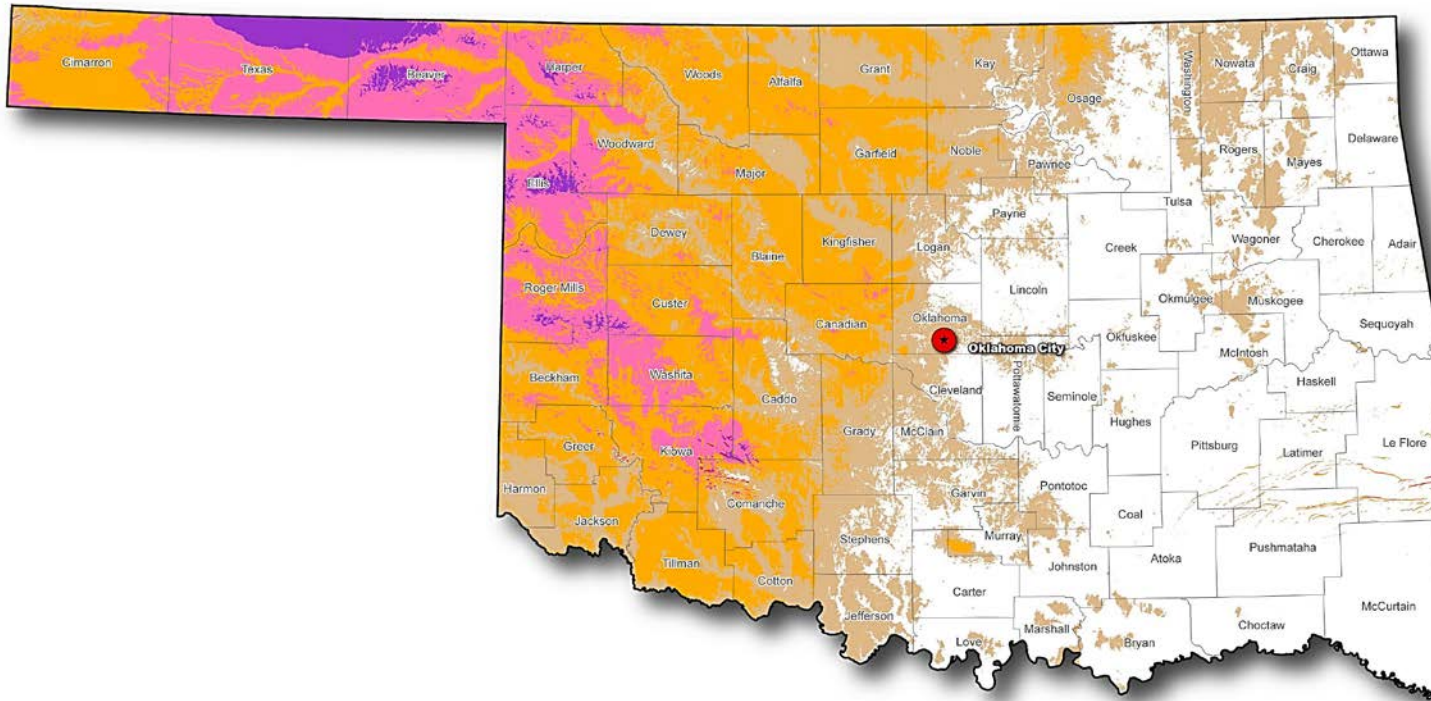
Wind Energy Resource Mapping: 80 m



Wind Resources in Oklahoma

50 m Wind Power Resource

Oklahoma



The wind power resource data for this map was produced by TrueWind Solutions using the Mesomap system and historical weather data. It has been validated with available surface data by the National Renewable Energy Laboratory and wind energy meteorological consultants.

Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50m W/m ²	Wind Speed ^a at 50 m m/s	Wind Speed ^a at 50 m mph
1	Poor	0 - 200	0.0 - 5.6	0.0 - 12.5
2	Marginal	200 - 300	5.6 - 6.4	12.5 - 14.3
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	> 800	> 8.8	> 19.7

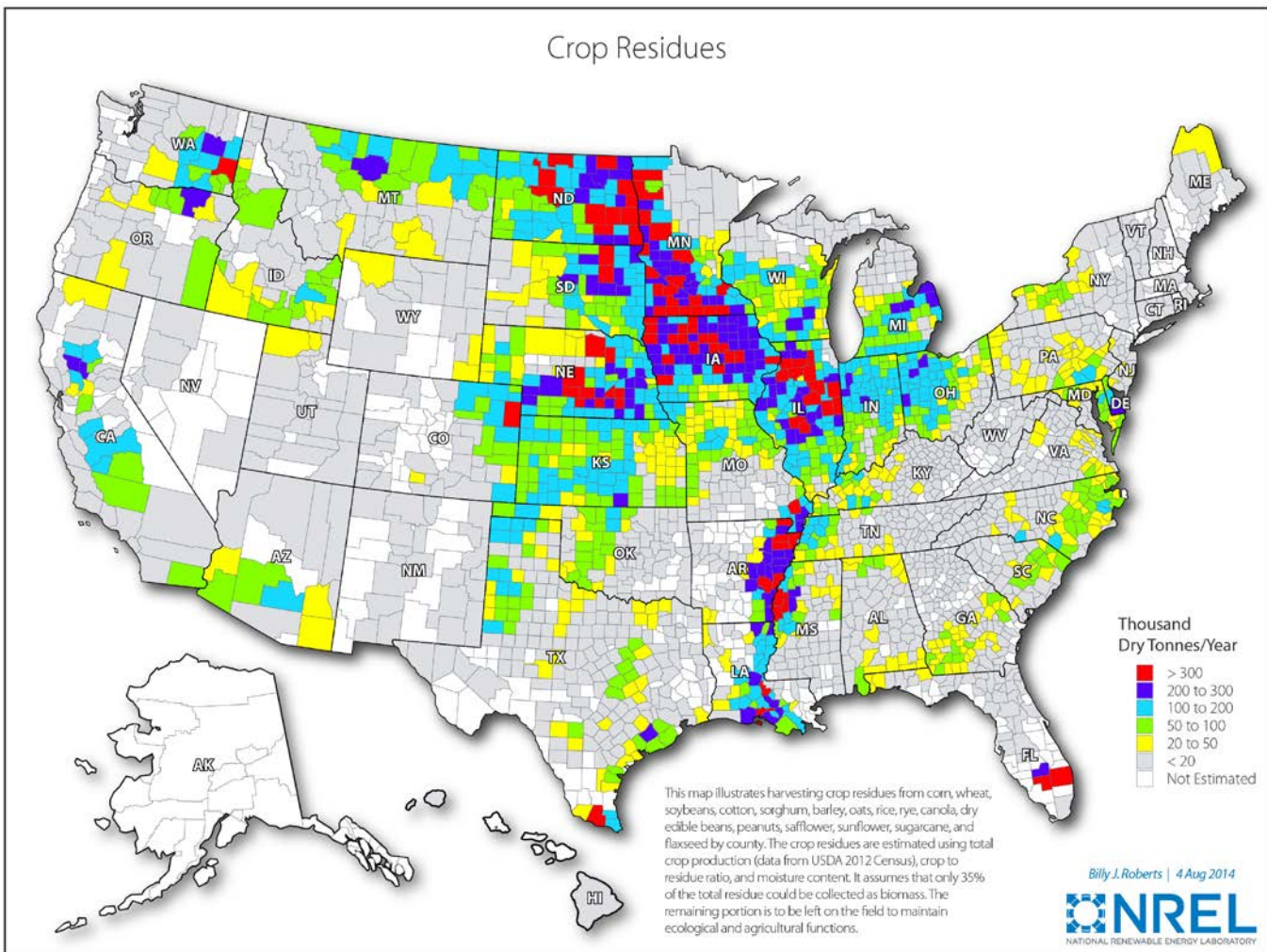
^a Wind speeds are based on a Weibull k value of 2.0



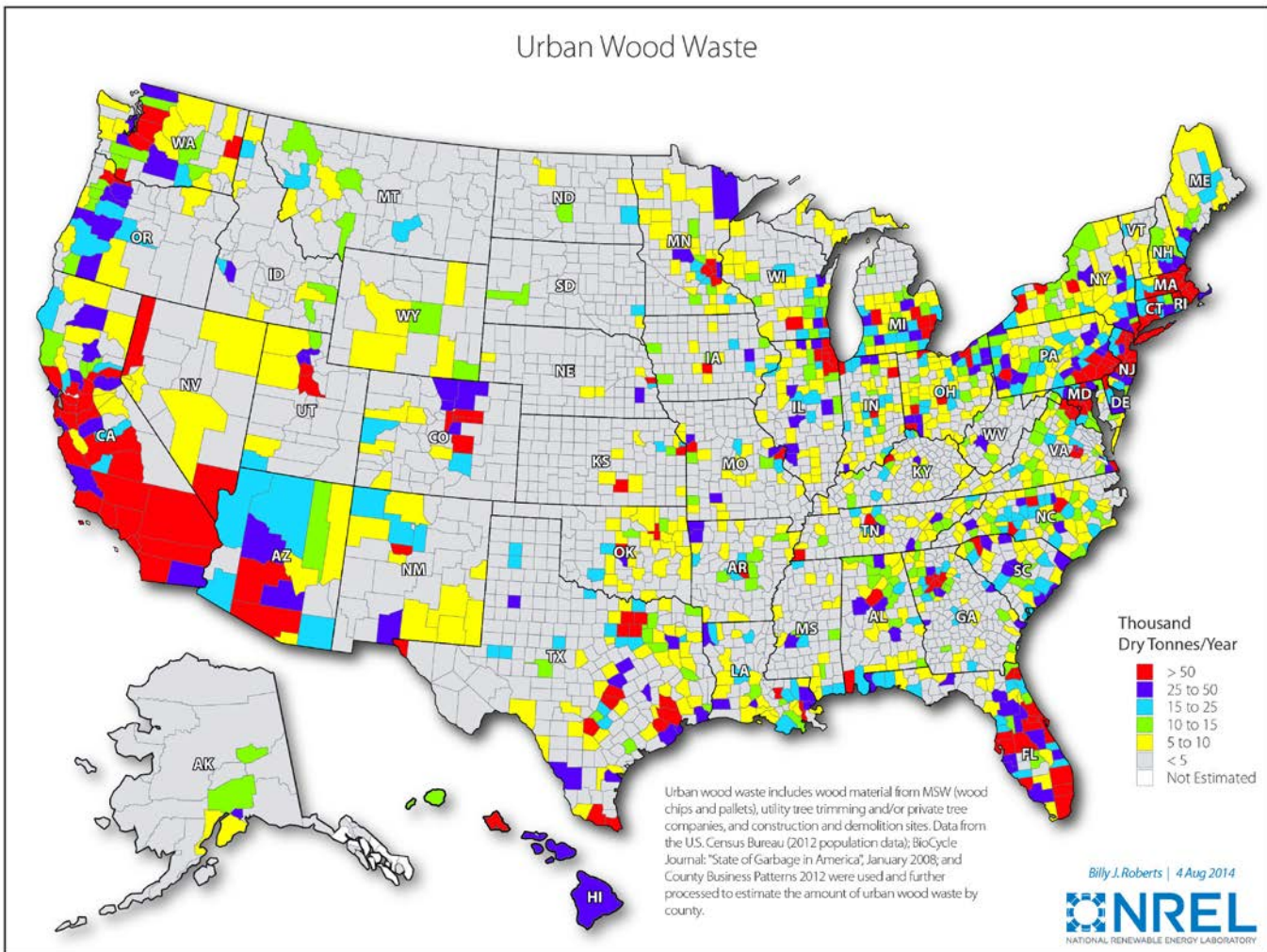
This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy June 1, 2010



Biomass Energy Resource Mapping: Crop Residues



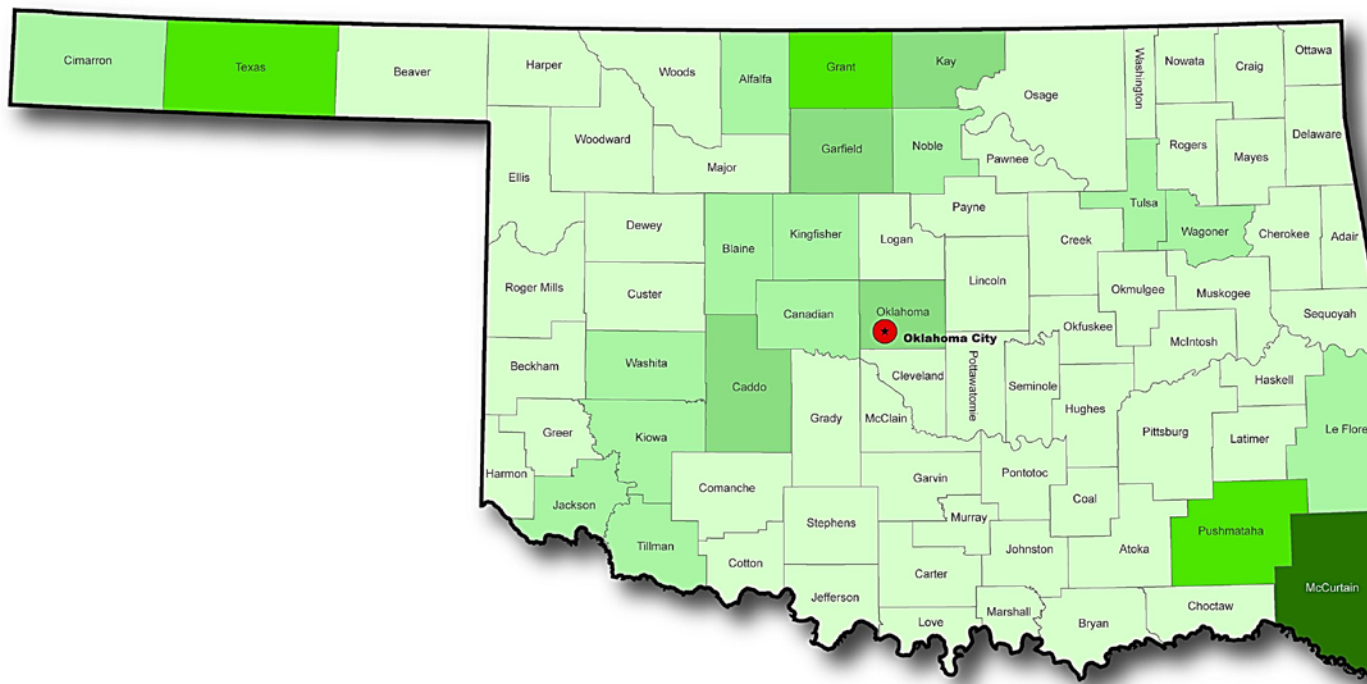
Biomass Energy Resource Mapping: Wood



Biomass Resources in Oklahoma

Biomass Resources

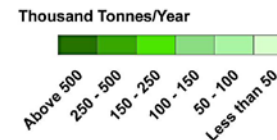
Oklahoma



This study estimates the technical biomass resources currently available in the United States by county. It includes the following feedstock categories:

- Agricultural residues (crops and animal manure);
- Wood residues (forest, primary mill, secondary mill, and urban wood);
- Municipal discards (methane emissions from landfills and domestic wastewater treatment);
- Dedicated energy crops (switchgrass on Conservation Reserve Program lands).

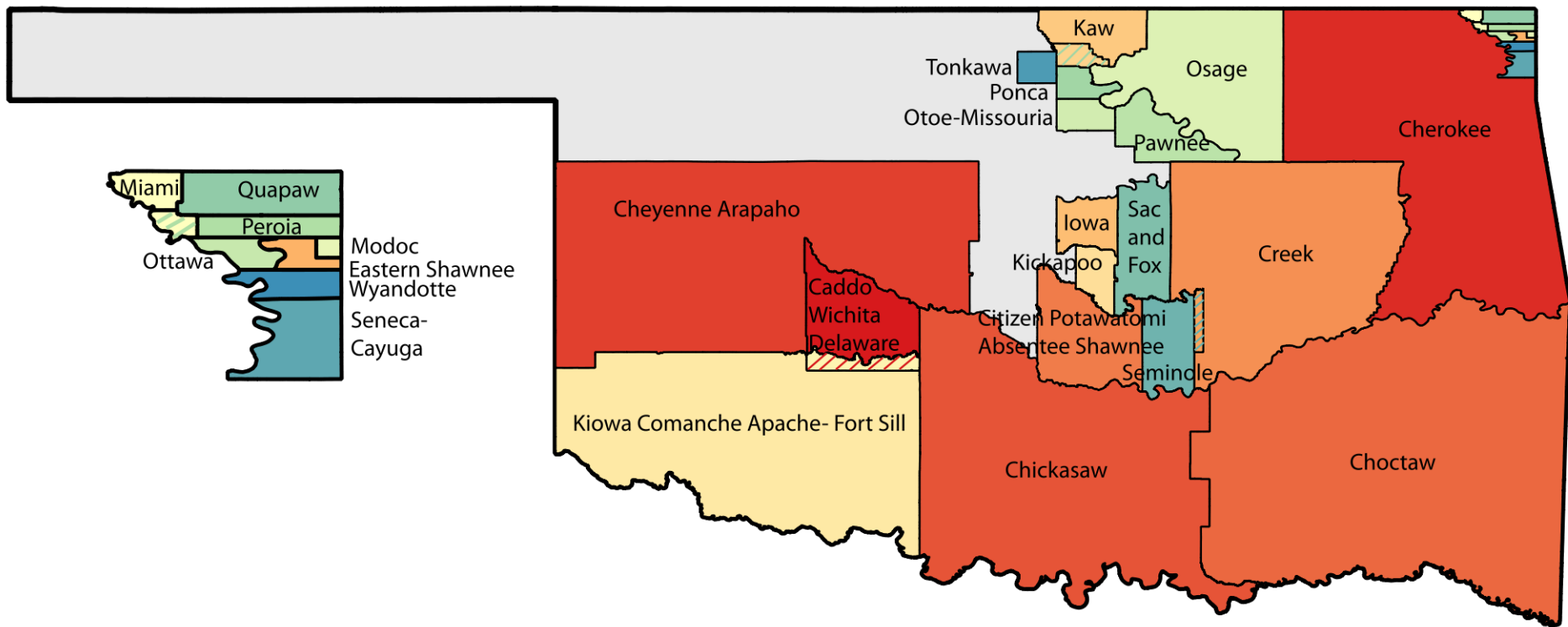
See additional documentation for more information at <http://www.nrel.gov/docs/fy06osti/39181.pdf>



This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy, September 25, 2007

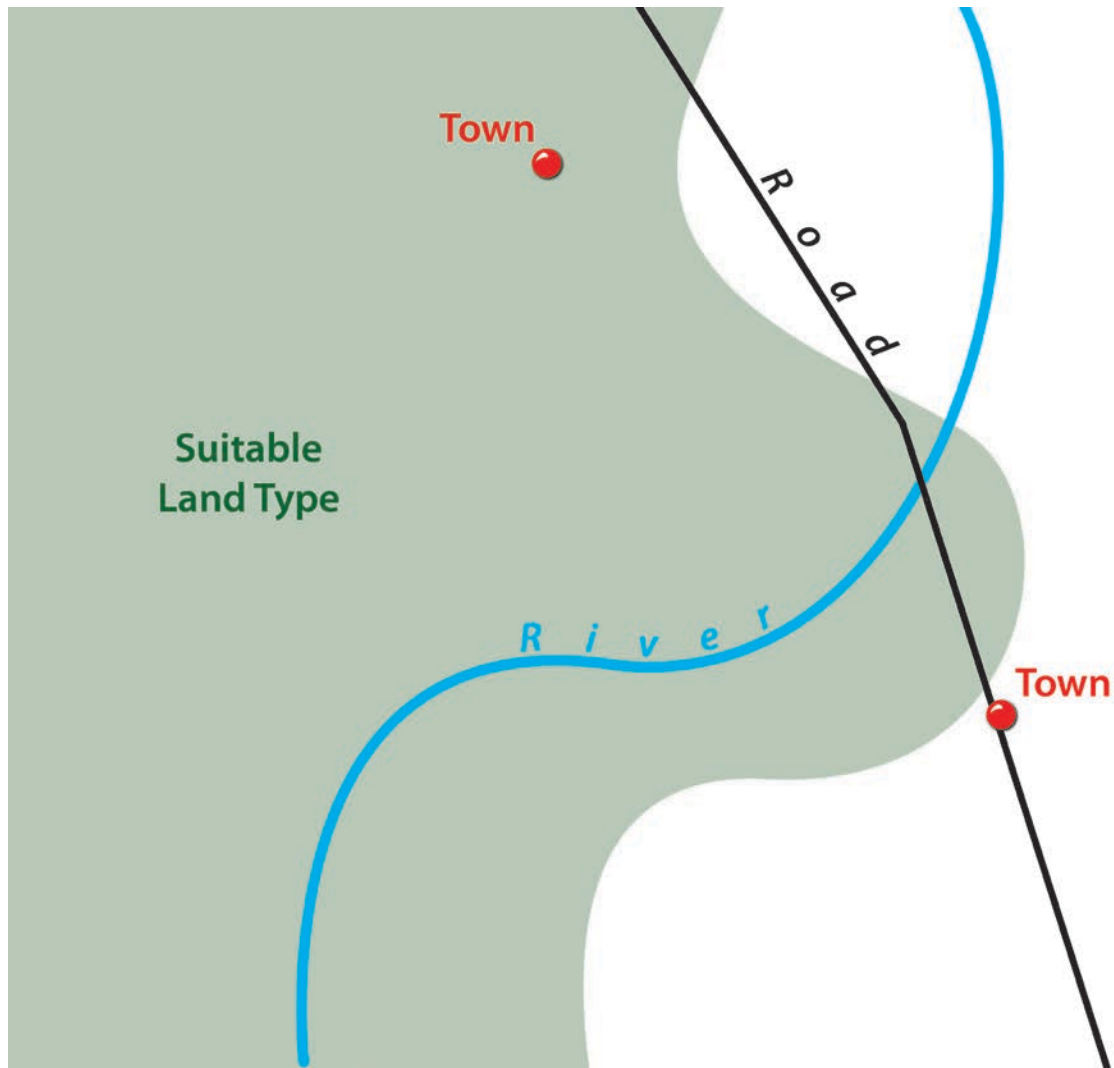


Tribal Partnership Opportunities

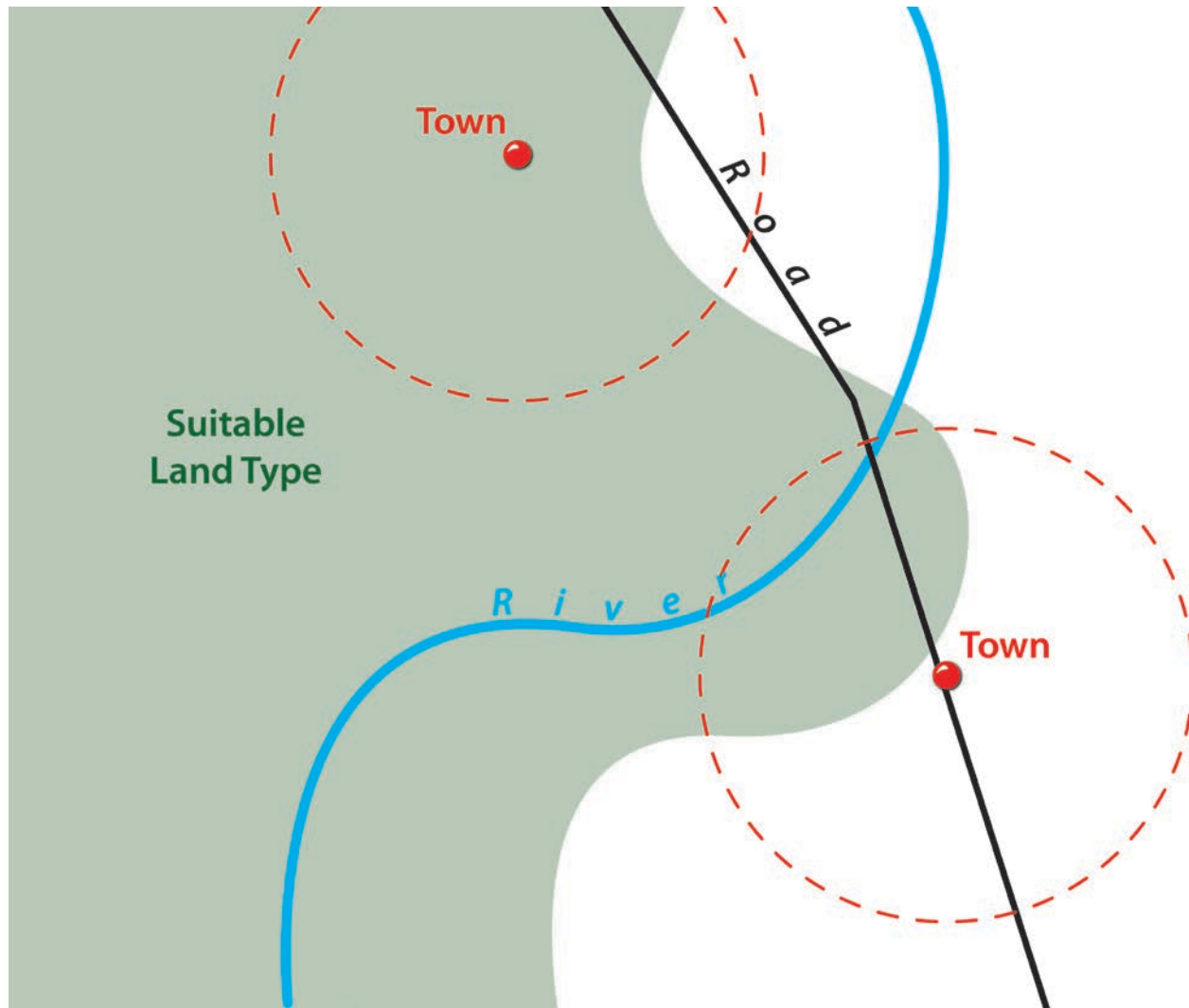


Source: http://en.wikipedia.org/wiki/Oklahoma_Tribal_Statistical_Area

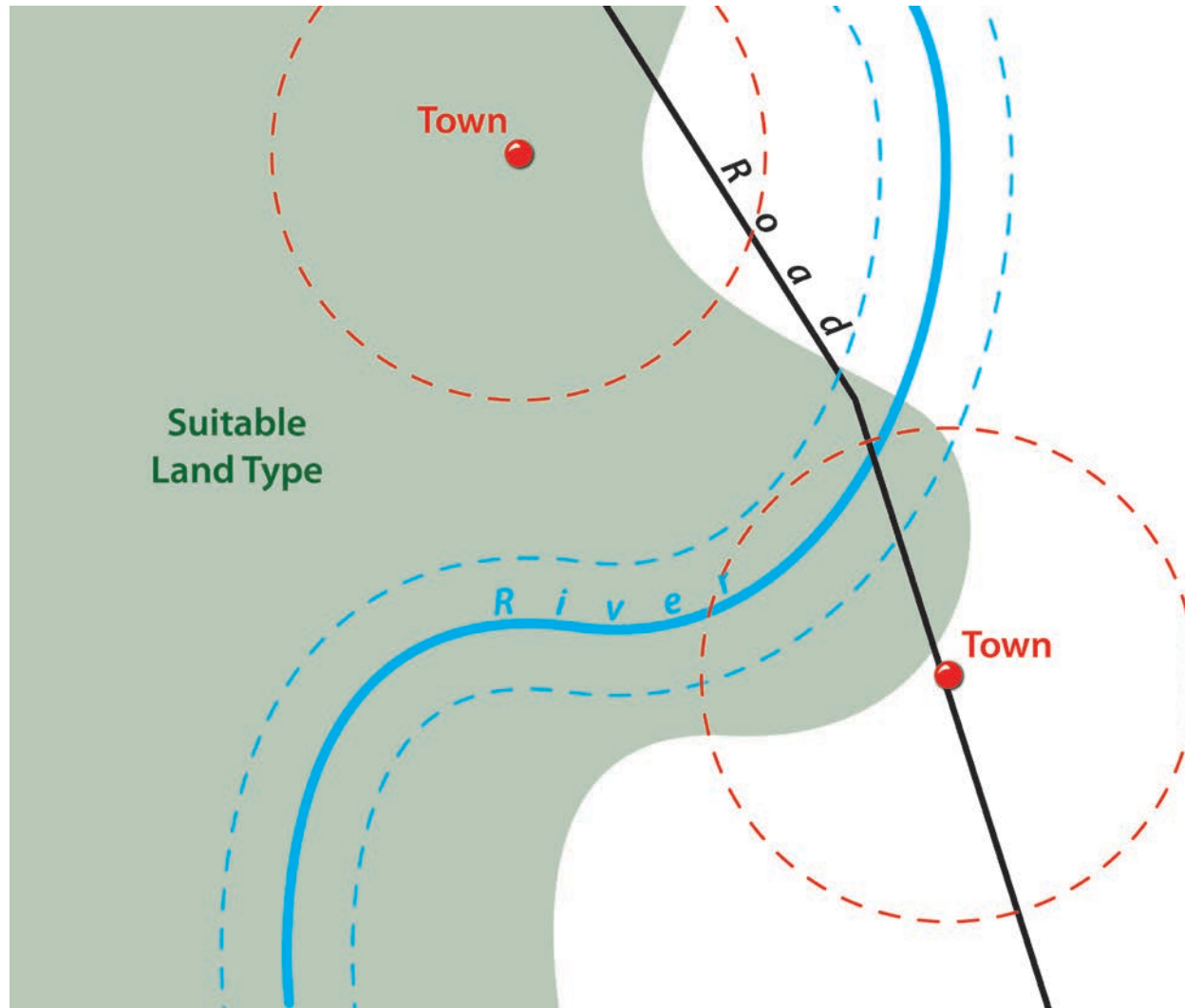
Local Site Considerations



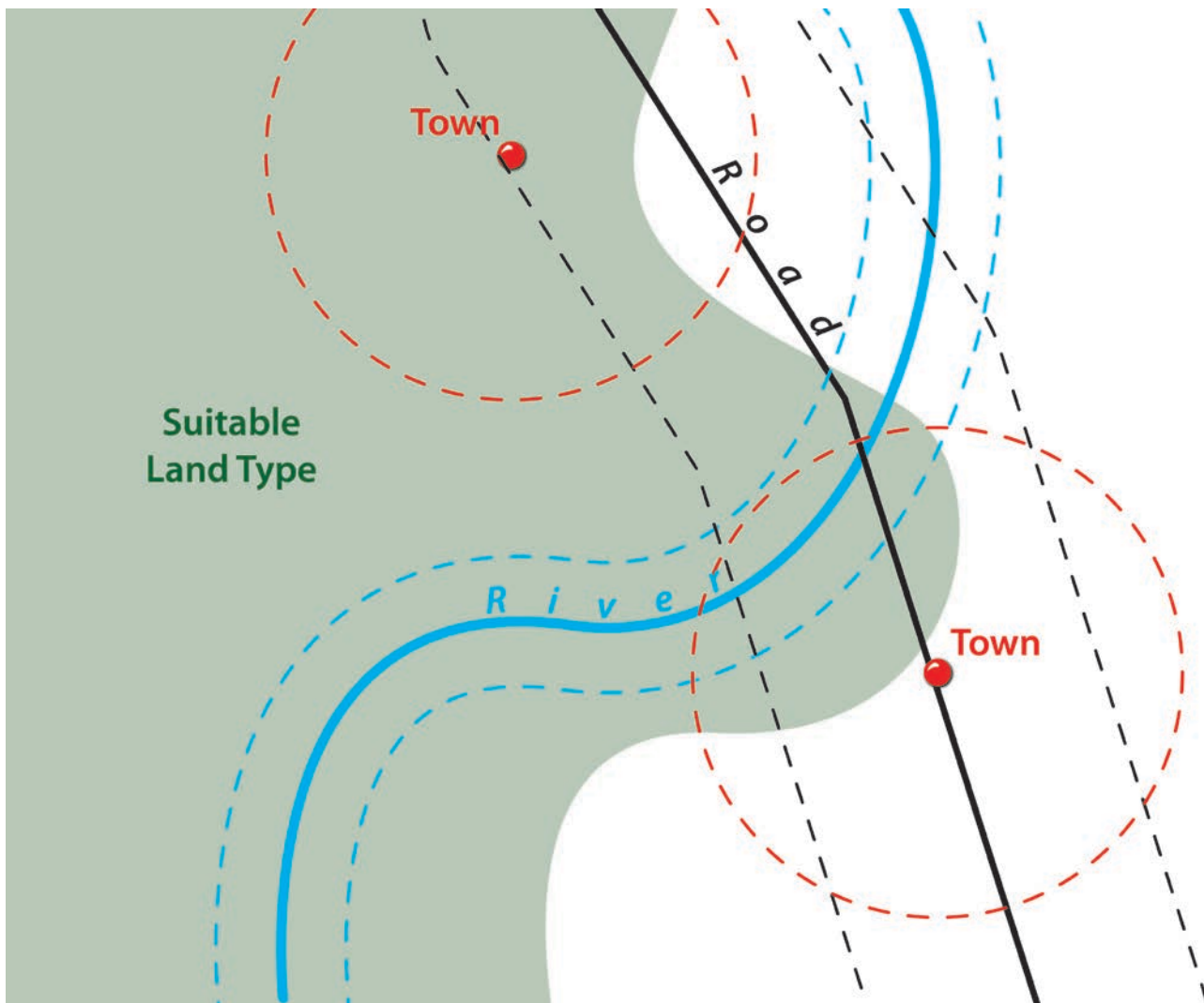
Local Site Considerations — Urban Centers



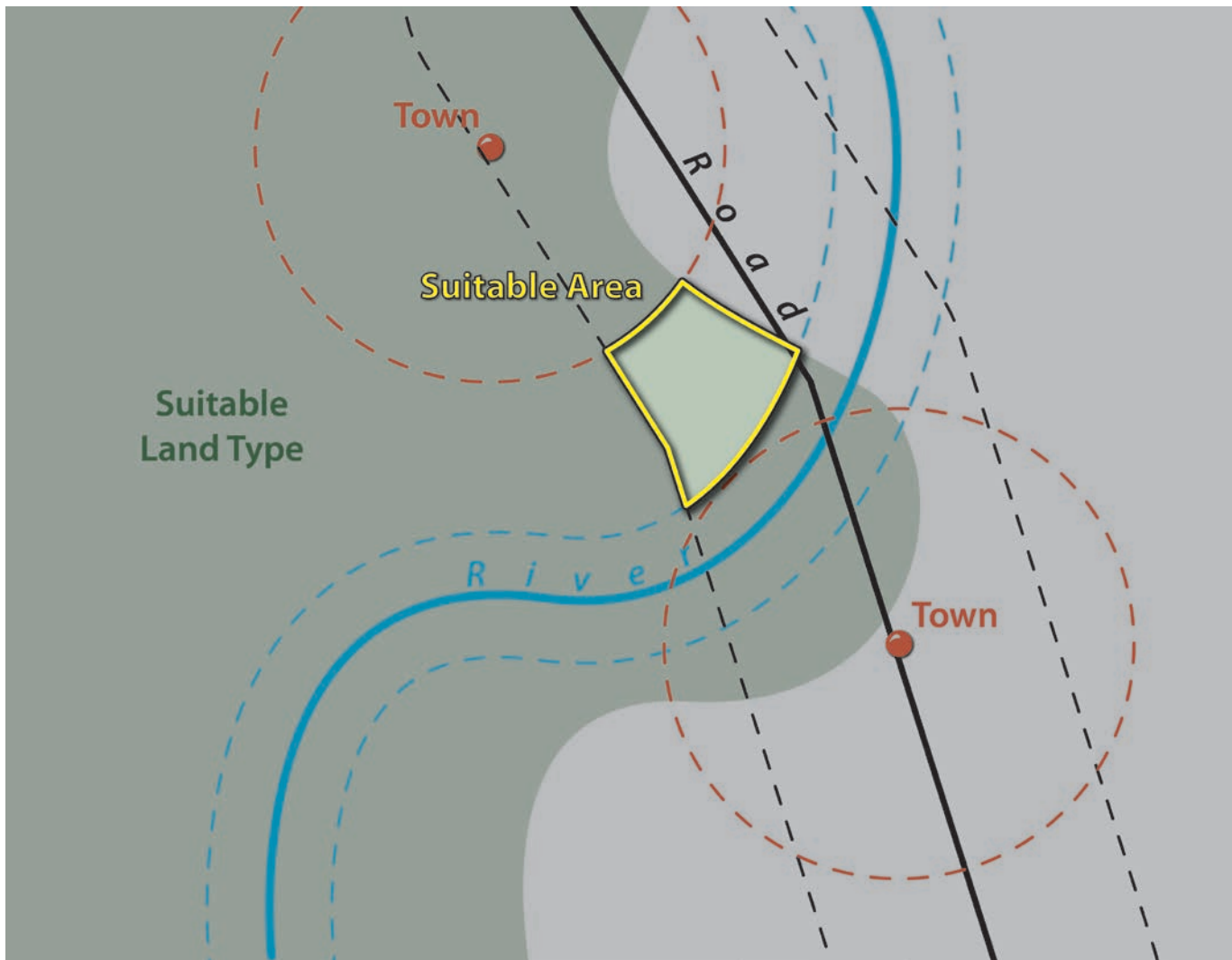
Local Site Considerations — Rivers



Local Site Considerations — Road Access



Local Site Considerations — Suitable Area



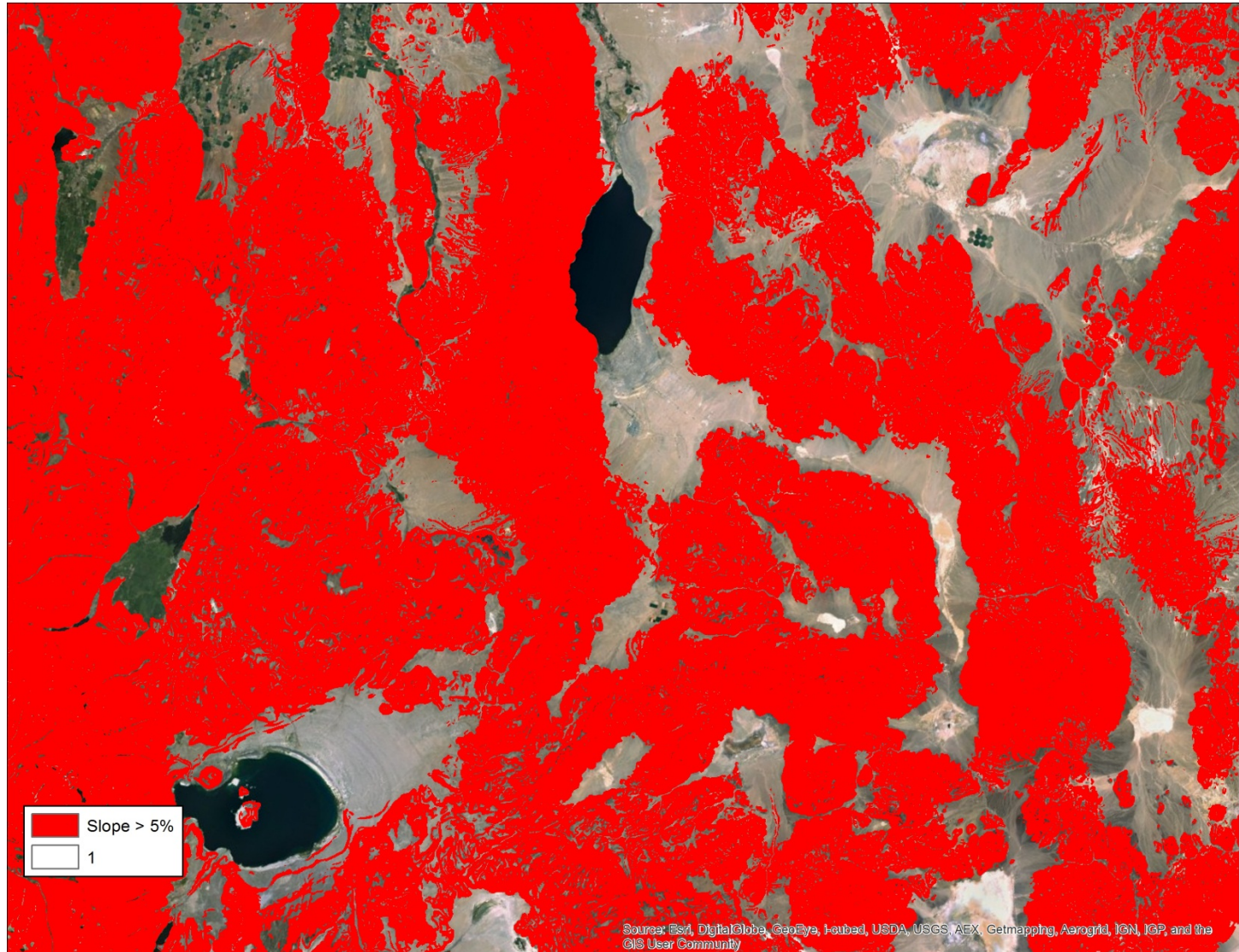
Initial Site Considerations — Example



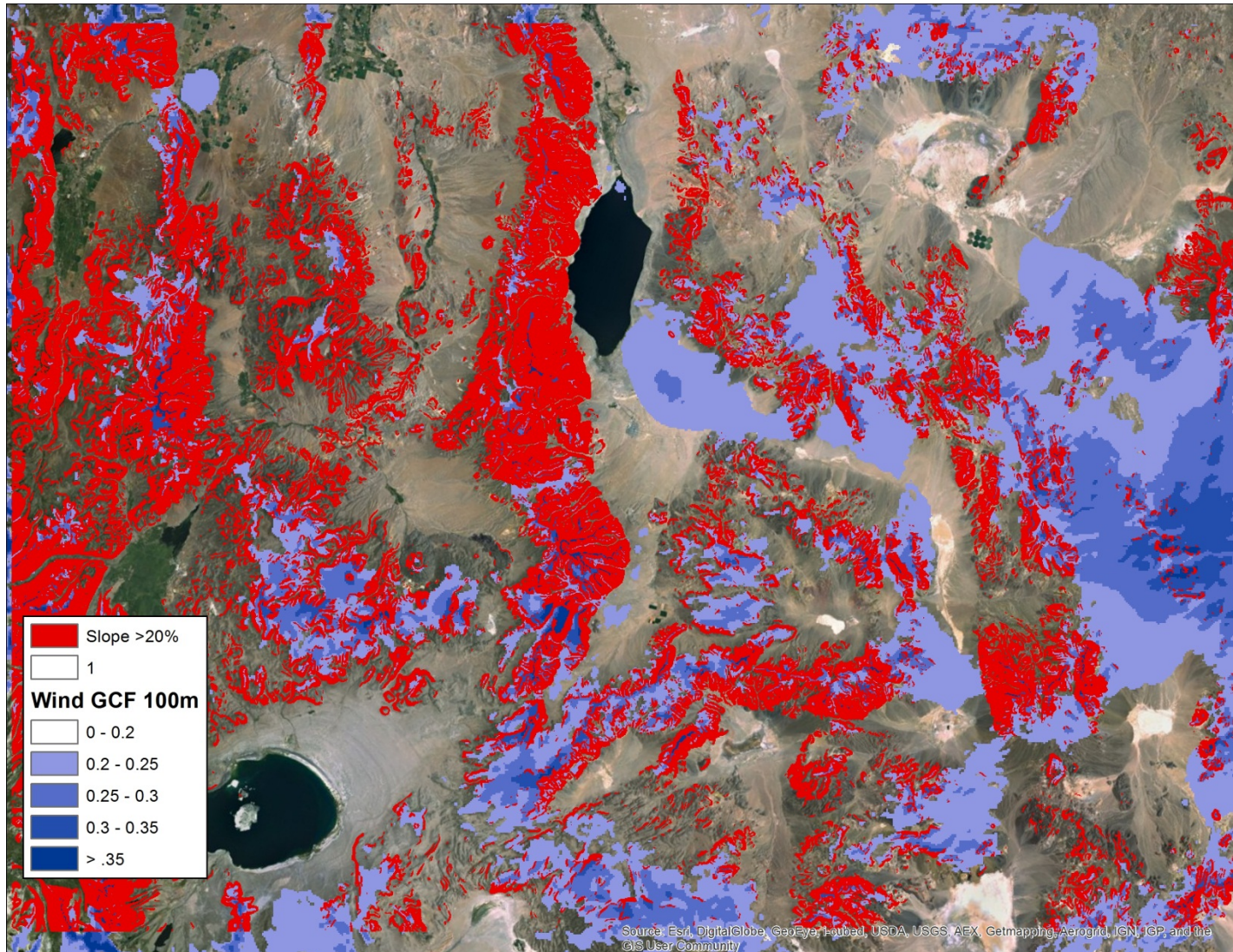
Initial Solar Site Considerations – Slope > 1%



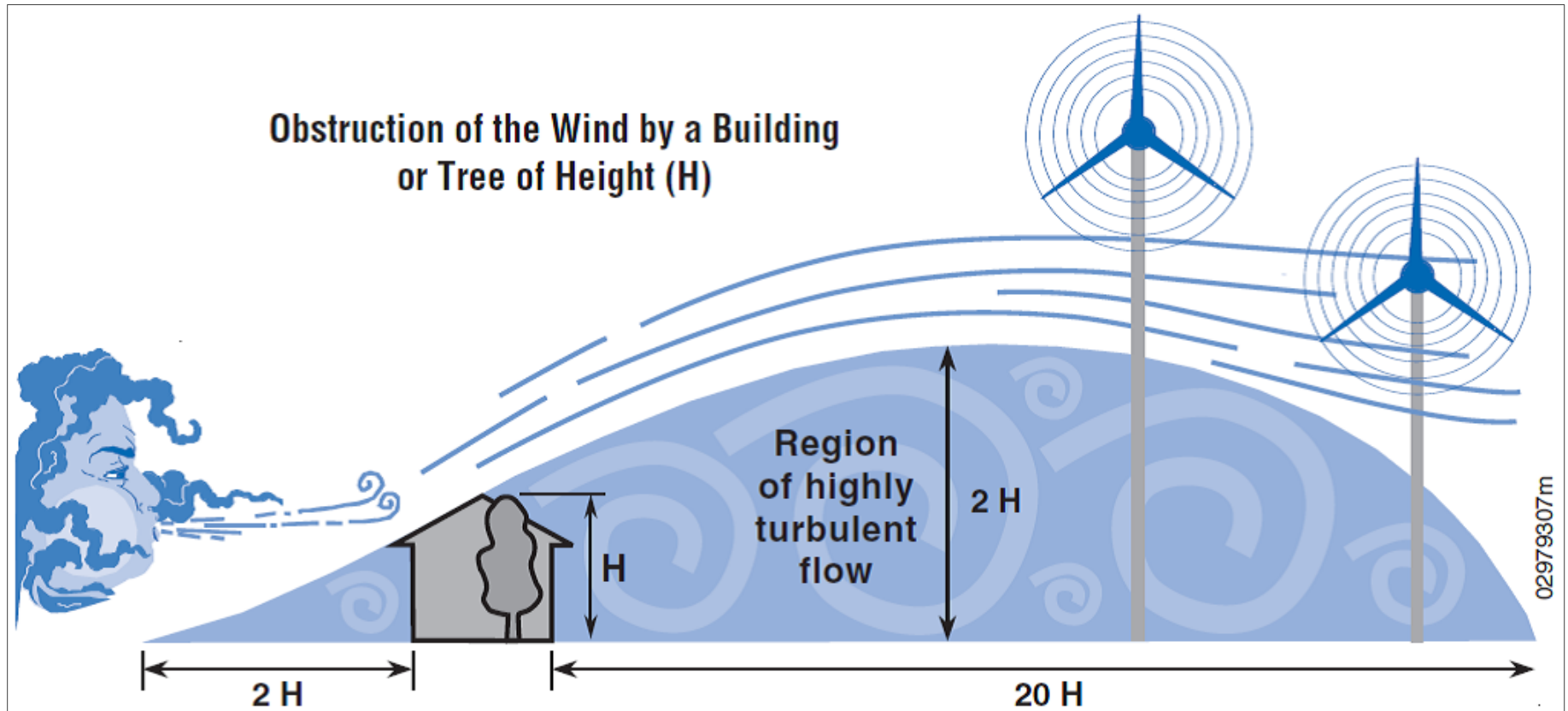
Initial Solar Site Considerations — Slope > 5%



Initial Wind Site Considerations — Slope > 20%



Wind Siting Obstructions



Source: OpenEI, <http://en.openEI.org/wiki/File:ObstructionOfWindByBuilding.png>

Initial Biomass Siting Considerations

Potential resource; determine:

- Local suppliers and equipment
- Quantities available (including long-term)
- Cost
- Quality
 - Sufficient volume
 - Future availability
 - Control (long-term purchase agreement)
- Distance (transportation cost)



Photo from Mississippi Band of Choctaw Indians, NREL 26448



Photo from Randy Hunsberger, NREL

Check permitting requirements:

- Air permits
- Ash disposal
- Fire permits

Initial Biomass Siting Considerations

Space requirements

- Ensure sufficient space for biomass boiler in boiler room
- Determine fuel requirements and storage space available
- Evaluate truck access, including space for maneuvering



Photo by Randy Hunsberger, NREL

Priorities: Where to Install Solar

- On the “built environment” where unshaded:
 - Existing building roofs that have an expected life of at least 15 more years and can accept added load - typically 2-4 pounds /ft².
Reduces solar load on building
 - All new buildings – all new buildings should be “solar ready”
 - See *Solar Ready Buildings Planning Guide*:
<http://www.nrel.gov/docs/fy10osti/46078.pdf>
 - Over parking areas– energy generation and nice amenity
- On compromised lands such as landfills and brownfields
 - Saves green-fields for nature
 - If installed on green fields, minimize site disturbance; plant native low height vegetation as needed

Solar PV Placement



PV Panels on Grand Ronde Tribal Housing Authority carport. Photo by GRTHA, NREL 11659046



Photo by Michael Deru, NREL 10075381



Facility Scale Hybrid System, NPS Range Station, San Miguel Island, CA.
Photo by Kent Bullard, NREL 6325496



Ballasted PV System on ESIF. Photo by
Dennis Schroeder, NREL 13163640

Solar Photovoltaics (PV) Fixed Tilt/Tracking

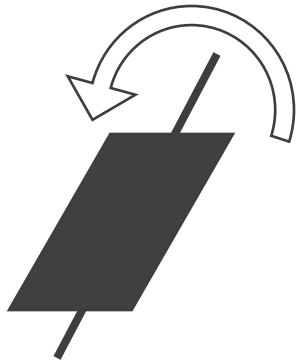


Fixed Tilt Facing Equator

tilt=latitude

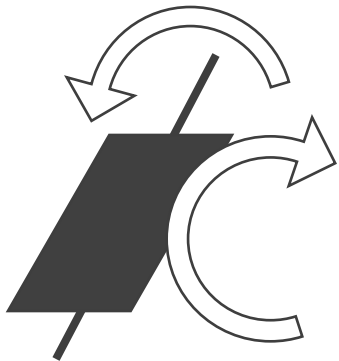
tilt<latitude for summer gain

tilt>latitude for winter gain



One Axis Tracking

around axis tilted or flat



Two Axis Tracking

both azimuth and altitude of sun around two axes



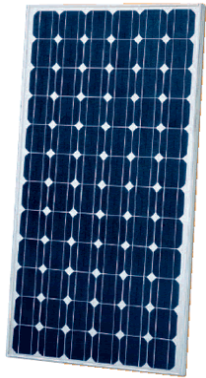
Total Area Required for PV

- Varies by technology, tilt, and location
- Roof mount - sloped roof, flush-mounted power densities of 11 direct current (DC)-watt (W)/square foot (ft²) crystalline
- Flat roof, slope panel = 8 DC-W/ft²

Ground Mount		
System Type	Fixed Tilt Energy Density (DC-W/ft ²)	Single Axis Tracking Energy Density (DC-W/ft ²)
Crystalline Silicon	4	3.3
Thin Film	3.3	2.7
Hybrid High Efficiency	4.8	3.9

Types of PV Cells

Single Crystal *



Efficiencies:

14 to 23%

Multi-Crystal *



13 to 17%

Thin Film *



6 to 11%

Cadmium Telluride *



10% to 11%

CIGS



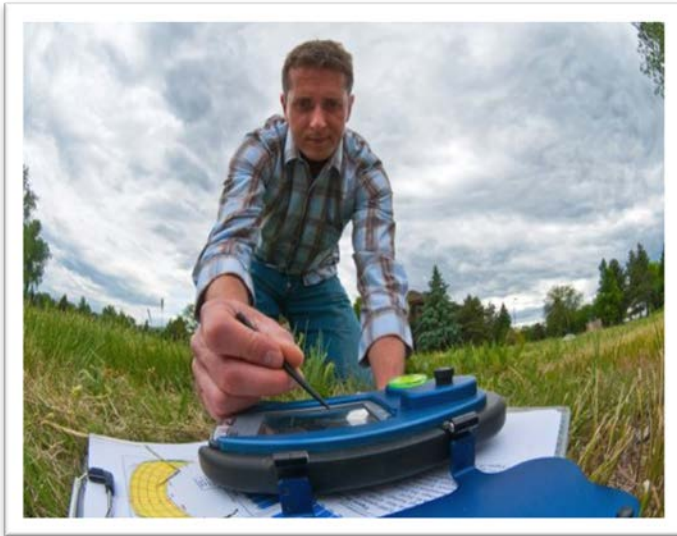
12% to 14%

Solar Assessment: PV is VERY Shade Sensitive



Once preliminary site assessment has been completed, you want to know:

- Estimated system size
- Estimated production (kilowatt-hour [kWh]/yr)
- Estimated cost
- Some economic analysis



Shade Analyzer

Photos top to bottom: NREL 10314 and 17509

PVWATTS Tool for Basic PV Modeling

Free interactive map-based tool allows you to:

- Estimate expected monthly and annual solar resource values
- Quickly obtain performance estimates for grid-connected PV systems
- Get a first cut of potential solar output
- Can identify potential incentives that a PV system in a particular area may be eligible for

PVWATTS Calculator

PVWatts® Calculator NREL NATIONAL RENEWABLE ENERGY LABORATORY

My Location *42 S Washington Denver Co 80209* Beta Release (?) **HELP** **FEEDBACK** ALL NREL SOLAR TOOLS

RESOURCE DATA **SYSTEM INFO** RESULTS

SYSTEM INFO

Modify the inputs below to run the simulation.

DC System Size (kW): i

Array Type: i

DC-to-AC Derate Factor: i

Tilt (°): i

Azimuth (°): i

ECONOMICS (Optional)

Modify the inputs below to estimate the cost of energy produced by the system.

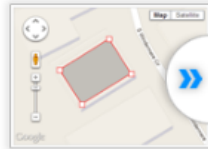
System Type: i

Utility Rate (\$): i

Initial Cost (\$/Wdc): i

Draw Your System

Click below to customize your system on a map. (optional)



RESTORE DEFAULTS

Go to resource data

Go to pvwatts results

<http://pvwatts.nrel.gov/>

Project Risk: Facility/Community-Scale Post Step 1

	Risks	Risk Assessment Post Step 1	✓
Development	<ul style="list-style-type: none"> Loss/waste of development resources 	<u>Low but rising; “calculated”</u>	
Site	<ul style="list-style-type: none"> Improper orientation or project affected by shade 	<u>Reduced</u>	✓
	<ul style="list-style-type: none"> Inadequate foundation or structural integrity 	Assumed low	✓
	<ul style="list-style-type: none"> Site control challenges for safety/security purposes 	Assumed low	✓
Permitting	<ul style="list-style-type: none"> Tribe-adopted codes and permitting requirements 	Unchanged	
	<ul style="list-style-type: none"> Utility interconnection requirements 	Unchanged	
Finance	<ul style="list-style-type: none"> Capital constraints 	Assumed low	
	<ul style="list-style-type: none"> Incentive unavailability or insufficiency 	<u>Reduced</u>	
Construction/Completion	<ul style="list-style-type: none"> Engineering, procurement, and construction difficulties 	Assumed low, mitigable, or allocatable	
	<ul style="list-style-type: none"> Cost overruns 	Assumed low, mitigable, or allocatable	
	<ul style="list-style-type: none"> Schedule overruns 	Assumed low, mitigable, or allocatable	
Operating	<ul style="list-style-type: none"> Output shortfall from expected 	Assumed low, mitigable, or allocatable	
	<ul style="list-style-type: none"> Operations & maintenance (O&M) issues 	Assumed low, mitigable, or allocatable	

NOTE: Underlining signifies that the risk assessment outcome changes during the step at hand.

Sources: Adapted from Holland & Hart, RE Project Development & Finance & Infocast, Advanced RE Project Finance & Analysis

Activity

- Resource Map/Siting