DOE OFFICE OF INDIAN ENERGY

The Five-Step Development Process
Step 1: Identify Project Potential

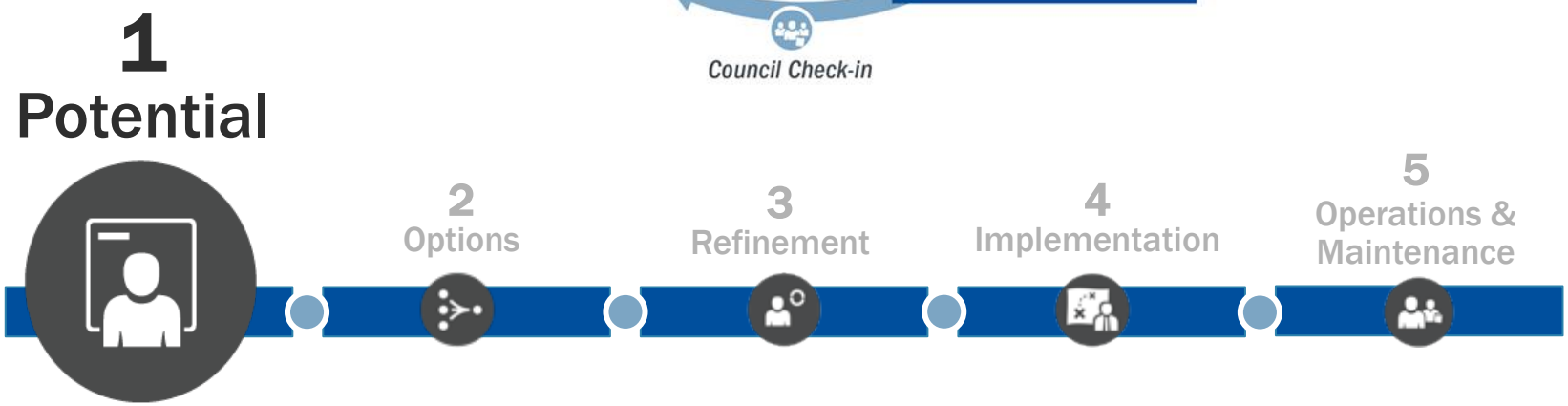


U.S. DEPARTMENT OF ENERGY | Office of Indian Energy

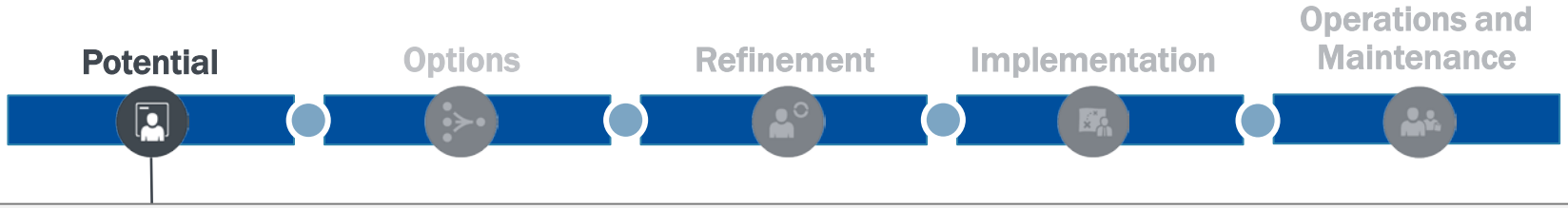
Presentation Agenda

- 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


Comprehensive Energy Plan
1 PROJECT POTENTIAL: Data Collection and Opportunity Assessment
Council Check-in
2 PROJECT OPTIONS: Strategy and Detail
Council Check-in
3 PROJECT REFINEMENT: Planning and Development
Council Check-in
4 PROJECT IMPLEMENTATION: Financing and Construction
5 PROJECT OPERATIONS AND MAINTENANCE
Project Development and Financing Strategy


1
Potential
2
Options
3
Refinement
4
Implementation
5
Operations & Maintenance

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)	#	#	#
Demand (avg kW)	#	#	#

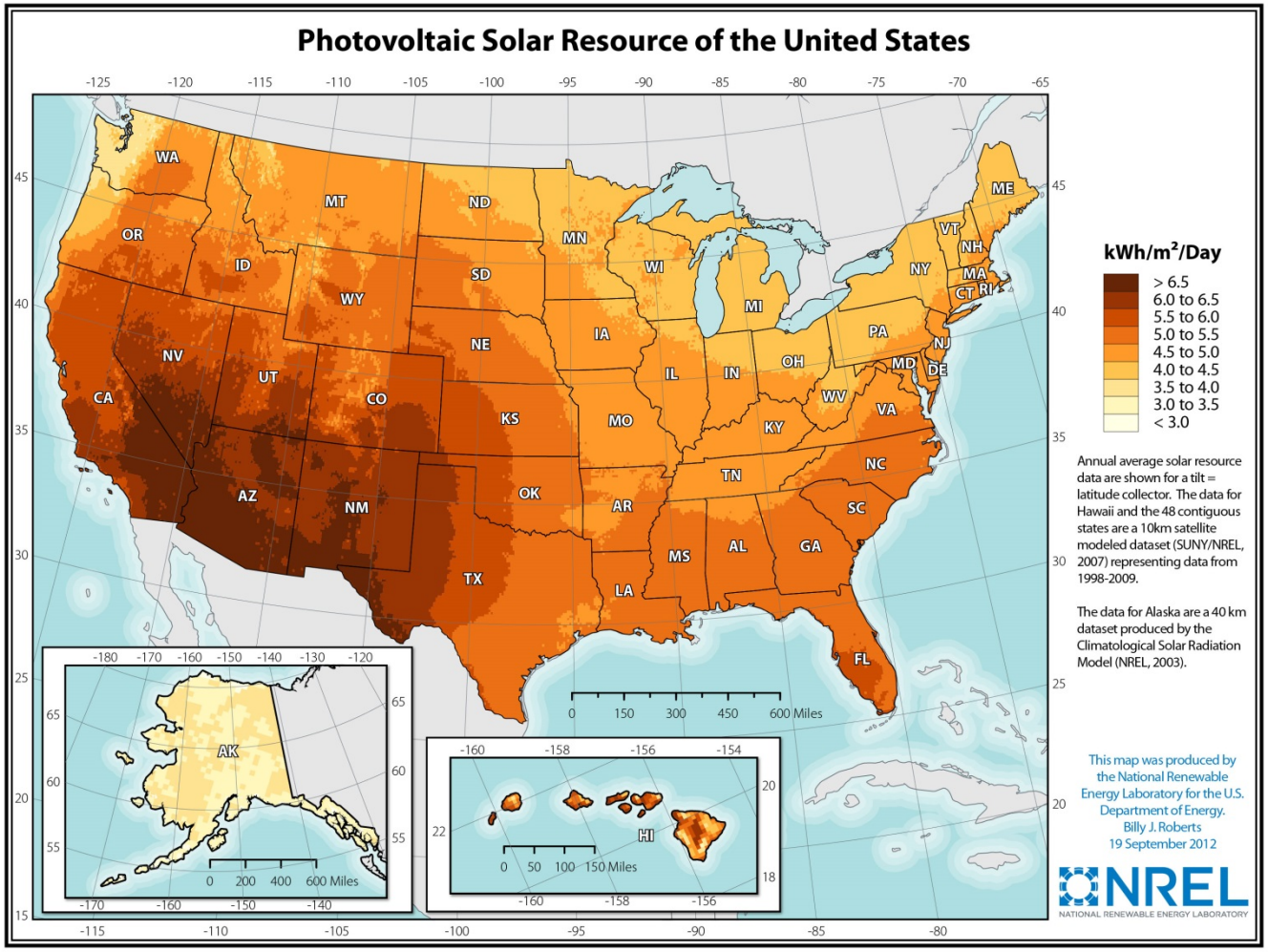
ASSESSING THE RESOURCE

Resource, Production & Savings

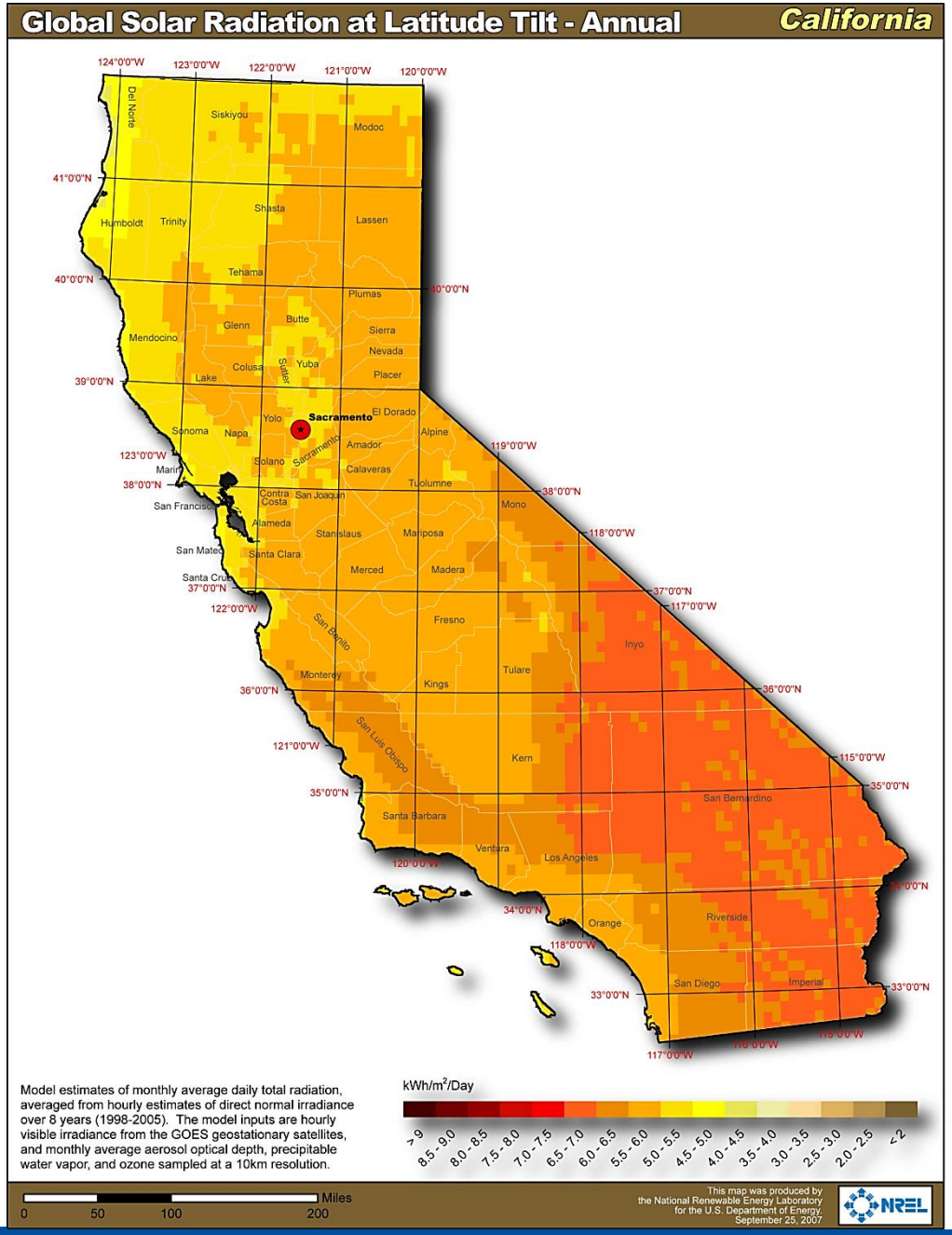
Assess available local energy resources

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

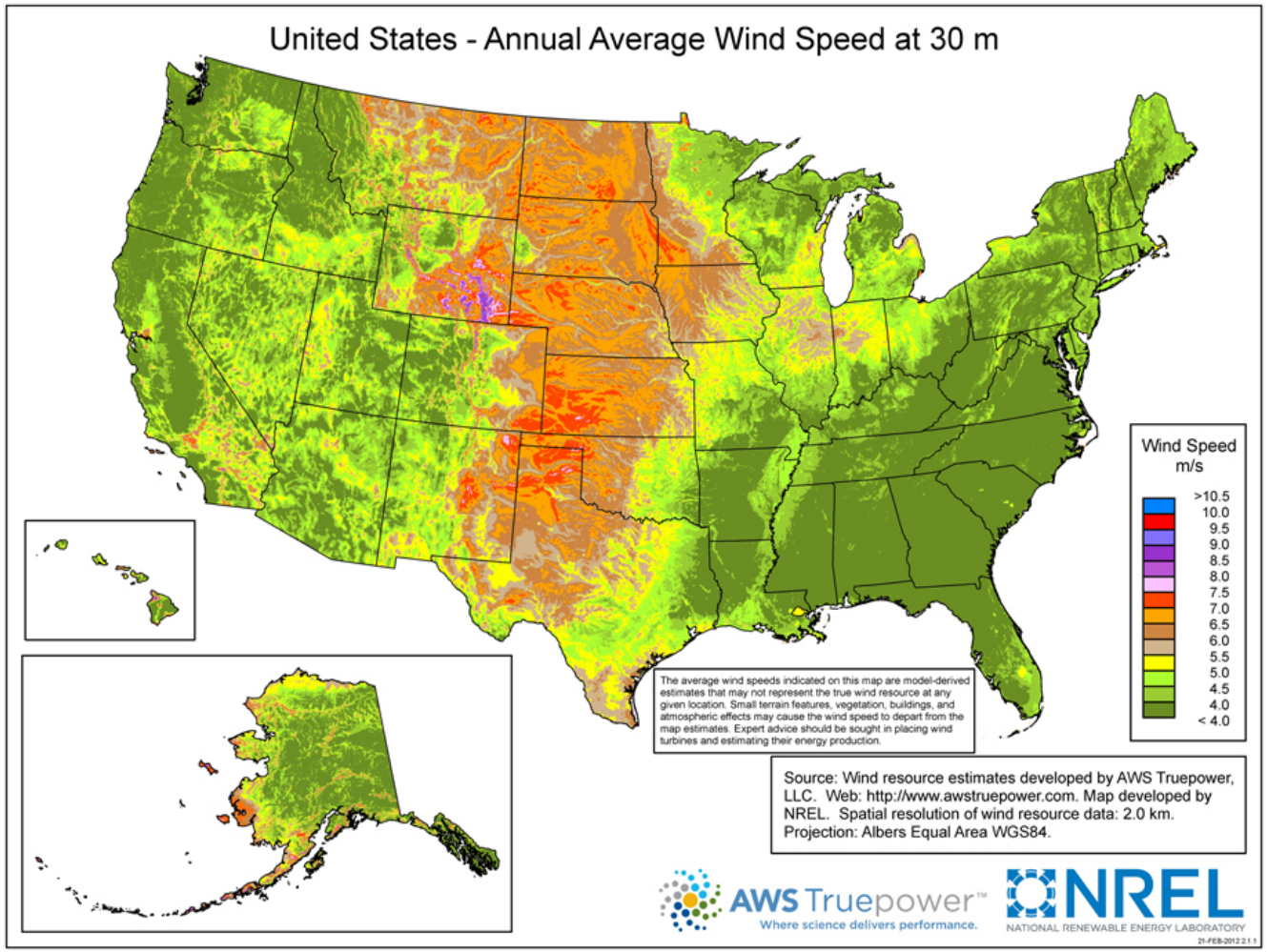
Solar PV Energy Resource Mapping



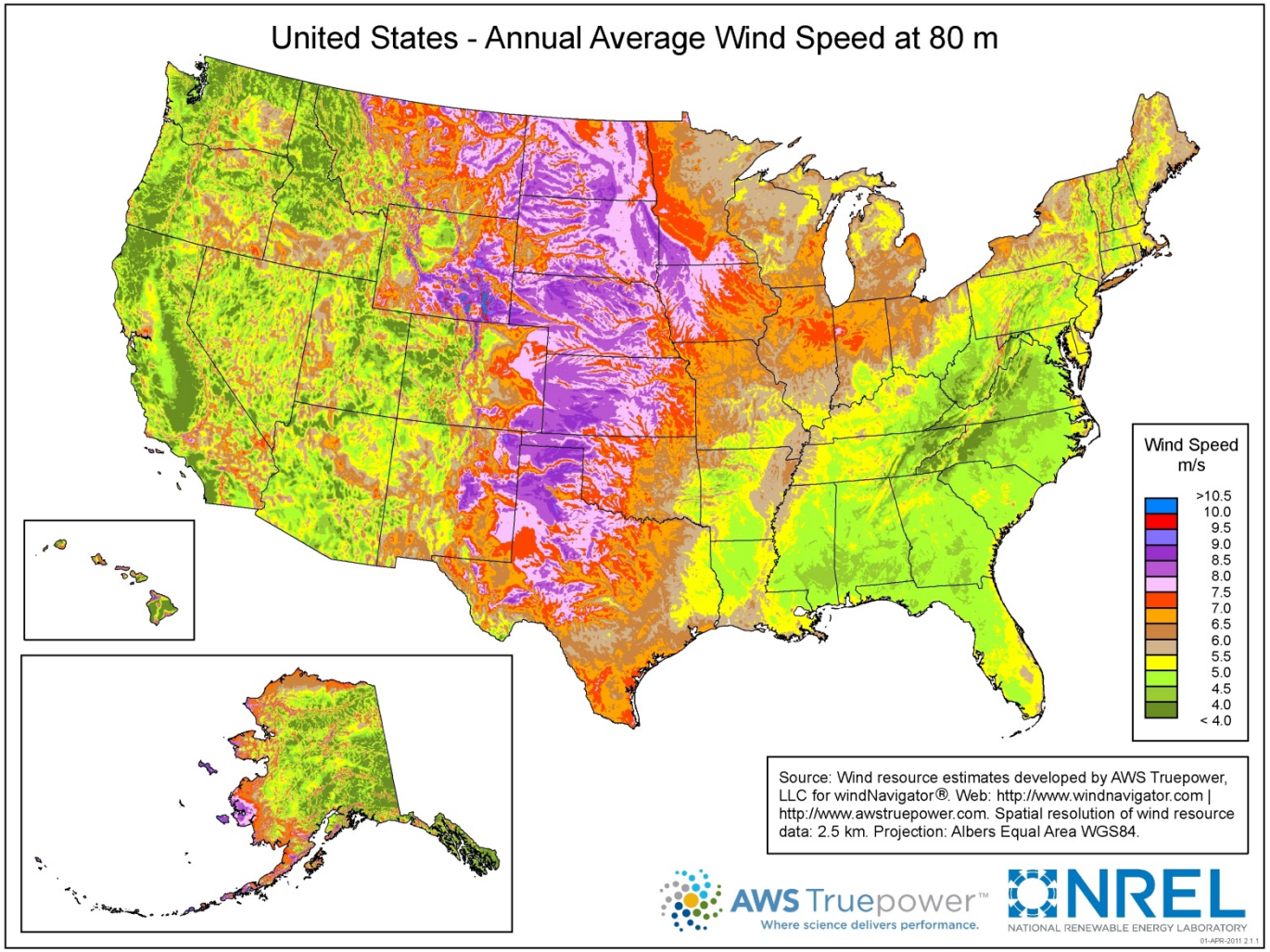
Solar Resources in California



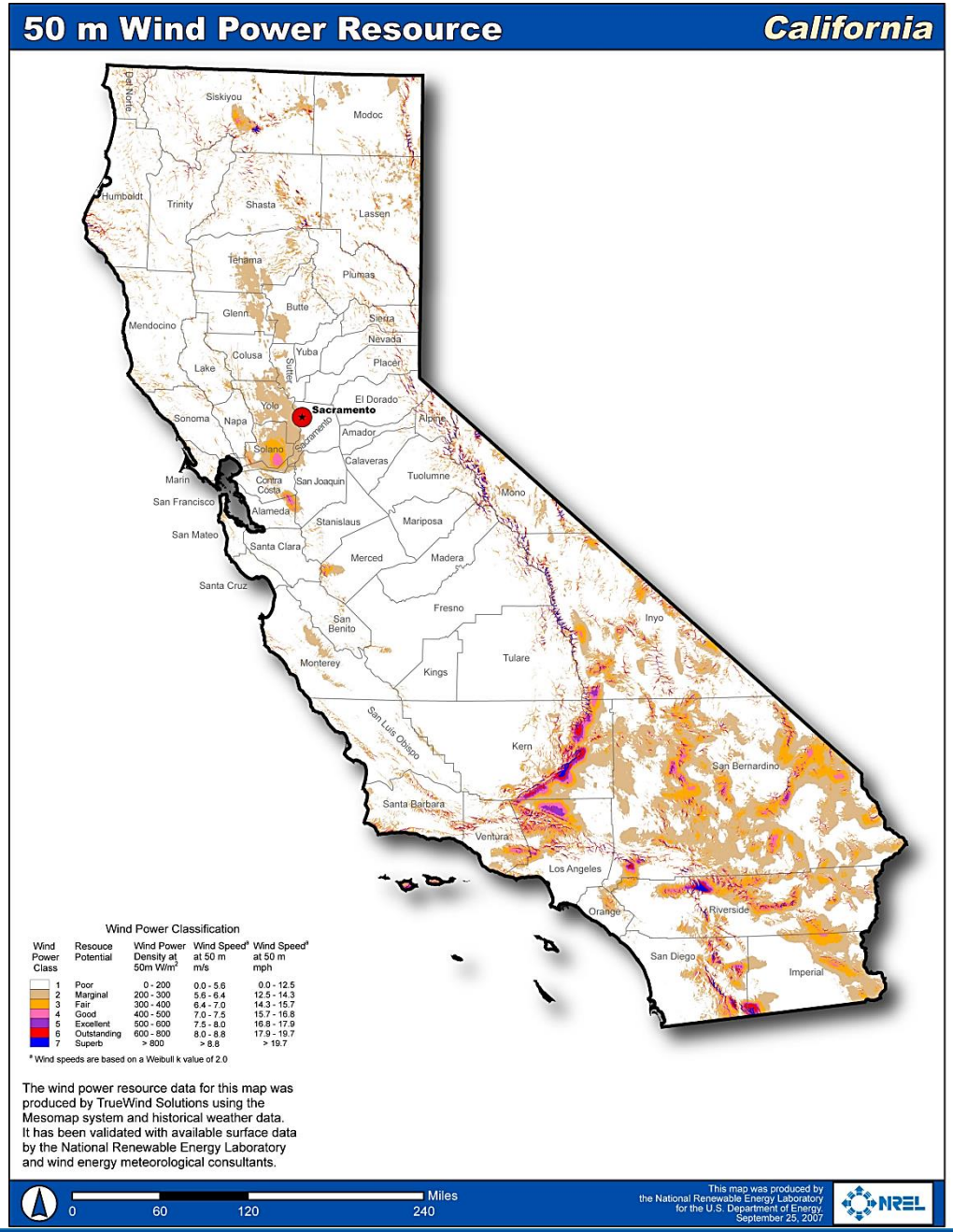
Wind Energy Resource Mapping: 30 Meter (m)



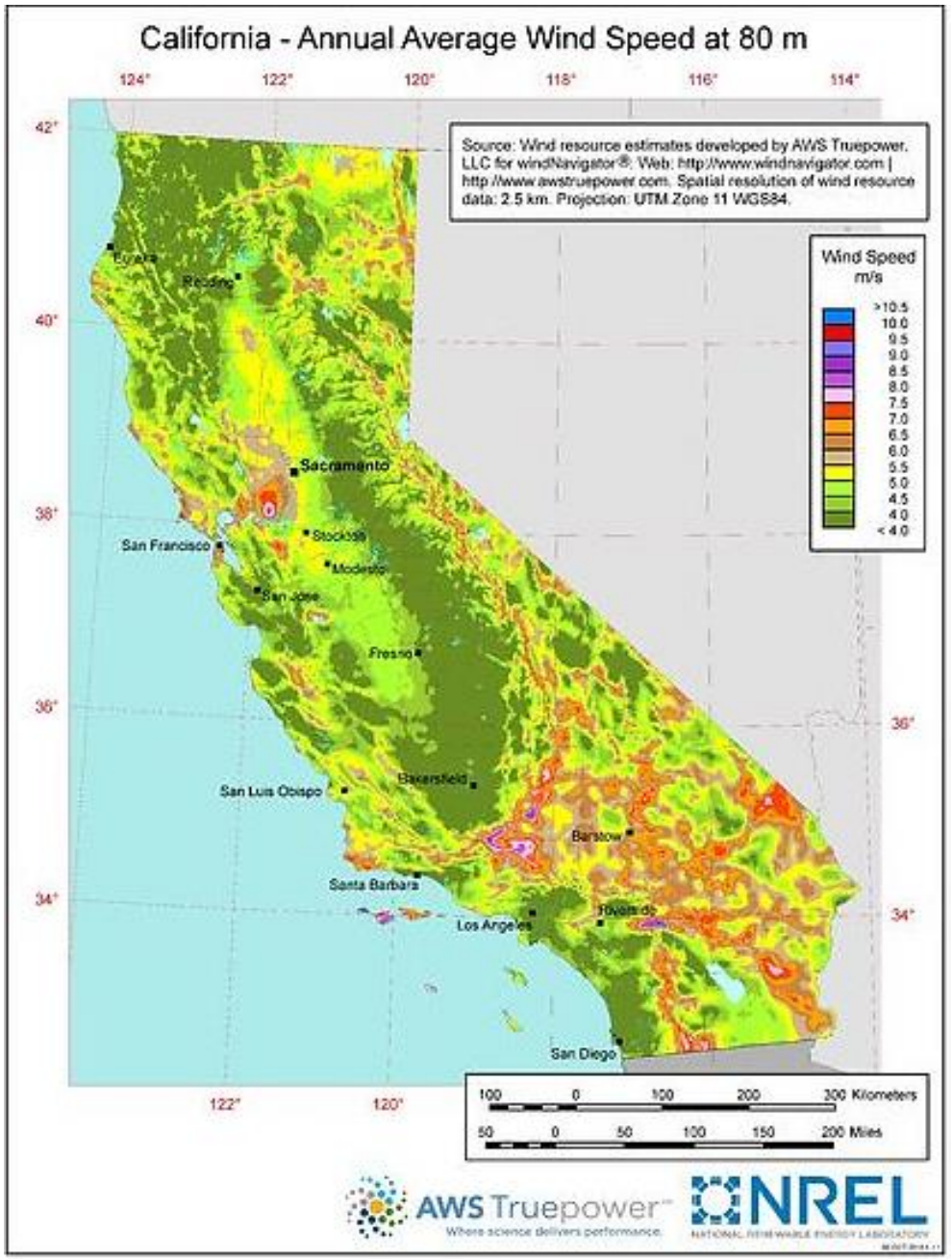
Wind Energy Resource Mapping: 80 m



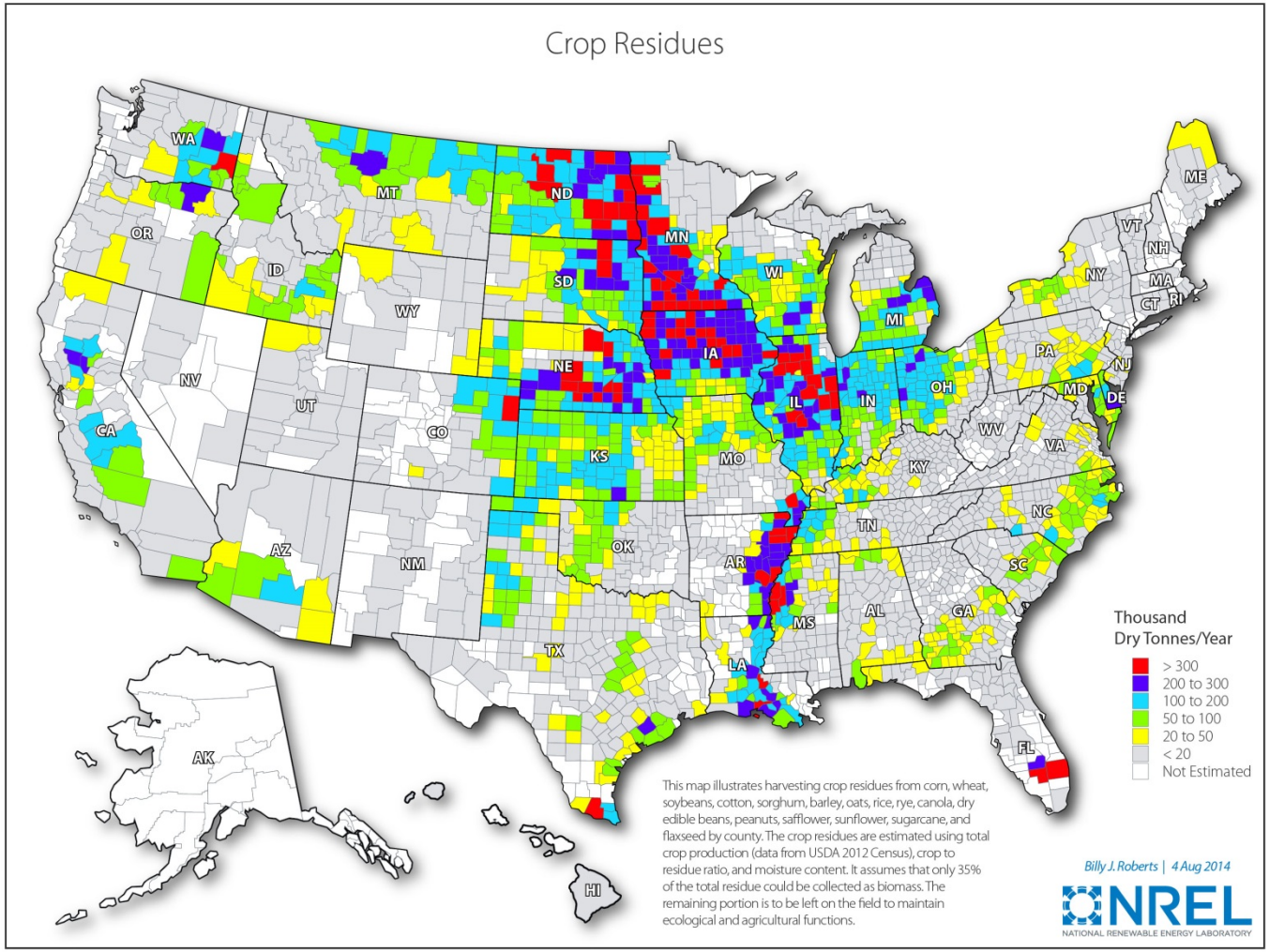
Wind Resources in California



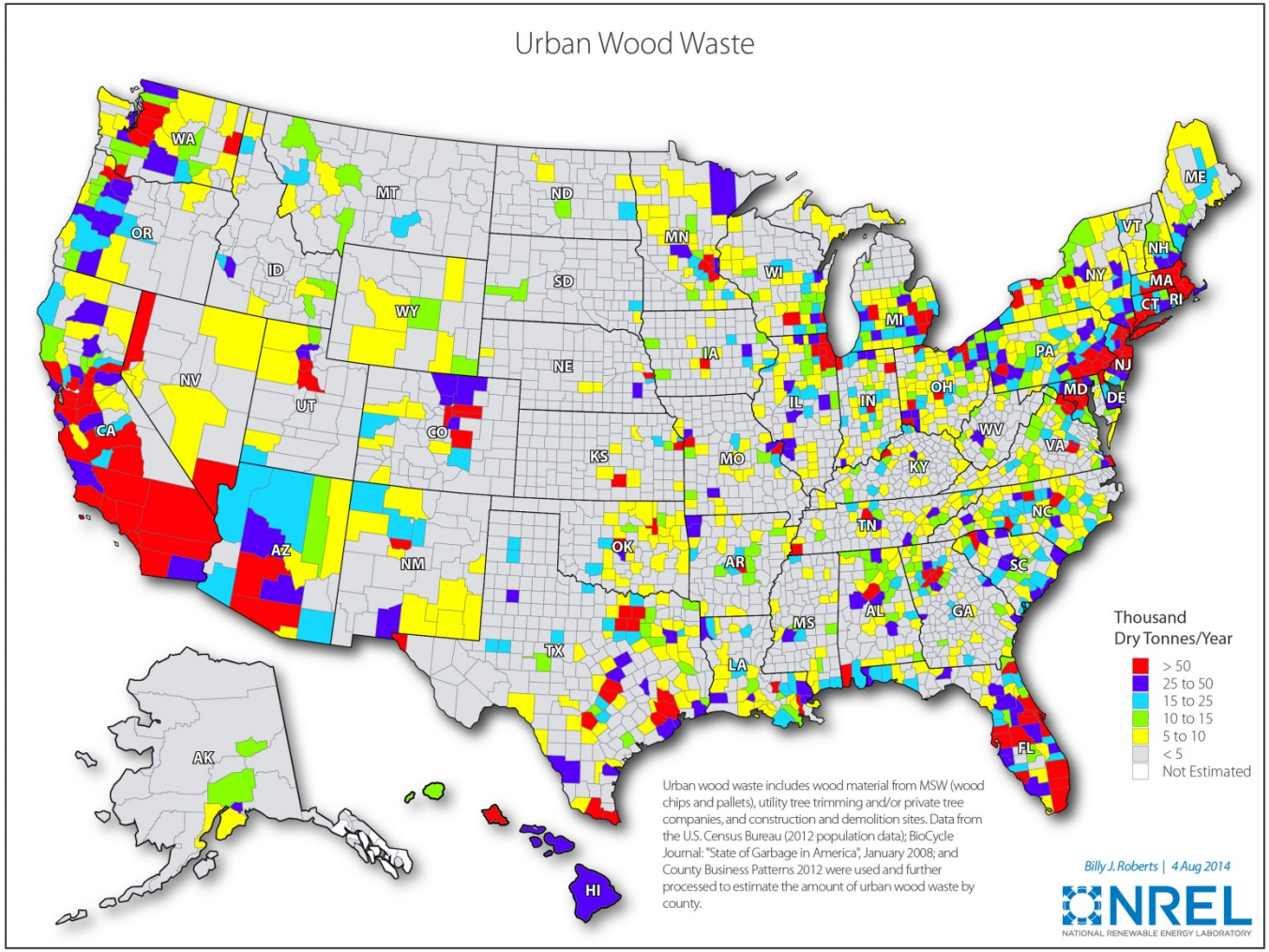
Average Wind Speed in California



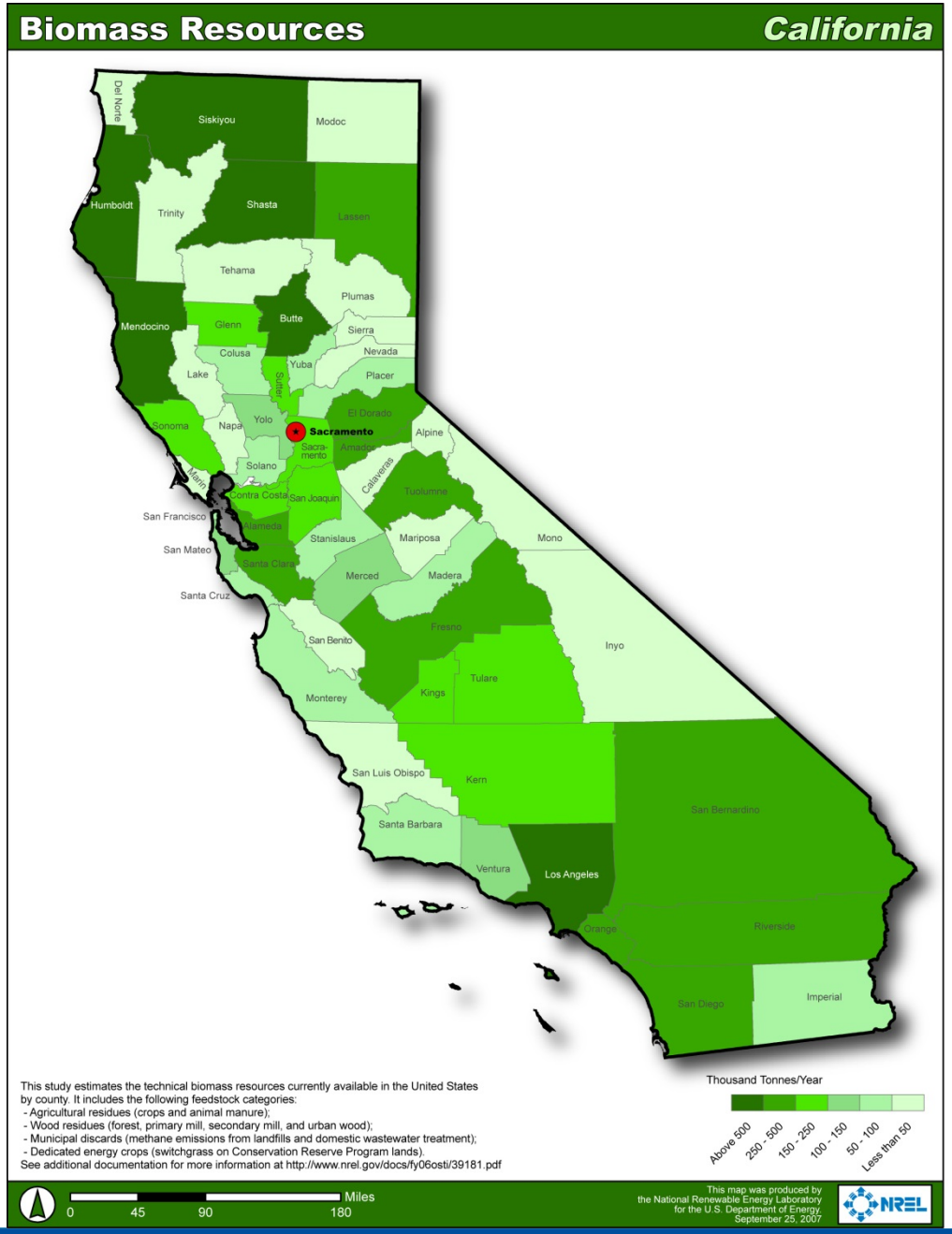
Biomass Energy Resource Mapping: Crop Residues



Biomass Energy Resource Mapping: Wood

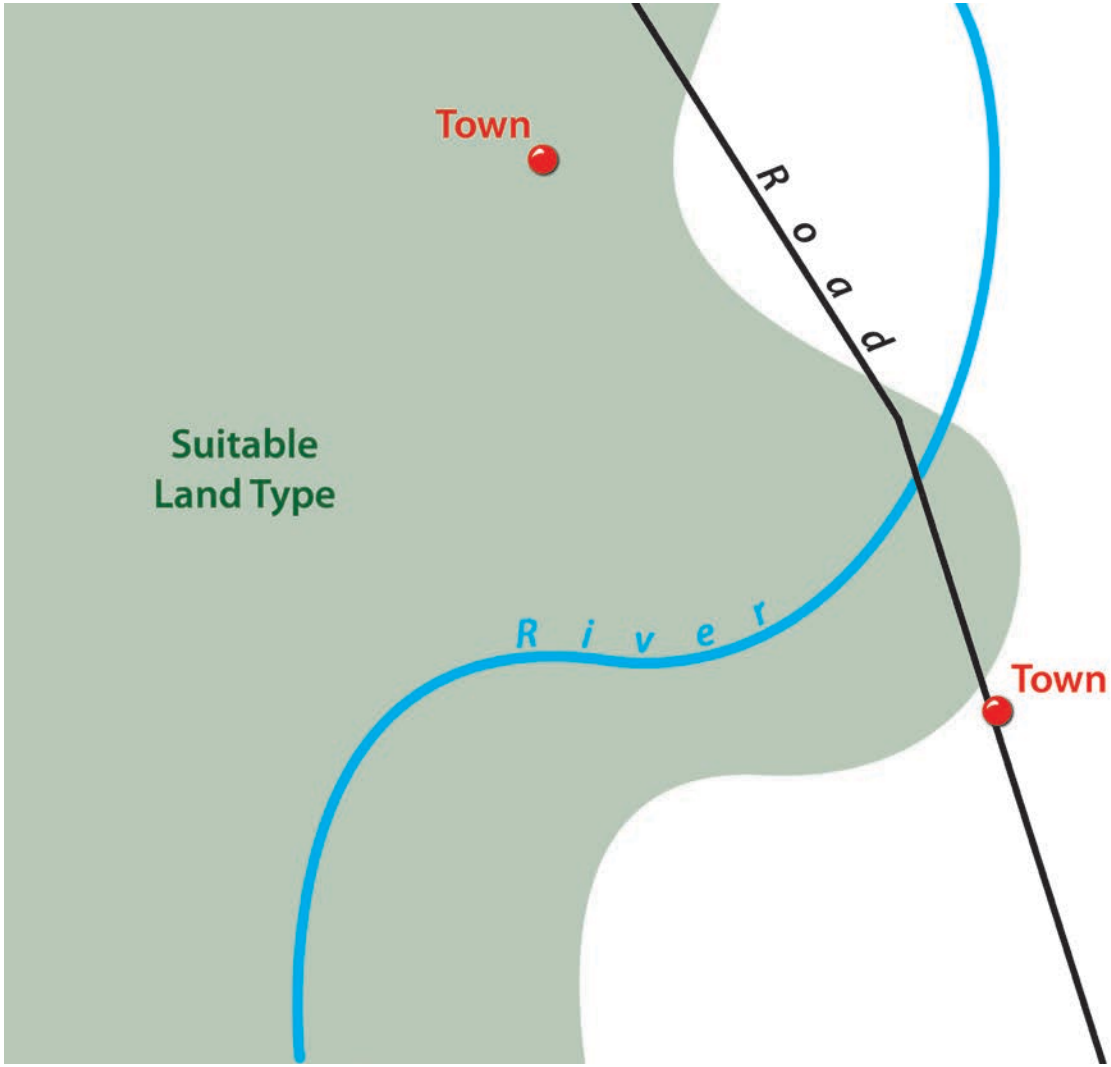


Biomass Resources in California

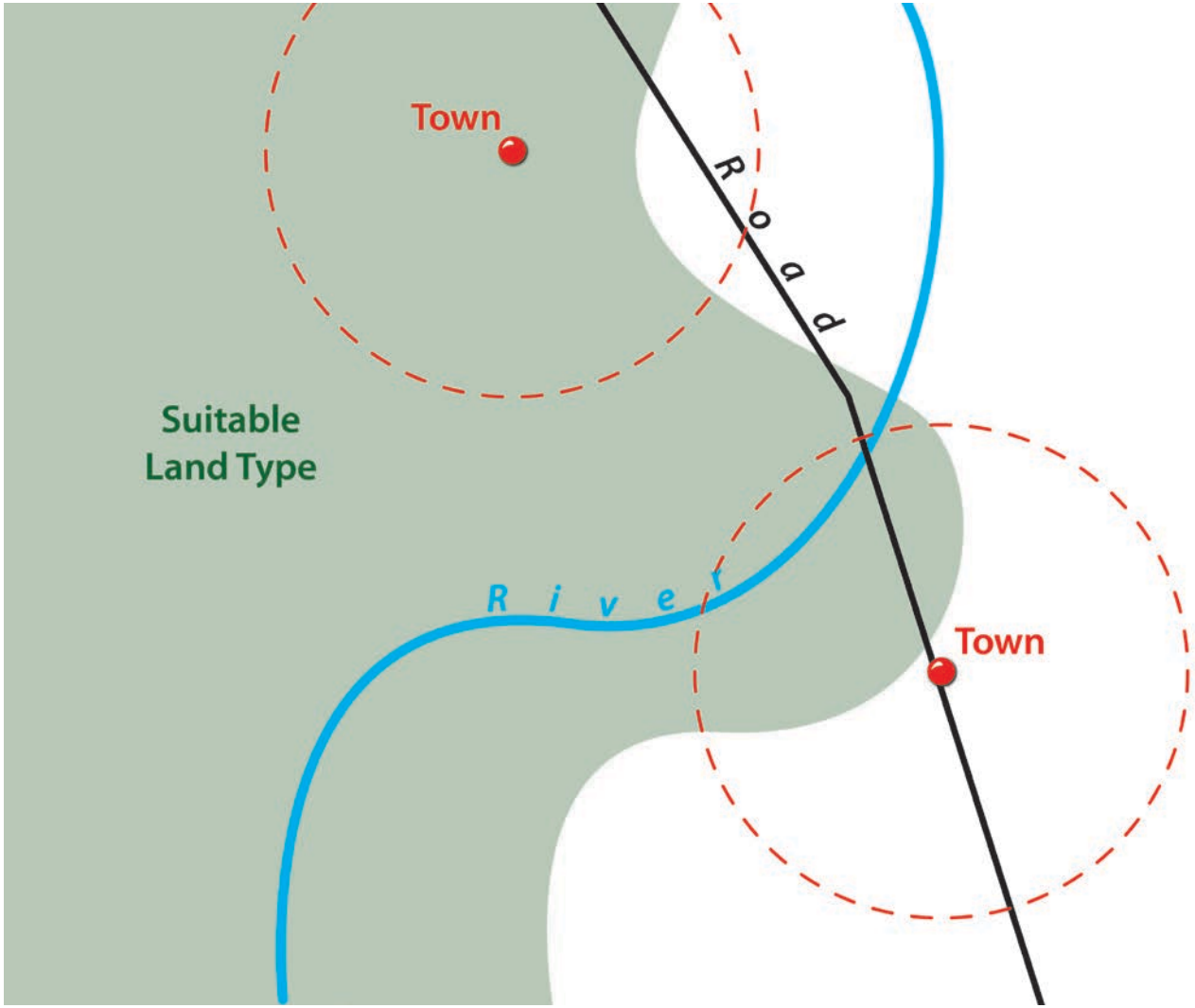


SITING CONSIDERATIONS

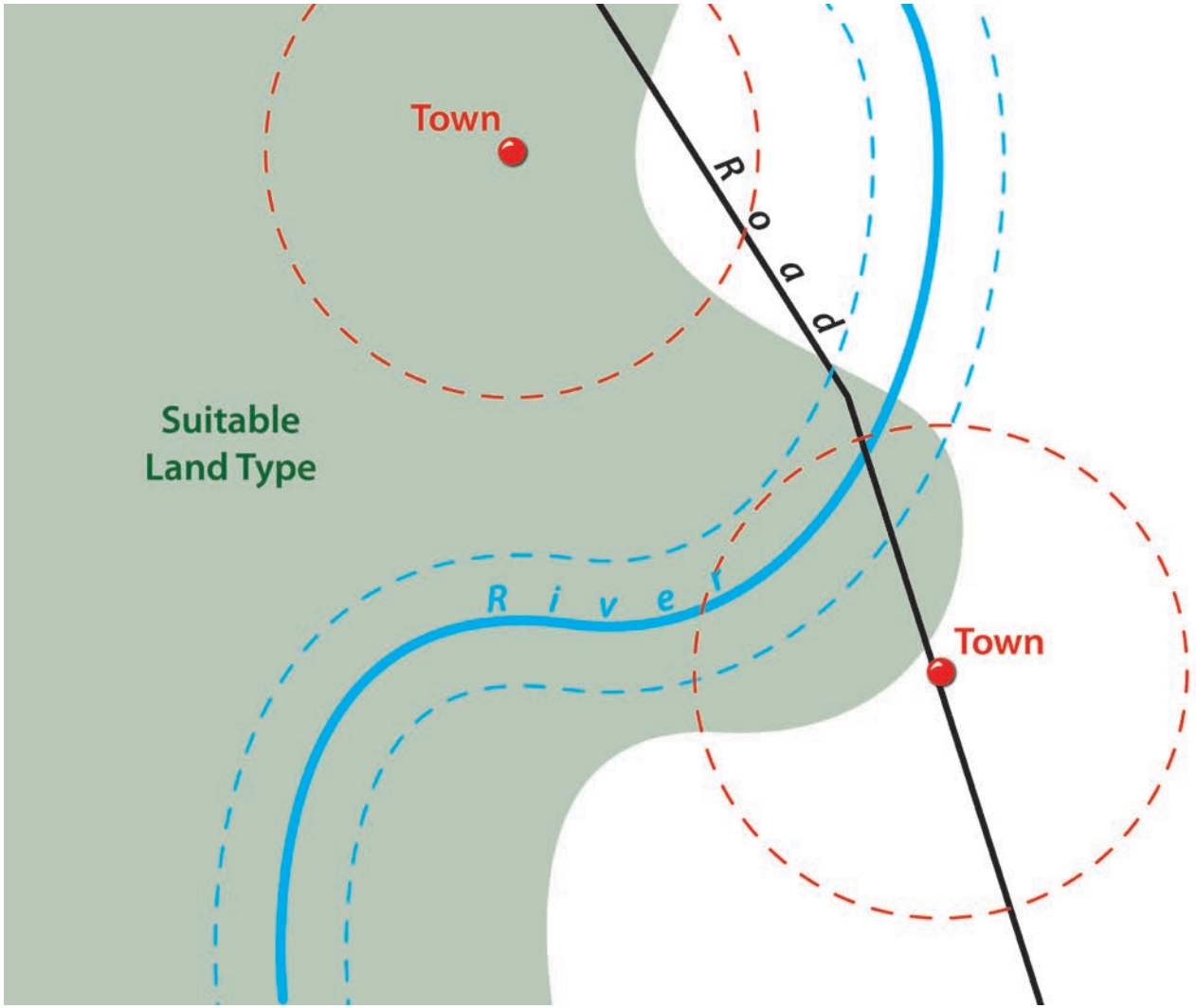
Local Site Considerations



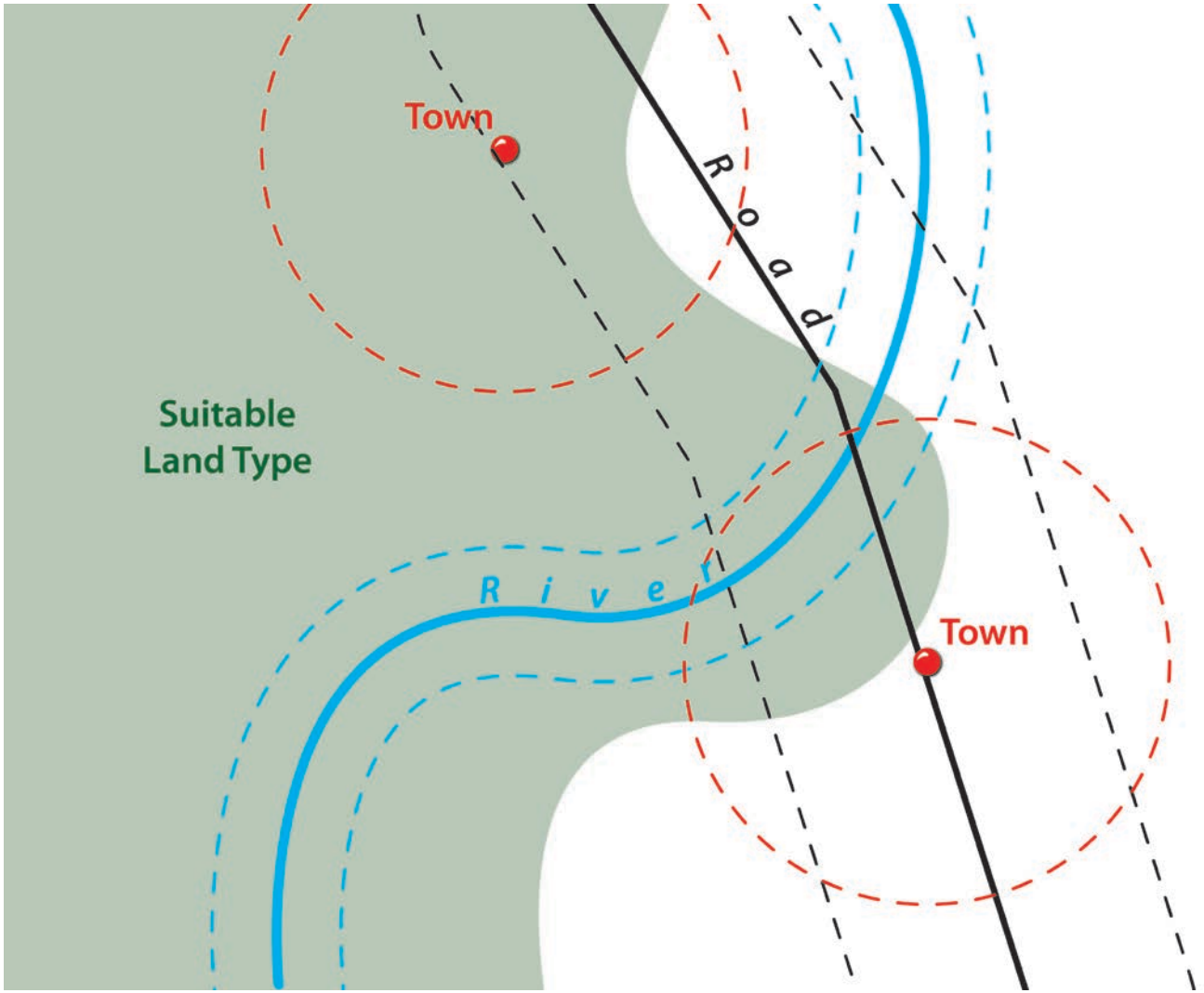
Local Site Considerations — Urban Centers



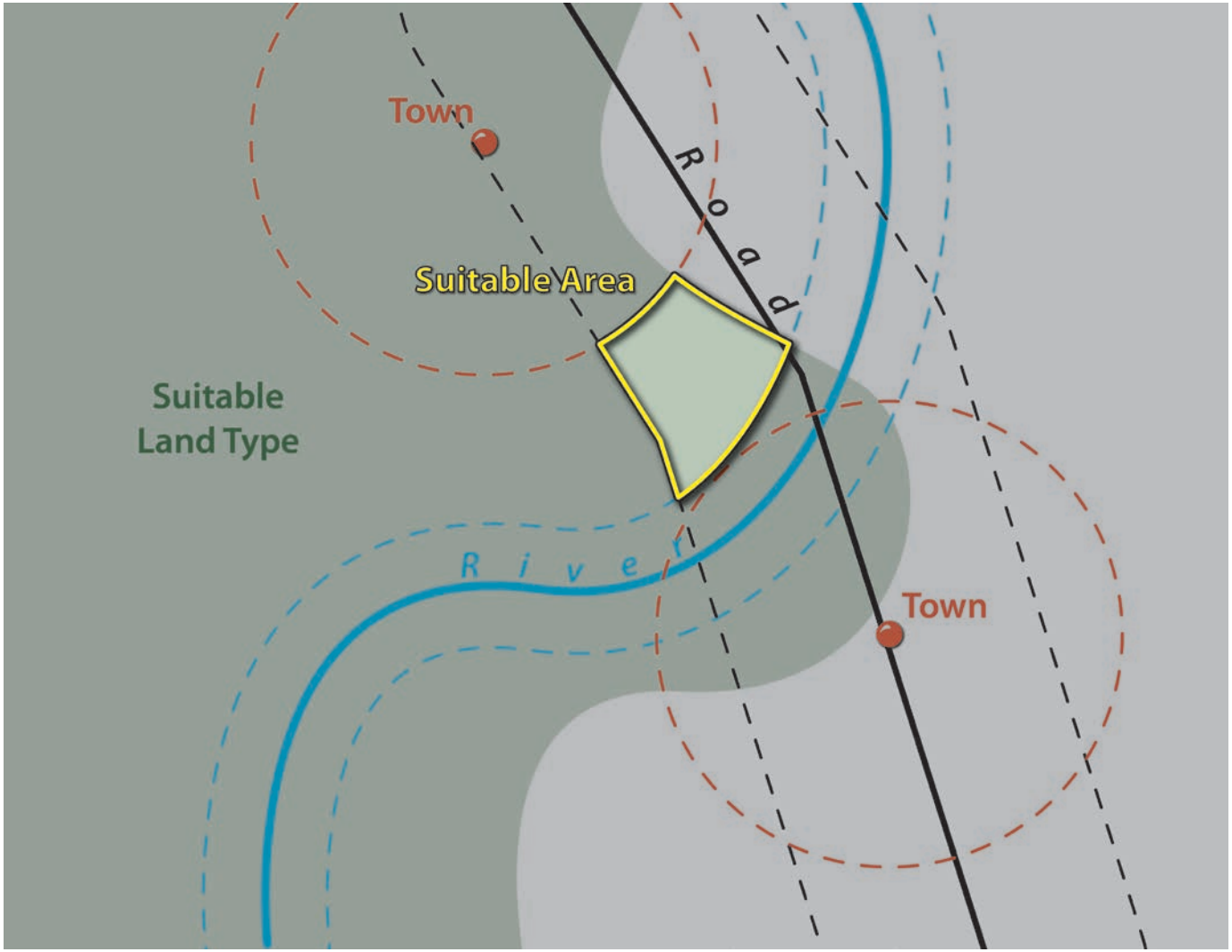
Local Site Considerations — Rivers



Local Site Considerations — Road Access



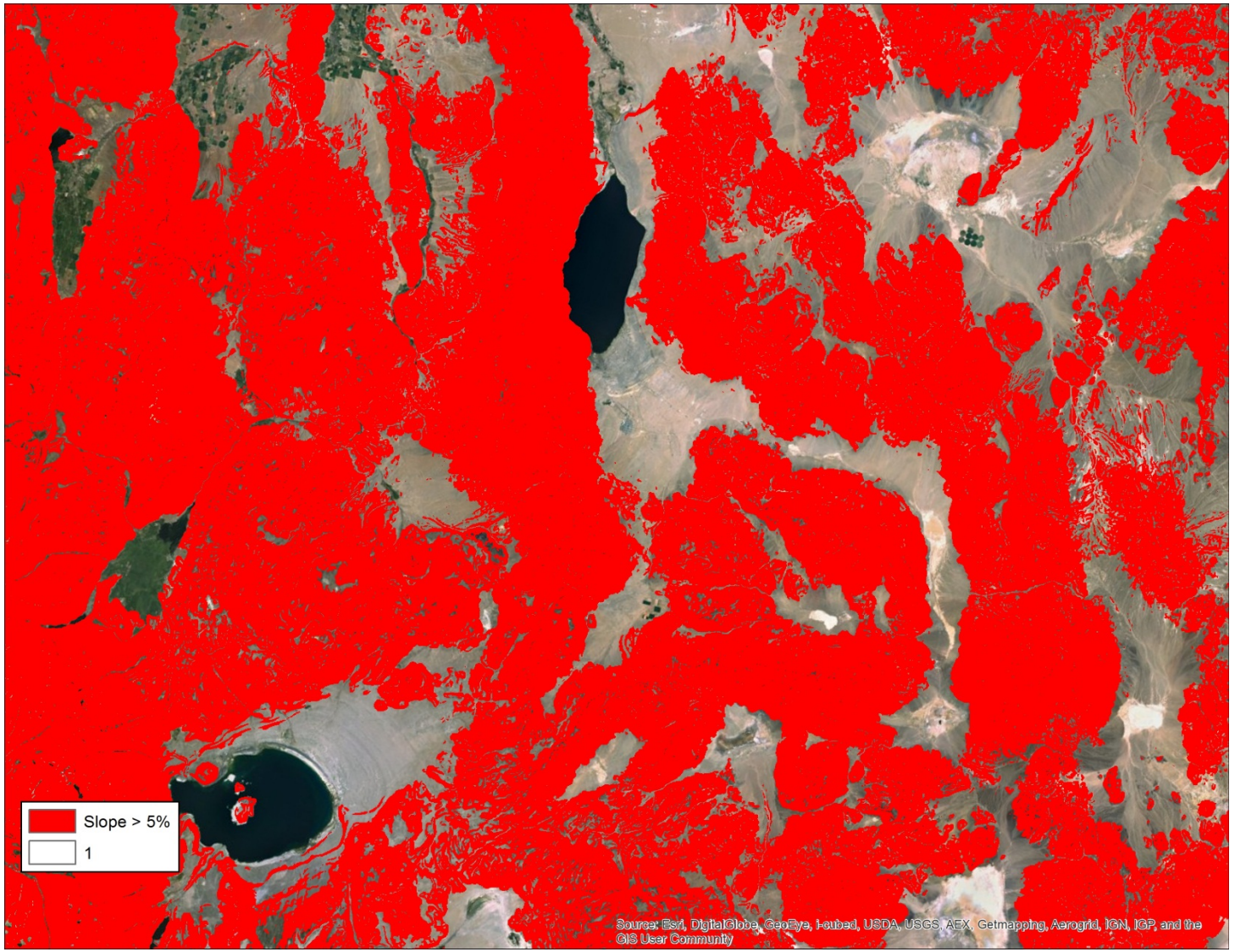
Local Site Considerations — Suitable Area



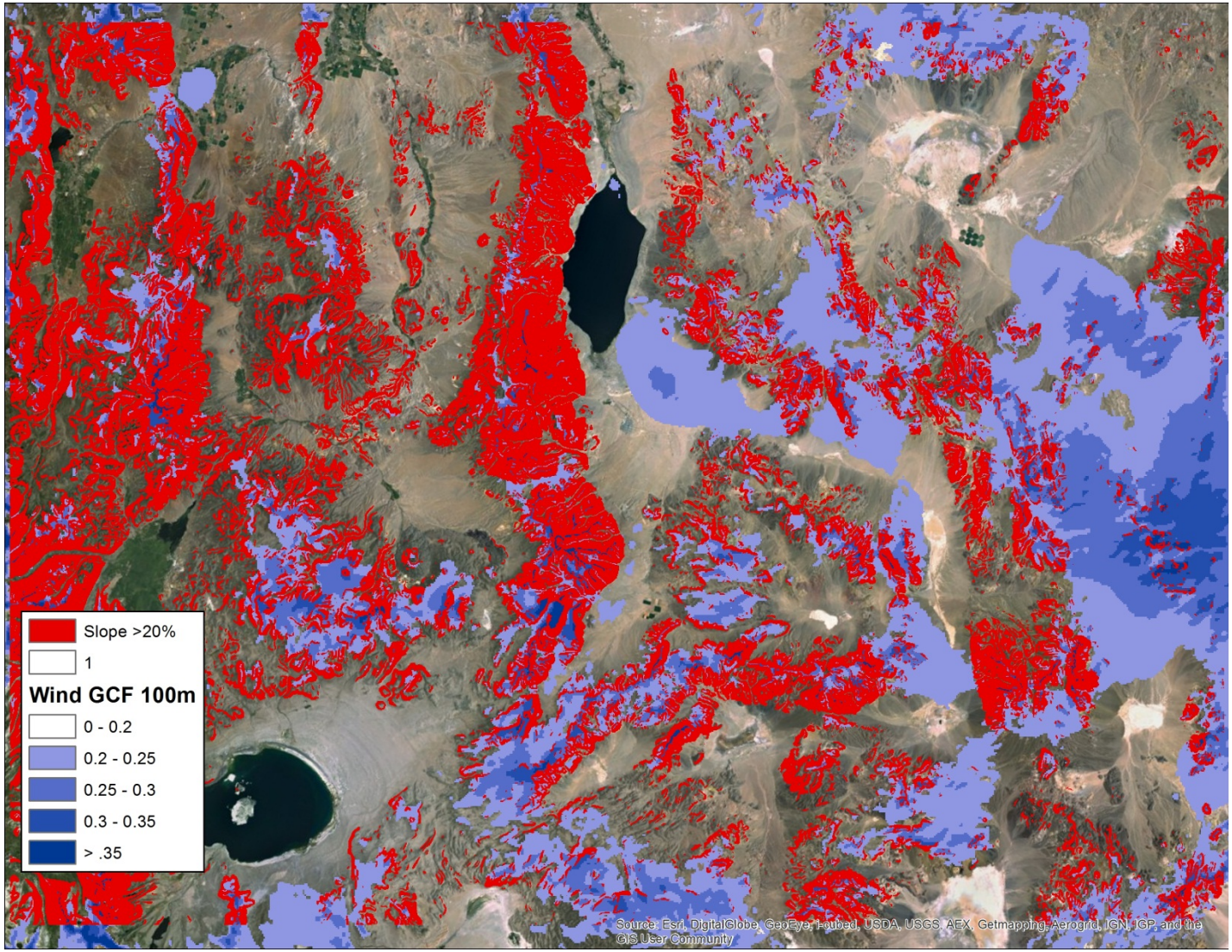
Initial Site Considerations — Example

Initial Solar Site Considerations — Slope>1%

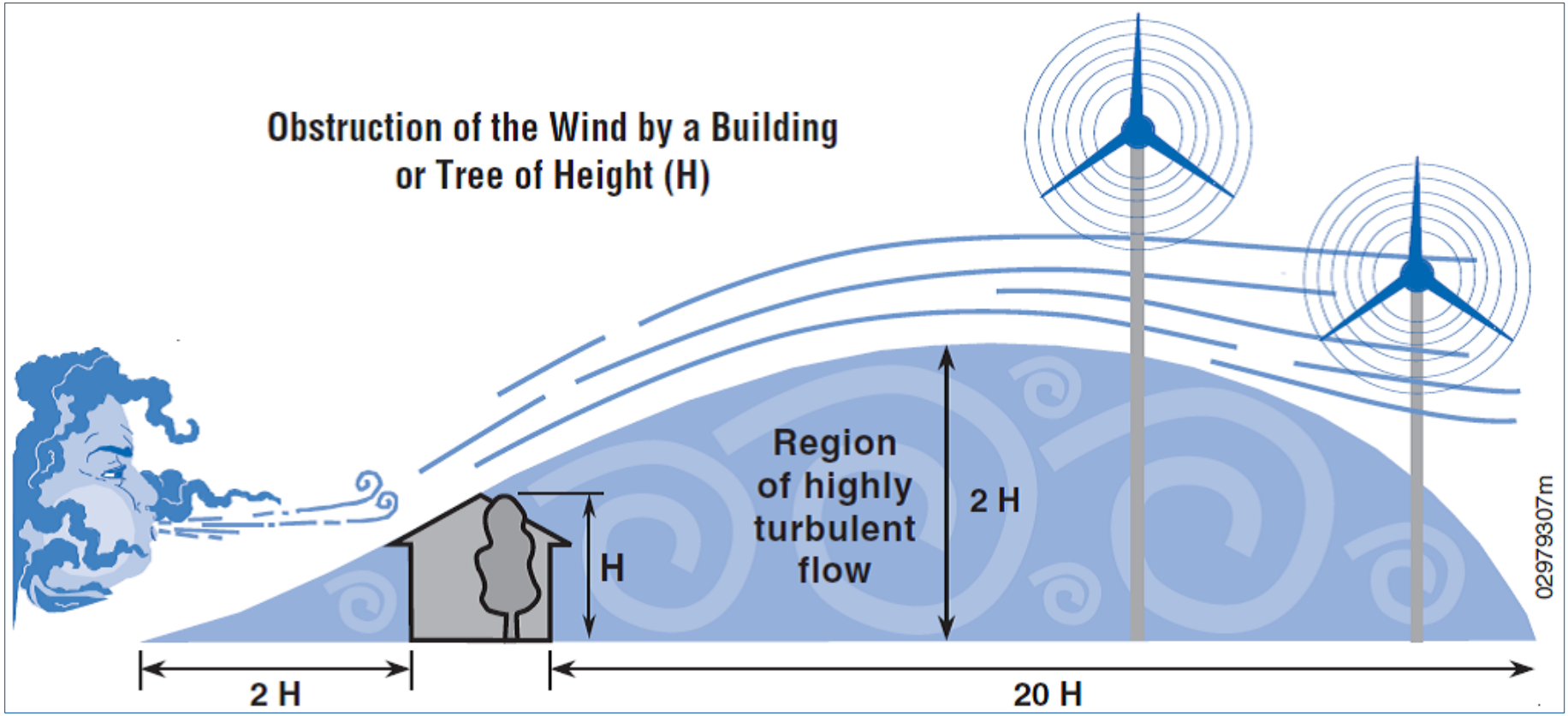
Initial Solar Site Considerations — Slope> 5%



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)

Check permitting requirements:

- Air permits
- Ash disposal
- Fire permits

Photo from Mississippi Band of Choctaw Indians, NREL 26448

Photo from Randy Hunsberger, NREL

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 /ft^2. 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

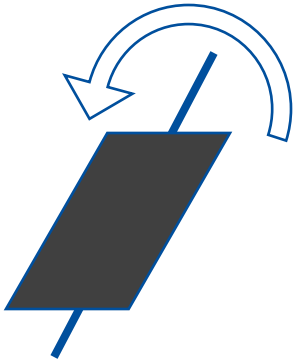
Solar Photovoltaics (PV) Fixed Tilt/Tracking

Fixed Tilt Facing Equator

tilt=latitude

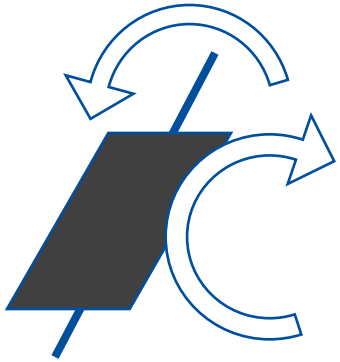
tilt<latitude for summer gain

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

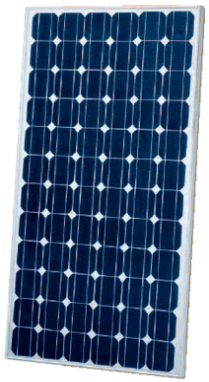
Total Area Required for PV

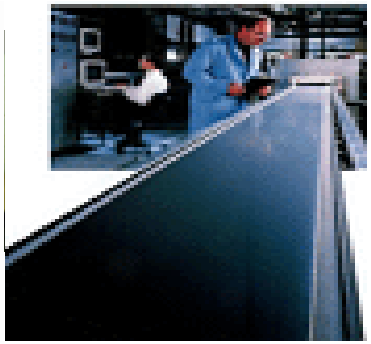
- Varies by technology, tilt, and location
- Roof mount - sloped roof, flush-mounted power densities of 11 direct current (DC)-watt (W)/square foot (ft^2) crystalline
- Flat roof, slope panel = 8 DC-W/ft^2

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 * Multi-Crystal * Thin Film * Cadmium Telluride * CIGS

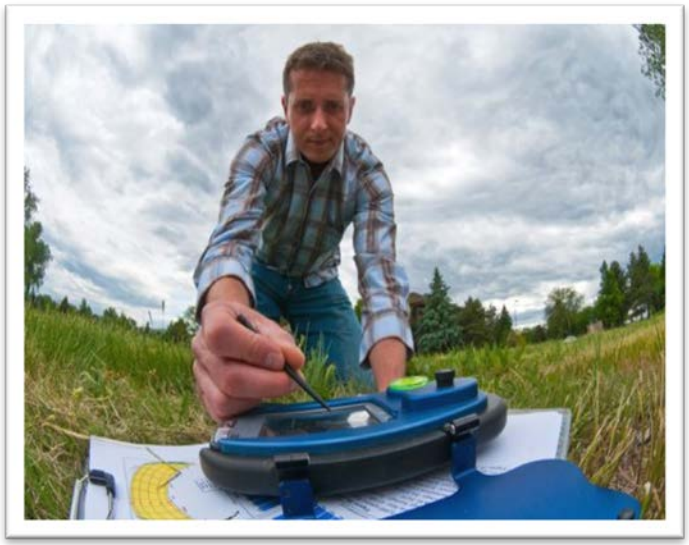




Efficiencies:

14 to 23% 13 to 17% 6 to 11% 10% to 11% 12% to 14%

Solar Assessment: PV is VERY Shade Sensitive



Shade Analyzer

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

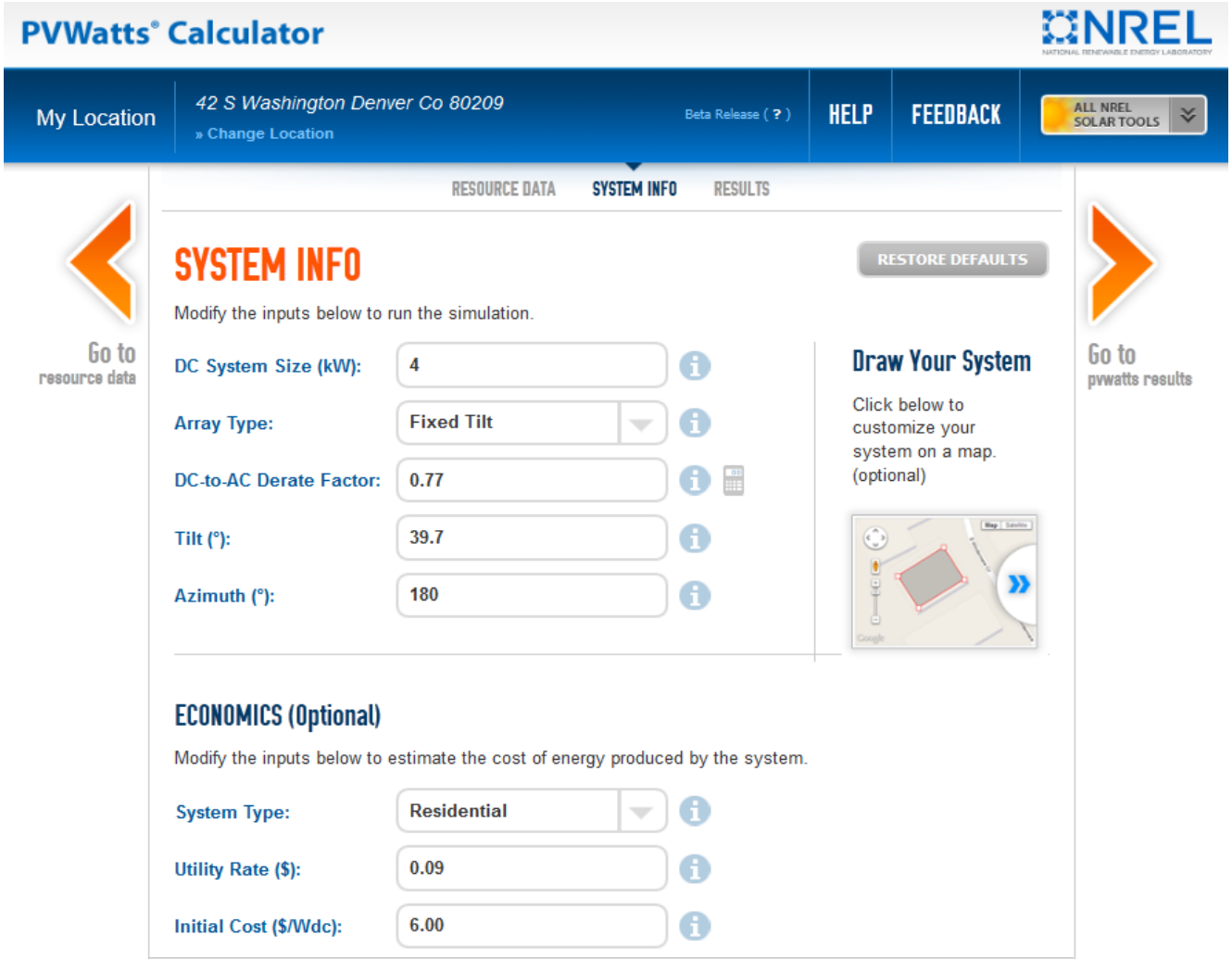
Photos top to bottom: NREL 10314 and 17509

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



http://pvwatts.nrel.gov/

Project Risk: Facility/Community-Scale Post Step 1

	Risks	Risk Assessment Post Step 1	✓
Development	• Loss/waste of development resources	Low but rising; "calculated"	
Site	• Improper orientation or project affected by shade	Reduced	✓
	• Inadequate foundation or structural integrity	Assumed low	✓
	• Site control challenges for safety/security purposes	Assumed low	✓
Permitting	• Tribe-adopted codes and permitting requirements	Unchanged	
	• Utility interconnection requirements	Unchanged	
Finance	• Capital constraints	Assumed low	
	• Incentive unavailability or insufficiency	Reduced	
Construction/ Completion	• Engineering, procurement, and construction difficulties	Assumed low, mitigable, or allocatable	
	• Cost overruns	Assumed low, mitigable, or allocatable	
	• Schedule overruns	Assumed low, mitigable, or allocatable	
Operating	• Output shortfall from expected	Assumed low, mitigable, or allocatable	
	• 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