Site Assessment Tools and Techniques

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Webinar

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Outline of talk

Site Assessment Tools and Techniques

- Wind measurement options for DG projects
  - Maps and Calculation Tools – typically adequate for residential scale
  - Third Party Mesoscale Model Estimate – quick and low cost
  - Wind Modeling – use of nearby wind data to predict at your site
  - Met Towers – recommended for complex terrain and urban areas
  - SODAR or LIDAR – portable and easy to install but still expensive
  - Public data from airports for long-term record (free)
  - Example project demonstrates value of wind measurement
- Company background

What is Appropriate Wind Measurement for Your DG Project?

- Residential up to 25 kW – Wind map and terrain data review plus calculations or third party estimates; on-site measurement only in complex terrain/urban areas (up to $5k)
- 25 kW to 100 kW – On-site wind measurement rare; desktop reviews or third party estimates typically adequate ($500-$12k)
- 100 kW to 1 MW – On-site wind measurement tower and airport correlation, some exceptions ($5k-$30k)
- 1 MW to 10 MW – 60 m wind measurement tower (1-2 years) and airport correlation, possibly SODAR if high shear or met tower is not at turbine site ($32k-$50k)

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Maps and Calculation Tools

- Reference 30 m wind map for typical small wind turbine tower heights of 18 m-37 m
  - 100 m-500 m grid resolution maps available from NREL, AWS and 3TIER
  - 50 m and 80 m wind maps also publicly available for most states
  - Shear corrections have substantial impact, need to be well understood
- Most SWT manufacturers offer calculation tools and guidance
  - "Method of Bins" WindCAD, 7th Generation & Wind Analytics models
  - Review USGS topo maps, satellite images for ground cover; consider terrain/surface effects by directional sector
- Consider inter-annual variation and effects of climate change on long-term average – individual years can be ±25% energy

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Third Party Wind Speed Estimates

- Low Cost is $500 Basic from AWS TruePower 200 m resolution, reasonably accurate in flat and open areas
  - Free in some states like NY and OR
  - Other vendors: 3TIER, United Wind (WindSight)...
- Useful in weighing risks to determine if investment in further study is warranted
  - May not be adequate for sites with mountainous terrain, with many trees or buildings nearby, and/or closer to ground level where sheltering and channeling is unclear
  - May not qualify as adequate data for grants or financing for projects larger than $200k

Modeling Wind Speed Over Site

- Useful when nearby wind met tower data is available, assists with micrositing
- WASP is the most commonly used software for MW-scale projects
  - Need to “digitize” roughness (vegetation) to make best estimate
  - Model needs minimum one year of wind data or **wind atlas**
  - Not typically affordable for small wind turbine projects
- Accuracy is higher when met tower is in same roughness and elevation area as target wind turbine site(s)

Tip up Met Tower

Installed cost:
$9,000 for 30 m,
$17,000 for 50 m,
$19,000 for 60 m

Used towers plentiful via installers: $3,500

Possible use of nearby radio tower with booms and redundant sensors

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Wind Data Quality Control

- Review "NYSERDA *Wind Resource Assessment Handbook*" by NRG (web search), comprehensive 200+ pages
- Retrieve and review data every two weeks to verify logger and sensors are working
- Ten minute intervals is industry standard
- "Clean data" by removing icing and tower shadow
- **Losing one month of wind data "ruins" the value of the data for that year, so constant attention to collecting and examining data is required!**

SODAR and LIDAR – Portable

- Reduce uncertainty on energy estimate, shear above met tower
- Not for stand alone measurement, LIDAR has best availability
- Cost: Approx $2,500/month for SODAR, $10,000/month for LIDAR

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Airport Data for Reducing Long Term Wind Speed Uncertainty

- Free from NCDC, up to 15 years of data available
- Airport data is in hourly average format
- May need help to make data useful
- Hard to translate 10 m measurements up to hub height accurately
- Website to retrieve airport data: http://www.ncdc.noaa.gov/oa/ncdc.html
  "Surface data hourly global"

Example of Value of On-Site Wind Measurement

- Richland College 100 kW Northwind on 37 m tall tower installed in 2009
- 18 months of data from nearby cell tower, instruments at two heights 60 m and 75 m – shear estimate incorrect, booms too short
- Actual performance was 1.5x estimated! Predicted 100,000 kwhrs, 150,000 actual
- ***Project would not have received grant due to "low wind resource"***

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Who is WES Engineering?

Wind Services:

- Wind Assessment
- Wind Modeling with WASP and Windfarmer
- Turbine Repair
- Project Operations

People at WES Eng:

- **Wes Slaymaker, P.E.** – President
- **Mike Stocking** – Wind Engineer I
- **Jake Stacken** – Meteorologist
- **Zach McIntyre** – Senior Wind Technician
- **Jason Vidas** – Wind Technician
- **Diana Cohen** – Data Analyst, Bookkeeper

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