



Wind Site Assessor Training

Lesson 3.1 Wind Quality

Introduction

The second characteristic of wind is its “quality”. Quality winds are typified by laminar air flow at the site of the wind turbine. Obstacles that disrupt laminar air flow create turbulent wind, and degrade the quality of the wind resource.

This lesson reviews how turbulence is created, and the effect that it has on the output of a wind turbine. Several rules of thumb are introduced that help minimize the effects of turbulence and maximize both the quantity as well as the quality of the wind resource.

Learning Objectives

Upon completion of this lesson, you should be able to:

1. Define turbulence and explain its effects using fluid analogies.
2. Explain how wind flows over and around buildings and home or farm sites, shelter belts, groves of trees, and suburban and urban areas.
3. Explain the consequences of ground clutter on a wind turbine and elucidate on the best practices for overcoming its effects.
4. Explain the rules of thumb for estimating the minimum acceptable tower height and distanced for any site based on terrain and obstacles.
5. Given the heights of obstacles at a wind site, calculate the minimum acceptable tower height for that site.
6. Explain the different approaches in siting small wind turbines and wind farms.
7. Identify several ways to test for turbulence at a site.
8. Explain the significance of a wind rose to a wind site assessor.
9. Identify several procedures and tools for measuring obstacle height at a site.
10. Demonstrate the use of basic techniques and tools used to determine the height of trees, buildings, other structures.
11. Given a site, estimate the mature tree height for the area over the life of the wind system.
12. Identify local topographic factors that reduce or enhance the amount of wind energy available to a wind installation.
13. Explain how wind flows over and around hills, bluffs, and valleys. Identify where the potential for the “venturi effect” can be found.
14. Given the surface roughness around a site, determine a suitable location to site a wind turbine on a bluff, ridge or cliff.
15. Define valley and mountain winds and explain how and why they work.

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This material is based upon work supported by the Department of Energy under Award Number DE-EE0000095 and the Minnesota Department of Commerce Division of Energy Resources.



16. Differentiate between on shore (sea breeze) and off shore (land breeze) winds, and what causes them and why.
17. Explain the effect that changing surface roughness has on a wind profile.
18. Differentiate between wind shear and turbulence intensity, and explain how each affects the performance of a wind system.
19. Identify appropriate distances between turbine rotors to minimize “wake effect” for small wind installations.
20. Define the wind window at a site.
21. Demonstrate the procedure for defining the “wind window” at a potential installation site.

Assignments

1. Read Chiras *Power from the Wind*, Chapter 2 pages 36 to 39.
2. Read Gipe *Wind Energy Basics*, Chapter 4, pages 61 to 64.

Resources

3. Read Sagrillo *Back to the Basics: Turbulence*.

<http://renewwisconsin.org/wind/Toolbox-Homeowners/Back%20to%20the%20Basics%202-Turbulence.pdf>

<http://www.solartoday-digital.org/solartoday/201003#pg28>

4. Read Sagrillo *Back to the Basics: Quantity + Quality = More Electricity*.

<http://renewwisconsin.org/wind/Toolbox-Homeowners/Back%20to%20the%20Basics%203-Quality%20Plus%20Quantity%20Equals%20More%20Electricity.pdf>

Or read <http://www.solartoday-digital.org/solartoday/201004#pg44>

5. Read Sagrillo *Back to the Basics: Determining the Minimum Tower Height for your site*.

<http://renewwisconsin.org/wind/Toolbox-Homeowners/Back%20to%20the%20basics%204-Determining%20Your%20Minimum%20Tower%20Height.pdf>

Or read <http://www.solartoday-digital.org/solartoday/201005#pg56>

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