Wind Energy Assessment

An Online Continuing Education Course for Engineers

Course Number: R-6001

Credit: 6 Hours / 6 PDH / 6 CPD

Wind Energy Assessment

CHAPTER 1
INTRODUCTION

This course presents industry-accepted guidelines for planning and conducting a wind resource measurement program to support a wind energy feasibility initiative. These guidelines, which are detailed and highly technical, emphasize the tasks of selecting, installing, and operating wind measurement equipment, as well as collecting and analyzing the associated data, once one or more measurement sites are located. The course's scope encompasses state-of-the-art measurement and analysis techniques at multiple heights on tall towers (e.g., 50 m) for a measurement duration of at least one year. These guidelines do not represent every possible method of conducting a quality wind measurement program, but they address the most important elements based on field-proven experience.

The intended audience for this course is any engineer or other individual who desires the planning framework and detailed procedures for conducting a formally structured wind measurement program. The organizational aspects of a measurement program, including the setting of clear program objectives and designing commensurate measurement and quality assurance plans, all of which are essential to ensuring the program's successful outcome, are emphasized. Considerable attention is also given to the details of actually conducting the measurement program in its many aspects, from selecting instrumentation that meets minimum performance standards to analyzing and reporting on the collected data.

1.1 OVERVIEW OF CHAPTERS

The course contains nine (9) chapters and an appendix. Following is a brief overview of the contents of each chapter.

Chapter 2: Guiding Principles of a Wind Resource Assessment Program
Discusses various resource assessment approaches and recommends the use of a formal measurement plan, a monitoring strategy, and a quality assurance plan.

Chapter 3: Siting of Monitoring Systems
Summarizes the most commonly used siting techniques and addresses land leasing and permitting requirements for a measurement tower.

Chapter 4: Measurement Parameters
Details the recommended measurement parameters and offers guidelines for incorporating other optional parameters that may benefit your monitoring program.

Chapter 5: Monitoring Station Instrumentation
Describes the instrument components (sensors, data loggers, towers, peripherals) of a recommended wind resource monitoring station, including the performance specifications for basic and optional sensors.

Chapter 6: Installation of Monitoring Stations
Provides guidelines on equipment procurement, inspection and layout, site layout, tower installation, sensor and equipment installation, site commissioning, and documentation.

Chapter 7: Station Operation and Maintenance
Details the key elements of an operation and maintenance program, including scheduled and unscheduled site visits, on-site procedures, checklists and logbooks, calibration checks, and a spare parts inventory.

Chapter 8: Data Collection and Handling
Highlights data issues related to in-field raw data storage, data retrieval and protection, retrieval frequency, and documentation.

Chapter 9: Data Validation, Processing, and Reporting
Recommends specific steps to inspect all recorded data values, deal with erroneous values, create validated data files, and generate standard summary reports.

Appendix A: Bibliography

CHAPTER 2
GUIDING PRINCIPLES OF A WIND RESOURCE ASSESSMENT PROGRAM

A wind resource assessment program is similar to other technical projects. It requires planning and coordination and is constrained by budget and schedule limitations. It demands a clear set of objectives so the best assessment approach is selected. Its ultimate success rests on the quality of the program's assembled assets—sound siting and measurement techniques, trained staff, quality equipment, and thorough data analysis techniques.

2.1 APPROACHES AND OBJECTIVES

Several approaches are available when investigating the wind resource within a given land area. The preferred approach will depend on your wind energy program objectives and on previous experience with wind resource assessment. These approaches can be categorized as three basic scales or stages of wind resource assessment: preliminary area identification, area wind resource evaluation, and micrositing.

A. Preliminary Area Identification

This process screens a relatively large region (e.g., state or utility service territory) for suitable wind resource areas based on information such as airport wind data, topography, flagged trees, and other indicators. At this stage new wind measurement sites can be selected. Details on site screening techniques are provided in Chapter 3.

B. Area Wind Resource Evaluation

This stage applies to wind measurement programs to characterize the wind resource in a defined area or set of areas where wind power development is being considered. The most common objectives of this scale of wind measurement are to:

- Determine or verify whether sufficient wind resources exist within the area to justify further site-specific investigations
- Compare areas to distinguish relative development potential
- Obtain representative data for estimating the performance and/or the economic viability of selected wind turbines
- Screen for potential wind turbine installation sites.

C. Micrositing

The smallest scale, or third stage, of wind resource assessment is micrositing. Its main objective is to quantify the small-scale variability of the wind resource over the terrain of interest. Ultimately, micrositing is used to position one or more wind turbines on a parcel of land to maximize the overall energy output of the wind plant. This step is beyond the scope of this course. For more information, refer to the sources listed in the bibliography.

2.2 MEASUREMENT PLAN

Common to all monitoring programs is the need for a measurement plan. Its purpose is to ensure that all facets of the wind monitoring program combine to provide the data you need to meet your wind energy program objectives. Therefore, the program's objectives should dictate the design of the measurement plan, which should be documented in writing, and reviewed and approved by the project participants before it is implemented. The plan should specify the following features:

- Measurement parameters
- Equipment type, quality, and cost
- Number and location of monitoring stations
- Sensor measurement heights
- Minimum measurement accuracy, duration, and data recovery
- Data sampling and recording intervals
- Data storage format
- Data handling and processing procedures
- Quality control measures
- Format of data reports.

This course provides guidance on all these features.

2.3 MONITORING STRATEGY

How the measurement plan is carried out is the basis for the monitoring strategy. Its core is good management, qualified staff, and adequate resources. Everyone involved should understand the roles and responsibilities of each participant, and the lines of authority and accountability. Everyone should be familiar with the program's overall objectives, measurement plan, and schedule. Communications among the players should be often and open.

Because of the complexities of siting and monitoring, the project team should include at least one person with field measurement experience. Data analysis, interpretation, and computer skills are also necessary assets. Available human and material resources must be commensurate with the measurement program's objectives. High standards of data accuracy and completeness therefore require appropriate levels of staffing, an investment in quality equipment and tools, prompt responsiveness to unscheduled events (e.g., equipment outages), access to spare parts, routine site visits, and timely review of the data.

2.4 QUALITY ASSURANCE PLAN

An essential part of every measurement program is the quality assurance plan, an organized and detailed action agenda for guaranteeing the successful collection of high-quality data. The plan should be prepared in writing once the measurement plan is completed.

- **Quality Assurance Policy:** The program manager must first establish and endorse the quality assurance plan. This will lend credence to the party assigned the responsibility of enforcing the plan.

- **Quality Assurance Coordinator:** The link between the plan and the program management should be the quality assurance coordinator. This person should be knowledgeable of the routine operation requirements for collecting valid data. If the quality assurance plan is to be taken seriously, this person must be authorized to ensure that all personnel are properly trained, correct procedures are followed, and corrective measures are taken. In addition, the coordinator should maintain the proper documentation in an organized format.

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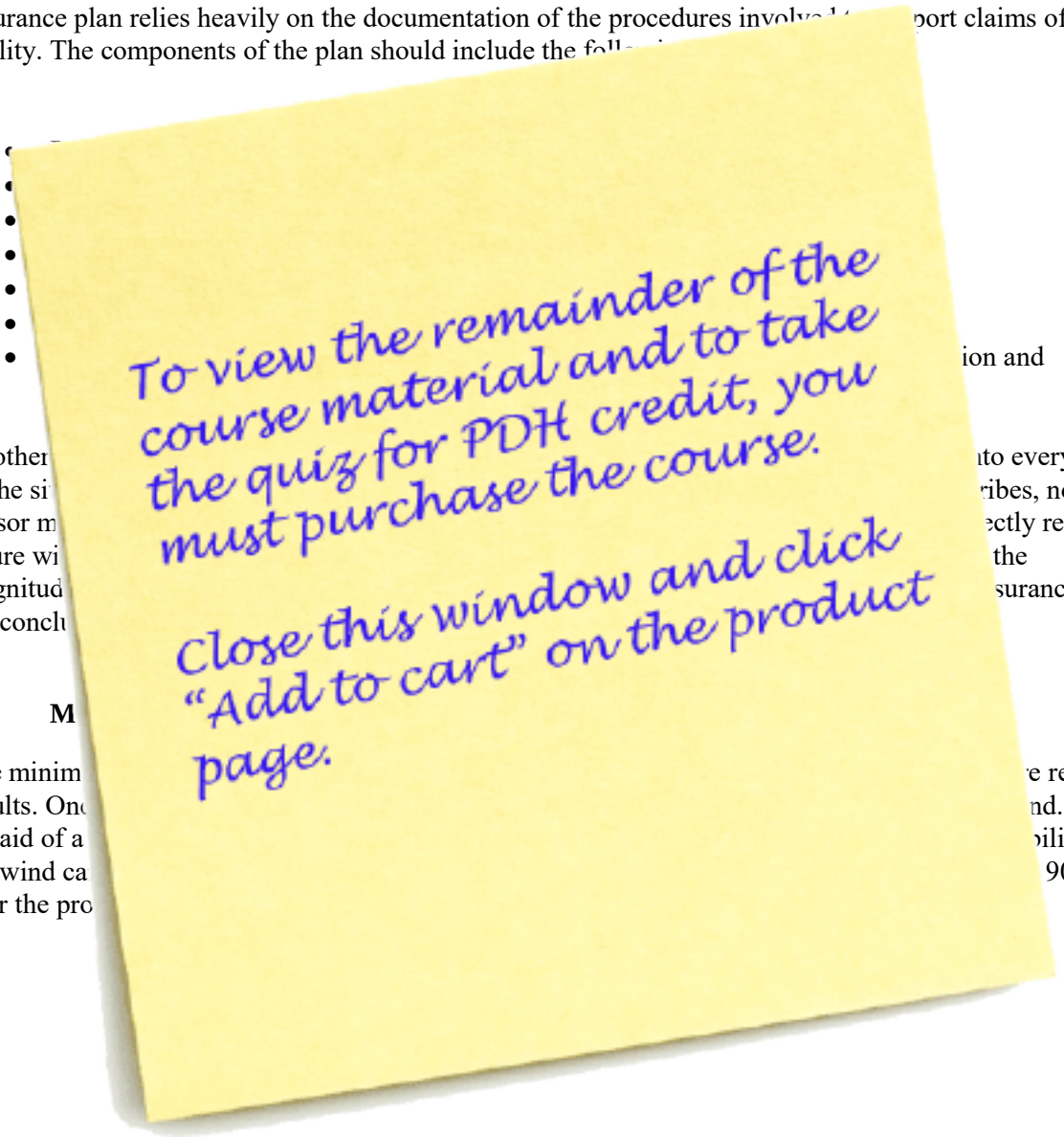

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