

Wind Generation Technology Short Course

October 20-23, 2009

Scheman Building • Iowa State University • Ames, Iowa



Sponsored by Electrical and Computer Engineering
Extension at Iowa State University

IOWA STATE UNIVERSITY
University Extension

Wind Generation Technology Short Course

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Tuesday, October 20

- 7:30 AM** **Registration**
- 7:45 AM** **Introductions and Short Course Overview**, *Tom Baird, Iowa State University*
- 8:00 AM** **National Wind Generation Picture**, *Dr. Jim McCalley, ECpE/EPES* Faculty, Iowa State University (ISU)*
Jim will identify areas with the greatest potential for development of wind generation, present levels of generation, growth curves, transmission constraints, and ISU's role in wind research.
- 9:00 AM** **Planning for Wind Generation Transmission at MidAmerican Energy**, *Jim Swanson, Senior Engineer-Electric System Planning, MidAmerican Energy Company (MEC)*
Jim will provide an overview of MEC's transmission planning process, including that related to long-term future wind generator additions, and comments on MISO's transmission plans for wind.
- 10:00 AM** **Planning for Wind Generation Transmission at ITC**, *Doug Collins, Executive Director, ITC Midwest*
Doug will discuss challenges to development of transmission of wind energy from wind-rich areas to load centers and proposed cost allocation and regulatory hurdles for regional transmission projects.
- 11:00 AM** **Wind Energy Basics**, *Dr. Jim McCalley, ECpE/EPES* Faculty, Iowa State University (ISU)*
Jim will cover the basic wind power equation, daily/seasonal wind speed variation, wind speed vs. height, usable speed range, annual energy production.
- 12:00 PM** **Lunch**
- 1:00 PM** **Wind Generator Basic Components**, *Dr. Dionysios Aliprantis, ECpE/EPES* Faculty, Iowa State University (ISU)*
Dionysios will briefly discuss the major wind generator components including the tower, blades hub, nacelle, gear box, generator, converters, auxiliaries, controls, and transformer.
- 2:30 PM** **Basic Aerodynamic Concepts for Capturing the Energy in Wind**, *Dr. Dionysios Aliprantis, ECpE/EPES* Faculty, Iowa State University (ISU)*
Dionysios will discuss the energy of the wind, an upper limit for power extraction, the performance coefficient, how blades work, wind shear and tower shadow, and power control mechanisms.
- 5:00 PM** **Adjourn**

Wednesday, October 21

- 8:00 AM** **Electromechanical Energy Conversion Systems**, *Dr. Dionysios Aliprantis, ECpE/EPES* Faculty, Iowa State University (ISU)*
Dionysios will cover basic energy conversion topologies; squirrel-cage, wound-rotor, and doubly-fed induction generators; synchronous generators; and basic concepts of power electronics systems.
- 10:30 AM** **Wind Turbine Site Layout, Financing and Economics, and High Penetration Case Studies**, *Tom Wind, Wind Utility Consultant*
Tom will discuss various factors affecting the placement of wind turbines, such as net energy production, wake losses, shadow flicker, noise, and setbacks; how smaller wind projects can be economically feasible even when they lack the economies of scale of larger projects; and what can be learned from high wind power penetration electric systems around the world to help increase the penetration of wind power in the U.S. electric grid.
- 12:00 PM** **Lunch**
- 1:00 PM** **Wind Turbine Site Layout, Financing and Economics, and High Penetration Case Studies-Continued**
- 2:00 PM** **Wind Farm Construction**, *Parker Lohrenz, Electrical Engineer, Mortenson Construction Company*
Parker will describe the work involved in wind farm construction including roads, foundations, towers, nacelles, rotors, electrical components, and the challenges of the design/build process including site conditions, schedule, quality assurance, and design completion.
- 3:00 PM** **Stability, Frequency, and Var Control with Wind Generation**, *Drs. Jim McCalley and Venkat Ajjarapu, ECpE/EPES* Faculty, Iowa State University (ISU)*
Jim and Venkat will discuss the impact of wind generation on system stability, system frequency, and voltage/var control.
- 5:00 PM** **Adjourn**

Thursday, October 22

- 8:00 AM** **Wind Generation Operations and Maintenance**, *Alden Zeitz, Director/Trainer, Wind Energy/Turbine Technology, Iowa Lakes Community College*
Al will describe operational characteristics of wind turbines, best practices for maintenance, best practices for project operations, and end-of-warranty inspections.
- 10:00 AM** **MidAmerican Energy's Wind Park Output, Control Performance, and Market Operations**, *Chris Schneider, Director, Resource Operations, MidAmerican Energy Company*
Chris will cover pre- and post-MISO integration operation of MEC's wind park output pertaining to NERC Balancing Area control performance and market operations.
- 11:00 AM** **MidAmerican Energy Wind Generation Development, Construction, and Operations**, *Tom Budler, MidAmerican Energy Company*
Tom will review MEC's wind generation, development, construction, and operations activities.
- 12:00 PM** **Lunch**
- 1:00 PM** **Wind Turbine Blade Manufacturing at TPI Composites**, *Crugar Tuttle, General Manager, TPI Composites, Newton, IA*
Crugar will discuss the challenges associated with constructing, ramping up, and stabilizing a new wind turbine blade manufacturing facility.
- 3:00 PM** **Wind Turbine Manufacturing at Clipper Windpower**, *Marty Stinson, Manager, Manufacturing Engineering, Clipper Windpower, Cedar Rapids, IA*
Marty will provide a brief history of wind development in the US and Iowa, reflect on Clipper's emergence and future in the industry, describe Clipper's Liberty Turbine and manufacturing plant.
- 5:00 PM** **Adjournment**

Friday, October 23

- 9:00 AM** **Wind Park Tour (Optional)**, *Sam Tasker, Plant Manager, NextEra Resources, Story Wind, Zearing, IA*
Sam will be our host and guide at NextEra's 150 MW wind farm in northwest Story County, comprised of 100 1.5 MW General Electric wind turbines.

Course Information

This short course features presentations from individuals and companies that manufacture, build, or work in the burgeoning wind generation industry in Iowa. Second in the nation in wind generation capacity, Iowa is home to a number of firms that manufacture wind turbines or major components for them. Other firms assemble and erect towers, nacelles, and hubs with blades. Iowa's electric utilities and wholesale merchant generators own, operate, and market the output of wind farms with hundreds of wind turbines, while smaller municipals, schools, and individuals participate with several or individual turbines. Utilities and transmission companies are planning for expansion of Iowa's high-voltage transmission system to accommodate still more wind capacity for energy export. Iowa's educational institutions are involved in research on the effects of high levels of wind penetration on the grid and in teaching graduate and undergraduate students in the principles of wind generation. Others are active in training operators and maintenance personnel. Consulting firms in Iowa layout wind farms and design collection circuitry and substations for interconnection with transmission. Construction firms build it all. Representatives from all of these sectors will participate in this course.

The course is titled "Wind Generation Technology" because several presentations will include some wind generator theory and design parameters. Some presentations will apply mainly to larger wind farms, but much will be applicable to smaller installations and single turbines as well. This course is designed to appeal to design engineers, power system operators, consultants, wind farm developers, regulators, teachers, and anyone interested in something more than the usual broad overview, and all at a modest cost compared to prevailing short course rates.

Further Information

For questions about program content, contact Tom Baird at (515)294-7678 or tbaird@iastate.edu. More information about course content, lodging, and course location can be found on the conference website at www.ucs.iastate.edu/mnet/wind/home.html

Continuing Education Credits

An application has been submitted to Iowa State University for approximately 2.2 Continuing Education Units (CEUs).

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Registration Information:* Mr. Ms. Mrs. Dr.

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* Iowa State University requests this information to preregister you in a conference. No one outside the university, with the exception of participants in this conference, is routinely provided this information. If you fail to provide the required information, we cannot promise accurate registration. (Reference: Iowa Code, Chapter 22.11; Iowa Fair Information Practices Act)

Registration Fee:

Registration Fee \$950
The registration fee includes all program materials and lunches and refreshment breaks each day. If you cancel on or before October 13, 2009, you will receive a full refund less a \$50 processing fee. No refunds will be given after October 13, 2009. If you cannot attend the course, you may send a substitute.

I have special dietary needs and/or need accommodations for a disability. Please contact me.

Please note: Smoking is not allowed on the Iowa State University campus (including the Scheman Building and surrounding property) pursuant to the Iowa Smokefree Air Act of July 1, 2008. For more information call 1-888-944-2247 or visit www.IowaSmokefreeAir.gov.

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