

## **Wind Generation in Power Systems: A Short Course on the Integration and Interconnection of Wind Power Plants into Electric Power Systems**

*September 21-24, 2010, Sheraton Austin at the Capitol, Austin, Texas*

Wind power is one of the fastest growing forms of generation in the world today, growing worldwide at the rate of 31% in 2009. Today, there is over 35,603 MW of wind capacity installed in the US, and over 1157,899 MW of wind capacity installed worldwide. New projects in the US completed in 2009 alone accounted for 39% of entire new generation capacity added during the year. Growth of wind generation in other countries, most notably China, has progressed at similar rates.

In order to properly study and evaluate the impact of this new capacity, which behaves differently from fossil or nuclear generation, an understanding of its characteristics is essential. This short course will provide an introduction to the underlying technology of wind turbine generators and wind power plants, how to model them for power system analysis purposes for planning and operating studies, and an introduction to using actual models in simulation programs.

This course is intended to provide the necessary background for engineers and researchers on the interconnection and integration of wind generation power plants into electric utility systems. It is also geared towards experts already working in this area, as there will be an opportunity to exchange knowledge and discuss experiences from around the globe. Experts from the US and Europe will provide state-of-the-art knowledge and expertise on the application of power system engineering methods to address the incorporation of wind power plants into electric power systems.

### **Co-sponsored by**



In addition, the European instructors will provide insights on dealing with high wind power penetration levels in European networks – for example, average wind power penetration levels of 20-30 % with peak penetration levels of up to 100%.

### **Target Audience**

This course is targeted towards power systems engineering and management personnel from utilities, RTOs, ISOs, and independent transmission companies as well as consultants, manufacturers and developers involved with the evaluation and planning of the interconnection and operation of new wind plants. Regional planning entities and regulatory authorities will also benefit from this course.

### **Topics**

#### **Background**

- Utility wind integration state of the art
- Costs and benefits of large scale integration of wind power
- Discussion of different wind turbine design concepts

### **Power System Planning Issues**

- Basic aspects of network integration
- Capacity value and cost of ancillary services
- Experiences with wind power integration in the US and Europe

### **Power System Operation Issues**

- Power system operation and balancing: evaluation and management of the uncertainty of short-term wind power variations
- Wind forecasting: Available tools and methods for short and medium term forecasting for improved power system operations planning
- Voltage control, power quality and protection issues
- Grid codes and recent US and European experiences
- High penetration issues

### **Wind Turbine Modeling and Simulation**

- Introduction to wind turbine modeling and simulation
- Wind turbine control issues
- Dynamic simulation studies related to wind power
- Specific simulation experiences, e.g., voltage control, reactive power control, low voltage ride-thru, system stability

### **Costs**

UWIG and AWEA Members – \$1695

Non-Members – \$1995

Government – \$1695

Academic/Faculty – \$1295

Space is limited to the first 35 registrants. The cost covers breakfast, coffee breaks, and lunch daily as well as a reception and a group dinner. Course materials and a copy of the book *Wind Power in Power Systems*, Editor: Thomas Ackermann, Publisher: Wiley & Sons, will be provided.

### **About the Instructors**

*THOMAS ACKERMANN – CEO, Energynautics & Lecturer – Royal Institute of Technology, Stockholm, Sweden*

Thomas Ackermann, Ph.D. is CEO of Energynautics, a German-based research and consulting company in the field of wind power and power systems. He provides research and consulting services for wind turbine

manufacturers, project developers and investors as well as for transmission system operators; among others, regarding the integration of wind power into power systems. He has worked in the wind power industry in Europe, Asia, Australia/NZ and North America and currently also lectures at the Royal University of Technology (KTH) in Stockholm, Sweden.

He is the editor of the book "Wind Power in Power Systems," and editor of the Wind Energy Journal, both published by Wiley & Sons. He holds the degree of a Diplom Wirtschaftingenieur (M.Sc. in Mechanical Engineering combined with an MBA) from the Technical University Berlin/ Germany, a M.Sc. in Physics from Dunedin University/ New Zealand and a Ph.D. from the Royal University of Technology in Stockholm/ Sweden.

*MARK AHLSTROM – CEO, WindLogics*

Since 2000, Mark has been the CEO of WindLogics, a provider of services for the assessment, forecasting, operations and integration of renewable energy. WindLogics became a subsidiary of NextEra Energy Resources (formerly FPL Energy) in 2006, allowing the company to expand its efforts for utility, wind and solar energy clients. Prior to joining WindLogics, Mark was founder of two software technology companies. He holds degrees in Biochemistry and Biomedical Engineering from the University of Wisconsin-Madison.

*KARA CLARK – Principal Consultant, GE Energy*

Kara Clark is a principal in GE's Energy Consulting group, which provides expertise in the analysis of large-scale power systems. She is involved in evaluating the impact of significant levels of wind generation on bulk power system performance, the integration of individual wind farm projects into the grid, the control of wind-turbine generators and wind plants, and modeling of WTGs for both cycle-by-cycle and fundamental frequency analysis. Ms. Clark has also worked on the analysis of transient, dynamic, and voltage stability of large power systems, and power electronics-based equipment application and control design. She is a senior member of IEEE and a registered Professional Engineer in New York.

*MARTIN HØGDAHL – Converter Control – Vestas*

Martin received his M.Sc.EE. in 1996 from Aalborg University. From 1997 to 1999 he worked for Ericsson DiAx in the R&D department. He received a Ph.D. from Aalborg University in 2003 for his work in the field of distribution network modeling. Since 2002, he has been working in the R&D department at Vestas in wind turbine modeling using the PSCAD simulation tool.

*MICHAEL MILLIGAN – Principal Analyst – National Renewable Energy Laboratory*

Michael Milligan works on the electric grid integration team at National Renewable Energy Laboratory, where he has analyzed various aspects of electricity supply related to wind energy since 1992. He has worked on issues such as the ancillary service impacts of wind generation, impact of balancing area combined operations on wind integration, impact of RTOs and ISOs on wind integration, the value of accurate wind forecasting, optimal selection of geographically disperse wind power plants, modeling wind plant variability, and reliability contribution and capacity credit of wind power plants.

He is a member of the IEEE Wind Power Coordinating Committee, WECC's Variable Generation Subcommittee, and the NERC Integration of Variable Generation Task Force, has authored or coauthored more than 100 papers, reports, and book chapters, and regularly participates in technical advisory committees for wind integration studies around the U.S. Before coming to NREL, Michael worked in the electric utility industry, where he was involved with load forecasting, rate analysis, and electricity production simulation. He has M.A. and Ph.D. degrees from the University of Colorado, and a B.A. from Albion College.

*DALE OSBORN – Transmission Technical Director– Midwest ISO*

Dale Osborn is the Transmission Technical Director for the Midwest ISO. Wind generation issues, economic long range transmission expansion and voltage stability are his main focus. He serves as one of the Directors of UWIG for the ISO/RTO sector. He is vice chair of the IEEE Wind Power Coordination Committee and serves on the NERC Integration of Variable Generation Task Force.

He serves on the DOE Peer Review for the Wind Energy Program. He is a registered engineer in the state of Nebraska.

He worked for ABB for nineteen years in various positions involving Static VAR System design and performance verification, HVDC studies, and small SVC applications for industry including a wind farm. Previously, he worked for the Nebraska Public Power District for 10 years as the Manager of Power Resource and Transmission Planning. He has a BSEE and MSEE from the University of Nebraska at Lincoln.

*STEVE SAYLORS – Chief Electrical Engineer, Vestas*

Steven Saylor, P.E is currently employed as Chief Electrical Engineer by Vestas Americas, a division of Vestas Wind Systems. Additionally, Steve is on the Adjunct Faculty of Portland Community College and Oregon Institute of Technology teaching courses on variable speed drive technology and wind energy systems design. While working for the Bechtel Power Corporation of San Francisco, and Portland General Electric he was assigned to the design, construction and operation of electrical power plants, mostly nuclear and coal-fired; as well as power transmission & distribution projects.

*REIGH WALLING – Director of Energy Applications and Systems Engineering – GE Energy*

Reigh Walling is a Director of Energy Applications and Systems Engineering for GE Energy and is involved in a wide range of power system issues including wind and solar generation systems, as well as ac and HVDC transmission and distribution technologies. He received his Bachelor's and Master's Degrees in Electric Power Engineering from Rensselaer Polytechnic Institute in 1974 and 1979, respectively, and is a registered Professional Engineer. He was a co-developer of GE Wind Energy's unique windfarm voltage and reactive power control system, and recently led a major wind integration study for the Electric Reliability Council of Texas (ERCOT).

He is a Fellow of the IEEE, has authored over forty papers, and has nine awarded patents.

*BOB ZAVADIL – Vice President and Principal Consultant – EnerNex Corporation*

Robert Zavadil has worked on electric power system issues for wind generation for over 15 years. His clients include wind turbine designers and manufacturers, project developers and operators, transmission service providers and ISOs, and research and development organizations including NREL and EPRI. He served as an observer on the NERC Integration of Variable Generation Task Force.

Bob earned his BS in Electrical Engineering from South Dakota State University and began his career as a special studies engineer in the Transmission and Distribution Engineering Division of the Nebraska Public Power District. He is a member of the IEEE Power Engineering, Power Electronics, and Industrial Applications Societies.

### **Location and Accommodations**

The course will be conducted at the Sheraton Austin at the Capitol located in downtown Austin, Texas. A landmark situated in the cultural heart of Austin, the hotel is next door to the famed Texas Capitol and just steps from the University of Texas, the allure of the Sixth Street/Warehouse District, and Austin's burgeoning business district. Learn more at <http://www.sheraton.com/Austin>.

Individuals are responsible for their own room reservations. You should contact:

Sheraton Austin at the Capitol  
701 East 11<sup>th</sup> Street  
Austin, Texas 78701  
888-627-8349 or 512-478-1111

When making reservations, mention the UWIG/2010 Wind Integration Short Course Meeting to receive the group rate of \$159/night plus applicable taxes. Alternately, you can make the reservation online at <http://www.starwoodmeeting.com/Book/uwig>. The group block expires September 7.

### **Registration**

Online registration is available at <http://www.uwig.org/shortcourse2010.html>.

Registrations can be paid by check, credit card (Visa, MasterCard, American Express, and wire transfer (with prior approval)).

### **Cancellations and Refunds**

All requests for refunds must be submitted to UWIG in writing. Refunds may not be processed until after the course takes place. There is a \$250 cancellation fee up to September 16, after which the fee increases to \$750. Registrations can be transferred within an organization. Refunds for no shows will be granted only under extreme circumstances. Payment must be received by September 16 or the registration may be cancelled.

### **Optional Program**

Attendees can attend an optional session on Friday morning, September 24. This will consist of an interactive demonstration of the use of wind plant models for power system analysis software applications for short circuit and stability studies. A discussion of the work of the UWIG Wind Plant Modeling and Interconnection Study User Group will follow. This program is available at no additional charge, but does require advance registration.

We are working on putting together a technical tour for the afternoon of September 24. Details will be announced when they are available.

### **Credit for Attendance**

2.4 Continuing Education Units will be awarded to course attendees.

### **For More Information**

Questions should be directed to:

Sandy Smith  
Conference & Communications Coordinator  
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