

September 11-14, 2007, Midwest ISO, St. Paul, Minnesota

Wind power is the fastest growing form of generation in the world today, growing worldwide at the rate of 26% annually over the past 5 years. Today, there is over 11,600 MW of wind capacity installed in the US, and over 74,000 MW of wind capacity installed worldwide. Many regions of the US have long queues of requests for interconnection studies, a large part of which are for wind power plants. The Midwest ISO alone has 40,000 MW of wind capacity in its interconnection queue. The State of Minnesota, where this course will be held, needs 7,000 MW of wind capacity built by 2025 to meet its RPS goal.

In order to properly study and evaluate the impact of this new capacity, which behaves differently from more conventional fossil 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 ITCs 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

Registration by September 5, 2007 \$US1495
Registration after September 5 \$US1995

Space is limited to the first 35 registrants. The cost covers breakfast, coffee breaks, and lunch as well as a reception and a dinner. Course material and a copy of the book *Wind Power in Power Systems*, Editor: Thomas Ackermann, Publisher: Wiley & Sons, published in January 2005, will be provided.

About the Instructors

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

Dr. Ackermann holds the degree of a Diplom Wirtschaftsingenieur (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. He is the editor of *Wind Power in Power Systems*. He has worked in the wind energy industry in Germany, Sweden, China,

USA, New Zealand, Australia and India. Currently, he is a researcher/lecturer with the Royal University of Technology (KTH) in Stockholm, Sweden and involved in wind power education at several universities. He is also a partner in Energynautics, a consulting company and project developer in the area of sustainable energy supply.

NICHOLAS W. MILLER – Principal Consultant – GE Energy

Nick is a Principal Consultant for GE Energy's Energy Consulting group. He has over 20 years of experience in analysis of power systems dynamics. He is currently leading analytical developments for integration of GE Wind Turbine-Generators into power systems.

Nick is an IEEE Fellow, and a member of CIGRÉ. He is a member of the IEEE System Dynamics Subcommittee, and Chairman of the IEEE Task Force on Dynamic Performance of Wind Generation. He is a licensed professional engineer in the State of New York.

KARA CLARK – Principal Consultant – GE Energy

Kara Clark is a principal consultant with GE's Energy Consulting group. Ms. Clark is involved in studies relating to integration of individual wind farm projects into power transmission systems, as well as evaluating the impact of large amounts of wind generation on bulk system performance in terms of load following reserves, unit commitment, and regulation. Other recent projects have included detailed under-voltage load shedding studies and system-wide reactive power planning studies. She earned her BSEE degree from the University of Colorado and a Master of Science in Electric Power Engineering from Rensselaer Polytechnic Institute. She is a Senior Member of the IEEE and a licensed professional engineer in the State of New York.

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.

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.

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 – Consultant – National Renewable Energy Laboratory

Michael Milligan is a consultant to the National Renewable Energy Laboratory, where he has conducted analysis on 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, the value of accurate wind forecasting, optimal selection of geographically disperse wind power plants, modeling wind plant variability, and reliability contribution of wind power plants. He is a contributing author for the Energy Encyclopedia (Elsevier Press, 2004) and the McGraw-Hill Handbook for Electrical Engineers (1999), both on wind energy-related topics. Recent projects include the Rocky Mountain Area Transmission Study, Technical Review Committee member for Minnesota Department of Commerce/Xcel Wind Integration Study, and member of California Renewable Portfolio Standard Integration Study team. 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.

MARK AHLSTROM – CEO – WindLogics, Inc.

Mark has more than 20 years of entrepreneurial and management leadership experience in software and systems

businesses. Prior to joining WindLogics in 2000, he was founder and President of Keller Group, a leading developer of fax and voice software where he oversaw the development and licensing of technology to IBM, Global Village Communications and others. Previously he founded Airplan Systems, a provider of decision support front-end technology for airline reservation systems, which he sold to Continental Airlines.

Mark holds degrees in Biochemistry and Biomedical Engineering from the University of Wisconsin and was a research scientist in the Artificial Intelligence group at the Honeywell Computer Sciences Center.

STEVE SAYLORS – Chief Electrical Engineer – Vestas

Steven Saylor, P.E is currently employed as Chief Electrical Engineer by Vestas Americas. Additionally, Steve is on the Adjunct Faculty of Portland Community College, Industrial Occupations Department teaching courses on variable speed drive technology, National Electrical Code, and HVAC system 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.

DALE OSBORN – Transmission Director, Transmission Asset Management – Midwest ISO

Dale Osborn works in transmission asset management at the Midwest ISO (MISO) and has had extensive involvement in generation and transmission system planning before coming to MISO in 2000 as a Transmission Expansion Planning Engineer. Currently, he is involved in the voltage stability and reactive adequacy study process for MISO and Exploratory Expansion Plans that investigate future regional generation scenarios to determine the transmission requirements for those scenarios.

Dale was involved with generation and transmission planning for the Nebraska Public Power District. Previously, he worked with High Voltage Direct Current and AC transmission systems for ABB. He has a BS and MS in Electrical Engineering from the University of Nebraska in Lincoln, Nebraska.

Location and Accommodations

The course will be conducted at the St. Paul office of the Midwest Independent System Operator. This location will provide attendees with an opportunity to see the control facilities of a Transmission System Operator in action.

Attendees will be housed at The Saint Paul Hotel. Located in downtown St. Paul and a member of Historic Hotels of America, The Saint Paul Hotel combines turn-of-the-century beauty with modern convenience and amenities. Transportation will be provided between the Midwest ISO and The Saint Paul Hotel.

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

The Saint Paul Hotel
350 Market Street
St. Paul, MN 55102
(800) 292-9292 or 651-292-9292

When making reservations, refer to group code 388051 or the Utility Wind Integration Group to receive the group rate of \$169/night plus applicable taxes. You will not be guaranteed the group rate or availability after the cut off date of Monday, August 13.

Registration

Online registration is available at <http://www.uwig.org/shortcourse2007.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 \$US300 cancellation fee up to September 5, after which the fee increases to \$US750 for cancellations made by September 10. Registrations can be transferred within an organization. Refunds for no shows will be granted only under extreme circumstances.

Optional Program

Attendees can attend an optional session on Friday, September 14. 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 will be followed by a tour of a nearby wind farm. This program is available at no additional charge, but does require advance registration.

Credit for Attendance

2.4 Continuing Education Units will be awarded to course attendees.

For More Information

Questions should be directed to:

Sandy Smith
UWIG Communications Coordinator
Phone: (865) 691-5540, ext. 141
Fax: (865) 691-5046
E-mail: sandy@uwig.org



*P.O. Box 2787 · Reston, VA 20195
(703) 860-5160
FAX (865) 691-5540
info@uwig.org
www.UWIG.org*