

wind week

January 17th – 22nd, 2011



Integration Workshop

The Current Status and Future of Wind and the Grid

Friday, January 21st, 2011

message from the director

January 2011

Dear workshop participants,

Wind energy contributes to an ever-growing percentage of electricity generation worldwide. While places like Denmark, Spain and Germany have already reached aggressive levels of wind adoption (contributing to near 20%, 10% and 8% of their respective electricity generation needs respectively), the US has had far less development on a national scale. However, on a regional scale, wind development in Midwestern states, Texas and California has also been considerable. The increased overall percentage of electricity generation that comes from this intermittent resource has led to a lot of discussion over the last decade on the future development of the grid and the impacts and implications of large scale wind energy development. This workshop will bring several experts in the area of wind-grid integration to MIT for a full day workshop that will explore issues from short-term grid code specifications to long-term capacity expansion planning and policy.

The MIT Energy Club's Wind Energy Group and MIT Wind Energy Projects in Action are proud to bring you this workshop which will feature talks from several experts in the field as well as an informal post-workshop networking reception.

Sincerely,

Katherine Dykes,

Managing Director of Wind Week

wind week

An intensive week of immersion in wind energy: technology, development, policy supports, environmental impact, and financing alternatives

- **Wind 101**
- **Resource Assessment Demonstration**
- **Museum of Science Wind Lab Tour**
- **Short Course on Wind Turbine Design**
- **Tour of the MA Wind Technology Testing Center**
- **Technical Workshop on Wind-Grid Integration**

<http://windenergy.mit.edu>

workshop agenda

9:15 am – 9:30 am:	<i>Opening Remarks</i> Dr. Tim Heidel, Research Director of the MIT Future Grid Study, MITEI
9:30 am - 10:10 am:	<i>Overview of wind integration status, issues and studies</i> Mr. Charles Smith, Executive Director, Utility Wind Integration Group
10:10 am - 10:30 am:	<i>Coffee Break</i>
10:30 am - 11:10 am:	<i>Wind forecasting and integration from minutes, to hours, to days</i> Dr. Michael Brower, CTO, AWS Truewind
11:10 am - 11:50 pm:	<i>Generation impacts from large-scale wind integration</i> Dr. Michael Milligan, Principal Analyst, NREL
11:50 pm – 12:50 pm:	<i>Lunch</i>
12:50 pm – 1:30 pm:	<i>Transmission impacts and planning for wind integration</i> Dr. Nicholas Miller, Director at GE and Mr. Stephan Wachtel, Principal at GE
1:30 pm – 2:10 pm:	<i>Case study on wind integration for ISO NE</i> Mr. William Henson, Senior Engineer Renewables Integration, ISO NE
2:10 pm - 2:50 pm:	<i>Integrating Wind in Ireland: Experience and Studies</i> Dr. Mark O'Malley, UCD
2:50 pm – 3:10 pm:	<i>Coffee Break</i>
3:10 pm – 3:50 pm:	<i>Storage solutions for wind integration</i> Mr. Eric Ingersoll, CEO, General Compression, Inc.
3:50 pm - 4:30 pm:	<i>Big Wind for Small Islands - Renewables Integration in the Azores</i> Mr. Steve Connors, MIT
4:30 pm - 5:10 pm:	<i>Policy Perspective on Wind Integration</i> Mr. Bo Hesselbaek, Vestas
5:30 pm - 6:30 pm:	<i>Reception and Student Research Presentations</i>

speaker biographies

In alphabetical order

Michael Brower, PhD, is the Chief Technical Officer for AWS Truepower, LLC. Dr. Brower has been involved in the renewable energy field since the mid 1990s. Early in his career he conducted research and analysis on energy and environmental issues for federal and state governments, private business, and nonprofit organizations. He also authored or co-authored two books, "Cool Energy: Renewable Solutions to Environmental Problems" and "The Consumer's Guide to Effective Environmental Choices." In his roles as Principal of Truewind Solutions and subsequently Vice President and Director of Meteorology and Modeling Services for AWS Truepower, Dr. Brower led the development of the MesoMap[®] and SiteWind[®] mapping and micrositing systems and the eWind[®] forecasting system, acted as project lead for wind maps of hundreds of sites and regions around the world, wrote AWS Truepower's Manual of Procedures for wind resource assessment and energy production studies, and led or participated in assessments of over 40,000 MW of wind and solar energy projects. As Chief Technical Officer, Dr. Brower is responsible for company-wide research and development and technical standards. He participates in all aspects of AWS Truepower's corporate management, product development and marketing.

Stephen Connors directs the Analysis Group for Regional Energy Alternatives (AGREA) at the M.I.T. Energy Initiative. Since the late 1980s, AGREA has conducted research on the transformation of local and regional energy infrastructures. Various projects in Europe, the Americas, and Asia have focused on the role of energy technologies such as renewable energy, smart grids, smart demands and electric mobility can have in providing reliable cost- and emissions-effective energy services. Mr. Connors is a graduate of the UMass-Amherst renewable energy group and MIT's Technology and Policy Program. A frequent speaker on energy topics, Steve is also board member of the US Offshore Wind Collaborative, and advises MIT and the State of Massachusetts on emerging energy technologies.

Tim Heidel is a Postdoctoral Associate and Research Director for the MIT's "Future of the Electric Grid" study. In this role, he is coordinating the research efforts of more than 20 faculty and students from economics, policy, and electrical engineering on the most important challenges and opportunities that are likely to face the electric grid between now and 2030. Previously, during 2009, Tim served as a Founding Summer Fellow at the U.S. Department of Energy's new Advanced Research Projects Agency – Energy (ARPA-E). He recently completed a term as Co-President of MIT's 2000+ member Energy Club and is a member of the IEEE. Tim holds S.B., M.Eng., and Ph.D. degrees in Electrical Engineering and an M.S. in Technology and Policy from MIT.

Bo Hesselbaek is a Director of Energy Systems for Vestas Technology R&D Americas in Houston, Texas. He has worked as a manager of power plant analysis for Vestas Wind Systems A/S and as senior consultant for Energinet.dk and Elsam/Eltra. He has founded/led a wind research department, managed department restructuring during merger of companies, and has general technical competence within renewable energy, wind, electrical engineering, power system/transmission and process improvements. He holds an MBA from Handelshøjskolen i Århus, a M.Eng. degree in electrical engineering from Aalborg University, and a B.S. degree from Syddansk Universitet.

William Henson, MSc. (TU Delft 2004) has been studying (post-graduate) and working as a researcher in wind power for approximately 9 years. He is currently working on his doctoral dissertation (at the University of Massachusetts, Amherst) in wind power integration, reviews electrical power and controls related articles for the journal "Wind Engineering", and participates in the North American Electric Reliability Corporation Integration of Variable Generation Task Force. He joined ISO-New England in 2008 to help write the request for proposals for the New England Wind Integration Study (NEWIS); to carry out the NEWIS, and to implement its recommendations, as well as to evaluate renewable energy power generation and enabling technologies and facilitate the cost-effective integration of renewable energy into the New England power system.

Eric Ingersoll is the Chief Executive Officer and Founder of General Compression. Eric, along with David Marcus and Michael Marcus founded General Compression in 2006. Eric is a nationally recognized expert in Compressed Air Energy Storage, and is the inventor of the GCAES™ technology. In addition to extensive experience managing technology development and commercialization as the CEO of several companies, Eric has advised the National Renewable Energy Lab, the California Energy Commission, the US EPA, the Massachusetts Renewable Energy Trust, and numerous other regional energy policy organizations on energy market transformation and new energy technology commercialization. Eric is a board member of the Clean Air Task Force, and a participant in the National Commission on Energy Policy.

Nicholas W. Miller is a Director for GE Energy Consulting in NY. He leads analytical developments for large scale wind generation. He is an IEEE Fellow; was chairman of the IEEE TF on Dynamic Performance of Wind Generation; a principal on the NY, CA, the Western Wind and ISO New England wind integration studies. He received the 2005 and 2009 UWIG Achievement Awards and the 2007 American Wind Energy Association Technical Award. He has lectured and provided consultation on Wind Power integration to governments and institutions in more than two dozen countries. He holds eight patents for wind technology and power control devices.

Michael Milligan leads power system operations research for the Transmission and Grid Integration Team at the National Renewable Energy Laboratory. He has authored more than 120 papers and book chapters and has served on numerous technical review committees for integration studies, including the recently-released New England Wind Integration Study and the DOE/NREL Western Wind and Solar Integration Study and Eastern Wind Integration and Transmission Study. Michael is co-lead for the probabilistic methods team of the NERC Variable Generation Task Force, member of WECC's Variable Generation Subcommittee, the International Energy Agency Task 25 on large-scale wind integration, and served on the Western Governors' Association Clean and Diverse Energy Wind Task Force. Michael has M.A. and Ph.D. degrees from the University of Colorado, and a B.A. from Albion College.

Mark O' Malley is the Professor of Electrical Engineering at University College Dublin (UCD), founder and Director of the Electricity Research Centre (<http://ee.ucd.ie/erc>) an industry supported research group, chaired by the Irish energy regulator. The ERC consists of over 30 people and currently has over €10M in research funding. His teaching and research interests are in Grid Integration of Renewable Energy. He has received two Fulbright awards (1994 & 1999) and works closely with the NREL. He is a Fellow of the IEEE and a Member of the Royal Irish Academy. He is a member of the Engineering Sciences Panel of the European Research Council and a member of the European Academy of Sciences Advisory Council Energy Panel. He is a member of the NERC Task Force on Integrating Variable Generation. He is the Irish representative on the IEA Research Task 25: Design and Operation of Power Systems with Large Amounts of Wind Power and is a lead author on the IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation.

J. Charles Smith is the Executive Director of the Utility Wind Integration Group. Mr. Smith is a Senior Member of the IEEE Power Engineering Society, and a member of CIGRE, the International Council on Large Electric Systems. He received his BSME and MS degrees from MIT in 1970. He currently serves as the Executive Director of the Utility Wind Integration Group (UWIG). Previously, he served as President of Electrotek Concepts, a power engineering consulting firm. He has 40 years of experience in the electric power industry.

Stephan Wachtel is a Principal at GE's Energy Consulting group and working in Salzbergen Germany. He was born 1968 in Braunschweig, Germany and studied electrical engineering at the Technical University of Braunschweig and the University of Stuttgart, Germany. Stephan worked for five years in the network planning department of the former German transmission system operator PreussenElektra¹ and joined the wind energy industry in year 2000. After some years in the R&D department at DeWind in Lübeck, Germany, Stephan worked for the German wind turbine manufacturer ENERCON. As the Head of Technical Support in the Sales Division he built up and managed a team of technical specialists working on the grid integration of wind power plants on six continents. Stephan is a member of the German Power Engineering Society¹ and a member of CIGRÉ. He is currently active in EWEA's WG on Grid Code Regulations and the German Technical Committee for Power System Control.

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NRG Systems manufactures precise, reliable and proven wind measurement and turbine control equipment. With more than 25 years of experience, NRG Systems is a world leader in wind measurement technology, with systems on every continent and more than 120 countries. Closely working with their customers, they use and test their own products and incorporate new technologies to develop tools that will help you produce more electricity from the wind. Based in Vermont, the company believes in taking care of the land; being innovative by being inventive; working with good tools that are durable simple and useful; helping people. These values are part of NRG Systems, shared by the people who work there, integrated in the products they make, and expressed in the service they provide our customers.

<http://www.nrgsystems.com/>



With a 20 per cent market share, and 38,000 wind turbines installed, Vestas is the world's leading supplier of wind power solutions, including development, manufacturing, sales, marketing, and maintenance of wind power systems that produce electricity. Vestas installed its first wind turbine in 1979 and has since played an active role in the fast-moving wind power industry. Starting as a pioneer in the industry with a staff of approximately 60 in 1987, today the global company has 20,000 employees and is the leading producer of high technological wind power solutions.

<http://www.vestas.com/>



Founded in 2004, the MIT Energy Club seeks to bring together and educate the MIT energy science, technology, policy, and business communities through initiatives focused on understanding the global energy challenge through fact-based analysis and education. Major initiatives include:

Energy Lecture Series, Energy Discussion Series, Energy Tours Series, Energy Happy Hours, MIT Energy Night @ the MIT Museum, The MIT Energy Conference. Energy Mentorship Program

<http://www.mitenergyclub.org/>

workshop host organizations

The *Wind Energy Group* of the *MIT Energy Club* is focused on providing opportunities to learn and discuss advances in wind power through unique interaction with members of industry, government, community groups and academia. We focus on all aspects related to wind energy - technology, development, policy, environment and finance - and seek to serve as a central node on campus for wind-related events.

MIT Wind Energy Projects in Action is a project-based organization expressly focused on wind energy - working with constituencies both inside and outside MIT (1) to implement projects that produce renewable energy outcomes and (2) to advance knowledge on use and strategies of such energy approaches through research and educational outreach.



Information about wind @ MIT

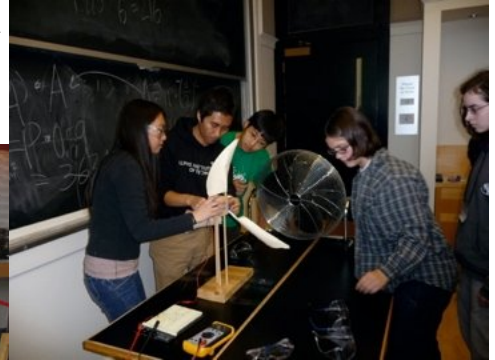
<http://windenergy.mit.edu>

Interest in wind energy technology and research at MIT has led to the formation of two student groups. The Wind Energy Group of the MIT Energy Club is dedicated to promoting awareness and education on the topic of wind energy through a series of lectures, tours, discussions and an annual Wind Week. The MIT Wind Energy Projects in Action is dedicated to the promotion of wind energy research and development through campus and community projects. Highlights of the activities of both groups are shown below and more information can be found on our websites which can be accessed from <http://windenergy.mit.edu>.



A visit to Hull includes a luncheon discussion of their green energy initiatives and potential plans for an offshore wind park.

NRG Systems Inc. loans a Windcube LiDAR for an on-campus project to look at wind resource assessment in complex terrain.



Annual 'Splash' class on wind energy for middle and high school students includes a wind turbine design lab and competition.



Tour of the Hull wind turbine. WEPA met installations including MIT's Briggs Field, Bates facility and Cambridge's Danehy Park.

Wind Week Organizers

Managing Director - Katherine Dykes

Wind 101 Organizer - Alex Kalmikov

Wind Group President and Tour Organizer - Kathy Araujo

Resource Assessment Presentation - Kalyan Veeramachaneni and Cy Chan

Treasurer - Sungho Lee

Webmaster - Alex Teuffer

Workshop Volunteers - Pearl Donohoo, Pamela Silva, Sharon Xu and Minshu Zhan

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