



**technical workshop**

# **Offshore Wind Technology:** ***Today and Tomorrow***

*Friday, April 3<sup>rd</sup> 2009*

# message from the director

April, 2009

Dear workshop participants,

With overseas installations of over 1100MW, offshore wind energy has been established as an important part of Europe's electricity supply mix. With several projects in various stages of planning, offshore wind energy is poised to enter the US scene. Those of us who live in Massachusetts are very familiar with many of the political controversies that may surround offshore wind energy projects. However, with the absence of any installed projects in the water to date, fewer of us are familiar with the actual offshore wind energy technology and the specific design challenges that wind energy faces when it moves from the land-based to marine environment. This workshop will focus on addressing the status, drivers, and challenges that are specific to offshore wind energy technology. Experts from the U.S. and abroad will provide an overview of the different aspects of the environment and technical sub-systems for offshore wind energy technology and then discuss where the industry may be headed going forward. While other conferences on offshore wind energy have been held in the US, we know of no conference or workshop to date that has focused exclusively and in such depth on the topic of offshore wind technology itself.

The MIT Energy Club is proud to work with the MIT Energy Initiative (MITEI), other universities, and industry leaders to hold this pioneering event. The workshop has involved several months of planning with input from MITEI and the American Wind Energy Association (AWEA). This workshop and the entire wind week initiative would not have been possible without the hard work of the mostly student organizers (listed on the back page). We'd also like to extend appreciation to Steve Connors who has served the MIT community as a general advisor for wind energy for many years. Finally, we'd like to recognize all our speakers who made the effort to join us for the workshop and share their expertise with us. We are fortunate to have so many of the US leading experts with us today as well as a few special guests from Europe. A big thanks to everyone who made this event possible and we hope you enjoy the opportunity to hear about the cutting-edge technology in offshore wind energy.

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**
- **The Future of Wind**
- **Poster Session**
- **Workshop**
- **Tour of Hull Community Wind Turbine**

<http://windweek.mit.edu>



## technical workshop

<http://windweek.mit.edu>

## workshop organizers

Managing Director - Katherine Dykes  
Director of Sponsorship and Finance - Malaika Thorne  
Director of Registration and Logistics - Ray Angelone  
Director of Outreach - Ben Glass  
Wind 101 Organizers - Daniel Livengood and Kevin Brokish  
Hull Tour Organizers - Andrew Stern and Anil Rachakonda  
Webmaster - Bryan Palmintier  
MITEI Support Staff - Marissa Blake and Daniel Enderton

## workshop sponsors



## supporting sponsors



## workshop reception sponsor



# workshop agenda

9:00-9:15	<b>Opening Remarks</b> <i>Representative, Massachusetts Institute of Technology Energy Initiative</i>
9:15-9:45	<b>Overview of Planned U.S. Offshore Wind Projects</b> <i>Mr. Peter Mandelstam, CEO of Bluewater Wind</i>
9:45-10:25	<b>Offshore Wind Resources and Forecasting</b> <i>Dr. Bruce Bailey, CEO of AWS TrueWind</i>
10:25-10:40	<i>Networking Break</i>
10:40-11:20	<b>Offshore Design Environment &amp; the IEC 61400-3</b> <i>Prof. James Manwell, University of Massachusetts Amherst</i>
11:20-12:00	<b>Technology R&amp;D-Offshore Turbine Design</b> <i>Dr. Carsten Hein Westergaard, Vestas</i>
12:00-12:50	<i>Lunch</i>
12:50-1:20	<b>History of Offshore Wind-A Look Back to Look Forward</b> <i>Prof. Jim McGowan, University of Massachusetts Amherst</i>
1:20-2:00	<b>Offshore Foundations</b> <i>Prof. Paul Sclavonous, Massachusetts Institute of Technology</i>
2:00-2:40	<b>Drivetrains, Gearboxes &amp; Generators</b> <i>Mr. Daniel McGahn, SVP and General Manager, American Superconductor</i>
2:40-3:00	<i>Networking Break</i>
3:00-3:40	<b>Innovation in Blade Design</b> <i>Mr. Steve Nolet, TPI Composites</i>
3:40-4:20	<b>Turbine Controls and Specific Offshore Concerns</b> <i>Prof. Matthew Lackner, University of Massachusetts Amherst</i>
4:20-4:50	<b>Projects, Installation, Service &amp; BOP</b> <i>Dr. Jim Lyons, Novus Energy Partners</i>
4:50-5:20	<b>Grid Integration</b> <i>Mr. Luis Altiensa Serna, CEO, Red Electrica SA</i>
5:20-5:30	<b>Closing Remarks</b>
5:30-6:30	<i>Wind Workshop Reception</i>

# speaker biographies

**Mr. Peter Mandelstam** is the CEO of *Bluewater Wind*. He began working in the wind industry as a project financing consultant, leveraging his experience in real estate development. Peter worked with Atlantic Renewable Energy Corporation in securing financing for the 30MW Fenner project, New York's third wind farm. In 1997 Peter formed Arcadia Wind Power, which developed the 181 MW Judith Gap project, Montana's first wind farm. He has displayed leadership through advocacy and policy-making in the wind industry, serving on the Board of the American Wind Energy Association (AWEA) for eight years, co-founding and chairing Wind Power New York (now ACENY.org), and actively supporting successful efforts for a Renewable Portfolio Standard in New York and New Jersey. Peter is currently Chair of AWEA's Offshore Wind Working Group. Peter attended Harvard University, was a founder and Executive Director of the non-profit Solar Technology Institute, and serves on the Board of the Greyston Bakery, a non-profit enterprise that creates jobs for disenfranchised residents of the inner-city. A native New Yorker, Peter lives on Manhattan Island with his wife Dawn and son Andrew.

**Dr. Bruce Bailey** is CEO of *AWS TrueWind*. He has been involved in the renewable energy and environmental fields since the 1980s and is one of the world's leading authorities on wind and solar energy applications. He has been the Project Director for hundreds of contracts in the areas of renewable energy technology applications, resource assessment, meteorology, and air quality on behalf of utility, government, and industrial clients. Technology applications include large and distribution scale wind and PV systems; offshore wind project planning; and remote sensing. He has performed management and technical services in site selection, systems integration, engineering analysis, general contracting, due diligence, field measurements, wind flow modeling, wind energy forecasting/scheduling, economic planning, and the validation of value-added benefits. Dr. Bailey is widely published and has made numerous presentations at domestic and international conferences. He was the Program Chair for the AWEA Windpower '95 Conference and was a U.S. Department of Energy Wind Program Reviewer for several years. He was the co-chair of the September 2006 AWEA Resource Assessment Workshop in Syracuse, New York. He has been a thesis mentor and guest instructor for several universities.

**Prof. James Manwell** is on the faculty of the Department Mechanical and Industrial Engineering at the University of Massachusetts at Amherst where he directs the Renewable Energy Research Laboratory (RERL). Working in the wind energy field for over 25 years, his research includes wind resource assessment, hybrid power system design, and offshore wind energy. Since the 1980's, he has been active in the design and modeling of hybrid power systems, including generators, electrical loads, storage units, control systems, and the Hybrid2 computer code. Under his direction, the Renewable Energy Research Laboratory installed the first utility scale wind turbine in Massachusetts in 1994. He assisted the Town of Hull in acquiring a 660kW turbine in 2001, and a 1.8MW turbine in 2006—the largest in New England. He is an author of the textbook [Wind Energy Explained: Theory, Design and Application](#), and works with the Massachusetts Technology Collaborative (MTC) and the Commonwealth of Massachusetts' Division of Energy Resources (DOER). He is the U.S. representative to the International Electrotechnical Commission's program (IEC TC88 WG3) to develop design standards for offshore wind turbines and is a member of the International Science Panel on Renewable Energy.

**Dr. Paul D. Sclavounos** is Professor of Mechanical Engineering and Naval Architecture in the Department of Mechanical Engineering of MIT. The research activities of the Laboratory of Ship and Platform Flows (LSPF) that Professor Sclavounos has directed over the past three decades focus upon the study of hydrodynamic flows around marine vessels and the development of analytical and computational models for the treatment of their responses. The theoretical solution methods obtained from this research have led to the development of the state-of-the-art computer programs SWAN and SML which have been widely adopted by the marine hydrodynamics, ship and offshore design communities worldwide for the analysis of the hydrodynamic performance and design of ships, sailing yachts, offshore platforms, floating wind turbines and the fuel efficient navigation of ships in stochastic environments. Professor Sclavounos has consulted widely for the U.S. Government, maritime, offshore and yachting and wind industries and has led the commercial development and licensing of the SWAN and Swim-Motion-Lines (SML) Software Suites to the maritime and offshore industries. Professor Sclavounos is the author and co-author of over 100 scientific articles, a contributor of the "Computation of Wave Ship Interactions" chapter in *Advances in Marine Hydrodynamics*, Computational Mechanics Publications, 1996 and the editor of the volume *Readings in Marine Hydrodynamics*, 2007.

**Dr. Jon G. McGowan** is a professor at the University of Massachusetts at Amherst. His renewable energy technical expertise includes systems analysis, siting, and resource assessment. He has served as principal or co-principal investigator on three state and national wind energy siting and feasibility studies, taught advanced wind power, solar, and renewable energy systems courses at the UMass-Amherst. Dr. McGowan is a co-principal investigator on current National Renewable Energy Laboratory (NREL) renewable energy contracts including "Wind Energy Curriculum Development," "Optimization Studies of Wind/Diesel Systems" and "Hybrid Power Systems." He has participated in and directed several research projects in renewable energy systems analysis and modeling including wind/solar heating, wind/domestic water heating, wind/Rankine cycle systems and wind/reverse osmosis water desalination systems. He served as a co-principal investigator on the original UMass (1970's) NSF/ERDA/DOE wind heating project and was responsible for the overall system analytical modeling, technical, and economic feasibility phases of this study. He currently serves as a solar/wind system consultant to the U.S. Department of Commerce's Office of Energy Related Inventions. He has published over 90 technical papers and numerous technical reports on renewable energy. He received a B.S. and a Ph.D. in Mechanical Engineering from Carnegie Institute of Technology in 1961 and 1965, and an M.S. in Mechanical Engineering from Stanford University in 1962.

**Dr. Matthew Lackner** is an assistant professor in the mechanical engineering department at the University of Massachusetts at Amherst. His general research focus is on wind energy, including offshore wind energy and smart rotor control. Before coming to the University of Massachusetts at Amherst, Matt did his post-doctoral research at TU Delft in the Netherlands and received his PhD from the University of Mass at Amherst, both focused on wind energy research.

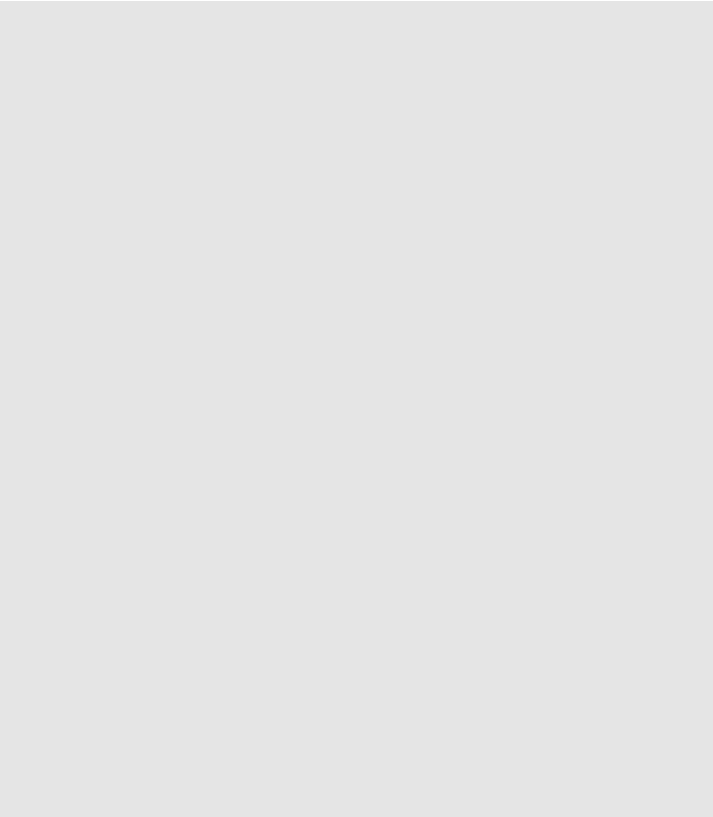
**Mr. Daniel McGahn** is Senior Vice President and General Manager of American Superconductor. He joined AMSC in 2006 and is responsible for the AMSC Superconductors business as well as all Asia/Pacific operations. Utilizing his experience in management, business development and strategy, he is spearheading the commercialization of 344 superconductors and applications. Additionally, in 2007 he established AMSC China, a wholly owned enterprise of AMSC in China focused on manufacturing, sales and service for AMSC products, and continues driving the company's growth in that country and the Asia/Pacific region. From 2003 to 2006, Mr. McGahn served as Executive Vice President and Chief Marketing Officer of Konarka Technologies, a venture-backed developer of polymer photovoltaic technology for renewable power. While at Konarka, he helped significantly boost the company's profile with key external audiences and secure nearly \$40 million in financing. Prior to 2003, Mr. McGahn was General Manager and Chief Operating Officer of Hyperion Catalysis, a world leader in carbon nanotube production and application development, where he managed research and development, product development, manufacturing, sales and operations. He also held managerial positions at IGEN International and Princeton Consultants. A New Jersey native, Mr. McGahn holds M.S. and B.S. degrees in engineering from the Massachusetts Institute of Technology.

**Mr. Steve Nolet** is principal engineer at TPI Composites in Warren, Rhode Island. He manages technical activities in the development of low-cost composite structures for the company's three primary business units: Wind Energy, Military Ground Vehicles, and Transportation Systems. Mr. Nolet also manages the activities of TPI Composite's Physical Sciences Laboratory and is responsible for the characterization and qualification of resins, reinforcements and their composites used in the development and production of composite products across the organization. Prior to joining TPI, Mr. Nolet was Vice President of Engineering for Fiberspar Corporation where he directed the development of spoolable composite tubulars for the oil and gas industry. His previous positions include Director of Engineering at American Composite Technology and Senior Engineer in the U.S. Air Force Advanced Composite Program Office in Sacramento, California. He received his B.S. degree in aeronautical engineering from the Massachusetts Institute of Technology in June of 1982 and completed his Masters of Science from MIT in the same field in 1984. His discipline and course of study focused on application of advanced materials in structural design at both the undergraduate and graduate level. Mr. Nolet's activities have led to the issue of 23 U.S. patents on which he is named as inventor.

**Dr. Carsten Hein Westergaard** finished his PhD titled "PIV measurements of turbulent structures" concerning optical computing and optical flow measurements in 1994 at the Danish Technical University. Part of his research was completed with Prof. Ronald Adrian at University of Illinois. He started his industrial career in wind technology as an aerodynamics blade designer. Through the years, he has been working with fluid and structure dynamics in many different industries. Joining Vestas Technology R&D, he started the Vestas office on the campus of the National Laboratory for Sustainable Energy in Denmark (Risø). Currently, he is assigned to Vestas' new research office in Houston as Global Technology manager, working with University collaborations.

**Luis María Atienza Serna** has served as president of Red Eléctrica de España (REE, the Spanish electric grid system operator) since 2005. He served as the national Minister of Agriculture, Fishing and Nutrition under President Felipe Gonzalez from 1994, and as Secretary General of Energy in 1993. He was Secretary General of the Institute for Nature conservation from 1991. He completed a BS in Economics and the University of Deusto (San Sebastian) with continued studies at the University of Nancy and the Free University of Brussels.

**Dr. James Lyons** serves as the Chief Technology Officer at Novus Energy Partners—a new venture capital firm focused on the creation and growth of clean/renewable energy companies—where he became a founding member in 2008. Prior to joining Novus, Jim had a distinguished 30-year technology career at GE where he was Chief Engineer for Electrical and Electronic Systems at GE Research, serving as technology leader and mentor to a 250-member global team. He was a leading advocate for renewable energy within GE and corporate champion behind then-principal technologist for its wind energy business—GE's most successful startup revenues in 2008 of \$6B+. He was also the technology leader behind the creation of GE's Digital Energy business unit in 2000. Most recently, he led new business/technology initiatives on waste gasification, plug-in hybrid vehicles, lithium technology batteries, and thin-film Si-PV. Jim has served on the board of directors of Powerex, the Electric Drive Trade Association, and Nordic Windpower. He was co-chair of the 2006 American Wind Energy Conference and an initiator of the AWEA/DOE roadmap to generate 20% of U.S. electricity from wind. Jim has a BSEE degree from Rensselaer Polytechnic Institute, an MSEE from Virginia Tech, and a Ph.D. from Cornell University.



## about the MIT energy club wind sub-community

Our group's mission is to bring together persons within the MIT and greater Cambridge community who are interested in all aspects related to wind energy: technology, development, policy, environment and finance.

We seek to serve as a central node on campus for wind related events and to support the activity of other MIT energy club chairs who are interested in planning wind related events.

In addition, we seek to educate and communicate information about wind to MIT and the larger Cambridge community.

# sponsors



The Renewable Energy Trust seeks to maximize environmental and economic benefits for the Commonwealth's citizens by pioneering and promoting clean energy technologies and fostering the emergence of sustainable markets for electricity generated from renewable sources. The Trust provides financial assistance to individuals and businesses for solar panels and wind turbines at their homes and facilities, works with communities to incorporate green design into schools, helps emerging clean energy businesses flourish in the Commonwealth, and much more.

<http://www.masstech.org>



North American Windpower magazine is the leading wind energy publication serving the continent. With record growth in the wind energy market, readers count on North American Windpower to provide informative analysis of the latest trends in the wind industry. And since 2004, North American Windpower has been providing industry news, technical innovations, business growth, new project development and government and regulatory action updates to our readers each month through our printed magazine and 24 hours a day on [www.NAWindpower.com](http://www.NAWindpower.com).

<http://www.NAWindpower.com>



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/>



<http://web.mit.edu/mit ei>



<http://www.renewableenergyworld.com>