2022 SANDIA BLADE WORKSHOP

October 17-20, 2022

Sandia National Laboratories

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WELCOME & OVERVIEW

Thank you for joining us at the 2022 Sandia Blade Workshop.
The wind energy departments at Sandia and I are excited to welcome you to Albuquerque, NM, to discuss wind turbine blades and more. We have not been able to host a workshop since the 2018 Sandia Blade Workshop in Lubbock, Texas, so we have a lot to catch up on!

At this workshop, we want to bring together wind industry experts, wind farm stakeholders and operators, manufacturers, and researchers to address the major topics for wind turbine blades, facilitate interaction and networking among the attendees, and identify future technology pathways.

We look forward to seeing you in-person to connect, exchange ideas, and explore the latest in wind turbine blade research and development. I'd like to thank all our panelists and speakers for their expertise and contributions in making this event possible.

Chris Kelley
2022 Sandia Blade Workshop General Chair

EVENT MAP & VENUE INFORMATION

HOTEL ALBUQUERQUE
at old town

800 Rio Grande Blvd.
Albuquerque, New Mexico 87104

AGENDA AT A GLANCE

TIME		SESSION	ROOM
MONDAY, OCTOBER 17TH			
10:00–12:00	●	Check in	East Atrium
10:30–12:00	●	Wind Turbine Blade Standards	Alvarado H
12:00–13:00	○	Lunch	South Atrium
13:00–15:00	●	Advanced Manufacturing System Integrated Tip	Alvarado FG
13:00–15:00	●	Scaled Rotor Testing and Microgrid	Alvarado H
15:00–15:30	○	Afternoon Break	South Atrium
15:30–17:30	●	Energy Equity and Environmental Justice	Alvarado FG
17:30–18:00	●	Check in	East Atrium
TUESDAY, OCTOBER 18TH			
07:30–08:30	●	Check in	East Atrium
07:30–08:30	○	Breakfast	Alvarado D
08:30–10:00	●	Opening Session	Alvarado EFGH
10:00–10:30	○	Morning Break	East Atrium
10:30–12:00	●	The Path to 100% Carbon-Free Electricity in New Mexico	Alvarado EFGH
12:00–13:00	○	Lunch	Portal/Pavilion
13:30–15:00	●	High Value Rotor Design	Alvarado EFGH
15:00–15:30	○	Afternoon Break	East Atrium
15:30–17:00	●	Owners and Operators	Alvarado EFGH
18:00–20:00	○	Reception	Portal/Pavilion

- ● Registration
- ○ Meal/Break/Reception
- ● Side Meeting
- ● Plenary
- ● Panel Discussion
- ● Podium Presentations

TIME		SESSION	ROOM
WEDNESDAY, OCTOBER 19TH			
07:30–08:30	○	Breakfast	Alvarado D
08:30–10:00	●	Data Analytics and Artificial Intelligence	Alvarado E
08:30–10:00	●	Reliability and Repairs	Alvarado FGH
10:00–10:30	○	Morning Break	East Atrium
10:30–12:00	●	Aerodynamics, Power Performance, and Wakes	Alvarado E
10:30–12:00	●	Materials and Manufacturing	Alvarado FGH
12:00–13:00	○	Lunch	Portal/Pavilion
13:30–15:00	●	Controls and Sensors	Alvarado E
13:30–15:00	●	Offshore and Large Rotors	Alvarado FGH
15:00–15:30	○	Afternoon Break	East Atrium
15:30–17:00	●	Future Rotor Technology	Alvarado E
15:30–17:00	●	Blade Modifications	Alvarado FGH
17:00–17:30	●	Closing Remarks and Feedback	Alvarado E
17:00–17:30	●	Closing Remarks and Feedback	Alvarado FGH
THURSDAY, OCTOBER 20TH			
07:30–08:30	○	Breakfast	East Atrium
08:30–12:00	●	Blade Reliability	Alvarado H
08:30–12:00	●	NuMAD Software Training	Alvarado FG
10:00–10:30	○	Morning Break	East Atrium
12:00–13:00	○	Lunch	East Atrium
13:00–15:00	●	Blade Recycling	Alvarado FG

- Registration
- Meal/Break/Reception
- Side Meeting
- Plenary
- Panel Discussion
- Podium Presentations

DETAILED AGENDA

TIME	SESSION	SPEAKERS
TUESDAY, OCTOBER 18TH		
08:30–09:00	**Opening Session** Session Chair: Chris Kelley	Chris Kelley *(Sandia National Laboratories)*
09:00–09:30		Matthew Malkin *(DNV)*
09:30–10:00		Ben Hallissy *(US Department of Energy)*
10:30–12:00	**The Path to 100% Carbon-Free Electricity in New Mexico** Moderator: Charles Hanley Session Chair: Michelle Williams	Cabinet Secretary Sarah Cottrell Propst *(State of New Mexico)*
		Stan Atcitty *(Sandia National Laboratories)*
		Nicholas Phillips *(Public Service Company of New Mexico)*
		Stephen Gomez *(Santa Fe Community College)*
		Johnny Casana *(Pattern Energy Group)*
13:30–15:00	**High Value Rotor Design** Moderator: Josh Paquette	James Martin *(Gulf Wind Technology)*
		John Korsgaard *(LM Wind Power)*
		Kevin Standish *(Envision)*
		Anurag Gupta *(CREADIS)*
15:30–17:00	**Owners and Operators** Moderator: Carsten Westergaard	Jeffrey Hammitt *(NextEra Energy Resources)*
		Ken Lee *(EDF Renewables)*
		Alexander Perry *(Northland Power)*
		Birgit Junker *(RWE Renewables)*
		Stanton Peterson *(BP Alternative Energy)*

TIME	SESSION	SPEAKERS
WEDNESDAY, OCTOBER 19TH		
08:30–09:00	**Data Analytics and Artificial Intelligence** Session Chair: Carsten Westergaard	Ben Schmuhl *(HUVR)*
09:00–09:30		Edward Stewart *(RWE Renewables)*
09:30–10:00		Ken Lee *(EDF Renewables)*
08:30–09:00	**Reliability and Repairs** Session Chair: Michelle Williams	Noah Myrent and Liliana Haus *(EPRI)*
09:00–09:30		Matt Malkin *(DNV)*
09:30–10:00		Kyle Wetzel *(Wetzel Wind Energy Services)*
10:30–11:00	**Aerodynamics, Power Performance, and Wakes** Session Chair: David Maniaci	Alexander Perry *(Northland Power)*
11:00–11:30		Jonathan Naughton *(University of Wyoming)*
11:30–12:00		Lawrence Cheung *(Sandia National Laboratories)*
10:30–11:00	**Materials and Manufacturing** Session Chair: Brandon Ennis	Stephen Nolet *(TPI Composites)*
11:00–11:30		Lars Hedegaard *(Siemens Gamesa)*
11:30–12:00		Bob Norris *(Oak Ridge National Laboratory)*
13:30–14:00	**Controls and Sensors** Session Chair: Chris Kelley	Mo Dua *(WindESCo)*
14:00–14:30		Mario Rotea *(University of Texas at Dallas)*
14:30–15:00		Nils Lesmann *(Phoenix Contact)*
13:30–14:00	**Offshore and Large Rotors** Session Chair: Brandon Ennis	Jacques Nader *(Siemens Gamesa)*
14:00–14:30		John Korsgaard *(LM Wind power)*
14:30–15:00		David King *(Gulf Wind Technology)*
15:30–16:00	**Future Rotor Technology** Session Chair: Josh Paquette	Pietro Bortolotti *(NREL)*
16:00–16:30		Todd Griffith *(University of Texas at Dallas)*
16:30–17:00		Ike Udoh *(Kent Houston Offshore Engineering)*
15:30–16:00	**Blade Modifications** Session Chair: Carsten Westergaard	Katelyn Reynolds *(Invenergy)*
16:00–16:30		Ryan Said *(Vaisala)*
16:30–17:00		Javier Ozores Arconada *(Bladena)*

SIDE MEETINGS

Wind Turbine Blade Design Standards

Monday October 17, 10:30 – 12:00
Room: Alvarado H

Discuss current and future updates to the IEC 61400-5 Blade Design standard.

Advanced Manufacturing System Integrated Tip

Monday October 17, 13:00 - 15:00
Room: Alvarado FG

The AMSIT project is seeking to use advanced manufacturing to produce and fly a winglet at the SWiFT facility. This meeting will serve as a general introduction to the AMSIT project for any interested conference participants. If sufficient representation of the External Advisory Board is present, this will also serve as a second EAB meeting. Feedback on (nearly) completed project components (aerodynamic design, structural design, field test plan) will be sought from all participants. Ongoing topics (lightning protection, leading-edge erosion, technoeconomic analysis and scale-up considerations) will be introduced and discussed, time permitting.

Scaled Rotor Testing and Microgrid

Monday October 17, 13:00 - 15:00
Room: Alvarado H

This meeting will provide a high-level overview of the SWiFT facility, including site capabilities, current and planned research, and the GLEAMM microgrid. SWiFT is Sandia's scaled wind farm technology center in Lubbock, Texas. The site consists of 3 Vestas V27 turbines. Additionally, feedback from those in attendance will be solicited.

Energy Equity and Environmental Justice

Monday October 17, 15:30 - 17:30
Room: Alvarado FG

This meeting will provide a high-level overview of Energy Equity and Environmental Justice (EEEJ) issues at multiple scales and in multiple contexts. Given the expected diversity of the audience, we will not go into too much detail on any specific aspect of EEEJ, but rather hope to provide some common basis for a constructive discussion and knowledge-share for participants to learn from each other.

Blade Reliability

Thursday October 20, 8:30 - 12:00
Room: Alvarado H

This will be a meeting of blade experts across the wind industry to discuss pressing issues in blade reliability. The current work of the Blade Durability and Damage Tolerance project will be reviewed. Participants are invited to give feedback on the direction and progress of the project. This feedback will be collected into a report to DOE.

NuMAD Software Training

Thursday October 20, 08:30 - 12:00
Room: Alvarado FG

NuMAD (Numerical Manufacturing and Design) v3.0 is an open-source software tool which simplifies the process of creating a three-dimensional model of a wind turbine blade. The new version has recently been released and is structured to be run from a scripting environment and easily called by optimization processes. NuMAD v3.0 has been successfully implemented for optimization of large, flexible rotor blades, and is available for public use and development. This session will provide an introduction and demonstration of the software.

Blade Recycling

Thursday October 20, 13:00 - 15:00
Room: Alvarado FG

This meeting will serve as a general introduction to the recently funded Wind Turbine Recycling Assessment project. The meeting will provide a summary of the analysis plan for assessment of wind turbine blade recycling technologies and seek feedback from participants on the proposed plan and technology approaches being studied. Outcomes of this meeting are to provide an overview of the project plan, seek input on a list of technology approaches to be prioritized and assessed, and to receive task-specific and open-ended feedback regarding the project tasks and objectives.

EXHIBITORS

During the workshop, the exhibitor booths will be located in the East Atrium.

Booth	Exhibitors
1	Lightning Diversion Systems
2	UTD Wind
3	Wetzel Wind
4	Luna Innovations
5	Hexion
6	Aerones
7	Phoenix Contact
8	Bladena
9	DEHN
10	WindSTAR

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ABOUT THE SPEAKERS

JAVIER OZORES ARCONADA

Javier Ozores Arconada is the Blade and Operations and Management Engineer, MSc Wind Energy, at Baldena. His work includes risk analysis on wind turbine blade´s operations and management strategies, leading edge erosion assessment, and structural failure modes on blades.

STAN ATCITTY

Dr. Stan Atcitty received his BS and MS degree in electrical engineering from the New Mexico State University in 1993 and 1995, respectively. He received his PhD from Virginia Tech University in 2006. He is presently a Distinguished Member of Technical Staff at Sandia National Laboratories in the Energy Storage Technology & Systems department. He has worked at Sandia for over 25 years. His research interest is the power electronics necessary for integrating energy storage and distributed generation with the electric utility grid. He leads the power electronics subprogram as part of the DOE Office of Electricity Energy Storage Program.

ABOUT THE SPEAKERS

PIETRO BORTOLOTTI

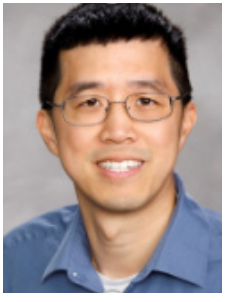
Pietro Bortolotti leads the U.S. Department of Energy–funded Big Adaptive Rotor and AMERICA projects, both focused on the next generation of land–based wind turbine technology. Pietro actively develops models for the multidisciplinary design, analysis, and optimization of wind turbines with a focus on rotor design.

JOHNNY CASANA

Johnny Casana is a Director of Strategy with Pattern Energy, one the country's largest renewable energy companies. Mr. Casana has developed over 4,500 MW of wind and solar energy facilities and transmission lines, including the largest wind project in US history, New Mexico's Western Spirit, and he is on the team developing an additional 3,600 MW of New Mexico wind along with the 515-mile SunZia HVDC line. Mr. Casana's company, Pattern Energy, operates more than 6,000 MW of wind, solar, and energy storage facilities as well as high voltage transmission lines. He has more than fifteen years' experience in the clean power industry and is a recognized leader in the field, having served in leadership for national organizations such as the American Clean Power Association, and as a clean energy voice for international delegations to Mexico, the United Nations, and the Vatican. Prior to his work in the private sector, Mr. Casana was an anthropologist for the US Government with a focus on Latin America.

ABOUT THE SPEAKERS

LAWRENCE CHEUNG



Lawrence Cheung is a member Sandia National Laboratories' Thermal/Fluids Science and Engineering department with expertise in high-fidelity simulation and modeling of wind turbines and wind farms. He is a member of the DOE A2e ExaWind and High-Fidelity Modeling projects and is also an active member in collaborations with NREL and industry on wind farm modeling and tools development.

MO DUA

Mo Dua worked for renewable energy independent power producers (IPPs) on project development and operations for eight years before founding WindESCo in 2014. WindESCo is an analytics company actively optimizing wind plant performance for over 40 customers in 13 countries globally. Mo is passionate about leveraging data and Industrial Internet of Things (IIoT) to help wind plant owners increase plant performance.

ABOUT THE SPEAKERS

STEPHEN GÓMEZ

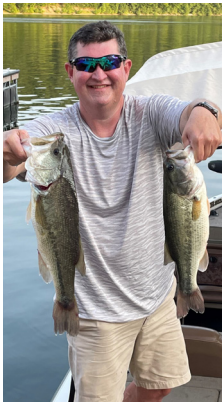
Stephen Gómez is a native New Mexican and land grant heir. He obtained a BS in Biology from the California Institute of Technology and holds a PhD in Molecular, Cell and Developmental Biology from the University of California–Los Angeles (UCLA). Dr. Gomez is a two–time Ford Fellow: one in biochemistry at UCLA and the other in botany at University of Wyoming. Currently, he is an assistant professor and chair of the Advanced Technologies and Sustainability Department (TATC) at Santa Fe Community College (SFCC).

Dr. Gómez started his career in the biomedical field with appointments at the Department of Molecular Biotechnology, University of Washington; Department of Oncology, Children's Hospital of Los Angeles; Pasarow Mass Spectrometry Laboratory, David Geffen School of Medicine, UCLA; and the Respiratory Immunology and Asthma Program, Lovelace Respiratory Research Institute. Before joining the faculty at SFCC in 2014, he taught at UCLA, University of Washington, University of Wyoming, University of New Mexico and Central New Mexico Community College.

At SFCC, he has developed a college curriculum for algae cultivation under contract to the U.S. Department of Energy/Algae Foundation and helped to establish the controlled environment agriculture and distributed energy technologies programs. The TATC is now ~50% energy sovereign and has the only solar–powered Welding and Controlled Environment Agriculture workforce training programs in the world.

ABOUT THE SPEAKERS

D. TODD GRIFFITH



Dr. D. Todd Griffith is an Associate Professor of Mechanical Engineering at the University of Texas at Dallas (UT–Dallas), where he also serves as Deputy Director of the UTD Center for Wind Energy. His research contributions are in the areas of wind turbine design and structural dynamics with a focus on developing new technologies to enable cost–effective, reliable, and large–scale wind energy systems, including new wind turbine rotor designs for land–based and offshore siting, floating vertical axis wind turbines, and digital twin technologies for wind energy. Prior to joining UT–Dallas, Todd was a staff member at Sandia National Laboratories in the Wind Energy, Water Power, and Structural Dynamics departments.

BEN HALLISSY

Ben Hallissy leads a portfolio of research and development (R&D) activities within the Wind Energy Technologies Office at the U.S. Department of Energy (DOE). The portfolio focuses on improving wind farm performance and reducing cost through innovations in aerodynamics, loads, and controls, and aims to mitigate the impact of current and future wind turbine installations on military and civilian radar infrastructure. Prior to DOE, he was a senior engineer on the wind turbine aerodynamics and acoustics team at General Electric Renewable Energy, working across the product development cycle, including airfoil design, wind tunnel testing, blade conceptual design, and wind turbine field validation. Before joining the wind industry, he worked as an aerospace engineer for Naval Air Systems Command (NAVAIR), the U.S. Navy's aviation enterprise.

ABOUT THE SPEAKERS

CHARLES HANLEY

Charles Hanley is Senior Manager of the Grid Modernization and Energy Storage Group at Sandia National Laboratories. His group conducts research on enhancing the resilience of our critical energy infrastructures, including grid–scale optimization, controls, and microgrids; energy storage technologies; renewable energy integration; power electronics; cyber security; and advanced analytics for complex systems. He joined Sandia in 1988, and has been working in Sandia's renewable energy and electric grid programs since 1994. From 2005 through 2014, Charlie managed Sandia's Photovoltaics and Distributed Systems Integration Program. Prior to that, he managed Sandia's international renewable energy programs, where he oversaw the implementation of more than 400 photovoltaic and wind energy systems in Latin America. He received his BS in Engineering Science from Trinity University in San Antonio, Texas, and his MS in Electrical Engineering from Rensselaer Polytechnic Institute, in Troy, New York.

JEFFREY HAMMITT

Jeffrey Hammitt is the Staff Technical Specialist in NextEra Energy Resource's Engineering and Operations Support Renewables organization. He leads the Blades & Structures team, responsible for technical support related to blade, tower, and foundation issues. Jeffrey has more than 30 years of experience in engineering, design, and construction in the power industry.

ABOUT THE SPEAKERS

LILIANA HAUS

Lili Haus is a member of the Wind Generation Program at the Electric Power Research Institute (EPRI). Her research focuses on applications of data analytics in wind energy to support the advancement of wind turbine performance and operation.

LARS HEDEGAARD

Lars Hedegaard is the manager for Structural Blade Design Team in Boulder, Colorado. He has more than 10 years of experience within structural blade design, new material and technology evaluation, blade prototype manufacturing, and certification.

ABOUT THE SPEAKERS

CHRIS KELLEY

Chris Kelley is the General Chair for the 2022 Sandia Blade Workshop. As member of the Wind Energy Design and Experimentation department at Sandia National Laboratories, he leads various projects involving experimental testing of wind turbines. His recent research focuses on measuring inflow, turbine performance, aerodynamics, and wakes in the Rotor Aerodynamics, Aeroelastics, and Wake (RAAW) project and the National Rotor Testbed (NRT) project to validate high fidelity and aeroelastic wind turbine models at Sandia and with commercial partners. Chris has experience using aeroelastic simulations to design new wind turbine blades, field campaigns, and estimate uncertainty. Chris has significant experience with wind tunnel testing and aerodynamic instrumentation. He was issued a patent for a small wake wind turbine blade design and enjoys studying innovative blade concepts like low induction rotors.

ABOUT THE SPEAKERS

DAVID KING

David King is an engineer and entrepreneur. He is co-founder and CTO of Gulf Wind Technology, a wind turbine innovator, and a composite designer. He has designed wind turbine blades deployed in China, India, Europe, and North America. He has worked on blade design for both offshore and onshore projects, including typhoon class blades that have been successfully deployed and maintained operation post named storm. He looks forward to solving a similar challenge in the Gulf of Mexico with the added challenge of low wind speed turbulent environments.

David grew up in South Texas working on and flying in general aviation aircraft. Flying sparked his interest in composites and the power of air. He co-founded Gulf Wind Technology with the mission of growing and catalyzing the offshore wind energy industry for the Gulf South. At Gulf Wind Technology he strives to develop the collaboration across industry required to bring about innovative solutions that will unlock the green electron for the gulf coast.

JOHN KORSGAARD

John Korsgaard has worked with wind turbine blades at LM Wind Power since 1990. He has a MSc degree in Mechanical Engineering from Aalborg University, Denmark. He has had various positions in the research and development department at LM Wind Power and is currently responsible for the Advanced Technology Development and Chief Engineering department.

ABOUT THE SPEAKERS

KEN LEE

Ken Lee received BS and MS Aerospace Eng. degrees from the University of Kansas and has spent 13 years in the wind industry. Ken's expertise covers manufacturing, testing, and certification of rotor blades, including in–factory/in–field inspections and repairs, RCAs, and NCR dispositions.

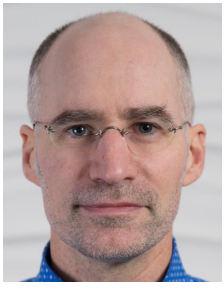
Currently, Ken leads performance and reliability engineering support for EDF's fleet, as a subject matter expert leading RCAs and improving long–term blade health management. He has held several positions in blade engineering, starting at Wetzel Engineering and Envision Energy for a combined 10 years, as blade product technical lead, structural composites designer, and project manager of advanced technologies. Ken later joined SkySpecs, as Senior Solutions Blade Engineer, providing blade domain expertise in uncovering damage insights from drone images and operations and management data, to support owner–operators in repair planning and blade asset management. Prior to joining EDF, Ken was COO at WindCom, where he led blade services' engineering and field operations team in delivery of composite repairs and blade maintenance.

NILS LESMANN

Nils Lesmann has spent much of his career in the wind sector and for the last 14 years has worked with Phoenix Contact. Starting as application engineer, he is now in charge for the blade monitoring platform called "Blade Intelligence."

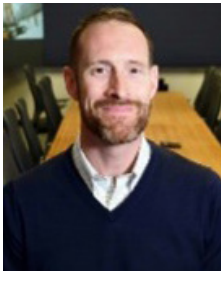
ABOUT THE SPEAKERS

MATT MALKIN



Matt Malkin has 27 years of engineering experience and 14 years of experience in wind energy with a focus on blade technology. He has led multiple blade failure investigations, turbine failure investigations, and field assessments of blade damage. He has conducted multiple blade manufacturing quality surveys in blade factories in North and South America, Europe, and Asia. Mr. Malkin was the lead author on a recent EPRI study regarding blade damage categorization.

JAMES MARTIN



James Martin is co-founder and CEO of Gulf Wind Technology, based at the historic Avondale Shipyard in Louisiana. One of company's established objectives is to develop and demonstrate technologies that will de-risk wind power in complex wind environments, through innovations in safety, rotor design, and system operation in peak wind events such as hurricanes. James moved from the UK to Louisiana in 2010 to establish one of the world's most advanced manufacturing and technology centers for wind turbine blades, based at the National Aeronautics and Space Administration campus in New Orleans. He has led innovation in the field of large rotors, including development of industrialized lightweight fully modular composite joints and demonstrated high throughput manufacturing-led-designs for both the onshore and offshore wind segments. James holds a BSc degree in Design and Technology from the University of Plymouth and an MBA from the Freeman Business School at Tulane University.

ABOUT THE SPEAKERS

NOAH MYRENT

Noah Myrent is a senior technical leader in the Wind Energy Research and Development Group at the Electric Power Research Institute (EPRI). His research focuses on the development of novel wind turbine digitalization and data analysis techniques that lead to actions for improved reliability, production, and cost-effectiveness of wind energy; and collaborative development of technologies that may have applications across the electric power industry.

Prior to joining EPRI in 2021, Noah headed ONYX Insight's global condition monitoring program where his team provided advanced warning on thousands of wind turbine component faults across the globe. Prior to that, Noah was a research scientist and wind energy research lead for the Vanderbilt Laboratory for Structural Integrity and Reliability. Noah's background includes structural dynamics, advanced signal processing, prognostic analytics, data fusion techniques, algorithm development and sensitivity analysis.

Noah holds a master's in Mechanical Engineering from Purdue University, where he performed his thesis research on wind turbine rotor blade fault detection. Noah also earned his bachelor's degree in Acoustical Engineering from Purdue University.

ABOUT THE SPEAKERS

JACQUES NADER

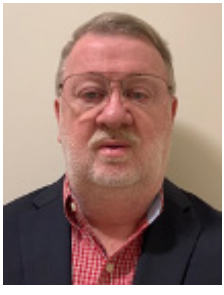
Jacques Nader is the head of Siemens Gamesa's Global Research and Development (R&D) Center located in Boulder, Colorado, and the head of Blade Design. The Boulder R&D Center is a world-class innovation center for wind energy and blade design. Over the last 10 years, Jacques played a critical role in shaping and leading the growth of this global R&D center. Jacques has MS degrees in Mechanical Engineering, Civil Engineering, and Business Administration from the University of Maine.

STEPHEN C. NOLET

Stephen C. Nolet serves as Senior Director for Innovation and Technology at TPI Composites and has nearly 20 years of activity supporting utility-scale wind energy. In his role at TPI, he manages the companies external research and development efforts. Recently, his focus has centered on creating a truly sustainable Circular Economy for end-of-life fiber reinforced composites and specifically, the growing number of decommissioned wind turbine blades.

ABOUT THE SPEAKERS

BOB E. NORRIS



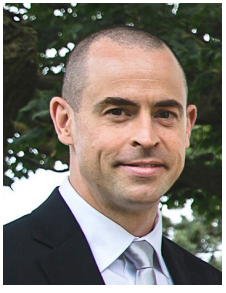
Bob E. Norris joined Oak Ridge National Laboratory in 1983, working in composite materials development and evaluation for advanced gas centrifuge applications. He has led a variety of initiatives in materials and process development for missions of interest to the U.S. Department of Energy and other federal agencies largely focused on enhancing and demonstrating cost-effective performance. Much of his focus in the last decade has been on alternative approaches to manufacturing composites with lower cost carbon fiber.

JOSH PAQUETTE

Josh Paquette is a member of the Wind Energy Design and Experimentation department at Sandia National Laboratories. He currently leads wind turbine design and reliability research efforts within the group, including the U.S. Department of Energy-sponsored Blade Reliability Collaborative and the National Rotor Testbed project. He is also responsible for safety systems on Sandia's V27 test turbines at the Scaled Wind Farm Technology (SWiFT) site. Josh received a master's degree in Engineering Mechanics from the University of Texas at Austin.

ABOUT THE SPEAKERS

ALEX PERRY



Alex Perry has been responsible for monitoring and optimizing the physical performance of Northland Power's operating North American wind, solar, and thermal generation assets since 2014. This includes evaluating, planning, and executing projects to upgrade, enhance, and/or repair operating wind turbine equipment to optimize yield and minimize operating risks, as well as advising on new projects and M&A due diligence.

NICHOLAS PHILLIPS

Nick Phillips manages the PNM Resource Planning department and is responsible for developing PNM resource plans and the regulatory filings to support those resource plans. Prior to joining PNM, Mr. Phillips was involved with numerous regulated and competitive electric service issues, including resource planning, transmission planning, production cost analysis, electric price forecasting, load forecasting, class cost of service analysis, and rate design. Mr. Phillips received the Degree of Master of Engineering in Electrical Engineering with a concentration in Electric Power and Energy Systems from Iowa State University of Science and Technology, and the Degree of Master of Science in Computational Finance and Risk Management from the University of Washington Seattle.

ABOUT THE SPEAKERS

SARAH COTTRELL PROPST

Sarah Cottrell Propst was appointed by New Mexico Governor Michelle Lujan Grisham to serve as the Cabinet Secretary of the Energy, Minerals and Natural Resources Department (EMNRD) in January 2019.

EMNRD's divisions include Energy Conservation & Management, Forestry, Mining & Minerals, Oil Conservation, and State Parks. From 2012 to 2018, she served as the Executive Director of the Interwest Energy Alliance, a non-profit trade association that represents the nation's leading companies in the renewable energy industry, bringing them together with non-governmental organizations in the West (Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming).

She is the founder of Propst Consulting LLC, specializing in energy and environmental policy. She was Deputy Cabinet Secretary of the New Mexico Environment Department after serving as Energy and Environmental Policy Advisor to New Mexico Governor Bill Richardson. She earned a Master of Public Affairs from Princeton University's Princeton School of Public & International Affairs, with a concentration in Science, Technology, and Environmental Policy. She worked as a Research Fellow for the Pew Center on Global Climate Change in Arlington, VA, and was a magna cum laude graduate of Davidson College with Honors in Political Science.

ABOUT THE SPEAKERS

KATELYN REYNOLDS

Since joining Invenergy in 2015, Katelyn Reynolds has been the company's subject matter expert in blade reliability. She has led a number of blade reliability improvement programs, including qualifying third-party blade contractors, developing in-house repair capabilities, and implementing quality control programs. Further, she has led pilot projects for LEP, ice mitigation, unmanned internal and external blade inspections, and conditional monitoring to prolong the life of the blades. Katelyn manages a team that analyzes trends in damage and repair to improve asset management costs and long-term blade performance. She holds certifications for composite repair and the Federal Aviation Administration's Part 107 certificate for commercial drone operations.

MARIO A. ROTEA

Mario A. Rotea is the director of UTD Wind, a center created at University of Texas-Dallas for the advancement of wind energy science and engineering. He is cofounder of WindSTAR, a National Science Foundation (NSF) Industry University Cooperative Research Center aimed at bringing together academia and industry to advance wind energy through industry-relevant research. Rotea has over 30 years of experience in the development of advanced methods for control systems design, and their application to chemical processes, helicopters, gas turbines, machine tools and wind energy systems. He is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for contributions to robust and optimal control of multivariable systems.

ABOUT THE SPEAKERS

KEVIN STANDISH

Kevin Standish earned his master's degree in Mechanical and Aeronautical Engineering from the University of California at Davis. He has spent his career in wind turbine blade design and technology research and development in several different roles. He spent five years with General Electric as an aerodynamic designer and CFD developer, seven years with Siemens as the head of their Blade Center of Excellence, and has spent the last seven years as the Director of Envision's Global Blade Innovation Center in Boulder, Colorado.

IKPOTO "IKE" UDOH

Dr. Ikpoto ('Ike') Udoh is a Principal Ocean Engineer with Kent Houston Offshore Engineering (KHOE) and has about 15 years of experience in the civil and offshore engineering industry. Dr. Udoh obtained his bachelor's degree in Civil and Environmental Engineering from the University of Port Harcourt, Nigeria, and his master's and doctorate degrees in Ocean Engineering from Texas A&M University, College Station, TX. He has been very active in offshore wind energy over the past 10 years, fulfilling leading roles in several world-class floating wind projects. At K-HOE, Dr. Udoh is a team leader in the floating offshore renewables group, an active researcher, and has published several technical papers in renewable energy and offshore engineering. Dr. Udoh is the Principal Investigator of a major DOE ARPA-E -funded FOWT project – "Scale Model Experiments for 15 MW FOWTs". He has also made valuable professional contributions to the industry, working in several diverse groups. Currently, he is serving as a member of the Ocean Engineering committee of COPRI ASCE, and as Chair of the SNAME Offshore Symposium under the Texas Section of SNAME for the third year consecutively.

ABOUT THE SPEAKERS

CARSTEN H. WESTERGAARD

Dr. Carsten H. Westergaard is a senior advisor (contractor) to Sandia National Laboratories, who has 25 years of industrial experience in wind energy research and product development. In his career, he has participated in numerous innovative projects building and testing small and large utility-scale wind turbines with companies such as LM Wind Power and Vestas Wind Systems. As a consultant, he has worked with many other companies, original equipment manufacturers (OEMs) as well as owners and operators. During his tenure as Professor of Practice at Texas Tech University, he taught wind energy technology courses, invented a novel motionless wind and water turbine concept, called Aeromine.

KYLE K. WETZEL

Dr. Kyle K. Wetzel has worked in the wind energy industry since 1993, and currently works as an independent engineering consultant focusing on rotor blades. Wetzel holds a PhD in Aerospace Engineering from the University of Kansas, is a Fellow of the American Society of Mechanical Engineers (ASME), and an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA). He currently serves as the Technical Advisor for the International Electrotechnical Commission (IEC) TC88 U.S. Technical Advisory Group (USTAG). He has published more than 70 conference and journal papers and holds 14 patents on wind turbine technology.

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