



Grid Integration of Renewables Workshop

Thursday, January 13, 2011

STANFORD UNIVERSITY

Jen-Hsun Huang Engineering Center, Mackenzie Room

Event Co-Chairs

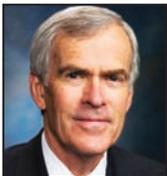
Mark Jacobson

Director, Atmosphere/Energy Program
Professor of Civil and Environmental Engineering
Stanford University

Stacey Bent

Director, TomKat Center for Sustainable Energy
Professor of Chemical Engineering
Stanford University

Keynote Speakers



U.S. Senator Jeff Bingaman, New Mexico

Senator Bingaman was elected New Mexico Attorney General in 1978. In 1982, he won election to the United States Senate, and in 2006, was re-elected to serve a fifth term. Senator Bingaman is the Chairman of the Senate Energy and Natural Resources Committee. He serves on the Finance Committee, where he chairs the Subcommittee on Energy, Natural Resources and Infrastructure. He also serves on the Subcommittee on International Trade and Global Competitiveness and the Subcommittee on Health Care. Senator Bingaman attended Harvard University and earned a Bachelor of Arts degree in government in 1965. He then entered the Stanford University School of Law, graduating in 1968.

Senator Bingaman's introduction will be by Dan Reicher, Executive Director of the Steyer-Taylor Center for Energy Policy and Finance, Professor in the Stanford Law School, and Lecturer in the Stanford Graduate School of Business.



Commissioner Jeffrey Byron, California Energy Commission

Byron was appointed to the California Energy Commission by Governor Arnold Schwarzenegger in June 2006. Commissioner Byron represents the public-at-large with over 30 years of experience in the electric power industry and over 10 years of service assisting customers in meeting their energy needs. He currently serves as Presiding Member of the Energy Commission's Research, Development, and Demonstration Committee and the Transmission and Regional Planning Committee. Prior to his appointment, he served as president of Byron Consulting Group, developing strategic energy solutions for mid to large-sized firms since 2002. Commissioner Byron received a Bachelor and a Master of Science degree from Stanford University.

Large-Scale Integration of Renewables



Gregor Czisch, Transnational Renewables, Germany

The Supergrid: 100% Renewable Electricity Supply for Europe and Its Neighborhood

Czisch is a fully qualified agriculturist and studied physics at Munich Technical University, specializing in energy supply. He wrote his Ph.D. in electrical engineering on scenarios for a future electricity supply with renewable energies. Since 1987, he has worked on various energy-related topics at Munich TU, the DLR Stuttgart, the Fraunhofer ISE in Freiburg, and the Max Planck Institute for Plasma Physics (IPP) in Garching. His areas of focus are solar building engineering, biomass, wind energy and hydropower, primary energy emissions, high temperature storage, and solar thermal.



Mark Jacobson, Stanford University

Grid Integration Challenges for 100% Conversion to Wind and Solar Power

Jacobson is a Professor at Stanford University in Civil and Environmental Engineering as well as, by courtesy, Energy Resources Engineering, director and co-founder of Stanford's Atmosphere/Energy Program, and a Senior Fellow with Stanford's Precourt Institute for Energy and Woods Institute for the Environment. His research focuses on understanding the physical, chemical, and dynamical processes in the atmosphere better in order to address atmospheric problems, such as climate change and urban air pollution, with improved scientific insight and more accurate predictive tools.



Hans Henrik Lindboe, Ea Energy Analyses, Denmark

Enabling Renewable Energy Integration in Denmark

Lindboe has extensive experience as project manager in the Nordic and Baltic area with focus on economy and security of supply in a liberalized electricity market. In recent years, he has contributed to analyses of the utility value of investments in the Nordic transmission grid, the economic conditions of integrating large amounts of RE in the electricity system, and the challenges to the district heating sector. Lindboe has been a partner at Ea Energy Analyses since 2005. Prior to this position he was Deputy Director of the Planning Department to Elkraft System, the Transmission System Operator in Eastern Denmark, and head of the Environment and Planning Section of Elkraft System and Elkraft Power Company.



Lynn Orr, Stanford University – Panel Moderator

Orr became the director of the Precourt Institute for Energy at Stanford upon its establishment in 2009. He served as director of the Global Climate and Energy Project from 2002 to 2008. Orr was the Chester Naramore Dean of the School of Earth Sciences at Stanford University from 1994 to 2002. He has been a member of the Stanford faculty since 1985 and holds the Keelen and Carlton Beal Chair of Petroleum Engineering in the Department of Energy Resources Engineering, and is a Senior Fellow at the Woods Institute for the Environment.

Capabilities and Limitations of the Existing Grid



V. John White, Center for Energy Efficiency and Renewable Technologies

Pulling the Pieces Together: Thinking Regionally and Cooperatively

White is the Executive Director of the Center for Energy Efficiency and Renewable Technologies (CEERT), which he co-founded in 1990. CEERT is a non-profit coalition of the nation's leading public interest environmental groups and businesses working on energy efficiency and renewable technologies. Through its public education, policy research, and advocacy programs, CEERT helps design and implement public policies, market reforms and legislative strategies to integrate efficiency and renewable technologies into the electricity and transportation systems in California and the West.



Antonio Alvarez, Pacific Gas and Electric Company (PG&E)

Efforts and Challenges to Manage California's Expected Intermittent Renewable Additions

Alvarez is the Renewable Integration Manager in PG&E's Energy Procurement organization. He is responsible for understanding the cost, reliability, and environmental impacts of increasing levels of intermittent renewable generation needed to meet California's 33% Renewable Portfolio Standard goal. Alvarez has held other positions in electric planning and power contracting. He earned a B.S. degree in Civil Engineering from the Universidad Javeriana in Colombia, a M.S. degree in Engineering Management from Stanford University, and a M.B.A. degree from the University of California, Berkeley.



Debbie Lew, National Renewable Energy Laboratory (NREL)

Finding Flexibility in the Existing System

Lew is a Senior Project Leader in the Transmission and Grid Integration Group, working on wind and solar integration and transmission issues. She led the Western Wind and Solar Integration Study, for which she won the 2009 Achievement Award from the Utility Wind Integration Group. During the past year, she was seconded to Hawaiian Electric Company where she worked on integration of wind and solar into island grids. She has a Ph.D. in Applied Physics from Stanford University and B.S. degrees in Electrical Engineering and Physics from MIT.



Richard Swanson, SunPower Corporation – Panel Moderator

Swanson received his Ph.D. in Electrical Engineering from Stanford University in 1974. In 1976, he joined the faculty at Stanford University where he and his group conceived and developed the point-contact solar cell. Laboratory versions of these cells achieved a record 28 percent conversion efficiency in concentrator cells and 23 percent large-area one-sun cells. In 1991, Swanson resigned from his faculty position to devote full time to SunPower Corporation, a company he founded to develop and commercialize cost-effective photovoltaic power systems. He currently serves as President Emeritus at SunPower.

Maximizing Renewable Penetration on the Grid



Nick Jenkins, Cardiff University, United Kingdom

Optimizing AC and DC Transmission Networks for High Penetration of Renewables

Jenkins is a Professor of Renewable Energy at Cardiff School of Engineering, a Fellow of the IET, IEEE, and Royal Academy of Engineering, and the Shimizu Visiting Professor to the Atmosphere/Energy Program at Stanford University. He is the Director of Cardiff School's Institute of Energy, which now coordinates all the School's world-leading research in sustainable energy technology. This includes energy supply and storage, alternative transport fuels, low carbon heat and power generation, environmental management, fluid and thermal systems, electrical systems, thermoelectrics and power magnetic.



Michael Wara, Stanford Law School

Key Regulatory Challenges for Deep Penetration of Renewables

Wara is an Assistant Professor of Law at Stanford University, a Research Fellow at the Program in Energy and Sustainable Development in Freeman Spogli Institute for International Studies, Affiliated Faculty of the Precourt Institute and Center Fellow in the Woods Institute for the Environment. An expert on environmental law and policy, Wara's research focuses on climate policy and regulation, both domestically and internationally. His current scholarship addresses the performance of the emerging global market for greenhouse gases and mechanisms for reducing emissions, especially in developing countries after the Kyoto Protocol expires in 2012.



Willet Kempton, University of Delaware

Low Cost Grid Integration via Met-Smart Interconnection and Storage Inherent in End-Use Devices

Kempton is a Professor in the College of Earth, Ocean, and Environment, and Professor of Electrical and Computer Engineering at the University of Delaware and Director of the Center for Carbon-free Power Integration. He has done extensive research on social and policy aspects of energy use and energy efficiency. His research interests include offshore wind, vehicle to grid power, lay environmental beliefs and values, environmental movements, and integration of large-scale renewables. His articles cover topics such as American citizens' understanding of global climate change, beliefs and behavior regarding home energy, and energy efficiency policies.



Mark Thurber, Stanford University – Panel Moderator

Thurber is Associate Director for Research at the Program on Energy and Sustainable Development at Stanford University's Freeman Spogli Institute for International Studies. The Program focuses on international frameworks for climate change mitigation, the role of state-controlled oil and gas companies in the world's hydrocarbon markets, the emerging global market for coal, and energy services for the world's poor. His research interests include how institutional factors affect the diffusion of technologies – both large-scale, infrastructure-intensive ones such as for central electricity generation or carbon capture and storage (CCS) as well as small, highly distributed ones such as improved cookstoves or generators for the very poor.

Workshop Moderator



Steve Eglash, Stanford University

Eglash is the Executive Director for the Energy and Environment Affiliates Program at Stanford University. He is responsible for developing and managing interactions for corporations and other organizations that have an interest in Stanford's research, faculty, and graduate students in energy-related and environmental fields. His background is in renewable energy, business, technology, and finance. Eglash was President and CEO of Cyrium Technologies, a solar energy startup company, and a consultant and advisor to the National Renewable Energy Laboratory and the U.S. Department of Energy. He received his Ph.D. and M.S. degrees from Stanford University, and a B.S. degree from the University of California at Berkeley, all in Electrical Engineering.

About the TomKat Center

The TomKat Center for Sustainable Energy at Stanford University was formed to harness the skills and creativity of the university's leading science, technology, and policy experts to transform the world's energy systems for a sustainable future. It focuses on challenges in electricity and transportation, promoting evaluation, analysis, and research in the areas of generation and conversion, transmission and distribution, storage, and land and water. The TomKat Center was created in 2009 with a \$40 million gift made by Stanford alumni and husband-and-wife team Thomas Steyer and Kat Taylor. As part of its mandate, the TomKat Center supports sustainable energy efforts and recently awarded \$1.2 million in its first set of grants to Stanford faculty conducting research related to the future electric grid.

About the Director



Stacey Bent is the Director of the TomKat Center for Sustainable Energy and a Professor in the Department of Chemical Engineering at Stanford University. She is also Professor, by courtesy, in the Departments of Materials Science and Engineering, Electrical Engineering, and Chemistry. Her research interests are in semiconductor processing, surface science, and materials chemistry. Bent leads a group of students and postdoctoral scholars

working toward applications in renewable energy devices and next-generation microelectronics. She also co-directs the DOE Energy Frontier Research Center on Nanostructuring for Efficient Energy Conversion.



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The workshop presentations (with permission from speakers) will be posted shortly at <http://tomkat.stanford.edu>.

