



The Institute for Sustainability, Energy, and Environment  
presents iSEE Congress 2016 ...

# ENERGY



---

## Paths to a Sustainable Future

Sept. 12-14, 2016  
Alice Campbell Alumni Center  
University of Illinois at Urbana-Champaign





# Welcome

Each year, the Institute for Sustainability, Energy, and Environment (iSEE) assembles leading national and international scientists from different disciplines to present the latest scientific research on a particular facet of future sustainability at the iSEE Congress.



In 2016, we are focusing on the potential for improvements in energy efficiency, alternative forms of renewable energy, and other low-carbon sources of energy to meet societal needs for electricity, transportation, and heating more sustainably in the future.

iSEE Congress 2016 — “Energy 2030: Paths to a Sustainable Future” — will advance understanding about the technological breakthroughs and global policy solutions for enhancing energy conservation and reducing the carbon footprint of energy consumption.

This Congress will provide not only a forum to discuss the challenges on the path toward sustainable energy consumption, but also key takeaways for an agenda of actionable research and policy directions that could contribute to long-term solutions.

iSEE is excited to host this extended discussion about the possibilities of — and the science behind — more sustainable energy sources in the near, medium, and long term.

Welcome to the conversation.

Madhu Khanna  
Associate Director for Education and Outreach  
Institute for Sustainability, Energy, and Environment (iSEE)  
University of Illinois at Urbana-Champaign



# Congress Schedule

*Conference attendees, please note: You are invited to join us for coffee breaks and lunch (if you have signed up for lunch). However, dinners are by invitation only.*

## MONDAY, SEPT. 12

**5-6:15 p.m. — Keynote Address: “Can We Ever Get to a Zero-Emissions World?”**

- Steve Koonin, New York University, <http://cusp.nyu.edu/people/steve-koonin/>

**6:15-7:15 p.m. — Reception and Student Poster Presentations (more on posters, presenters at <http://bit.ly/iSEECong16>)**

**7:30-9 p.m. — Dinner for speakers (invitation only)**

## TUESDAY, SEPT. 13

**8-8:30 a.m. — Registration**

**8:30-8:45 a.m. — Opening Remarks**

- Peter Schiffer, Vice Chancellor for Research, University of Illinois at Urbana-Champaign

**8:45-10:15 a.m. — Session I: “Low-Carbon Energy: The Science, the Reality, and the Future”**

*Moderator: Bruce Elliott-Litchfield, Professor of Agricultural and Biological Engineering, University of Illinois at Urbana-Champaign ([http://abe.illinois.edu/faculty/B\\_Litchfield](http://abe.illinois.edu/faculty/B_Litchfield))*

- Sharon Hammes-Schiffer, University of Illinois at Urbana-Champaign: <http://hammes-schiffer-group.org/>
- Kenneth Christensen, University of Notre Dame: <http://engineering.nd.edu/profiles/kchristensen>
- Kenneth Gillingham, Yale University: <http://environment.yale.edu/gillingham/>

**10:15-10:30 a.m. — Coffee Break**

**10:30 a.m.-noon — Session II: “Advanced Biofuels: A Myth or Impending Reality?”**

*Moderator: Huimin Zhao, Professor of Chemical and Biomolecular Engineering, University of Illinois at Urbana-Champaign (<http://www.scs.illinois.edu/~zhaogrp/>)*

- Evan H. DeLucia, University of Illinois at Urbana-Champaign: <http://www.life.illinois.edu/delucia/delucia.htm>
- David Zilberman, University of California Berkeley: <http://vcresearch.berkeley.edu/faculty/david-zilberman>
- Coleman Jones, General Motors: [http://www.sae.org/congress/2012/fevpif/jones\\_coleman.htm](http://www.sae.org/congress/2012/fevpif/jones_coleman.htm)

**Noon-1:30 p.m. — Lunch (provided) and Keynote Address: “Disruptive Trends in the Energy Sector”**

- KR Sridhar, Bloom Energy: <http://www.bloomenergy.com/about/management-team/#sridhar>

**1:30-3 p.m. — Session III: “Reducing the Carbon Footprint of Energy Services: Strategies and Potential”**

*Moderator Kathy Baylis, Associate Professor of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign (<http://ace.illinois.edu/directory/baylis>)*

- Chris Jones, University of California Berkeley: <http://coolclimate.berkeley.edu/chris>
- Mike Toman, World Bank: <http://www.worldbank.org/en/about/people/michael-toman>
- Erica Myers, University of Illinois at Urbana-Champaign: <http://ace.illinois.edu/directory/ecmyers>

**3-3:30 p.m. — Coffee Break**



# Congress Schedule

## TUESDAY, SEPT. 13, CONTINUED

### 3:30-5 p.m. — Session IV: “Integrating Renewables with the Grid”

*Moderator: Alejandro Dominguez-Garcia, Associate Professor of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign (<https://www.ece.illinois.edu/directory/profile/aledan>)*

- David Nicol, University of Illinois at Urbana-Champaign: <http://web.engr.illinois.edu/~dmnicol/nicol-cv.pdf>
- Thomas Overbye, University of Illinois at Urbana-Champaign: <https://www.ece.illinois.edu/directory/profile/overbye>
- Miroslav Begovic, Texas A&M University: [http://smartgridcenter.tamu.edu/sgc/web/?page\\_id=1096](http://smartgridcenter.tamu.edu/sgc/web/?page_id=1096)

### 5-6 p.m. — Reception and Student Poster Presentations (more on posters, presenters at <http://bit.ly/iSEECong16>)

### 6-7 p.m. — Keynote Address: “The 3 Transportation Revolutions and What They Mean for Energy and Climate Change”

- Daniel Sperling, University of California Davis: <http://desp.ucdavis.edu/people/daniel-sperling>

### 7:15 p.m. — Dinner for speakers (invitation only)

## WEDNESDAY, SEPT. 14

### 8 a.m. — Registration

### 8:15-10 a.m. — Session V: “Nuclear Power: A Panacea for Future Energy Needs?”

*Moderator: Cliff Singer, Professor of Nuclear, Plasma, and Radiological Engineering, University of Illinois at Urbana-Champaign (<http://acdis.illinois.edu/aboutacdis/profile.html&pid=25>)*

- Hans Gougar, Idaho National Laboratory: <http://nuclear.inl.gov/gougar.shtml>
- Rizwan Uddin, University of Illinois at Urbana-Champaign: <http://npre.illinois.edu/directory/faculty/rizwan>
- Martin Freer, University of Birmingham: <http://www.birmingham.ac.uk/staff/profiles/physics/freer-martin.aspx>
- James Stubbins, University of Illinois at Urbana-Champaign: <http://npre.illinois.edu/directory/faculty/jstubbins>

### 10-10:15 a.m. — Coffee Break

### 10:15-11:30 a.m. — Session VI: “Frontiers of Energy Innovation”

*Moderator: Kevin O'Brien, Director of Illinois Sustainable Technology Center, University of Illinois at Urbana-Champaign ([http://www.istc.illinois.edu/about/staff\\_Kevin\\_OBrien.cfm](http://www.istc.illinois.edu/about/staff_Kevin_OBrien.cfm))*

- Kathy Ayers, Proton Onsite: <http://protononsite.com/>
- Haroon Kheshgi, Exxon Mobil: <http://www.aiche.org/community/bio/dr-haroon-s-kheshgi>
- Krish Krishnamurthy, Linde North America: <https://www.usea.org/profile/dr-krish-r-krishnamurthy>

### 11:30 a.m.-1 p.m. — Lunch (provided) and Keynote Address: “The Energy Access Opportunity”

- Jonathan Mingle, Author and Environmental Writer: <http://greenburger.com/client/jonathan-mingle/>

### 1-2:30 p.m. — Session VII: “Energy Policies for a Sustainable Future”

*Moderator: Don Fullerton, Professor of Finance, University of Illinois at Urbana-Champaign (<https://business.illinois.edu/profile/don-fullerton>)*

- Gilbert Metcalf, Tufts University: <http://ase.tufts.edu/economics/people/peopleMetcalf.htm>
- Madhu Khanna, University of Illinois at Urbana-Champaign: <http://ace.illinois.edu/directory/khanna1>
- George Gross, University of Illinois at Urbana-Champaign: <http://gross.ece.illinois.edu/bio/>

### 2:30-3 p.m. — Rapporteur Summary

### 3 p.m. — Closing Remarks

- Evan H. DeLucia, Director of iSEE, University of Illinois at Urbana-Champaign



## Our Expert Speakers

# Kathy Ayers

*Session VI: "Frontiers of Energy Innovation," 10:15-11:30 a.m. Wednesday, Sept. 14*



**Presentation Title:** "Renewable Hydrogen Production: Leveraging Today's Knowledge for Tomorrow's Solutions"

**Abstract:** Renewable hydrogen is an essential component of converting CO<sub>2</sub> to liquid fuels and upgrading biomass/crude oil, as well as "greening" the ammonia production process, which currently consumes 2% of the world's energy. This concept has been recently gaining momentum, through publicized work in solar fuels (direct photoelectrochemical conversion of sunlight and water to hydrogen), as well as isolated work on

components such as oxygen and hydrogen evolution catalysts. In parallel, commercial water splitting technology has advanced to larger and larger scale, and similar fuel cell technology can be leveraged to advance component and manufacturing development. The product development cycle is long, and these near term solutions will be needed as building blocks and stepping stones for nascent technologies of today. This talk will focus on the evolution of membrane-based water electrolysis as a renewable hydrogen pathway, and implications for industrial and energy applications.

**Bio:** Katherine Ayers is Vice President of Research and Development at Proton OnSite, with responsibility for Proton's technology roadmap strategy and execution. She is recognized as a strong technical leader in electrochemical technologies, particularly hydrogen generation, and manages many of Proton's external research collaborations with universities and national labs. She has served as Principal Investigator on many successful programs leading to commercial implementation of R&D advancements, and provides technical expertise for multiple scientific advisory boards as well as serving on the Hydrogen and Fuel Cells Technical Advisory Committee (HTAC) to the Secretary of Energy. Under her leadership, Proton has been highlighted as a Small Business Innovation Research success story, and recognition of her work includes awards from DOE, ACS, ECS, and the Fuel Cell Seminar. Prior to joining Proton OnSite, Ayers worked in the battery field for 10 years. She received her B.S. in Chemistry/Chemical Physics at University of California San Diego, and her Ph.D. in Chemistry at the California Institute of Technology.

**More about Proton Onsite:** <http://protononsite.com/>

## Our Expert Speakers

# Miroslav Begovic

*Session IV: "Integrating Renewables with the Grid," 3:30-5 p.m. Tuesday, Sept. 13*

**Presentation Title:** "Photovoltaics in Modern Power Systems"

**Abstract:** Worldwide consumption of electricity is expected to nearly double over the next 25 years. The International Energy Agency (IEA) predicts that meeting this demand for power will require more than 5,000 GigaWatts of new electricity-generating capacity (including replacement capacity) at a cost of more than \$5 trillion. The new plants will require an additional \$6 trillion worth of additional infrastructure, making electric power an \$11 trillion market over the next 25 years. The search for new generation technologies is accelerating. In 2013, photovoltaic generation accounted for 0.28% of the renewable generation mix in the U.S. It has recently grown at an annual rate of over 220%. The proliferation of photovoltaic (PV) systems offers opportunities (such as a reduction in peak load and loss) but also potential for use in Volt/Var management and control. It also creates need for additional generation that covers uncertainty involved in PV output. In fact, that need may in some cases increase fossil fuel consumption (compared to not using renewables with rapid output changes) because of intermittency. Numerous North American utilities are integrating growing numbers of investor-owned photovoltaic distributed generation (PV-DG) plants into their distribution systems to comply with state-mandated Renewable Portfolio Standards (RPS). Given the fact that distribution systems have been designed to be operated in a radial fashion, interconnection of PV-DG may lead to significant impacts on planning and operations that need to be studied to identify mitigation measures and ensure seamless integration.



**Bio:** Miroslav M. Begovic (FIEEE'04) is Professor and Head of Electrical and Computer Engineering at Texas A&M University. Prior to that, he spent 25 years as a faculty member of ECE at Georgia Tech, where he was the Chair of the Electric Energy Research Group in the School of Electrical and Computer Engineering, and an affiliated faculty member of the Brook Byers Institute for Sustainable Systems and University Center of Excellence in Photovoltaic Research. Begovic's research interests are in monitoring, analysis, and control of power systems, as well as development and applications of renewable and sustainable energy systems. He is Immediate Past President of the Institute of Electrical and Electronics Engineers (IEEE) Power and Energy Society (PES), has served on the IEEE PES Power System Relaying Committee for two decades and chaired many of its working groups as well as chairing the IEEE PES Emerging Technologies Coordinating Committee.

**More about Begovic:** [http://smartgridcenter.tamu.edu/sgc/web/?page\\_id=1096](http://smartgridcenter.tamu.edu/sgc/web/?page_id=1096)



## Our Expert Speakers

# Kenneth Christensen

*Session I: “Low-Carbon Energy: The Science, the Reality, and the Future,” 8:45-10:15 a.m. Tuesday, Sept. 13*



**Presentation Title:** “I2CNER: Powering the Future, Internationalizing Research”

**Abstract:** The mission of the International Institute for Carbon-Neutral Energy Research (I2CNER) is to contribute to the creation of a sustainable and environmentally-friendly society by conducting fundamental research for the advancement of low-carbon-emission and cost-effective energy systems. I2CNER’s approach to creating an energy vision for Japan with targeted CO<sub>2</sub> emission reductions is presented based on an array of technologies holding promise for the future. In this talk, the institutional structure to enable this vision is outlined, and I2CNER’s research efforts on an array of technologies as Solid Oxide Fuel Cells, biomimetic and other novel catalyst concepts, CO<sub>2</sub> capture and storage or the conversion of CO<sub>2</sub> to a useful product, and production, storage, and use of hydrogen as a fuel are described.

**Bio:** Kenneth T. Christensen is a Professor and the College of Engineering Collegiate Chair in Fluid Mechanics at the University of Notre Dame, with a joint appointment in the Departments of Aerospace & Mechanical Engineering, Civil & Environmental Engineering, and Earth Sciences. He also serves as Assistant Dean of Faculty Development in the College of Engineering. He joined the ND faculty after 10-plus years on the faculty at the University of Illinois at Urbana-Champaign. Christensen directs a research group that pursues experimental studies of turbulence, geophysical flows and microfluidics and is a WPI Principal Investigator in the Carbon Dioxide Storage Division of the International Institute for Carbon-Neutral Energy Research (I2CNER) based at Kyushu University in Japan. He is a Fellow of both APS and ASME, an Associate Fellow of AIAA and serves on the Editorial Boards of Experiments in Fluids and Measurement Science and Technology. Past recognition includes the AFOSR Young Investigator Award (2006), the NSF CAREER Award (2007), the Francois Frenkiel Award for Fluid Mechanics from APS-DFD (2011) and the Dean’s Award for Excellence in Research (2012) from the College of Engineering at Illinois.

**More about Christensen:** <http://engineering.nd.edu/profiles/kchristensen>

## Our Expert Speakers

# Evan H. DeLucia

*Session II: “Advanced Biofuels: A Myth or Impending Reality?” 10:30 a.m.-noon Tuesday, Sept. 13*

**Presentation Title:** “Can Biofuels Cool the Planet?”

**Abstract:** Meeting the U.S. demand for biofuels to reduce reliance on fossil fuels will require growing dedicated bioenergy crops on a large amount of land. How we use land affects the warming potential of the atmosphere by regulating the exchange of greenhouse gases (GHGs) — CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub> — between the land surface and the atmosphere. Once in the atmosphere, these gases trap longwave radiation, creating the greenhouse effect that warms the Earth’s surface. The type of vegetation and how it is managed also affects surface temperature by reflecting radiation (albedo) and cooling the surface by evapotranspiration. Side-by-side comparisons of miscanthus and switchgrass, important bioenergy crops, with traditional maize-bean agriculture, revealed that growing bioenergy crops dramatically reduces the emission of GHGs to the atmosphere, cools the Earth’s surface by evapotranspiration, and reflects more radiation back to the atmosphere than annual row crops, creating a strong net cooling effect. This effect is in addition to the benefit provided by bioenergy of displacing fossil fuels, the largest source of GHGs. A combined economic-ecological model predicts that growing bioenergy crops on marginal land would provide sufficient bio-ethanol to meet the 32 billion-gallon mandate in the Renewable Fuel Standard without displacing food crops, while simultaneously cooling the planet.



**Bio:** Evan H. DeLucia is the G. William Arends Professor of Plant Biology at the University of Illinois at Urbana-Champaign and the Baum Family Director of the Institute for Sustainability, Energy, and Environment (iSEE). DeLucia is a faculty member at the Carl R. Woese Institute for Genomic Biology (IGB) and an Affiliate in the Department of Natural Resources and Environmental Sciences (NRES). At Illinois, he was the founding Director of the Program in Ecology and Evolutionary Biology and also served as Head of the Department of Plant Biology as well as Director of the School of Integrative Biology. After completing his B.A. at Bennington College and working as a teaching fellow at Phillips Andover Academy, DeLucia completed a M.F.S. (1982) in Forest Ecology at Yale University and a Ph.D. (1986) in Plant Ecology and Physiology at Duke University. He joined the faculty at Illinois in 1986, where he was recognized as a University Scholar in 1997. In 1994, DeLucia was a Bullard Fellow at Harvard University and in 2002 he was a Fulbright Fellow at Landcare Research in New Zealand. DeLucia became a fellow of the American Association for the Advancement of Science in 2005 and of the Ecological Society of America in 2015.

**More about DeLucia:** <http://www.life.illinois.edu/delucia/delucia.htm>



## Our Expert Speakers

# Martin Freer

*Session V: "Nuclear Power: A Panacea for Future Energy Needs?" 8:15-10 a.m. Wednesday, Sept. 14*



**Presentation Title:** "The Future of Nuclear Energy in the UK"

**Abstract:** Sizewell B, the last nuclear power station in the UK, was brought into operation more than 20 years ago. The UK has an aging fleet of advanced gas-cooled reactors (AGRs) that will close from 2023 onward, and it is decommissioning coal power stations in line with emissions directives. Coal and nuclear make up about 40 percent of the UK's electricity, and there is a looming crisis. Despite strong investment in offshore wind, it is unlikely that this will meet the UK demand, particularly given the intermittent nature of wind energy. Meeting the COP21 targets is also going to require a de-emphasis on gas. This all looks very challenging, and most realistic scenarios point to a need for a significant amount of nuclear power by 2040. This talk will focus on how that might be achieved.

**Bio:** Professor Martin Freer is Director of the Birmingham Energy Institute. He is also the theme lead for T-ERA, the thermal part of the Energy Research Accelerator (ERA) project that combines the research expertise of the Universities of Aston, Birmingham, Leicester, Loughborough, Nottingham and Warwick together with the British Geological Survey. Freer is a nuclear physicist who in 2010 won the Rutherford medal for his contribution to the field. He is also Head of Physics and Astronomy at the University of Birmingham.

**More about Freer:** <http://www.birmingham.ac.uk/staff/profiles/physics/freer-martin.aspx>

# Our Expert Speakers

## Kenneth Gillingham

*Session I: “Low-Carbon Energy: The Science, the Reality, and the Future,” 8:45-10:15 a.m. Tuesday, Sept. 13*

**Presentation Title:** “Using Behavioral Economics for the Diffusion of Low-Carbon Energy”

**Abstract:** This talk presents new results in the use of behavioral economics for the diffusion of low-carbon energy, with a focus on solar photovoltaic technology. “Nudges” have become widespread as an approach for encouraging pro-social behavior, with contexts ranging from retirement savings to exercise and energy conservation. The results presented will highlight how behavioral interventions, based on grassroots activity fostering social interactions, can significantly influence the adoption of solar photovoltaic technology in a cost-effective manner. The results will further point to key aspects of human behavior that influence the success of the interventions, and how the interventions can be better structured to improve the cost-effectiveness and meet further policy objectives.



**Bio:** Kenneth Gillingham is an Assistant Professor of Economics at Yale University with appointments in the School of Forestry & Environmental Studies, the Department of Economics, and the School of Management. During the 2015-16 academic year, he was the Senior Economist for Energy and the Environment at the White House Council of Economic Advisers. He is an applied microeconomist focusing on the intersection of energy and the environment, industrial organization, and behavioral economics. His work has examined topics such as energy efficiency policies, adoption of new energy technologies, transportation policies, and uncertainty in climate change policy. Gillingham is a Faculty Research Fellow at the National Bureau of Economic Research (NBER) and in 2014 was a visiting fellow at the University of Chicago Energy Policy Institute. He studied for his Ph.D. at Stanford University and his A.B. at Dartmouth College. He was a Fulbright Fellow in New Zealand, and has worked at Resources for the Future and the Joint Global Change Research Institute of Pacific Northwest National Laboratory. His work has been covered in *The New York Times*, *The Wall Street Journal*, *The Washington Post*, *The Huffington Post*, *Forbes*, and other outlets.

**More about Gillingham:** <http://environment.yale.edu/gillingham/>



## Our Expert Speakers

# Hans Gougar

*Session V: "Nuclear Power: A Panacea for Future Energy Needs?" 8:15-10 a.m. Wednesday, Sept. 14*



**Presentation Title:** "Nuclear Power: Potential and Challenges"

**Abstract:** Nuclear power plants generate almost 20 percent of electricity consumed in the U.S. and more than 50 percent of electricity generated by nonfossil sources. Despite some noteworthy plant disasters, it remains one of the most benign industrial technologies in terms of public safety and impact on the environment. It can generate, 24/7, power at levels that can sustain and grow a modern industrial society for generations, even centuries, to come. Yet nuclear struggles to compete against other forms of electricity in today's utility markets. Innovation comes slowly, if at all, and investment is spotty at best. Gougar will discuss nuclear technology as it exists today, what it could look like tomorrow, and why such a promising and sustainable technology struggles to realize its potential as the foundational energy technology of the future.

**Bio:** Hans Gougar is a nuclear engineer who has worked at the Idaho National Laboratory (INL) since 1998, performing and supervising the design and analysis of unconventional test and power reactor systems. His particular expertise is in the modeling and engineering of high-temperature reactors for electricity and process heat generation. In 2007, he took leave from the INL to serve as a consultant to the Pebble Bed Modular Reactor Company of South Africa. Upon returning to the INL in 2009, he led the Design Methods and Validation effort for the VHTR Technology Development Office. In July, he became the Director of INL's Advanced Reactor Technology Development office and serves as one of two National Technical Directors for DOE's Advanced Reactor Technologies Program. He also serves on the Experts Group of the Generation IV International Forum and is an Affiliate Professor of Nuclear Engineering at Idaho State University. Gougar earned his Bachelor's Degree in Science Education from the University of Wisconsin in 1985. He taught physics and other science courses at various secondary schools in the U.S. and in England before commencing graduate studies at Penn State in 1994. He earned a Ph.D. in 2004 while working at the INL.

**More about Gougar:** <http://nuclear.inl.gov/gougar.shtml>

## Our Expert Speakers

# George Gross

*Session VII: “Energy Policies for a Sustainable Future,” 1-2:30 p.m. Wednesday, Sept. 14*

**Presentation Title:** “The Integration of Utility-Scale Energy Storage into Grids with Deepening Penetrations of Integrated Renewable Energy Resources”

**Abstract:** The electricity business is unique, as it is the only industry sector that sells a commodity — the MegaWatt-hour — without sizable inventory. The marked lack of utility-scale storage in today’s power system drives electricity to be a highly perishable commodity whose production is the prototypical just-in-time manufacturing system. Moreover, the limited storage capacity in today’s grid severely restricts the flexibility with which the grid can be operated — a particular concern for systems with deepening penetrations of integrated renewable energy resources. In recognition of the need of a bold move to reduce the costs of storage through increased demand, California has mandated the installation of 1,325 MWs of cost-effective energy storage by 2024 by the three major investor owned utilities — PG&E, SCE and SDG&E. The action is likely to engender similar measures in other venues, as well as to be a catalyst for the speedier large-scale storage deployment. This presentation discusses the critical importance of energy storage, the current status of storage and the barriers to large-scale storage deployment and the challenges and the opportunities in the push for storage deployment. In addition, we discuss the challenges in the policy formulation and analysis, regulatory framework development and environmental assessment areas.



**Bio:** George Gross is a Professor of Electrical and Computer Engineering and a Professor in the Institute of Government and Public Affairs at the University of Illinois at Urbana-Champaign. His research and teaching activities are in power system analysis, economics and operations, renewables, demand response and energy storage resource integration, utility regulatory policy and industry restructuring. He was formerly with the Pacific Gas and Electric Co., where he founded its Management Science Department and held key management, technical and policy positions. He is a co-founder of POWERWORLD and a board member from 1996 to 2001. A Fellow of IEEE, Gross received the Franz Edelman Management Science Achievement Award by the Institute of Management Science. He earned his undergraduate degree at McGill University in Montreal and did his graduate studies at the University of California Berkeley. He has consulted on electricity issues with utilities, government organizations and research institutions worldwide. His work on smart grid issues has focused on the technical and the regulatory aspects.

**More about Gross:** <http://gross.ece.illinois.edu/bio>



## Our Expert Speakers

# Sharon Hammes-Schiffer

*Session I: "Low-Carbon Energy: The Science, the Reality, and the Future," 8:45-10:15 a.m. Tuesday, Sept. 13*



**Presentation Title:** "Solar Energy through Better Chemistry"

**Abstract:** Solar energy is a promising renewable source of energy. Harnessing the power of the sun requires solar cells that can absorb the sunlight and use the resulting energy to generate electricity directly or convert this energy to chemical bonds, such as hydrogen, for storage. The many parts of a solar cell must be tailored to work efficiently and effectively. A critical area of research is the development of catalysts to facilitate key chemical reactions, such as the splitting of water into protons and oxygen or the production of molecular hydrogen from protons and electrons. Often biological systems serve as models: plants perform photosynthesis in an exemplary fashion, and hydrogenase enzymes efficiently oxidize and produce hydrogen. Learning from biology, teams of chemists are working together to design more effective catalysts that are environmentally friendly, cost effective, and earth abundant. These interdisciplinary and collaborative teams are comprised of synthetic chemists to make the systems, physical chemists to characterize and test the systems, and computational chemists to guide the synthetic chemists through the discovery of underlying design principles. These efforts are yielding positive results but still have more to accomplish to bring solar energy to its full promise.

**Bio:** Sharon Hammes-Schiffer received her B.A. in Chemistry from Princeton University in 1988 and her Ph.D. in Chemistry from Stanford University in 1993, followed by two years at AT&T Bell Laboratories. She was the Clare Boothe Luce Assistant Professor at the University of Notre Dame from 1995 to 2000 and spent the next 12 years at Penn State University as the Eberly Professor of Biotechnology. In 2012, she became the Swanlund Professor and Chair of Chemistry at Illinois. Her research centers on the investigation of charge transfer reactions, dynamics, and quantum mechanical effects in chemical, biological, and interfacial processes. Her work encompasses the development of analytical theories and computational methods, as well as applications to a wide range of experimentally relevant systems. She is a Fellow of the American Physical Society, American Chemical Society, American Association for the Advancement of Science, and Biophysical Society and is the Editor-in-Chief of an American Chemical Society journal. She is a member of the American Academy of Arts and Sciences, the National Academy of Sciences, the International Academy of Quantum Molecular Science, and the Basic Energy Sciences Advisory Committee. She has written more than 210 publications and has given more than 320 invited talks.

**More about Hammes-Schiffer:** <http://hammes-schiffer-group.org/>



## Our Expert Speakers

# Chris Jones

*Session III: “Reducing the Carbon Footprint of Energy Services: Strategies and Potential,” 1:30-3 p.m. Tuesday, Sept. 13*

**Presentation Title:** “Enabling Low-Carbon Communities: The Roles of Smart Planning Tools and Place-Based Solutions”

**Abstract:** Addressing climate change requires long-term planning and governance at multiple scales, from global to household. Using national household surveys, we estimate consumption-based carbon footprints for all populated U.S. zip codes and further develop carbon footprint reduction scenarios of 780 California cities and counties. Policy intervention areas include urban planning, energy efficiency, renewable energy, biofuels, waste management, food systems, electrification and conservation strategies. We incorporate technical potential for each policy area from several state-level studies covering the years 2010 to 2050, and apply those to detailed carbon footprints of household transportation, energy, food, goods and services. Due to different rates of population growth between cities and counties, the mitigation potential varies considerably between locations; a 50% reduction in average household carbon footprints by 2050 translates to between 0% and 50% reduction in absolute terms. The mix of strategies also differs based on population characteristics, geography, and the time horizon of reduction targets. Given these differences, we suggest the need for per capita GHG reduction targets and highly tailored policies that consider the unique opportunities of each community.



**Bio:** Christopher M. Jones is Program Director of the CoolClimate Network at UC Berkeley. CoolClimate develops leading greenhouse gas management software and behavior-based programs that engage, educate, and motivate individuals, businesses, and communities to adopt low carbon technologies and practices. CoolClimate’s carbon management software has been adopted by the state of California, non-governmental organizations, businesses, and communities throughout the United States. CoolClimate programs include the Cool California Challenge, a competition between California cities to reduce household carbon footprints, and the University of California’s Cool Campus Challenge, a greenhouse gas reduction program engaging University of California students, staff and faculty. Jones is a leading expert in carbon footprint analysis and the design and evaluation of behavior-based programs. He is serving his sixth year as Program Chair of the Behavior, Energy and Climate Change (BECC) Conference. He received his Ph.D. in Energy and Resources at UC Berkeley in 2014. He also holds an M.S. in Energy and Resources and an M.A. in Latin American Studies, both from UC Berkeley, and a B.A. in Politics from UC Santa Cruz.

**More about Jones:** <http://coolclimate.berkeley.edu/chris>



## Our Expert Speakers

# Coleman Jones

*Session II: "Advanced Biofuels: A Myth or Impending Reality?" 10:30 a.m.-noon Tuesday, Sept. 13*



**Presentation Title:** "Pathways to Light Duty Vehicle GHG Reductions"

**Abstract:** National greenhouse gas reduction goals for the light duty fleet are ambitious. Multiple pathways are being pursued to achieve goals. These include efficiency improvements, light-weighting and electrification. However, current EIA forecasts indicate that liquid fuels will be the dominant energy source for decades to come; thus more focus on improving liquid fuel is required. The U.S. Department of Energy has initiated a program to develop new lower-carbon fuels that will facilitate higher engine efficiency.

**Bio:** Coleman Jones is Fuels Technical Fellow for General Motors in North America. He concentrates on petroleum and bio-derived fuels including properties, manufacturing processes, costs, and interactions with vehicles. He supports GM engineering and public policy worldwide on fuel issues. He is also chair of the American Society for Testing and Materials (ASTM) Gasoline and Oxygenated Fuels Subcommittee and several ASTM task groups and represents GM on the CRC board. Jones has been manager of fuels and lubricants for GM Powertrain. His group was responsible for current product support for fuels, engine oils, and transmissions fluids for General Motors. After completing his B.S., M.S. and Ph.D. in Chemical Engineering and Materials Science, his first GM positions were at the Powertrain Advanced Materials Development Center working on process and material development.

**More about General Motors:** <http://www.gm.com/index.html>

## Our Expert Speakers

# Madhu Khanna

*Session VII: “Energy Policies for a Sustainable Future,” 1-2:30 p.m. Wednesday, Sept. 14*

**Presentation Title:** “Low-Carbon Policies in the U.S.: Effectiveness, Costs, and GHG Implications”

**Abstract:** The U.S. has established a number of overlapping policies in the electricity and transportation sectors to increase the share of renewable energy, reduce dependence on fossil fuels, and mitigate greenhouse gas (GHG) emissions. This presentation discusses the extent to which existing policies can change the mix of energy utilized in the U.S. by 2030, and displace fossil fuels and the cost implications for consumers and producers. It examines the synergies and trade-offs between increasing renewable energy consumption and GHG mitigation. Recent experience highlights the challenges of implementing supply-side focused renewable energy policies, particularly in the transportation sector, and emphasizes the need for a more coordinated mix of policies within and across sectors.



**Bio:** Madhu Khanna is the ACES Distinguished Professor of Environmental Economics at the University of Illinois at Urbana-Champaign and a Fellow of the Agricultural and Applied Economics Association (AAEA). She is the Associate Director for Education and Outreach at the Institute for Sustainability, Energy, and Environment (iSEE) at Illinois. Khanna received her Ph.D. in 1995 from the University of California Berkeley. Her research focuses on environmental policy analysis and incentives for adoption of environmentally friendly technologies in the agricultural and energy sectors. She also analyzes the motivations and effectiveness of socially responsible corporate practices. Her current work is examining the economics, land use, and environmental implications of renewable energy policies, and she has co-edited the Handbook of Bioenergy Economics and Policy. She serves on the Science Advisory Board of the U.S. EPA, the Board of Directors of the AAEA and on the editorial boards of several leading journals.

**More about Khanna:** <http://ace.illinois.edu/directory/khanna1>

## Our Expert Speakers

# Haroon Kheshgi

*Session VI: "Frontiers of Energy Innovation," 10:15-11:30 a.m. Wednesday, Sept. 14*



**Presentation Title:** "Technology and a Low-Carbon Transformation"

**Abstract:** Stabilization of atmospheric carbon dioxide concentration implies that net global emissions peak and then decline toward zero, with the pace of this transformation related to stabilization level. Stabilization ultimately implies a transformation of technology for energy supply and use across the global economy. Researchers have developed many scenarios or pathways of how such a transformation might occur, and these pathways differ in the technologies that become important in major energy end-use sectors. In this presentation, pathways for major end-use sectors and the implied pace of technology deployment are reviewed. Pathways provide information to help guide technology R&D portfolios, and enabling environments for the deployment of technologies.

**Bio:** Haroon S. Kheshgi is a Distinguished Research Associate at ExxonMobil's Corporate Strategic Research. He studied chemical engineering at the University of Illinois at Urbana-Champaign (B.S. 1978) and the University of Minnesota (Ph.D. 1983). He pursued research at Lawrence Livermore National Laboratory (1983-86) before joining Exxon Research and Engineering Co. in 1986. At ExxonMobil Corporate Strategic Research, his work addresses many aspects of global climate change including carbon cycle, detection and attribution of climate change, paleoclimate implications, and the mitigation of greenhouse gas emissions. He has contributed to the Intergovernmental Panel on Climate Change as lead author, contributing author, and review editor in the IPCC's last four assessment reports, its Special Report on Carbon Dioxide Capture and Storage, and its Special Report on Land Use Change. His activities have included chairing the International Petroleum Industry Environmental Conservation Association (IPIECA) Climate Change Working Group, the Society of Petroleum Engineering's committee on carbon capture and storage, and the first Carbon Management Technologies Conference.

**More about Kheshgi:** <http://www.aiche.org/community/bio/dr-haroon-s-kheshgi/>

## Our Expert Speakers

# Steve Koonin

*Keynote Address: 5-6:15 p.m. Monday, Sept. 12*

**Presentation Title:** “Can We Ever Get to a Zero-Emissions World?”

**Abstract:** Politicians from some 200 countries agreed in December to limit human influences on the climate consistent with a global temperature rise of well below 2 degrees Celsius. I will review the scientific, technological, and economic dimensions of that aspiration to assess the likelihood that it can be realized. I will also discuss backup strategies in the event that human influences cannot be stabilized at purported safe levels.



**Bio:** Steven E. Koonin was appointed as the founding Director of NYU’s Center for Urban Science and Progress in April 2012. That consortium of academic, corporate, and government partners will pursue research and education activities to develop and demonstrate informatics technologies for urban problems in the “living laboratory” of New York City. He previously served as the U.S. Department of Energy’s second Senate-confirmed Under Secretary for Science from May 19, 2009 through Nov. 18, 2011. As the Chief Scientist at BP from 2004 to early 2009, Koonin developed the long-range technology strategy for alternative and renewable energy sources. He joined the California Institute of Technology’s faculty in 1975, was a research fellow at the Niels Bohr Institute in 1976-77, and was an Alfred P. Sloan Foundation Fellow in 1977-79. He became a Professor of Theoretical Physics at Caltech in 1981 and served as Chairman of the Faculty from 1989 to ’91. Koonin was the seventh provost of Caltech from 1995 to 2004. In that capacity, he was involved in identifying and recruiting a third of the Institute’s professorial faculty and left an enduring legacy of academic and research initiatives in the biological, physical, earth, and social sciences, as well as the planning and development of the Thirty-Meter Telescope project.

**More about Koonin:** <http://cusp.nyu.edu/people/steve-koonin/>



## Our Expert Speakers

# Krish Krishnamurthy

*Session VI: "Frontiers of Energy Innovation," 10:15-11:30 a.m. Wednesday, Sept. 14*



**Presentation Title:** "Clean Energy Technologies by Linde"

**Abstract:** As a leading technology company and a supplier of industrial gases and engineering, Linde's products and solutions cover a wide range of industries. For the emerging clean energy future, Linde continues to develop innovative solutions that enable transformation in the energy generation and transportation fuel sectors, including biogas purification and liquefied natural gas, hydrogen as fuel, carbon capture, utilization and storage as well as renewable power. This presentation will highlight some of the specific developments and applications that contribute to increasing clean energy generation and reducing greenhouse gas emissions.

**Bio:** Krish R. Krishnamurthy currently leads the Group R&D — America's team in Technology & Innovation corporate and support function for Linde North America. He has been with Linde for more than 30 years and has worked on various roles in the R&D, innovation, and engineering functions. Over the past 10-plus years, he has focused his efforts on industrial gas separations and clean energy technologies covering projects and technologies in carbon capture, liquefied natural gas, and hydrogen production and applications. Krishnamurthy has an M.S. and a Ph.D. in Chemical Engineering from Clarkson University, Potsdam, N.Y. His technical expertise is in the areas of energy generation processes, carbon capture and storage, separation process development, industrial gases production and applications, and cryogenic technology.

**More about Krishnamurthy:** <http://www.usea.org/profile/dr-krish-r-krishnamurthy/>

## Our Expert Speakers

# Gilbert Metcalf

*Session VII: “Energy Policies for a Sustainable Future,” 1-2:30 p.m. Wednesday, Sept. 14*

**Presentation Title:** “Can a Carbon Tax Get Us to a Sustainable Future?”

**Abstract:** Pigouvian pricing — whether in the form of a carbon tax or a cap-and-trade system — is the textbook policy choice to deal with the problem of greenhouse gas emissions and climate change. The real world, in contrast, is a messier place. Is a carbon tax sufficient to move the U.S. economy to a zero-carbon future? If not, what other policies do we need? And which barriers constitute real market failures as opposed to political barriers? How should we adapt a textbook carbon tax for real-world political and economic constraints?



**Bio:** Gilbert E. Metcalf is a Professor of Economics at Tufts University and a Research Associate at the National Bureau of Economic Research. Metcalf has taught at Princeton University, the Kennedy School of Government, and MIT. He has frequently testified before Congress and served on a number of expert panels. In 2011-12, he served as the Deputy Assistant Secretary for Environment and Energy at the U.S. Department of the Treasury.

**More about Metcalf:** [http://works.bepress.com/gilbert\\_metcalf/](http://works.bepress.com/gilbert_metcalf/)



## Our Expert Speakers

# Jonathan Mingle

*Keynote Address: 11:30-a.m.-1 p.m. Wednesday, Sept. 14*



**Presentation Title:** “The Energy Access Opportunity”

**Abstract:** More than 3 billion people worldwide still depend on burning fuels like wood and dung in polluting, inefficient devices for their daily cooking needs. More than 2 billion lack reliable, consistent access to electricity. About 1 billion people still light their homes with dangerous kerosene lamps. In his keynote talk, Mingle will discuss new developments, trends and opportunities in extending access to clean, affordable energy to these populations, and share his experiences working with remote communities in the Indian Himalaya.

**Bio:** Jonathan Mingle is a freelance journalist whose writing on the environment, energy, climate, development, and South Asia has appeared in a variety of publications, including The New York Times, Slate, The Los Angeles Times, Quartz, and The Boston Globe. He is the author of “Fire and Ice: Soot, Solidarity and Survival on the Roof of the World,” a nonfiction narrative published by St. Martin’s Press in 2015 about black carbon pollution, its health and climate impacts around the world, and promising solutions for addressing it. He has worked as a consultant for the World Health Organization on household energy and air pollution, and as a researcher on social enterprise at Harvard Business School. He is a former Middlebury Fellow in Environmental Journalism. He is a graduate of Dartmouth College, and holds an M.Sc. degree from the Energy and Resources Group at the University of California Berkeley.

**More about Mingle:** <http://greenburger.com/client/jonathan-mingle/>

## Our Expert Speakers

# Erica Myers

*Session III: “Reducing the Carbon Footprint of Energy Services: Strategies and Potential,” 1:30-3 p.m. Tuesday, Sept. 13*

**Presentation Title:** “Do Energy Conservation Investments Deliver? The Role of Energy Efficiency in Climate Policy”



**Abstract:** Residential energy efficiency improvements are often touted as one of the most cost-effective ways to reduce greenhouse gas emissions and have become a key policy instrument used to address climate change in the United States. Based on projections of energy savings from engineering models, energy efficiency advocates maintain that significant investments may be made in the residential sector that would pay for themselves in a short period. However, recent evaluations of energy efficiency programs have revealed that, in many cases, projections systematically overestimate the energy savings realized. These studies have sparked a debate in the policy community about why realized savings are found to be lower than the projections. I explore several hypotheses as to why realized savings may be lower than projected savings, including biases in ex-ante modeling of savings, low quality workmanship, and ex-post changes in consumer behavior. I suggest opportunities for future research to help inform policy makers in improving the design of energy efficiency programs.

**Bio:** Erica Myers is an Assistant Professor of Agricultural and Consumer Economics (ACE) at the University of Illinois at Urbana-Champaign and a faculty affiliate of the E2e Project. She received her Ph.D. in Environmental and Resource Economics from University of California Berkeley in 2014. Prior to her doctoral studies, she received an M.S. in Environmental Economics from the University of Rhode Island in 2007 and worked as a research assistant at Resources for the Future. Her primary area of interest is in environmental and energy economics. She has done work on the design and implementation of carbon allowance markets and testing for the presence of market failures that may lead to under-investment in energy efficiency. Recently, her work has focused on the salience of energy costs in home rental and purchase decisions and its implications for investment in energy efficiency.

**More about Myers:** <http://ace.illinois.edu/directory/ecmyers/>



## Our Expert Speakers

# David Nicol

*Session IV: "Integrating Renewables with the Grid," 3:30-5 p.m. Tuesday, Sept. 13*



**Presentation Title:** "Cyber-Resilience in the Grid"

**Abstract:** The trend toward deployment of new technologies in the grid creates new problems and challenges for the resiliency of the grid. The dynamic nature of renewables provides an excellent case in point. This talk sketches the problems we see, and efforts we are making in the DOE-funded CREDC (Cyber Resilient Energy Delivery Consortium) center to address these problems.

**Bio:** David M. Nicol is the Franklin W. Woeltge Professor of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign, and Director of the Information Trust Institute ([iti.illinois.edu](http://iti.illinois.edu)). He is the Primary Investigator for two national centers for infrastructure resilience: the Department of Homeland Security-funded Critical Infrastructure Reliance Institute ([ciri.illinois.edu](http://ciri.illinois.edu)), and the Department of Energy-funded Cyber Resilient Energy Delivery Consortium ([cred-c.org](http://cred-c.org)). His research interests include trust analysis of networks and software, analytic modeling, and parallelized discrete-event simulation, research which has led to his election as Fellow of the Institute of Electrical and Electronics Engineers (IEEE) and Fellow of the Association for Computing Machinery (ACM). He is the inaugural recipient of the ACM SIGSIM Outstanding Contributions award, and coauthor of the widely used undergraduate textbook "Discrete-Event Systems Simulation."

**More about Nicol:** <http://web.engr.illinois.edu/~dmnicol/nicol-cv.pdf>

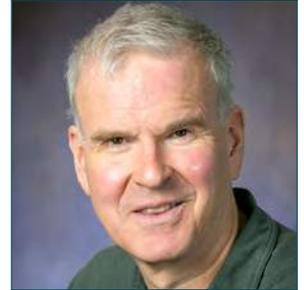
## Our Expert Speakers

# Thomas Overbye

*Session IV: "Integrating Renewables with the Grid," 3:30-5 p.m. Tuesday, Sept. 13*

**Presentation Title:** "Transient Stability Aspects of Renewable Generation Integration"

**Abstract:** In the power system transient stability time frame of seconds after a disturbance, the inertia of an electric machine is seen by the system as the injection or withdrawal of electrical energy in response to changes in the electrical frequency. With the generation resources in the grid changing to include substantially more renewable resources connected by power electronics, such as wind and solar photovoltaics (PV), the grid is shifting toward less inertia. The resulting decline in system frequency response threatens the reliability of the grid. With lower grid inertia, small events result in larger frequency excursions, which, in turn, result in greater burden on generator governors. This talk discusses the transient stability aspects of renewable generation integration, including the results of recent research on quantifying the importance of electrical system inertia.



**Bio:** Thomas J. Overbye is the Fox Family Professor of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign. He received his B.S., M.S., and Ph.D. degrees in Electrical Engineering from the University of Wisconsin-Madison. Prior to joining the faculty at Illinois, he was employed with Madison Gas and Electric Co. Overbye is the original developer of PowerWorld Simulator, an innovative, widely used software package for power system analysis and visualization, a co-founder of PowerWorld Corporation, and is a member of the U.S. National Academy of Engineering.

**More about Overbye:** <https://www.ece.illinois.edu/directory/profile/overbye>

## Our Expert Speakers

# Daniel Sperling

*Keynote Address: 6-7 p.m. Tuesday, Sept. 13*



**Presentation Title:** “The 3 Transportation Revolutions and What They Mean for Energy and Climate Change”

**Abstract:** Passenger transportation has seen little system innovation since the advent of the Interstate Highway System. That is now changing. The ubiquity of smart phones is enabling the commercialization of a range of new mobility services, led by Uber and Lyft; rapid advances in battery and fuel cell technology are enabling electrification of vehicles; and rapid advances in digital technologies are enabling automation of vehicles. The

challenge for researchers is to anticipate and understand the transformations, and for policymakers to direct these revolutions toward the public interest — especially reduced energy use and GHG emissions.

**Bio:** Daniel Sperling is the Distinguished Professor of Civil Engineering and Environmental Science and Policy, and founding Director of the Institute of Transportation Studies at the University of California Davis (ITS-Davis). He holds the transportation seat on the California Air Resources Board and served as Chair of the Transportation Research Board of the National Academies in 2015-16. Among his many prizes are the 2013 Blue Planet Prize from the Asahi Glass Foundation Prize for being “a pioneer in opening up new fields of study to create more efficient, low-carbon, and environmentally beneficial transportation systems.” He served twice as lead author for the IPCC (sharing the 2007 Nobel Peace Prize), has testified seven times to the U.S. Congress, and provided 40 keynote presentations in the past five years. He has authored or co-authored over 250 technical papers and 12 books — including “Two Billion Cars” (Oxford University Press, 2009). He is widely cited in leading newspapers, has been interviewed many times on NPR radio, including “Science Friday”, “Talk of the Nation”, and “Fresh Air”, and in 2009 was featured on “The Daily Show with Jon Stewart”.

**More about Sperling:** <http://desp.ucdavis.edu/people/daniel-sperling>

# Our Expert Speakers

## KR Sridhar

*Keynote Address: Noon-1:30 p.m. Tuesday, Sept. 13*

**Presentation Title:** “Disruptive Trends in the Energy Sector”

**Abstract:** For the very first time since the widespread acceptance of central electrification and liquid fuel-based transportation systems, there is serious discussion of radical changes to our energy landscape that are already beginning to disrupt traditional models. Underlying this discussion are several mega trends that are aligning to drive this disruption. This talk will focus on those trends and the transformation it will bring to the energy sector — and the impact it will have on society, including sustainability.



**Bio:** KR Sridhar is the Principal Co-Founder, President, Chairman and CEO of Bloom Energy. Prior to founding Bloom Energy, Sridhar led a team developing technologies to sustain life on Mars for NASA. For his work, Fortune Magazine cited him as “one of the top five futurists that are inventing tomorrow today”. Before this Sridhar was a professor of Aerospace and Mechanical Engineering as well as Director of the renowned Space Technologies Laboratory (STL) at the University of Arizona. Sridhar received his B.S. in Mechanical Engineering with Honors from the University of Madras, India, as well as his M.S. in Nuclear Engineering and Ph.D. in Mechanical Engineering from the University of Illinois at Urbana-Champaign. He is a member of the National Academy of Engineering and has served on many technical committees, panels and boards. He has over fifty publications and is a sought-after speaker and advisor on energy and environmental issues. He is outspoken in his belief that the climate crisis we face is also a tremendous economic opportunity, that energy policy must be technology-neutral and performance-based, and that we can solve our current energy problems through a combination of technology, innovation, and conservation.

**More about Sridhar and Bloom Energy:** <http://www.bloomenergy.com/about/management-team/#sridhar>



## Our Expert Speakers

# James Stubbins

*Session V: "Nuclear Power: A Panacea for Future Energy Needs?" 8:15-10 a.m. Wednesday, Sept. 14*



**Presentation Title:** "Poseidon's SONGS"

**Abstract:** The lack of a defined, forward-looking energy policy in the United States has tilted the energy market toward the construction of low-cost, low-risk energy production facilities. The approach allows the energy market, and thus short-term energy pricing, to dominate policy on energy. This places the production security and cost of electricity at risk due to variability in fuel costs and matching demand cycles to production availability, particularly in the long run. However, the evolving needs for energy

both in the U.S. and around the world require a much more measured approach to meet future energy needs. This talk will discuss how advances in nuclear power systems are an important component to both meet the evolving energy demand needs and environmental goals over the next 30 years.

**Bio:** James F. Stubbins is the Donald Biggar Willett Professor of Engineering and Head of the Department of Nuclear, Plasma, and Radiological Engineering at the University of Illinois at Urbana-Champaign. His primary research interests are in materials performance and development for advanced energy systems, including the influence of radiation effects, liquid metal corrosion, high temperature gaseous corrosion, moderate and elevated temperature materials' mechanical properties, and microstructural-level examination of materials using advanced electron-optical techniques. Stubbins earned a B.S. in Nuclear Engineering in 1970 from the University of Michigan, and an M.S. in Nuclear Engineering and a Ph.D. in Materials Science and Engineering from the University of Cincinnati, in 1972 and 1975, respectively, and later was a principal investigator in a major high-temperature reactor materials program at General Electric. Since joining the Illinois faculty in 1980, Stubbins has held a number of visiting scientist positions at Argonne National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, and the Pacific Northwest National Laboratory. He is the co-author of more than 100 journal articles and holds one patent. In 2004, Stubbins was named International Scientist of the Year, and was elected an American Nuclear Society (ANS) Fellow in 2007. The American Society for Engineering Education (ASEE) recognized his teaching contributions by awarding him the Glenn Murphy Award in 2010.

**More about Stubbins:** <http://npre.illinois.edu/directory/faculty/jstubbins>

## Our Expert Speakers

# Mike Toman

*Session III: “Reducing the Carbon Footprint of Energy Services: Strategies and Potential,” 1:30-3 p.m. Tuesday, Sept. 13*

**Presentation Title:** “International Cooperation for Technology Breakthroughs to Enable Deep Decarbonization”



**Abstract:** We know that international cooperation to cut global emissions of greenhouse gases requires broad international participation with ambitious goals in order to be environmentally effective. The 1997 Kyoto Protocol, with its international “targets and timetables,” was not able to achieve the necessary breadth of participation or anticipated degree of emissions reductions. The 2015 Paris Agreement, with its emphasis on individually determined national targets for emissions reductions, may do better in terms of breadth of participation, but the actual degree of emissions reductions remains to be seen. This presentation makes the case for changing the focus of international negotiations on greenhouse gas mitigation from emissions reductions per se to the development of affordable low-carbon technologies. Under this approach, an “R&D Club” of high-income and middle-income countries with significant capacity to research and develop such technologies would agree to substantially increase their national R&D budgets for low-carbon technologies, and to promptly share the fruits of any breakthroughs internationally. Focusing directly on achieving the development of low-carbon energy and other technologies through international cooperation, rather than hoping to induce their development through other policy measures, offers better prospects for setting the global economy on a path to deep decarbonization in a timely way.

**Bio:** Michael A. Toman is Lead Economist in the Development Research Group and Manager of the Energy and Environment Team at the World Bank. His current research interests include energy-poverty nexus, mechanisms for achieving environmentally sustainable growth, electricity sector restructuring, and mechanisms for mitigating greenhouse gas emissions through reduced deforestation. Prior to joining the World Bank, he held senior analytical and management positions at RAND Corporation, Inter-American Development Bank, and Resources for the Future. Toman has a B.A. from Indiana University, an M.S. in Applied Mathematics from Brown University, and M.A. and Ph.D. degrees in Economics from the University of Rochester.

**More about Toman:** <http://www.worldbank.org/en/about/people/michael-toman>



## Our Expert Panel

# Rizwan Uddin

*Session V: “Nuclear Power: A Panacea for Future Energy Needs?” 8:15-10 a.m. Wednesday, Sept. 14*



**Presentation Title:** “Comparing Energy Sources (Nuclear vs. Fossil)”

**Abstract:** Public perception plays a large role in energy choices we make. And this is arguably more true for nuclear power than for any other energy source. Ability to make informed decisions when formulating energy policy hinges on our ability to quantify the benefits and risks associated with different energy sources and different technologies. While benefits are often local (in both space and time) and better quantifiable (and thus comparable), risks associated with different technologies often span vast space and

time — making their comparison a daunting task. Uddin will outline factors that need to be taken into account to allow us to develop a rigorous mathematical model for cost benefit and risk analysis associated with different energy sources (nuclear vs. carbon emitting) and technologies.

**Bio:** Rizwan Uddin is a Professor of Nuclear, Plasma and Radiological Engineering (NPRES) and a Professor of Computational Science and Engineering in the College of Engineering at the University of Illinois at Urbana-Champaign. He received his M.S. and Ph.D. from Illinois and has studied in Pakistan, Turkey and the United States. After initially serving on the faculty of the University of Virginia, he returned to the Urbana campus as an NPRES faculty member in 1996. He served on the Executive Committee of the College of Engineering for two three-year terms, and is currently serving as the Associate Head of Academic Programs. He has appeared on the partial list of excellent teachers in every year that he has taught at Illinois, is a recent recipient of American Society of Engineering Education’s Glenn Murphy Award, and he is a Fellow of the American Nuclear Society. He was also awarded the Arthur Holy Compton Award for his teaching and research accomplishment by the American Nuclear Society (2016). In addition to his contributions in the field of nuclear, plasma and radiological engineering, he has also been active in academic and research programs in the wider fields of energy, environment and sustainability. He holds a courtesy appointment of Professor, Institute for Sustainability, Energy, and Environment (iSEE), and is Director of the Master of Engineering in Energy Systems Program, as well as Environment and Sustainability Engineering Program. His areas of interest include thermal hydraulics; CFD; computational methods; biological systems and general modeling and simulation.

**More about Uddin:** <http://npres.illinois.edu/directory/faculty/rizwan>



## Our Expert Panel

# David Zilberman

*Session II: "Advanced Biofuels: A Myth or Impending Reality?" 10:30 a.m.-noon Tuesday, Sept. 13*

**Presentation Title:** "Biofuels Have a Bright Future"

**Abstract:** First-generation biofuels have already played a modest role in replacing fossil fuels, and in many locations these biofuels are profitable. We found that investment in sugarcane-based biofuel in Brazil will pay handsomely and can meet 15% of global liquid fuel demand on 1.7% of global agricultural land. The potential for profitable use of first-generation biofuels is higher with more enlightened regulation of agricultural biotechnology. Second-generation biofuels are on the right track, especially if farmers are compensated for carbon sequestration and investment in R&D expands.



**Bio:** David Zilberman is a Professor and holds the Robinson Chair in the Department of Agricultural and Resource Economics at the University of California Berkeley. His areas of expertise include agricultural and environmental policy, the economics of innovation, risk and marketing, water, pest control, biotechnology and climate change. He is a Fellow of the American Agricultural Economics Association (AAEA) and the Association of Environmental and Resource economics (AERE), and is the recipient of the 2000 Cannes Water and the Economy Award. He won the AAEA 2002 and 2007 Quality of Research Discovery Award and the 2005 and 2009 AAEA Publication of Enduring Quality Award. He has edited 16 books and co-authored 300 papers in refereed journals. Zilberman received his B.A. in Economics and Statistics at Tel Aviv University, Israel, and his Ph.D. at UC Berkeley, in 1979. He has served as a consultant to the World Bank, FAO, USDA, EPA, and CDFA. He served as Department Chair from 1994 to '99, was on the boards of the AAEA and C-FARE, and participated in three NRC panels.

**More about Zilberman:** <http://vcresearch.berkeley.edu/faculty/david-zilberman>

## For the Record

# Congress Rapporteurs

*A look at the students who will help summarize the Congress conversation*



**Kathleen Gegner** (*Session I: “Low-Carbon Energy: The Science, the Reality and the Future,” 8:45-10:15 a.m. Tuesday, Sept. 13*)

Gegner is an M.S. Candidate in Electrical and Computer Engineering at Illinois (graduation date May 2017). Gegner received a B.S. in Electrical Engineering from the University of Nebraska-Lincoln in 2014. She is advised by Professor Thomas Overbye and has a research focus in power system visualization. Her current projects include the development of geographically realistic, though entirely synthetic, models of the U.S. electric grid, and the development of new visualization tools to improve operator awareness and understanding of the electric grid they are operating.



**Chloé Mattia** (*Session II: “Advanced Biofuels: A Myth or Impending Reality?” 10:30 a.m.-noon Tuesday, Sept. 13*)

Mattia is an M.S. Candidate in Crop Sciences at Illinois. Mattia received her B.S. in Natural Resources and Environmental Science at Illinois in 2014 and is a graduate research assistant working under Sarah Taylor Lovell in the Multifunctional Landscape Analysis and Design Lab. Her research entails identifying agricultural landowner adoption preferences for agroforestry practices and mapping marginal land for conventional row crop production that would be suitable for multifunctional perennial cropping systems that provide conservation and production benefits.



**Mateus Nogueira Meirelles de Souza** (*Session III: “Reducing the Carbon Footprint of Energy Services: Strategies and Potential,” 1:30-3 p.m. Tuesday, Sept. 13*)

De Souza is a Ph.D. Candidate in Agricultural and Consumer Economics at Illinois. De Souza received his Bachelor’s in Economics in 2014 from the University of Sao Paulo, Brazil, and is pursuing specialization in environmental and natural resource economics. His research interests include topics related to energy efficiency and technology adoption. He is currently investigating the possible causes of low rates of adoption of energy-efficient technologies in U.S. residences. He is also working as an iSEE Levenick Scholar on a project with his adviser, Erica Myers, to identify behavioral interventions that reduce campus energy consumption.

## For the Record

**Cecilia Klauber** (*Session IV: “Integrating Renewables with the Grid,”*  
3:30-5 p.m. Tuesday, Sept. 13)

Klauber is a Ph.D. Candidate in Electrical and Computer Engineering at Illinois with an emphasis in power and energy systems. She received her B.S. in Electrical Engineering from Baylor University in 2014. Working with Professor Hao Zhu at Illinois, her work has focused on improved computational methods for electric power distribution system monitoring and control. She also works on improving power system stability and reliability by exploring mitigation techniques for geomagnetically induced currents induced by solar storms.



**Joseph Larkin Bottini** (*Session V: “Nuclear Power: A Panacea*  
*for Future Energy Needs?”* 8:15-10 a.m. Wednesday, Sept. 14)

Bottini is a first-year graduate student seeking a Ph.D. in Nuclear Engineering. He graduated from Illinois with a B.S. in Nuclear, Plasma, and Radiological Engineering (NPRE) in May 2016. Bottini worked with NPRE Assistant Professor Caleb Brooks for two years in the areas of thermal hydraulics and heat transfer, and his current research focuses on the critical heat flux (CHF) of fluids and how surface modification and radiation effects can affect the CHF point.



**William Lubega** (*Session VI: “Frontiers of Energy Innovation,”*  
10:15-11:30 a.m. Wednesday, Sept. 14)

Lubega is a Ph.D. Candidate in Civil and Environmental Engineering at Illinois and a member of the iSEE-funded Critical Infrastructure and Transportation Project. Lubega received his B.S. in Electrical Engineering and his M.S. in Engineering Systems and Management from Masdar Institute of Science and Technology, United Arab Emirates. Advised by CEE faculty member Ashlynn Stillwell, he is working in the Energy-Water-Environment Sustainability (EWES) Program, where his research area is in maintaining grid reliability under drought and heat wave conditions.



**Olesya Savchenko** (*Session VII: “Energy Policies for a Sustainable Future,”*  
1-2:30 p.m. Wednesday, Sept. 14)

Savchenko is a Ph.D. Candidate in Agricultural and Consumer Economics at Illinois. Savchenko’s research interests lie in applied microeconomics with a focus on environmental and energy economics. Her research measures housing market response to redevelopment of urban contaminated land through state voluntary cleanup programs, investigates the performance of econometric techniques for empirical estimation of hedonic models, and uses satellite data to understand the impact of renewable energy in developing countries. She was awarded the University of Illinois Clean Energy Education Fellowship and the R.J. Mutti Fellowship, and she earned a Distinction for Best Research Paper in her Ph.D class.



# Acknowledgments

The Institute for Sustainability, Energy, and Environment (iSEE) is grateful for the assistance it received from the University of Illinois Urbana-Champaign campus to bring together quality speakers and passionate participants for iSEE Congress 2016.

## SPONSORSHIP HELP

We would especially like to express gratitude to the Office of Public Engagement and the Center for Global Studies at Illinois for their generous support of this Congress.

We are also grateful to the Alice Campbell Alumni Center, a wonderful venue for our annual event!

## CONGRESS ORGANIZING COMMITTEE

- Madhu Khanna, Professor of Agricultural and Consumer Economics and iSEE Associate Director
- Don Fullerton, Professor of Business
- Bruce Elliott-Litchfield, Professor of Agricultural and Biological Engineering
- Stephen P. Long, Professor of Crop Sciences/Professor of Plant Biology
- Thomas Overbye, Professor of Electrical and Computer Engineering
- Rizwan Uddin, Professor of Nuclear, Plasma and Radiological Engineering

## iSEE DIRECTORS AND STAFF

- Evan DeLucia, Director
- Madhu Khanna, Associate Director for Education & Outreach
- Ben McCall, Associate Director for Campus Sustainability
- Jenny Kokini, Managing Director
- Stephanie Lage, Assistant Director
- Morgan Johnston, Associate Director of Facilities & Services (F&S)/Director of Sustainability, F&S
- Micah Kenfield, Student Sustainability Committee Coordinator
- Tony Mancuso, Communications and Public Affairs Coordinator
- Amy Rosenbery, Office Administrator
- Olivia Webb, Sustainability Programs Coordinator
- Olivia Harris, Communications Specialist
- **Student Interns:** Catherine Yee, Katie Watson, Kate McQueen, Lois Yoksoulian

# Poster Sessions

*Visit <http://bit.ly/iSEECong16> to read about the student and postdoc energy research presenters — as well as the posters from the Illinois Sustainable Technology Center (ISTC) and the Student Sustainability Committee (SSC)*





# ENERGY

# 2030

**Paths to a Sustainable Future**

**Updates on Twitter at #iSEECongress2016**

**University of Illinois  
at Urbana-Champaign**



**Office of the Vice  
Chancellor for Research**