Emerging Technology Series

IEEE Webinar - The Smart Grid: From Appliance to Generator and Back

Wednesday, September 8, 2010

7:30AM (logon time, PDT) – 5:00 PM (PDT)

Simulcast by the IEEE Oregon Section, from Portland, Oregon

Sponsors: **IEEE Region 6 and IEEE Oregon Section**
Co-Sponsors: **IEEE Oregon Section PES and Computer Society Chapters**

Join us in this one-day workshop which provides a systems view of how the Smart Grid provides interactions between the end uses of electricity ("appliances" or industrial processes) and utilities, viewed from the perspective of the technologies, standards, and policies that will enable those interactions and foster innovation and interoperability.

The Smart Grid marries the electrical grid – an extremely complex system based on mature, conservative technology – with two fast moving innovative technologies: computers and communications. It is one of the greatest (if not *the* greatest) electrical, electronic and information processing challenges of our time and represents a significant engineering opportunity over the next two decades and beyond. It captures information about supply, system demand, individual usage, and pricing that fundamentally shifts how electricity is used. It enables the operators of the power system to increase efficiency and reliability while reducing costs and empowering consumers of electricity to minimize their own electricity costs.

Date:	Wednesday, September 8, 2010
Time:	7:30 AM – 5:00 PM
Location:	Ambridge Event Center, 1333 NE Martin Luther King Jr. (MLK) Blvd, Portland, Oregon, and on the Internet as a live webcast.
Webcast:	This event will be webcast in its entirety and recorded for later review. See Registration section for pricing.
Cost:	Webinar is $99 for IEEE members; $150 for non-members, $25 for full-time students. (Onsite fee: $225/$275 - See Registration Section for complete pricing info)
Web:	www.e-grid.net/docs/1009-smartgrid.pdf
Register:	www.regonline.com/ieee_smart_grid_workshop2010

Workshop Agenda – September 8, 2010 *(all times Pacific Daylight Time)*

Time	Subject	Speaker/Topic
7:30 – 8:00am	**Website Logon**	Check your internet connection and register
8:00 - 8:05	**Opening Remarks**	Welcome, day plan
8:05 – 8:50	**Opening Keynote**	**The Smart Grid – What will it take to make it possible;** *Saifur Rahman*, IEEE Distinguished Lecturer, Virginia Tech
9:00 – 9:45	**Controllability**	**The Challenge of Synchrophasors and Wide Area Control;** *Dmitry Kosterev*, BPA
9:45 – 10:15	**Break**	
10:15 – 11:00	**Communications**	**Smart Grid Communications**: You want how much bandwidth? And that little latency?; *Joe Andres*, BPA
11:10 – 12:00	**Supply and Demand**	**Managing Supply and Demand:** Supply and demand control methods and control points; *Rob Pratt*; PNNL
12:00 – 1:00	**Lunch Keynote**	**Turning the Smart Grid Vision into Reality**: A Policy Perspective; *Jeff Hammarlund*, PSU
1:10 – 2:00	**Security**	**Smart Grid Cyber Security**: Protecting the grid and its customers; *Dave McKinnon*, PNNL
2:10 – 3:00	**Applications and Services**	**Smart Grid Enabled Applications and Services**: What's the killer app (and for whom); *Linda Rankin*, PSU
3:00 – 3:30	**Break**	
3:30 – 4:15	**Interoperability and Standards**	**Interoperability and Standards:** What standards are needed/being developed to make the Smart Grid work; *Steve Widergren*, PNNL
4:30 – 5:00	**Panel Discussion**	**Q+A** with the day's speakers
5:00 – 5:10pm	**Webinar Sign-off**	

Summaries of the talks and speaker biographies are at the end of this document.

Learning Objectives:
Attendees will gain an understanding of the monitoring, communications, security and control systems of the Smart Grid, how they interact, the flow of data and control, and design and implementation considerations including:

- Information requirements for optimal control of generating capacity, regional transmission grids, and municipal distribution grids to meet end user demands.
- How generation, transmission and distribution control systems utilize digital information.
- How suppliers and distributors of electricity use information to minimize costs while increasing reliability, flexibility, and security.
- How usage monitoring and automation will allow end users to make informed decisions that reduce their electricity costs.
- How to ensure grid security.
- Balancing optimization of the grid's subsystems and the grid as a whole.

Target Audience:
The target audience is engineers, policy makers, and entrepreneurs who want to understand the Smart Grid in order to make better professional, technical and business decisions.

Prerequisites:
Attendees should be generally familiar with the electric power system, software, or data communications concepts; a power engineering background is not required.

Registration:
Register online at **www.regonline.com/ieee_smart_grid_workshop2010**.
Onsite seats are limited.

The workshop will be held Wednesday, September 8, 2010 at the Ambridge Event Center at 1333 NE Martin Luther King Jr. (MLK) Blvd, Portland, Oregon 97232. Registration/check-in starts at 7:30 AM PDT, with the workshop starting promptly at 8:00 AM PDT.

Lecture notes will provided to all attendees (by PDF, to webinar registrants). Details for webcast access will be provided upon registration. Webcast will be recorded and available for limited period (min. 90 days) for replay/review by **all** attendees. No CEUs will be provided for webcast only registrations.

Fees	IEEE Member	Non-Member	Student/Life Member
On-site	$225	$275	$75
Webcast	**$99**	**$150**	**$25**

NOTE: The registration fee includes one electronic media with course materials for webinar attendees. On-site attendees receive the media, continental breakfast, breaks, lunch and reception (cash bar). The organizing committee reserves the right to substitute speakers, restrict size, change venues, or to cancel the seminar. In the event the seminar is canceled by the organizing committee, registration fees only will be fully refunded. Individuals canceling their registration prior to September 1 will receive a full refund. No refunds will be made to individuals who cancel their registration after September 1. Substitute attendees accepted. Attendance is limited. Registration will be confirmed on a first come, first served basis.

Program and Speakers:

- **Saifur Rahman - Opening Keynote: The Smart Grid: What will it take to make it possible**

  The concept of the smart grid originated from the desire to make the grid - starting from the power station to the end-use appliance - smarter, safer, reliable and more cost-effective using advanced sensors, communication technologies and distributed computing. A smart grid will look more like the Internet, where information about the state of the grid and its components can be exchanged quickly over large distances. It will also allow integration of new sustainable energy sources, such as wind, solar, off-shore electricity, etc. There are five attributes of the smart grid that need to work interactively for this concept to be a reality. These are: Technology, Standards, Cyber Security, Policies and Incentives, and Public Awareness.

At present there are efforts from various vendors globally to develop technologies which will become building blocks of this grid. At the same time standards are being developed that can make technologies from different vendors interoperable so that many players will be able to participate giving customers a broad choice. At the same time, since much of the data related to the smart grid will reside on the Internet and it will carry personalized information, there are significant concerns about data integrity and privacy. Also, there must be policies and regulations in place that will encourage participation by creating a differential pricing structure for the electricity consumed which will discourage peak load growth. Whether all of these will take root will depend on the end-user finding value in participating in this opportunity. And this will depend on two things – awareness and incentives – which are interrelated. The public must be made aware of the benefits and challenges of participating including up-front investments.

Dr. Saifur Rahman is the director of the Advanced Research Institute at Virginia Tech where he is the Joseph Loring Professor of electrical and computer engineering. He also directs the Center for Energy and the Global Environment at the University. He is a Fellow of the IEEE and the editor-in-chief of the IEEE Transactions on Sustainable Energy. In 2010 he is serving as the vice president for New Intiatives and Outreach for the IEEE Power & Energy Society and a member of its governing board. In 2006 he served as the vice president of the IEEE Publications Board, and a member of the IEEE Board of Directors. He is a distinguished lecturer of IEEE.

- **Dmitry Kosterev - Controllability: The Challenge of Synchrophasors and Wide Area Control**

Synchrophasors are precise grid measurements now available from monitors called phasor measurement units (PMUs). PMU measurements are taken at high speed, typically 30 observations per second – compared to one every 4 seconds using conventional SCADA technology. Each measurement is time-stamped according to a common time reference. Time stamping allows synchrophasors from different utilities to be time-aligned (or "synchronized") and combined together providing a precise and comprehensive view of the entire interconnection. Synchrophasors enable a better indication of grid stress, and can be used to trigger corrective actions to maintain reliability.

BPA is starting a 5-year project to install synchro-phasors, develop telecommunication network to bring the data in control centers and exchange with other WECC utilities, to integrate the data in control center environment and to deploy a variety of reliability applications. BPA project is "synchronized" with the National Smart Grid efforts. US Department of Energy made multiple Smart Grid Investment Grant awards across the nation to support deployment of synchro-phasor technology. The SGIG recipients include WECC, Midwest ISO, PJM Interconnection, New York ISO, New England ISO, Dominion, and Entergy. WECC's Western Interconnection Synchro-Phasor Project (WISP) is the largest SGIG project in the area of synchro-phasors.

The talk will describe the synchro-phasor technology, its application and the expected value provided by the projects.

Dmitry Kosterev was involved with synchro-phasors since 1995, and had privilege to work closely with and learn from the pioneers in the area of Wide-Area Measurements and Controls like Bill Mittelstadt, Carson Taylor, John Hauer, and Jules Esztergalyos. He was involved in the development of PMU applications for power plant monitoring and model validation, and most recently development of wide-area controls based on synchronized wide-area measurements.

Dmitry Kosterev received his PhD in Electrical Engineering from Oregon State University in 1996. Dmitry Kosterev is with Bonneville Power Administration, where his responsibilities include transmission planning, power system controls, power system modeling, power system performance analysis.

Dmitry Kosterev has chaired WECC Load Modeling Task Force since 2002, and was a chair of generator Testing Task Force during the development of WECC Generating Unit Model Validation Policy. He is current chair of WECC Modeling and Validation Work Group, involved in activities of load modeling, developing models for renewable generation, and system-wide model validation.

- **Joe Andres - Communications: You want how much bandwidth? And that little latency?**

  This presentation covers possible solutions for Smart Grid network deployments in Substations, WAN, Generation, etc. The discussion will use a presentation covering a vision of "Smart Grid Security Architectures" by Cisco as our starting point.

  Joe Andres is an EE from Oregon State University. He has focused on WAN and LAN networking since 1987 spending six years as the network manager for BPA's control centers network. From 1996 to 2004, Joe was a Cisco field SE with DOE accounts responsibilities. Since 2004, he has provided BPA network and security management for a substation maintenance network including SME duties for all field NERC CIP requirements.

- **Rob Pratt - Managing Supply and Demand**

  This presentation focuses on smart grid technology and its role as the information backbone for a sustainable electric power system, providing an overview and some illustrative examples. The smart electric power grid of the future will integrate the traditional elements of supply and demand, transmission and distribution with new technologies such as customer demand response, distributed generation, and energy storage, using information to make them function as a "society" of devices in a complex, integrated system. The vision for transforming the nation's electric system—from central generation down to customer appliances and equipment—into a collaborative network filled with information and a myriad of market-based opportunities—is being put forward by leading thinkers in the U.S Department of Energy, national laboratories, and industry as a major scientific and engineering challenge for the nation and as an important economic value proposition for ratepayers and the electric industry.

  Ongoing federal and state policy discussions indicate that carbon management for the grid will be increasingly likely and widespread (cap-and-trade, renewable portfolio standards, etc). Demand response programs and controls can be leveraged to obtain efficiency, in

addition to peak load and reliability benefits. These capabilities will be used to measure and verify avoided carbon emissions from both active and passive measures with high temporal and end-use resolution. They can also be used to manage the charging plug-in hybrid vehicles to provide large reductions in foreign oil imports and carbon emission reductions.

Rob Pratt is one of the early thought leaders behind the smart grid, focused on an information-rich future for the power grid. As a Staff Scientist he manages Pacific Northwest National Laboratory's (PNNL's) Smart Grid R&D program activities for the U.S. Department of Energy. He leads a team studying communications architecture, advanced control technology, and simulation of the combined engineering and economic aspects of the future grid, including the effect of plug-in hybrid electric vehicles.

Rob also lead a PNNL initiative that recently commissioned the Electricity Infrastructure Operations Center. The EIOC is a fully-equipped grid control center with live data resources from around the U.S. It is a unique technology development, valuation, training, and technology transfer platform used for advanced grid applications and situational awareness.

Rob has a M.S in Mechanical Engineering from Colorado State and has been a scientist at Pacific Northwest National Laboratory since 1985.

- **Jeff Hammarlund – Lunch Keynote: Turning the Smart Grid Vision into Reality: A Policy Perspective**

The National Academy of Engineering selected the nation's electric grid as "the most significant engineering achievement of the 20th Century" and the largest industrial investment in history. But the last time we could honestly describe this national engineering marvel as "state of the art", Sputnik was still orbiting the planet.

Suddenly and to almost everyone's surprise, modernizing and digitalizing the entire electric grid –from the extra high voltage transmission system to the smart meters and appliances in our homes and businesses - has become almost "sexy." Within days of his inauguration, President Obama called for action to "update the way we get our electricity by starting to build a new Smart Grid that will save us money, protect our power sources from blackout and attack, and deliver clean, alternative forms of energy to every corner of out nation." In an era when bi-partisan support is almost non-existent, members of Congress from both parties were quick to lend their support. Some even predicted that the Smart Grid would be described by future generations as "the first great engineering achievement of the 21st Century."

If the smart grid becomes a reality, it will be because its champions overcome some major challenges that will make the creation and adoption of the nationwide telecommunications network and the Internet look easy. While some of the key challenges are of a technical nature, the most daunting task may involve forging agreement among three major industries – electricity, telecommunications, and information technology – that have had very different histories, missions, and cultures.

This presentation will explore the new laws, policies, and information campaigns that have helped the smart grid to blossom on the national stage. We will also examine some of the policy and regulatory challenges that remain, and consider what next steps that will be needed to move the Smart Grid from vision to reality.

Jeff Hammarlund is an adjunct associate Professor at Portland State University's Mark Hatfield School of Government, a senior research fellow at PSU's Executive Leadership Institute, and the president of Northwest Energy and Environmental Strategies, a small consulting firm. He teaches graduate courses on energy, environmental and natural resource policy. Two years ago, he launched a new team-taught interdisciplinary course for graduate students and mid-career professionals called Planning the Smart Grid for Sustainable Communities. He is the co-author of The Political Economy of Energy Policy and has written numerous academic and professional publications on energy and environmental policy and planning.

Jeff has held a number of senior positions as an energy policy advisor, analyst, and manager and as a land use and transportation planner. He has served in senior staff positions with the U.S. Senate Energy and Natural Resources Committee and the US Department of Energy and as an advisor to presidents, presidential candidates, and governors. He has also been a senior manager for conservation services at Southern California Edison, a senior policy analyst for a regional utility trade association, and a consultant to utilities, governmental agencies, environmental organizations, and Indian tribes. Jeff serves on the executive committee and chairs the Oregon Caucus of the NW Energy Coalition. He is PSU's representative to the GridWise Alliance, the national smart grid trade association, where he serves on the legislative and policy and the education and workforce work groups. He is also on the policy committee of the new state trade association called Smart Grid Oregon.

- **Dave McKinnon – Smart Grid Cyber Security: Protecting the grid and its customers**

The introduction of new technology to make today's existing electric grid even smarter holds great promise: power will be produced and consumed more efficiently; and consumers will be able to actively manage their energy usage. On the other hand, these new technologies could also be exploited by those with malicious intent. Now is the time for all to consider the impacts of smart grid cyber security and insecurity so that we can "build in" cyber security protections for both the grid and its customers. This talk will present the key cyber security concepts of confidentiality, integrity, availability, and privacy and how they apply to the smart grid. This talk will also give a brief overview of the new NIST Interagency Report 7628, Guidelines for Smart Grid Cyber Security.

A. David McKinnon, Ph.D. is a Senior Research Scientist in the Pacific Northwest National Laboratory's statistics and sensor analytics group. His research interests are in distributed sensor systems and cyber security. He is a member of the Smart Grid Interoperability Panel's Cyber Security Working Group and an active participant in its high-level

requirements team. Dr. McKinnon is an active member of the North American SynchroPhasor Initiative's Data and Network Management Task Team. He is also a member of the IEEE-USA Critical Infrastructure Protection committee. Dr. McKinnon has led efforts to develop network communications for embedded sensor systems and currently leads a team that uses a hardware-in-the-loop simulator to test performance of a distributed, embedded system for the U.S. Department of Homeland Security. Dr. McKinnon is also an adjunct professor at Washington State University where he teaches computer and network security. He earned the B.S. and M.S. degrees in mathematics and computer science, respectively, from Brigham Young University and a Ph.D. in computer science from Washington State University. He has received several Battelle Software Creator awards as well as a R&D 100 award for applied research and a Federal Laboratory Consortium award for excellence in technology transfer. Dr. McKinnon is a member of the IEEE, IEEE Computer Society, and ACM.

- **Linda Rankin – Smart-Grid Enabled Applications and Services: What is the killer app and for whom**

Making our electric power transmission and distribution "smarter", known as the Smart Grid, is viewed as a key ingredient to meeting future energy demands in a sustainable manner. Over $4B in the 2009 federal stimulus package was allocated to Smart Grid projects, and a recent report estimated that additional global investment will exceed $45B by 2015. Continued strong interest by venture capitalists, and the entry of high tech heavy weights such as Microsoft, Google, Cisco, and Intel, is also indicative of the transformation of an industry that has traditionally moved at a glacial pace.

While the definition of Smart Grid is shaped by ones perspective, Smart Grid architectural frameworks are emerging along with a set of primary applications and services. I will emphasize the role of digital technology within the context of these frameworks and applications and the role they play in making the grid "smart". During the presentation, the value proposition of a smarter grid as viewed by industry stakeholders, both new and old, will be addressed.

Linda Rankin is a consultant as well as a Research Scientist and Adjunct Faculty in the Maseeh College of Engineering and Computer Science at Portland State University. Her area of interest is the role and application of digital technology to electric power transmission and distribution. In addition to teaching graduate classes on the topic, she has been involved at the national level in the development of standards and demand-response technologies. She holds a BS in Economics from Lewis and Clark College, and a MS in Computer Science and Engineering from the Oregon Graduate Institute.

A former Principal Engineer from Intel Corporation, she has over 20 years experience in the high tech industry in applied research and advanced development. She has managed multi-national projects and has published in journals, international conferences, and is frequently invited to speak at Smart Grid technology forums. She is a Senior member of the IEEE, and holds more than 25 patents or pending patents, many of which are international.

- **Steve Widergren - Interoperability and Standards**

  The smart grid vision emphasizes a flexible electric system that integrates a broad array of generation resources and enables the participation of demand-side resources in reliable system operation. As our use, delivery, and generation of electricity becomes more complicated, the work being done to ease integration and promote interoperability of a heterogeneous environment of devices and systems becomes ever more important. This talk introduces the concepts and issues related to interoperability. It also provides an overview of the efforts underway to develop standards, apply methodology, and provide tools that enhance interoperability to enable smart grid capabilities. This includes the smart grid standards priorities being pursued by the National Institute of Standards and Technology (NIST), a maturity model to develop a culture for interoperability, and tools for regulators and decision-makers that strengthen project sensitivity to fulfilling interoperability requirements.

  

  Steve Widergren contributes to new solutions for reliable operation of electric power systems. Common throughout his career is the application of information technology to power engineering problems including, simulation, control, and system integration. He is a principal engineer at Pacific Northwest National Laboratory and is the 2010/2011 Plenary Chair for the Smart Grid Interoperability Panel, a group established by NIST to advance interoperability of smart grid devices and system through the coordination of standards and best practices. He was recently Administrator for the GridWise Architecture Council – a group formed to enable interoperability of automated systems related to the electric system.

  Prior to joining the Laboratory, Mr. Widergren engineered and managed energy management systems products for electric power operations and supported power system computer applications. Application areas include information modeling, SCADA systems, and power system reliability assessment tools.

  Mr. Widergren received his BS and MS degrees in electrical engineering from the University of California, Berkeley. He is actively involved in the IEEE Power & Energy Society and participates in standards efforts that bridge power engineering with information technology.

- **Interdisciplinary panel discussions**
  Interdisciplinary panel discussions will further attendees understanding of how diverse technologies interact to make the grid smart.

- **Reception**
  Post workshop networking no-host reception (cash bar) with speakers and attendees.

Organizing Committee

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