



**Asia-Pacific  
Economic Cooperation**

**Report on the  
Workshop on Regulatory Approaches to Smart  
Grid Investment and Deployment**

May 16-17, 2012  
Quebec City, Canada

**APEC Subcommittee on Standards and  
Conformance**

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## Background

In November 2011, Asia-Pacific Economic Cooperation (APEC) Ministers and Leaders endorsed the recommendations of the Committee on Trade (CTI) that “APEC economies commit to prevent unnecessary obstacles to trade and investment related to Smart Grid interoperability standards.” These recommendations were based on the report of the APEC Regulatory Cooperation Mechanism on Trade-Related Standards and Technical Regulations (ARCAM) Dialogue and the U.S. paper presented at CTI 1, 2011, in Washington, DC. This Report identified smart grid interoperability standards as an emerging regulatory issue with significant potential to impact trade and investment in the APEC region.

One of the key recommendations developed from the foundational work of the ARCAM was that APEC economies:

*Promote interoperability of Smart Grid standards as a core objective in economy-wide programs to develop and deploy Smart Grid technologies. Implement mechanisms for internal coordination within APEC member economies among regulatory authorities, standards developing bodies and trade officials to advance interoperability of Smart Grid requirements.*

Building on this important work, and seeking to fulfill the primary objective of coordinating and engaging APEC regulatory authorities on smart grid standards and interoperability issues, the APEC Subcommittee on Standards and Conformance organized the 2012 Workshop on Regulatory Approaches to Smart Grid Investment and Deployment.

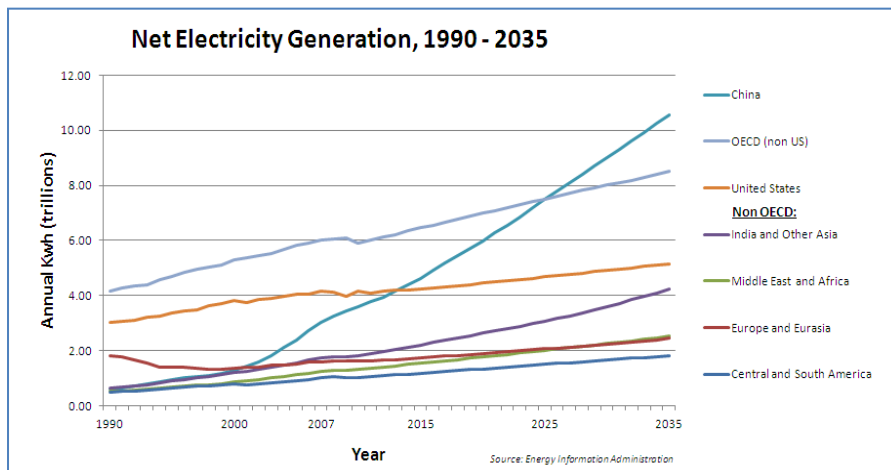
This report presents the outcomes of the workshop, provides extensive background on issues impacting smart grid trade and investment, and includes resources shared by regulatory authorities from APEC economies, the international standards community, and other key global smart grid stakeholders.

Around the world, governments, businesses, and citizens are beginning to understand that aging electric grids are not equipped to be the critical infrastructure of our energy future and are actively investing in a smarter grid. Electricity demand, opportunities to realize efficiency gains (both in distribution/end-use and operations), and the potential to lower carbon emissions are the key factors driving massive global investment in the modernization of electric infrastructure and the development and deployment of smart grid technologies.

### ***Accelerating Global Electricity Demand***

According to the International Atomic Energy Agency, world electricity demand in 2030 will be double what it was at the start of the millennium and growth in the electric sector will outpace any other energy source.

Total energy consumption is expected to increase from 18% in 2000 to 22% in 2030.<sup>1</sup> In order to meet this surging demand, global investment in electric transmission and distribution infrastructure will total \$5.18 trillion between 2001 and 2030.<sup>2</sup> Additionally, industry estimates place the total global investment in smart grid technologies as high as \$200 billion over the next five years.<sup>3</sup>



APEC economies are investing in grid modernization and smart grid deployment in order to meet surging electricity demands and enable the integration of a range of energy sources while striving to meet objectives for energy efficiency and reduced carbon emissions. These investments also serve to modernize critical infrastructure that can support economic growth and innovation in member economies.

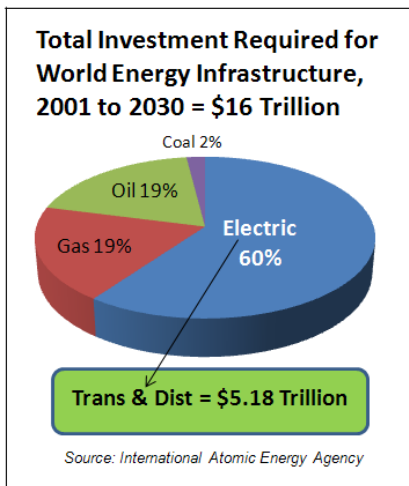
Smart grid deployments are moving forward to varying degrees in nearly every APEC member economy. Australia, Canada, China, Korea, Japan, Singapore, and the U.S. have all recently completed highly-publicized rounds of investment and smart grid pilot projects. While there are differences in the challenges faced in different economies, the electricity infrastructure in every economy is evolving thanks to investments in technologies that integrate information and communication infrastructures with the electric grid.

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<sup>1</sup> Fatih Birol, “Power to the People: The World Outlook for Energy Investment”, International Atomic Energy Agency Bulletin. Available at: [http://www.iaea.org/Publications/Magazines/Bulletin/Bull461/power\\_to\\_the\\_people.html](http://www.iaea.org/Publications/Magazines/Bulletin/Bull461/power_to_the_people.html)

<sup>2</sup> Ibid

<sup>3</sup> Pike Research, “Smart Grid Investment to Total \$200 Billion Worldwide by 2015”, December 28, 2009. Available at: <http://www.pikeresearch.com/newsroom/smart-grid-investment-to-total-200-billion-worldwide-by-2015>



Investments are ramping up in many grid modernization products, energy storage technologies, smart meters, AMI, communications networking technologies, and a range of software applications and platforms. The Information and Communication Technology (ICT) sector is already shifting its business focus with the smart grid in mind: the International Data Corporation (IDC) expects that ICT industry spending on intelligent grid technology in North America, including smart metering, meter data management, supervisory control and data acquisition (SCADA) and substation automation, and grid automation control, will grow 15 percent each year to \$17.5 billion by 2013.<sup>4</sup>

## ***Targeted Outcomes of the 2011 CTI Recommendations***

The 2011 ARCAM Dialogue confirmed that many APEC economies are actively promoting - or considering promoting - Smart Grid as a central means to achieve objectives related to environmental sustainability, energy security and economic growth. ARCAM Dialogue participants engaged actively to produce a set of consensus outcomes, including actions for APEC economies to advance the deployment of Smart Grid and to prevent the emergence of barriers to trade and investment in Smart Grid technologies.

The Workshop on Regulatory Approaches to Smart Grid Investment and Deployment, held in Quebec City, Canada on May 16 and 17, 2012, sought to build on the ARCAM dialogue by facilitating collaboration and information sharing between key stakeholder groups involved with the development and implementation of Smart Grid interoperability standards. The workshop is directly responsive to the CTI call for APEC economies to “implement mechanisms for internal coordination within APEC member economies among regulatory authorities, standards developing bodies and trade officials to advance interoperability of Smart Grid requirements.”

## **Workshop Themes, Conclusions, and Next Steps**

The Workshop participants agreed on these themes, conclusions and next steps:

- The efficient development of standards and interoperability will reap key benefits for electricity regulators
- There is a need for more robust engagements between the standards community and regulators

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<sup>4</sup> IDC Press Release, “New IDC Energy Insights Study Reveals ICT Spending on Intelligent Grid to Reach \$17.5 Billion by 2013”, December 10, 2009. Available at:

<http://www.idc.com/about/viewpressrelease.jsp?containerId=prUS22112909&sectionId=null&elementId=null&pageType=SYNOPSIS>



- The standards community could benefit from an analysis of the needs of regulators, more effectively engaging regulators in the standards development process and the implications of regulation for the modernization of electric grids and the trade in smart grid technologies.
- There is a need for the development and communication of best practices for regulators in providing input to the standards community.
- Continued education and outreach on standards interoperability issues will be beneficial and organizations and forums that are well-positioned for this task should be identified.

# Report on the Workshop on Regulatory Approaches to Smart Grid Investment and Deployment

## *Welcome and Introduction*

**Dr. George Arnold**, the National Coordinator for Smart Grid Interoperability, National Institute of Standards and Technology, United States, opened the Workshop on Regulatory Approaches to Smart Grid Investment and Deployment in Quebec City, Canada with a welcoming address and overview of the workshop agenda. In summarizing the goals of the workshop, Dr. Arnold stressed that “it is important that as APEC regulators consider smart grid investments and regulations, that they have an appreciation for the role of standards in facilitating smart grid development and optimal functionality.”

Dr. Arnold reported on the successful conclusion of the World Forum on Energy Regulation, held the previous two days in Quebec City. Fulfilling one of the objectives of the CTI, the World Forum helped further ARCAM outcomes by engaging energy regulators on the topics of standards, interoperability, and critical regulatory issues impacting smart grid development and trade.

Dr. Arnold thanked the organizers of the World Forum, along with workshop participants and organizers, including the U.S. Department of Commerce, the Office of the U.S. Trade Representative, the APEC Secretariat, and key underwriters and sponsors.

## *APEC Overview*

**Jennifer Stradtman** - Director, Technical Barriers to Trade, Office of the U.S. Trade Representative and U.S. Representative to the APEC Subcommittee on Standards and Conformance, United States – provided workshop participants with an overview of APEC’s structure, membership, and mission. She also briefed the group on the comprehensive smart grid work being undertaken at APEC, including the activities of the Energy Working Group.

Ms. Stradtman reviewed the 2011 ARCAM work and noted that the results of the current workshop would also be reported to the Committee on Trade and Investment.

## *Goals of the Workshop*

**Paul Centolella**, Commissioner, Public Utilities of Ohio, United States, presented on the goals of the workshop and highlighted its importance. Building on existing APEC work, Mr. Centolella encouraged APEC participants to engage on issues impacting interoperability; promote dialogue on policy issues; exchange lessons learned/best practices; and “share our visions for the future for the electric sector.”

Centolella noted that APEC economies are challenged by increasing demand for electricity, issues of energy security, and the goals of carbon emissions reductions. Mr. Centolella suggested that smart grid is part of a solution to these challenges and noted the key role for regulators in ensuring that this system of systems can operate reliably and efficiently as we move forward.

To provide a common framework for discussion for the workshop, Mr. Centolella encouraged regulators to think about smart grid as the integration of an advanced communications infrastructure with the power grid and stressed the fact that they are providing a platform for innovative applications that provide economic value to the energy sector and to the economy as a whole. He also noted the importance of ensuring the modernized power system's transition into the future, which will require thoughtful investments in technologies that last and interoperate efficiently.

The role of interoperability standards will be a major factor in determining the success of the smart grid in achieving the goals of governments, regulators, and citizens. Mr. Centolella detailed the benefits of interoperability and encouraged workshop participants to engage in an active dialogue in the days to come that will help further the APEC objectives and ensure that the benefits of the smart grid are realized for their economies.

### ***Keynote Address 1: Ms. Lise Duquette***

**Lise Duquette**, Chair, Canada's Energy and Utility Regulators (CAMPUT), delivered the opening keynote speech; Duquette provided insights on the perspective of regulators seeking to balance the needs of the consumer with the need for utility investment in smart grid technologies. Ms. Duquette helped frame the workshop discussion and posed critical questions to be considered by the participants, as well as the wider regulatory and standards communities, on the issues of technology reliability, affordability, lifecycles, innovation, and return on investment.

Regulators and standards makers do not speak to each other nearly enough, noted Ms. Duquette. From the regulatory perspective, key objectives are: reliability, affordability to consumers, and ensuring utilities a fair rate of return.

To a regulator, new technology means an investment. In Canada, the electric network will require tens of billions of dollars in investment. Ms. Duquette posed the following questions for consideration as regulators consider smart grid investments:

- How many people are unable to pay their electricity bill as it is and how will new investment further impact affordability?
- But can a utility afford NOT to invest?
- And if investment moves forward, how can the technology be future proof?
- There are four over-arching questions: who will benefit? who will pay? over what time frame? And how much?

Ms. Duquette noted that the fact that so many regulators and stakeholders from the World Energy Forum were participating at the workshop is a sign of progress on the path of education for regulators considering smart grid investment and deployment.

## ***Panel Session 1: Interoperability Standards and the Role of Energy Regulators***

The panel examined major smart grid issues facing regulators and provided information on international standards development activities that will be valuable to regulators.

Panel participants included **Collette Honorable**, *Chairman, Arkansas Public Service Commission*; **John Caskey**, *Vice-Chair, Smart Grid Interoperability Panel, Vice President, NEMA, United States*; **John O'Neil**, *Canadian Standards Association*; and **Sunny Rai**, *Regional Vice President, Renewables and Smart Grid, Intertek, United States*.

**Chairman Honorable** provided detailed examples of challenges facing regulators in economies where smart grid deployment is moving forward. In the Chairman's district in the U.S., regulators are seeking to ensure the integration of sustainable energy resources and the deployment of smart grid technologies for their efficient management. In order to address consumer concerns relevant to these investments, regulators require detailed plans from the utility on privacy and cyber security issues. Chairman Honorable noted the importance of education and capacity building among regulators in order to provide robust analysis of such plans and ensure that smart grid deployments meet the public interest.

**John Caskey** briefed participants on the progress of the international standards community in developing smart grid standards that are interoperable and supportive of efficient smart grid deployment and functionality. Mr. Caskey presented an update on the work of the Smart Grid Interoperability Panel (SGIP), which has developed a Catalogue of Standards that meet a variety of interoperability requirements, including communications architecture, cyber security, and testing and certification. Mr. Caskey noted that the SGIP and the Catalogue can provide important tools and solutions for both utilities and regulators.

**John O'Neil** presented an overview of the work of the Canadian Standards Association and its role in overseeing Canada's national standards system, including standards for the smart grid. Mr. O'Neil highlighted the open and inclusive process that defines standards development in Canada, as well as the importance of the participation of the international standards community, including the SGIP. Regulators play an important role in the development of standards and Mr. O'Neil invited more robust engagement from regulators in the international standards making process for the smart grid.

**Sunny Rai's** presentation featured a detailed look at the development and implementation of the Open Automated Demand Response (ADR) standard for the smart grid along with the work of the SGIP to ensure its interoperability. The Open ADR standard has applications in utility communications with smart meters and provides the benefits of lower-cost technologies. Open ADR was first published in 2009. Multiple Standards Development Organizations (SDOs) and a wide variety of other stakeholders contributed its development over the previous 7 years. Regulators can provide a vital perspective on the utility of standards as they are developed, and Mr. Rai encouraged engagement with organizations like the Open ADR Alliance, which continues to develop certification requirements for the standard.

## ***Panel Session 2: International Standards Development***

Participants included **Dr. George Arnold**, *National Coordinator for Smart Grid Interoperability, National Institute of Standards and Technology, United States*; **Mr. Koichi Noda**, *Director, Technical Regulation, Standards, and Conformity Assessment Policy Division, METI, Japan*; **Mr. Jacques Regis**, *Past President, International Electrotechnical Commission (IEC)*; and **Dr. W. Charlton Adams, Jr. (Chuck)**, *Past President, IEEE Standards Association*. The session examined the value proposition of international standards development and explored the topics of why and how regulators could participate in standards development and how they could make their needs known to standards developer.

**Dr. George Arnold** provided an overview of the Smart Grid interoperability standards activities in the U.S. that is being led by the National Institute of Standards and Technology. He highlighted the NIST Smart Grid Interoperability Framework and Roadmap version 2.0 that was published in February 2012. Dr. Arnold noted that the Smart Grid Interoperability Panel is a partnership to coordinate and accelerate Smart Grid interoperability standards development. He used an example of a recent initiative, the Green Button, which provides U.S. utility customers with their energy usage data as a success story that was enabled by the standard development process.

**Mr. Koichi Noda** described the Smart Grid Standardization Implementation in Japan. He emphasized the importance of standardization and that Japan is contributing to the international standards development effort. Mr. Noda laid out the complex landscape of Smart Grid standardization which involves the fusion of information and networking technology with the power system that integrates many technologies such as renewable generation and storage. The 2011 Great Japanese Earthquake/tsunami and subsequent nuclear accident have accelerated the implementation of the Smart Grid technologies to combat the severe energy shortage due to the shutting down of nuclear power plants. Japan is getting ready to roll out feed-in tariff scheme for renewable energy that is similar to the schemes in Germany and Spain. Mr. Noda reviewed Japan's Roadmap on Smart Grid Standardization that includes 26 focus areas, providing a strategy for Japan to contribute to the international standardization effort.

**Mr. Jacques Regis** gave an overview of the International Electrotechnical Commission (IEC) and its relevant activities on developing Smart Grid standards for regulators. The IEC was also involved in the ARCAM Smart Grid Dialogue that emphasized interoperability. However, there are other areas for standardization including architecture and new technologies. The IEC has 24 technical committees that coordinate smart grid efforts and work closely with other organizations such as ISO, ITU-T, and IEA. Mr. Regis stressed the importance of storage for Smart Grid implementation and that it is a powerful tool to ensure backup for renewable generation and power quality. He highlighted the IEC's structure including its global reach and independent status. The IEC has a recognized standards and conformity system covering all aspects of the electrical system. It contributes to supporting good regulatory practices and facilitates the development of new technologies. The regulatory community can get involved in the IEC process through their national committees. Mr. Regis closed his presentation by stating that IEC is a good conduit for Smart Grid standards development that can help to avoid duplications.

**Dr. W. Charlton Adams, Jr. (Chuck)** provided an overview of IEEE activities in Smart Grid standards development. Smart Grid is a great business opportunity that has potential to create new markets and spur economic development. Standards are crucial to complex system such as the Smart Grid

that crosses many technology boundaries. Standards format technology and enable wider distribution of technology, ensure interoperability, and enabling economies of scale. APEC economies are at the forefront of grid modernization and should participate in the international standardization activities. IEEE is partnering with APEC economies to develop economies' strategies that include both technology and policies. IEEE has global offices include those in APEC regions such as Japan, China, and Singapore. IEEE Standards Association (IEEE-SA) has Memorandums of Understanding with many organizations in the APEC economies including those in China, Korea, and Japan. IEEE-SA collaborates with other SDOs including ITU-T, IEC, ISO, SAE International. Dr. Adams believes that we are at a critical state for Smart Grid development as we need to tackle the challenge of integrating a complex technology; cooperation is key to taking advantage of this tremendous business opportunity.

## ***Keynote Address 2: Mr. David Wright***

**David Wright**, *President, National Association of Regulatory Utility Commissioners (NARUC), United States*, addressed the challenge for regulators to facilitate smart grid innovation while achieving their mandate to ensure the reliability of the network. Mr. Wright's speech included an explanation of the role of NARUC in bringing regulators together to facilitate information sharing and coordination on important issues that ultimately impact utility management of – and consumer engagement with – smart grid technologies.

Mr. Wright highlighted the fact that four trillion dollars of infrastructure improvements are occurring in the United States, including water, gas, interstate pipeline and electricity. In the midst of this investment, the role of utility commissioners is to ensure that new systems are fair, reasonable and in the public interest. With regulators receiving pressure for Smart Meter programs to expand, they need to keep the bar high for approval.

Federal government resources can drive deployment, and they can also serve the interests and education of regulators. Mr. Wright pointed to varying degrees of success for different Department of Energy funded programs across the country, which can serve as case studies for regulators. As deployments have advanced, NARUC has further engaged with the President's energy team in order to deliver input and receive valuable information.

When it comes to smart grid investment and deployment, regulators need to consider a series of principles focused broadly on cost, reliability, privacy and consumer engagement, which includes considering the effect on low-income communities. Mr. Wright highlighted the work of consumer interest groups in delivering critical information to both citizens and regulators on issues like privacy and pricing.

Mr. Wright concluded by stressing the need for cyber security in smart grid deployments. The current roles between the federal and state regulators are still being defined and continuing communication is necessary to prevent threats and attacks on systems. Mr. Wright underscored the need for teamwork, and coordination among the federal agencies and noted that the main take away from the World Forum on Energy Regulation was "hurry up the adoption of Smart Grid...but slowly."

### ***Panel Session 3: Lessons Learned from Smart Grid Projects***

Participants included **Mr. Joseph Paladino**, *Senior Advisor, Office of Electricity Delivery and Energy, U.S. Department of Energy, United States*; **Mr. Sungbong Chang**, *Director, Smart Green Business Office, R&D Lab, KT, Korea*; and **Mr. Peter Fraser**, *Managing Director, Regulatory Policy, Ontario Energy Board, Canada*. The session looked at the approaches and outcomes from Smart Grid Projects in Canada, Korea and the United States. These case studies examined provided great insights for regulators. Panelists suggested that further analysis would benefit regulators as they meet the challenges in applying and using standards to support Smart Grid deployments.

**Peter Fraser**, of the Ontario Energy Board, briefed participants on the goals, challenges, and progress of Ontario's Smart Meter Initiative, which began in 2006. By 2010, smart meters had been installed for 93% of Ontario's electricity users and Time-of-use pricing (TOU), which provides for variable rates at different times of day (mid, off, and peak), was also introduced as a part of the initiative.

Mr. Fraser noted key challenges faced in Ontario, including the lack of standards, customer acceptance of new pricing, and difficulties in implementing policies that help realize the objectives of the smart grid. Six different meters were used in the Ontario pilot projects; there was no standard billing system among the 77 distributors. The lack of standardization in these areas was a problem in implementation. Mr. Fraser stressed the importance of regulatory engagement with the standards community to help mitigate challenges such as this. He noted that the Ontario Energy Board participates in international standards development through the Standards Council of Canada and works to advance regulatory needs and ensure that they are considered.

Following the smart meter deployment in Ontario, the implementation of Time-of-Use (TOU) Pricing benefited some consumers, but resulted in increased rates at certain times for other consumers. Mr. Fraser stressed the need for robust communications with consumers by both the utility and the regulator to ease customer acceptance of applications like TOU Pricing. He also noted the difficulty in fully realizing the efficiency gains that can be driven by TOU pricing because of excess capacity in Ontario's system, effectively restricting energy efficiency incentives that can be pushed out to consumers.

**Sungbong Chang** highlighted Korea's status as one of the largest energy users in the world, the energy constraints it faces to meet the demand, and the potential for smart grid technologies to provide critical solutions. He then discussed the field trials 1 and 2 of the Jeju Island Smart Grid Project that was launched in August 2008 and is expected to be complete by May 2013. Jeju stakeholders are now moving forward on five broad application domains for the project: Smart Place, Smart Transportation, Smart Renewables, Smart Power Grid, and Smart Electricity Service. The Smart Power Grid and Electricity Service required the implementation of a bidirectional power network, to increase energy efficacy, to encourage TOU pricing with customer participation and to promote an on-line system for power exchange and derivatives. The final goal of the Jeju Island project is to have full Smart Grid implementation in 2030.

In providing advice to regulators, Mr. Chang reviewed several challenges encountered in the Jeju trials including the skepticism by stakeholders, low consumer participation, lack of private

investment attraction, and at times too many technology options and at other times no technology options. Solutions could include deregulation, dedicated organization for Smart Grid planning, government's role as a driving force, and change in consumer behavior. Korea's government has taken bold steps in developing the smart grid in close partnership with private sector stakeholders.

**Joseph Paladino** presented an analysis of the status of smart grid deployments in the U.S. that were funded by the American Recovery and Reinvestment Act of 2009. The U.S. Department of Energy has since allocated \$4.5 billion – to be matched by an additional \$4 billion from the private sector – for smart grid pilots and regional demonstration projects. Today, approximately half of these funds have been deployed by awardees and 131 Smart Grid projects have been initiated.

The 2003 electricity blackouts in North America shaped recent U.S. smart grid investments and technology solutions. Improving sensor networks, enhancing real time self-healing capabilities, and increasing wide-area visibility are priorities for the development of the grid in the U.S. Mr. Paladino noted the technology needed was complex to put in place. He provided examples of existing projects under the DOE grant program and their varying levels of success and their shared best practices on both technical and policy levels.

Mr. Paladino concluded the presentation by sharing the high level economic matrix developed by DOE to analyze the results reported from the projects. The analysis of these economic factors is extremely important in analyzing the benefits and success of Smart Grid Initiatives and sharing lessons learned with a variety of stakeholders. More information is available on [SmartGrid.gov](http://SmartGrid.gov)

### ***Panel Session 4: Cyber Security***

Participants included **Mr. Ken Modeste**, *Security and Global Communications, Underwriters Laboratories, United States*; **Mr. Rodney Howes**, *Portfolio Manager and CoP leader e-Security, Centre for Security Science, Research and Development, Canada*; **Mr. James St. Pierre**, *Deputy Director, Information Technology Laboratory, National Institute of Standards and Technology, United States*. The session examined issues related to securing the grid and discussion topics included the evolving threat landscape and best practices for risk mitigation in the electric sector.

**Ken Modeste** began the panel with an overview of the elements and importance of cyber security for the electric grid. He noted that utilities and energy industry have the second highest targeted rate of cyber crime and encouraged diligent risk assessments and comprehensive investments in protection. "Why did we put brakes on cars?" Mr. Modeste asked the audience, "so they can go faster!" Likewise, cybersecurity can be viewed as an enabler of technology and does not have to be designed to slow down the smart grid. Modeste concluded by stressing the need to ensure cyber security solutions are *sustainable* and noted that standardization of policies and procedures that allows for easy audits is one way to support sustainable cyber security.

**Rodney Howes** briefed participants on the work of the Canadian Safety and Security Partnership, which helps to further the mission of Defense R&D Canada by conducting security assessments, engaging a wide range of stakeholders on solutions, and advising Public Safety Canada. When it comes to smart grid security, Mr. Howes noted that the network will soon be producing unprecedented amounts of data, which can be of use to those trying to protect the grid. There is a great deal of critical analysis still to be done and there are important exchanges to be made between utilities and users in order to better inform both groups of cyber risks on the smart grid.



**Jim St. Pierre** presented an overview of the work of NIST and the Cyber Security Working Group (CSWG), a free and open public private partnership designed to coordinate stakeholders and develop guidelines and other information on smart grid cyber security. The CSWG recently collaborated with SGIP to further the efforts in the cyber security Priority Action Plan and to work on overlapping issues of privacy. Mr. Pierre stressed the importance of the engagements between CSWG and SGIP in developing and accelerating consensus on critical issues.

In the discussion with workshop participants, the presenters discussed the challenges of ensuring that the power system is safe and reliable and the frameworks and best practices for regulators and utilities to consider when trying to deal with this challenge.

### ***Keynote Address 3: Professor Ja-Yoon Koo***

**Professor Ja-Yoon Koo's, Chair, Korea Electricity Commission**, keynote address focused on the need for regulation and standards to ensure the interconnected functional structure of the smart grid: regulation determines the rate of return and, therefore, investment; Koo stressed that standards and interoperability are required to ensure the interconnection of the smart home.

Mr. Koo presented Korea's path to interconnection and interoperability, highlighting the tools, resources, and organizations providing support, including the recent smart grid promotion law to develop the smart grid industry. This law is a key next step in ensuring that the smart grid in Korea reaches beyond Jeju and out to the average consumer.

Professor Koo concluded his remarks by stating that "in order to realize the benefits of the smart grid, business should be activated through the convergence of ITC and power technology and standards, international cooperation, and regulation should work together at promoting this."

### ***Panel Session 5: Consumer Data Access and Privacy***

Participants included **Janine Migden-Ostrander**, *Principal, Regulatory Assistance Project*; **Dr. David Wollman**, *National Institute of Standards and Technology, United States*; and Ms. **Ruth Yodaiken**, *Attorney, Division of Privacy and Identity Protection, Federal Trade Commission, United States*. This session focused on key regulatory considerations for the development of the smart grid in the realm or privacy. Participants considered the matter of the security and protection of consumer data in the context of the smart grid, and how consumers can use that data for their benefit.

To set the stage for an examination of issues of privacy, **David Wollman** highlighted the importance of engaging the consumer through the utilization of their electricity data in realizing the benefits of the smart grid. He then gave an overview of data access policies in the U.S. that govern how private companies and law enforcement deal with consumer energy data.

Mr. Wollman described the Green Button concept, a smart grid tool that allows consumers to access and obtain electricity usage data from their utility through a secure Internet-based application. The development of standard schemas and file formats and the utilization of a standard machine-readable protocol for the transmission of this data add great value from the consumer, utility, and regulatory perspectives. Mr. Wollman reported on the success of early implementations of the Green Button and noted that the SGIP has a PAP supporting further development.

**Ruth Yodaiken** briefed participants on the work of the U.S. Federal Trade Commission concerning consumer data privacy issues and provided an analysis of recent developments of privacy frameworks and other tools of use to regulators confronting issues of privacy impacted by smart grid technologies. She posed key questions for regulators on the topics of aggregated and anonymized data, anticipating potential new implications of certain data as technology changes, determining how utilities can better control data, and third party access to data.

In light of the emergence of new technologies and new business models – including social media, the cloud, mobile, and smart grid – the FTC has reexamined its approach to privacy. Ms. Yodaiken described the highly collaborative process of engaging with a wide range of stakeholders during this reassessment, including through public fora around the nation. Based on these engagements, the FTC reports that unprecedented amounts of consumer data are now available – often unbeknownst to consumers – and useful for new business models to monetize. However, there are also benefits from the evolution - consumers are concerned about protecting privacy while at the same time interested in the benefits of sharing data and utilizing innovations. The FTC Privacy Framework offers regulators useful tools in striking this balance for smart grid consumers.

**Janine Migden-Ostrander** provided detailed examples of consumer data privacy issues arising in the smart grid domain and reported on principles and tools that have been developed and will be of use to regulators. She stressed the fact that consumer data access and privacy issues are important to consumers and must be addressed by all smart grid stakeholders.

She noted that Smart Grid deployments that reach the consumer domain can expose electricity usage data to an unprecedented level, which has serious implications for consumers, as well as energy companies, law enforcement agents, and civil society in general. Ms. Migden-Ostrander reported that the Critical Consumer Issues Forum (CCIF) has developed a set of principles for privacy and security protection in Smart Grid implementation that can be useful to stakeholders seeking to understand the privacy landscape. Ms. Migden-Ostrander presented the following recommendations to workshop participants: elevate privacy to a prominent level before implementation and deal with it upfront; help customers understand what they are agreeing to when they use a smart meter; and, do more to protect those in the home who are not the bill payers and may not be aware of the privacy implications of the smart grid.

### ***Panel Session 6: Economies' Vision for the 21<sup>st</sup> Century Grid***

Participants included **Paul Centollela**, *Former Commissioner of Public Utilities of Ohio, United States*; **Mylene C. Capongcol**, *Director IV, Electric Power Industry Management Bureau, Department of Energy, Philippines*; **Tatsuya Shinkawa**, *chief representative, New Energy and Industrial Technology Development Organization (NEDO)*; and **Juan Carlos Martina**, *Professional, Security Division and Electricity Market, Ministry of Energy, Chile*.

In this session, representatives from three economies presented on their national experience in upgrading electricity infrastructure to achieve a 21<sup>st</sup> century grid. Presenters delivered important lessons learned and discussed next steps toward grid modernization.

**Tatsuya Shinkawa** briefed participants on the wide-scale policy and regulatory efforts that have been undertaken to drive investment in a modernized, reliable, and more efficient electricity network in Japan. Following the 2011 earthquake and Japan's subsequent success in transforming its

energy supply, there is now a need for smart meters and smart grid technologies and services that will further the goals of diversifying supply and maximizing energy efficiency.

Meeting new challenges in Japan's energy market is not just about technology, it's also about the regulatory and policy environment. Mr. Shinkawa presented on recent legislative and policy initiatives in Japan to accelerate the deployment of renewable energy sources and smart grid technologies necessary for their efficient integration with the network. Japan's government is also focused on crafting an effective regulatory environment that facilitates competition and expands the energy market.

**Mylene Capongcol** provided an overview of the energy market in the Philippines and discussed the development of smart grid projects designed to enhance the resiliency of the network and enable new innovations in the market. The policy and regulatory framework for smart grid in the Philippines will be developed by 2013, and the government is interested in coordinating and receiving input from international partners.

The electricity market in the Philippines is at an important phase of development: there has been significant privatization and retail competition is on the way. Ms. Capongcol provided details on new investments by the private sector in the power sector that will support energy security, the diversity of the energy supply, and the efficiency of the power network. Investments in the modernization of the grid – including an upcoming smart grid feasibility study – will support wider government goals for the energy sector and provide an infrastructure for innovations like electric vehicles in the future.

**Juan Carlos Martina** presented an overview of the history of Chile's energy sector and laid out the coming challenges in the smart grid domain that the government will take on in order to achieve world class infrastructure that meets the needs of growing demand. Mr. Martina stressed the importance of communicating to consumers during this period and educating them about the value of smart grid and energy efficiency.

Chile was the first electric market to be deregulated in 1982. Competition has driven robust service, but determining the government role in driving smart grid investments is a challenge. According to Mr. Martina, the necessary tasks in the electricity sector in Chile include the goal of exploiting local energy sources; regional and international connection of transmission; and ensuring the recent net metering law is implemented and achieves its goals. Meeting the needs of a population growing in wealth will be an additional challenge: the growth rate of electricity demand in Chile could be as high as 7% per year in the near future and there is a challenge in transmitting power to population centers from distant hydro-electric sources.

## ***Summary of Conference Outcomes***

Dr. George Arnold summarized the deliberations, reviewed key themes from the Panel sessions and presentations, and summarized the Workshop themes and conclusions:

### **Interoperability Standards and the Role of Energy Regulators**

- It is important for regulators to educate themselves about the interoperability standards and best practices for Smart Grid implementation
- Communication among regulators, industry and other stakeholders is key to the successful implementations of Smart Grid technology based on international interoperability standards

- Regulators should consider consumer rate impact, education, and engagement, privacy and security, among other factors, when considering applications for Smart Grid deployments

## **International Standards Development**

- International standards offer key benefits to smart grid development – reducing trade barriers, increasing economies of scale, reducing costs, and reducing risk in deploying new technologies
- Regulators should be aware of available international standards and their benefits to smart grid deployments
- National processes involving stakeholders (including regulators) in developing roadmaps, priorities and requirements for smart grid standards should provide input to international standards development.

## **Lessons Learned from Smart Grid Projects**

- Set policy objectives at a national level (congress/administration) in concert with state and local governments that help drive grid modernization
- Develop a structured approach to share benefits and lessons-learned realized through early deployments with decision-makers in the utility industry
- Develop an international standard (like ISO 14000) that credits companies for implementing common or standardized interoperability/cyber practices and procedures (eventually to drive requirements for technology development)

## **Cybersecurity**

- Regulators can look at using U.S. Department of Energy Risk Assessment Model and NIST IR 7628 to inform their assessment of utilities cybersecurity capabilities
- There should be more collaboration on research from all APEC economies on cybersecurity standards, risk assessment and implementation and evaluation

## **Consumer Data Access and Privacy**

- Privacy issues should be addressed prior to and through-out the roll-out and implementation of smart grid
- Individual customer data should not be disclosed to a third party prior to obtaining appropriate customer consent
- There is value in consumers having access to their own data and having clear information about the data practices of companies/utilities with whom the consumer may interact

## **Economies' Vision for the 21st Century Grid**

- Smart grid deployments may be tailored to the needs of different economies and considered to address a range of regulatory, policy, and economic objectives including:
  - Developing efficient power markets;
  - Addressing load growth and resource scarcity;
  - Integrating electric vehicles, renewable and distributed generation; and

- Electrification of economies, providing a reliable supply of electricity, and maintaining grid stability in remote areas.
- Develop a policy framework, roadmap, and rollout plan for smart grid implementation, including capacity building; international cooperation and building on best practices; and experiments for better understanding consumer interactions and new energy / social systems.
- Consider smart approaches to demand and supply management when implementing more competitive and open power markets.
- It is essential for developing economies to have a reliable supply of electricity to foster growth and development.

## **Other Key Themes and Conclusions**

- The Standards community should consider developing education programs and training for the regulatory community and be aware of the needs of the regulatory community
- Pacific Area Standards Congress (PASC) might consider develop training materials or guidelines for the standards community to better understand the needs of the regulatory community, how to better engage regulators in the standards development process, and the implications of regulation for the modernization of electric grids and the trade in smart grid technologies
- The International Confederation of Energy Regulators (ICER) has multiple working groups – for example, on education and training for regulators – that, consistent with the ICER’s 2012 to 2015 work plan to address technological changes in how electricity networks are developed and operated, could provide an ongoing mechanism to inform regulatory staff on standards and the standards development process
- Standards can play an important role in reducing costs and enabling innovation
- Regulatory needs can drive standard development; for example, the OpenADR standard was a response to the California energy crisis of 2001
- Communication between the regulatory and standards communities must be established and strengthened especially in areas in which standards have policy implications such as customer data access, privacy, and cyber security
- Use the opportunity to upgrade the infrastructure to modernize by using new technologies

## ***Acknowledgements***

This Workshop on Regulatory Approaches to Smart Grid Investment and Deployment was organized by the United States. The Workshop organizers thank the Project co-sponsors: China, Chinese Taipei, Japan, and Korea; and express their appreciation to the APEC Secretariat and the USAID-managed APEC Technical Assistance and Training Facility (TATF) for invaluable support and assistance.

This event drew on the talents of many persons:

The Workshop report was written by Andrew S. Bennett, (Smart Grid Industry Analyst and International Trade Specialist, U.S. Department of Commerce, International Trade Administration), with the assistance of Patricia Harris, Ryan Kane, Cuong Nguyen, and Jennifer Stradtman. Ms. MaryAnn Hogan from the National Institute of Standards and Technology, U.S. Department of Commerce served as the Workshop webmaster. Ms. Estefania McPhaul of TATF managed meeting logistics and materials.

The Workshop organizers also extend their thanks and appreciation to the organizers of the 5th World Forum for Energy Regulation, in particular Mr. Pierre Méthé, for assisting with agenda development, program planning, and meeting logistics.

The organizers also thank the workshop speakers for their thoughtful and well-informed presentations and the workshop participants for their full engagement in the discussions.

And, finally, the workshop benefitted from the hospitality provided by the CSA Group, IEEE, Intertek, and Underwriters Laboratory which allowed the workshop participants to carry on their deliberations and conversations in a relaxed and amiable setting.

Cuong Nguyen  
Heather Grell

# APPENDIX 1 - Agenda

**APEC SCSC Workshop on  
Regulatory Approaches to Smart Grid Investment/Deployment  
May 16-17, 2012  
Quebec City, Canada  
Quebec City Convention Centre \*\* Room 301AB**

## AGENDA

The scope of the workshop is regulatory considerations for Smart Grid investments and deployments including standardization.

### Wednesday, May 16, 2012

1:00pm - 2:00pm      **Registration**

Refreshments sponsored by the IEEE

2:00pm - 2:10pm      **Welcome and Introduction**

*Dr. George ARNOLD, National Coordinator for Smart Grid Interoperability, National Institute of Standards and Technology, United States*

#### **APEC Overview**

*Ms. Jennifer STRADTMAN, Director, Technical Barriers to Trade, Office of the U.S. Trade Representative and U.S. Representative to the APEC Subcommittee on Standards and Conformance , United States*

2:10pm-2:40pm      **Goals of the Workshop**

*Mr. Paul CENTOLELLA, Former Commissioner of Public Utilities of Ohio, United States*

*This session will provide an overview of the rationale for the workshop including goals and objectives. The workshop will focus on key issues for regulators in Smart Grid investments and deployments such as interoperability, international standardization, cybersecurity, and data privacy. The outcome of this workshop is to improve awareness among regulators about current international coordination efforts and the benefits of harmonization. A broader objective of the workshop is to improve communication between regulators and the standardization community.*

- 2:40pm – 3:00pm      **Keynote Address**
- Ms. Lise DUQUETTE, Chair, Canada's Energy and Utility Regulators*
- 3:00pm – 4:30pm      **Panel Session 1: Interoperability Standards and the Role of Energy Regulators**
- This session will explore the benefits of interoperability standards such as reducing costs and opening up for more vendors and the role of energy regulators' role in achieving these objectives. It will also include a discussion on what regulators should expect from utilities' Smart Grid implementation and deployment plans.*
- Moderator: Ms. Colette HONORABLE, Chairman, Arkansas Public Service Commission, United States*
- Mr. John CASKEY, Vice-Chair, Smart Grid Interoperability Panel, Vice President, NEMA, United States*
- Mr. Sunny RAI, Regional Vice President, Renewables and Smart Grid, Intertek*
- Mr. John O'NEILL, CSA Group, Canada*
- 4:30pm – 4:45pm      Coffee Break \*\* Sponsored by Intertek
- 4:45pm – 6:00pm      **Panel Session 2: International Standards Development**
- This session will examine the value proposition of international standards development. It will include a discussion of the value on standards and the benefits of international harmonization. In addition, the session will explore the topics on why and how regulators could participate in standards development and how they could make their needs known to standards developer. Further, it will include a discussion on how regulators can learn about available standards and standards development activities currently underway.*
- Moderator: Dr. George ARNOLD, National Coordinator for Smart Grid Interoperability, National Institute of Standards and Technology, United States*
- Mr. Koichi NODA, Director, Technical Regulation, Standards, and Conformity Assessment Policy Division, METI, Japan*
- Mr. Jacques REGIS, Past President, International Electrotechnical Commission*



*Dr. W. Charlton ADAMS, Jr. (Chuck), Past President - IEEE Standards Association*

6:30pm **Evening Reception sponsored by Intertek**

**Thursday, May 17, 2012**

9:00am – 9:10am **Review of Day 1 Discussions**

9:10am – 9:40am **Keynote 2:** *Mr. David WRIGHT, President, National Association of Regulatory Utility Commissioners*

9:40am – 11:00am **Panel Session 3: Lessons Learned from Smart Grid Projects**

*This session will look at the approaches and outcomes from some of the Smart Grid projects in different economies that are underway or completed. These case studies can provide great insights on what regulators can take away from these implementations and deployments. In addition, it would be useful for regulators to learn about the challenges in applying and using standards to support Smart Grid deployments and how these challenges can be or have been successfully overcome.*

*Moderator: Mr. Joseph PALADINO, Senior Advisor, Office of Electricity Delivery and Energy, U.S. Department of Energy, United States*

*Mr. Sungbong CHANG, Director, Smart Green Business Office, R&D Lab, Korea Telecom (KT), Korea*

*Mr. Peter FRASER, Managing Director, Regulatory Policy, Ontario Energy Board, Canada*

11:00am – 11:15am Coffee Break \*\* Sponsored by the CSA Group

11:15am – 12:30pm **Panel Session 4: Cybersecurity**

*This session will examine issues related to securing the grid. Discussion topics include the evolving threat landscape and best practices for risk mitigation in the electric sector.*

*Moderator: Mr. Ken MODESTE, Security and Global Communications, Underwriters Laboratories, United States*

*Mr. Rodney HOWES, Portfolio Manager and CoP leader e-Security,  
Centre for Security Science, Research and Development, Canada*

*Mr. James ST. PIERRE, Deputy Director, Information Technology  
Laboratory, National Institute of Standards and Technology, United  
States*

12:30pm – 2:00pm **Lunch with Keynote Address**

***Professor Ja-Yoon KOO, Chair, Korea Electricity Commission***

***Luncheon sponsored by Underwriters Laboratories***

2:00pm – 3:30pm **Panel Session 5: Consumer Data Access and Privacy**

*This session will discuss privacy related to consumer access to energy usage data. Discussion topics include third party data access and who may have the rights to the data. It will also showcase an example of an initiative, the Green Button (NAESB) implementation in the USA, which provides consumer access to usage data.*

*Moderator: Ms. Janine MIGDEN-OSTRANDER, Principal, Regulatory Assistance Project*

*Dr. David WOLLMAN, National Institute of Standards and Technology, United States*

*Ms. Ruth Yodaiken, Staff Attorney, Federal Trade Commission, United States*

*Ms. Janine MIGDEN-OSTRANDER, Principal, Regulatory Assistance Project*

3:30pm – 3:45pm **Coffee Break**

**Sponsored by the CSA Group**

3:45pm – 4:45pm **Panel Session 6: Economies' Vision for the 21<sup>st</sup> Century Grid**

*This session will explore how economies are upgrading and building the electric infrastructure to support the 21<sup>st</sup> century grid. This would provide useful insights on how different countries are approaching grid modernization including their frameworks and architectural approaches.*

*Moderator: Mr. Paul CENTOLELLA, Former Commissioner of Public Utilities of Ohio, United States*

*Ms. Mylene C. CAPONGCOL, Director IV, Electric Power Industry, Management Bureau, Department of Energy, The Philippines*

*Mr. Tatsuya SHINKAWA, chief representative, New Energy and Industrial Technology Development Organization (NEDO)*

*Mr. Juan Carlos MARTINA, Professional, Security Division and Electricity Market, Ministry of Energy, Chile*

4:45pm – 5:15pm

**Summary of Conference Outcomes and Adjourn**

## APPENDIX 2 – Participants

### ROSTER OF PARTICIPANTS

#### APEC SCSC WORKSHOP: REGULATORY APPROACHES TO SMART GRID INVESTMENT AND DEPLOYMENT May 16-17, 2012 \*\* QUEBEC CITY, CANADA

Chuck Adams	Past President	IEEE Standards Association	USA
Julio Apaza	Regulator	Ministry of Energy and Mines, Peru	Peru
Gianluca Arcari	Global Business Director, Appliance & Gas	CSA Group	Canada
Dr. George Arnold	National Coordinator for Smart Grid Interoperability	National Institute of Standards and Technology	USA
Gabriel Barta	Head of technical coordination	IEC International Electrotechnical Commission	Switzerland
Oksana Boytsova	Chief Specialist of Strategic Development Department	Russian Energy Agency Ministry of Energy of the Russian Federation	Russia
Tom Brett	Partner	Fogler, Rubinoff LLP	Canada
MYLENE CAPONGCOL	DIRECTOR, ELECTRIC POWER INDUSTRY MANAGEMENT BUREAU	DEPARTMENT OF ENERGY	The Philippines
John Caskey	Vice President, Industry Operations	National Electrical Manufacturers Association (NEMA)	USA
Paul Centolella			USA
Sungbong Chang	Director	KT	Republic of Korea
Dr. Lisa Dignard-Bailey	Director, Integration of Renewable and Distributed Energy Resources	CanmetENERGY-Natural Resources Canada	Canada
Lise Duquette	Chair	CAMPUT	Canada
Peter Fraser	Managing Director	Ontario Energy Board Foreign Affairs and International Trade Canada	Canada
RACHEL GEDDY	Senior Trade Policy Officer Global Government Affairs		Canada
Derek Greenauer	Manager	UL	USA
Heather Grell	Program specialist	Nathan Inc.	
Pat Harris	International Standards Specialist	National Institute of Standards and Technology	USA
Collette Honorable	Commissioner	Arkansas Public Service Commission	USA
Rod Howes	Special Advisor Cyber Security	Defence Research Canada- Centre for Security Sciences	Canada
Yi-Shen Hung	Section Chief	Bureau of Standards, Metrology & Inspection, Ministry of Economic Affairs	
Ryan Kane	International Trade Specialist	U.S. Department of Commerce	USA

Ja-Yoon KOO	Professor Chair	Hanyang University Korea	Republic of Korea
Brent Layton	Chair, Electricity Authority NZ	Electricity Regulatory Commission	New Zealand
David Malkin	Deputy Director, Government Affairs and Policy	Electricity Authority GE - Digital Energy	USA
JIRASAK MANTHARNGKUL	ASSISTANT DIRECTOR, DEMAND SIDE MANAGEMENT AND PLANNING DIVISION - TECHNICAL	ELECTRICITY GENERATING AUTHORITY OF THAILAND	Thailand
Juan Carlos Martina Sanchez	Advisor - Electricity Market & Security	Ministry of Energy	CHILE
Estefania McPhaul	Program specialist	Nathan Inc.	
Pierre Methe	Commissioner	The Regie de l'energie Quebec	Canada
Janine Migden-Ostrander	Principal Principal Engineer, Security and Global Communications	Regulatory Assistance Project	USA
Ken Modeste		UL LLC	USA
Cuong T. Nguyen	Program Manager	National Institute of Standards and Technology Ministry of Economy, Trade and Industry	USA
Koichi NODA	Section Chief	CSA Group	Japan
John O'Neill	Senior Project Manager	DOE	Canada
Joseph Paladino	DOE	DOE	
Park, Gi-Hyun	Manager	Korea Power Exchange(KPX)	Republic of Korea
PHUNG QUANG MINH	Planning section	Vietnam Standard and Quality	Viet Nam
Mike Prasad	Manager, International Standards	ULC Standards	Canada
Andhika Prastawa	Director	Center for Energy Conversion and Conservation Agency for the Assessment and Application of Technology, Indonesia	Indonesia
Sunny Rai	Regional Vice President	Intertek	USA
Marcel Paul Raymond	President	Marcel Paul Raymond Énergie	Canada
Jacques REGIS	IEC Immediate Past President	International Electrotechnical Commission	Switzerland
Daniel Héctor Rico R.	Profesional Especializado	Ministerio de Comercio, Industria y Turismo de Colombia	Colombia
Kiyomi SAKAMOTO	Assistant Director	Ministry of Economy, Trade and Industry	Japan
Tatsuya SHINKAWA	Cheif Representative	NEDO Representative office in Washington, DC	Japan
Shu-Ya CHIU	Executive Officer	Bureau of Energy, Ministry of Economic Affairs	Chinese Taipei
P. SIRITIPRUSSAMEE	SENIOR PROFESSIONAL	OFFICE OF ENERGY REGULATORY COMMISSION	Thailand
Jennifer Stradtman	Director, Technical Barriers to Trade	Office of the U.S. Trade Representative	USA

Ravi Subramaniam	Technical Director	IEEE Conformity Assessment Program	USA
VU THI HONG HANH	OFFICIAL IN CHARGE	STANDARDS DEPARTMENT, DIRECTORATE FOR STANDARDS, METROLOGY AND QUALITY Union des consommateurs (on behalf of Me Hélène Sicard)	Viet Nam
Dominic Thiffault	Energy Analyst	Régie de l'énergie	Canada
Pierre Tourigny	Director - Legal Services	BC Utilities Commission	Canada
Julie Tran	Senior Economist	Federal Energy Regulatory Commission	Canada
Sandra Waldstein	Director, State, International & Public Affairs, FERC		USA
David Wollman	Deputy Director, Smart Grid and Cyber-Physical Systems Program	National Institute of Standards and Technology	USA
David Wright	President	National Association of Regulatory Utility Commissioners (NARUC)	USA
Ruth Yodaiken	Attorney	Federal Trade Commission	USA
Samir Zakhary	President & CEO	Power Utilities Management Advisors (PUMA)	Canada

## APPENDIX 3 - Speakers

### Speakers

#### APEC Workshop on Regulatory Approaches to Smart Grid Investment/Deployment

May 16-17, 2012  
Quebec City, Canada

#### **George W. Arnold**

Dr. George Arnold was appointed National Coordinator for Smart Grid Interoperability at the National Institute of Standards and Technology (NIST) in April 2009. He is responsible for leading the development of standards underpinning the nation's Smart Grid and also co-chairs the White House National Science and Technology Council's Smart Grid policy subcommittee. Dr. Arnold joined NIST in September 2006 as Deputy Director, Technology Services, after a 33-year career in the telecommunications and information technology industry. Dr. Arnold received a Doctor of Engineering Science degree in Electrical Engineering and Computer Science from Columbia University in 1978. He is a Fellow of the IEEE and has delivered or authored over 100 talks and publications.

#### **Jennifer Stradtman**

Ms. Stradtman is the Director of Technical Barriers to Trade at the United States Trade Representative's Office. Ms Stradtman has 10 years of experience in working on standards, conformity assessment and technical regulations as non-tariff barriers working for the U.S. Department of Commerce, in the Office of the International Trade Administration's Standards Liaison's Office, and previously in the Department's Trade Compliance Center as the expert on the WTO Agreement on Technical Barriers to Trade. A native of Buffalo, New York, Jennifer holds a Bachelor of Arts in Political Science from the State University of New York, College at Fredonia, and a Master of Arts in Geography from the State University of New York, University at Buffalo. Ms. Stradtman has been an active U.S. delegate in the APEC Subcommittee on Standards and Conformance since 2006, and has initiated or led several other successful SCSC projects, including "Business Engagement in Standards and Conformance" (with Vietnam, Chile, Japan, Korea and Singapore); the APEC Toy Safety Initiative (with Chile, China, Chinese Taipei, Japan, Malaysia, and Viet Nam) and the Partnership Training Institute Network of the Food Safety Cooperation Forum (with Australia, China and the Philippines) –all of which have been recognized and endorsed at the highest levels in APEC.

#### **Paul A. Centolella**

Mr. Centolella served as a Commissioner on the Public Utilities Commission of Ohio (PUCO) from 2007 until April 2012. He is a member of the Governing Board of the Smart Grid Interoperability Panel (SGIP). SGIP is a public-private partnership of more seven-hundred-fifty organizations created by the U.S. National Institute of Standards and Technology to coordinate and accelerate the

development of standards for the smart grid. In 2011, he was as a member of the U.S. delegation to the Asia-Pacific Economic Cooperation (APEC) Senior Officials Meeting, participating in talks on the development of Smart Grid standards. From 2009 to 2012, he was a member of the Electric Power Research Institute's public Advisory Council and served on the Advisory Council's Executive Committee. Earlier this year, the U.S. Assistant Secretary of Energy for Electricity Delivery and Energy Reliability, nominated him to serve on the Secretary of Energy's Electricity Advisory Committee. In 2011, he received the GridWeek Leadership Award, recognizing his role in advancing policies to modernize the electric system. In 2010, he was honored by the Demand Response Coordinating Council with its Smart Grid Leadership Award, by the Gridwise Architecture Council with its Gridwise Applied Award for development of policies consistent with the principles of interoperability, and by the SGIP for ensuring access to information about smart grid standards.

### **Lise Duquette**

Ms. Duquette is commissioner at the Régie de l'énergie du Québec (the Québec Energy Board) since 2009 and is the current Chair of CAMPUT -Canada's Energy and Utility Regulators. She is a lawyer and also holds an MBA. After beginning her career in regulated gas transmission and distribution companies, she was, from May 2005 until her appointment as commissioner, executive assistant to the president of the Régie.

### **Colette D. Honorable**

Ms. Honorable was designated Chairman of the Arkansas Public Service Commission by Governor Mike Beebe in January 2011. She was appointed to the Arkansas Public Service Commission by Governor Beebe in October 2007, and designated interim Chairman from January through August 2008. Chairman Honorable previously served as Executive Director of the Arkansas Workforce Investment Board. Honorable is a native of Little Rock, Arkansas and is a graduate of the University of Memphis (previously Memphis State University). She obtained her Juris Doctor from the University of Arkansas at Little Rock School of Law. Prior to her gubernatorial appointments, Honorable served as Chief of Staff for Attorney General Mike Beebe. She worked in the Attorney General's Office for over five years, serving as an assistant attorney general in the Consumer and Civil Litigation Departments, and as senior assistant attorney general in Medicaid Fraud. Her previous work experience includes serving as a staff attorney at the Center for Arkansas Legal Services, as a judicial law clerk at the Arkansas Court of Appeals and as an assistant public defender.

### **John F. Caskey**

Mr. Caskey developed and implemented the National Electrical Manufacturers Association's (NEMA's) Smart Grid program and is currently the Assistant Vice President of Industry Operations and Director of the Power Equipment Division at NEMA. Mr. Caskey was also recently re-elected as the Vice Chairman of the national Smart Grid Interoperability Panel Governing Board. At NEMA, Mr. Caskey developed and managed the first phase of NEMA's Smart Grid program. At the request of the National Coordinator for Smart Grid Interoperability, Dr. George Arnold, Mr. Caskey led a team of meter manufacturers and utilities to develop the first Smart Grid standard, NEMA SG-AMI 1, Requirements for Smart Meter Upgradeability. This standard was written and approved within 90 days of the start of the project. This standard and the associated standards development process has been recognized by the U.S. Secretary of Commerce, the Director of the National Institute of Standards and Technology (NIST) and the National Smart Grid Coordinator as the new "best practice" for developing standards. In addition, Mr. Caskey has supported various Smart Grid activities at NIST, the Federal Energy Regulatory Commission (FERC), the U.S. Department of Energy (DOE), the Edison Electric Institute (EEI), the Electric Power Research Institute (EPRI), the Institute for



Electrical and Electronics Engineers (IEEE) Power and Energy Society (PES) and was selected to serve as the Chairman of the Smart Grid taskforce for the IEEE Surge Protective Devices Committee (SPDC). Mr. Caskey holds a BS in Physics from George Mason University and an MS in Energy Technology from George Washington University's School of Civil, Mechanical and Electrical Engineering. Mr. Caskey also completed GE's Lean Six Sigma Black Belt program and is a Certified Energy Manager.

### **Sunny Rai**

Mr. Rai is regional vice president for renewable energy at Intertek, provides strategic direction for Intertek's smart grid, photovoltaic, wind and semiconductor businesses. In his 25 years with Intertek, Sunny has helped several solar, semiconductor and flat panel display (FPD) equipment manufacturers and users establish product safety and global regulatory compliance programs, while also being instrumental in establishing Intertek as a key player in the renewable energy and smart grid industries. Sunny is also working on implementing end-to-end smart grid testing, certification and consulting services for safety, compliance and interoperability. With a B.Sc. degree from the University of Delhi in India and a degree in Electronic Engineering Technology from San Francisco, California, Sunny is recognized worldwide as an expert in the field of smart grid and renewable energy product testing and certification.

### **John O'Neill**

Mr. O'Neill is a Project Manager with the Canadian Standards Association in Mississauga and has over 25 years of industry experience. For the past six years he has worked with CSA committees responsible for the utility distribution and transmission equipment standards and the Canadian Electrical Code Part III. Prior to joining CSA John worked for 13 years in the Engineering and Operations Division of the Municipal Electrical Association. He also has several years' experience as an Applications Engineer in the manufacturing sector and in certification of equipment to electrical safety standards. John is a licensed Professional Engineer in Ontario and is an Electrical Engineering graduate from the University of New Brunswick.

### **Koichi Noda**

Mr. Noda is a Director, Technical Regulations, Standards and Conformity Assessment Policy Division, Ministry of Economy, Trade and Industry (METI), Japan. He has successively held a number of significant positions such as a Director to Japan External Trade Organization which also represents the Japan Industrial Standard Committee (JISC) in Geneva, Nuclear Energy Policy Planning in Agency for Natural Resources and Energy; Tohoku Bureau of Economy, Trade and Industry as well as Regional Economic Department and Industrial Policy Group. Throughout his career he has been devoted to energy affairs, technology and industrial policy. He has been served in his present position since 2011 and manages standardization and conformity assessment policy.

### **Jacques Régis**

Mr. Régis studied science at the Université de Montréal, where he obtained a B.Sc. (1968) and an M. Sc. in materials chemistry (1973). In 1983, he received a diploma in administration from the École des hautes études commerciales and a diploma from the International Centre for Research and Studies in Management, in Montréal. Mr. Régis joined Hydro-Québec in 1968 and held various technical and management positions. From 1997 to 2003, Mr. Régis was President and Chief Operating Officer of Hydro-Québec Trans Énergie, Hydro-Québec's transmission division. The division's mission is to operate and develop Hydro-Québec's power transmission system, including telecommunication networks. Furthermore, it is responsible for the control of energy dispatching throughout Québec, according to safety standards. For three years, Mr. Régis chaired the

Transmission Council of the Canadian Electricity Association (CEA). He was also Vice President of the Executive Committee of the Northeast Power Coordinating Council (NPCC) and represented Canada on the Management Committee of the North America Electric Reliability Council (NERC). Mr. Régis was Vice Chairman of the board of Transelec, in Chile, from 2000 to 2006. He also served as the Chief Executive Officer of HQI Transmision Sud America S.A. from 2003 to 2005. Mr. Régis has been a member of the IEC CBoard since November 2005. From 2008-2011, Régis served as president of the IEC.

### **W. Charlton (Chuck) Adams, Jr.**

Dr. Adams served as the 2009-2010 President of the IEEE Standards Association (IEEE-SA). Adams now serves on the IEEE Board of Directors as Chair, Public Visibility. He is and he is Distinguished Standards Strategist for Corporate Standards for Huawei Technologies (USA).

### **David Wright**

Mr. Wright was elected to the South Carolina Public Service Commission from the Second Congressional District in a special session of the S.C. General Assembly on March 3, 2004. He serves as one of seven elected commissioners of the SCPSC. In July 2010, he was sworn in as Vice-Chairman of the S.C. Commission. Since his election, David has accepted active roles in many phases of commission activities locally, regionally and nationally. In November 2011, in St. Louis, Mr. Wright was elected to serve as President of the National Association of Regulatory Utility Commissioners (NARUC) for 2011-2012. Commissioner Wright is also member of NARUC's Executive Committee and NARUC's Board of Directors. David is a Past President of the Southeastern Association of Regulatory Utility Commissioners (SEARUC). In August 2010, Commissioner Wright was appointed to be the NARUC representative on the Advisory Board of the Board of Directors of the Electric Power Research Institute (EPRI) and serves as a NARUC representative on the Keystone Energy Board.

### **Joseph Paladino**

Mr. Paladino serves as Senior Advisor within the Department of Energy's Office of Electricity Delivery and Energy Reliability where he oversees the communications and analysis efforts associated with the smart grid projects funded by the American Recovery and Reinvestment Act of 2009. Mr. Paladino has worked at DOE for over 19 years in programs involving nuclear waste management, energy efficient buildings, and electric grid modernization. His particular interest is in the advancement and commercialization of technology. Prior to joining DOE, Paladino worked for over ten years in the private sector. This experience includes undertaking marketing, sales and technology development efforts at Westinghouse Electric Corporation in Pittsburgh, Pennsylvania. Mr. Paladino has an undergraduate degree in Biology from Middlebury College and a graduate degree in Civil Engineering from the University of Pittsburgh.

### **Sungbong Chang**

Mr. Chang joined KT Corporation as a Research member after receiving his Master's degree in Mathematical Statistics from the Graduate School of Seoul National University. In the early years in KT R&D Center, he focused on Software development for electronic switching systems. Mr. Chang also job-trained in Sweden working in the international business department for the introduction of new telecom services based on ISDN, Intelligent Network. He served with APT (Asia Pacific Telecommunity) as a Rapporteur and Acting Vice Chairman of Rural Telecommunications Study Group. For five years, experienced overseas businesses in KTAI (KT America Inc.) located in Los

Angeles, U.S.A. He worked as a coordinator in a big project for preparing a business plan for WiBro (Korean WiMAX) service license bid in Korea, winning 1<sup>st</sup> place. With the social emphasis of energy efficiency issues, he joined the ICT network energy efficiency enhancement projects in 2009. Currently, Mr. Chang is working on Smart Grid and Micro Grid projects (K-MEG) in the Smart Green Business Office of KT Corporation, preparing KT as the leading energy sustainable company.

### **Peter Fraser**

Mr. Fraser joined the Ontario Energy Board (OEB) in 2004 and is currently Managing Director of Regulatory Policy. Prior to joining the OEB, Peter worked for six years at the International Energy 5 (IEA) in Paris, France, as Senior Electricity Policy Advisor and spent nearly nine years as an energy policy advisor at the Ontario Ministry of Energy. Peter holds master's degrees in physics from Queen's University and in environmental studies from York University and a B.Sc. physics from the University of Toronto.

### **James St. Pierre**

Mr. St. Pierre is Deputy Director of the Information Technology Laboratory (ITL), one of six research Laboratories within the National Institute of Standards and Technology (NIST). Mr. St. Pierre coordinates ITL's involvement in the NIST Smart Grid efforts focusing on cybersecurity and networking. His work has been published in the NIST Journal of Research and in external publications. He has given dozens of presentations on both technical and management topics, to both national and international audiences. Before joining NIST, in 1994, he worked as a technical project leader within Loral Space Systems semiconductor design group and worked for IBM on the development of hardware and software for Los Angeles-class submarines. In addition, he worked with several universities to develop their semiconductor design curricula.

### **Ken Modeste**

Mr. Modeste is a Principal Engineer with UL LLC (Underwriters Laboratories Inc.) with global responsibilities for Cybersecurity, Interoperability, Protocols and Life Safety and Security. With these responsibilities he is responsible for technically developing and maintaining programs within all of UL's industries to ensure security and interoperability. As part of the cyber security strategy for UL, he is responsible for strategically determining long term growth opportunities that align with UL's mission to address public safety and trustworthiness in life, industrial, IT and health sciences equipment. Mr. Modeste has a proven track record in leading large diverse teams delivering commercial enterprise software in rapid environments with major business financial commitments. Excellent leadership and analytical skills with the ability to develop long term software and hardware strategies and execute successfully.

### **Rodney Howes**

Mr. Howes graduated with a Bachelor of Science (Physics Major) in 1980 followed by a Bachelor of Electrical Engineering in 1983, his work career started in the private sector in the Ottawa area. From 1983 to 1996 Mr. Howes spent 14 years in the private sector at Marconi as a Radar engineer and at Bell Northern Research as a Communications Engineer. In 1996, he joined Foreign Affairs and International Trade as a technical advisor within the Export Controls Office until 2000. Mr. Howes's career continued with 12 years at Communications Security Establishment Canada as a member of the research office until 2011, when he joined the Public Security Technical Program with the Centre for Security Sciences for DRDC. Currently Mr. Howes occupies the position as Special Advisor, Cyber Portfolio for the Defense Research Development Canada's Centre for Security Sciences.

## **Jayoon Koo**

Dr. Koo received B.S. degree from Seoul National University in 1975, M.S. from the ENSEEIHT in 1980 and the Ph. D. from the ENSIEG in 1984 all in electrical engineering in France. He has been in charge of the Center for Electro-Fusion Technology, established in 2003 under the financial support by Ministry of Knowledge and Economy, Korea and serving the Board Committee of LS Cable since 1999. On August 26, 2009, Koo was elected as the General Chairman of ISH (International Symposium of High Voltage Engineering) to be held in 2013. He was also appointed as the Chairman of KOREC (Korean Electricity Regulatory Commission) by the President of Korea. KOREC, affiliated with Ministry of Knowledge Economy, plays a leading and essential role in the restructuring the Korean electricity industry and creating markets based on competition.

## **Janine L. Migden-Ostrander**

Ms. Migden-Ostrander has worked in public utility law for approximately 35 years, most recently as the Ohio Consumers' Counsel where she oversaw the state agency that represents the interests of Ohio's 4.5 million residential households with their investor-owned electric, natural gas, telephone, and water companies. In her role as Consumers' Counsel, Ms. Migden-Ostrander championed a variety of energy and telecommunications policies from integrated portfolio management, alternative sources of energy, energy efficiency programs, and innovative rate designs in the energy industry to the delivery of broadband services in the telecommunications industry. Ms. Migden-Ostrander also made it an agency priority to find solutions for the growing number of customers who struggle with affordability of utility services. Ms. Migden-Ostrander's previous experience also includes serving as an Assistant Consumers' Counsel where she litigated a wide variety of cases involving electric, gas, telephone, and water cases; serving as a Senior Director of Government Affairs for Enron Corporation focusing on the development of competitive markets in the Midwest; and serving as Partner at the law firm Hahn Loeser and Parks where she represented environmental organizations, non-utility generators, community action agencies serving the low-income, and the Ohio Domestic Violence Network, among others. Ms. Migden-Ostrander is a past board member of the Midwest Energy Efficiency Alliance, the Smart Grid Consumer Collaborative, Green Energy Ohio, Ohio Partners for Affordable Energy, the Ohio Environmental Council, and the National Low Income Energy Consortium as well a member of the executive committee of the National Association of State Utility Consumer Advocates. She currently serves on the National Coal Council, a federal advisory committee to the U.S. Secretary of Energy. Ms. Migden-Ostrander earned a Bachelor of Arts Degree from the State University of New York, and she earned a Certificat de la Langue et Civilisation Francaise from the Universite de la Sorbonne in Paris, France, where she gained fluency in French. Her law degree is from Capital University in Columbus, Ohio.

## **David Wollman**

Dr. Wollman is Deputy Director of the Smart Grid and Cyber-Physical Systems Program Office, and Manager of Smart Grid Standards and Research at the National Institute of Standards and Technology (NIST), the lead agency in the U.S. Federal Government responsible for coordinating and accelerating the private-sector development of smart grid standards (see [www.nist.gov/smartgrid](http://www.nist.gov/smartgrid) for additional information). He also leads NIST's effort in the White House's Green Button Initiative to enable consumers to securely download their energy usage information from their electric utilities in human- and machine-readable common electronic format, working in close coordination with the U.S. Department of Energy and the Office of Science and Technology Policy. Before joining the Smart Grid and Cyber-physical Systems Program in the NIST Engineering Laboratory, he managed efforts within the NIST Physical Measurement Laboratory to maintain and advance the Nation's electrical standards and metrology supporting the electric power industry. In addition, he has served in several other positions at NIST, including Scientific Advisor for the former Electronics and Electrical

Engineering Laboratory, Program Analyst in NIST Director's Program Office, and bench-level scientist in Boulder, Colorado developing advanced high-resolution x-ray detectors. Dr. Wollman received his Ph.D. from the University of Illinois at Urbana-Champaign in the areas of superconducting electronics and device micro/nanofabrication. He has given numerous invited talks at international conferences, and holds three U.S. patents. He has received many awards, including two U.S. Department of Commerce Gold Medals and the NIST Applied Research Award.

### **Mylene Celestino Capongcol**

Ms. Capongcol has almost 27 years experience in the electric power industry covering planning and design, advisory services, policy development and project management involving international donor and locally-funded projects. As the Director IV for the Electric Power Industry Management Bureau (EPIMB) of the Department of Energy (DOE), Ms. Capongcol is tasked to provide support to the DOE management in the supervision and implementation of power sector reforms. This also includes development of policies and implementation strategies to meet the objectives of the power sector reforms as well as assessment of the performance of the power sector relative to generation, transmission, and distribution and supply sectors including the total electrification of the Philippines. Specifically, Ms. Capongcol oversees the preparation and development of Philippine Power Development Plan, Distribution Development Plan, Missionary Electrification Development Plan and review and endorsement of the national Transmission Development Plan. Ms. Capongcol previously worked for Adrian Wilson International Associates, Inc., a multi-disciplinary engineering consulting firm and Leyte I Electric Cooperative, Inc. Ms. Capongcol obtained her Master's Degree in Public Management (MPM) at the Development Academy of the Philippines (DAP) in Pasig City, Metro Manila and was awarded The Emmanuel V. Soriano Award for the Outstanding Action Plan and Program on Provision of Sustainable Electricity Services in Culion, Palawan. Ms. Capongcol sits as the DOE Representative to the Advisory Board of the Philippine Electricity Market Corporation, the administrator of the Philippines Wholesale Electricity Spot Market (WESM). She is currently serving as the Chairperson for the Technical Working Group in the Operational Audits of both the Market Operator and Metering Service Provider.

### **Tatsuya Shinkawa**

Mr. Shinkawa is the Chief Representative, Representative Office in Washington, DC of New Energy and Industrial Technology Development Organization (NEDO), Japan. He worked on the electricity policy, nuclear safety policy and, economic and industrial policy in the Ministry of Economy, Trade and Industry (METI), Japan from 1991. He was in charge of the electricity regulation in Japan from 2000 to 2004. He designed the LLP law of Japan in 2005. His former position was as the Director, Human Resource Policy Office, Economic and Industrial Policy Bureau, METI. He earned his Master degree at Kyushu University, Interdisciplinary Graduate School of Engineering Sciences, Japan in 1991. He was a visiting researcher in Stanford University in 1999.

### **Juan Carlos Martina**

Mr. Martina has worked as an analyst in the Electricity Markets Division of the Energy Ministry of Chile since 2010. Martina specializes in the markets for distribution, transmission and wholesale electricity generation. Previously, he worked in the Economic Regulation Department at Chile's National Energy Commission, Chile's energy market regulator. Martina received his master's degree in economics at Georgetown University and his bachelor's degree in economics at Cordoba National University in Argentina.

**Ruth Yodaiken**

Ruth Yodaiken is an attorney in the Division of Privacy and Identity Protection, in the Bureau of Consumer Protection, at the U.S. Federal Trade Commission, an independent agency of the U.S. government. The FTC is the only federal agency focused on both consumer protection and competition jurisdiction in broad sectors of the U.S. economy. Ms. Yodaiken's responsibilities at the FTC focus on privacy and data security law enforcement and policy development. During the past five years at the FTC she has also worked on fraud enforcement and related policy development, including the impact of new technologies, and the intersection of consumer protection and communications law. Before joining the FTC, Ms. Yodaiken worked for five years at the U.S. Federal Communications Commission focusing on wireless, wireline and consumer protection issues.