

Energy Smart Communities (ESCI) and APEC Smart Grid Initiative (ASGI) Update

Cary Bloyd

EGNRET-38

Wellington, New Zealand

June 18-20, 2012



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The Energy Smart Communities Initiative (ESCI) was Launched in November 2010 by U.S. President Obama and Japan's Prime Minister Kan

- ▶ The ESCI is meant to help realized APEC Leaders' goal to reduce the energy intensity of their economies by 45% by 2035
- ▶ The ESCI contains two crosscutting elements and four pillars
 - Cross-Cutting elements
 - Knowledge Sharing Platform (KSP)
 - ◆ Draft website at: <http://esci-ksp.org> (revised release at EWG 43)
 - Low Carbon Model Towns (LCMT)
 - ◆ Samui Island , Thailand has been chosen for the next LCMT



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The Energy Smart Communities Initiative has Four Pillars (1)

▶ Smart Transportation

- Energy-Efficient Urban Transport Network
- Energy-Efficient Freight Transport Network
- Electromobility Survey and Road Map

▶ Smart Buildings

- Low Energy Buildings Network
- Materials Testing and Rating Centers
 - EWG 6/2012 – Energy Saving Window Thermal Performance Simulation Training
- Cool Roof Demonstrations
- Low Energy Window Demonstrations



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The Energy Smart Communities Initiative has Four Pillars (2)

▶ Smart Grids

- Interoperability Survey and Road Map
- Smart Grid Test Bed Network
 - U.S. sponsored APEC-ISGAN Smart Grid Test Bed Network Workshop January 24-25, 2012 in Washington, DC

▶ Smart Jobs and Consumers

- Energy Efficiency Training Curricula
- Energy Efficiency School Curricula
- Sister Schools Program



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Instructions from Energy Ministers at EMM-9

- ▶ The Fukui Declaration from the Ninth Energy Ministers Meeting (EMM-9), June 2010, states that “**smart grid technologies**, including advanced battery technologies for highly-efficient and cost-effective energy storage, can help to integrate intermittent renewable power sources and building control systems that let businesses and consumers use energy more efficiently, and they can also help to enhance the reliability of electricity supply, extend the useful life of power system components, and reduce system operating costs.”
- ▶ EMM-9 instructed the Energy Working Group (EWG) “to start an **APEC Smart Grid Initiative (ASGI)** to evaluate the potential of smart grids to support the integration of intermittent renewable energies and energy management approaches in buildings and industry.”



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Suggested Elements of the Smart Grid Initiative

- ▶ Element 1 – Survey of Smart Grid Status and Potential
- ▶ Element 2 – Smart Grid Roadmap
- ▶ Element 3 – Smart Grid Test Beds
- ▶ Element 4 – Development of Smart Grid Interoperability Standards

The Smart Grid Initiative is being led by the U.S, Korea, and Chinese Taipei

Element 1 – Survey of Smart Grid Status and Potential

- ▶ A recently completed report “Using Smart Grids to Enhance Use of Energy-Efficiency and Renewable-Energy Technologies” (EWG 01/2009S), evaluated the potential of smart grid technologies in APEC economies to enhance the use of renewable energy and energy efficient buildings, appliances and equipment
- ▶ A related project, “Addressing Grid-interconnection Issues to Maximize the Utilization of New and Renewable Energy Resources” (EWG 02/2009) was led by Japan and completed in late 2010

<http://www.egnret.ewg.apec.org/>



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Element 2 – Smart Grid Roadmap

- ▶ Organize workshops to elaborate a roadmap for advancing smart grid technologies in APEC
- ▶ Due to the wide range of electric grids in place, APEC members can work together to learn from others and develop suggested procedures that will be useful in developing economy specific road maps
- ▶ The roadmap process would be developed in coordination with the International Smart Grid Action Network (ISGAN)
- ▶ The roadmap process also supports the APEC Leaders endorsed Energy Smart Communities Initiative



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Three projects related to different aspects of road mapping were implemented in 2011

- ▶ “Addressing Challenges of Advanced Metering Infrastructure (AMI) Deployment in APEC” was implemented August 24-25, 2011 by Chinese Taipei alongside the Expert Group on New and Renewable Energy Technologies meeting (EGNRET-37)
- ▶ “APEC Workshop on Energy and Green Transport Benefits of Electric Vehicles” was implemented jointly China and Hong Kong, China on October 24-25, 2011
- ▶ Workshop on “Smart Appliance’ Standards for Air Conditioners and other Appliances” implemented November 10-11, 2011 by Australia alongside the Expert Group on Energy Efficiency & Conservation meeting (EGEE&C-38)



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Three new projects have been approved for implementation in 2012

- ▶ “Stock-take of electric vehicle interface with electricity and smart grids across APEC economies and the potential for harmonization” implemented by New Zealand. Workshop will be held alongside EGNRET 38 in June 2012
- ▶ “Promotion of Energy Efficiency and Renewable Energy in Low Carbon Model Town of APEC through Distributed Energy Source – Identification of Potential, Challenges and Solutions” implemented by China
- ▶ “Piloting Smart / Micro Grid Projects for Insular and Remote Localities in APEC Economies” implemented by Russia



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Element 3 – Smart Grid Test Beds

- ▶ Establish a network of test beds to provide operational data on emerging smart grid technologies
- ▶ Economies may also wish to offer smart grid test beds for use by grid operators, electric power suppliers, and manufacturers of energy efficient building systems and equipment
- ▶ APEC test beds would become part of a Smart Grid International Research Facility Network (SIRFN) to be coordinated by the International Smart Grid Action Network (ISGAN)
- ▶ U.S. sponsored APEC-ISGAN Smart Grid Test Bed Network Workshop January 24-25, 2012 in Washington, DC



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Smart Grid Test Beds Activities: Jeju Island in Korea



- Begin in 2009 with the goal of becoming the worlds largest smart grid community that allows the testing of advanced technologies
- Expected investment of US\$ 50 million public funds matched by US\$150 million private investment from 2009-2013



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Smart Grid Test Beds Activities: Distributed Energies Technology Laboratory (DETL) at Sandia National Laboratories

Reconfigurable infrastructure simulates a variety of real-world scenarios and scaled portions of utility feeders and the transmission infrastructure

- Electric Grid Integration of Renewable Energy Sources
- Advance Power Electronics
- Interoperability, Communications & Security
- Solar Technology & Grid-Related Standards & Codes



Cornerstone facility for DOE program on Solar Energy Grid Integration Systems (SEGIS)

Tests & evaluates new power conversion and energy management technologies



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Element 4 – Smart Grid Interoperability Standards

- ▶ Discuss interoperability standards for Smart Grid technologies under the APEC Regulatory Cooperation Advancement Mechanism on Trade-Related Standards and Technical Regulations (ARCAM) in 2011
- ▶ Based on the discussions, consider follow-up steps to develop interoperability standards across the APEC region and globally through ISGAN



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Elements of ARCAM Interoperability project

- ▶ U.S. develops a paper presented at CTI 1 (SOM1) in Washington, DC that outlined smart grid interoperability standards
- ▶ ARCAM smart grid dialogue held at CTI 2 (SOM2) in Big Sky, Montana
- ▶ Thirteen smart grid recommendations are developed for SCSC 2 (SOM3) in San Francisco, CA across three areas:
 - Promote Transparency, Collaboration and Global Solutions in the Development of Smart Grid Interoperability Standards
 - Enable Competition and Innovation in Specific Markets for Smart Grid
 - Integrate ARCAM Outcomes into Cooperative Work on Smart Grid Interoperability Standards in APEC and Other Fora



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ARCAM Interoperability project- 2012

- ▶ Workshop on Regulatory Approaches to Smart Grid Investment/Deployment
 - Project led by the U.S. under the Committee on Trade and Investment/Subcommittee on Standards and Conformance (CTI/SCSC)
 - Associated with the World Forum on Energy Regulators
 - Quebec City, Canada, May 16-17, 2012
 - Participants included central and sub-central regulatory authorities, and officials from ministries responsible for technology, trade, and import policy as well as private sector representatives
 - Workshop included panels on Interoperability Standards and the Role of Energy Regulators and International Standards Development



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New smart grid project proposals for 2012

1. Russia: Piloting smart/micro grid projects for insular and remote localities in APEC economies: \$81k
2. Russia: Combined heat and power (CHP) technologies for distributed energy systems: \$90k
3. Vietnam: Small Hydro and Renewables Grid Integration Workshop: \$60k
4. China: Study of Demand Response's Effect in Accommodating Renewable Energy Penetration in the Smart Grid: \$100k
5. China: Promotion of Energy Efficiency and Renewable Energy in Low Carbon Model Town of APEC through Distributed Energy Source – Identification of Potential, Challenges and Solutions: \$80k
6. New Zealand: Christchurch Smart Energy Grids: Earthquake Recovery Project: \$90k



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**Asia-Pacific
Economic Cooperation**

Report on the

APEC Subcommittee on Standards and Conformance

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

May 16-17, 2012
Quebec City, Canada

Background

In November 2011, 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 that outlined 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.*

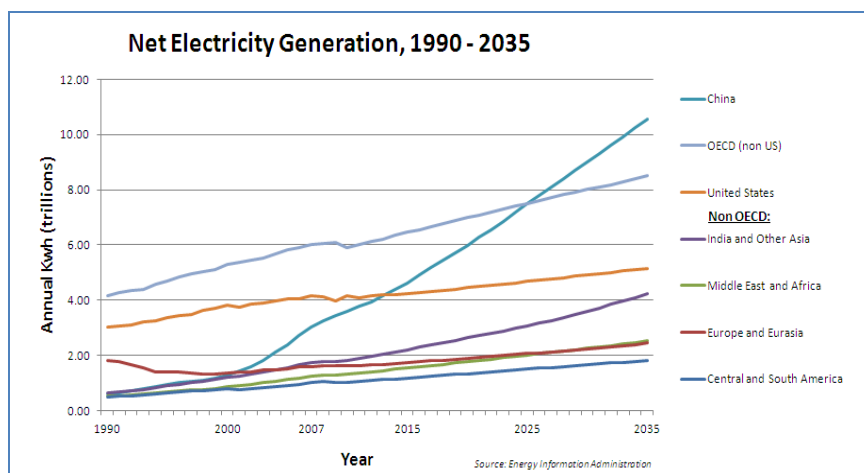
Building on this important work, and seeking to fulfill the primary objective of coordinating and engaging APEC regulatory authorities on smart grid standards and interoperability issues, the APEC Subcommittee on Standards and Conformance organized the Workshop on Regulatory Approaches to Smart Grid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

Overview of Smart Grid Investment and Deployment

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, 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 the growth in the electric sector will be faster than that of any other final energy source, with electricity's share of total energy consumption rising from 18% in 2000 to 22% in 2030.¹ In order to meet this surging demand, global investment in electric transmission and distribution infrastructure will total \$5.18 trillion between 2001 and 2030.² Additionally, industry estimates place the total global investment in smart grid technologies as high as \$200 billion over the next five years.³

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 all 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.

¹ 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%20to%20the%20people.html)

² Ibid

³ 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>

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

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 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 2013.⁴

Targeted Outcomes of the 2011 CTI Recommendations

The 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 [See Appendix XX].

The Workshop on Regulatory Approaches to Smart Grid Investment and Deployment, held in Quebec City, Canada on May 16 and 17, 2012, sought to further select recommendations on smart grid interoperability standards that were developed through the ARCAM by facilitating collaboration and information sharing between key stakeholder groups involved in the development 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.”

⁴ 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§ionId=null&elementId=null&pageType=SYNOPSIS>

Workshop 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
- The standards community could benefit from an analysis of the needs of regulators in their efforts to better understand the standards making process and its implications 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.

Summary of the Workshop on Regulatory Approaches to Smart Grid Investment and Deployment

Welcome and Introduction

Dr. George Arnold - *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 highlighted the fact 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 also 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.”

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 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 alike. Mr. Centolella detailed the benefits of interoperability and encouraged workshop participants to actively engage in 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 (CAMPUR)* – delivered the workshop’s opening keynote speech, which 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 and Ms. Duquette sought to present the standards community with the regulatory perspective, including the objectives regulators have for electricity networks: that they ensure reliability, are affordable to consumers, and offer utilities a fair rate of return.

To a regulator, new technology means an investment. In Canada, the electric network will require 10s 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

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 required 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 gave a presentation on 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 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 of standards need 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 and IEC standards cover full aspect 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 market

and spur economic development. Standards are crucial to complex system such as the Smart Grid that crosses many technology boundaries. Standards format technology and not create them and standards enable wider distribution of technology, ensure interoperability, and enable economy 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, and etc. Dr. Adams believes that we are at a critical state for Smart Grid development as we need to tackle the challenge of integrating complex technology and 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*, opened the second day of the workshop addressing 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 the utility commissioners is to ensure new systems put into place 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.

He 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 the 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 ensure regulatory needs 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 highlighted the challenge from the Jeju trials included 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 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 have 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 all 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

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 is an enabler of technology and does not have to be designed to slow down the smart grid. He 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.

Rod 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 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 coop, 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 of privacy. Participants considered the questions of what the implications of the smart grid are when it comes to the security and protection of consumer data, and also how consumers can use that data for their benefit.

In order to set the stage and context 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 in detail 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 added 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 21st 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 21st 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 – and competition has driven robust service, but determining the government role in driving smart grid investments is a challenge. According to Mr. Molina, the necessary tasks in the electricity sector in Chile include the goal of 12% energy consumption reductions by 2020; regional and international connection of transmission; and ensuring the recent smart 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 and Adjourn

Following the presentations and discussions 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 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 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 tests for 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 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 understand the needs of the regulatory community
- The International Confederation of Energy Regulators (ICER) has multiple working groups – for example, on education and training for regulators – that can provide an ongoing mechanism to inform regulatory staff on standards and the standardization process
- Standards can play an important role in reducing costs and enabling innovation
- Regulatory needs can drive standard development, for example the OpenADR
- Communication between the regulatory and standards communities must be established and strengthened especially in areas with policy implications such as privacy and cybersecurity
- Use the opportunity to upgrade the infrastructure to modernize by using new technologies

**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 21st Century Grid**

This session will explore how economies are upgrading and building the electric infrastructure to support the 21st 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**

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
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Paul Centolella			USA
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Lise Duquette	Chair	CAMPUT	Canada
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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
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