

Using Smart Grids to Enhance Use of Energy Efficiency and Renewable Energy Technologies

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Using Smart Grids to Enhance Use of Energy Efficiency and Renewable Energy Technologies (EWG 01/2009S: APEC#211-RE-01.2)

- ▶ This US self-funded project examined the status and potential within APEC economies of smart grid technologies to enhance the use of renewable energy and energy efficient buildings, appliances and equipment. Information was gathered from three sources
 - A survey of APEC members
 - A review of APEC member smart grid domestic and international activities
 - A review of broader efforts (beyond APEC)



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The report supports the APEC Smart Grid Initiative and was completed in May 2011

Report prepared for the APEC Energy Working Group by

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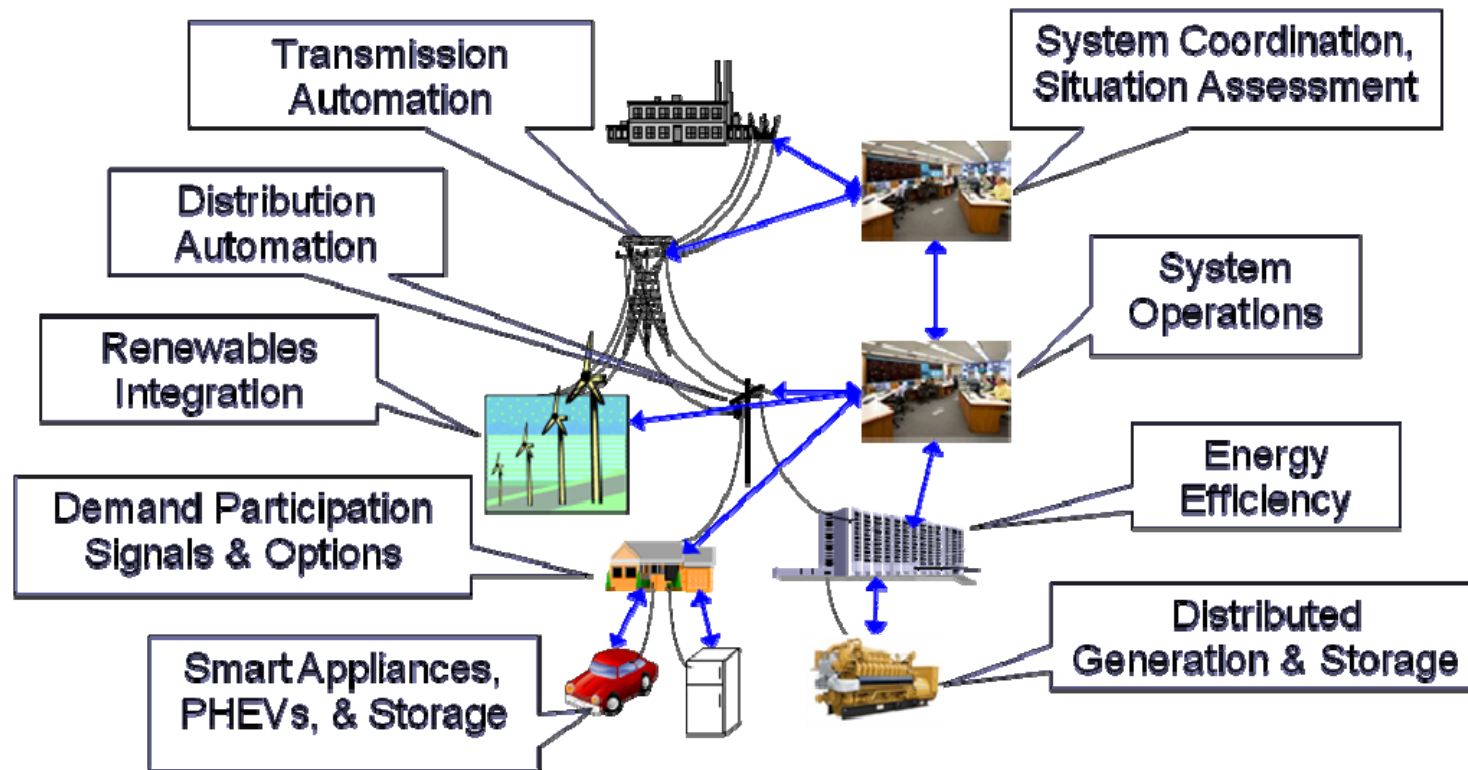
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The smart grid utilizes assets to create value with two way communications



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The project survey was completed by 16 economies*

- ▶ The survey is comprised of five sections:
 - The *Baseline* section is oriented to familiarity of all concerned parties (customers, utilities, and policy makers) with the smart grid concept, technologies, and applications.
 - The *Standards, Institutional, and Policy/Regulatory* sections are to identify issues relevant to these three domains.
 - The *Other* section asks if the respondent can specify issues not addressed by a survey question and for other information that might be helpful in developing the status and recommendations.

* Australia; Canada; The Peoples Republic of China; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Russia; Singapore; Chinese Taipei; Thailand; The United States; and Viet Nam.



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Survey results points to the importance of communicating smart grid benefits

- ▶ All economies included in the survey indicate that customers have either no familiarity with Smart Grid, or it is familiar to only a minority of customers
- ▶ Over a third of the economies indicate that 75-100% of policy makers and utility providers are now aware of Smart Grid
- ▶ Awareness is hampered by a common definition
- ▶ To the extent that smart grid technologies are perceived to reduce the need for new supply resources, customer receptivity is improved, as many generation projects face public opposition.



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Challenges Facing Smart Grid Deployment

- ▶ Two broad challenges are:
 - There is a need to increase the awareness of smart grid capabilities and their benefits for advancing energy-efficiency and renewable-resource integration policies
 - The speed with which new ideas and deployment strategies are being generated can challenge decision-making as there is pressure to revisit project definitions and approaches
- ▶ Other challenges were summarized according to technical, business and financial, and societal issues



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Technical challenges

- Constantly changing technologies means that a heterogeneous mix of technology must be accommodated. Existing generation and delivery infrastructure (i.e., legacy) systems must be adapted to work with new technologies.
- Being flexible to changing technologies requires identifying the important interfaces between technology components.
- Achieving alignment across service providers, end-users, and technology suppliers is difficult particularly in a growing, international marketplace. Interoperability can allow multiple parties to connect their devices and systems for proper interaction, but attaining interoperability is difficult.



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Business and financial challenges

- Understanding and communicating the value proposition of a smart grid deployment for each stakeholder in the electricity supply chain is daunting.
- The financial environment for risk and reward can challenge business plans for smart grid investments.
- Regulatory understanding and sensitivity to providing an appropriate environment for smart grid investment takes time. Regulatory decisions (or lack of decision) can create new challenges.
- Developing an appropriate incentive structure that aligns economic and regulatory policies with energy-efficiency and environmental goals needs to be tailored to each member economy.



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Societal challenges

- Strategies need to account for a variety of policy objectives (affordability, sustainability, growth, and cultural values).
- Assigning value to externalities, such as environmental impacts, is difficult, but necessary, in balanced decision-making.
- Understanding and accounting for the beneficial aspects of smart grid investments as a mechanism for job creation and advancing a technically skilled workforce needs development.



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Five areas of potential activities were identified for priority consideration (1)

- ▶ *Policy Goals.* Consideration should be given by APEC to develop a common framework for describing smart grid policies supporting renewable energy and energy efficiency
- ▶ *Education.* An important result from the survey was the need for better education on the nature of smart grid and its role in supporting energy efficiency and renewable-energy integration.
- ▶ *Interoperability.* APEC members need to consider their active participation in interoperability discussions that are setting the direction for international information and communications technology standards that support the integration of smart grid



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Five areas of potential activities were identified for priority consideration (2)

- ▶ *Methods and Workshops.* The development of frameworks, metrics, and other tools can be coordinated through a series of APEC-sponsored workshops.
- ▶ *Roadmaps.* Consideration should be given by APEC to create a common framework for smart grid roadmap development. Such a framework could be used as a starting place for each member economy.



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A first step could be to develop a framework for roadmap development that identifies the desired roadmap characteristics

- ▶ Roadmap for grid technology to support electric drive vehicles (New Zealand project proposal).
- ▶ Roadmap for grid technology to build microgrids in isolated communities (Russian project proposal)
- ▶ Roadmap for grid technology to reinforce distribution networks (Chinese project proposal)
- ▶ Roadmap for grid technology to support EERE on highly interconnected and well-developed grids



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Ten areas for further study were identified (1)

- More comprehensive survey, or perhaps more detailed in a specific area of concern.
- APEC situation within the global marketplace related to smart grid.
- Regulatory policy considerations related to smart grid for APEC members.
- Further study to quantify and be able to measure smart grid capabilities to improve environment (air water, land).
- Predict technology maturity gaps, looking at expected phases of smart grid progression.
- Prepare coordination (R & D, marketplaces, regulatory environments, legislation) as needed for different smart grid development scenarios. Plan for scaling-up of smart grid (geographically, functionally, and market-wise).



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Ten areas for further study were identified (2)

- Characterization of price impacts and environment impacts of various technologies (e.g., PEV) as a function of economy characteristics.
- Many smart grid advances depend on or result in bi-directional flows of information and electricity at the distribution system level. Recognizing the need to move toward supporting bi-directionality is essential, developing expertise, familiarity and data analysis infrastructure adapted to different economies.
- Study the potential long-term financial avoided capital costs for new capacity. Avoiding growth in electricity demand and reinvesting in smart grid provides significant potential financial gains under different scenarios. What are these scenarios and what are the potential financial gains?
- Smart grid represents a significant change for electricity service providers. Strategies are needed for utilities to manage the disruptive nature of this change (Microsoft 2010). Preparation is needed for information technology to support new business processes and integrate with new smart grid technologies.



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The report concluded with a call for APEC members to take charge of their energy future

- ▶ APERC projects that APEC economies will need to invest \$6.2 to \$8.4 trillion from 2005 to 2030 to meet electricity and heat demand (APERC 2009). Choices about how these sums are invested can result in very different outcomes. The benefits emerging from current smart grid developments indicate that the inclusion of smart grid best practices into the electricity supply and demand infrastructure will provide both long term economic and environmental benefits for APEC member economies and the APEC region as a whole.



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Thank you for your attention!

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**REPORT OF THE CHAIR OF THE APEC EXPERT GROUP ON
NEW & RENEWABLE ENERGY TECHNOLOGIES (EGNRET)
TO THE 42nd APEC ENERGY WORKING GROUP (EWG) MEETING**

Kaohsiung, Chinese Taipei
17-21 October 2011

EGNRET ACTIVITIES SINCE EWG 41

The Expert Group on New and Renewable Energy Technologies (EGNRET) has met once since EWG 41.

The 37th meeting of the Expert Group on New and Renewable Energy Technologies was held on August 22 to 26, 2011 in Taipei, Chinese Taipei. In addition to EGNRET 37, the APEC Workshop on Addressing Challenges in AMI Deployment and Smart Grid in APEC Region was held alongside the meeting.

The EGNRET 37 meeting was co-chaired by Dr. Hom-Ti (Tom) Lee of the Industrial Technology Research Institute (ITRI) and Mr. Jin-Sheng Su of the Bureau of Energy (BOE) at MOEA, Chinese Taipei. Representatives from Canada, Japan, Korea, Singapore, Chinese Taipei, Thailand, USA, APEC Secretariat, APERC, and Low Carbon Model Town Task Force (LCMT TF) participated in the meeting.

The economy presentation topic for EGNRET 37 was "Current New and Renewable Energy Priorities in APEC Member Economies." The EGNRET has set this topic every two years to review the priorities on developing new and renewable energy technology in APEC economies. The last review program was at EGNRET 32 in April 2009 in Honolulu, Hawaii, USA.

Three invited presentations were also given in the meeting, including Progress on APEC Peer Review on Low-Carbon Energy Supply (PRLCE) and PREE from APERC, Overview of Low-Carbon Model Town (LCMT) Task Force Activities from LCMT TF, and APEC Research Network for Advanced Biohydrogen Technology from Feng Chia University, Chinese Taipei. The last presentation was the outcomes of a self-funded project supported by APEC Industrial Science and Technology Working Group (ISTWG).

Also, special gratitude is due to Mr. Augustine Kwan, the Communications and Outreach Officer at APEC Secretariat for his excellent coverage to exhibit the fruitful outcomes of the EGNRET 37 meeting and related events. The event media release and video interview can be found at:

<http://www.egnret.ewg.apec.org/news/index.html>

The EGNRET 37 meeting presentations are available on the website at:

<http://www.egnret.ewg.apec.org/meetings/egnret37/index.html>

and presentations of APEC Workshop on Addressing Challenges in AMI

Deployment and Smart Grid in APEC Region can be found at:

<http://www.egnret.ewg.apec.org/workshops/AMIWorkshop/index.html>

In addition, 2011 APEC Photovoltaic Conference, a self-funded project sponsored by Chinese Taipei was held on 14 October 2011, Taipei. 220 participants from 10 APEC Economies attended the Conference to discuss the PV market and policy developed in the APEC region.

Moreover, the Chair of EGNRET was invited to give a presentation “PV Utilization in APEC Region” at the APEC Workshop on Ensuring Photovoltaic (PV) Reliability and Durability. The workshop hosted by APEC Subcommittee on Standards and Conformance (SCSC) was held on October 12-13, 2011 in Taipei, Chinese Taipei, and it featured 17 speakers from 8 APEC economies, including energy trade specialists, scientists studying and evaluating PV performance, testing and conformity assessment experts, and industry leaders. Totally 84 participants from 8 APEC Economies attended the Workshop to discuss best practices for PV supply chain, solutions for PV materials reliability, etc. It can be seen that engaging with other APEC fora will assist in consolidating our efforts, and expand the capacity to respond to future energy challenges.

The presentation “PV Utilization in APEC Region” is available on the website at:

<http://www.egnret.ewg.apec.org/news/index.html>

Completed EGNRET Projects

Two EGNRET projects have been completed recently, and also have been reported at last EWG meeting (EWG 41).

- **Addressing Grid-interconnection Issues in Order to Maximize the Utilization of New and Renewable Energy Sources (EWG 02/2009)**

The final report and workshop presentations are available on the workshop’s website at:

<http://www.egnret.ewg.apec.org/workshops/Grid-interconnection/index.html>

- **Using Smart Grids to Enhance the Use of Energy Efficiency and Renewable Energy Technologies (EWG 01/2009S)**

The project final report is available on the EGNRET website at:

<http://www.egnret.ewg.apec.org/reports/index.html>

EGNRET Current Project Update

The EGNRET is currently implementing two projects, as described below. Two-page project summary reports were also prepared for EWG 42 (see Agenda Item 12(a) Annexes 1 & 2.)

- **Addressing Challenges of AMI Deployment in APEC (EWG 07/2011A)**
(Chinese Taipei lead, US\$ 59,586)

The 9th Energy Ministerial Meeting (EMM 9) in 2010 instructed 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. Advanced Metering Infrastructure (AMI) is a foundation enabling technology for the Smart Grid. Many countries in the worldwide announce and start their AMI programs. However, it seems many issues are needed to overcome. These issues include policy, meter reliability, information security, customer education, and so on. This project will investigate the development strategies and current status of AMI in all APEC economies, and provide recommendations for AMI deployment. The methodology of this project involves survey and analysis of AMI development status, and an two-day AMI workshop.

Currently, the worldwide AMI deployment status is continuously collected, and the first completed region was Australia. It was found out that each economy has its own deployment plan. More important, the plan adopted the Minimum AMI Functionality Specification and Minimum AMI Service Levels Specification to ensure the quality of system integration. In addition, the interconnection with HAN (Home Area Network) and the functionality of IHD was also considered in Australia.

The APEC AMI Workshop has been held on 24-25 August in Chinese Taipei. In total 16 speakers were invited from 9 economies, and 216 participants from 7 economies attended the Workshop.

APEC member economies which are developing their AMI can be beneficiary most from the project. They will gain valuable experiences from field trials, policy making, system requirements, etc. As a result, effective action plans can be made to accelerate the development of AMI in the APEC region.

- **Stock-take of Electric Vehicle Interface with Electricity and Smart Grids Across APEC Economies and the Potential for Harmonization (EWG 11/2011)** (New Zealand lead, US\$ 57,000)

Electric and plug-in hybrid electric vehicles (EVs) are an important opportunity to achieve sustainability outcomes as they can actively displace the use of oil throughout the APEC region with electricity, including renewably generated electricity; reduce greenhouse gas emissions; improve air quality; improve transport energy end use efficiency; increase local and regional energy security; improve integration of renewable electricity generation; and improve resilience in the transport sector.

The objective of the project is to enhance understanding in APEC economies of EV connectivity to electricity grids and identify opportunities to increase the harmonisation of standards and requirements to promote the deployment and integration of EVs, both vehicles and supporting technologies, by providing an assessment of current and planned grid and vehicle interconnection standards and regulations for EV deployment in different APEC economies; an assessment of

EVs in existing and proposed smart grid deployment projects and policies; and recommendations on opportunities where improved harmonisation in EV - grid connectivity standards and requirements can reduce barriers for trade and promote deployment. Finally, the project will provide a uniform source of information to car makers and other EV technology investors to minimise public and private costs.

The methodology of this project involves 3 main steps, including a survey of APEC economies on existing EV connectivity infrastructure, regulations, and standards; a desktop review of the results; and a workshop to discuss the findings and collect APEC feedback. Currently, the project is finalizing an RFP to select a consultant to carry out the research. The RFP will be posted in the APEC website within the next week.

New Project Proposals for Funding in 2011

The EGNRET has submitted 3 project concept notes for funding in Session 3/2011 to EWG on September 9, 2011 for further endorsement and ranking. The new project proposals are described briefly as below.

1. Best Practices in Energy Efficiency and Renewable Energy Technologies in the Industrial Sector in APEC Region (Thailand lead, US\$75,000 total/US\$50,000 APEC).

The project is cooperated with EGEE&C, and led by Thailand. The key objective of this project is to develop a report which clearly identifies the examples of successful adoption of new and renewable energy technologies combined with energy efficiency in the APEC industrial sector, the obstacles that prevent the adoption of technologies, and the applicability of lesson learned from previous reports including APEC supported activities. The final output will be suggested roadmap for the successful implementation of industrial sector new and renewable energy and energy efficiency system in APEC member economies.

2. Piloting Smart/micro Grid Projects for Insular and Remote Localities in APEC Economies (Russia lead, US\$162,000 total/US\$ 82,000 APEC)

The objectives of this project is to compile and share member economies' experiences in introducing new technologies for local energy systems including smart grid technologies to support sustainable development of insular and remote areas. Also, the aim of the project is to emphasize micro grid as a special case of smart grid that is designed to maximize the economic and environmental effect of tested and ready-to-use technologies for local energy systems. The outcomes of the project will provide a menu of options to APEC economies for piloting of smart/micro grid projects in the form of successful case studies, toolkits and/or specific recommendations.

3. Prospects for Marine Current Energy Generation in APEC Region (Russia lead, US\$188,000 total/US\$ 90,000 APEC)

APEC economies are naturally endowed with access to vast ocean and marine resources that offer potential of tidal, wave and current energy. Technology and

expertise to utilize marine current energy exist in a number of APEC and non-APEC economies, but the industry is in its infancy. Information/technology sharing is needed to advance the understanding of options for marine energy production at large and marine current energy in particular. Therefore, the objectives of this project are to raise awareness of the benefits of marine energy generation with particular focus to marine current energy, and to build capacities for successful deployment of marine current generating technologies in APEC economies.

Upcoming EGNRET Meeting

The venue and date of the next meeting (EGNRET 38) will be determined later.