PACIFIC
ENERGY SUMMIT

INNOVATIVE GENERATION

POWERING A PROSPEROUS ASIA

A report from the Pacific Energy Summit
Hanoi | March 20–22, 2012

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Printed in the United States of America.

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INNOVATIVE GENERATION:
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EXECUTIVE SUMMARY

The tremendous economic growth in developing Asia is driving a rapid rise in electricity demand—an estimated 56% increase between 2015 and 2025. The Pacific Energy Summit in Hanoi, Vietnam, gathered experts to discuss market-oriented and policy solutions for providing electricity while addressing energy and environmental concerns. Summit participants hailed from a wide range of backgrounds, perspectives, and expertise, but several common themes emerged.

POWER SECTOR REFORM: INVESTMENT, INFRASTRUCTURE, AND RURAL ELECTRIFICATION

- The Institute for Energy Economics, Japan (IEEJ) forecasts that $9 trillion is needed to meet electricity demand growth in Asia between 2010 and 2035. Due to high start-up costs and the long-term planning required for building infrastructure, investment decisions made in the next five years will affect the region and the world for decades to come.
- To attract private investment both domestically and from abroad, a more transparent and competitive electricity market is vital. Host governments, sponsors, and financial communities also need to develop a coordinated mechanism to streamline the investment approval process and accelerate the development of public-private partnerships.
- Real market reform needs to reflect the cost of fuel. Energy analysts concur that price subsidies send incorrect market signals, drain state budgets, and hamper investment. Moreover, perversely, 80% of current subsidies go largely to medium- and high-income groups.
- While there is no single model for successful power sector reform, there are steps that are essential. "Unbundling"—the separation of the industry into three components: generation, transmission, and distribution—is a key first step.
- Rural electrification is a critical priority for policymakers in developing countries to raise standards of living and improve the economy. Rural electrification programs face a number of challenges. Investors must recover capital to fuel long-term expansion plans, and recovering investment through tariff design is essential for long-term success.

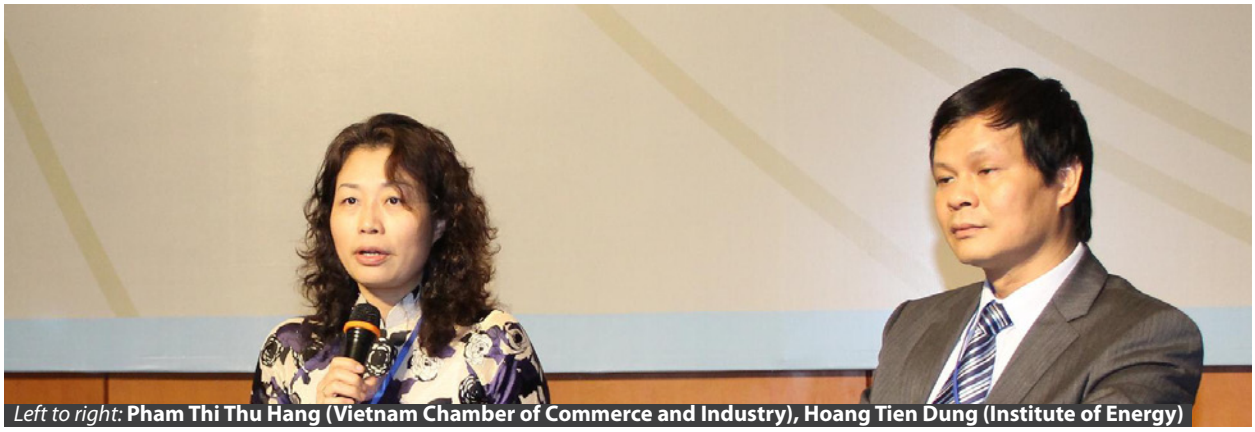
THE ENERGY AND POWER OUTLOOK FOR A PROSPEROUS ASIA

- Electricity is the foundation for economic development and improving living standards, yet it is also the source of 42% of global carbon emissions.
- Despite the devastating Fukushima Daiichi nuclear power plant meltdown and Japan's retreat from nuclear energy, most experts concur that Asia's nuclear power development will continue to develop rapidly, particularly in China and India.
- Public perception of the safety of nuclear energy will be a critical factor in shaping the industry outlook. Safety concerns have taken on a new emphasis throughout the region.
- Across the region there are growing efforts to address climate concerns. However, coal remains the most widely used and carbon-intensive fuel source in Asia's power generation. There is an urgent need to slow growth in traditional coal-fired power generation, reduce emissions, and increase the thermal efficiency of new coal-fired units. Cost reduction, incentives, and new technology development are essential to increase the diffusion of clean coal technologies.

- Natural gas presents a cleaner-burning alternative to coal. Despite the tremendous growth of global supply, Asia has yet to maximize the full potential of natural gas. Hurdles include infrastructure costs, shipping, and the region's oil-linked price structure. Many Summit participants expressed great interest in the potential for growing liquefied natural gas (LNG) exports from North America to Asia.
- Development of renewable energy to decrease dependence on imports, reduce emissions, and deploy smaller-scale distributed electricity generation, particularly in rural areas, is a priority for countries throughout the region.
- New technologies are addressing renewable energy challenges, such as intermittency, transmission, and storage capacity. Solar and wind power are becoming increasingly cost-competitive in some environments.
- Hydropower offers opportunities for large-scale power generation as well as a platform for energy integration and cross-border trade. Successful implementation of hydropower dams includes addressing management and design concerns, downstream environmental impacts, international environmental standards, and investment and infrastructure.
- Regional cooperation provides tremendous opportunities for maximizing energy security. Integration, collaboration, and cross-border trade can help address energy shortages, diversify supplies, and support the development and deployment of environmentally friendly technologies and resources.
- Escalating power demand has the potential to spur deeper integration, particularly in South Asia, which lags far behind the Association of Southeast Asian Nations (ASEAN) in this regard.

POWERING INNOVATION, DEPLOYING TECHNOLOGY, AND MAXIMIZING EFFICIENCY

- Traditional models for electricity generation have emphasized large-scale and centralized projects, leading to the development of large enterprises, which are often monopolistic and frequently state-owned. This model can create barriers to the adoption of new energy technologies, which lend themselves to more decentralized and distributed applications.
- Regulators must be sure that technologies are proven and that the costs of deployment make sense for consumers.
- There is significant untapped potential in enhanced efficiency, which, if maximized, could be a pillar of energy supply. Strong policy frameworks for responsive market structures and clear price signals are inextricably tied to manage demand and encourage efficiency gains.



Left to right: **Pham Thi Thu Hang (Vietnam Chamber of Commerce and Industry), Hoang Tien Dung (Institute of Energy)**

Left to right: **Robert Hormats (Department of State, United States), Tatsuo Masuda (Nagoya University)**

INNOVATIVE GENERATION

MEETING ASIA'S SURGING POWER DEMAND

"At no other time in the history of mankind has energy been so central to our security, prosperity, and our living environment," said **Dang Dinh Quy,** President, Diplomatic Academy of Vietnam. Addressing over 150 energy sector leaders, Quy launched the third Pacific Energy Summit in Hanoi, Vietnam. "Ensuring energy supply, therefore, is not limited to the energy sector, but it requires well-coordinated and comprehensive solutions, cutting across sectors."

The 2012 Pacific Energy Summit gathered leaders from 17 countries and across sectors to address the theme, "Innovative Generation: Powering a Prosperous Asia." Convening high-level policymakers, industry executives, and research experts, the Summit's goal is to promote realistic, market- and policy-based solutions for long-term economic growth. To that end, the Summit hosted a series of plenary sessions and targeted workshops led by renowned experts in the field. Discussion topics included: designing effective and responsive power markets; the potential for transforming natural gas into Asia's baseload fuel; the outlook for new technology to reduce coal's environmental footprint; the promise of economic opportunity through renewable energy resources; the benefits and impacts of innovation, technology, and policy to support increased access to electricity; and the scope of financing and infrastructure challenges.

Across the Asia-Pacific region, the last three decades have been uniquely characterized by breathtaking economic advances. Exceptional growth and development have transformed Asia into the world's most dynamic economic region. These advances are driving an enormous expansion in global energy demand. The booming pace of development is expected to continue, creating greater opportunity, prosperity, and affluence, but it will also lead to a staggering increase in electricity needs.

Over the last decade alone, the regional energy supply and demand outlook has evolved dramatically. Electricity consumption has doubled in Asia, tripled in China, and quadrupled in Vietnam. Investment and infrastructure expansions, however, have not kept pace with the swift rise in power generation requirements, leading to chronic shortages that threaten to undermine economic growth. Meanwhile, nearly 700 million people, many living in rural areas, still do not have access to electricity and, therefore, do not benefit from an improved quality of life or the economic opportunities this basic amenity provides.

"We have to go beyond what is currently the state of the art in terms of generating power," said **Dennis Blair**, Member, Board of Directors, The National Bureau of Asian Research (NBR). "We have to generate a lot more power than today, and we must both use it more efficiently, and generate less pollution than we do today, if we are to have the economic growth and the quality of life that we need for succeeding generations."

Dang Dinh Quy (Diplomatic Academy of Vietnam)

Left to right: **Kwon Hong Ryu (Wonkwang University School of Law), Mikkal Herberg (NBR), Chi Zhang (BP), Ken Koyama (The Institute of Energy Economics, Japan)**

WHY POWER GENERATION, WHY ASIA, WHY NOW?

"We talk extensively about oil supply security and rising prices, but I frankly believe that Asia's real energy crisis is electricity," said **Mikkal Herberg,** Research Director, Energy Security Program, NBR. "Asia will need energy for electricity generation from every source available and to mobilize all resources, including efficiency, which should be considered as a pillar of energy supply."

A succession of momentous geopolitical events over the last year, particularly in the Middle East, have led to volatile energy markets and prompted many countries to re-examine their dependency on fossil fuel imports. Japan's nuclear disaster following the tragic earthquake and tsunami in March 2011 has had a lasting impact on the global energy outlook.

"The nuclear accident has had a spillover effect on fossil fuel markets," explained **Ken Koyama,** Chief Economist and Managing Director, Institute for Energy Economics, Japan (IEEJ). As of early 2012, Japan's nuclear program is on hold, resulting in a loss of more than 30% of carbon-free power generation and adding pressure on regional fossil fuel markets. "In Japan, there is an urgent need to find a substitute for nuclear energy," he stated.

Meeting the electricity demand of a prosperous Asia will require large-scale investments. According to the International Energy Agency's (IEA) latest forecast, electricity demand in developing Asian countries will rise by 56% from 2015 to 2025, and another 40% from 2025 to 2035. From 2010 to 2035, IEEJ forecasts $20 trillion will be required to meet electricity demand growth worldwide, of which $9 trillion alone will be needed in Asia. Due to the high start-up costs and long-term planning required for energy infrastructure, decisions made in the next five years will affect the region and the world for decades to come.

Left to right: **Dennis Blair (Board of Directors, NBR) , Melody Meyer (Chevron Asia-Pacific Exploration and Production Company)**

Regional leaders have recognized the urgency of working together on this challenge. APEC leaders have called for a 45% reduction in energy intensity among the 21 member economies by 2035. Together with G20 leaders, APEC also pledged to reduce and phase out inefficient fossil fuel subsidies. Pacific Energy Summit discussions coincided with the U.S. government's recent foreign policy shift toward Asia, with an emphasis on strengthening multifaceted ties with countries in the region.

"We're trying to demonstrate that the United States wants to play a sustained role in the region economically, from a political and security point of view. And a very important component of that is energy," said **Robert Hormats,** U.S. Under Secretary of State, Economic Growth, Energy, and the Environment. He emphasized that the United States has stepped up its engagement with APEC and ASEAN, and is collaborating with Asian governments on developing new technologies to meet the challenge of energy and environmental security.

"Two of our most important natural resources in Asia today are its visionary leaders and strong business partnerships between countries and companies," said **Melody Meyer,** President, Chevron Asia-Pacific Exploration and Production Company. "Partnerships generate projects, new investments, new energy supplies, and new revenue streams."

Meyer's vision for energy partnerships in Asia provided a substantive departure point for Summit discussions and an in-depth examination of the sustained high-level commitment, political will, regional cooperation, and cross-sector collaboration needed to realize these ambitious and essential energy resource and power sector development goals. Summit delegates acknowledged that energy security and environmental stability must be addressed with equal vigor, requiring creative partnerships and engagement of skills and expertise across the stakeholder chain. Vietnam's high-level commitment to forward-looking energy policy provided important and relevant insights for thought-provoking discussions.

> *"There are four interrelated dimensions for successfully addressing the power equation: the technical dimension, the social dimension, the economic dimension, and that of the environment."*
>
> **Jose Rene Almendras,** Secretary of Energy, Philippines

SPOTLIGHT ON VIETNAM

Vietnam is a fast-track economy at the epicenter of Asia's growth, and the power generation sector is bearing the brunt of the nation's breakout economic advances. Despite Vietnam's growing pains, a tremendous annual economic growth rate of 7%–8% is the envy of many countries, and the brisk pace of development has put the country on track to grow to 70% of the size of the United Kingdom's economy by 2050.

To sustain economic success Vietnam must meet a 14%–15% annual increase in power demand. Fluctuations in oil markets and rising fuel prices, along with the fear that chronic power shortages could undermine the country's prospects, have prompted the government to put energy security at the top of the national agenda. The Summit hosted industry experts and senior leaders from Vietnam's government and research institutions to discuss the strategic energy decisions Vietnam has taken.

ENERGY MARKET REFORM TO SUSTAIN ECONOMIC GROWTH

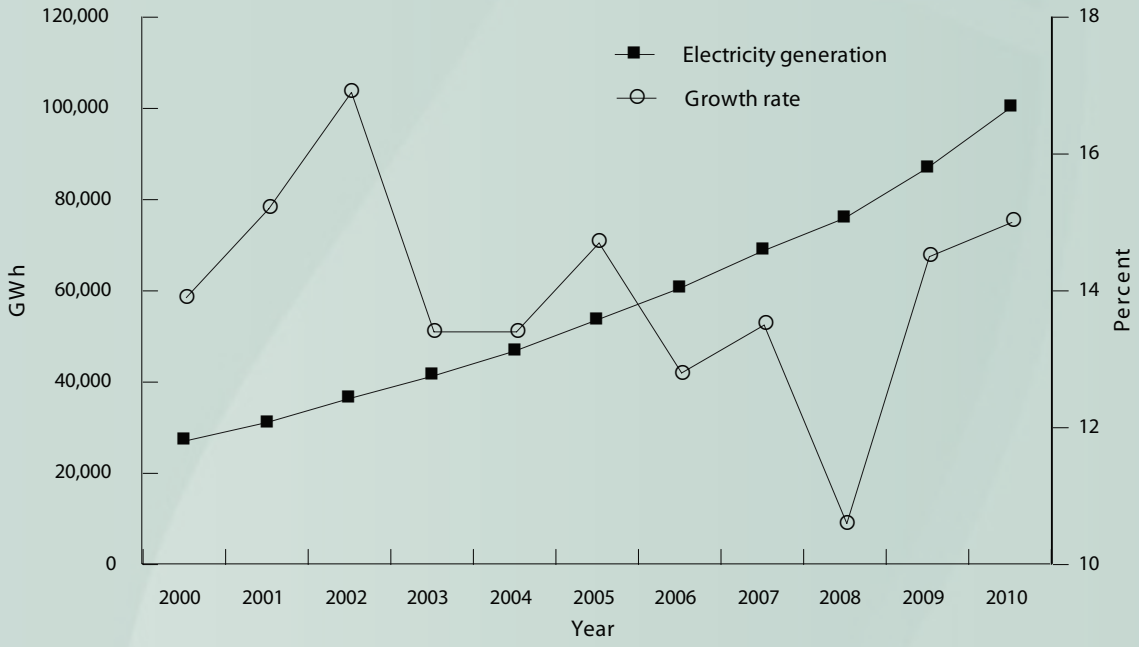
"We have to design a market that not only brings benefits to investors and generators, but also the consumer and end users," said **Hoang Quoc Vuong,** Deputy Minister, Ministry of Industry and Trade, Vietnam. "The biggest challenge facing Vietnam's power system is mobilizing funding."

The Seventh Master Power Development Plan is Vietnam's roadmap for the power sector, addressing energy supply diversification, pricing reform, market restructuring, and efficiency. According to the plan, Vietnam's energy sector reforms will cost $48 billion through 2020. An estimated $29 billion will be required for generation, $10 billion for transmission, and an additional $9 billion for distribution.

"That's a staggering amount, and it will require considerable investment from the private sector," said **Anthony Jude,** Director, Energy Division, Southeast Asia, Asian Development Bank (ADB). The plan includes proactive demand- and supply-side initiatives, as well as aggressive restructuring plans for Vietnam's power generation sector to attract greater foreign investment flows. As the economy rapidly evolves, pricing reform has become critical to securing foreign capital. In response, Vietnam's power sector is transitioning to the competitive generation market (CGM), a long-term market restructuring initiative.

FIGURE 1

Power Generation and Growth Rate in Vietnam, 2000–2010



Source: "Power Development Plan VII," Institute of Energy, 2011.

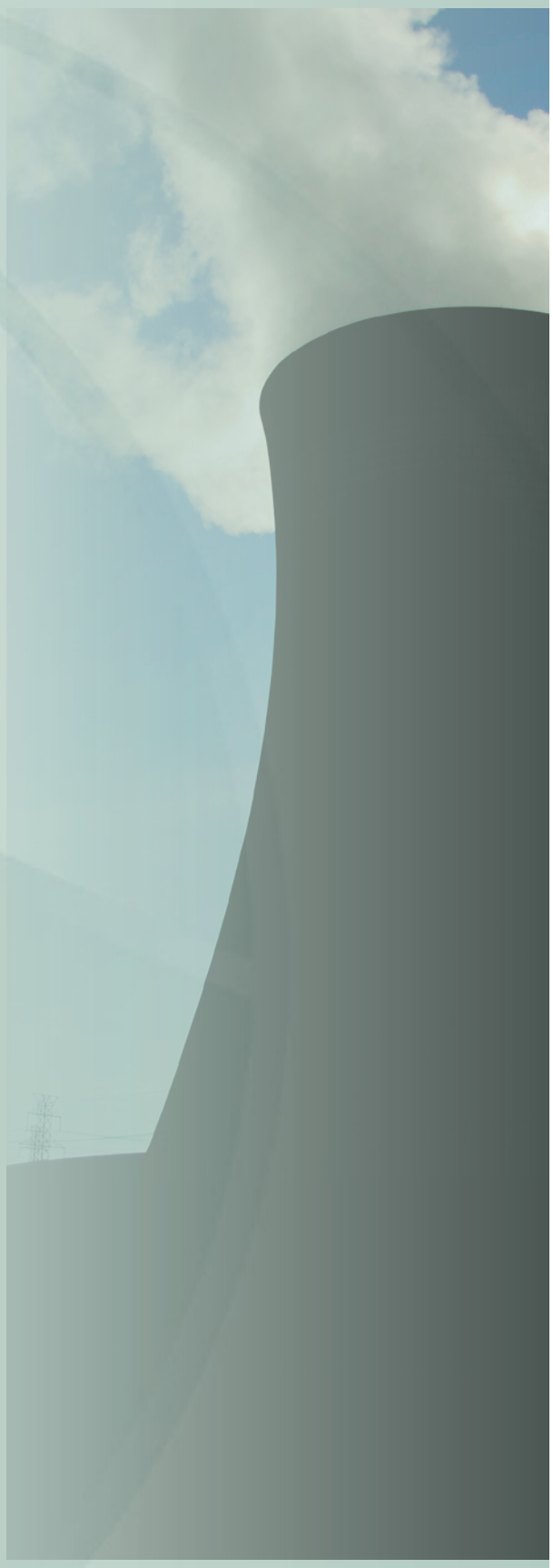
Note: For further discussion of this figure see Nguyen Anh Tuan. "A Case Study on Power Sector Restructuring in Vietnam." The National Bureau of Asian Research. PES Working Paper. March 2012.

The government is incrementally moving the cost of electricity toward market prices through a pilot CGM planned for May 2012, explained **Nguyen Van Vy,** Deputy Director-General, Department of Sectoral Economy, Prime Minister's Office, Vietnam. "We are moving the pilot program to a wholesale competitive market by 2015, and by 2022, it will transition to a competitive retail market."

Vietnam is now poised to unbundle the power market, to separate the industry into its natural components—generation, transmission, and distribution. "Unbundling is not enough by itself," said **Nguyen Anh Tuan**, Director, International Relations Department, Institute of Energy, Vietnam. "The bottleneck is in the reform of electricity tariffs. We need to enable investors to expand the infrastructure."

There was general consensus among Summit participants that tariff reform is essential as regional countries seek to expand the power generation sector.

In addition to pushing electricity prices toward market levels, Vietnam is diversifying its energy resources and bolstering its domestic supplies, said **Hoang Tien Dung,** Director-General, Institute of Energy, Vietnam. Hydroelectric power provided as much as 50% of the country's power supply, but capacity has dropped to 37%. Meanwhile, Vietnam's domestic coal reserves are dwindling, and coal exports are being reduced to fuel growing domestic power demand. Nuclear power is now a component of Vietnam's energy development plan; the first two reactors are scheduled to go online by 2020. In the renewable energy sector, Vietnam is aiming to boost wind power to 1,000 megawatts (MW) by 2020 and to do this, the government is offering feed-in tariffs of $0.078 per kilowatt-hour (kWh) for wind power and selling emission reduction certificates, according to Dung.



Efficiency and conservation are central pillars of the government's new energy policy. The Energy Efficiency Law of 2011 calls for a 10%–20% increase in energy efficiency in the commercial sector. "Improved technology and modernization of outdated machinery—a key contributor to energy inefficiency—is a must. It's not just for the sake of energy efficiency, but also to keep production costs low and to increase profit margins. This will help Vietnamese businesses improve their competitiveness," said **Pham Thi Thu Hang,** Secretary General, Vietnam Chamber of Commerce and Industry (VCCI).

Vietnam has taken strategic steps to attract private sector funding through CGM as well as legislation that emphasizes transparency and competition. Despite important progress, Vietnam has a great wealth of resources that have yet to be tapped, remarked **Hank Tomlinson,** President, Chevron Vietnam Ltd. He outlined the benefits of the proposed Chevron Block B Gas Project, which has the capacity to supply nearly half a billion cubic feet per day of natural gas. The project would fuel up to 3,500 MW of new power for Vietnam, a 15% increase in power capacity that would also provide greater energy security, according to Tomlinson. He added that as an alternative to importing coal, the Block B Gas Project offers a significant positive impact toward Vietnam's balance of trade.

Tomlinson provided an investor's perspective for the key elements of a successful collaboration: "It must be a mutually beneficial arrangement. Investors seek long-term clarity and government guarantees to ensure a win-win solution."

"We are implementing efficiency activities among enterprises to reduce elasticity ratio between GDP growth and electricity consumption rate. In 2011, the ratio for Vietnam was 1.4%, falling from 2.4%, so these efforts have shown considerable progress."

Nguyen Thi Hong Lien, Deputy Director, Planning Department, Vietnam Electricity (EVN)

Left to right: **Hank Tomlinson (Chevron Vietnam), Nguyen Anh Tuan (Institute of Energy), Jose Rene Almendras (Department of Energy, Philippines)**

MARKET TRANSFORMATION

REFORMS FOR ENHANCED COMPETITION AND EFFICIENCY

Vietnam's transition to a competitive power market provides a valuable example for other countries attempting to do the same. Summit delegates acknowledged that while each country faces a unique set of circumstances, there are common paths that lead toward a robust power sector.

Mark Hutchinson, Senior Director, IHS Cambridge Energy Research Associates, defined a healthy market as one founded on adequate supply delivered by viable entities that are capable of balancing consumer and producer needs. The market must also simultaneously foster environmental protection, economic growth, and social development. Hutchinson also emphasized cost-reflective electricity tariffs as the genesis of a healthy investment environment.

"Any efficient, flexible domestic power project should be considered as part of the broader energy value chain from resource to consumption… a chain that takes years to develop, has an operational life of three decades or more, and costs hundreds of millions of dollars," explained **Emma Cochrane,** Vice President, Asia Pacific, Africa, and Power, ExxonMobil Gas and Power Marketing Company. "To attract developers and their financiers, there have to be returns commensurate with risk through the value chain."

In many countries, however, the power generation sector is managed by inefficient state monopolies, short on investment capital and vulnerable to political influence, that offer artificially low power prices to support social stability. As a result, state utilities often do not cover the cost of generating, transmitting, and distributing electricity, draining state budgets and undermining reinvestment into new generation capacity.

Left to right: **Charles Ebinger (Brookings Institution), Mark Hutchinson (IHS Cambridge Energy Research Associates), Emma Cochrane (ExxonMobil Gas and Power Marketing Company), Donald Hertzmark (DMP Resources), Kwang-In Kim (Korea Power Exchange)**

Donald Hertzmark, Principal, DMP Resources, pointed to even graver consequences of state-subsidized pricing. "Failing to cover electricity production costs leads to other problems," he warned. "At some point, electricity financing increases to such a high proportion of government business that it affects the credit rating of the country; it affects the ability to borrow money."

Industry experts emphasized market transparency as a critical requirement to transform the traditional state utility model into the innovative, competitive, and agile power generation sector. Summit delegates concurred that a substantive discussion of market reform should address the negative impact of subsidies and corruption.

The underpinnings of true price reform and responsive markets, as identified by a number of Summit delegates, include adequate infrastructure, rule of law, independent regulation, ready access to fuel markets, and risk management. Unbundling allows a government to create opportunities to introduce robust competition and attract private capital or private-public partnerships (PPP) to invest in developing new electricity supplies.

A free market is also a necessary ingredient. "Power generation is most effectively developed when there is a level playing field for all fuel types," said Cochrane. "If you overrule market forces with subsidies or other artificial barriers, it can lead to unintended consequences."

Charles Ebinger, Director, Energy Security Initiative, the Brookings Institution, noted that multilateral funding institutions such as the World Bank and the Asian Development Bank have been working toward pricing reform for over 25 years. "We now have more than enough models and historical experience to draw on to understand what has worked and what has not," he said. To overcome the equity questions that arise from pricing reforms, Ebinger recommended targeted subsidies for the poor who cannot afford electricity.

Delegates noted that there is no "one-size-fits-all" approach for restructuring the power sector. They identified a number of common elements in a successful, domestic-market policy framework, which include deregulation, broad stakeholder input, an empowered and independent regulatory and oversight agency, and regulation implementation.

> *"Optimal power market design varies from country to country, but we believe that market efficiencies are increased by competition; the more competitive a market is, the more efficient it becomes."*
>
> **Kwang-In Kim,** Vice President, Korea Power Exchange

Left to right: **Pil-Bae Song (Asian Development Bank), Hideo Naito (Japan Bank of International Cooperation), Agung Wicaksono (President's Delivery Unit for Development and Oversight, Indonesia)**

INVESTING IN INFRASTRUCTURE, ACCELERATING SOLUTIONS

STREAMLINING PUBLIC-PRIVATE PARTNERSHIPS (PPPs)

Countries embarking on electricity market reforms face a number of competing priorities. Top among them is the need for large-scale investment and adequate infrastructure. **Agung Wicaksono,** Special Assistant to the Head of Indonesia's President's Delivery Unit for Development, Monitoring, and Oversight in Indonesia, offered an insider's perspective on the effort to strengthen the nation's domestic power sector.

A key regional fossil fuel exporter, Indonesia is also an economic powerhouse with bright prospects. Yet, despite the effort to sustain average annual economic growth of 7%, Indonesia lags in infrastructure development. Indonesia saw no new power-generation plant construction between 1999 and 2008. As a result, the domestic electricity grid is weak, inefficient, and crippled by chronic power shortages. The government is now prioritizing investments and fast-tracking new projects. Estimates of the investments needed in infrastructure to meet Indonesia's growing power demand run up to $270 billion per year.

"We estimate that only 20% of that can come from the government," Wicaksono acknowledged. "Therefore, private sector participation is very important. The PPP scheme is the way to go."

Indonesia has taken steps to secure investor confidence and is successfully forging PPPs through a scheme of guarantee agreements provided by the government and a Ministry of Finance initiative called the Indonesian Investment Guarantee Fund, which is backed by the World Bank.

Hideo Naito, Head, Power and Water Finance Department, Japan Bank for International Cooperation (JBIC), remarked that large financial institutions that provide the bulk of the funding for large infrastructure projects are the fourth, unspoken "P" in the PPP framework.

Left to right: **Claire Pierangelo (U.S. Embassy, Vietnam), Hank Tomlinson (Chevron Vietnam), Viraphonh Viravong (Ministry of Energy and Mines, Laos)**

Naito underscored the need to accelerate PPPs and offered a suggestion to those governments seeking sponsors to fund large projects: "Governments are competing against each other to invite experienced international sponsors and lenders into their own country. Therefore, mechanisms are needed to ensure there is an actual partnership among the parties concerned and to streamline the process."

He emphasized that partnerships must exist not only between private entities and the government, but also among key stakeholders in the host countries: relevant ministries; contracting agencies; municipal and local government; and the communities that will benefit from the project.

Donald Hertzmark (DMP Resources)


Mark Thurber
(Stanford University)

BUILDING THE ENERGY SYSTEM OF 2030

RURAL ELECTRIFICATION: A PORTAL TO INCLUSIVE ECONOMIC GROWTH

The true measure of modern development is a robust energy system that provides equal access to electricity.

"Economic growth needs to be inclusive," stated **Jose Rene Almendras,** Secretary of Energy, Philippines.

Electrifying rural and remote areas has a measurable impact; it improves quality of life and offers fuel for economic development. However, in the Asia-Pacific region, this basic amenity remains out of reach for nearly 700 million people. The difficulty of accessing electricity suppresses economic prospects in rural and remote areas and prompts residents to abandon their rural communities and seek opportunity in urban areas.

"We need to provide an even playing field for all; children who have no electricity in their homes will never be able to compete with those who come from electrified communities," Almendras added.

The estimated cost of providing universal access to electricity by 2030 worldwide is $48 billion annually, much of which will be spent in Asia. Vietnam, China, and the Philippines are three countries that have made solid commitments and taken enormous strides to extend power to rural and remote regions.

Almendras outlined the ambitious electrification plan underway in the Philippines, an archipelago facing extreme geographic challenges. Channeling significant resources to the effort, the Philippine government has targeted 36,000 communities and aims to bring the current 70% household electrification rate up to 90%. The current program provides grants, rather than subsidies, to support low-income consumers with the expensive start-up costs. Each home is supplied with a meter, light bulbs, and an

Left to right: **Pil-Bae Song (Asian Development Bank), Edith Bueno (National Electrification Administration, Philippines), Daniel Waddle (National Rural Electrification Cooperative Association International), Fuqiang Yang (National Resources Defense Council), Hoang Quoc Vuong (Ministry of Industry and Trade, Vietnam), Jose Rene Almendras (Department of Energy, Philippines)**

electrical outlet, in addition to the "drop line." Almendras highlighted innovations on the "soft side" that contributed to the success of the program: preparing consumers for the monthly expense that comes with electrification.

The effort to expand infrastructure is often stymied by geography, high costs, and low return on investment; therefore, reaching remote areas requires a careful balance that brings long-term institutional and financial sustainability.

"Electrification programs by their very nature are designed to operate in the most financially risky extremes of the power sector," said **Daniel Waddle,** Senior Vice President, National Rural Electric Cooperative Association (NRECA) International. He added that capital recovery is essential to fuel long-term expansion plans and that operational subsidies have not proven effective and should be avoided if at all possible. "Recovering investment through good tariff design is essential for long-term success."

Fuqiang Yang, Senior Adviser on Climate Change, Energy, and Environment, China Program, Natural Resources Defense Council, highlighted the transformation taking place in Asia's largest economy. In the 1980s, more than 300 million people in China had no access to electricity. Today, that number stands at less than 10 million.

China's program, he said, addresses a common thread that runs through many rural electrification programs: the need to help low-income customers use electricity efficiently. "The Chinese government subsidizes high-efficiency lighting systems and appliances, so rural families can afford to purchase these items and simultaneously save electricity."

Rural electrification is a national priority in Vietnam, and it has already achieved significant progress. Nearly 96% of rural households have access to electricity. "By 2020, we aim to provide electricity to almost every household in rural areas," said Deputy Minister Vuong, Ministry of Industry and Trade, Vietnam.

Providing universal access to electricity presents each country with specific challenges, yet there is also a common denominator, noted Waddle. "As you go that 'last kilometer' or the 'last mile' to the most remote village, you really have to think about technological change [that is associated with extending electricity to remote locations and the increased costs]."

Left to right: **Srinivasan Padmanaban (USAID), Tran Xuan Hoa (Vietnam National Coal and Mineral Industries Holding Corp.), Pham Hoang Luong (Hanoi University of Science and Technology), Nguyen Xuan Thang (GE Energy)**

ENABLE AND INCENTIVIZE

INTEGRATING TRANSFORMATIVE TECHNOLOGY AND INNOVATION

The world of new technology is fast and fluid. Today's transformative tools offer great prospects for increasing cleaner energy supplies through innovation, which requires sustained commitment from policymakers. Novel technologies, permitting smaller-scale and decentralized applications, present inherent challenges to efforts to transform power sector models, which tend to be large, centralized, and often resistant to change.

"We need to facilitate the opportunities for new smaller players to come in and to be innovative and entrepreneurial, and this needs to be done through new policy approaches," said **Peter Hughes,** Director and Head, Energy Practice, Ricardo Strategic Consulting. "[Regulation] must enable and incentivize rather than control and confront."

Still, regulatory structures are often hesitant to approve and support technology that is not proven or in use. "I see a lot of potential in distributed generation, but we have to do it in the context of utility regulation which must be balanced, just, and reasonable," said **Philip Jones,** Commissioner, Washington State Utilities and Transportation Commission, and who also serves on the International Relations and Telecommunications Committee and the Executive Committee of the National Association of Regulatory Utility Commissioners (NARUC). "Until the technology provides benefits to ratepayers and is proven, it's difficult for a commissioner like me to say yes and pass the cost along to the consumer."

Left to right: **Young Chang Kim (Ajou University), Ambuj Sagar (Indian Institute of Technology, Delhi), Philip Jones (Washington Utilities and Transportation Commission; National Association of Regulatory Utility Commissioners), Peter Hughes (Ricardo Strategic Consulting)**

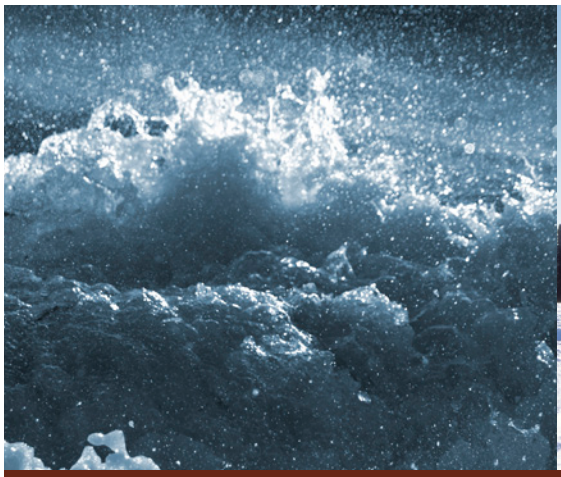
Distributed generation is widely seen as a viable option for island nations such as Indonesia and the Philippines, where geography and remote populations challenge the centralized grid model. South Korea too is moving briskly ahead on a Smart Grid Project, which aims to install smart meters in 50% of households by 2016, with an estimated 10% reduction of electricity use by 2030. China is aiming higher still: 80% of households to be covered that same year.

Jones added that the financial support for promising technology should be robust, but limited. "I'm not opposed to a one-time funding injection to get a technology going," he said. "But then the technology must stand on its own feet, quickly."

Implementing innovative tools must actively engage diverse players across the stakeholder chain. "Successful early deployment for large-scale impact requires an end-to-end perspective," said **Ambuj Sagar,** Professor of Policy Studies and Dean of Alumni Affairs and International Programs, Indian Institute of Technology, Delhi. "To organize for innovation requires a bird's-eye view that aligns technology with finance, policy, human resources and expertise, institutions, and end users."

A focus on R&D needs to fit into a broader system. Innovation efforts must focus on lowering costs and reducing emissions as well as ensure energy efficiency to manage demand. Electricity costs that accurately reflect transparent pricing schemes can further develop innovation by creating competition.

Consumer pricing also comes into play because deploying new technology can be expensive, prompting a pivotal question in the debate. "Are you willing to subsidize the development and the early deployment of a technology with the intention that it will lead to gains down the line, not just in terms of energy supply, or cleaner energy supplies, but also positioning the country in an emerging set of technologies that are likely to be large and in very competitive markets?" concluded Sagar.



ENERGY MIX OF THE FUTURE

For policymakers there are many uncertainties and difficult choices that lie between the energy supply source and the electricity consumer.

The Summit hosted a series of roundtables to explore short- and long-term prospects for coal, gas, nuclear, renewable sources, and hydropower.

Roundtable moderators led discussions on cost-structure comparisions, environmental portfolios, and the realistic prospects for effectively diversifying Asia's energy mix.

"We should have a new mechanism, a new platform in order to cope with the climate change because in the past, we only talked about power reliability and power security. Now we have to talk about power sustainability."

Luluk Sumiarso, Chair, Indonesian Institute for Clean Energy

"There is no reasonable scenario in which coal use won't increase significantly in Asia."

Mikkal Herberg, Research Director, Energy Security Program, NBR

PAIRING TECHNOLOGY WITH POLICY TO TRANSFORM COAL

Coal is abundant, cheap, readily available, and central to the energy portfolio of the region. It is expected to remain Asia's baseload fuel for decades to come and is fundamental to achieving energy security, meeting increasing energy demand, and fueling Asia's power-hungry economies.

However, compared to other fossil fuels such as natural gas and oil, coal creates a higher percentage of CO2 emissions and contributes significantly to regional and local pollution, undermining the public health and quality of life of millions of people. Globally, Asia is the primary coal market. Over the last decade, Asia accounted for the entire net global increase in coal consumption.

Transforming coal into a cleaner-burning, more efficient baseload fuel is an especially salient issue looking to the future. Investments made in coal-fired power plants today will lock in the patterns of energy use—and emissions—for the lifespan of those facilities that could be 50 years or more. Aspirations for cleaner and more efficient coal use have largely rested on a portfolio of new technologies and innovations.

TABLE 1

The Energy Mix of the Asia-Pacific Region (Mtoe)

Consumption	Asia-Pacific	World	Share of Asia-Pacific
Oil	1267.8	4028.1	31.47%
Natural gas	510.8	2858.1	17.87%
Coal	2384.7	3555.8	67.07%
Nuclear	131.6	626.2	21.02%
Hydroelectricity	246.4	775.6	31.77%
Renewables	32.6	158.6	20.55%
Total	**4573.8**	**12002.4**	**38.11%**
Share of fossil fuels	91.02%	87.00%	N/A
Share of non-fossil fuels	8.98%	13.00%	N/A

Source: This table was created by Hooman Peimani based on data from *BP Statistical Review of World Energy 2011* (London: BP pic, 2011), 41.

Note: For further discussion of this figure see Hooman Peimani. "Prospects for Nuclear Energy in Asia." The National Bureau of Asian Research. PES Working Paper. March 2012.

Efficiency in coal combustion can be gained through high-efficiency turbine technology and co-generation power stations that simultaneously generate electricity and then reuse waste heat. The newest technology, ultra-supercritical, which is used in Japan, South Korea, and many parts of the U.S., takes efficiency rates as high as 52%–56%, said **Nguyen Xuan Thang,** Country Executive, GE Energy, Vietnam. "This is competitive with the efficiency rates of gas-powered plants, and we've reduced the CO2 emissions about 20%. So, that is very significant improvement in terms of environmental impact."

Tran Xuan Hoa, Chairman, Vietnam National Coal and Mineral Industries Holding Corporation (Vinacomin), outlined new developments in Vietnam, such as Vinacomin's joint ventures with partners from Australia and Japan to pilot coal gasification projects in the Red River Delta region. Yet the greatest obstacle in the effort to implement urgently needed environmentally friendly technologies on a broader scale is the higher price when compared to traditional sources of energy.

"In the absence of strong climate regulation, the cost of cleaner coal is difficult for power companies to justify," said **Mark Thurber,** Associate Director of Research, Program on Energy and Sustainable Development, Stanford University. "There's no business model at the moment that makes [carbon capture storage (CCS)] work for power applications." Citing successful CCS projects involving natural gas separation in Norway that were economically attractive because of the country's robust carbon tax on offshore oil and gas activities, Thurber said, "It's not a technology problem; it's whether the society is willing to absorb the cost and whether there's an institutional ability to enforce limits on carbon emissions."

China, Thurber continued, has staggering energy demand growth, yet has emerged as an encouraging example for pollution control efforts in a few areas, notably for the case of sulfur dioxide (SO2). Progress on limiting SO2 emissions in China has been achieved through policies that require the installation of continuous emissions monitoring systems in power plants and a power tariff structure that rewards the operation of scrubbers.

"We need to develop a network in our region, collectively fund new technology development, and build the needed policy framework. This is going to be critical to promote clean-coal development,"

"I am a believer in nuclear technology; I believe it is a gift. The problem at Fukushima was not a technological problem; the problem was human error. The real question is humans. Are we truly capable to deal with this technology?"

Tatsuo Masuda, Professor, Nagoya University of Commerce and Business Graduate School; Advisor, Japan Petroleum Exploration Company

said **Pham Hoang Luong,** Vice Chancellor, Hanoi University of Science and Technology. Efforts to optimize coal usage are fragmented, and the barriers are largely institutional, he added, but cleaner coal use could be achieved through joint regional efforts.

ASIA'S NUCLEAR OUTLOOK: LEARNING THE RIGHT LESSONS FROM FUKUSHIMA

Nuclear energy has been a core tenet of the low-carbon electricity generation scale-up needed to meet Asia's meteoric rise in power demand. It provides reliable domestic energy supply without damaging the environment with corresponding C02 emissions. Nuclear power has provided a substantial degree of energy security for economies, such as Japan and South Korea, that do not have indigenous fossil fuel resources.

"No country wants an energy mix dominated by one or a small number of fuels," said **Hooman Peimani,** Head of the Energy Security Division, Energy Studies Institute, National University of Singapore. The Arab Spring and uncertainty in the Middle East have put a renewed premium on access and affordability for countries importing oil and gas from that region. "Once a country is dependent on imports from a major supplying region, its economy is vulnerable to the political and social instabilities of that region," said Peimani.

The tragic earthquake and tsunami disaster of March 2011 in Japan, leading to the core meltdown at the Fukushima Daiichi nuclear power plant, reopened the debate over the safe and reliable use of nuclear energy. Until last year, Japan's nuclear program, which generated more than 30% of the nation's energy in 2010, was set to grow to 50% of the energy mix by 2030. After the March 2011 disaster, Japan instead began taking nuclear reactors offline for maintenance and safety checks. By May 2012, none of the country's 54 reactors were operational, and authorities remain uncertain when the reactors will be reactivated. Kansai Electric Power Company, the Japanese utility most reliant on nuclear energy, stated it will face a 20% power shortage by July 2012 unless reactors resume functioning.

Left to right: **Xu Qinhua and Xu Ying (Renmin University)**

Peimani warned against "learning the wrong lessons" from the Fukushima disaster and reasserted that countries across Asia, including Vietnam, are taking their established nuclear development plans forward.

"We are now focusing on investment for the first two nuclear projects in Vietnam," explained **Phan Minh Tuan,** Director-General, Nuclear Power and Renewable Energy Project Pre-Investment Board, Vietnam Electricity (EVN). Vietnam's inaugural nuclear power plants, currently in the "site evaluation and feasibility study" stage of construction, are funded by Japan and Russia and are slated to have 1,000 MW online by 2020. Tuan added, "We want nuclear to provide 20%–25% of domestic electricity consumption."

Summit delegates largely agreed that "safe nuclear power" is not an oxymoron, and that it has a key role to play in providing carbon-free and reliable energy supplies. Nuclear power offers significant energy security prospects. Public perception, development of and adherence to rigorous safety standards, fear of weapons proliferation, and the need for viable waste disposal will, nonetheless, shape the future of nuclear development.

REALIZING THE FULL POTENTIAL OF NATURAL GAS

The "Golden Age" of gas could be crucial to reaching energy security in Asia. For example, new technology developed to access gas in tight shale formations has repositioned the United States to potentially become a major LNG exporter to Asia. Among the fossil fuel supply options, "the scale of U.S. shale gas supply expansion is truly staggering," said **Mikkal Herberg**. He described the increase of supply coming from the United States, largely through unconventional gas resources, which has increased on average by 48% per year since 2006.

"This is perhaps one of the two or three largest step-function shifts in industry expectations and outlook in the last three decades," said Herberg.

With its growing role in power generation, gas has the potential to help Asia meet its staggering energy demands while helping to mitigate climate change. Compared to a global average of 24%, natural gas currently comprises 11% of Asia's energy mix. As an alternative to oil and coal, natural gas is, on average, 40%–45% less carbon-intensive and partners well with intermittent renewable energy sources. Nonetheless, a number of challenges must be faced before natural gas becomes more widely used as a baseload fuel in Asia.

Herberg noted that further development of Asia's natural gas resources, especially LNG, is hindered by geography and the need for long-term planning and expensive infrastructure. Combined, these factors contribute to a higher comparative cost of natural gas to coal, compounded by a regional market that remains linked to oil prices.

Kwon-Hong Ryu, Professor of Law, Wonkwang University and Advisor, Energy Law Community, Seoul Bar Association, highlighted the case of South Korea, a nation that imports nearly 100% of

its fossil fuel supplies, with nearly 90% of oil supplies hailing from the Middle East. South Korea is implementing a Green Growth policy and considers the environmental benefits of natural gas central to that effort. However, South Korea must overcome geopolitical constraints before plans to expand regional supplies of gas are implemented.

"The Russian gas pipeline would have to pass through North Korea, and that presents security and political risks," said Ryu. "Physically, South Korea is a peninsula, but due to geopolitics, it is really an island, and this presents a no-win scenario for the South Korean policymaker."

Compared to South Korea, China's natural gas policy differs widely. "The government doesn't encourage natural gas as a baseload fuel, and for power generation it is only used for peaking power," said **Chi Zhang,** Head of Asian Economics, BP. "Priority goes to industrial use, as gas gives higher output values."

Before China can fully benefit from abundant gas resources for increased energy security, it must change gas policy and regulate power tariffs. Furthermore, pipelines are owned by state oil and gas companies and, despite increasing demand for free access and competition, China has yet to optimize its network system. Yet due to rising demand and a policy of energy diversification, China is positioned to be the third largest importer of both LNG and pipeline gas by 2017 and is actively exploring the potential to develop unconventional gas resources.

Gas is an abundant resource, and more gas supplies are coming online. As discussed at the 2011 Pacific Energy Summit in Jakarta, commitment to developing both conventional and unconventional gas requires long-term vision. The International Energy Agency recently published a set of "Golden Rules" for regulation and oversight to help usher in the "Golden Age" of gas, thereby providing a key to unlock gas's potential to meet rising energy demand in Asia.

OPTIMIZING THE CURRENT: HYDROPOWERING ASIA'S ECONOMIC GROWTH

Asia has long harnessed the abundant and inexpensive energy that comes from its powerful river systems: hydropower. Myanmar has the highest capacity at 108,000 MW, followed by Laos with 25,000 MW, Malaysia with 24,000 MW, and Cambodia with 10,000 MW. Hydropower remains an important source of energy in the region, has the potential to meet growing energy demand, and is perceived to be a cleaner energy source than more traditional forms. However, several challenges need to be addressed in order for capacity to grow: management and design; environmental impacts; and investment in infrastructure needed to expand access and capacity.

"There are areas that need more attention when planning and implementing hydropower projects to minimize environmental and social impacts," said **Franz Gerner,** Energy Sector Coordinator, World Bank, Vietnam. "Very often there is a disconnect between what has been planned, and what is happening on the ground during project implementation," he explained. To resolve these issues, Gerner recommended stronger in-country, capacity-building programs to successfully implement plans according to international standards.

Like many plans to expand electricity capacity to rural areas, infrastructure and investment are key. Hydropower project development requires governments and funding institutions to recalibrate their approach, said **Anthony Jude.** "It is not about putting up a hydroelectric project today and walking out tomorrow. ADB ensures that project impacts are adequately addressed and measures are in place to monitor both environmental and social impacts [livelihood impacts] and stays engaged to monitor the downstream impacts."

To address the issues of management in the planning and monitoring stages of a hydropower project, civil society can play an important part. "We need greater mobilization of civil society in the planning stages of a hydro project," said **Pham Quang Tu,** Deputy Director, Consultancy on Development Institute, Vietnam. Vietnam conducts impact assessments and develops a mitigation plan for hydropower project development, but Tu suggested that the approach needs to be more vigorous.

While hydropower is a cleaner alternative to coal for fueling electricity, the social, economic, and environmental impacts of dams still raise concerns. International standards, low-impact dams, and environmental mitigation plans come at a high cost for a developing country like Laos, stated Vice Minister **Viraphonh Viravong,** Ministry of Energy and Mines, Laos. "It's expensive to be poor," he explained, noting that Laos is doing its best to conform to all international standards, but, being a poor country, it may not be able to afford full compliance in every area.

Laos' hydroelectric projects are largely responsible for powering 73% of the nation's households, an increase from an estimated 15% household electrification rate in 1995. By 2020, Laos will generate 12,500 MW of hydropower, 80%–85% of which will be exported, mostly to Thailand, Vietnam, and Cambodia.

RENEWABLE ENERGY RESOURCES: A PIVOT TOWARD ENERGY SECURITY AND ECONOMIC OPPORTUNITY

Renewable energy sources are maturing against a backdrop of increasingly volatile fossil fuel markets, the uncertain future of nuclear power in Japan and Germany, and the growing desire for reliable domestic energy supplies. Thus, the renewable energy sector has a growing role to play in energy security as well as in realizing a tremendous economic opportunity in the world's largest markets.

Nearly two decades of steady growth in renewable energy sources, particularly in solar and wind power, contributed to a tipping point in the 2010 global energy mix. "Globally, we added more renewable capacity in terms of gigawatts than we did fossil fuel capacity," said **Letha Tawney,** Senior Associate, Climate and Energy Program, World Resources Institute.

Increasingly compelling and cost-competitive, renewable energy sources such as wind and solar are gaining momentum on the energy—and economic—agenda. Wind power has moved to the fore and in 2011 produced 20% more than in the previous year. Meanwhile, global solar power generation grew 73% in 2010, largely due to the drop in cost, which has elevated its ability to compete on a price basis.

Technological developments and economies of scale are pushing prices down, prompting Asia's policymakers to grow the share of renewables in their domestic energy portfolios. South Korea, for example, currently uses just 2.5% renewable energy, but has pledged to boost the figure to 6% by 2020. This policy is complemented by a $35.4 billion government investment over the next five years to develop commercial wind turbine manufacturing.

"One thing that governments can do, and are doing, is to serve as the model—to be the producer and to be the first procurer," said **Phyllis Yoshida,** Deputy Assistant Secretary, Asia, Europe, and the Americas, U.S. Department of Energy. She identified the U.S. Department of Defense, the world's largest consumer of energy, as an example. "The Navy has purchased enough renewables to power 250,000 houses a year and has pledged to get half its energy from alternative sources by 2020."

Manoj Vohra, Director, Asia-Pacific Custom Research, Economist Intelligence Unit, stated that scale and price remain the key determinants for renewable energy resource development in domestic power markets. Subsidies, he continued, have a defining role and have to be carefully considered. "Subsidies should not crowd out private or public investment into meaningful R&D," he said, adding that the ideal policy environment is "a broader ecosystem that delivers breakthrough innovation."

Subsidies sparked lively debate, and Summit delegates expressed diverse perspectives regarding government investment in renewable energy resource production and feed-in tariffs, as well as how to best integrate renewable power supplies into the grid. Participants largely agreed on two points. First, renewable energy resources have the potential to meet carbon reduction goals when other low carbon technologies, such as CCS, have fallen short. Second, the current constraints or limitations of renewables, such as intermittency and storage capacity limitation, provide the broader opportunity for innovation, robust domestic industry development, and with it, job creation.

Left to right: **Letha Tawney (World Resources Institute), Manoj Vohra (Economist Intelligence Unit), Phyllis Yoshida (Department of Energy, United States)**

Left to right: **Dennis Blair (Board of Directors, NBR), Amnuay Thongsathitya (Ministry of Energy, Thailand), Srinivasan Padmanban (USAID)**

FINDING COMMON GROUND

REGIONAL POWER TRADE AND COOPERATION

Hydroelectric power offers more than an abundance of cleaner kilowatts and economic benefits. It is also a blueprint for collaborative regional energy systems. "Ongoing economic growth will continue to exacerbate energy supply shortfalls against growing demand," remarked **Srinivasan Padmanaban,** Program Director, South Asia Regional Initiative on Energy, USAID. "Therefore, the most viable long-term solution for energy security in the region is energy integration through cross-border trade."

The effort to forge regional cooperation requires a keen understanding of the fault lines that exist among neighboring countries. The Summit explored prospects for strengthening the regional energy network in Southeast Asia, an area where there is tremendous room for new opportunities, promising initiatives, and shared benefits.

Focusing on South Asia, Padmanaban noted that the region has exceptional potential but perhaps the lowest level of energy integration in the world. Across the region, with the exception of Bhutan, countries are grappling with crippling energy shortages, a result of inadequate capacity that ranges on average from 25% to 30%. Yet Bhutan, Nepal, Sri Lanka, India, and Bangladesh, he remarked, represent a solidified market. "The core for cross-border trade exists, the markets are fairly sophisticated, the demands are quite high, and there is a rationale for trading to take place there."

The benefits of cross-border trade are readily apparent. When India invested in hydropower plants in Bhutan, Bhutan's GNP grew 25% and government revenues increased by 40%. In Southeast Asia, ASEAN and the Greater Mekong Subregion (GMS) provide a platform for regional cooperation, and Thailand is developing regional power-trade operating agreements with its neighbors, explained

Amnuay Thongsathitya, Chief Inspector-General, Ministry of Energy, Thailand. He acknowledged that regional cooperation among nations and their neighbors is an endeavor of inherent complexity and risks. "Greater harmonization of standards between countries is the hurdle to greater cooperation among countries," he said.

To realize broader multi-state networks, political sensitivities will have to yield to investors' need for confidence that there will be stability in the region.

"The economic and environmental benefits of integration are well known," remarked Padmanaban. Summit delegates largely concurred that while there is a legacy of mistrust and suspicion among states, particularly in South Asia, the benefits of energy connectivity are so significant that they may weaken political resistance. As energy demand continues to escalate, compromises may come more readily.


Anthony Jude
(Asian Development Bank)

Mikkal Herberg (NBR)

STRENGTHENING THE LINKS BETWEEN ENERGY AND ENVIRONMENTAL SECURITY

Decisions made in the next five years on the development of energy and power generation markets will have a dramatic impact on decades to come. Policymakers seeking to implement long-term policies, market reforms, and secure institutional and technological investments must also tackle short-term operational, financial, and crisis management concerns.

From the supply side, policymakers' energy mix choices will determine the types of energy infrastructure that will be built and used for many years. Innovation is a key factor in future fuel use, from expanding cleaner sources of energy to making existing energy sources more efficient.

"We have much work to do on system integration, incorporating regulators and grid operators. We need to really tackle the costs and the organizational and market innovations that are going to put these resources to use effectively," said Letha Tawney, in reference to the successful deployment of renewable energy sources.

Summit delegates concluded that there is much work to be to be done across the entire sector, connecting realistic, market-based policy, adequate investment and infrastructure, and technology and innovation.

However, the critical link and the region's most important asset is the sustained commitment of forward-looking leaders and policymakers, said Dennis Blair. "When the situation gets complicated, when there are a lot of factors, it really boils down to the decision-makers: their skills; the depth of their experience; their ability to communicate and trust one another; and their willingness to chart a way forward."

AGENDA OVERVIEW

INNOVATIVE GENERATION: POWERING A PROSPEROUS ASIA

Hanoi, Vietnam | March 20–22, 2012

The Asia-Pacific is the most economically dynamic region in the world, boasting astonishing growth figures of nearly 7% in 2011. To keep pace, the power sector must shift into high gear. Adequate electricity supplies are fundamental for every sector and to ensure Asia's growing prosperity. Though vital to improving living standards and furthering development goals, power generation is also the source of 42% of global energy-related carbon emissions. Preserving a livable and secure environment, while meeting economic and social goals, requires commitment, leadership, and the confidence to explore innovative and collaborative solutions. The steps taken at the Pacific Energy Summit will have a lasting impact on the economy, environment, and energy markets for decades to come.

DINNER DISCUSSION

What Is at Stake?
Finding the Path to Economic and Environmental Security

Welcome:	DANG Dinh Quy *Diplomatic Academy of Vietnam*
	Dennis C. BLAIR *Board of Directors, The National Bureau of Asian Research*
Keynote:	HOANG Quoc Vuong *Ministry of Industry and Trade, Vietnam*
Moderator*:*	Tatsuo MASUDA *Nagoya University of Commerce and Business, Japan* *Japan Petroleum Exploration Company*
Discussant:	Robert D. HORMATS *Department of State, United States*

Left to right: **Abdul Rahim Hashim (Malaysian Gas Association; International Gas Union), Emma Cochrane (ExxonMobil Gas and Power Marketing Company)**

SESSION ONE

Welcome: DANG Dinh Quy
Diplomatic Academy of Vietnam

Dennis C. BLAIR
Board of Directors, The National Bureau of Asian Research

Fueling Asia's Future with Energy Partnerships

Remarks: Melody MEYER
Chevron Asia Pacific Exploration and Production

The Energy Mix: Mapping the Next Generation of Power Supplies

Moderator: Mikkal HERBERG
The National Bureau of Asian Research

Panelists: Ken KOYAMA
The Institute of Energy Economics, Japan (IEEJ)

NGUYEN Thi Hong Lien
Vietnam Electricity (EVN)

SESSION TWO

Designing Efficient and Flexible Domestic Power Markets

Moderator: Charles EBINGER
Brookings Institution

Panelists: Emma COCHRANE
ExxonMobil Gas and Power Marketing

Donald HERTZMARK
DMP Resources

Mark HUTCHINSON
IHS Cambridge Energy Research Associates (CERA)

Kwang-In KIM
Korea Power Exchange

LUNCH PROGRAM

Efficiency and Integration: The Advantages of Regional Cooperation

Moderator: Dennis C. BLAIR
Board of Directors, The National Bureau of Asian Research

Panelists: Srinivasan PADMANABAN
United States Agency for International Development, India

Amnuay THONGSATHITYA
Ministry of Energy, Thailand

ROUNDTABLE WORKSHOPS

Roundtable 1

Energizing Vietnam's Growth: Clearing the Path Ahead

Moderator: Anthony JUDE
Asian Development Bank

Panelists: NGUYEN Anh Tuan
Institute of Energy

NGUYEN Van Vy
Office of the Prime Minister, Vietnam

Hank TOMLINSON
Chevron Vietnam

Roundtable 2

Nuclear Power in Asia: Post-Fukushima

Moderator: Charles EBINGER
Brookings Institution

Panelists: Hooman PEIMANI
Energy Studies Institute

PHAN Minh Tuan
Vietnam Electricity (EVN)

SESSION THREE

Electricity for All: Expanding Access to Boost Economic Development

Moderator: Pil-Bae SONG
Asian Development Bank

Introducers: Jose Rene D. ALMENDRAS
Department of Energy, Philippines

HOANG Quoc Vuong
Ministry of Industry and Trade, Vietnam

Panelists: Edith BUENO
National Electrification Administration, Philippines

Daniel WADDLE
National Rural Electrification Cooperative Association International

Fuqiang YANG
Natural Resources Defense Council (NRDC)

MORNING COFFEE PROGRAM

Renewable Energy Sources: The Tipping Point

Moderator: Letha TAWNEY
World Resources Institute

Panelists: Young Chang KIM
Ajou University; International Atomic Energy Agency

Oliver MASSMANN
Duane Morris Vietnam LLC

Manoj VOHRA
Economist Intelligence Unit

Phyllis YOSHIDA
Department of Energy, United States

SESSION FOUR

Starting Up, Scaling Up: Financing Infrastructure

Moderator: Fung Lin LEUNG
Fulbright & Jaworski LLP

Panelists: Hideo NAITO
Japan Bank for International Cooperation (JBIC)

Agung WICAKSONO
President's Delivery Unit for Development Monitoring and Oversight, Indonesia

ROUNDTABLE WORKSHOPS

Roundtable 3

Testing the Waters: Assessing the Impact of Hydroelectric Projects

Moderator: Anthony JUDE
Asian Development Bank

Panelists: Franz GERNER
World Bank

Victor JONA
Ministry of Industry, Mines and Energy, Cambodia

PHAM Quang Tu
Consultancy on Development

Viraphonh VIRAVONG
Ministry of Energy and Mines, Laos

Roundtable 4

Unlocking the Potential of Natural Gas in Power Generation

Moderator: Mikkal HERBERG
The National Bureau of Asian Research

Panelists: Kwon-Hong RYU
Wonkwang University School of Law

Chi ZHANG
British Petroleum

Roundtable 5

Can Technology Transform Coal?

Moderator: PHAM Hoang Luong
Hanoi University of Science and Technology

Introducer: TRAN Xuan Hoa
Vietnam National Coal and Mineral Industries Group (Vinacomin)

Panelists: NGUYEN Xuan Thang
GE Energy

Mark THURBER
Stanford University

LUNCH PROGRAM

Defining New Prospects: A View from Vietnamese Industry

Moderator: VU Tu Thanh
US-ASEAN Business Council

Speaker: PHAM Thi Thu Hang
Vietnam Chamber of Commerce and Industry (VCCI)

Respondent: HOANG Tien Dung
Institute of Energy

SESSION FIVE

Utilizing Innovation: Realizing the Potential of New Technology

Moderator: Peter HUGHES
Ricardo Strategic Consulting

Panelists: Philip JONES
Washington Utilities and Transportation Commission
National Association of Regulatory Utility Commissioners, United States

Young Chang KIM
Ajou University; International Atomic Energy Agency

Ambuj SAGAR
Indian Institute of Technology, Delhi

Roundtable Reports

Powering a Growing Asia: Policy Options

Drawing on the diversity of backgrounds and expertise, participants joined Summit leaders in an exchange of main discussion threads, lessons learned, new insights, and perspectives. Far from the end of the conversation, this was an opportunity for ongoing collaboration and to crystallize partnerships and cooperation toward a shared vision of the reliable, affordable, and environmentally friendly power generation required to sustain the Asia-Pacific's economic growth.

Moderator: Dennis C. BLAIR
Board of Directors, The National Bureau of Asian Research

Closing Remarks: DANG Dinh Quy
Diplomatic Academy of Vietnam

Left to right: **Philip Jones (Washington State Utilities and Transportation Commission; NARUC), Viraphonh Viravong (Ministry of Energy and Mines, Laos), Nguyen Thi Hong Lien (Vietnam Electricity), Ken Koyama (The Institute of Energy Economics, Japan), Mikkal Herberg (NBR)**

POLICY PAPERS

To inform discussions at the 2012 Pacific Energy Summit on power generation, NBR commissioned seven policy papers on the challenges and opportunities confronting the region's power and energy sectors.

Powering Asia's Growth: Meeting Rising Electricity Needs
Mikkal Herberg
The National Bureau of Asian Research
University of California–San Diego

Electricity at the Right Price
Donald Hertzmark
DMP Resources

First Principles: Technology as an Enabler for Productive Power Markets
Peter Hughes, Scott Hare, Maite Pina
Ricardo Strategic Consulting

A Case Study on Power Sector Restructuring in Vietnam
Nguyen Anh Tuan
Institute of Energy, Vietnam

Prospects for Nuclear Energy in Asia
Hooman Peimani
Energy Studies Institute

Taking Renewable Energy to Scale in Asia
Letha Tawney
World Resources Institute

Principles of Successful Expansion of Rural Electrification Programs
Daniel Waddle
NRECA International

These papers are available at www.nbr.org.

PARTICIPANTS

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ANDITYA, Chrisnawan – Ministry of Energy and Mineral Resources, Indonesia

ANDREOZZI, Marco – Pegaso Canton Ltd., China

ANGELL, Ian – Talisman Energy, Malaysia

AU, Tuan Minh – Asian Development Bank, Vietnam

BERKOBEN, Russell – ExxonMobil Exploration and Production, Vietnam

BICKEL, Dustin – Embassy of the United States, Laos

BLAIR, Dennis – The National Bureau of Asian Research Board of Directors, United States

BLAND, Ben – Financial Times, Indonesia

BOUNSOU, Xayphone – Ministry of Energy and Mines, Laos

BREBER, Pierre – Chevron, United States

BUENO, Edith – National Electrification Administration, Philippines

BURKE, Fred – Baker & McKenzie, Vietnam

CHATSIS, Deborah – Embassy of Canada, Vietnam

CHU, Minh Thao – Diplomatic Academy of Vietnam, Vietnam

CHUA, Thai Keong – Shell Eastern Petroleum Ltd., Singapore

CHUNG, Sean – ExxonMobil, Vietnam

COCHRANE, Emma – ExxonMobil Gas & Power Marketing Company, United States

COCKETT, Richard – The Economist, Vietnam

COLLINS, Jimmie – Department of Energy, United States

COOPER, Giles – Duane Morris Vietnam LLC, Vietnam

DAITO, Michio – Embassy of Japan, Vietnam

DANG, Dinh Quy – Diplomatic Academy of Vietnam, Vietnam

DAO, Minh Hien – Electricity Regulatory Authority of Vietnam (ERAV), Vietnam

DAO, Trong Tu – Centre for Sustainable Water Resources Development and Adaptation to Climate Change, Vietnam

DINH, Tien Hoa – Vietnam National Coal and Mineral Industries Holding Corporation, Ltd. (Vinacomin), Vietnam

DO, Dinh Khang – Vietnam Academy of Science and Technology (VAST); Company for Improvement of Technology (IMTECH), Vietnam

DO, Tuan Manh – Sectoral Economic Department, Government Office of Vietnam, Vietnam

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