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Summary and Conclusions

Opening Remarks by Dr. Lee-Jay Cho

Beginning in 1997, the Northeast Asia Economic Forum (NEAEF) began a discussion of energy issues as a major part of functional cooperation in the Northeast Asian region at its annual conferences.

Twelve years ago, in the year 2000, Dr. Taro Nakayama, former Foreign Minister of Japan, Member of Parliament, and Chairman of the Commission for the Promotion of the Asias Energy Community (APAEC), and I initiated this series of expert group meetings in Honolulu. The first meeting focused on natural gas in Asia. This meeting was the second in a series of working group meetings on energy co-organized by the NEAEF and CPAEC with support from Ministry of Foreign Affairs of Japan, in cooperation with the Japan Bank for International Cooperation (JBIC), the Japan National Oil Corporation (JNOC), the Korea Gas Corporation (KOGAS), Japan's Ministry of International Trade and Industry (MITI), the Russian Academy of Sciences (Far Eastern Branch), and the U.S. Geological Survey.

The main objective of the meeting was to explore key energy issues that will confront Northeast Asia in the 21st century and to discuss the critical role of natural gas from both a regional perspective and the perspective of individual countries, by examining four major themes: 1) the role of natural gas, including the obstacles to and means of promoting its use; 2) natural gas and regional and global environmental concerns and imperatives; 3) the electric power industry and

clean-power generation; and 4) energy security and regional cooperation. The subsequent meetings have been extremely valuable and served as a catalyst for work among the experts of the Northeast Asian region.

This year (2012) we will be discussing 1) green energy policies, 2) post-Fukushima energy outlooks, and 3) challenges and solutions for a low carbon future.

We are truly grateful to Dr. Nakayama Taro for his vision and support through Ministry of Foreign Affairs and other institutions for having been able to continue this series of meetings. We want to extend appreciation to the Korea Energy Economics Institute (KEEI) for lendings its support toward this meeting series, particularly through the continuous efforts of Dr. Kyung-Hwan Toh who is with us here for this meeting. This is a difficult time economically, and with the spirit of common sacrifice, everyone is trying to provide support toward this meeting series, including Japan's Agency for Natural Resources and Energy, Hitachi, the Blue Planet Foundation founded by Henk Rogers, and the Hawaiian Electric Company.

Session 1: Green Energy Policies - Country Situation, chaired by Denise Konan, *Dean of the College of Social Sciences, University of Hawaii at Manoa*

Hori Shiro
Senior Policy Adviser for International Affairs, Agency for Natural Resources and Energy, Japan

The great earthquake in 2011 exposed the vulnerability of Japan's energy system. Therefore, Japan is rethinking its basic plan. We need a sustainable policy that emphasizes demand-side control and utilizes diverse resources. Nuclear power is not enough. Our objectives are to establish the highest safety standards and to reduce dependency on nuclear power in the mid- to long-term.

The biggest challenges are ensuring safety and a stable electricity supply.

For ensuring safety as of December 2011, a cold shutdown was successfully achieved at the Fukushima Daiichi nuclear plant, but will try to put the reactor on a different control system in the future. For other nuclear plants, the minister decided to include new regulations requiring a stress test to be able to resume operations.

The two pillars of the Energy Conservation Act of 1979 are to reduce energy in the industry sector, and increase efficiency of home appliances. Energy conservation is important because the areas of homes are increasing and therefore so is energy consumption.

For promoting renewable energy generation, RPS was introduced in 2003. In January 2012, the feed-in tariff for renewables was started. Grid stabilization and securing land is also important.

Three types of smart grids are for housewide, communitywide and nationwide application. Cooperation between utilities and regions is the key. Hawaii and Okinawa collaboration is important to test the new smart grid technology.

What are we doing now? Last year, it was challenging to reduce peak demand in the summer of 2012. If all nuclear plants are not in operation, this summer will be tough as well. We are having meetings to reach a decision this year about what to do. The basic energy plan in 2007 said that 50% of Japan's energy would come from nuclear sources, but that is no longer acceptable after the Fukushima incident.

Toh Kyung-Hwan
Director-General, Ministry of Knowledge Economy, Republic of Korea
Energy and Industry Policy for Green Growth

Green growth means to take the risks of climate change and take advantage of this case as a new green growth engine for Korea. Climate change is the world's most pressing issue. Countries have started a green race. The US announced a climate change technology program, the EU introduced its 20-20-20 plan, and Japan announced the Fukuda vision. Korea has also made an ambitious plan. First, Korea is highly vulnerable to climate change due to dependence on fossil fuels and imports. Greenhouse gas (GHG) emissions doubled in Korea from 1990 to 2007. Korea has adopted a paradigm shift for each stage of its growth plan. First it put more investment into heavy industries. Then came investment in semiconductors and autos, then information technology (IT) ventures and research and development. And now Korea has shifted to green growth.

Green growth means a virtuous cycle between growth and the quality of life, with conversion to low consumption and increased efficiency. New industries such as renewables and smart grids were created because of climate change. Korea also plans a green transformation of current industries, like autos, to be cleaner.

Korea plans to reduce energy consumption by 46% by 2030. There are 4 key points for energy efficiency. Industry is to have stronger regulation, assistance and incentives. The transportation fuel efficiency goal is 17 km/liter by 2015, better building regulation, and also a strong energy-savings initiative by the government, reducing consumption by 10% annually. Korea's mid-term GHG reduction goal is a 30% cut from BAU levels by 2020. Korea's greenhouse gas reduction master plan is to consider each industry separately and to give appropriate reduction targets to each industry. The master plan also includes deployment of new technology and expansion of clean energy. Our plan is to reduce the share of fossil fuel to 62% by 2030. Korea also has a RPS starting from 2012 to reach a level of 11% of total energy from renewables by 2030. Nuclear energy plants will double by 2030, will be a higher percentage of our energy mix and will have a higher capacity. There is no choice for Korea other than to depend on nuclear energy.

The world renewable energy market is growing rapidly and, according to the International Energy Agency (IEA), renewable energy is expected to account for 16% of the world's primary energy in 2035.

Current status: In the past 5 years, Korea's renewable industry has dramatically expanded: more companies, more employees, more sales, and more exports. Our target is to invest $36 billion in renewables over the next 5 years. Korea is aiming to be in the top 5 countries in renewables by 2015. There are four sectors in industry policy:

1. Strategic R&D: invest in core technology, support different parts, establish a test bed.
2. New domestic market: implement RPS, introduce RFS in 2013.
3. Facilitate export industrialization: offshore wind, push overseas projects, nurture 50 global star corporations exporting over 100 million by 2015.
4. Strengthen growth ground for corporations.

Plans for smart grids include:

1. National smart grid roadmap, enacting law ro provide a legal basis to set up a smart grid.
2. Smart grid test bed in Jeju Island since it is independent, with $2.3 billion dollars, and nearly 168 companies joining.
3. Seeking overseas markets, e.g., in 2012 cooperation system with the state of Illinois to try to enter the US market.

Jeju Island has a mini-city with schools and homes to test the smart-grid technology. Maybe also collaboration with Hawaii in the future.

Jeffrey Mikulina
Executive Director, Blue Planet Foundation

The Blue Planet Foundation is an NPO focused solely on clean energy, doing everything to get Hawaii off oil. Eventually, we want to expand the plan to the whole world. Blue Planet was founded in Hawaii because it is the best place in the world for renewable resources. The islands' proud history of innovation is also another reason Hawaii is the perfect place, like using boats to get here, and how to survive here on the islands. Hawaii also used to be the center for whaling in the 1850s and 1860s. King Kalakaua had the first telephone, Charlie Matson had the first cold storage ship and the first electric light aboard a ship. Iolani palace was the first royal building to have electricity. Hilo boarding school had a half-ton ice maker. Finally, the first vehicle in Hawaii was electric.

As early as 1977, the state discussed weaning off of fossil fuel. However, Hawaii is still addicted to oil today. Hawaii consumes 50 million barrels annually of imported oil. That is the equivalent of 1 supertanker per week in Hawaii. Most of this fuel used to come from the US, but now the vast majority comes from other countries. This costs Hawaii $15 million daily. Since 2007, the imported oil has stayed steady. Overall trend is the energy use is dropping. The residential sector spends $1 billion on electricity per year. There is a lot of PV on roofs and lots of wind capacity. Annual oil consumption is going down due to clean energy sources and less use.

RPS, increasing requirement on the utility, comes from independent third-party power producers. The RPS requires 40% of energy to come from renewables by 2030, and failing to meet this will cause fines. The barrel tax is 1.05 for oil used for electricity and ground transport. The majority goes to the general fund, some of it to clean energy, some for agricultural security. Also tax credits are particularly helpful to distribute solar (35% state and 30% federal), but the state legislature is talking of getting rid of this. Net energy metering, and a feed-in tariff of 80 MW total out of 1,600, helps people finance clean energy. On the supply side, the portfolio side for efficiency is difficult, but still with a 30% requirement by 2030 to reduce 4,300 GWh from the estimate. But the state is deciding who the responsibility falls on. Public funds benefit: 1.5% revenue requirement, $33 million annually for energy efficiency, such as rebates, audits, and educational efforts. There is a solar water-heat mandate for most new homes: 85–90% of new

homes being built now. Without RPS, the trend would be an increase in energy use, but it reduces the wedge a lot with efficiency and renewables. We are on track, but there is a long way to go with renewables. Looking at the challenges: How to integrate large amounts of variable renewables on a very small grid? Some islands have only 5–6 MW of installed capacity, and islands are not connected. Large centralized energy production system: not a lot of information on the demand side. But if adding the variable energy sources, it will be increasingly challenging. An analogy can be made, comparing communications technology: old TV, versus today's internet and iPads. One way to two-way forms of communication. Demand-side response, smart grid project, need to control both sides of the equation. Also, storage of resources will be essential. There has been a lot of work in Japan on storage. The price of PV has dropped dramatically. The cost of electricity continues to increase. If you get storage, it's more expensive, but as the electricity price increases, eventually it will cost the same to get PV as it does to get your electricity from fossil fuels. Storage technology is increasing very quickly. The wind farm on the North Shore of the island of Oahu has a 60-MW battery, designed for second-to-second fluctuations. Much innovation is happening in the auto industry. Transportation fuels are another big challenge: there are 1 million vehicles in Hawaii, made around the world; standards are set in Washington, DC, and Hawaii has little control. There are 800 EVs in Hawaii today, so a very small percentage of the fleet. If we could use car batteries for long-term storage for solar and wind, vehicle-to-grid solutions would be great for islands. Finally, energy efficiency will become increasingly difficult as we become more and more efficient. Blue Planet also focuses on community-wide educational efforts, related to individual actions. Blue Planet is also active in the legislature and got on-bill repayment. Blue Planet Foundation's mission is getting Hawaii off oil. We are targeting youth for education. We have community programs, like the light bulb exchange, but most of our work is with the Public Utilities Commission.

Richard Rocheleau
Director, Hawaii Natural Energy Institute
Overview of US Energy Policy

The US Department of Energy's (DOE's) first energy review summarizes a lot of information from many sources. So where are we today? Where does our energy come from and where does it go? Mostly petroleum, and mostly goes to transportation. 90% of coal is used for stationary power. Less than 4% is from renewables. One of the things that will have a great

impact in the future is the role of natural gas. It is very versatile and is cleaner than other fuels, so it could be a transition path.

High and volatile prices are a big incentive for making changes. 60% of primary energy is lost as waste heat. Sources of US petrol come from the Persian Gulf, Africa and the Middle East. 50% of US oil is imported. The DOE has 6 focus areas that deal with stationary power supply and transportation. Transportation versus stationary: transportation seems easier to tackle than stationary sources, and is very important.

Principles for Department Investment are maturity, materiality, and market potential. Specific administration goals are (1) to reduce oil imports by one-third by 2025, put 1 million EVs on the road by 2015, but infrastructure is going to be difficult; and (2) make non-residential buildings more efficient by 2020, which is going to be expensive. We want an 83% reduction in GHG by 2035. The US has plans to go from goals to technology, like lightweighting for cars, grid modernization, and cleaner power. Natural gas will be a big issue in future policy decisions. When comparing the costs of fuels over time, natural gas doesn't correlate with the price of crude oil, but almost everything else does. But it has to do with domestic resources (fracking). People are seriously looking at bringing LNG to Hawaii to temporarily substitute dirtier power sources. Looking at the DOE's budget, nuclear funding went down, and everything else went up. The budget for grid modernization didn't go up as much as one would have thought.

Questions and Answers in Session 1

The questions in this section focused on liquefied natural gas (LNG) and nuclear energy. The group agreed that there are currently no alternatives to nuclear energy, despite the events at Fukushima, and that it is probably too soon to promote the use of nuclear energy, but in the future it will be inevitable in order for Northeast Asia to have a secure supply of energy. LNG is used for taxicabs and buses in Korea, but they have a tax-incentive to do so. Also, Jeff Mikulina said there is discussion of bringing natural gas to Hawaii, but only as a last-resort, and the life-cycle of fuels still needs to be studied. Finally, former Governor Ariyoshi reminded us all that we need to find the best ideas for the best solutions, and not think about whether it will be politically acceptable. Leave it up to those in charge of policy whether something is politically acceptable.

Session 2: Post-Fukushima Energy Outlook, chaired by Toh Kyung Hwan

Iinuma Yoshiki
Director, Research Department, Japan Electric Power Information Center (JEPIC)
Electricity Outlook after Fukushima

There are so many energy issues confronting us: some are structural and institutional, whereas some are concerned even with our way of living. After the giant earthquake in Japan in 2011, many issues under the surface almost erupted. The world watched what happened to nuclear power plants when we had station blackouts with disastrous consequences. We now have only 1 of TEPCO's 17 nuclear units (17 GW) in operation. As a result, thermal power generation using fossil fuel has been increasing to compensate for the loss of nuclear. This is the case for all electric utilities in Japan because utilities cannot resume operation of nuclear power plants. Without the consent of various stakeholders, in particular the public, it is not possible to restart nuclear power plants after inspection. Every 13 months nuclear power plants are supposed to be inspected in Japan. Now the share of thermal power generation stands at more than 80 percent. If restart is not permitted, all 54 nuclear power units in Japan will be suspended two months from now.

The transmission system in Japan is divided into two systems. One is 50Hz and another is 60Hz. This system goes back to the nineteenth century, when each region imported from the US and from Europe, respectively. Ever since then, the system remains the same. In light of the fact that we faced serious shortage of power as a result of the earthquake and the tsunami, lack of sufficient interconnection capability between electric utilities is now a focal point. One solution would be to unify the frequency, but this solution is simply nost cost effective. Replacement of the generators/turbines and transformers owned by electric utilities would cost 10 trillion yen (US$125 billion), and the replacement would take about 40 years. It seems that the realistic option is to upgrade the frequency conversion stations.

A major mid-term issue is to introduce smart meters. The smart meter is a major feature of the smart grids that many countries have been competing. There will be improvement in energy efficiency if energy consumption is visualized as being coupled with electricity pricing that reflects marginal costs. Economists know the importance of marginal cost pricing.

Tanabe Yasuo
Executive Vice President, Government and External Relations Division, Hitachi
Hitachi's Smart City

Hitachi has about 10 trillion yen ($120 billion) in revenue coming from many different business segments, but lately is focusing more on energy-related issues. Hitachi addresses both the power and demand sides of the energy problems.

The "smart city" should be compact, sustainable, and ecological. We considered the issues and needs of developed countries and emerging nations for the concept of a smart city. There needs to be a balance between taking care of the environment and human quality of life. There are four important areas in a smart city: energy production, transportation, water and environment, and the community.

There is a hierarchy of actors involved with a smart grid: at the highest level is the electric system (power plants, renewables, energy storage), then the local communities, and then households, factories, and offices. Each tier has its own management system.

Real Hitachi projects include the Tianjin Eco-city Energy Management, and a similar project in Guangzhou, some smart-city sites in Rokkasho and Kashiwa-no-ha, and also managing the EV charging stations in Okinawa. Charging stations have a centrally controlled management system, and a billing system.

The Smart Grid Project on Maui is to demonstrate the validity of PV power generation and wind power. EVs are the key because they have demand, but also can contribute to storage. There are different layers to the project on Maui, consisting of Smart Energy and Smart Mobility. Eventually, we want to spread this to the rest of the world.

Terry Surles
Executive Vice President for Research and Development, Desert Research Institute, University of Nevada; Board Member, Pacific International Center for High Technology Research (PICHTR)

Right now everyone is running to natural gas, because it is much more efficient, and you get a big reduction of CO_2 emissions. But in the end, there could be some major issues with the environmental impacts of fracking, which could limit the usefulness of this resource.

There is a division between the utilities about a carbon price. Nuclear is all for it, but not the fossil fuel users. US energy policy is to not have an energy policy (at least, not a coherent one). Recent legislation suggests constantly changing political interests.

The driver to reduce coal use is going to come from environmental regulations. Many coal plants are being retired because it is too expensive to update them to comply with environmental legislation.

The commerce clause is causing problems: can't regulate commerce, related to the Low Carbon Fuel Standard in California.

Building energy codes: some states have aggressive energy efficiency, and also appliance standards in California.

Transmission planning is critical, because it can take longer to get the permitt than it does to build a plant. There is proven technology of transmission cables under water in San Francisco bay.

Questions and Answers in Session 2

Similar questions were raised about public opinion concerning nuclear energy during this session, and similar conclusions were reached as to the necessity of nuclear energy in the future. However, the question of what to do with nuclear waste is still looming. The US may eventually have underground storage at Yucca Mountain if political winds shift, and Korea would like to reprocess waste but the US does not allow it to do so. Dr. Cho pointed out that this also raises some ethical issues, when rich countries export their waste to smaller countries.

Session 3: Challenges and Solutions for a Low Carbon Future, chaired by Tanabe Yasuo

Robert Alm
Executive Vice President, Hawaiian Electric Company

Hawaii could get off carbon-based products for electricity, we have enough resources here. Oil imported here is used one-third for electricity, one-third for transportation, and one-third for jet fuel. The one-third for jet fuel will have to wait for the military to develop an alternative. The transportation third is the reason we are so interested in EVs. At least half of Hawaii's use of oil could be reduced by renewables and EVs.

There are three main challenge areas: schedule/timing, technical (grid) challenges, and financial challenges.

Schedule/timing: Renewables right now are driven by the generators, not by policy, not by the government. There is a push for geothermal on the Island of Hawaii right now. The majority of

it is on small islands. Until we can tie the island grids together with underwater cables, the geothermal generation will be limited; we cannot build large-scale geothermal. The Islands of Maui and Hawaii could become 100% renewable within 10 years because they have plenty of natural resources. The key is the Island of Oahu, which accounts for three-quarters of the state's oil use. But Oahu has no geothermal potential, and there are significant restrictions on wind-generated electricity because the island is so highly urbanized. There are hopes for more biofuels, and high hopes for wave energy and ocean-thermal energy conversion (OTEC).

Grid challenges: There is plenty of capacity to back up any kind of renewable energy. The problem is handling the intermittency of wind and solar, and on small grids. It's a frequency and voltage issue, and also a circuit issue. There are great wind resources, but no load to match it at night, but hope to eventually use that spillover for EVs. Solar has some matching to the load, but ramps very fast. Clouds move through constantly in Hawaii, so ramping can be a significant issue. The operator has to decide every day of the week about where to put the frequency for the wind farm.

On the Big Island we have put sensors to see how to predict wind and solar energy sources. Wind forecasting is more advanced, but we have to do both. Forecasting is really helping us with wind. Circuit by circuit on every island, we have to know what that gap is and we need to be prepared to fill it and with little warning.

Hawaii does not use a lot of coal, just oil. At the current cost of oil, renewables makes sense because almost every other form of energy is more expensive. The challenge is that politicians view the work required to put in renewables as an "addition" to our current build. But it's not: it's a "substitute." In fact, renewables would lower people's bills because the energy it is facilitating is actually incrementally cheaper. (By the way, coal is much cheaper than everything else, which is why it is so hard for the US Mainland to transition to renewables.) Renewables projects in Hawaii now total 1,000 MW. Everyone loves renewable energy until it comes to their neighborhood. So it remains to be seen whether Hawaii has the political will, because they do have the financial feasibility and resources.

Terry Surles
Executive Vice President for Research and Development, Desert Research Institute, University of Nevada; Board Member, Pacific International Center for High Technology Research (PICHTR)

If you're looking for one silver bullet solution you will fail; if you're looking for a portfolio of solutions you're good. Efficiency is the cheapest way to get big gains. In the US, 50% of total energy use goes into buildings, so look into more efficient lighting systems and air conditioning. Hawaii is not an economy where you can drive these changes, but if you couple it to California, which drives change, then it might work.

Renewables costs are going down, but intermittency is a problem. One of the big problems we see all over the country is that you have some mechanical engineers but when it comes to IT, they are clueless. Smart grid is all about IT. As you get into wind and solar, you still need fossil fuels to make up for variability in renewables.

The biggest issue for carbon capture is cost, storage, and who is in charge?

Fracking is advanced oil recovery. New York has lots of shale, but fracking is illegal there.

You need water to make energy but you also need energy to transport and treat water. You have to talk about energy, the environment, and economics all together, or you won't be successful.

Christa Chavez
Staff, Northeast Asia Economic Forum Energy Meeting; Intern, Union of Concerned Scientists

Summary of EU/Iceland/Japan Geothermal Energy meeting

The geothermal energy meeting was divided into three sessions: The first was on the political and historical context of geothermal energy in each individual country. In the second session, each country gave its current status and perspective on geothermal energy. Finally, in the third session, a representative from the Swiss federal office of energy gave a presentation on future policy plans as an example of what comes next for geothermal energy in the future.

The meeting showed that there is a lot of untapped potential for geothermal energy, that there is a lot of room for international cooperation, and that there is a huge lack of policy relating to geothermal, in terms of well-protection and allowance for more exploitation of the environment.

China's Green Growth and Energy Policy in the Twelfth Five Year Plan by Liu Ming

China's economic accomplishment has been achieved at an immense environmental cost. The foremost threat coming from the rapid increase of energy consumption is energy security. Therefore, a dilemma has popped up for China between economic expansion and sustainable development.

Since 2011, China started the new 12th Five Year Plan (FYP), which is addressed as the "Greenest FYP in China's History," it contains a series of social and economic objectives to be achieved by 2015, of which one-third are targets relating to natural resources and environmental issues, aiming to build sustainable development practices into Chinese industries.

The targets can only be realized if we meet the following challenges: First, Local governments must accept the targets and take action. Second, Chinese enterprises must make a long term commitment to saving energy and reducing emissions. Third, China has already implemented the quick, low-cost measures; now we need to expand our green development philosophy, strengthen our targets, establish sound legislative standards, phase out backward production capacity, increase the central government's capital investment, and encourage innovation.

Uchida Mitsuho
Former Director, Central Research Institute of Electric Power Industry; Visiting Professor, Chukyo University, Japan

Electricity Is the Key to a Sustainable and Competitive Future

Electricity is the key to the challenge of climate change. With its potential for carbon-neutrality, electricity is an ideal vector to decarbonize the global economy. Electricity and high-efficient end-use electric technologies such as electric vehicles, heat pumps and efficient industrial applications will therefore play more important roles in the functioning of modern societies, thus combating climate change, achieving greater energy efficiency, and creating economic growth and jobs.

In the twenty-first century, emerging countries' behavior is very important for our future sustainability. In particular, China's energy demand and supply condition will affect the global sustainability. China has a very large population and is expected to grow economically at the rate of 8–10 % until 2020. And China is highly dependent on fossil fuels. This has already caused a third energy shock in the beginning of the twenty-first century. And we also have to consider the effect of the Fukushima nuclear incident. From the second oil shock in 1979–80 up to the end of the twentieth century, the oil prices were relatively stable, but at the turn of the twenty-first century, the price of oil started to rise. This was caused mainly by the oil demand increase from emerging countries such as China. And today, the oil price is high again because of the Fukushima incident. If we look at China, its fossil fuel demand increased very much. Chinese energy consumption has risen, and China's GDP is now bigger than Japan's and Korea's, although not in per-capita terms. China is now the No. 1 country in CO_2 emissions, but per-capita

CO_2 emissions are still much lower than those of Japan, Korea, and the US. This fact suggests that China's CO_2 emissions will continue to increase in the long run. The IEA forecasts that world CO_2 emission will more than double by 2050, and Northeast Asia's share of CO_2 emissions will then be more than half of world emissions.

How can we reduce the emissions? Despite the Fukushima disaster, we will have to rely on nuclear energy and renewables. At the same time we need to improve energy efficiency and reduce fossil fuel dependency. Integrated wholesale markets and grid development are the best solutions for meeting the renewables target in the timeliest and most cost-efficient way. This requires top-down grid planning on a regional scale, followed by significant and prompt investments to increase cross-border capacity and trading.

Round Table Discussion

Hori Shiro outlined the two challenges for an international grid: (1) economic feasibility and (2) the function of the grid and how it will be connected. Toh Kyung Hwan talked about the gas pipeline which is going to be buried underground and will run from Russia's Sakhalin Island through North Korea and provide gas to South Korea. A memorandum of understanding has already been signed, and once the pipelines are buried, it should be relatively simple to bury transmission lines also to transfer electricity. Finally, Robert Alm and Toh Kyung Hwan talked about renewables and separating transmission from generation. Toh pointed out that the purpose of decoupling those two is to promote competition and also that renewable energy is not currently competitive in the market, so there is no need to decouple in this case. What is needed is for people to invest in and buy renewable energy.

Policy Recommendations and Conclusions

Everyone agreed on the major themes of this meeting: that the smart-grid is important, that grid modernization is important, and that grid internationalization is important as well. We reemphasized our common desire to have common infrastructure, which will lead to peace within the region. Denise Konan reminded us that there are also social issues to think about, in addition to the technological ones. Tanabe Yasuo indicated that, by sharing ideas, we can create a social infrastructure in addition to a physical one. Dr. Cho ended the meeting by saying that we are all faced with tremendous challenges, but with great challenge comes great opportunity. We hope that we can continue the dialogues held in this meeting more intensely in the future.