

***Final Report***  
***on***  
***Northeast Asia Green-Growth in***  
***2009:***

***Creating a Northeast Asian Green-Growth Community through Cooperation  
on Energy Efficiency, New Technology and Market Mechanisms***

**BY**



**For Korea Energy Economics Institute**  
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## ***Contributors***

Lee-Jay Cho, Chairman, Northeast Asia Economic Forum

John Tichotsky, Senior Fellow & Advisor, Northeast Asia Economic Forum

Weiye Xia, Member, Energy Research Team, Northeast Asia Economic Forum

Editorial Staff:

Jeremy Cho, Affiliate Fellow, Northeast Asia Economic Forum and Research Assistant,  
MIT

Seth Corpuz-Lahne, Project Coordinator, Northeast Asia Economic Forum

Yoon S. Nam, Project Coordinator, Northeast Asia Economic Forum

## ***Preface***

The Northeast Asia Economic Forum (NEAEF) is a regional nongovernmental organization created in 1991 to sponsor and facilitate research, networking, and dialogue relevant to the economic and social development of Northeast Asia. The Forum is also committed to promoting understanding and relations among the peoples of Northeast Asia, North America and Europe. It is the only nongovernmental regional organization in which all the nations of Northeast Asia and the U.S. have been consistent and active participants.

Since 1991, the NEAEF has held an annual international meeting, beginning in Changchun and Tianjin, China, bringing together government officials, business leaders and preminent experts. Our previous meetings have taken place in Vladivostok, Russia; Ulaanbaatar, Mongolia; Pyongyang, DPRK; Alaska and Hawaii in the U.S.; Tianjin, Changchun, China; and Yongpyeong, South Korea. The annual meeting has been held in Japan, Niigata City in 1995 and 2003 and Yonago in 1998, and recently in Seoul, Korea in 2004, in Shenyang, China in 2005, Khabarovsk, Russia in 2006, Toyama, Japan in 2007, Tianjin in 2008, and this year's annual meeting in Busan, Korea.

This year, the NEAEF placed its emphasis on Energy Efficiency, New Technology, and specifically focused on Green-Growth Policy as a separate project. In addition, NEAEF looked at how market mechanisms can be used to encourage regional use of energy efficiency and new technology within the context of Green Growth Policies. It has carried out this research project directly, through special sessions at workshops and meetings. These are critical themes since energy markets and the treatment of the environment are both at a critical crossroads for the Northeast Asian Region, as it is globally. NEAEF provided an opportunity for theoretical and policy discussion to tackle the Northeast Asia green-growth and associated challenges.

NEAEF activity in this area included:

1. An energy expert workshop at the Annual Conference and a working group meeting on energy which both featured sessions and themes strongly associated with green-growth, energy efficiency, and new technology,
2. A review and analysis by NEAEF staff of various policy documents and reports specifically for this research document, and,
3. An NEAEF site visit to Sandia National Laboratories, Albuquerque, New Mexico, USA.

This report summarizes work done on the three points.

## ***Introduction***

***By Lee-Jay Cho, Chairman NEAEF and John Tichotsky, Senior Fellow, NEAEF***

Northeast Asia Economic Forum's cooperative project with the Korea Energy Economics Institute (KEEI) for 2009 resulted in the preparation of this report entitled, *Northeast Asia Green-Growth in 2009: Creating a Northeast Asian Green-Growth Community through Cooperation on Energy Efficiency, New Technology and Market Mechanisms*.

This report utilized information gathered over the year at several meetings, most notably, *The Fifth Expert Working Group Meeting on Energy: Economic Crisis and Green Energy Partnership* and also *The International Expert Workshop for Northeast Asian Energy Cooperation Held during the NEAEF Annual Meeting*. In addition, this report summarizes some of the key policy papers and speeches delivered at NEAEF meetings, as well as at other forums.

The Forum's meetings related directly to green growth, energy efficiency, and new technology included:

- 1) **The Fifth Expert Group Meeting on Energy Cooperation in Northeast Asia.** This meeting was held on the 19th and 20th of March 2009 in Honolulu, Hawaii, USA to tackle two major issues that face North East Asian energy cooperation: The Economic Crisis and the opportunity for a Green Energy Partnership. The first session was entitled *Green Energy Partnerships and a New Sustainable Energy Agenda for Northeast Asia* and is particularly pertinent to this report.
- 2) **The 18<sup>th</sup> Annual Northeast Asia Economic Forum.** The forum, held on August 27-28, 2009 in Busan, Korea, included a session that entitled *Green Energy Cooperation and Partnerships in Energy Efficiency and Conservation*. In addition, there were several key addresses that related-to green growth, in particular the President of Korea's welcoming remarks.

For information about the United States, we reviewed official public documents, and also visited Sandia National Laboratories in Albuquerque, New Mexico, USA. Sandia Laboratories is one of the US national labs that focus on energy. Sandia has many projects that focus on green energy, as well as efficient technologies. The significance of the role of the national labs within the Obama administration as well as the opportunities for NEAEF will be discussed in the specific section relating to the Sandia visit.

The Northeast Asia Economic Forum is grateful for the cooperation in this research of a number of people from government, research institutes, international and non-governmental organizations. NEAEF would like especially to thank the Korea Energy Economics Institute whose generous support made the research and activities covered in this report possible. It is the support and leadership of institutes such as KEEI that allows for the analyses and various perspectives included in this report to reach a wider audience.

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Clearly, the work carried out under this NEAEF program made a considerable contribution to the year's results. We further believe that the papers and discussion in this report begin to outline the year's achievements and set an initial trajectory that will allow for significant cooperation in the area of green growth, energy efficiency and technology for Northeast Asia in the years to come.



# **PART 1: NEAEF Research Summary on Green-Growth**

## ***“Green-Growth” Policies and Recent Major Actions by Northeast Asian Countries***

### **Republic of Korea: “A National Vision”**

The Republic of Korea’s president, Lee Myung-Bak, in a major “Independence Day” speech on August 15, 2008 introduced Korea’s “green growth policy” as a major part of the platform for his administration. (See Appendix A for excerpts of pertinent sections of President Lee’s speech) In order to implement his policy vision, in August 2008, the Korean President created a Presidential Committee on Green Growth, enacted legislation entitled *The Framework Act on Low Carbon Green Growth*, and organized the Secretariat for the Presidential Committee on Green Growth.

The concept of Green Growth is also part of the 100 policy tasks the Lee Myung-Bak administration has set for itself. Specifically, it is part of the second major policy direction “For a Lively Market Economy” and the seventh objective, “To create new jobs through green growth.” In this way five major tasks relate directly to green growth:

- Task 31 : Creating the core infrastructure for eco-friendly industries and energy savings
- Task 32 : Exploring new industries by actively addressing climate change
- Task 33 : Enhancing energy self-sufficiency
- Task 34. Developing new and renewable energies as well as clean energies
- Task 35 : Creating a green Korean Peninsula

The Presidential Committee on Green Growth, an organization directly responsible to the President to promote low carbon green growth as a national agenda, has spent the last year and a half preparing an overall plan to have the Republic of Korea become the 7<sup>th</sup> “Greenest Power by 2020 and the 5<sup>th</sup> “Greenest Power” by 2050. The basic approach to achieve leadership in Green Growth is through three main strategies<sup>1</sup>:

1. Climate Change Adaptation & Energy Independence
2. Creation of Driving Force for New Growth
3. Improvement of Quality of Life and Enhancement of National Status

There are ten major policy directions to implement the three strategies:

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<sup>1</sup> [http://eng.me.go.kr/content.do?method=moveContent&menuCode=pol\\_pol\\_edu\\_gov\\_growth](http://eng.me.go.kr/content.do?method=moveContent&menuCode=pol_pol_edu_gov_growth)

1. Climate Change Adaptation & Energy Independence
  1. Efficient GHG Reduction
  2. Enhancement of Energy Independence
  3. Intensification of Climate Change Adaptation Capability
2. Creation of Driving Force for New Growth
  1. Boosting Green Technology Development as a New Growth Engine
  2. Fostering Green Industry
  3. Heightening Industrial Structure
  4. Building a Foundation of Green Economy
3. Improvement of Quality of Life and Enhancement of National Status
  1. Creating Green Territory and Green Transportation
  2. Green Revolution of Daily Lives
  3. Building Worldwide Green Growth Model Nation

Over the last year and a half several members of the Presidential Committee have expanded on its agenda. A very good summary of the Committee's agenda is outlined in Dr. Toh's presentation to the NEAEF<sup>2</sup>. Another good summary of the Green Growth implementation is provided on the website of the Korean Ministry of Environment<sup>3</sup>.

By July 2009, the Presidential Committee had finalized a Five-Year National Plan for Green Growth, and one month later presented action plans for their overall policy. In November 2009, as part of the green growth process, the government announced a plan to cut carbon emissions by 20 percent from the "business-as-usual" scenario and this put Korea as the first of the emerging and developing nations to put forward a reduction plan of such scope.

In August 2009, President Lee Myung-Bak in his remarks on the occasion of the 18th Annual Conference of the Northeast Asia Economic Forum spoke directly to the NEAEF agenda that "...discussion on the subject of low carbon green-growth is timely and most appropriate..."

Most recently, December 17, 2009, President Lee Myung-Bak, made a keynote speech at the UN Climate Change Conference in Copenhagen that continued to put forward an aggressive agenda for Korea toward decreasing carbon emissions. In addition, the President announced the creation

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<sup>2</sup> See NEAEF *The Report of the International Expert Workshop on Northeast Asia Energy Cooperation, September 14, 2009*, Page 65

<sup>3</sup> [http://eng.me.go.kr/content.do?method=moveContent&menuCode=pol\\_gre](http://eng.me.go.kr/content.do?method=moveContent&menuCode=pol_gre)

of the Global Green Growth Institute as an international think-tank based in Korea to deal with green growth. In Lee Myung-Bak's own words:

“In the case of Korea, we set up "Low Carbon Green Growth" as our new national vision.

We are annually investing 2% of our GDP into R&D of new green technologies and green infrastructure.

For this, the Basic Law on Green Growth is about to be passed by the end of this year.

We will do our best to reduce carbon emissions but also seek new engines of growth that will ensure sustainable development, more jobs and a greener future. And I hope to share this with all of you.

This is one reason why Korea will establish a Global Green Growth Institute or GGGI during the first half of next year.

The GGGI will help all of us share our experiences and know-how with each other.

We will gather scholars, scientists and civil society leaders from around the world to come up with workable solutions to our problems.

In the spirit of global partnership, the GGGI can act as a global think tank and as a bridge between the advanced and the developing countries.”

South Korea has pledged to invest 107 trillion KRW (about 84.4 billion USD) in the green energy economy. The 107 trillion KRW investments will go into areas like solar energy, wind power, carbon credit trade, hybrid electric vehicles, energy saving LEDs, smart grids, bio-fuel, energy conservation, illumination, etc. Within a ten year period, it is expected that 206 trillion KRW industrial outputs will be produced and more than 1.8 million green environmental protection jobs will be created. Meanwhile, the government will issue a series of accommodated tax-reduction measures and support the enterprises and institutions that vigorously improve and reform energy efficiency through bringing in various commodities to attract private investors. Besides this the government proposes the establishment of investment firms, a 500 billion KRW green fund, launching green savings accounts and green bonds in banks, and providing small and medium companies of green technology and high energy efficiency with preferential investment, credit, and tax policies.

## China: An Inventory of Green Energy (Low Carbon) Economic Achievement, Policies and Recent Measures<sup>4</sup>

China is the largest developing country in the world, and the world's second-largest energy producer and consumer. The sustained growth of a global energy supply has provided an important support for the country's economic growth and social progress, while the rapid expansion of energy consumption has created a great demand driver for the global energy market. Within the world energy market, China places an important role in maintaining energy security. Guided by what it calls a *Scientific Outlook on Development*, the Chinese government is accelerating its development of a modern energy industry, taking resource conservation and environmental protection as two fundamental policies. This is interpreted as giving priority to building resource-conservation and environment-friendly technology while continuing to industrialize and modernize. The stated policy is to enhance the country's capability for sustainable development and make China a leader in innovation.

China's energy development emphasizes cost-reduction, concern for the environment, and safety. With a strong belief that development is the only way for its survival, China's strategy is to solve problems through a development and reform process. To this end, China applies the *Scientific Outlook on Development*, a policy that puts people first, changing its concept of development over time, making innovations in the mode of development, and improving the quality of development. Priority is placed on scientific and technological content, low resource consumption, minimal environmental pollution, good economic returns, and guaranteed safety in energy development, so as to realize the coordinated and sustained development of all energy resources to the fullest possible extent. In recent years, in the area of green energy, low carbon energy, and renewable energy, China has made considerable progress. Energy-saving effects are conspicuous. There has been a push to "optimize" the structure of energy production. Considerable progress has been made in environmental protection.

The basic themes of China's energy strategy are giving priority to reducing cost, relying on domestic resources, encouraging diverse patterns of development, relying on science and technology, protecting the environment, and increasing international cooperation for mutual benefit. It strives to build a stable, economical, clean, and safe energy supply system, so as to support sustained economic and social development with sustained energy development. The 17th National Congress of the Communist Party of China, held in October 2007, set the goals of quickening the transformation of the development pattern and quadrupling the per-capita GDP of

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<sup>4</sup> Sources for this section include: State Council Information Office of the People's Republic of China, Report on China's Energy Conditions and Policies, December 2007; China National Development and Reform Commission, State Plans for Medium and Long-Term Development of Renewable Energy, September 2007; Zhang Kunmin, Pan Jiahua, Cui Dapeng, Introduction to Low Carbon Economy, China Environmental Sciences Press, May 2008; Wei Yiming, Liu Lancui, Fan Ying, Wu Gang, China Energy Report (2008): CO2 Emission Research, Science Press (China), May 2008; Cui Xuanmin, Annual Report on China's Energy Development (2009), Social Sciences Academic Press (China), October 2009; and Wang Tingkang, Tang Jing, The Enlighten of American Energy Policies and the Measure of China's New Energy Development, Journal of Southeast Petroleum University (Social Science Edition) Vol.2 No.4, July 2009.

the year 2000 by 2020 through optimizing the economic structure and improving economic returns while reducing the consumption of energy resources and protecting the environment.

The Outline of the 11th Five-Year Plan for National Economic and Social Development of the People's Republic of China projects that the per-unit GDP energy consumption by 2010 will have decreased by 20 percent compared to 2005, and the total amount of major pollutants discharged will have been reduced by 10 percent.

NEAEF has not verified these claims, but certainly considerable reduction in energy consumption has occurred since 2005. Moreover, considerable government policies have focused on reducing emissions. In absolute terms China has taken first place among countries in greenhouse gas emissions, overtaking the US in 2009. However, when looked at in terms of per capita emissions and in terms of per-unit GDP energy consumption China's claims are justified.

To realize the country's economic and social development goals, the energy industry has set the following targets as stated in the 11th Five-Year Plan (2006-2010); by 2010 the energy supply will basically meet the demands of national economic and social development; and noticeable progress will have been made in energy conservation; energy efficiency will have been noticeably enhanced and the energy structure optimized; technological progress, economic benefits and market competitiveness will have been greatly increased; and energy-related macro-control, market regulation, legislation and emergency pre-warning system and mechanism compatible with the socialist market economy will all have been improved. The result will be that the coordinated development will have been achieved between energy production, the economy, the society and the environment.

### **The general state of China's green energy and renewable energy**

During the period 1980-2006, China's energy consumption increased by 5.6 percent annually, boosting the 9.8-percent annual growth of the national economy. Calculated at 2005 constant prices, the energy consumption for every 10,000 yuan of GDP dropped from 3.39 tons of standard coal in 1980 to 1.21 tons in 2006, making the annual energy-saving rate 3.9 percent, putting an end to the rising trend of per-unit GDP energy consumption. The comprehensive utilization efficiency in the processing, conversion, storage and end-use of energy was 33 percent in 2006, up eight percentage points over 1980. Per-unit product energy consumption has dropped noticeably, and the gaps between the overall energy consumption, the net energy consumption rate of electricity generation for steel and cement production as well as synthetic ammonia produced by plants with an annual output of 300,000 tons or more and the international levels are narrowing.

China is the world's second-largest country in terms of energy demand, after the United States. In 2006, its total consumption of primary energy was 2.46 billion tons of standard coal<sup>5</sup>. China pays

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<sup>5</sup> Billion metric tons coal equivalent approximately equals 0.675 million ton of oil equivalent

great attention to improving its energy demand structure. The proportion of coal, its biggest energy input, in primary energy consumption decreased from 72.2 percent in 1980 to 69.4 percent in 2006, and that of other forms of energy rose from 27.8 percent to 30.6 percent, with that of renewable energy and nuclear power rising from 4.0 percent to 7.2 percent. The shares of oil and gas have increased. The proportion of coal converted into power increased from 20.7 percent to 49.6 percent. More commercial energy and clean energy are being used in people's daily life.

The Chinese government sets great store by environmental protection, and has made it a fundamental policy to strengthen environmental protection. Public awareness of environmental protection has been raised. After the 1992 UN Conference on the Environment and Development, China worked out its "21st Century Agenda," and has reinforced environmental protection in an all-round way through legislative and economic means, making positive progress in this regard. China's energy policies give priority to the reduction and rehabilitation of environmental damage and pollution resulting from energy development and utilization. In 2006, coal-fueled generating units reported nearly 100-percent installation rate of some kind of particulate-cleaning facilities. The amount of discharge in 2006 was almost the same as that in 1980, and the particulate emission per-unit electricity had decreased by 90 percent. The installation capacity of thermal power units with FGD built and put into operation in 2006 totaled 104 million kW, exceeding the combined total of the previous 10 years. Such thermal power units accounted for only 2 percent of all thermal power units in 2000, but the proportion had risen to 30 percent by 2006.

China has also made resource-conservation a basic state policy, and stresses both developing and saving, with priority given to saving. For this, it is actively changing the pattern of economic growth, adjusting the industrial structure, encouraging research and development of energy-saving technologies, popularizing energy-saving products, improving energy management expertise, improving energy-saving legislation and standards, and enhancing energy efficiency.

China will continue to develop coal resources and intends to increase capacity in the power industry and oil and natural gas exploration - including coal bed methane development. Additionally, the country plans to increase hydroelectric power capacity, as well as other renewable energy resources, actively promote nuclear power development, develop substitute energy resources, "optimize its energy structure", and allow for substitution among multiple energy resources, all as part of a greater effort to guarantee a steady supply of energy.

China fully relies on science and technology to enhance its ability for independent innovation and its ability to import and improve imported technologies, tackle technological bottlenecks in energy development, improve key technologies and the manufacturing level of key equipment, seek new ways for energy development and utilization, and redouble the strength for further development.

China has set the goal of building a resource-conserving, environment-friendly society, and is endeavoring to coordinate energy development with environmental protection. It seeks to make the two promote each other for "sustainable development."

**To promote all-round energy conservation, China promises to take the following measures:**

**Promote structural adjustment.** The major reasons for low efficiency of energy utilization for a long time have been the extensive mode of economic growth and a high proportion of high energy-consuming industries in China. The country has placed priority on the adjustment of the industrial structure and of the internal structures of industries with an energy-conservation strategy - "low input, low consumption, less emission and high efficiency." China's policies have been developed to accelerate the optimization and upgrading of its industrial structure, make energetic efforts to develop high- and new-tech industries and service trades, set strict limits on the development of high energy-, material- and water-consuming industries, and eliminate industries with backward productivity, so as to fundamentally change the pattern of economic development and put in place an energy-saving industrial system.

**Improve energy conservation in industry.** Industry is a major sector of energy consumption in China. The country is determined to take a new road to industrialization characterized by high scientific and technological content, good economic returns, low resource consumption, minimal environmental pollution, and full use of human resources. To achieve this, China's policies are set to accelerate the development of high-tech industries and transform traditional industries with high- and new-technologies, as well as advanced and applicable ones, and in turn upgrade the overall industrial standard. Industries with high energy consumption, such as steel, nonferrous metals, coal, electricity, petroleum and petrochemicals, chemical engineering and building materials, will be the target sectors for saving energy and reducing energy consumption. The Chinese government has launched an energy-conservation drive among 1,000 enterprises, with the focus on tightening control over those consuming 10,000 tons of standard coal or more each year. It will require these enterprises to readjust their product mix, speed up technological reform, improve management and economize on energy. There is also support available for a group of key demonstration projects aiming to conserve energy and cut consumption so as to show workable examples to industries of energy-savings. It will continue to raise the standards for energy efficiency of industry, eliminate backward and high energy-consuming products, and perfect access of such products to the market.

**Launching energy-saving projects.** China is carrying out ten key energy-saving projects, including petroleum substitution, co-generation of heat and power, surplus heat utilization, and the construction of energy-saving buildings. The Chinese government supports demonstration energy-saving projects, and encourages extensive application of high-efficiency, energy-saving products. China has pledged to construct energy- and land-saving buildings, actively promote the energy-saving renovation of existing buildings, and extensively use new walling materials. The Chinese government has pledged to eliminate old automobiles and ships, bring new vehicles into public transport, set limits on high oil-consuming automobiles, and develop energy-saving and environment-friendly automobiles. China is promoting innovation of coal-fueled industrial boilers, regional co-generation of heat and power and surplus heat and pressure utilization, and improving the efficiency of energy utilization. China has a plan to save more energy in the sphere of electrical machinery and optimize energy systems, so as to improve the efficiency of

both. There is a Green Lighting Project and a plan to distribute high-performance electrical appliances. There is also a plan to spread technologies for firewood- and coal-saving stoves and energy-saving houses in rural areas, and eliminate old, high energy-consuming farm machinery and fishing boats, so as to promote energy conservation in agriculture and the rural areas. There is a plan in place to encourage government agencies and offices to save more energy, giving full play to the role of the government in leading energy conservation. Finally, there is a plan to create a system of energy-conservation monitoring and technological support, strengthening energy-conservation monitoring and establishing new energy services platforms.

**Strengthening the administration of energy conservation.** The Chinese government has established a system of compulsory government procurement of energy-saving products, actively advocating energy-saving (including water-saving) products as a priority for government procurement, as well as lists of products of compulsory procurement. The policy will place the role of governmental purchase to encourage all sectors of society to produce and use energy-saving products. In addition, the government will study and formulate fiscal and taxation policies to encourage energy conservation, implement preferential taxation policies for those effectively making comprehensive use of resources, and set up an energy-saving mechanism with multi-channel financing. The policy will link the policy energy price reform with a pricing mechanism favorable for energy conservation. The policy will put in force an evaluation and examination system in respect of energy conservation for fixed assets investment projects. It will set up a new energy-conservation mechanism for enterprises, adopt an energy efficiency labeling mechanism, and promote contract-based energy management and voluntary energy-conservation agreements. It will improve the legal framework regarding energy conservation, and strengthen energy-conservation management by law. There is a promise to train energy-conservation managerial personnel, and step up efforts in law enforcement, supervision and examination.

**Advocating energy conservation in society.** The Chinese government shall advocate energy conservation by various means, including strengthening the public awareness of the importance of resources conservation. The government wants to promote the culture of energy conservation. The government intends to incorporate energy conservation into the system of elementary education, vocational education, higher education and technical training, and publicize and popularize relevant knowledge by means of mass media.

### **Coordinating Energy and Environment Development**

The Chinese government attaches great importance to environmental protection and prevention of global climate change. The Chinese government has made environmental protection a fundamental state policy, signed the United Nations Framework Convention on Climate Change, established the National Coordination Committee for Climate Change, submitted to the UN the Initial National Communication on Climate Change of the People's Republic of China, worked out the Management Measures on the Implementation of Clean Development Mechanism Projects, formulated the National Climate Change Program, and adopted a series of proactive policies and measures regarding environmental protection and climate change. China's stated

aims are to achieve the goal of basically curbing the trend of ecological deterioration, reducing total emissions of major pollutants by 10 percent, and gaining visible results in the control of greenhouse gas emissions during its 11th Five-Year Plan period (2006-2010). Meanwhile, the country is actively adjusting its economic and energy structures, comprehensively advancing energy saving, emphatically preventing and controlling the pressing problems of environmental pollution, and effectively controlling emissions of pollutants to facilitate coordinated development between energy and the environment.

China points out that because it is a developing country in the primary stage of industrialization and has low accumulative emissions, a different strategy of emissions reductions than for industrialized countries should be applied within its borders. From 1950 to 2002, the aggregate amount of China's fossil fuel carbon dioxide emissions accounted for only 9.3 percent of the world's total in the same period. The amount of China's per-capita carbon dioxide emissions ranked 92nd in the world, and the elasticity coefficient of carbon dioxide emissions per-unit GDP was very small. However, this year China has assumed the number one position in absolute greenhouse gas emissions, second to the United States. In any case, China has a very active policy to address this issue.

**Comprehensive control of greenhouse gas emissions.** China is transforming its economic development to account for the role of energy saving and optimizing the structure of energy demand in the belief that this can slow climate change. Part of this plan is to cut fossil energy consumption.

**Environmental degradation and environmental pollution.** China will pay more attention to the clean utilization of energy resources, especially coal. The country is quickening its pace of control of coal mining subsidies and the exploitation and utilization of coal-bed methane gas, and establishes and improves the compensation mechanism for the exploitation of coal resources and restoration of the environment. It promotes the orderly exploitation of coal resources, restricts the exploitation of high-sulfur and high-ash coal, and forbids mining coal with toxic and harmful substances, such as arsenic and radiological toxins, exceeding permissible limits. It actively develops clean coal technology and encourages the application of coal washing, processing, conversion, clean-burning and particulate-purifying technologies. At the same time, it is expediting the construction of desulfurizing facilities in coal-fired power plants, requiring that newly built coal-fired power plants must install and use desulfurizing facilities according to the permissible emission standards. Such existing plants must speed up their desulfurization upgrading. The Chinese government strictly prohibits the construction of new coal-fired power plants for the sole purpose of power generation in medium and large cities or on their outskirts. They must be able to provide co-generation.

**Proactive prevention of motor vehicle emission pollution.** The development of the automobile industry and the improvement of the people's livelihood have led to a rapid growth in the number of motor vehicles. Consequently, preventing motor vehicle emission pollution has been put high on the environmental protection agenda. China is actively taking effective measures to this end: strictly enforcing vehicle emission standards; intensifying inspection for the environment-

friendly production of vehicles; strictly implementing the annual emission inspection system for motor vehicles; strictly forbidding manufacture, sale and import of motor vehicles exceeding the emission limits. At the same time, China encourages the production and use of vehicles burning clean fuels, and the production of hybrid electric vehicles, and supports the development of rail transport and electric buses.

**Exercising strict environmental management of energy projects.** Strengthening the environmental management of energy projects is an effective measure to ensure coordinated development between energy construction and environmental protection. China strictly enforces the environmental impact assessment system, restrains extensive mode of economic growth by exercising a strict environment access system. It ensures simultaneous design, construction and launching of environmental protection facilities at new, expansion and rebuilding projects, intensifies safe management of nuclear power projects, reinforces supervision and management of the safety and radiation environment of nuclear power plants, research reactors and fuel cycle facilities in operation, and practices meticulous safety examination and supervision of nuclear power facilities under construction. It further enhances environmental protection efforts in the construction of hydropower projects, pays equal attention to the requirements of comprehensive development and utilization of river basins while protecting the environment, and increasing the level of comprehensive utilization of water resources and eco-environmental benefits.

### **Recent Chinese Measures Regarding New and Alternative Energy**

The Chinese government recently drafted a resolution for new and alternative energies industries. It has not been issued yet. The draft resolution confines the definition of new energies in two areas: one is the new energy related to wind power, solar energy and biomass. The other is energies produced from innovation in the traditional energy technology, including smart power grid, and new automobile fuels. The Chinese measures on new energies in this draft resolution include discussion of wind, solar, nuclear, biomass, and coal-bed methane (See Appendix B: Chinese government draft resolution for new and alternative energies industry)

Recently, Zhou Shengxian, the Minister of Environmental Protection Ministry of PRC, pointed out that only the development of green energy can assure the development of a green environment, followed by a green economy. Chinese government has enacted a medium and long term plan for renewable energies, implemented the key clean energies projects like transporting the natural gas from the West to the East, actively encouraging the development of nuclear power. As a result, compared with 2005, the whole-year application amount of hydropower, nuclear power and wind power in 2008 increased by 37.2%, natural gas by 61.4% and the newly increased clean energies are equivalent to 110million ton standard coal. This has a direct effect on Chinese environment and a move from China's traditionally coal-centered energy structure.

## **Japan: “Cool Growth” and New Government**

Japan, the strategy for “green energy” is also often referred to as “cool energy”. In pursuing green growth the Japan policies include such efforts to decrease carbon emission through changes in energy efficiency through changes in behavior and new technologies that leave smaller carbon footprints and a change in the mix of primary fuel consumption. The result is to tackle the overriding issue of climate change due to greenhouse gas emission. Naturally, Japan is associated with these efforts with the Kyoto Protocol. Moreover, fosters a green energy sector that is as an engine of economic growth. Japan provides a very compelling review of how electrification might be a key to reducing greenhouse gas emissions and Japan is vanguard in the development of energy-saving technologies, especially in heat pumps.

Generating mix for power generation in Japan is approximately: follow: Nuclear 29%, Coal 25%, Natural Gas 24%, Oil 11%, Hydro 6% and Other 5%.

Japan currently faces the challenge to increase its nuclear capacity as a major method to reduce greenhouse gas emissions. However, the construction of new nuclear capacity is problematic in the light of several nuclear energy accidents within the last two decades. The general forecast for nuclear capacity is that it will increase in Japan. Japan has 54 nuclear plants with 48GW power generation capacity, and 13 plants with 17GW output capacity are under construction or are planned. Because of several accidents at existing Japanese nuclear plants over the last two years, some local governments and NGO have been against the expansion of new plants. Without the development of new nuclear plants as previously planned, however, it is considered by several analysts that the commitment of the new Japanese government to reduce greenhouse gas emissions by 25% by 2020 is not possible. It follows that the new government should be very supportive developing nuclear plants in order to achieve greenhouse gas emission reduction and that at least eight to ten new plants could be constructed as planned. At the same time, the government may propose enhancing capacity utilization rate of the existing nuclear plants for covering the shortage of construction of the new plants. However, it may be technologically, according to some nuclear engineers, difficult to increase the capacity of existing nuclear plants sufficiently to cover the anticipated shortfall. The Democratic Party of Japan included in its manifesto to Japanese voters that "with obtaining support and understandings from local community, DPJ will continuously work on development of nuclear plants". Although it is rational to argue large growth in nuclear within Japan, the theoretical growth potential might be suppressed by public opinion. A large part of the support Prime Minister Hatoyama receives on his green energy is from people who do not traditionally support the potential of nuclear energy. President Obama probably seems to have the same problem within the US landscape. The reluctance to embrace more nuclear capacity continues in Japan, especially on the regional level. For example, the Monju reactor (the site of a nuclear accident) was supposed to reopen in February 2009 is still not online.

Meanwhile, the Japanese are very comfortable with gas, especially LNG. This is different from the US, where many people believe, at least on the West Coast, that an LNG terminal is tantamount to placing an exploding bomb within a community.

A realistic option for Japan might be to bring more natural gas into the Japanese markets. Currently, Japan has no real internal trunk-line pipeline infrastructure and almost all natural gas is brought in by about 25 Liquefied Natural Gas Terminals. Historically, there has been no incentive for creating a domestic or international gas pipeline network (in contrast to Republic of Korea or the US), since Japanese electrical utilities owned the LNG terminals and utilized the natural gas primarily for the generation of electricity. The Japanese utilities have been regionally monopolized ones and traditionally protected from competition. With changing conditions and a changing environment Japanese utilities might at least become interested in pipeline natural gas. Since natural gas still emits 50% of the emissions of coal and hydro is maxed out it is argued that nuclear is the best option to meet emissions reductions targets. While most of the country's hydro assets are fully developed Japan needs base load capacity and nuclear is base load. However, based upon the preliminary calculations of CO<sub>2</sub> reduction should there be an effort toward massive gas conversion within Japan, pipeline natural gas' 50% advantage over coal and it being a fuel that the population is used to and comfortable with, might become an excellent mid-term candidate to expand the fuel base and help partially meet emissions requirements.

Gas is quick and relatively cheap to mobilize, even at \$20 billion a pipeline that can serve 130 million people is low cost, especially relative to nuclear. Current natural gas prices into Japan are historically low. Potential supplies, especially the undeveloped reserves of the Russian Far East, are extremely large. The natural gas infrastructure is proven technology. The economic gains could be considerable since there is a huge price differential between the landed price of energy and the price to consumer. Finally, technological innovation seems to be available to continue to reduce the rate of emission of natural gas (and coal). In addition, natural gas is used extensively in transport, unlike the US.

However, such gas pipeline projects will require investment in the billions of dollars, internal realignment, and considerable political coordination with Russia, China, DPRK, and ROK (depending on the source of natural gas might be and the pipeline routes). In the same way, clean coal technology, which is well accepted by Japanese utilities, might also play a greater role than previously anticipated.

Continued reliance on further electrification, especially in transport, as a way to reduce carbon emissions, regardless of whether it will make real gains or not, plays well for growth in the use of natural gas.

Recently elected (September 2009) Japanese Prime Minister Yukio Hatoyama has accelerated Japan's commitment to emissions reduction. In his speech at the United Nations Summit on Climate Change in New York, on September 22, 2009, shortly after election, Yukio Hatoyama stated his position on reduction of greenhouse gas emissions:

“Based on the discussion in the Intergovernmental Panel on Climate Change (IPCC), I believe that the developed countries need to take the lead in emissions reduction efforts. It is my view that Japan should positively commit itself to setting a long-term reduction target. For its mid-term goal, Japan will aim to reduce its emissions by 25% by 2020, if compared to the 1990 level, consistent with what the science calls for in order to halt global warming.

This is a public pledge that we made in our election manifesto. I am resolved to exercise the political will required to deliver on this promise by mobilizing all available policy tools. These will include the introduction of a domestic emission trading mechanism and a feed-in tariff for renewable energy, as well as the consideration of a global warming tax.

However, Japan's efforts alone cannot halt climate change, even if it sets an ambitious reduction target. It is imperative to establish a fair and effective international framework in which all major economies participate. The commitment of Japan to the world is premised on agreement on ambitious targets by all the major economies.

On the establishment of the domestic emission trading market, we will promote exchange of information on systems of other countries, and hold discussions on the issue, bearing in mind the impact on international competitiveness as well as possible future linkages among countries.”

This emissions reduction commitment was reiterated at the end of 2009.

“... I announced Japan’s aim to reduce its emissions by 25% by 2020 if compared to the 1990 level, despite concerns of the industry.”<sup>6</sup>

Further in November 2009 during the UN speech, the Prime Minister announced a "Hatoyama Initiative" that would assist developing countries with finances, including calling on other developed countries to invest, as well as technology transfer to expand the aim to reduce greenhouse emissions globally:

“Climate change requires a global response. In the process of furthering sustainable development and poverty reduction, developing countries must aim to reduce greenhouse gas emissions under the principle of "common but differentiated responsibilities". This is especially important for developing countries with large emissions.

Solving the problem of climate change will entail a vast amount of financial resources, in particular to support adaptation efforts by vulnerable developing countries and small island countries. Such financing should be strategically

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<sup>6</sup> Statement by H.E. Dr. Yukio Hatoyama, Prime Minister of JAPAN, at the Informal High-level Event, the Fifteenth Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (18 December 2009, Copenhagen)

expanded. Japan is prepared to provide more financial and technical assistance than in the past, in accordance with the progress of the international negotiations.

Public financial assistance and technology transfer to developing countries are critically important.

However, they alone will not meet the financial needs of developing countries. I therefore intend to work with world leaders on creating a mechanism that not only ensures the effective use of public funds but also facilitates the flow of private investments.

Japan deems the following four principles essential in assisting developing countries:

First, the developed countries, including Japan, must contribute through substantial, new and additional public and private financing.

Second, we must develop rules that will facilitate international recognition of developing countries' emissions reductions, in particular those achieved through financial assistance, in a measurable, reportable and verifiable manner.

Third, on assistance to developing countries, consideration should be given to innovative mechanisms to be implemented in a predictable manner. And an international system should be established under the auspices of the UN climate change regime. This system should facilitate one-stop provision of information on and matching of available bilateral and multilateral financing, while securing transparency and effective utilization of assistance.

Fourth, Japan proposes to establish a framework to promote the transfer of low-carbon technologies which ensures the protection of intellectual property rights.

I would like to propose to the international community a "Hatoyama Initiative", based on what I have just outlined. The Kyoto Protocol was a historic milestone, as the first international framework that obligated nations to reduce greenhouse gases. Effective efforts, however, cannot be realized unless a new framework is created. To that end, towards establishing a fair and effective new single undertaking, I will exert every effort for the success of Copenhagen, in the course of formulating this initiative. “

Again in late 2009, the financial commitment to developing countries was made, with a specific dollar amount explicitly stated:

“The day before yesterday, Japan announced that it would provide assistance to developing countries in the amount of about 15 billion US dollars in total up to 2012, including 11 billion in public financing. These are premised upon the

establishment of a fair and effective international framework by all major economies and agreement on their ambitious targets.”<sup>7</sup>

Finally, the Prime Minister also recognized the new efforts of the Obama Administration on green growth issues, with several specific examples about technology.

“Active measures to address climate change such as the Green New Deal initiated by President Obama will open new frontiers and create new opportunities for employment in the world economy, particularly in such fields as clean energy technologies, including electric vehicles, and solar power generation.

Japan has relatively strong potential for technological development as well as considerable financial capacity. Thus I recognize that Japan is expected to take the lead in the international community in setting its own reduction target, and to achieve such target through the development of innovative technologies. I have full confidence in the abilities of the Japanese people and our companies. Political leaders at this time also have a responsibility to future generations to create a sustainable society by transforming the social structure that we have known since the Industrial Revolution.”

Coordination with the US was again a major focus for Japan when the Prime Minister met with President Obama:

“We also discussed climate change. Japan and the US have concurred on a major goal--that the two countries would each reduce their respective greenhouse gas emissions by 80 percent by 2050. They also agreed to cooperate for the success of COP15. As for various issues that need to be resolved, including that of China[’s stance on this issue], we agreed to cooperate and collaborate closely.”<sup>8</sup>

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<sup>7</sup> Statement by H.E. Dr. Yukio Hatoyama, Prime Minister of JAPAN, at the Informal High-level Event, the Fifteenth Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (18 December 2009, Copenhagen)

<sup>8</sup> Joint Press Conference by Prime Minister Yukio Hatoyama of Japan and President Barack Obama of the United States of America (13 November 2009)

## ***A Summary and Evaluation of the Ability of Northeast Asian Countries, with a Focus on China and Korea, to Collaborate in the Area of “Green-Growth” in the Short-term and Mid-term***

Under current severe economic conditions, governments of all countries advocate the need to rely on the “green economy” in order to rebuild the global economy. This is highlighted by Lee Myung-Bak, the president of South Korea “green growth” agenda and also highlighted by a substantial proportion of the first step of the Chinese government’s 4 trillion recovery investment in the areas of energy conservation and environmental protection. This is seen as a demonstration of the importance Chinese government attaches to the “Green Economy.”,

On May 26<sup>th</sup>, 2009, in Beijing witnessed the establishment of “Sino-South Korean Green Energies cooperation Forum” co-hosted by China and South Korea. More than 200 entrepreneurs from China and South Korea exchanged their opinions on how to carry out economic, trade and investment cooperation in areas of new energies, green industries, energy conservation and environmental protection and other areas. Economic and trade organizations of two countries signed a related cooperation MOU. The two sides agree in the forum that in the future two years the two sides will build up new Sino-South Korean Green Energies Cooperation Model and try to explore together the sustainable development path by establishing high-level dialogue mechanism, promoting mutual visits between country delegations, strengthen information exchange, improve arbitration related to green industries disputes, vigorously advocate exhibitions of green industries and so on. The two countries also pledged to also promote the exchange and cooperation of methods to use new energy sources, renewable energies, climate change, energy conservation, efficiency improvement, new materials, environmental protection and other green industries areas.

The two sides pledged that the principle driving economic growth should be both low carbon emitting, as well as green energies. China and Korea have committed to cooperate with each other on these two goals in the long term. The two sides pledged to expand the scope of cooperation to achieve the “3E-”objectives of low carbon energy growth (Energy Security, Energy Efficiency and Environmental Friendly) .

The two countries have reached a strategic goal of green energies development that includes early stage in nine key areas: photovoltaic, wind power, efficient lightening, electricity IT, hydrogen fuel cell, clean fuel, efficient coal IGCC, CSS and energy storage. In addition, the preliminary key areas include nuclear energy, small scale thermoelectricity production, green cars, super conduct, energy-conserving buildings and heat pumps. In the long term process of two countries green energies cooperation, will look to try to form a common carbon market, support it with the discharge right gained through emission reduction projects and develop special new industries that would be provided capital and other support if they take on emission reduction project. The two countries pledged to establish the research and development cooperation between the two governments and their respective green energies enterprises. They state that will not only rely on government policies support to develop the new energies career but also utilize the results of new energy industries’ independent research and development so that can take advantage of the two governments’ supporting policies .

Short-term objective for Sino-South Korea energy cooperation include carrying out bilateral cooperation in the area of photovoltaic technologies and also biofuels. Recently the two countries agreed to cooperate in areas of solar energy cell research and development and system integration technology development. In order to promote photovoltaic market, the two sides will jointly look at promoting research and the market for photovoltaic technologies. As part of this the countries pledged to promote the establishment of photovoltaic technology standards and specification and the mutual authentication system. The two governments will appoint the representative cooperation institutions to actively promote photovoltaic cooperation so as to assure the capital for the related work and to accelerate the networking between the two countries' industries, research institutions and universities. They plan to conduct a joint research plan for improving solar energy cell efficiency and developing the photovoltaic market, technical standards, and management rules. They agreed to train professionals in photovoltaic electricity generation; the countries agreed to implement common training procedures and establish a common management system for recruiting talent.

The two countries intend to promote technology exchange and cooperative research and development in the area of bio-fuel, strengthen technical exchange and cooperation in cellulosic ethanol and synthetic dyes and adopt international standards in making bio-fuel materials and products standards. The two countries intend to conduct joint research, manufacturing and promotion of bio-fuel production equipments and develop whole set fuel processing production equipment that that can creating bio-diesel from varied feed-stock (sorghum ethanol and jatropha curcas bio-diesel). Given that both countries have relatively young bio-fuel industries, the plan is to develop a resilient commercial model for industry orientation and provide assistance in marketing bio-fuels, and to generally market promote the cooperation and development of the two countries' bio-fuel industries.

In summary, the main focus for China's and Korea's cooperation in the area of green energy is new sources of energy, renewable energy, energy efficiency and clean fossil fuel technology. The countries feel it is that they should great strengthen long-term cooperation in the area of green energy. Part of the mutual strategy is to carry out green energy industry cooperation with a view to reinforcing energy security and addressing global warming in the North-Eastern Asian region. In the short-term the two countries are pledged to focus cooperation in photovoltaic electricity generation and bio-fuel, to conduct joint research on new technology in this area and to explore jointly the photovoltaic electricity generation and bio-fuel markets. The two sides have initially agreed to develop standards for new energy and renewable energy, as well as train the work-force in green industries. The two countries intend to appoint representative green economy cooperation institutions for the common management of two countries green energy cooperative project.\*

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\* Some of the statements are based on *Lee, Won-Wu. "Korea's New Deal of New Energy and China-Korea Energy Cooperation." China-Korea Green Economy Forum, May 2009.*

## ***A Summary and Evaluation of the “New Energy for America” Policy of the US, with a focus on “Green Growth” and US-China energy cooperation.***

### **United States and Northeast Asia Energy**

There was an overwhelming agreement throughout the various discussions at NEAEF meetings and conferences that there is a need to understand President Obama’s “New Energy Policy” and the USA’s commitment to “Green Growth” so that the opportunity for The Northeast Asian to expand its cooperation and transfer its hard learned lessons with its nearest eastern neighbor. This is important in light of a new US administration and the fact that the US economy is extremely intertwined with Northeast Asia.

Since the election of Barack Obama as president a new energy policy is being presented from the US that several ways is anticipated to be significantly different from the Bush administration policy, in implementation. An analysis of the stated Bush Administration policy compared to the stated policy of Obama campaign may be argued as not being that different. There recognition of global climate change (although with the Bush Administration very late in the game), an increase in renewable, increasing efficiency and conservation and new technological solutions such as carbon capture and increase use of nuclear are the stated direction in both camps.

Upon his election, President Obama promised to, “Invest in alternative and renewable energy, end our addiction to foreign oil, address the global climate crisis and create millions of new jobs.”

Of course all US administrations have been focused on the rhetoric of decreasing oil imports, seen as a symbol for the US solving many energy problems. However, oil imports continue to rise, now at 60%. However, the rhetoric is confusing to the average American who believes that most oil imports are from the Middle East. In reality, the US is relatively better diversified in its imports than probably generally accepted within the US. Americans generally do not consider that considerable oil imports by source, that are “foreign” come from Mexico and Canada and that almost as much comes from Venezuela and Nigeria as the Middle East.

However, the most likely and extremely crucial difference where the Obama Administration will set itself apart will be in the effort it expends to implement a “green approach.” Especially, strong will be the policy imperative to make significant reduction in green house gas emissions within the context of a global agreement. This is an area where Northeast Asia stands to best interact with the US, especially as an initial starting point for serious discussion.

The current policy substance in the “New Energy in America” promises to:

- Help create five million new jobs by strategically investing \$150 billion over the next ten years to catalyze private efforts to build a clean energy future.
- Within 10 years save more oil than the US currently imports from the Middle East and Venezuela combined.
- Put 1 million Plug-In Hybrid cars -- cars that can get up to 150 miles per gallon -- on the road by 2015, cars that we will work to make sure are built here in America.

- Ensure 10 percent of our electricity comes from renewable sources by 2012, and 25 percent by 2025.
- Implement an economy-wide cap-and-trade program to reduce greenhouse gas emissions 80 percent by 2050.

The priorities are not without their problems.

A \$150 billion over ten years is equal to \$15 billion a year investment in a “clean energy future.” Although this seems like a considerable investment, its scale relative to the size of the industry can be said to be barely significant. In 2008, \$45.22 billion in profits were made only by Exxon Mobil. The top ten companies earned over \$1.5 trillion in revenue in the US in a single year. So, a government investment of \$150 billion is not in line with the scale of the industry for a policy of radical change.

Currently, the environmental and political pressure to increase share of nuclear and renewable fuels generation to replace dirtier petroleum and coal sources of fuel is considerable. Whether it remains so in a low price energy environment is unknown and is likely to be a key question in the future.

The first major proposal related to energy made by the Obama Administration has been the recent higher CAFE (Corporate Average Fuel Economy) Standards- measured in average miles per gallon. The new CAFE regulations would increase the standards to 39 miles per gallon by 2016. Further a proposal to put 1 million plug-In hybrid cars - cars that can get up to 150 miles per gallon - on the road by 2015 was made. These kinds of vehicles increase the average price at \$1200 per vehicle in higher cost. In connection with this proposal a further proposal to ensure 10 percent of US electricity comes from renewable sources by 2012, and 25 percent by 2025 has been made.

While electric cars are “green,” a more pertinent question is to ask where does/will the electricity come from? A look at the current US electricity generation by fuel shows that the majority of electricity is produced by coal, which continues to be a base fuel within the US.

Coal is one of the worst emitters of green house gas emissions. Natural gas is number two in terms of an energy used for electricity generation. Natural gas emits green house gases, but half of the amount that coal produces when burned. It may be realized by the American public, but has not been until now.

Investment in alternative energies and implementing new technologies is a long and difficult process. This is clearly not recognized by the majority of the American people. There needs to be recognition that it is a long time to implement a technological innovation in the area of energy to bring an idea to mass use. It takes at least 3 years from idea to proto-type. Then, it takes at least 3 years to bring a proto-type to pilot plant stage and at least a further 2 years from a pilot to mass use of technology. Elections cycles are much shorter. “Clean Coal” technology is one possible technology for carbon capture. The current available technology uses supercritical and ultra-supercritical steam to reduce coal consumption through the sublimation of coal, the coal goes from solid to gas by-passing a liquid phase, at the plant. The USA has not introduced a single new technology “clean coal” plant while China has introduced more than forty.

In general, within the US financing the capital investment in new energy sources, new energy infrastructure or new energy technology requires the following conditions:

- A promise of an upward trend demand in energy, infrastructure and technology,
- A promise of an upward trend in prices, that is represented by greater demand,
- OR much greater volume of demand with falling prices – the process of commoditization.

None of these conditions are currently being met.

Further, from the list of where new technology and innovation within the US comes from:

- Large corporation R&D
- Universities and research institutes
- Government laboratories (including military and space programs)
- Entrepreneurs

Probably, the most effective place for revolutionary technology development is with entrepreneurs, yet that is not the focus of government funding, rather in capital markets and the investment of many share-holders. This seems to be a model that might receive greater attention in the post-crisis Northeast Asia.

Northeast Asia shares a commonality with the continental United States, that both areas are likely to pursue gas resources to the north of the areas of demand. However, natural gas markets in the US have the “reverse” problem Japan has in terms of infrastructure. The US has an extensive natural gas pipeline system. Just as in the Japan case, it could be argued that increase use of natural gas within the US could be helpful in reducing greenhouse gas emissions, especially if it replaces coal in electricity generation. Coal currently represents 60% of all fuels generating electricity.

The US utilizes North American (US and Canadian) supplies. The US imports very little natural gas as LNG, unlike Japan. US benefits significantly from Canada’s natural gas supply. However, low cost natural gas reserves for North America have been heavily depleted and the North American reserve to production ratio is about 9 years, on the other hand, the rest of the world has reserve to production ratio. In other words, as low-cost North American reserves are depleted how will the United States be able to tap into the global supply of relatively low cost natural gas?

One clear solution is more LNG terminals to US Markets. However, more LNG terminals are not really possible because of the public perception that LNG terminals are extremely dangerous and could “blow up.” This sentiment is particularly held in the US Northeast and the West Coast. The reality is the physical properties of LNG terminals are significantly less volatile than petroleum refineries. In a liquid state LNG cannot explode easily since the system cannot access sufficient quantities of oxygen. On the other hand, when natural gas evaporates the amount of fuel is too dispersed to ignite. However, the result of effective opposition to LNG terminals has made it virtually impossible to construct a new terminal on the West Coast of the United States. One way around the problem is to build terminals away from population centers and bring the natural gas in by longer pipelines, an added cost, but a growing feasible solution to the problem as prices increase. For example, an LNG terminal was constructed in Baja California, Mexico where there was little opposition to the project. The gas is then transported by pipeline into California.

Another way North America can resolve its need for natural gas as demand increases is through tapping into Arctic supplies of natural gas. Two priority areas are the Canadian Mackenzie Valley and Alaska North Slope gas. The advantage of arctic gas is that once the pipeline infrastructure is constructed to Alberta, the natural gas flows into existing proven infrastructure.

Most promising has been President Obama’s statement during his first meeting with the Canadian Premier in early 2009 that he supports the “Prioritize the Construction of the Alaska Natural Gas Pipeline.” This might have considerable repercussions in global gas markets, that in turn could spell considerable changes for the ability of Northeast Asia to garner capital for developing Northeast Asian gas supplies.

### **How Will Obama’s Visit to China Affect China’s New Energy?**

Currently, China and the United States are examining ways to build a positive, cooperative and comprehensive China-US relationship in a post-crisis environment. For US and China, economic cooperation seems to be at the core of the country-to-country relationship. At The First Round of the Sino-US Strategic Economic Dialogue Held recently, a Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and Environment has been drafted. Energy cooperation is a new and important part of current Sino-US economic cooperation.

On November 15<sup>th</sup> 2009, President Obama made his first visit to China. Before this visit, the American Commercial Secretary Gary Locke revealed that energy would be a very important issue in Obama’s visit. Specific progress in energy cooperation is expected between the two countries to pave the way for US enterprises to open the way for a new energy market in China. After the crisis, China sees a new impetus as indispensable in order to attain robust growth in the United States. In this context, China sees the logic Obama’s efforts to promote new energy strategy and low carbon economy as part of introducing a new engine of growth for the American economy.

Until recently, the US has discharged the largest amount of green house gas emissions, and the most per capita, while China’s has had the greatest increase in emissions of any country. The commonality of being the largest global greenhouse gas emitters, but having a very different energy use pattern provides significant opportunities for mutual cooperation, as well as opportunity for significant disagreement. China sees, to an extent, the US as one of the leading countries now to call for a low carbon economy, but does not always agree with demands the US makes on China in the area of emissions. Neither does China see recognition for the considerable efforts it has made in tackling the problem of emissions. In any case, there is considerable dialogue and it is hoped that some of the larger areas of potential conflict can be turned to areas of close cooperation.

During Obama’s four-day state visit to China, U.S. and China have jointly issued a China-U.S. clean energy proclamation as the contents with regard to the promotion of clean energy in a document entitled, *China-U.S. Clean Energy Announcements*. The two sides also signed three government cooperation documents and a series of enterprise agreements, which include:

- *China-U.S. Fact Sheet on Coal,*
- *China –U.S. Fact Sheet on Efficiency Action Plan,*
- *China-U.S. Fact Sheet on Electric Vehicles, and*

- *China-U.S. Fact Sheet on Electric Vehicles.*

The five documents are reprinted here in their entirety and are good summaries of the current state of discussion between the two countries<sup>9</sup>.

(See Appendix C for U.S. – China Clean Energy Announcements, November 2009)

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<sup>9</sup> Office of the Press Secretary of the White House, U.S.-China Clean Energy Announcements, November 2009; Office of the Press Secretary of the White House, Fact Sheet: U.S.-China Cooperation on 21st Century Coal, November 2009; Office of the Press Secretary of the White House, Fact Sheet: U.S.-China Energy Efficiency Action Plan, November 2009; Office of the Press Secretary of the White House, Fact Sheet: U.S.-China Electric Vehicles Initiative, November 2009.

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## **Part 2: Organization of Meetings and Seminar on Green-Growth**

The following is a brief summary of NEAEF expert meetings and sessions at the annual meeting that related to Green-Growth and associated issues.

### **The Fifth Expert Group Meeting on Energy Cooperation**

The Fifth Expert Group Meeting on Energy Cooperation in Northeast Asia was held on the 19th and 20th of March 2009 in Honolulu, Hawaii, USA to tackle two major issues that face North East Asian energy cooperation: The Economic Crisis and the opportunity for a Green Energy Partnership. In spite of the fact that the region, as the rest of the world, faces some of the hardest economic choices in over eighty years, the conference participants focused on the opportunities the crisis offered in terms of allowing for both gradual and radical solutions to long term problems in the region, especially in how energy issues interacted with issues of environment.

The two day meeting included the session that is most pertinent to this report, the first session. This session was entitled *Green Energy Partnerships and a New Sustainable Energy Agenda for Northeast Asia*. This session was a comprehensive overview of green energy policies for Korea, China and Japan. Dr. Toh gave a very detailed presentation of Korea's "green growth" policy. He gave an overview of the motivation of the policy, the general government concept of "green growth" and outlined the elements of "green growth." Dr. Toh explained the green growth strategies that the Korean government intended to use to implement transition to a low carbon economy (as part of the national energy plan), foster green energy industries and tackle climate change and a reduction in greenhouse gas emissions. Dr. Shen described the results that the Chinese government has achieved in the area of energy saving and emission reduction. He gave an overview of the kind of policies the Chinese government promoted to develop and use new forms of energy and renewable energy. Finally, Dr. Shen reiterated that China supported a policy strengthen "green energy" cooperation among Northeast Asia and to advance the sustainable energy supply and development. Mr. Tanabe overviewed the Japanese vision for a new sustainable energy agenda for Northeast Asia and how Japan imagined green energy partnerships for the regions. Mr. Tanabe suggested that Japan felt that Northeast Asia should share the long-term vision for "cool earth," or "cool Asia." This "cool" vision is defined as an economy with low emissions. Mr. Tanabe related that as part of this strategy for Japan meant that government and business investment and activities, both for long-term and short-term should be focused on energy conservation and cleaner energy. Japan is committed to collaborate in the continuation of cool economy with its Asian partners. He concluded that political leaders, technocrats and business sectors should work together on concrete policies, programs and projects. There were two specific industry presentations that related green energy with the work of the Korean Electric Power Corporation, by Dr. Lee Yong-Kwan, and a presentation that related Japanese electricity production with green policies, by Dr. Inuma and Dr. Uchida.

All the countries in the region, especially those that have a net demand in energy, see the need to promote "Green Growth" as a new sustainable energy agenda in a post-crisis environment. That is, a transition to economies where economic growth and development are in synergy with the environment and health of the planet. Specifically, presentations showed that all the demand countries where committed to continue to focus such "Green Growth". An overview of the

specific green energy policies and practices for China, Korea and Japan were presented. In Japan, the strategy for “green energy” is also often referred to as “cool” energy. In pursuing green growth the policies include such efforts to decrease carbon emission through changes in energy efficiency through changes in behavior and new technologies that leave smaller carbon footprints and a change in the mix of primary fuel consumption. The result is to tackle the overriding issue of climate change due to greenhouse gas emission, as well as fostering a green energy sector that would act as an engine of economic growth.

Two challenges were pointed out – how do you promote a green energy economy when non-green energy is available at low prices? What will be the results of the new approaches of much greater government intervention in energy within the last year?

Energy conservation and energy efficiency was the centerpiece of many of the presentations, including in other sessions, as a solution to decreasing energy demand, as well as reducing the overall carbon footprint. There is a huge potential in improving energy efficiency throughout the world, but in particular in Northeast Asia. It was pointed out by several speakers that energy efficiency can be improved at the same time that costs can be reduced. In addition, speakers also suggested that a demand side rationalization, through tools such as increased efficiency, are as important, or more important, as increasing supply capacity as Northeast Asia addresses a “green recovery.”

The Fifth Expert Group Meeting on Energy Cooperation in Northeast Asia concluded that most important for regional cooperation needs to be the careful consideration of the menu of solutions that can be crucial in attending Northeast Asia’s energy and conservation issues in the environment of crisis and post-crisis. There continues to be lively discussion on how the solutions will manifest themselves, especially in examples such as energy efficiency efforts.

The conference participants all agreed that there is a need to understand President Obama’s “New Energy Policy” and the USA’s commitment to “Green Growth” so that the opportunity for The Northeast Asian to expand its cooperation and transfer its hard learned lessons with its nearest eastern neighbor. This is important in light of a new US administration and the fact that the US economy is extremely intertwined with Northeast Asia. To an extent, this report attempts to do begin discussion and information gathering for NEAEF members about this topic.

Discussion also included the role of market mechanisms as well as government participation in dealing with energy markets, energy efficiency, environment and economic crisis. Those discussants and presenters that expressed support for large-scale showed a clear preference that this infrastructure needs to focus on the delivery of energy and power to the region. For the most part issues of efficiency, green growth policy and technology were consistently and primarily presented as domestic issues. However, there was considerable agreement that large-scale commercialization and effective implementation of policy and products required global participation. This seems to be a fundamental issue for discussion and resolution for the region and, certainly, for NEAEF and its members.

## NEAEEF Annual Meeting

Two sessions were held at the NEAEEF Annual meeting. Specifically, the second session on *Green Energy Cooperation and Partnerships in Energy Efficiency and Conservation* is pertinent to the current report. The second session informed the participants about the new Green Growth Policy of the Republic of Korea, provided information on the tangible recent achievements within China in energy efficiency and reduction of greenhouse gas emissions, and featured technological solutions, specifically the use of electricity within Japan, were offered as a significant pathway for energy efficiency and emissions reduction.

The first session also had some elements pertinent to the present report, entitled, *Energy Cooperation in Northeast Asia*, included presentations that discussed significant detail about global factors such as restructuring of energy markets, the problem of carbon emissions and global climate change, and a new US administration with a green energy and environment agenda suggests a significant opportunity to develop regional strategies to diversify sources of energy resources to meet a diverse profile of energy needs. These strategies should promote stability for the Northeast Asian region and continue to support the region's position as the fastest growing region of the world. It was proposed that Northeast Asia would likely continue to have growing demand for energy resources and that this demand would require significant investment in infrastructure in order to take advantage of real efficiencies in utilizing energy, as well as gaining access to new sources of energy.

In addition to a summary about green growth in Korea and energy conservation in China and Japan, the second session concluded that energy storage and smart-grid technology was identified as areas of particular promise. At the same time at the session, there was a key presentation concerning the Green Growth Policy of the Republic of Korea. Specifically, that Korea proposes a new pathway, via Green Growth Policy, that provides a solution to the issue of climate change, energy vulnerability and economic recovery. Finally, it was recognized by the second session that Northeast Asia should feature its strength as a leader in *Green Growth* that is broadly defined as an approach that simultaneously promoted economic growth, quality of life, job creation and concern for the environment, especially the role of emissions in global climate change.

Both sessions had very specific and detailed discussion of policy, technology and likely outcomes in redefining issues of green growth, conservation and energy efficiency. The following is not a comprehensive summary of the sessions, rather a summary of issues pertinent and of interest to this report topic.

Dr. Zhang reported that in the context of global economic crisis, the economic growth rate of Northeast Asian countries has significantly receded, and energy supply and demand balance has marked reversal, from short supply to oversupply. He added that with the global energy price reduction, together with global economic crisis, that major energy producing and consuming countries in Northeast Asia had an historic opportunity to rebuild the energy structure in this region. Dr. Zhang stated that Northeast Asian countries should take advantage of the opportunity that conflict between energy supply and demand has mitigated, to build confidence, create mutual benefit and take advantage of an environment of a win-win situation. That this

environment could accelerate the promotion of large-scale cross-border energy cooperation projects. Based on their own advantages, Northeast Asian countries should establish a long-term energy cooperation mechanism in Northeast Asia to stabilize the energy market and keep energy supply and demand balance in this region.

Dr. Tichotsky summarized the Obama Administration's "Guiding Principles" and related President Obama Administration's press statement "To take this country in a new direction, the President is working with Congress to pass comprehensive legislation to protect our nation from the serious economic and strategic risks associated with our reliance on foreign oil and the destabilizing effects of a changing climate. Policies to advance energy and climate security should promote economic recovery efforts, accelerate job creation, and drive clean energy manufacturing....," and further that the Administration would begin by investing \$150 billion over ten years in "energy research and development to transition to a clean energy economy." Dr. Tichotsky pointed out that these goals were rather unrealistic given the scale of foreign imports, especially from places close to home like Mexico and Canada, and that \$150 billion is dwarfed by the actual scale of the oil and gas industry. He made detail references to the North American gas market, as well as the potential role of pipeline natural gas from Alaska and Arctic Canada. In general, he added, that financing the capital investment in new energy sources, new energy infrastructure or new energy technology requires conditions that are not being met and pointed out that probably, the most effective place for revolutionary technology development is with entrepreneurs, yet that is not the focus of government funding.

Dr. Toh presented a very effective keynote address about Green Growth and Korea. In his address he related the importance of Green Growth for the Korean government. Green Growth is not "Plan B," it is "Plan A" for the Korean government. It is the strategy of change that jumps over the chasm and problems of climate change and energy costs. It is also a concept of creativity that opens all possibilities. He gave quite a detailed set of strategies that would be used by the Korean government to implement the Green Growth strategy. This is outlined in his presentation within this volume.

Dr. Uchida presented the idea that natural gas was a quick way to cut CO<sub>2</sub> emissions and to secure energy in NEA. He pointed out that renewable energy supplies, such as solar and wind power, represented an unstable supply. At the same time huge gas fields are close by Northeast Asia, such as Russia Far East, Australia, Southeast Asia and Central Asia. Given that it was likely that almost the entire power generation infrastructure in Japan and Korea would likely need to be replaced. The advantage of replacing conventional coal-fired generation by latest gas combined cycle could cut CO<sub>2</sub> emissions by more than half. Dr. Uchida noted that for the NEA Energy Community priorities included to start with the integration of infrastructure in energy (gas and electricity), transport and communications in NEA countries. The availability of such infrastructure and efficiency encouraged entrepreneurship and investments, leading to economic prosperity in the region. Dr. Uchida pointed out that climate change is a long-term issue, which will need to be tackled over the next 50 years or more and added that if we delay our actions, our cumulative emissions will require steeper reductions and lead to higher costs. He concluded that any actions to tackle with the climate challenge needed huge investment and international cooperation and that the global energy-climate challenges require a global approach.

Mr. Iinuma provided a very compelling review of how electrification might be a key to reducing greenhouse gas emissions. He noted that CO<sub>2</sub> mitigation needs both demand and supply options and that electrification at the end-use level is effective measure to reduce CO<sub>2</sub> emission. He further added that Japan is vanguard in the development of energy-saving technologies, especially in heat pumps, and that these leading edge technologies can be key options for CO<sub>2</sub> reduction in NEA countries.

Dr Shen made a presentation on the progress China has made in energy saving and greenhouse emission reduction, as well as the country's achievements in developing and using of renewable energy sources. He noted that energy saving is the key measure to cope with climate change and that China's policy attaches great importance in energy saving and its relation to reducing emission and that the country considered its progress in energy savings and emissions reduction remarkable in recent years. He added that part of China's success is based on the development and use of renewable energy sources. He concluded that to strengthen the cooperation among Northeast Asia in energy saving and emission reduction and renewable energy fields that China could play a significant role since China owns large market with tremendous energy saving potential and China will to enhance comprehensive cooperation with the nations in Northeast Asia in the technology and energy saving service to explore the energy saving potentials. The main energy in China is coal, strengthening the R&D and cooperation in the technology of clean coal could reduce more CO<sub>2</sub> emission. He further hoped that there would be more cooperation in R&D and utilization of new energy and renewable energy in Northeast Asia. Further, in order to cope with climate change, all nations in Northeast Asia should strengthen the technology cooperation in emissions mitigation and adaptation of new technologies.

The overall conclusion from the conference is that significant work on understanding the role of policy, conservation and technological efficiency, in Northeast Asia has been done, especially in 2009. The need for a cooperative and long-term strategy in the area of energy, energy infrastructure and financing energy project for the region is likely the key for regional prosperity.

However, much work lies ahead in realizing the overall goals set by Northeast Asia Economic Forum. Specifically, The Forum should continue looking at the relationship with green growth and market mechanisms, admittedly an area still in need of significant research prior to addressing next order issues for the coming decade.

## ***NEAEF Site Visit to Sandia National Laboratories, Albuquerque, New Mexico, USA***

Two NEAEF researchers visited Sandia National Laboratories in Albuquerque, New Mexico, USA. Sandia Laboratories is one of the US national labs that focus on energy. Sandia has many projects that focus on green energy, as well as efficient technologies.

The role of the national labs within the Obama Administration is significant, since the US Secretary of Energy is a former director of Lawrence Berkeley National Laboratory. In addition, although born in the United States, US Secretary of Energy Dr. Steven Chu (朱隶文), a Nobel Laureate, is both Chinese-American and a great proponent of research in looking at alternative energy and nuclear energy as an alternative to the use of fossil fuel, in light of global climate change. Moreover, he is interested in industry-science collaboration, as demonstrated by his putting together a \$500 million multi-disciplinary collaborative project (Energy Biosciences Institute (EBI)), on energy and global climate change. At the time of its inception, the institute was not without controversy, especially the fact that BP sponsored most of the institute. For all of the above reasons, NEAEF is very excited about further contacts with the US Department of Energy and Sandia Laboratories, and is especially excited about how this can relate to green growth in Northeast Asia and its relationship to the United States.

In the original premise of the trip to Sandia was related to the DOE Secretary specific interested in Northeast Asia in terms of environment and energy. NEAEF researchers provided the Sandia Laboratories with some basic documents from China, Japan and Korea. It also posed a short list of current issues, admittedly simplified, to spark interest in discussion.

1. China and US are the largest absolute emitters of green house gases
  - a. whatever the US and China do is therefore critical and how they interact (cooperatively or antagonistically) is also critical
  - b. The American public does not seem to know or understand whether China is making any effort or is successful in addressing emissions
    - i. China seems to be, but in a different way than possible in US
    - ii. China is working closely with Korea, and to an extent with Japan
  - c. Avenues for cooperating with China is probably key for US and a premium compared with cooperation with other parts of the world
2. South Korea's official policy is "Green Growth" and the President is actively pursuing this policy.
3. Japan's new government and Prime Minister want to accelerate their emissions reduction goals!
  - a. How can they do this?
    - i. More nuclear, but serious issues with
      1. Increasing output of current reactors
      2. Social- political and technology implications of more nuclear plants

- ii. Role for natural gas, including pipeline gas from Russia
- b. Problem of North Korea and implications of giving them pipeline gas in exchange for not letting them build any kind of nuclear reactors.
- c. What are the challenges to US?
- 4. Domestically, Hawaii and Senator Inouye are playing an increase role in energy policy. To an extent, Hawaii is President Obama's "hometown."

At Sandia, the NEAEF researchers learned about the larger division of Sandia Labs thematically. A large part of the institution is dedicated to research and activities related to controlling the nuclear missile arsenal, as well as non-proliferation. For the most part, NEAEF researchers had little discussion with issues related to nuclear missiles, and limited discussion about non-proliferation, except in the area of expanding nuclear energy as a fuel source. The other part of Sandia laboratory is primarily committed to energy research and this is the primary area of discussion NEAEF researchers carried out.

In general, the NEAEF researchers found out that there is a growing interest in international programs and specifically a growing interest in working with Northeast Asia. Several programs exist, and they are primarily bi-lateral in nature. There seem to be no programs in energy or technology that cut across the countries of Northeast Asia.

A considerable amount of time was spent looking at solar, both solar tower technologies as well as "distributed energy technology," specifically photovoltaic, and wind technologies, as well as composite technologies, which didn't seem to have a direct application to energy, except in the area of pipeline repair. Of potential interest may be water heating technology, prevalent in China and Hawaii that seems to have very, very little application within the continental United States. The main reason given was that 1980s water heating technologies were costly and the technology often failed, creating significant water damage to roofs. This problem cut the advance of water heating technology within the continental United States.

Systems studies by the Sandia Labs included a project in China that looked at water balances and climate change and is a good example of the interest in China. Many of the international projects seem to rely either on a personal interest of a researcher or a specific funding opportunity. By generating its own projects NEAEF can join in or complement existing or future areas of Sandia interest.

On a practical level, there are several current activities carried out in Hawaii in the area of energy that may result in a Sandia person resident in Honolulu. This could be a good connection for the Northeast Asian Economic Forum for cooperation.

Clearly, inviting Sandia staff members to NEAEF expert meetings and sessions is an excellent way to introduce Sandia Laboratory to the experts that may be interested in collaboration.

One area of potential cooperation that interests experts in Northeast Asia, as well as in Hawaii is methane hydrates.

One virtually untapped energy source of arctic Russia, arctic North America, as well as coastal areas in Northeast Asia is methane hydrate deposits of natural. A growing body of evidence suggests that the global resource of **methane hydrates**, a form of natural gas trapped under pressure in crystals of water ice, which is found to occur both in undersea formations along continental margins and in onshore permafrost zones, is more abundant than ALL other forms of

combustible hydrocarbons in the earth's crust, including oil, conventional natural gas and coal. The existence of these substances was barely suspected by science or industry twenty-five years ago, and no direct commercial exploitation of methane hydrates as such is yet occurring, although liberation of gaseous methane from hydrates deposits may already contribute to the natural-gas volumes produced or producible from conventional gas wells in some high-latitude permafrost areas and in Europe's North Sea. As of 2010, it seems a reasonably plausible speculation that natural gas will ultimately be proved commercially producible from onshore and/or offshore hydrates in an order of magnitude that is at minimum comparable to the volumes of natural gas now produced in Russia and the Middle East, consumed in Europe and East Asia, or produced and consumed in North America.

The State of Alaska is currently in negotiation with the owners of Alaska's North Slope gas resources to bring this stranded gas to market via pipeline to the US via Canada. This is a mega-project of over \$20 billion dollars and is of a scale analogous to the Trans Alaska Oil Pipeline System (TAPS). Conventional estimates of the North Slope's natural gas have been estimated as 35 trillion cubic feet (tcf) of reserves. However, taking into account the reserves associated with methane hydrates the scale of reserves changes dramatically. According Mark Myers, former Director of the State of Alaska Division of Oil and Gas, based on estimates of to Timothy Collett, of the US Geological Survey, and Craig and Sherwood, of the US Minerals Management Service, there may be as much as 590 tcf onshore gas hydrates in place and more than 32,000 tcf of offshore gas hydrates in place or seventeen to 914 times the conventional estimate! This could turn a major gas pipeline project that promises 4.5 billion cubic feet of gas a day for twenty years to a project that provides energy for over 360 years or, potentially, 20,000 years! Industry is well aware of this, since they have been involved with the USGS and the State of Alaska under the first Methane Hydrate Research and Development Act (2000), in a \$40 million plus research and drilling project to delineate and identify methane hydrates under the permafrost of Alaska's North Slope. However, the person in the street in Alaska or the US does not know that the resources at stake may as well be an infinite energy source.

Such a scenario, of course, has complex and heretofore nearly unexamined implications for established markets in crude oil and refined petroleum products, natural gas, coal, and electricity—including huge gains and losses among industries and political entities. This resource, also has a dramatically Faustian dimension as it is both the most abundant and most powerful of naturally occurring greenhouse gases, and may have been implicated in the biggest-ever die-off in the history of life on Earth several billions of years ago. It is reasonable to speculate that even marginally convincing scientific or technical indications of probable success in commercialization of hydrates will inevitably unleash an investment boom denominated in billions of dollars annually within the current decade. Moreover, even the very absence of persuasive evidence to the effect that large-scale development is not feasible technically or economically, or is prohibitively hazardous, may be insufficient to prevent a global investment boom in methane hydrates, perhaps constituting a spectacular investment bubble followed by a catastrophic collapse.

For the reasons summarized above, that which is already known, believed, or suspected about methane hydrates is doomed, at minimum, to provoke quantum increases in attention by the public media, opinion- and decision-makers, and in public support for government-sponsored and other academic research, when it does reach a wide-scale audience. Those individuals or institutions that first publicize plausible energy (btu) or dollar values for the impending boom are

likely to be greeted or remembered as prophets or even as its creators. It may be worth to propose to construct and examine one or more plausible scenarios consistent with contemporary scientific and technical knowledge, belief and suspicions about methane hydrates, and contemporary understanding of energy market behavior, and draw the implications of such scenarios for investment, energy supply, demand and prices by fuel type; and industrial and market structure in the energy sectors. Sandia Laboratory's expertise in system studies might be an excellent partner for any interest NEAEF might have in methane hydrates.

## Conclusions

The goals of this project, *Creating a Northeast Asian Green-Growth Energy Community through Cooperation on Energy Efficiency, New Energy Technology and Market Mechanism*, were as follows:

- 1) To summarize existing green growth policies and recent major actions by Northeast Asian countries
- 2) To evaluate the ability of Northeast Asian countries, as well as the US, to collaborate in the area of “green growth” in the short-term and mid-term
- 3) To evaluate the “New Energy for America” policy, to focus on its “green growth” components and see how it can contribute to strengthening Northeast Asian “green growth” collaboration.
- 4) In all of the three above efforts, to understand the role of energy efficiency and technology, as well as market mechanisms in evaluating realistic and tangible results.

The NEAEF research team has completed the major tasks, and have added a few interesting areas of interest that come out of its research efforts. First, the team summarized Green-Growth strategies and policies in Korea, China and Japan in the following chapters:

- Republic of Korea: “A National Vision”
- China: An Inventory of Green Energy (Low Carbon) Economic Achievement, Policies and Recent Measures
- Japan: “Cool Growth” and a New Prime Minister

In the beginning of 2009, Korea announced a long term strategy for its national energy policy until 2030. A critical part of this strategy is a commitment to “green growth”. This strategy is a policy format that based on the belief that environmental protection no longer is seen as an impediment to economic growth, but becomes a basic driver for economic growth – “green growth”. As part of its efforts Korea has been working closely with other Northeast Asian countries, especially the People’s Republic of China, which also has implemented an ambitious “green growth” strategy. China has had considerable experience in pursuing significant work in the area of energy efficiency and reduction in the emissions of greenhouse gases that to an extent seems largely ignored in the English-speaking world.

By the end of 2009, major global meetings, as well as significant Northeast Asian leadership meetings, including with the United States, further defined the importance of green-growth and associated issues.

China and Korea have cooperated actively on green growth and we have reported on these efforts.

In addition, the team provided a specific focus on China and Korea collaboration in the area of “Green-Growth,” as well as a summary and evaluation of the “New Energy for America” Policy of the US with a focus on “Green Growth.” In addition, in the Japan section above, there was discussion of Japan-US issues as they relate to “Green-Growth,” in addition to a significant

discussion of US-China energy cooperation. This is all a result of the significant outcomes of major meetings to take place in Northeast Asia.

In a separate section, NEAEF summarizes the results of several NEAEF meetings and seminars as they reflect issues of Green-Growth. This information can be found in other publications, but it is very useful to concentrate these results in terms of how they relate to Green-Growth.

There is a continual need for key experts in the area of green-growth to gather and prepare a coherent map illustrating how the individual countries “green growth” policies can interact and strengthen the regional economy and standard of living for Northeast Asia. This can be done through understanding and summarizing existing green growth policies and recent major actions by Northeast Asian countries. Next, the key experts can provide critical evaluation and recommendations about the ability of Northeast Asian countries to collaborate in the area of “green growth” in the short-term and mid-term. To a great extent the meetings of the NEAEF achieved the task of continued collaboration in the area of green growth, energy efficiency, and new technology.

In the energy sector, the green growth strategy leads to two main consequences improving the efficiency of energy consumption through promoting energy savings and energy efficiency – either through technology, government regulation, incentives, emissions reduction and sequestration or changes in social behavior, as well as the development of new “green energy” sources – either those that produce low or no levels of green house gases or energy sources where green house gases can be feasibly reduced or captured. In Korea and China the effort cuts across the industrial sector, the transportation sector, the residential and commercial sector and the public sector. At the same time, these strategies stress that providing ‘green growth’ to its citizens must be affordable, must engage the private sector, must extensively utilize the market economy and should attract private and public investment capital. Finally, it is viewed as integral to the solution for coming out of the current world economic crisis.

For all areas of energy policy, particularly among the political leadership of Northeast Asian demand countries, there is a desire to emphasize energy conservation and energy efficiency. At the meetings many of the experts point out here is huge potential for improving energy efficiency all over the world and in particular in Northeast Asia such as Japan, China, Korea, and, to an extent, Russia. Further, that a substantial part of the efficiency improvement can be realized even with negative cost. Several experts at NEAEF point out that in time of recession small scale, day-to-day, pragmatic investment and activities might be more realistic than large scale investment to strengthen supply side. This view’s argument is strengthened when there is over-supply of capacity in the economy, which is certainly the case in the post-crisis economy. In order to shift back to “sustainable growth path” the proponents of this viewpoint state that attention should be paid to both the demand and supply, or even an emphasis on the demand-side, rather than just on the supply-side. On several occasions it was noted that from the perspective of environment protection and energy security, it is much better to focus on demand side and efficiency of the total energy system than to pay much attention to increasing supply capacity, especially sources that add to greenhouse gas emissions. Energy conservation and efficiency should be relevant for any “green” growth or recovery strategy in the midst of economic crisis. In this way, such a view would suggest that every effort should be made for energy efficiency before turning to increasing supply capacity.

Finally, this report also was based on the assumption that it is vital for Northeast Asia to interact with its nearest western neighbor in “green growth” strategy and activities. Specifically, the states of Hawaii and Alaska will be engaged since they have engaged actively with Northeast Asia on energy issues, one is a major energy supplier, and the political leadership of these two states is particularly focused on energy issues and are also engaged in green growth. As part of this effort, NEAEF is looking to those agencies within the US that are interested in working with Northeast Asia via the network NEAEF has built up. There is a summary of the NEAEF site visit to Sandia National Laboratories, Albuquerque, New Mexico, USA, especially as it relates to green-growth and technology, and the promotion of collaboration for Northeast Asia.

## ***Appendix A: Relevant Excerpt of President Lee Myung-Bak's "Independence Day" speech***

“Vision for Another 60 Years: Low Carbon, Green Growth

My fellow citizens,

Currently, the Korean economy is undergoing difficulties stemming from the energy crisis. The socio-economic divide and job shortages are putting an increasing burden on ordinary citizens. There is a growing sense of crisis that we might collapse. In order to weather through this crisis and jump over the threshold to advancement, more creative ideas and dauntless resolution are needed.

Now, we are witnessing changes in civilization. The world has gone through the stages of the agricultural, industrial and information revolutions. Now, it is entering the age of an environmental revolution. Leaving behind the era of wood, coal and oil, an age of new energy is now being opened.

For the Republic that does not produce even a single drop of oil, such changes are both a crisis and an opportunity as well. In retrospect, the Republic has exhibited great capacities in turning crises into opportunities. The Republic took the first oil shock as a springboard for its inroads into the overseas construction market and advancement of local industries. The second oil shock served as a catalyst for growth while pursuing stability and opening to the outside world. Now is the time for us to turn the recent surge in oil prices into an opportunity to transform economic fundamentals and create new growth engines.

Today, on the occasion of the 60th anniversary of the founding of the Republic of Korea, I want to put forward ‘Low Carbon, Green Growth’ as the core of the Republic’s new vision. Green growth refers to sustainable growth which helps reduce greenhouse gas emission and environmental pollution. It is also a new national development paradigm that creates new growth engines and jobs with green technology and clean energy. Green technology puts together information and communications technology, biotechnology, nanotechnology and culture technology, and transcends them all. Green technology will create numerous decent jobs to tackle the problem of growth without job creation. The renewable energy industry will create several times more jobs than existing industries. In the information age, the gap between the haves and have-nots has widened. On the contrary, the gap will narrow down in the age of green growth.

Green growth will enable a Miracle on the Korean Peninsula to succeed the Miracle on the Han River. When the Republic first manufactured its own vehicles, the technology gap with the advanced countries amounted to at least 50 years. As far as semiconductors are concerned, it was more than 20 years behind. However, the Republic grew into a technology powerhouse, which ranks first in terms of producing semiconductors and ships, and fifth in automobiles. If we make up our minds before others and take action, we will be able to lead green growth and take the initiative in a new civilization. To do this, I will make sure that the country comes up with new green growth engines for the next generation to use for 10 to 20 years.

#### All-out Investment to Shift the Energy Paradigm

Fellow Koreans,

I am committed to ensuring energy security more than anything else with a view to laying the groundwork for green growth overcoming the energy crisis. The energy self-sufficiency rate is currently hovering around a mere 5 percent, but it will be increased to 18 percent during my term in office. The rate will eventually be raised to more than 50 percent by 2050, thus helping the country realize its ambition of becoming an energy independent nation, unfettering itself from the pain of energy shortages.

Exploration and research in the Arctic Ocean and Antarctic, which are thought to be a treasure trove of natural resources, will be actively conducted. By doing so, we will show the world that a spirit of adventure and creativity in pioneering uncharted territory runs in the Korean blood.

The Government will make all-out investments to boost the use of new and renewable energy from the current 2 percent to more than 11 percent by 2030 and, ultimately, to more than 20 percent by 2050. R&D investments in green technology will be increased more than two times, thereby making Korea a leading powerhouse in the green technology market, which is expected to amount to 3 quadrillion won by 2020.

Every nook and cranny of the homeland, including Saemangeum, will be turned into a new world filled with flowers where solar, wind and tidal energy are fully utilized. The Government will carry out the Green Home Project so that one million homes will use new and renewable energy. New green energy technology for such things as pollution-free coal and light-emitting diodes will be developed.

In addition, great emphasis will be placed on nurturing eco-friendly and highly

efficient green cars as one of the new growth engines. During my term in office, I will help empower Korea to emerge as one of the top four nations producing green cars in the world.

This year will be the beginning year for the country to move toward a low-carbon society in earnest based on a package of measures against climate change to be unveiled in September.

It is said that the Stone Age did not end for a lack of stone, and the oil age will end long before the world runs out of oil. Even if soaring oil prices drop in the years to come, now is the time for us to bid farewell to the era of excessive oil dependence.

Admittedly, Korea has lagged behind in the carbon era, but the country should move a step ahead in the coming hydrogen era. The road ahead of us will be bumpy and will sometimes come to rivers with rapid currents and valleys that are deep and rough. There will also be difficult periods of suffering and undue inconveniences. If Korea makes an audacious and swift move just as it did to advance its information capabilities to make up for belated industrialization, the country will undoubtedly be reborn as a green power.”

## ***Appendix B: Chinese government draft resolution for new and alternative energies industry***

### **1) Wind power generation**

Compared with the just issued ten industries rejuvenation plan, the new energies rejuvenation plan in embryo seems push the trend to a new high,” wind power plan will be adjusted appropriately because the former 30million kilowatt plan can not meet the demand”. Up to now, we have decided the ten million wind kilowatt wind power generation base in provinces like Hebei, Inner Mongolia, Gansu, Jiangsu, Jilin and so on. Noticeably the total installed capacity will break 50million kilowatt in eastern Inner Mongolia and Eastern China. All the ten million kilowatt bases should be constructed step by step in the unit of million kilowatt bases. The planned total installed capacity in Hebei, Gansu and other places has reached 10million kilowatt.

### **2) Solar energy**

Solar energy is another beneficial section in this plan. Zhao Yuwen, the vice chairman of Chinese renewable energies council said when interviewed by CBN that solar energies was sure to be involved in this plan, which is in accordance with the authority from National Energy Administration. “The biggest bright spot of this plan is the adjustment of wind power and solar energy, and the total installed capacity is expected to reach 10million kilowatt.” Said the authority, “If calculated with the cost of 30 thousand RMB to 50 thousand RMB per kilowatt, the investment on solar energy will exceed 300billion RMB”

### **3) Nuclear power**

Nuclear energies development is accelerating. It’s decided that nuclear energies will be involved in the plan. “The influence of nuclear power at present is enormous” the above mentioned authority said. According to amending views of the national energies administration on medium and long term plan on nuclear energies, by 2020 Chinese nuclear energy total installed capacity will be adjusted to more than 70million kilowatt ,capacity in construction to 30 million kilowatt, raising the proportion of nuclear power in the total power production to more than 5%. According to development goal of China, by 2020 the proportion of renewable energies power generation will reach more than 15%, after 2040 it will reach 30% or more and serve as an important alternative energy.

### **4) Biomass energy**

In terms of biomass energy, the plan draft resolution pointed out, “Because biomass energy involves too many areas and too many species, the details have gone into air supply, heat supply and other aspects.” Since 2004, pilot work on ethanol gasoline used on vehicle has been carried out in five provinces, namely, Heilongjiang, Liao Ning,

Henan and Anhui, and in 27 cities of Hebei, Shandong, Jiangsu and Hubei province. The production in 2006 reached 1.65 million ton. "Since 2007, Chinese government began to restrict the ethanol fuel production with grains as raw materials, so the momentum of ethanol fuel production slows down.

According to the meeting materials from Chinese renewable energies council, the recent technology research on Chinese biomass liquid fuel will be focused on using non-grain materials to produce ethanol fuel (mainly sorghos, cassava, lignocelluloses .etc), on biodiesel production technology with seeds of tung trees and other oil plants as the raw materials, and on building large-scale raw materials supply base and establishing biomass liquid fuel processing industries. The former plan is that by 2010, the annual production capacity of ethanol fuel will reach about 2million ton, that of biodiesel 200thousand ton, which in total is equivalent to substitution of 2 million refined oil products. "But in this plan, the statistics have been made proper adjustments."

##### **5) Coal bed methane (CBM)**

The draft resolution of the plan shows that china has chosen 15 ore fields for producing CBM and 5 long pipelines paths for transporting CBM, and China will give more support to CBM producing industries in fiscal policies. The draft resolution makes it clear that the application amount of CBM in 2011and 2020 will reach 8billion cubic meters and 24billion cubic meters respectively. Besides, two new CBM industrialization bases have been decided -----Qinshui basin in southern Shanxin and Erdos basin;

The project of CBM pump and utilization decide 15 large scale ore fields like Yangquan, Longmei, Panjiang, Shuicheng, and Fushun and so on. The draft resolution mentioned that the usage charge of the CBM ore fields and the price will be properly reduced, and the subsidiary standard of CBM exploitation should be improved from the current 0.2 RMB per cubic meter to 0.3 RMB per cubic meter. It is not enough to just pump the CBM from the underneath but to break the path or construct the new CBM transporting pipelines. 5 long pipelines are mentioned in the draft resolution :one from Shizhuang in Shanxi province to Duanshi in Shanxi province, one from Duanshi through Jincheng to Boai in Henan province, one from Zhengzhuang in Shanxi province to Yangcheng in Shanxi province to Yangcheng ,Shanxi, one from Baode,Shanxi to Shanjing, and one from Hancheng,Shanxi to Xian,Shanxi.

## **Appendix C: U.S. – China Clean Energy Announcements, November 2009**

### *U.S.-China Clean Energy Announcements, November 2009*

*Published November 17, 2009*

*"Today, President Barack Obama and President Hu Jintao announced a far-reaching package of measures to strengthen cooperation between the United States and China on clean energy. Attached are six fact sheets on the U.S.-China clean energy announcements.*

- 1. U.S.-China Clean Energy Research Center. The two Presidents announced the establishment of the U.S.-China Clean Energy Research Center. The Center will facilitate joint research and development of clean energy technologies by teams of scientists and engineers from the United States and China, as well as serve as a clearinghouse to help researchers in each country. The Center will be supported by public and private funding of at least \$150 million over five years, split evenly between the two countries. Initial research priorities will be building energy efficiency, clean coal including carbon capture and storage, and clean vehicles. The Protocol formally establishing the Center was signed in Beijing by U.S. Energy Secretary Steven Chu, Chinese Minister of Science and Technology Wan Gang, and Chinese National Energy Agency Acting Administrator Zhang Guobao.*
  
- 2. U.S.-China Electric Vehicles Initiative. The two Presidents announced the launch of the U.S.-China Electric Vehicles Initiative. Building on the first-ever US-China Electric Vehicle Forum in September 2009, the initiative will include joint standards development, demonstration projects in more than a dozen cities, technical roadmapping and public education projects. The two leaders emphasized their countries' strong shared interest in accelerating the deployment of electric vehicles in order to reduce oil dependence, cut greenhouse gas emissions and promote economic growth.*
  
- 3. U.S. China Energy Efficiency Action Plan. The two Presidents announced the launch of a new U.S.-China Energy Efficiency Action Plan. Under the new plan, the two countries will work together to improve the energy efficiency of buildings, industrial facilities, and consumer appliances. U.S. and Chinese officials will work together and with the private sector to develop energy efficient building codes and rating systems, benchmark industrial energy efficiency, train building inspectors and energy efficiency auditors for industrial facilities, harmonize test procedures and performance metrics for energy efficient consumer products, exchange best practices in energy efficient labeling systems, and convene a new U.S.-China Energy Efficiency Forum to be held annually, rotating between the two countries.*

4. *U.S. China Renewable Energy Partnership.* The two Presidents announced the launch of a new U.S.-China Renewable Energy Partnership. Under the Partnership, the two countries will develop roadmaps for wide-spread renewable energy deployment in both countries. The Partnership will also provide technical and analytical resources to states and regions in both countries to support renewable energy deployment and will facilitate state-to-state and region-to-region partnerships to share experience and best practices. A new Advanced Grid Working Group will bring together U.S. and Chinese policymakers, regulators, industry leaders, and civil society to develop strategies for grid modernization in both countries. A new U.S.-China Renewable Energy Forum will be held annually, rotating between the two countries.

5. *21st Century Coal.* The two Presidents pledged to promote cooperation on cleaner uses of coal, including large-scale carbon capture and storage (CCS) demonstration projects. Through the new U.S.-China Clean Energy Research Center, the two countries are launching a program of technical cooperation to bring teams of U.S. and Chinese scientists and engineers together in developing clean coal and CCS technologies. The two governments are also actively engaging industry, academia, and civil society in advancing clean coal and CCS solutions. The Presidents welcomed: (i) a grant from the U.S. Trade and Development Agency to the China Power Engineering and Consulting Group Corporation to support a feasibility study for an integrated gasification combined cycle (IGCC) power plant in China using American technology, (ii) an agreement by Missouri-based Peabody Energy to invest participate in GreenGen, a project of several major Chinese energy companies to develop a near-zero emissions coal-fired power plant, (iii) an agreement between GE and Shenhua Corporation to collaborate on the development and deployment of IGCC and other clean coal technologies; and (iv) an agreement between AES and Songzao Coal and Electric Company to use methane captured from a coal mine in Chongqing, China, to generate electricity and reduce greenhouse gas emissions.

6. *Shale Gas Initiative.* The two Presidents announced the launch of a new U.S.-China Shale Gas Resource Initiative. Under the Initiative, the U.S. and China will use experience gained in the United States to assess China's shale gas potential, promote environmentally-sustainable development of shale gas resources, conduct joint technical studies to accelerate development of shale gas resources in China, and promote shale gas investment in China through the U.S.-China Oil and Gas Industry Forum, study tours, and workshops.

7. *U.S. China Energy Cooperation Program.* The two Presidents announced the establishment of the U.S.-China Energy Cooperation Program. The program will leverage private sector resources for project development work in China across a broad array of clean energy projects, to the benefit of both nations. More than 22 companies are founding members of the program. The ECP will include collaborative projects on renewable energy, smart grid, clean transportation, green building, clean coal, combined heat and power, and energy efficiency."

#### FACT SHEET: U.S.-China Cooperation on 21st Century Coal

Today, President Barack Obama and President Hu Jintao pledged to promote cooperation on

*cleaner uses of coal, including large-scale carbon capture and storage (CCS) demonstration projects. Through the new U.S.-China Clean Energy Research Center, the two countries are launching a program to bring teams of U.S. and Chinese scientists and engineers together in developing clean coal and CCS technologies. The two countries are also actively engaging industry, academia and civil society in advancing clean coal and CCS solutions. The Presidents welcomed the following agreements and initiatives:*

*U.S. Trade and Development Agency announced it will support a feasibility study for an integrated gasification combined cycle (IGCC) power plant in China, utilizing American technology developed in cooperation with the China Power Engineering and Consulting Group Corporation.*

*Missouri-based Peabody Energy finalized its participation in GreenGen, a project partnership between several major Chinese energy companies to develop a near-zero emissions coal-fired power plant.*

*GE Energy and China's Shenhua Group are pursuing a joint venture that will advance coal gasification projects in China, and further develop related technology and business models*

*AES, through its subsidiary Climate Solutions Asia, will enter into a joint-venture agreement with Shenzhen Dongjiang Environmental Recycled Power Company and Songzao Coal and Electricity Company to use methane recovered from a coal mine in Chongqing to generate electricity and reduce greenhouse gas emissions.*

*U.S. National Energy Technology Laboratory and West Virginia University agreed to conduct a feasibility study with Shenhua Group of China on capturing and sequestering CO<sub>2</sub> from Shenhua's coal-based facility in China's Inner Mongolia Province*

*U.S. National Energy Technology Laboratory and the Wyoming State Geological Survey agreed to conduct a feasibility study with the Shaanxi Institute of Energy Resources and Chemical Engineering on capturing and sequestering CO<sub>2</sub> from coal-based facilities in China's Shaanxi Province.*

*The United States and China together account for more than half of global coal consumption. These projects, together with the newly-established U.S. China Clean Energy Research Center, reflect the growing cooperation between the two countries on clean coal and CCS and lay the foundation for large-scale joint demonstration projects in the years ahead. They also complement clean coal and CCS initiatives underway in the United States today. The American Recovery and Reinvestment Act includes \$3.4 billion in CCS investments, including \$1.1 billion for the FutureGen project. Collaborating in the development of clean coal and CCS solutions in China will open new markets for U.S. businesses and workers and, through the insights gained in the process, help accelerate CCS deployment in the United States.*

#### *FACT SHEET: U.S.-China Energy Efficiency Action Plan*

*Today, President Barack Obama and President Hu Jintao announced the launch of a new U.S.-China Energy Efficiency Action Plan to strengthen the economy, improve energy security and combat climate change by reducing energy waste in both countries. The United States and China consume over 40 percent of global energy resources, costing businesses and households in the*

*two countries roughly \$1.5 trillion per year. Working together to improve energy efficiency in buildings, industry and consumer products, the United States and China can reduce spending on imported and highly polluting sources of energy and reinvest in new sources of economic growth and job creation. The U.S.-China Energy Efficiency Action Plan will help achieve this through:*

*Green buildings and communities: the Action Plan will promote greener buildings through energy efficient building codes and labels, training building inspectors and developing advanced energy rating systems. The two countries will establish a Mayors Sustainable Cities Program where local officials from the two countries visit each other's cities to share experiences and best practices in sustainable urban development and planning.*

*Industrial energy efficiency: The Action Plan will reduce energy waste in industry through energy efficiency benchmarking, on-site energy audits and development of the tools and training programs to support these activities. Industry accounts for roughly half of the two countries' combined energy consumption and the Action Plan will help ensure both countries meet their domestic energy efficiency goals.*

*Consumer product standards: The Action Plan will promote energy efficient consumer products through harmonization of test procedures and performance metrics. The two countries will exchange best practices in energy efficient labeling systems and promote awareness of the benefits of energy efficient products.*

*Advanced energy efficiency technology: The U.S. and China will work together to demonstrate energy efficient technologies and design practices, building on the research and development work of the new U.S.-China Clean Energy Research Center.*

*Public-private engagement: The Action Plan will engage the private sector in promoting energy efficiency and expanding bilateral trade and investment through a new U.S.-China Energy Efficiency Forum that will be held annually, rotating between the two countries. The work of the Action Plan will also be supported by the U.S.-China Energy Cooperation Program, a newly-formed public-private partnership with leading U.S. clean energy companies.*

*The U.S. and China are making unprecedented investments in energy efficiency. The American Recovery and Reinvestment Act includes more than \$17 billion in energy efficiency investments, including \$5 billion for home weatherization and \$4.5 billion to green federal buildings. China has set a goal of reducing the energy-intensity of economic activity by 20% in five years and has established a "Top 1000 Enterprise" program to ensure that the country's largest industrial enterprises help meet the national efficiency target.*

#### *FACT SHEET: U.S.-China Electric Vehicles Initiative*

*Today, President Barack Obama and President Hu Jintao announced the launch of a U.S.-China Electric Vehicles Initiative. The two leaders emphasized their countries' strong shared interest in accelerating the deployment of electric vehicles in order to reduce oil dependence, cut*

*greenhouse gas emissions and promote economic growth. Activities under the initiative will include:*

- *Joint standards development. The two countries will explore development of joint product and testing standards for electric vehicles. This will include common design standards for plugs to be used in electric vehicles, as well as common test protocols for batteries and other devices. Each country currently has extensive literature and data on its own standards. Making this information mutually available and working towards common standards can help facilitate rapid deployment of electric vehicles in both countries.*

- *Joint demonstrations. The Initiative will link more than a dozen cities with electric vehicle demonstration programs in both countries. Paired cities will collect and share data on charging patterns, driving experiences, grid integration, consumer preferences and other topics. The demonstrations will help facilitate large-scale introduction of this technology.*

- *Joint technical roadmap. A U.S.-China task force will create a multi-year roadmap to identify R&D needs as well as issues related to the manufacture, introduction and use of electric vehicles. The roadmap will be made widely available to assist not just U.S. and Chinese developers, but also the global automotive industry. It will be updated regularly to reflect advances in technology and the evolution of the marketplace.*

- *Public awareness and engagement. The United States and China will develop and disseminate materials to improve public understanding of electric vehicle technologies. Building on the success of the first-even U.S.-China Electric Vehicles Forum in September 2009, the United States and China will sponsor the event annually, alternating between the two countries. The Forum will bring together key stakeholders in both countries to share information on best practices and identify new areas for collaboration.*

*The United States and China are the world's two largest automobile markets. In the past year, both countries have made unprecedented investments in electric vehicles. In the United States, the American Recovery and Reinvestment Act expanded a \$7,500 consumer tax credit for electric vehicles and included \$2.4 billion to support battery manufacturing. The U.S. government has also provided more than \$8.5 billion to help automakers retool their factories to produce electric vehicles. China has also provided significant investments for battery research and its economic recovery package includes significant funding for electric vehicle demonstrations and charging infrastructure.*