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On The Horizon — Renewable Energy in Asia

A PRACTICAL GUIDE

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On The Horizon – Renewable Energy in Asia

A Practical Guide

Prepared by Meritas Lawyers in Asia

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About this Book

On The Horizon — Renewable Energy in Asia was prepared by lawyers in Asian Meritas firms. It offers practical insights targeting foreign investors and business people who are interested in pursuing opportunities throughout Asia. The twelve chapters provide general information, not legal advice. Do not rely upon the materials without prior consultation with legal advisors familiar with the specifics of your particular areas of interest.

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INR	Indian Rupee	TWD	New Taiwan Dollar
IDR	Indonesian Rupiah	THB	Thai Baht
JPY	Japanese Yen	USD	United States Dollar
KRW	Korean Won	VND	Vietnamese Dông
MYR	Malaysian Ringgit		

ON THE HORIZON — RENEWABLE ENERGY IN ASIA

As this book goes to press, the global economy is still struggling to climb out of its worst downturn since the Great Depression. At the same time, Japan faces its most significant crisis since 1945 as it deals with the impact of the tsunami and damaged nuclear reactors at Fukushima. While some countries such as China, Singapore, and India have successfully rebounded, most nations are facing dual threats of exceptionally slow economic growth combined with chronic levels of high unemployment. Unlike past recessions, this one has hit developed economies just as hard as less developed countries, which have traditionally borne the brunt of economic downturns.

No matter how the world economy performs over the next few years, two factors stand out that will strongly influence global economic prospects over the next decade. One factor is population growth. Most experts predict that the world's population will grow from 6.9 billion today[1] to 8 billion by 2025 and will add another billion by 2050. This projected increase is as many people who currently live in China and India. Continual population growth places high demands on the world's resources, as more people are demanding more goods and services. Equally significant, the large and rapidly growing economic powerhouses like China and India are accelerating their demand for energy and the goods and services it provides. Between just these two countries, over 3.5 billion people will be pushing their governments to promote rapid industrialization in order to meet the demands of their burgeoning middle classes. These are pressures that neither China nor India, nor any government for that matter, can resist for political reasons.

Economics aside, the combination of these two factors is also putting a heavy strain our world's delicate environmental balance. The problem is that the energy resources supplied today to meet a growing population's increasing needs for goods and services are mainly derived from carbon-based sources that have significant long-term impacts on the environment. Coal is the dominant fuel in Asia and accounts for 54 percent of energy used today. While this share will go down over time (to an estimated 44 percent share in 2030), the use of coal in developing Asia is expected to increase by nearly 40 percent by 2030.[2]

[1] U.S. Census Bureau estimate at www.census.gov/main/www/popclock.html

[2] Estimates from USAID ECO-Asia Clean Development and Climate Program, based on data from International Energy Agency, Asian Development Bank, and Asia-Pacific Energy Research Center

For example, the Peoples Republic of China in 2011 is over 70 percent dependent on coal for its total energy needs, and it is the fastest growing economy in the world. As energy needs increase, so does the degradation of the environment. Adding another 2.5 billion people over the next 40 years will magnify the imbalance even more.

Another consideration involves the political climate where carbon-based energy is extracted and consumed. For example, much of the global oil supply is located in geographic areas that regularly experience bouts of political instability. Think about Venezuela, Nigeria, Libya, and points throughout the Middle East. As we have seen time and time again since the oil crisis of the 1970s, any even minor disruption in the assured supply of oil, gas, or other energy sources can and will have a significant impact on global prices.

And the trends of oil import dependency are going in the wrong direction. Over the past decade, oil imports to Asia have increased by 140 percent, and in 2010 the Asia region imported 60 percent of its oil.[3] China's dependence on foreign oil is expected to keep rising, reaching 65 percent by 2015 and 80 percent by 2030.[4]

For all of these reasons, the current global energy mix, which is primarily carbon-based, is untenable over the long run. China, India, and other nations need to find alternate ways to fulfill their energy demands. The only real answer — and our best chance to bring balance back to the environment — is to turn toward alternative sources of energy, which can at least in part replace existing coal and oil sources.

The most cost-effective way of weaning ourselves from fossil fuels is through energy efficiency, and this can be done by taking actions to make homes, buildings, factories, and our transport systems more efficient.[5] But at the same

[3] National Association of State Energy Officials, "What's Hot in Trade and Imports," available at: http://www.naseo.org/committees/energyproduction/oil/Trade_Hot.htm#What's%20Hot:%20The%20Asian%20Magnet

[4] Estimates for China's oil import dependency in 2030 range from 75%-82% based on these references: The World Bank, "Winds of Change: East Asia's Sustainable Energy Future," available at: http://www.recoalition.com/re2010/userfiles/files/Winds%20of%20Change%20(Full%20Text).pdf and Japan Times, "What is Beijing willing to do to secure oil and gas supplies?" (stating US Dept. of Defense predicts oil imports will amount to four-fifths of oil consumption by 2030), available at: http://search.japantimes.co.jp/cgi-bin/eo20101227mr.html

[5] Based on estimates in International Energy Agency (IEA), World Energy Outlook 2010

time, it is also important to aggressively develop the most feasible alternatives for supplying sustainable fuel and power directly – through renewable energy. Some examples of renewable energy with real potential are solar, wind, hydro, biomass, biogas, and tidal. While some of these technologies have been commercialized and entered the market, none of them has yet reached anywhere near their full economic and market potential.

Such renewable energy sources cannot become commercially viable without long-term financial incentives and comprehensive pricing policies backed by national governments around the world. Just the sheer size of the capital investments required in order to develop and exploit renewable energy demands that governments underwrite part of those costs, at least initially. This includes government-backed targeted incentives and grants for research and development of these emerging technologies, funding renewable energy demonstration projects, and adopting tax regimes for renewable energy that will attract private investors over the long run. Without the right policies and regulatory incentives, renewable energy sources are unlikely to succeed in Asia or elsewhere.

Globally, investments in clean energy have quadrupled over the past five to six years, from USD46 billion in 2004 to USD173 billion in 2008, and then falling slightly to USD162 billion in 2009.[6] And the upward trend is expected to continue, as technological developments, in combination with the policies and incentives mentioned above, boost the market for clean energy. The total expected investment in clean energy, for just the G-20 countries alone, is expected to be USD2.3 trillion over the next 10 years.

The real growth in global energy demand will occur in developing Asia — most notably China and India — which will demand access to greater and greater levels of energy over the next several decades. The overall demand for energy in the developing Asia region is expected to increase by 65 percent in the next 20 years, and electricity consumption is expected to increase by 114 percent.

Given these strong trends, we wanted to find out where key countries in Asia stand now on renewable energy as a workable alternative and what we can expect in the future.

[6] UNEP, 2010, Global Trends in Sustainable Energy Investment 2010. Sustainable Energy Initiative (SEFI), in cooperation with Bloomberg New Energy Finance

In order to find the answers, we approached 12 of the leading Asian law firms and asked each to comment on 10 basic questions about renewable energy policies and the regulatory framework in their individual countries:

1. *What are the driving factors for increasing renewable energy production?*
2. *Which renewable energy sources are viewed as the best opportunity for your country and why?*
3. *What role does your government play in regulating the energy industry? Describe the regulating environment and trends in deregulation in your country.*
4. *What agencies or bodies of government oversee the energy sector? What goals or mandates has your government set for electricity generation or fuels production from renewable sources?*
5. *What are the opportunities for private ownership (vs. public ownership) in clean energy development and technologies?*
6. *What is the level of government investment or what incentives are in place to support these goals and targets?*
7. *What kind of emphasis is placed on researching and developing renewable energy technologies versus looking to outside energy resources?*
8. *Is your country on track to be a clean energy importer or exporter from the standpoint of power production supply and manufacturing?*
9. *How developed is your country's workforce to support innovation, development and the production of renewable energy?*
10. *What are the key barriers to increasing renewable energy as a part of your country's energy mix?*

Each chapter of this book is devoted to insights on a specific country in Asia. Our hope is that this book will spark the beginning of an ongoing dialogue among government officials and planners, venture capitalists, individual entrepreneurs, researchers, multinational corporations in the energy sector, and NGOs as they focus their attention on how best to accelerate the deployment of renewable energy resources in Asia and elsewhere. The stakes are high for all of us. We cannot afford to step back from the challenges and ignore the great opportunities renewable energy technologies offer.

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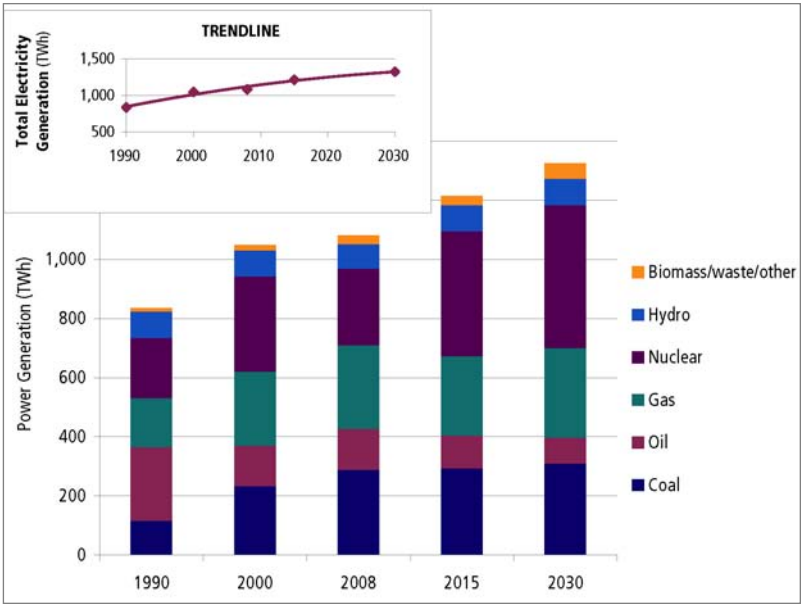
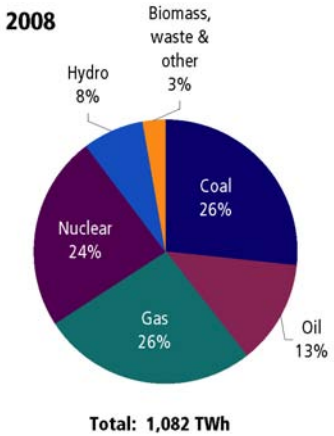
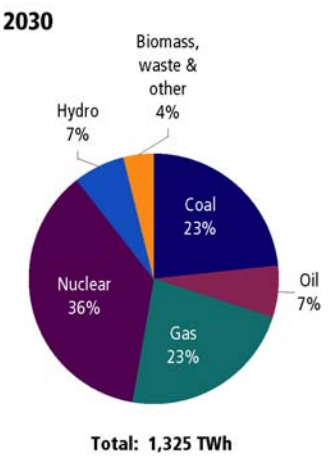
USAID's ECO-Asia CDCP program uses policy and market interventions to promote the scale up of investment and implementation in clean energy in developing Asian economies. The program is active in China, India, Indonesia, the Philippines, Thailand, and Vietnam. ECO-Asia CDCP partnered with Meritas in the development of this guide as part of its Asia Clean Energy Policy and Regulatory Dialogue, which is aimed at building capacity in the region to design and implement effective policy, regulatory, and legal frameworks for energy efficiency and renewable energy.

Electricity Generation by Fuel Type: Japan







Source: Asian Development Bank, International Energy Agency, Asia-Pacific Energy Research Center, and The World Bank

1. What are the driving factors for increasing renewable energy production in Japan?

Japan is heavily dependent on imported energy. One of the driving factors in Japan for increasing renewable energy production is the necessity to diversify energy sources in order to enhance national energy security. Japan needs to secure efficiency of energy and contribute to countermeasures against global warming as well. It's important to note that this chapter was prepared before the massive 11 March 2011 earthquake and tsunami in eastern Japan that resulted in the crisis at the Fukushima Nuclear Power Stations. It is generally anticipated that this crisis will encourage movement for renewable energies to replace nuclear power, but at the time of printing it is premature to discuss details.

Japan imports nearly all fossil fuel consumed in the country. Oil and LP gas are imported mainly from the Middle East. Natural Gas comes from South East Asia, Australia, and the Middle East. Coal comes from Australia. Energy domestically produced in Japan, which constitutes only four percent of energy consumed in Japan, is limited to hydraulic power, geothermal power, wind power, and natural gasses, etc. Even adding atomic energy, which is produced in Japan using imported uranium, the percentage of conventional energy self-sufficiency in Japan was no more than 18 percent[1] (in 2007).

As such, more than 80 percent of the energy consumed in Japan depends on imported fossil fuel. Considering recent wild fluctuations in the prices of fossil fuel (especially oil), rising resource nationalism, and increase in demand for energy in China, India, and other newly developing countries, as well as the global demand to reduce CO_2 emissions from fossil fuel, Japan is facing continuing potential risks to the stability of energy supply.

Based on such recognition and from the viewpoint of diversification of energy sources, as well as securing efficiency of energy, and contributing countermeasures against global warming, the Japanese government has declared in its recent Strategic Plan for Energy (see section 3) to aggressively expand production and utilization of renewable energy in

[1] As per IEA, Energy Balances of OECD Countries 2009 Edition. http://www.enecho.meti.go.jp/topics/hakusho/2010/2.pdf

Japan. The plan states that the introduction of renewable energy, atomic energy, and other non-fossil resources are urgent issues. Among them, the introduction of renewable energy is deemed one of the most effective means to enhance the national energy security, construct a new society and industries, and invite new economic growth and market expansion.

2. Which renewable energy sources are viewed as the best opportunity for Japan and why?

Japan is heavily dependent on imported energy, and 99.7 percent of its oil is imported. Since Japan experienced oil shocks in the 1970s, it has improved energy efficiency in all sectors and has focused on development and prevalence of renewable energy for a long time. Solar photovoltaic is the most promising renewable energy resource in Japan. Because of its advanced technologies (for example, technologies regarding solar photovoltaic cells), Japan was leading in solar photovoltaic generation until the end of 2004. While Japan was overtaken in its first position in the photovoltaic generation by Germany in 2005 due to the huge worldwide expansion of the solar photovoltaic market, Japan still retains third position (in 2009) in the amount of solar photovoltaic generation. Global photovoltaic generation was 20.38 GW in 2009 and Japan's share was 13 percent (Germany had 48 percent and Spain 17 percent)[2]. Besides the development in Germany and Spain, other countries, such as Italy, the United States, Czech Republic, Belgium, France, Canada, Australia, etc., continued their progress in 2009. Japan also developed the market with 484 MW installations. Japan is now attempting to regain lost ground by renewal of subsidies and the Japanese version of the Feed-in Tariff (see section 6 for details).

Wind-generated electricity is expected to develop along with solar photovoltaic. In 2010, Japan was the 12th largest producer of wind energy in the world. Production of wind energy has increased about 10 percent per year from 2006 to 2009. Recently, the New Energy and Industrial Technology Development Organization (NEDO) started to experimentally study floating wind production facilities. (See section 8 for additional information about NEDO.)

[2] Static from Federation of Electric Power Companies of Japan
http://www.fepc.or.jp/future/new_energy/jisseki/index.html

3. What role does the government play in regulating the energy industry? Describe the regulating environment and trends in deregulation.

As mentioned above, Japan is addressing the urgent task of reform of the construction of energy supply, aiming to decrease dependency on imported fossil fuel, ensure stability of energy supply, and cope with global warming. To tackle such task, the Ministry of Economy, Trade and Industry of Japan (METI) mapped out the Strategic Plan for Energy (Strategic Plan) under the Basic Act on Energy Policy, for the purpose of promoting comprehensive and systematic policies for energy supply and demand. The Strategic Plan was modified in 2007 and again in June 2010, the latest version of which now sets the goals and mandates of the government for electricity generation and fuel production from renewable sources as outlined in section 4. In line with the Strategic Plan, the Japanese government enacted the following laws and regulations to lead the private sector and other institutes in regulating the energy industry:

RPS Act

In 2003, an "Act on Special Measures Concerning New Energy Use by Operators of Electric Utilities" (so-called "Renewable Portfolio Standard" and "RPS Act" for short) was enacted, requiring electric power companies to use renewable energy up to a certain percentage decided in proportion to quantity of supplied electricity in the previous year (see section 6 for detail). The RPS Act also serves as a basis of the Japanese version of the Feed-in Tariff. A buy-out system of surplus electricity produced by renewable energy, similar to the Feed-in Tariff, for other energy production than solar photovoltaic is presently being studied (see section 6 for details).

Act on Constitution of Energy Supply

In 2009, a new "Act on Constitution of Energy Supply" was enacted, requiring gas companies and petroleum companies in addition to electric power companies to cooperate using renewable energy and to promote efficient use of fossil energy resources. This Act, the full name of which is the "Act on Acceleration of Utilization of Non-Fossil Fuel Energy and Effective Utilization of Fossil Fuel Energy by Energy Supply Business Operators," obliges electric power companies, gas supply companies, and petroleum companies to accelerate their use of non-fossil fuel, as well as to efficiently use fossil fuel. The Act aims to secure a stable supply of energy

into the future. As for non-fossil fuel, the Act requires expansion of solar photovoltaic power and atomic energy. Each of the electric power companies is obliged to make a plan to increase the use of non-fossil generation resources and increase the ratio of non-fossil generation resources including solar photovoltaic power and nuclear power up to 50 percent or higher by 2020 (in electric utilities). Each of the gas companies is obliged to make a plan to increase the use of biogas up to 80 percent of the estimated total volume of gas to be generated from sewage-treatment plants, etc. Petroleum companies are also obliged to make a plan to increase their use of bio-ethanol. Electric power companies, gas companies and petroleum companies shall all take necessary measures to realize such plan.

Many electric power companies have already started undertaking various efforts. For example, the biggest electric power company in Japan, Tokyo Electric Power Company, set up the long-term vision, and plans to make capital investment in the total amount of JPY2,500,000 million for the next 10 years for the purpose of achieving low carbon power generation and increase the ratio of electric energy from non-CO_2 emission up to 50 percent or more. They intend to introduce solar photovoltaic power, wind power and other renewable energy, which will include development of new renewable energy power supply of 400,000 KW in addition to the current 280,000 KW. As to photovoltaic power generation, the company plans to newly start the operation of "mega-solar" power generation plants in Kawasaki-city and Kofu-city in 2011 or 2012.

Gas companies also have started introducing renewable energy. Two gas companies in Kanazawa-city and Nagaoka-city are already purchasing and distributing biogas. Other gas companies, such as Tokyo Gas Co., Ltd. and Osaka Gas Co., Ltd., started in 2008 a system of purchasing and accepting biogas produced by their customers. At present, purchase of biogas has not yet grown in large scale. However, it is encouraging that the biggest gas company in Japan, Tokyo Gas, started accepting biogas derived from food residue, which is the first attempt in Japan.

4. What agencies or bodies of government oversee the energy sector? What goals or mandates has the government set for electricity generation or fuels production from renewable sources?

The Ministry of Economy, Trade and Industry (METI) oversees the overall energy sector in Japan. As an extra-ministerial bureau of METI, the Agency for Natural Resources and Energy (ANRE), plays a main role in promoting Japan's renewable energy. ANRE has jurisdiction over the stable supply of energy, renewable energy, and energy saving.

ANRE leads and funds a large number of policies in the renewable energy or the energy saving area such as: (a) the establishment of subsidies available to individuals or companies that set up solar photovoltaic systems for residents; (b) the introduction of tax reductions when people or companies set up solar photovoltaic systems for up to 10 percent of the price of solar photovoltaic systems; (c) the implementation of the assessment of possible introduction of energy saving systems to factories of small-scale enterprises for the purpose of driving energy saving of small-scale enterprises.

The Environment Ministry also has jurisdiction over policies regarding renewable energy for purposes of the environment, such as reducing CO_2 emissions by promotion from renewable energy sources. They have led to the establishment of the Japanese version of the Feed-in Tariff. Now, they are promoting electrical vehicle use for the purpose of reducing CO_2 emissions by promotion of electrical energy as a renewable energy.

In the latest Strategic Plan, METI lays out the goals and mandates of the government with respect to the energy composition, including the ratio of electricity generation and fuel production from renewable sources, as outlined below.

The conventional energy self-sufficiency (18 percent, currently) will double in 2030. In addition, the energy independency ratio (which means the ratio of the conventional energy self-sufficiency plus the ratio of energy obtained from foreign sources developed by the Japanese government or Japanese entities) will become approximately 70 percent (38 percent, currently) by doubling the self-developed fossil fuel supply ratio (26 percent, currently).[3]

3 http://www.meti.go.jp/english/press/data/pdf/20100618_08a.pdf

The plan also set a goal to be attained in 2020 covering 10 percent of the primary energy needs by renewable energy in the course of attaining such targets in 2030. Key points of the Strategic Plan[4] are as outlined below.

Basic perspectives

In addition to the three fundamental principles of national energy policy (energy security, energy conservation, and efficient supply), the Strategic Plan focuses on new perspectives: economic growth based on energy and structural reform of the energy industry.

Targets for 2030

- Double the energy self-sufficiency ratio in energy supply and the self-developed fossil fuel supply ratio, and as a result raise the energy independence ratio from current 38 percent to about 70 percent
- Raise the zero-emission power source ratio from current 34 percent to about 70 percent
- Half CO_2 emissions from the residential sector
- Maintain and enhance energy efficiency in the industrial sector at the highest level in the world
- Maintain or obtain top-class shares of global markets for energy-related products and systems

Specific measures to achieve the targets

- Comprehensive efforts to secure resources and enhance supply stability
- Establishment of an independent and environmental-friendly energy supply structure
- Establishment of a low carbon energy demand structure
- Building next-generation energy and social systems
- Development and diffusion of innovative energy technologies
- Enhancement of international cooperation on energy
- Pursuit of structural reform of the energy industry
- Facilitation of mutual understanding with the public and development of human resources
- Division of roles among local governments, businesses, and non-profit organizations and citizens' commitment

[4] http://www.meti.go.jp/english/press/data/20100618_08.html

5. What are the opportunities for private ownership (vs. public ownership) in clean energy development and technologies?

Deregulation of Electric Utilities Supply

All electric power companies in Japan are private companies, subject, however, to the regulations under the Electricity Business Act. In the last 15 years, through a series of amendments to the Electricity Business Act, deregulation of electric utilities has been promoted. Companies other than existing electric power companies are now permitted to sell surplus electricity. Retail electricity liberalization started in 1995 with the amendment of the Electricity Business Act. The Electribity Business Act was amended again in 2000 and 2004, and the scope of retail elctricity liberalization has been expanded little by litle. Over 60 percent of electricity use classes, such as electricity for household use or institutional use, were liberated in 2005. For example, an industrial company that generates electricity from hydropower can sell the excess power to existing electricity companies. The intent of the deregulation is to promote the production of renewable energy by small-scale enterprises and therefore to stimulate the renewable energy market. However, there is some thought within Japan that such relaxation of regulations will not promote renewable energy by small-scale enterprises due to the fact that the cost for transmission systems is too high.

Restrictions of Foreign Ownership

With regard to opportunities for private ownership of electric power companies by foreign investors, there are restrictions of foreign share ownership of electric power companies. There is an example of a share purchase being called off based on Article 27 (10) of the Foreign Exchange and Foreign Trade Act when a foreign company tried to purchase a Japanese electric power company's shares. The restriction is applied when the share purchase is judged as influencing national security or maintenance of public order. However, a share purchase of small-scale enterprises would not likely influence national security, so the above restriction would not likely be applied to foreign share purchases of small-scale enterprises.

6. What is the level of government investment or what incentives are in place to support these goals and targets?

In Japan, a variety of active support is being offered to business and nonprofit organizations, etc. that are introducing renewable energy. As mentioned above, the Japanese version of "Feed-in Tariff" system started in November 2009 as an attempt to increase introduction under the RPS Act. In addition, the private sectors are able to enjoy the support for their independent approaches such as utilization of so-called "Green Power Certificate" as described below. Research and development of technologies for the renewable energy is also promoted.

Japanese version of "Feed-In Tariff" under RPS Act

RPS Act obliges electric power companies to purchase excess photovoltaic power. Under this Act, the surplus electricity purchasing scheme for photovoltaic power started in November 2009 to promote the use of photovoltaic power.

This system covers the purchase of surplus electricity of photovoltaic power. If people produce more electricity than they consume in their home, office, etc., then people can sell such surplus electricity to electric power companies for a 10 year period at a fixed price designated in the regulations (current unit price is JPY48 per 1 KW; however, the unit price will go down from year to year to give people incentive to introduce photovoltaic systems to their homes and offices). The costs of purchase of surplus electricity will be shared by all consumers who purchase electric power from the electric power company in proportion to the volume of electricity they have used.

In addition, an all-quantity buyback program is currently being studied by a project team set up by METI. Under the currently planned program, electric power generated at all of the following plants will be purchased by electric power companies at fixed prices for a period of 15 to 20 years, in addition to the surplus electricity of photovoltaic power which is covered by the present program: (a) photovoltaic facilities, including so-called "Mega-Solar" facilities for business use: (b) wind-power stations: (c) small- or medium-scale hydroelectric facilities: (d) geothermal power plants; and (e) biomass power stations. METI plans to launch the all-quantity buyback program in fiscal year 2012.

Green Power Certificate

The system of "Green Power Certificate" involves a mechanism to trade in the form of the certificate for "a value other than that of electricity itself (=environmental added value)" contained in the electric power generated by using wind power, sunlight, biomass, water power, and geothermal heat ("Green Power"). As the enterprises and organizations that purchased such certificate can be deemed to have used the Green Power, this mechanism is utilized in the electric power consumed in offices, broadcast stations, and so forth. By the Green Power Certificate economic merit accrues to the power generator, leading to further increase in the dissemination of new energy, etc.

Subsidies

METI re-established a subsidy system in 2009 following the abolishment of a former subsidy system that was created in 2005. The purpose of the subsidies is to promote price reductions for solar photovoltaic systems for Japanese residents and to develop the market. The subsidies are available to individuals or companies that set up solar photovoltaic systems for residents.

Tax Reductions

If the solar photovoltaic system does not satisfy the requirements for receipt of the subsidy (subsidies depend on the price of the solar photovoltaic system), there is the possibility of a tax reduction of up to 10 percent of the price of solar photovoltaic systems.

Penalizing CO_2 Emissions

As of 2010, there are no material restrictions on CO_2 emissions in Japan at the level of the national government, but a restriction is presently being studied by the national government. However, the Japanese government has set ceilings on the amount of CO_2 emissions permissible for large companies that create CO_2 emissions exceeding certain amounts. A legislative bill including restrictions was submitted to the Japanese Diet in 2010 (not yet passed). In addition, some local governmental bodies in Japan have set up restrictions of CO_2 emissions. For example, the Tokyo metropolitan government obliges large-scale establishments to reduce CO_2 emissions and assigns the rate of reduction of CO_2.

In addition, a large number of industrial groups implement self-restrictions regarding CO_2 emissions under the leadership of Nippon Keidanren, the comprehensive industrial organization in Japan, comprised of almost all major Japanese companies, industrial associations, and regional economic organizations. Nippon Keidanren announced its Voluntary Action Plan on the Environment in 1997, and each industrial group set a goal of reducing CO_2 emissions, improving CO_2 consumption rates, and/or improving the saving of energy under the Plan. Nippon Keidanren analyzes, evaluates, and reports the results of each industry's effort every year.

These restrictions are incentives for increasing renewable energy.

Support to R&D

In addition to the above, as mentioned in section 9, the Japanese government, through several entities (such as NEDO), provides companies, universities, and other institutes with support with respect to their research and development activities.

7. What kind of emphasis is placed on researching and developing renewable energy technologies versus looking to outside energy resources?

While the Japanese government, with private sectors, invests a great amount of effort and funds to secure energy resources outside Japan, such as developing and/or financing of new oil fields, it also pursues development of renewable energy technologies to promote the diversification of energy sources. For example, as already mentioned, Japan is a global leader in the technology for solar photovoltaic.

8. Is Japan on track to be a clean energy importer or exporter from the standpoint of power production supply and manufacturing?

Because of geography, Japan will not export or import large amounts of renewable generated energy. Japan, however, can be a major exporter of technology to produce renewable energy. Japanese companies are

advancing efforts in joint-venture businesses with overseas companies and in business operations taking advantage of their technological advantages.

Major examples of participation of Japanese companies in overseas projects are described below[5]:

Mitsubishi Heavy Industries, Ltd. (MHI): Wind power generation (Britain)
MHI and its motor section headquarters in Europe, Power Systems Europe (MPSE), signed a memorandum with the British government to work for a demonstration and development project of offshore wind turbines with subsidies from the Department for Business, Innovation and Skills (BIS). This is the first time for a Japanese manufacturer to enter the offshore wind turbine market.

Sumitomo Corporation: Photovoltaic power generation (Spain)
Sumitomo Corporation started operation of mega solar (large-scale photovoltaic) power plants in Tenerife Island in the Spanish Canary Islands, which have been aggressively introducing wind power and photovoltaic power generation in recent years with the view of protecting environmental resources. This is the largest power plant in the world with an output of 12.6 MW among the power plants operated mainly by a Japanese company. Sumitomo procured photovoltaic panels manufactured by Sharp Corporation.

Sharp Corporation: Solar cells (Italy)
Sharp made a joint venture contract related to the business of manufacturing thin-film photovoltaic cells with Enel Green Power (EGP) and STMicroelectronics, and a joint venture contract for independent power producing business with EGP.

Mitsubishi Corporation: Photovoltaic, solar heat, and wind power (Spain)
Mitsubishi Corporation is jointly developing and operating a new energy power generation business with Acciona, which owns new energy power generation facilities with an output of approximately 7 million KW.

NGK Insulators Ltd.: NAS cells (UAE)
NGK received an order for a sodium-sulfur (NAS) battery system with the output of 50 MW from the Abu Dhabi Water and Electricity Authority of

5 http://www.meti.go.jp/english/press/data/pdf/20100615_04a.pdf

the United Arab Emirates. Operation of gas turbine electric generators has been made more efficient by leveling the electric load using energy efficient NAS batteries with high energy density. NGK is studying the future application for the Abu Dhabi Emirates where demand for electric power is expanding remarkably and for large scale photovoltaic power generation.

Showa Shell Sekiyu K.K.: Photovoltaic (Saudi Arabia)
Showa Shell started a feasibility study with the national oil company, Saudi Aramco, on a small-scale distribution power generation business utilizing solar light in Saudi Arabia.

Eurus Energy: Wind power generation, etc. (Europe and America)
Eurus Energy, a joint venture company between Tokyo Electric Power Company and Toyota Tsusho Corporation, will build and operate new power generation plants with the total output of one million KW in the coming five years.

9. How developed is Japan's workforce to support innovation, development and the production of renewable energy?

The workforce supporting innovation, development, and production of renewable energy is scattered over the private sectors of energy industries and machine manufacturers (such as manufacturers of solar photovoltaic cells), universities, and all other business or nonprofit organizations. One driving force and leading organization that plays a role as a bridge among such private sectors, universities, and other organizations are the government-affiliated agencies. Among such agencies, NEDO (as mentioned in section 2) and the National Institute of Advanced Industrial Science and Technology (AIST), etc., play initiative roles with regard to the research and development of renewable energy technologies.

NEDO[6]
NEDO is a project management organization, which does not own its own R&D center, but executes its research and development activities, as a sponsor, by commissioning research projects to private companies and research institutes, as well as universities.

[6] Please refer to NEDO's homepage: http://www.nedo.go.jp/english/index.html
http://www.nedo.go.jp/kankobutsu/pamphlets/kouhou/2008gaiyo_e/180_181.pdf

NEDO carries out the industrial technology development activities which relate to renewable energy, such as national projects dealing with high-risk technological themes that are difficult for private enterprises to address by themselves and that require a medium- to long-term development period before practical application (for example, verification tests of smart grid, development of electrical accumulator, development of fuel battery); practical application and commercialization promotion activities aimed at immediate market creation and economic revitalization; and technology seed development activities to promote promising new technologies at universities and public research institutes.

In most cases, the companies, institutes, or universities which join the research and development projects which NEDO carries out are decided through tender procedures open to the public. NEDO also accepts the dispatch of experts from companies and universities and contributes to the promotion of development of technologies regarding renewable energy. (There are almost 1,000 researchers and officers who are in charge of planning and arrangement of research and development activities in NEDO, and most of them are dispatched from companies and universities.)

The budget scale of NEDO is relatively large; JPY209,700 million (which included budget for R&D activities in the amount of JPY128,800 million) in fiscal year 2010.

AIST[7]

AIST specializes in research and development in the field of industrial technology. Unlike NEDO, AIST has over 40 autonomous research units, which are located at nine research bases and several sites throughout Japan, in various innovative research fields. About 2,400 researchers (about 2,100 with tenure, and about 80 from abroad) and thousands of visiting scientists, post-doctoral fellows, and students from home and abroad are working at AIST.

AIST's activities cover the technology of expansion of the use of renewable energy, energy saving, securing effective use of natural resources, and reduction of environmental loads.

The results of research and development, such as patents, copyrights, and other intellectual properties acquired through the research and

[7] Please refer to AIST's homepage: http://www.aist.go.jp/aist_e/about_aist/index.html

development at AIST are transferred to the society and companies. AIST supports the commercialization of its research and development results by providing companies and engineers with the joint research, technical assistance, consultation, and training. It also supports setting up of venture capital entities and provides financial assistance.

The budget scale of AIST is relatively small compared to NEDO, but it still amounted to around JPY80,000 million in fiscal year 2010.

10. What are the key barriers to increasing renewable energy as a part of Japan's energy mix?

Key barriers to increase renewable energy in Japan are the geographical restrictions peculiar to Japan, high costs, and instability in its supply.

Geographical Restrictions

The geographical characteristics of Japan, such as the limited space suitable for large-scale facilities, make it difficult to construct large-scale facilities for renewable solar energy. It is essential to develop technologies to generate energy more efficiently so that it is possible to generate enough energy even at small-scale facilities.

High Cost

The costs of development and introduction for renewable energy are very high for companies or individuals at present. The Japanese government is trying to cover the costs to companies or individuals by subsidies and introduction of the Feed-in Tariff system.

Instability of Supply

A general problem of renewable energy is that wind and solar power are both subject to natural conditions and the variability of these resources makes the electricity sources unstable. To conquer the instability, the energy has to be used as efficiently as possible.

Smart grid is one of the solutions to secure the stability of energy supply and maximize the energy efficiency. As referred to in section 9, NEDO, one of the governmental agencies, is now making large-scale verification tests to establish smart grids in Japan.

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