

Symposium on "Challenge to the Future"

The Green New Deal

– How will the world and Japan change? –

REPORT

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- Organizer: **Japan Science and Technology Agency (JST)**
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Japan Science and Technology Agency

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Objectives of the Symposium

The so-called “Green New Deal policy” which President Obama proposed is exercising a significant influence to the world. The U.S. is envisioning the employment of around 5 million people by doubling natural energy such as those from solar power or wind power generation in three years, spreading the use of home-rechargeable “plug-in hybrids vehicles” to 1 million vehicles by 2015, and this policy is also referred to as the “New Apollo Program” of the 21st century. Furthermore, the U.S. is drastically boosting the environment, technological development and economic stimulus programs through “economic stimulus legislations” that amounts to a total of 780 billion dollars (about 72 trillion yen), such as the innovative electrical transmission and distribution network (smart grid) that adopts leading technologies, energy-saving at public facilities, subsidies on research to develop high performance batteries for automobiles, etc. Germany, France, England, China and Korea are all concurrently moving to prioritize investments in environment/energy fields. Since the wave of the “Green New Deal” could not only bring new business opportunities to the industrial world, but could also decide the shape of the earth’s future, it is also expected to lead to a significant innovation in international politics and how international cooperation should be conducted. At this symposium we would like to search how the Japanese business community, universities, Japan as a country and its citizens should respond within this big wave, and what path Japan should take in the future.

Opening Remarks by the Organizers



Koichi Kitazawa

President, Japan Science and Technology Agency (JST)

“What is the ultimate purpose of human life?” That is the question that discussions on global environmental issues eventually lead to. One may argue that every human being has a different purpose and way of living, but there must be something that binds us all--all human beings are confronted by the same global environmental issues. During their lifetime, humans pass on their genes to their offspring, and I am sure that no one will dispute the importance of looking after the Earth carefully and preserving the environment so that we may share it, rather than fight over it, with future generations. Costs associated with these actions should not be an issue here.

To achieve this, we must first establish environmental policies, and then work out, in detail, a rational and economically feasible action plan. This will also determine specific strategies for technological development.

This symposium was inspired by the Obama administration’s Green New Deal strategy. I was extremely surprised when John Holdren, a Professor at Harvard University and a strong advocate of nuclear disarmament, was appointed advisor to President Obama for Science and Technology. President Obama has campaigned to lead mankind away from nuclear weapons, and with regard to environmental issues too, the world is now set to take sweeping action. Unlike Europe, Japan still has natural forests and woodlands situated near populated areas. Traditionally too, the Japanese people have adapted to nature, and many of the world’s leading environmental technologies were developed in Japan. Drawing inspiration from this, we must now try to link these achievements to Japan’s future industrial and economic revival.

I look forward to seeing such discussions taking place today.

Guest Greetings

Global environmental problems are top-priority issues that the world must address through concerted action.

Setting reduction targets for greenhouse gas emissions and providing technological and financial assistance to developing countries are some of the major issues with regard to measures to help reduce global warming. In the background to these issues is research and development in environment and energy related fields.

Japan has set the goal of reducing greenhouse gas emissions by 25% by 2020, compared to 1990 levels. In order to achieve this goal, measures are being taken to promote “green innovation,” namely, the research and development of the world leading, innovative environmental and energy-related technologies and the widespread application of the results. The Council for Science and Technology Policy has also adopted this approach in its policy for resource allocation.

To broadly promote research and development for “green innovation,” the Japanese Ministry of Education, Culture, Sports, Science and Technology has formulated a comprehensive R & D strategy for the creation of a low-carbon society. To date, the Ministry has engaged in various activities to study the actual status of global warming by collecting and analyzing observation data from man-made satellites and research vessels and using simulation models and other means to forecast global climatic changes and to conduct research and development of nuclear power as a long-term energy generation technology.

The comprehensive R & D strategy includes mitigation measures such as the development of advanced technologies that will enable further energy conservation and CO2 emissions reductions, and the creation of low-carbon societies. The strategy also promotes the research and development of leading-edge low-carbon technologies and the creation of social scenarios that incorporate the correlated, synergetic effect between technical systems and social structures and lifestyles, with the aim of achieving further reductions in CO2 emissions of 60 - 80 % by 2050.

Research and development organizations such as the Japan Science and Technology Agency and universities play a major role in achieving these goals. Through cooperation and collaboration with related authorities and the industrial world, we will endeavor to contribute to the achievement of these reduction goals while striving to achieve balance in enhancing and maintaining international competitiveness.



Shinichiro Izumi

Director General,
Science and Technology
Policy Bureau,
Ministry of Education,
Culture, Sports,
Science and Technology (MEXT)

Challenging the Energy-Climate Continuum

- Are Big Steps Big Enough-



Gerald Hane

President and CEO, Battelle-Japan

Today, many of the advanced nations of the world are facing a severe economic crisis. For this reason, their economies may not be able to respond effectively to environmental issues on a global scale. This underscores the importance of making the Green New Deal a success. Implementing these initiatives, however, is difficult.

Firstly, the Green New Deal is comprised of two major parts – the “Green” and the “New Deal” aspects. Why were the two combined?

“Green” was a central Obama priority even during his presidential campaign. Topics such as war in the Middle East, healthcare reform, and revisions to national energy policies were initially the focus of his presidential campaign, but the massive housing crisis and the stock market crash that took place during the later stages of the campaign shook the entire economy. These events prompted the drafting of the “New Deal” strategy, resulting in the Green New Deal strategy.

Initiatives under the Green policy are firstly, to provide immediate relief from cost of energy, followed by measures to incentivize markets, set regulations and standards, promote primary energy mix, offer tax incentives, provide financing, invest in research and development, and improve energy infrastructure.

The Obama administration has put forth its official energy policies in a new plan, titled “New Energy for America.”

In the plan, Obama proposes to provide short-term relief to American families by cracking down on excessive energy speculation; increase fuel economy standards and get one million plug-in hybrid cars on the road by 2015 in order to eliminate current imports from the Middle East and Venezuela within 10 years; create a new \$7,000 tax credit for purchasing advanced technology vehicles; establish a national low-carbon fuel standard; promote new green jobs by ensuring that 10% of US electricity comes from renewable sources by 2012, and 25% by 2025; weatherize one million homes annually to raise energy efficiency; prioritize the construction of the Alaska natural gas pipeline; implement a Clean Development Mechanism (CDM) program to reduce greenhouse gas emissions 80% by 2050; and make the U.S. a leader on climate change.

These concepts, however, are not necessarily new. Different types of studies and research have been conducted in the past on these issues. Further, state-level initiatives have been implemented with regard to the utilization of renewable energy. In other words, the Obama administration could emphasize these actions because the framework was already in place when they came into power.

The economic stimulus package proposed by the Obama administration is formally known as the American Recovery and Reinvestment Act of 2009. It includes more than \$80 billion in clean energy investments. This amount will primarily be concentrated on energy conservation and renewable energy-related measures. Investments in different areas, such as Carbon Capture and Storage (CCS) will be made based on annual plans. Funding will peak at a certain period, and this will stimulate the economy. Tax incentives for renewable energy facilities will be increased to \$14.0 billion, and additional financing of \$6.0 billion will be provided to

projects that avoid emissions of greenhouse gases. Further, as many renewable energy companies currently cannot claim tax credits because they have not enough profit, the Department of Energy (DOE) will provide tax grants that allow businesses that invest in building renewable-energy facilities to claim a government grant that covers 30% of the investment, rather than claiming a tax credit.

The budget for development of scientific technologies is set at \$11.0 billion. In addition to investments in smart grids that integrate electrical power systems, \$3.5 billion will be allocated to CCS verification plans. Other measures include funding for the Clean Coal Power Initiative, biomass research, and the U.S. Department of Energy's Advanced Research Projects Agency - Energy (ARPA-E). CCS verification plans center on the FutureGen Alliance, the world's largest and most advanced CCS project with a power generation capacity of 275 megawatts, in which DOE has already invested \$1.1 billion.

ARPA-E is another promising initiative that is scheduled to receive \$400 million in funding. On April 27, 2009, the Agency solicited preliminary ideas for projects to receive funding, and received 3,500 concept papers. 2% of these proposals will receive a total of \$150 million in grants. The first projects selected include Liquid Metal Grid-Scale Batteries and a biofuel program using bacteria and solar energy.

Other energy/environment policy measures include increasing fuel economy standards for Model Year 2011 cars and trucks, and raising appliance efficiency standards for household appliances such as washing machines, refrigerators and dishwashers. The plan also proposes the development of off-shore energy and increased electricity generation from wind, wave, and ocean currents particularly on the waters of the US Outer Continental Shelf.

The Executive Order on Federal Greenhouse Gas Emissions, that was issued on October 5, 2009, requires Federal agencies to set the 2020 greenhouse gas emissions reduction targets within 90 days, for example, 30% reduction in vehicle fleet petroleum use by 2020; and reduction of waste and increase of recycling rates by 50% by 2015. In addition, 95% of all applicable contracts must meet sustainability requirements. Implementation of the net-zero-energy building by 2030 will also be made a requirement.

The Innovation Systems Approach will be adopted to effectively integrate all of the above proposals. This approach will take the following steps into consideration: increase discovery, speed adoption, improve infrastructure, stimulate markets, and finally social impact. Market stimulation is particularly important to provide momentum for achieving energy goals.

Is the scale of spending sufficient to achieve the required market stimulation? After the economic stimulus is spent, will there be enough financing for domestic and international needs?

The thinktank, Gigaton Throwdown Initiative, projects that in order to reduce one gigaton of CO₂ in 2020, the investment required would be approx. \$1.8 trillion, three times that estimated in the BAU scenario (BAU in 2020: approx. \$600 billion). This will create 4.5 million direct jobs. CO₂ emissions reduction is estimated to be 5 to 7 gigatons. However, current technologies fall short of achieving the 2020 climate stabilization and achieving these targets, indicating the need for more investment than incentives.

The International Energy Agency (IEA) estimates that a \$10 trillion investment in renewable energy, biofuels and nuclear power over the next 20 years is necessary in order to stabilize greenhouse gas emissions. By 2030, 33% (triple the current figure) of energy would have to be from renewable sources,

including nuclear power. The government must consider how it will cover these costs.

The federal deficit and national debt are increasing sharply. Figures released last week indicate a national debt of \$1.4 trillion. As a result, the government is now dependent on revenues from cap-and-trade for investment in clean energy technologies.

Adopting the cap-and-trade approach until 2020, President Obama proposed a 17% cut in greenhouse gas emissions compared to 2005 levels by 2020 and 83% by 2050. A detailed bill regarding allocation of emissions allowances has been created by the House of Representatives, but specifics are yet to be determined by the Senate. With the support of regional state governments, however, almost half the states have reached agreements regarding cap-and-trade initiatives. Regional state governments and governing bodies are also actively promoting the Feed-In Tariffs (to give premiums of some sort to suppliers of renewable energy to power grids) policy mechanisms.

It will be difficult, however, to realize the New Deal with a single-sector approach, or to achieve green goals with only US efforts. Support for developing countries is also an issue.

To achieve an economic New Deal, it must be more than Green. To achieve our Green goals, we need more than a New Deal. A comprehensive methodology to make all of the above compatible with both US and international frameworks must be defined.



Societal Expectations and Change

(A New Definition of Researchers and a Research-oriented Nation)



Hiroyuki Yoshikawa

Director-General,
Center for Research and Development Strategy,
Japan Science and Technology Agency (JST)

Between 1950 and 1970, researchers all over the world clearly demonstrated the importance of maintaining environmental sustainability based on observations of the Earth. The Japanese society, government, and industry were the quickest to take necessary action. As a result, Japan's energy efficiency is the highest in the world today.

The new administration in Japan has declared its commitment to reduce CO₂ emissions by 25%. Based on our experience, here is how we should interpret this declaration: Japanese products sold worldwide, such as renewable energy devices, energy-saving devices and hybrid cars, are all well-suited to the concept of a sustainable world. In other words, they are all sustainable products. All other products are struggling in the international competition. Consequently, we believe that reductions in emissions are proportional to international competitiveness. Assuming that this trend continues to grow, reducing the emissions reduction target from 25% to 12% will mean a drop in international competitiveness by half. Thinking along these lines, the declaration to reduce CO₂ emissions by 25% is a declaration to raise international competitiveness of the Japanese economy.

This is an extremely crucial requisite for Japan's survival as a nation.

According to the UN World Population Prospects: The 2006 Revision, the population in developing regions of the world is increasing rapidly, while that in developed regions is not. Japan's population, in particular, is declining at a rapid pace and could shrink considerably in the future. Furthermore, the Japanese society is aging at an alarming rate. 40% of the population will be 65 or older in 2050. Under these circumstances, how do we realize societal expectations such as those visualized in Innovation 25?

Looking at the GDP of the nation as a whole, Japan ranks second in the world. In terms of the GDP per capita, however, it ranks 23rd. Per capita income projections estimate that salaries in Japan will approximately double by the year 2050, but salaries in larger countries such as Russia, Mexico, Brazil and China will increase to levels that are on par with Japan. This means that the GDPs of countries with large populations, including China, the US, India, Brazil, Mexico, Russia, and Indonesia, will grow larger. Japan is currently referred to as a 10% nation, but will become a 3% nation in 2050. How can Japan covering only 3% of the overall income of the world, develop its economy while maintaining international competitiveness? How will it contribute to the world through its significant presence?

The world today is confronted by two issues--an increasing population and economic growth, and shortage of resources and environmental deterioration. This is an unprecedented situation in the history of mankind. As mankind, faced by these common issues, progresses towards the realization of sustainability, we must keep in mind that Japan's future standing in the world will differ from its current position. In order to exist as a nation that contribute to the world while building a new future different from that of the past, the country needs intellectuals and creative thinkers who can constantly tackle new problems and determine what needs to be done through a creative approach, rather than just producing quality products at a low cost. This definition probably applies to today's researchers. But whatever the definition, I would like to propose that we increase the number of "creative thinkers" in the country.

The current generation of youngsters born into a prosperous country do not have the notion to become more prosperous. They like to do work that interests them, in a workplace where relationships are not restricted and free from the constraints of organization. The job of a researcher fits these conditions, and the current situation in Japan is just right to increase the number of researchers.

Societal expectations are based on the essential conditions of increased employment, industry competitiveness and a sustainable society. Many hidden demands exist that have not surfaced yet. But there are issues that are unknowingly growing, and they need to be resolved.

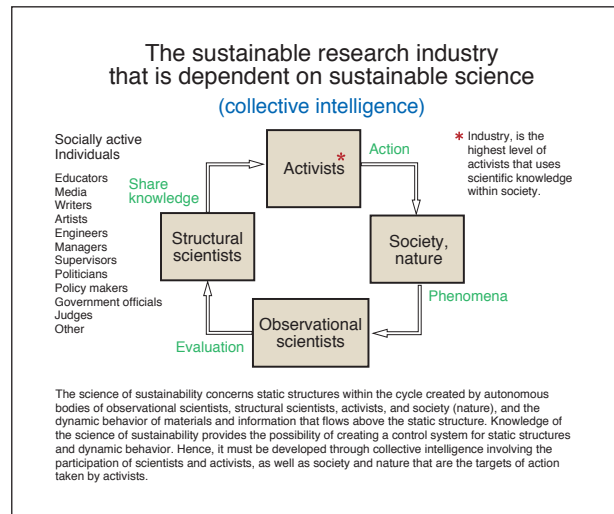
My proposal is to first enhance personnel, and increase the number of creative thinkers and intellectuals (researchers). Next, industry must focus on new businesses as the main force of industry that are supported by the work of researchers. This will bring about changes in industry structure and enable the comprehensive development of sustainable technologies and products.

What will be the role of the new researchers? In addition to increasing the number of researchers, it is important to first diversify the process of becoming a researcher. The definition of “researcher” as a profession must also be expanded. The term “intellectuals” must include people engaged in basic research and research assistants, as well as designers and entrepreneurs, and switching of jobs between these professions must be made possible. This will continually transform the hitherto narrow definition of “researcher” and “non-researcher.” Conventional researchers, as well as those included under the extended definition who enjoy thinking outside the box, can switch between being researchers at universities, designers who create innovative products or successful entrepreneurs. In other words, they can switch freely between different fields.

We know many young people who actually want to be able to do so. In reality, however, once they start work at a particular research center, they abandon their entrepreneurial dreams based on conventional thinking that they stand to gain more from lifetime employment at the same research center. The systems that are currently in place unfortunately restrict the growth of such talented individuals.

A country that is a leader in science and technology must have the necessary human resources to support those strengths. Firmly establishing the ideal image of these individuals and developing a concrete vision is crucial in communicating this need to younger generations. Although some people are of the opinion that the postdoctoral system leaves individuals nowhere else to go after joining universities or research centers, creating unemployment, but I think postdoctoral students are Japan’s treasures. As adults, we have the responsibility to create a society where these individuals can lead fulfilling lives.

Each observation must be carried out with regard to the relationship between two or more applicable items. For example, the introduction of a machine raised efficiency in a particular area; the adoption of a particular law improved the lives of people, etc. Modern science, however, does not allow discussions from a comprehensive perspective, such as for example, on the current effects on Japan due to such introductions in the past five years. To put it simply, the study of science has been divided into numerous disciplines, stemming from the lack of communication between disciplinary fields, but there is a very strong relationship between interdisciplinary problems and industrial structures. Scientists need to stop conducting segmented research, so that industry as a whole can make concerted efforts toward realizing sustainability. We need to think of sustainable science and industry as collective intelligence, and take a comprehensive approach. Collective intelligence is



indispensable to maintain the evolutionary cycle and realize sustainability. This may be said of both the manufacturing and service industries.

Looking forward to 2020, and further ahead to 2050, there are many changes that we need to realize. Conventional businesses to new companies, material-based industries to service industries, and from A to B in the field of research. And from competing for resources to sharing of resources, as exemplified by the excellent example of CO₂ emissions. Instead of fighting over this issue, we made joint efforts to reduce emissions. An altruistic economy originates from such efforts. We discovered a mechanism to achieve mutual benefits, not confrontation and war, through change. An altruistic economy focuses on such mechanisms.

The topic of this symposium is “How will the world and Japan change? From a different perspective, we must think of “what we can do to change the world?” “Can we bring about change?” Personally, I envisage an altruistic society formed by creative thinkers. To realize such a society, education, research, development, and industrial activities must be carried out based on altruistic considerations. We must create a society where public spending on education and basic research will be twice the current spending, and creative thinkers can lead fulfilling lives. Although, in a sense, Japan will become a relatively smaller nation due its shrinking population and rapidly decreasing number of younger people, we can draw on our rich history and contribute greatly to the world and to the sustainability of the Earth.

Summary



Masahiro Kuroda

President, Tohoku University of Community Service and Science

Developing and newly industrialized nations, and BRIC countries in particular, are widely expected to undergo remarkable economic growth in the twenty-first century. However, economic growth accompanied by dependence on demand for fossil fuels on par with current demand will likely result in an increase in the price of energy produced with fossil fuels above current levels and greater economic growth in oil-producing nations. At the same time, there will be deeper income disparities between and within countries and increasing global systemic instability. Furthermore, we will see a loss of biodiversity and a significant threat to the existence of life on Earth.

The Green New Deal is a challenge to address the medium-term issues facing humanity of structure of dependence on energy and the structure of economic growth, and what forms these should take, with a real emphasis on the long-term perspective.

In order to eliminate this dependence on energy from fossil fuels it will be necessary to step out of the heavy energy consumption we have seen to date, or create technological, industrial and social systemic structures that enable the same level of economic growth with smaller amounts of energy. To enable a potential transition to natural, renewable energy, transitional costs will need to be reduced and technological support structures for developing nations will need to be established. This is one course of action that will lead to benefits across the entire planet.

Another essential topic of discussion will be the appropriate utilization of nuclear energy and whether or not safety systems for nuclear power generation, and associated activities, can actually be applied globally, including in developing nations. In the not-too-distant future, back-end systems for the dismantling and disposal of nuclear power stations and of nuclear waste around the world will have to be addressed. The issues with nuclear power, separate to those on global warming, will be a major focus in terms of impact of mankind on the environment. All of the above issues will require deep deliberation. In addition, it is necessary to determine whether it is possible to deploy low-energy technologies more thoroughly.

To achieve that goal will require reflection on a society that understands the need for benefits to reach people all around the planet, otherwise it will not be possible for humanity to continue to develop sustainably. The debate surrounding the possibility of obtaining international agreement on the creation of global systems, the establishment of reductions targets and associated cost burdens will need to take into account the creation of benefits to humanity from a long-term viewpoint.

Finally, when considering the Green New Deal over the short to medium term, there are bound to be issues with the balance between benefits for the country and benefits for humanity across the planet as a whole.

Summary

Keigo Akimoto

Group Leader, Systems Analysis Group,
Research Institute of Innovative Technology for the Earth

Global CO₂ emissions are projected to increase dramatically going forward unless there is significant social innovation from the present social structure. And with continued economic development, CO₂ emissions are projected to rise to around 90 billion tons by 2050. At present, global CO₂ emissions exceed 26 billion tons and a target of halving emissions by 2050 equates to a 13 billion ton emissions reduction. This is an incredibly challenging task.

In order to carry out this task at the lowest cost possible, appropriate technologies must be applied in the right places and introduced in a timely fashion.

For Japan to achieve a 70% reduction in CO₂ emissions by 2050, it will be necessary to greatly expand nuclear power generation capability, as well as solar power generation.

Although it is vitally important to stop global warming, this will be impossible without economic development. A revolutionary change in energy systems will be required to achieve reductions targets. To realize this, we will need to think of systems that provide a balance between CO₂ reduction and economical aspect. By taking a panoramic and global approach, we must come up with methods that achieve goals at minimum cost. From the perspective of timescales, it will clearly take time to develop new technologies and to implement reforms in social structures. Here, it will be necessary to take a balanced approach and work out how much reductions can be implemented within the most appropriate timeframes.

The current American Green New Deal focuses more on stimulating the economy and improving energy security rather than global warming. This is extremely important. It is essential to think of systems that not only deal with global warming but also take a synergistic approach, thereby enabling the most effective measures to be put into place.

Electricity has the same applications, whether it is produced using cheap coal or expensive solar energy, providing a great deal of alternatives to energy policies. Thus selecting high cost options mean that those investment funds will not be available to invest in areas other than energy giving a negative impact to the economy. This makes the lower cost alternative important. In order to reduce costs, it will be essential to develop and deploy innovative new technologies.

However, developing technologies independently is an extremely expensive task. Therefore whether the technology is something we have not yet thought about, we need to think of developing it as a part of system otherwise it will not be possible to reduce costs. To do this, it will be necessary to combine policies that address global warming with those that create additional benefits.

Raising citizens' awareness will be essential. If the number of people who feel that it is reasonable to bear additional costs in order to prevent global warming increases, a number of new benefits can be created. Through education, if this change in the awareness can be achieved, combined with technological innovation provide both sides of a strategy to address environmental and economic issues.



Summary



Tetsuro Muramatsu

Executive Officer, Group General Manager,
Solar Systems Development Group, SHARP CORPORATION

One major issue going forward is how to create sustainable energy generation on a global scale in order to enable a sustainable society. How can solar energy contribute to this goal?

The current guidelines stipulate that by 2050, 21% of renewable energy generated should be solar power. To achieve this will require the installation of enough solar panels to cover an area the size of Kyushu, Shikoku and Okinawa combined, a very difficult task.

It is important to discuss the realization of grid parity (the point at which the costs of electricity production from renewable and other new energy sources is equal to or cheaper than grid power) and mechanisms for stable electricity generation.

Current forms of solar electricity generation include those for: mobile solar applications (PDAs, PCs, etc.), “healthy” solar (air purifier, air conditioner, etc.), electric vehicles (solar panels for charging batteries at charging stations, etc.), and “eco” solar applications (eco-houses, solar towns).

Until now, we manufacturers have produced electronic devices and appliances that use energy. However, in future we would like to take a holistic approach by looking at energy generation, storage and distribution.

Looking at individual households, the installation of solar panels on the rooftops generates energy while new type of insulation reduces the thermal loss from the house. For household electrical appliances, it is better to be enabled to use direct current (DC) electricity and so it is important to develop products that effectively use DC electricity, including LED lighting. Electric vehicles can be used as storage devices for electricity. Starting with a focus on turning one’s own house into a zero-emissions home, these kinds of innovations will lead to greater integration across the whole grid.

By connecting zero-emission homes, commercial buildings and apartment complexes into the main grid, it will be possible to create integrated towns and energy management systems with the target of zero CO2 emissions. These systems can be expanded to city and national scales. Thinking forward to 2050, the function of solar batteries will require an approach that extends beyond national boundaries to the global level.

Plans are already underway for a Mediterranean energy project focused on the development of megasolar plants in the North African desert and laying of undersea cables to Southern Europe. The Genesis Project is also progressing steadily. Furthermore, thinking of the difference between night and day on a global level, if a solar energy belt is established along the equator with distribution technologies it would be possible to supply the whole planet’s energy needs. These lateral approaches will lead to the creation of a smart grid, the goal of which is the implementation of a system that makes effective use of energy on a global scale. Solar battery manufacturers must take the responsibility to work towards this goal.

Summary

Akira Ozaki

Senior Fellow, Nuclear Energy Systems & Services Division,
Power Systems Company, TOSHIBA CORPORATION

It has been a long time since the term green energy invoked a response such as “With the exception of nuclear,” but recent practice is to clearly state: “Including nuclear.”

Comparing CO2 emissions per kilowatt-hour (kWh) from various types of energy sources we see that whereas thermal power generation incurs around 600-1,000g of emissions, nuclear power is on par with natural energy sources at around 20g, a very low amount. For example, a 1.3 million kW nuclear power station running over one year would reduce CO2 emissions by 9 million tons compared to a coal-fired power station and 5 million tons compared to the latest LNG power plants. Within current technologies, there are high expectations for nuclear energy as a low-carbon energy source.

According to the International Energy Agency (IEA), due to limiting conditions nuclear energy will contribute a modest 6% of CO2 emissions reductions through to 2050.

Even so, increasing global demand for energy will require an additional 15-23% energy production capacity over current levels. This will require the construction of a total of 1,280 new power plants by 2050, an average of 32 per year for the next 40 years.

In the West, accidents such as Three-Mile Island, Pennsylvania, and Chernobyl, Russia, served to significantly depress nuclear power plant construction with no new nuclear power plants being constructed in America in the last 30 years. This has resulted in declines in equipment production capabilities and construction technologies.

On the other hand, Japan has continued construction since the 1960s and accumulated significant amounts of technology and knowledge. As the world moves to reassess nuclear energy, Japan's advanced plant construction capabilities and integrated engineering capacity are engendering high expectations.

These technologies are, in a sense, national resources. By strategically applying these resources, we hope to contribute to the creation of a global low-carbon society.

There are several challenges associated with this task. First, to manufacture large numbers of nuclear reactors will require bilateral treaties on their peaceful use and the creation of legal frameworks in countries newly adopting nuclear energy. Furthermore, the construction of new plants requires significant initial investment. From the perspective of financial support, the necessity for the inclusion of nuclear energy in the clean development mechanism (CDM) framework may need to be investigated. In addition, supply chains need to be enhanced to determine whether Japan can provide everything when building the plants.

Second, the fuel cycle must be taken into account. Going forward, management of both the front-end (uranium procurement, enrichment and conversion) and back-end (waste reprocessing, treatment and disposal) will be a topic of debate. Furthermore, it will be essential to develop human resources with the ability to take a wide viewpoint and critical thinking capabilities.

To promote understanding across society, it is vitally important to open strong lines of communication to society with a major focus on safety and reliability. Once this understanding has been assured, the industry can pursue steady development activities.



Summary



Junko Okayama

Fellow, Center for Research and Development Strategy,
Japan Science and Technology Agency (JST)

Investment in research and development by East Asian countries has exceeded that by EU27, and these countries possess remarkable potential for technological growth. Sandwiched between Japan and China -- the economic power of Asia -- there is an acute sense of urgency in South Korea in this area.

The Lee Myung-bak Administration that came into power in 2008, announced the "Low Carbon, Green Growth" policy as Korea's national vision for development. The Green Growth policy seeks to achieve economic development while also implementing environmentally friendly initiatives. In addition to the initial economic stimulus package, similar to the Green New Deal, numerous other initiatives to stimulate growth through research and development focusing on green technologies are also underway.

In January 2009, the Green Growth Committee was established within the president's office to promote Ministry-wide development of green technologies. At the same time the new administration took office, the Ministry of Knowledge Economy was created to consolidate the management of energy, information and communications, and industrial technology sectors, that had hitherto been fragmented.

Further, the administration has put forward a plan to raise investment in research and development to up to 5% of the GDP by the end of its term in 2012 (as of 2006, investment was 3.22% of the GDP).

One simple example of green technologies is the online electric vehicle (Olev). It runs on electromagnetic induction from cables buried underground, charging itself while running. KAIST (Korea Advanced Institute of Science and Technology) succeeded in developing a prototype model of the electric vehicle and President Lee participated in a test ride event held in February 2009.

Earnest efforts are being made towards commercialization and promoting widespread use of the system after practical tests are conducted in selected areas. Plans also call for the development of sophisticated green urban areas that incorporate intelligent traffic systems. Overseas sales of these urban traffic systems are expected to enhance economic growth.

South Korea is also taking action to establish global networks. For example, alliances have been formed with smart grid related industries in the US. To create channels that will help it gain a better understanding of trends related to technologies and standards in the EU, South Korea participated in the Europe-wide Network for Market-oriented Research and Development (EUREKA) in June 2009, becoming the first nation from outside the European region to do so.

There is much that Japan can learn from South Korea, such as the systemization of technologies for commercialization, increased awareness of trends related to technologies and standards in other countries, and the creation of improved global marketing structures for systems developed domestically.

Early this month, Prime Minister Hatoyama visited South Korea. At the summit meetings that were held, an agreement was reached regarding creating a framework for a Green Partnership between Japan and Korea. Specific proposals to create a green society, including technology development, will be discussed at a later stage. From the perspective of maintaining good relations between the two countries, however, it is important to first understand current developments in South Korea.

Panelists

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Moderator: Junichi Taki, Editorial and Senior Writer, NIKKEI INC.

25% reduction in CO2 emissions

TAKI: From a technological perspective I think we can achieve this target by the year 2050 or later. But can we do it earlier? The new administration has announced the goal of reducing CO2 emissions by 25% by the year 2020, but can we really achieve this midterm goal? What methodologies can be adopted to help us achieve this goal? What are the issues related to technical and social aspects, as well as societal and other systems that must be considered? What will be the economic and other impact?

AKIMOTO: As someone directly involved in studying the feasibility of this midterm goal, I think this is a very difficult goal to achieve. However, the Hatoyama administration has stipulated two conditions to achieving this goal. The first is participation by other major CO2 emitting nations. Getting the US and China to participate will be the key. The second condition relates to genuine reduction of CO2 emissions in Japan. The Aso administration's declaration to reduce CO2 emissions by 15% compared to 2005 clearly specified a 15% cut in emissions within Japan. The 25% reduction specified by the Hatoyama administration, however, most likely includes emissions rights purchased from other countries and reductions through forest sink initiatives. This will significantly change the domestic reduction volume.

If other countries do not take action, the Japanese industry will hollow out, potentially destabilizing the economy. On the other hand, if nations worldwide, including the US and China, set stringent reduction goals and implement initiatives, an overseas market for Japan's outstanding industrial technologies, such as nuclear and solar power generation technologies, can be developed. This will stimulate the Japanese economy while drastically reducing CO2 emissions worldwide. Attention is focused on future negotiations in this area.

TAKI: We hope that a new framework will be built to ensure that all countries share the burden in a fair manner. Assuming that such a framework is created, how should the financial and

other costs be shared? What about technological development? And how should industrial structures be changed?

We cannot avoid the financial burden

KURODA: With regard to the Kyoto Protocol too, cost reduction, efficiency of operations, financial burden, and methods to ensure fair sharing of costs were major issues. In working to achieve the midterm goal of reducing CO2 emissions by 25% in approximately ten years, there is bound to be a conflict of interests both among different sectors of society within Japan and with international bodies. The main issue is who will bear the overall costs? All citizens must be aware that this problem cannot be solved without bearing some of the cost. The introduction of emissions trading and a carbon tax must be studied.

Most industries in Japan are opposed to the introduction of an emissions trading scheme. From an economic perspective, the rationality of the program cannot be realized if market mechanisms do not operate to transfer the associated financial burden, in some form or other, to industrial products. Ultimately, consumers must bear some of the costs, but this is totally dependent on how the market is designed.

Potential factors to reduce financial burden include the nature of cost sharing agreements with developing nations; whether Japan will provide technological assistance; or how promising business opportunities can be created by propagating Japanese technologies to the world. Detailed discussions on the kind of global markets to be built must be held and solutions clarified independently of the political implications.

AKIMOTO: The emissions trading program and environmental tax are extremely effective to achieve economic rationality in the short-term, but long-term technology development must also be carried out simultaneously. The responsibility of providing funding for this must not fall on industry. It is important to formulate policies based on a well balanced approach to determine if

the environmental tax or the emissions trading program is the best solution; or whether the Top Runner program, an excellent energy-efficient program in Japan, can be incorporated well in to future policies.

TAKI: What are your thoughts on carbon leakage that may occur if Japan introduces a carbon tax?

For example, the industrial materials manufacturing industry and the fabricating industry have their production bases in Japan because the industrial infrastructure (industries and consumers who support the infrastructure) is better developed here, and it is unlikely that rising



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energy costs alone will make them move their bases overseas. Companies that build production facilities at overseas locations do so to cater to the growing demand in those markets. CO2 emissions related regulations do not influence such decisions at all. The financial burden created by a carbon tax or emissions trading schemes may make operating conditions in Japan harder for companies, but it is not a decisive factor to transfer production overseas.

MURAMATSU: Regardless of market demand, energy issues cannot be solved without the assistance of the state. Take the case of solar power. Structures are required whereby solar power generation companies can be nurtured over a period of 10, 15 or 20 years with governmental support. Japanese companies can act as intermediaries with the goal of ultimately transferring management to the people of the respective country.

Introduction of a carbon tax will not provide a long-term solution. CO2 emissions volumes are proportional to productivity. Improved manufacturing technologies enhance productivity, enabling high output with only a small energy input, and Japan is a world leader in this aspect. Energy conservation costs however, will rise, as Value Engineering programs are stretched to their maximum. Some steps the national government can take to avoid this include creating a framework for acquiring CO2 reduction points by adopting Japan's low carbon technologies in developing countries; and packaging Japan's technologies for export (technologies for eco-cities that use solar power; nuclear and solar power batteries; renewable energy; and power generation mechanisms for non-fossil fuel energy). CO2 reduction points for these activities will be collected on a global scale.

TAKI: Enhanced versions of Clean Development Mechanisms (CDM) that can be used to popularize Japan's low carbon technologies in developing countries.

CO2 emissions reduction through export of technologies

KURODA: Reducing CO2 emissions on a global scale through CDM, sales of Japanese technologies to developing countries, or technological assistance is a top-priority issue. I think there is a slight misunderstanding regarding carbon tax and CDM. If CO2 emissions cannot be reduced by just bearing the financial burden, of course, there is no meaning in taxation. Japan relies on other countries for its energy, and prices of gasoline and coal in Japan are on average much higher than the rest of the world. In order to reduce costs and raise energy efficiency, Japan spent several long years developing world-leading energy-saving technologies. The concept of the carbon tax is based on the expectation that raising fuel prices will stimulate the development of even more efficient and innovative technologies. With regard to CDMs too, the cost of emissions trading includes expectations for improved efficiency. The aim is to promote more efficient technology development through various means, in order to reduce total costs.

AKIMOTO: Another important point is that the payout time in Japan is longer than the rest of the world. Stable management structures in Japan allowed for long-term investments. Overseas, stockholders demand profits in the short-term, and investment in long-term energy technologies is not promoted. We must try to communicate to the world the advantages of Japan's conventional management methods.

TAKI: On the other hand, if studies clearly indicate that efforts to achieve the long-term or the mid-term goals will certainly raise energy prices, will it promote investment?

OKAYAMA: About two years ago, I heard from the CEO of a California-based venture company, about Google's entry into the electricity generation network. At the time I didn't quite understand the concept, but after President Obama assumed office and details about smart grid systems gradually began to be made available to the public, I realized that it was a system that exceeded our current scope of knowledge about such systems. We must offer to the market systems that are on an entirely new plane. To do so, it is important to get rid of any fixed notions we may have and look into creating new systems by thinking outside the box.

TAKI: What is your opinion from the perspective of a concentrated generation system manufacturer (as against that of a distributed generation system manufacturer)?

OZAKI: Japan currently has 53 nuclear power generating plants with a 60% utilization rate/generator. Plants in America and South Korea have a utilization rate of 90% or more. Regulations in Japan stipulate that nuclear power generating plants be switched off after 13 months of operation, even in the absence of earthquakes and other special reasons. Thus, the maximum utilization rate that can be achieved is 80%. This 10% difference significantly affects CO2 emissions volumes. Recently revised regulations are leaning toward allowing plants with exceptional safety track records to operate for longer periods of time. Regulatory and structural changes are also required.

TAKI: Expectations are high regarding mechanisms to transform Japan's nuclear power generating industry into an export industry, and by shutting down coal-fired power generating plants overseas and replacing nuclear power plants, Japan will hopefully get emissions rights.

OZAKI: Japan leads the world in terms of technological strengths. Including nuclear power in CDMs, and linking that contribution directly to emissions rights would be very beneficial for Japan.

TAKI: A system to purchase excess power from domestic-use solar batteries has begun, and Japan's solar batteries manufacturing industry is thriving. According to the government's calculations, the cost per household is approximately 100 yen/month. How much financial cost should we be



willing to bear? There are media reports that we should bear costs of 360,000 yen.

AKIMOTO: A questionnaire conducted by the government reveals that very few families are willing to bear a cost of even 2,000/month. The figure of 360,000 yen is being highlighted, but the right figures during discussions were in the range of approximately 220,000 yen - 770,000 yen. This is, of course, based on the condition that the 25% reduction in Japan is a genuine one.

KURODA: This is the cost that will be incurred if everything is done in Japan; similar levels of efficiency at lower costs can be expected in America and China, and many other countries.

TAKI: Japan possesses superior technologies, but has many times in the past lagged behind other countries in terms of social applications of those technologies.

OKAYAMA: In South Korea, policies for science and technology include systems for adoption of technologies by society, in addition to investments for individual elemental technology and IT. Japan needs policies from a similar perspective.

TAKI: In Japan too, model regions are selected and verification tests are carried out, but there is no follow-up.

OKAYAMA: Perhaps Japan is unwilling to bear the discomfort that change can bring? In South Korea, on the other hand, there is concerted action by the whole nation based on a sense of life or death. Japan is a privileged nation.

TAKI: Is Japan really a privileged nation?

KURODA: I have been living in Yamagata Prefecture for about 18 months now, and I am impressed with the various kinds of natural resources available in the countryside. For example, in Shonai there are many wind power generating facilities; 70% of Tsuruoka-city is covered by forests and possibilities abound for the use of bio-energy. In the area around the Mogamigawa River, a small hydroelectric generation system can be installed. However, the idea of drawing up an indigenous plan to create an integrated system that incorporates all the above has not yet been conceived. With emphasis now being placed on stimulating regional economies, we must change our perspectives in using local resources to their full potential in order to design the entire regional area.

TAKI: Are there any systemic issues or problems related to financing by the local governments?

How to bear the costs of long-term investments?

KURODA: Problems related to financing by the local governments are major. However, if a truly safe and secure, green society can be built in the country side within Japan's longevity society, many new businesses can be created that will attract young people. I believe that we can design such an environment even in the countryside, but it will take time. Relaxation of regulations is also needed. For instance, legal issues such as water rights must be tackled when installing a small hydroelectric generator.

TAKI: How do we raise money for long-term research and development funds? Initiatives such as responses to help alleviate global warming will cost industry large sums of money. How much and how long can the nation finance long-term research and development?

AKIMOTO: Eliminating wasteful spending will help raise some financing. Another method is to divert money collected as taxes (environmental, CDM, etc.) towards research and development. However, it will be difficult to secure enough tax to lead to reductions in emissions. Our analysis shows, for example, for a 25% reduction, the marginal reduction cost (cost required to reduce one unit of CO₂) will be around 50 - 100 thousand yen. Looking at the basic theoretical efficiency of the environmental tax, the tax amount will be about 50 - 100 trillion yen. This is impossible. But it may be possible to collect about 1,000 -2,000 yen as tax to promote technological development.

OKAYAMA: Since the Lee administration came to office in South Korea, the national investment in research and development has undergone a major shift in focus to long-term issues that cannot be handled by individual companies, such as elemental research and environmental problems. Investment in IT has been cut substantially, and policies drafted to pour 50% of the country's research and development investment into elemental and infrastructure research. A drastic shift in investment focus is another way to raise funds,

TAKI: During an economic slump, private sector companies find it difficult to secure long-term investment in research and development, but on the other hand this investment is important in order to survive.

MURAMATSU: The investment efficiency of private sector companies in research and development is also highly questionable. Currently, high resolution simulations are carried out and discussions are held to determine

whether research topics hold good or not and their potential for success. Not deciding on a research topic based on one's intuition is causing wastage.

I also participate in JST and NEDO projects. There seems to be a tendency to only involve people from one particular field. It is important to seek the advice of experts to select research topics, and from among many unique ideas that come up, invite participants from varied fields in order to share knowledge.

TAKI: That is a good point. The words "selection" and "concentration" became popular once, increasing tendency to concentrate on efficient fields, but this is the opposite. Although there is the need for identifying and separating applications, it is important to invest broadly and in a balanced manner in several fields. Keeping this balance is difficult.

OZAKI: Companies will undoubtedly want to undertake individual research on promising topics. For heavy risk topics that companies are unsure about, they seek the country's help. There are limits to individual research too. Companies must form alliances for research that cannot be done by a single company. Foreign participation must be solicited for long-term research topics in terms of knowledge and funding.

TAKI: In that sense, it is important to have a professional in the decision making team. But the current administration allows politicians to make those kinds of decisions. It should be a system that respects the opinion of experts.

Thank you.

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