

THE STANFORD-SASAKAWA PEACE FOUNDATION NEW CHANNELS DIALOGUE

FINAL REPORT

ENERGY CHALLENGES AND OPPORTUNITIES FOR THE UNITED STATES AND JAPAN



March 2014 / Bechtel Conference Center & Oksenberg Conference Room, Encina Hall, Stanford University



THE WALTER H. SHORENSTEIN ASIA-PACIFIC RESEARCH CENTER

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FINAL REPORT

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Sponsored by the Sasakawa Peace Foundation (SPF)
and organized by the Shorenstein Asia-Pacific Research Center at Stanford University
in partnership with SPF and in association with U.S.-Japan Council.

March 2014 / Bechtel Conference Center & Oksenberg Conference Room, Encina Hall, Stanford University

Acknowledgements

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We also appreciate generous support that we received from Walter H. Shorenstein Asia Pacific Research Center (S-APARC) and the Freeman Spogli Institute (FSI) for International Studies at Stanford University. Staff members of S-APARC and FSI, including, Debbie Warren, George Krompacky, Mary Ellen Horwath, Roger Winkelman, Huma Shaikh, Denise Masumoto, Irene Bryant, Heather Ahn, Lisa Lee, Lisa Griswold and Wena Rosario, who worked tirelessly to make the dialogue proceed smoothly. Our special thanks go to Meiko Kotani, administrative associate of the Stanford Japan Program at S-APARC, who assisted us in all the aspects. We could not have done this without her extraordinary efforts.

The dialogue also benefited from collaboration with the US Japan Council (USJC), which helped us identify several participants. We are especially grateful to Daniel Okimoto and Kaz Maniwa. We hope this marks the beginning of a productive relationship between the USJC and the Stanford Japan Program at S-APARC.

We are also grateful to Hiro and Betty Ogawa for opening up their beautiful house for the welcome reception and dinner for the dialogue participants. The event set the right start for the successful dialogue.

Finally, we thank the dialogue participants for their contributions and dedication. We also thank Jingwen Xing and Kenji Kushida for taking notes during the conference and the dialogue and preparing a draft for this final report. We received valuable advices from James Sweeney and Ambassador John Roos in the planning stage of the dialogue. Hidetoshi Nishimura, Executive Director of Economic Research Institute for ASEAN and East Asia (ERIA), also helped us developing the program. Hidetoshi agreed to be a panelist but his duty prevented him from joining us. Nonetheless we appreciate his contributions from the view point of U.S.-Japan energy cooperation in the East Asian region.

Thanks to all of the people, we believe the first meeting of the Stanford-Sasakawa Peace Foundation New Channels Dialogue was very successful.

Takeo Hoshi
Director
Japan Program
Shorenstein Asia-Pacific Research Center

Hideichi Okada
Sasakawa Peace Fellow
Shorenstein Asia-Pacific Research Center

Executive Summary

The status of energy in the world has transformed dramatically in recent years. The shale gas revolution has transformed the United States into an energy exporting country. Japan's Fukushima nuclear accident draws greater attention to nuclear safety, forcing Japan to search hard for alternative energy sources. The rapidly increasing demand for energy in emerging countries requires securing stable and inexpensive energy supplies, creating new challenges for global warming.

The Stanford Japan Program at the Walter H. Shorenstein Asia-Pacific Research Center has launched a three-year project from 2013 to create new channels of dialogue between experts and leaders of younger generations from the United States, mostly from the West Coast, and Japan under the name of "New Channels: Reinvigorating U.S.-Japan Relations" with a grant received from the Sasakawa Peace Foundation. The goal is to reinvigorate the bilateral relationship through the dialogue on 21st century challenges faced by both nations.

The dialogues are structured to examine the new challenges of the 21st century, in particular, economic growth and employment creation; innovation and entrepreneurship; energy; and East Asian regionalism, including regional security issues. The aim is to develop mutual understanding and constructing a new relationship for cooperation in dealing with 21st century challenges through dialogue between scholars, entrepreneurs, and policy makers from the two countries. Our intent is that this multi-year initiative will generate a network of trans-Pacific expertise as a vital supplement to existing avenues of communications.

In its inaugural year, the Stanford-Sasakawa Peace Foundation New Channels Dialogue focused on energy issues. A public conference titled "Energy Challenges and Opportunities for the United States and Japan," took place on February 13th at Stanford University with participants that include policy makers, business leaders, academia and experts from both the United States and Japan. On February 14th, a closed dialogue among participants was held at Stanford. The program was in association with U.S.-Japan Council.

Agenda For Panel Discussions

2/13/2014... Day 1 - Bechtel Conference Center, Encina Hall

8:30 - 9:15 am	REGISTRATION AND BREAKFAST	
9:15 - 9:30 am	WELCOME Gi-Wook Shin Yuji Takagi	Director, Shorenstein APARC, Stanford University President, Sasakawa Peace Foundation
9:30 - 10:45 am	PANEL DISCUSSION I: The Changing World Energy Picture and U.S. / Japan Energy Policies Chair: Hideichi Okada Panelists: Hideto Nakahara Julia Nesheiwat Hirofumi Takinami Joao Felix Nobuo Tanaka	
		Sasakawa Peace Fellow, Shorenstein APARC, Stanford University Senior Executive Vice President, Mitsubishi Corporation Deputy Assistant Secretary, Bureau of Energy Resource, U.S. Department of State Member, House of Councilors, The National Diet of Japan Director, External Communications, Schlumberger Ltd. Professor, University of Tokyo, Former Executive Director, International Energy Agency
10:45 - 11:15 am	BREAK	
11:15 - 12:30 pm	PANEL DISCUSSION II: Increasing Energy Demand in Asia and Energy Innovation (Smart Grid, Energy Saving, Renewables) Chair: Michael Armacost Panelists: Genevieve Shiroma Yukari Yamashita Thomas Starrs Koichiro Ito	
		Shorenstein Distinguished Fellow, Shorenstein APARC, Stanford University President of the Board of Directors, SMUD Board Member, Institute of Energy Economics, Japan Vice President, SunPower Assistant Professor, Boston University School of Management
12:30 - 2:00 pm	LUNCH	

2:00 - 3:15 pm	<p>PANEL DISCUSSION III: New Technologies after Fukushima <i>(Distributed Generation, Fuel Cells, Renewables connected to the Grid)</i></p> <p>Chair: Masahiko Aoki Panelists: Shigeru Muraki K. R. Sridhar Kaichiro Nakano Yoriko Kishimoto Gerald Hane</p>	<p>Freeman Spogli Institute Senior Fellow, Stanford University Senior Executive Vice President, Tokyo Gas Co-Founder/CEO, Bloom Energy Senior Manager, Smart Energy Business Planning Division, NEC Mayor (former), City of Palo Alto President/CEO, Battelle-Asia</p>
3:15 - 3:45 pm	BREAK	
3:45 - 5:00 pm	<p>PANEL DISCUSSION IV: Reforming the Electricity Market</p> <p>Chair: Takeo Hoshi Panelists: Kazuhiko Ogimoto Takeo Kikkawa Shmuel Oren</p>	<p>Director, Japan Program, Shorenstein APARC, Stanford University Project Professor, Institute of Industrial Science, University of Tokyo Professor, Graduate School of Commerce and Management, Hitotsubashi University Professor, Department of Industrial Engineering and Operations Research, University of California, Berkeley</p>
5:00 - 5:15 pm	<p>CLOSING REMARKS Hideichi Okada</p>	<p>Sasakawa Peace Fellow, Shorenstein APARC, Stanford University</p>
5:15 - 6:15 pm	RECEPTION	

Agenda For Closed Dialogue

2/14/2014... Day 2 - Oksenberg Conference Room, Encina Hall

8:30 - 9:00 am	REGISTRATION AND BREAKFAST
9:00 - 10:30 am	<p>DISCUSSION I:</p> <p>Reforming Electricity System in Japan-Lessons Learned from California</p> <p><i>What can we learn from the experience in California?</i></p> <p><i>What mistakes Japan should avoid?</i></p> <p>Discussion Leader: Hideichi Okada Sasakawa Peace Fellow, Shorenstein APARC, Stanford University</p> <p>Speakers: Hiroshi Takahashi Research Fellow, Economic Research Center, Fujitsu Research Institute</p> <p>Frank Wolak Professor, Department of Economics, Stanford University</p>
10:30 - 11:00 am	COFFEE BREAK
11:00 - 12:30 pm	<p>DISCUSSION II:</p> <p>Coping with Declining Dependence on Nuclear Energy in Japan</p> <p><i>How much can we rely on shale gas technology?</i></p> <p><i>How can we promote renewable energy effectively?</i></p> <p>Discussion Leader: Kenji Kushida Research Associate Fellow, Shorenstein APARC, Stanford University</p> <p>Speakers: Hajime Ito Executive Vice President, Japan Petroleum Exploration (JAPEX)</p> <p>Harry Rowen Senior Fellow, Shorenstein APARC & Hoover Institution, Stanford University</p>
12:30 - 2:00 pm	LUNCH
2:00 - 5:00 pm	<p>Site Visit</p> <p>Bloom Energy 1229 Orleans Dr. Sunnyvale, CA 94089</p>

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The Changing World Energy Picture and U.S./Japan Energy Policies

PANEL DISCUSSION I



Courtesy of Calaidea at Morguefile

Hideichi Okada

Sasakawa Peace Fellow, Shorenstein APARC, Stanford University

Hideto Nakahara

Senior Executive Vice President, Mitsubishi Corporation

Julia Nesheiwat

Deputy Assistant Secretary, Bureau of Energy Resource, U.S. Department of State

Hirofumi Takinami

Member, House of Councilors, The National Diet of Japan

Joao Felix

Director, External Communications, Schlumberger Ltd.

Nobuo Tanaka

Professor, University of Tokyo, Former Executive Director, International Energy Agency

In the US, energy suppliers are going through a major renaissance with the shale gas revolution, a product of new technology. **Joao Felix**, Director of External Communications at Schlumberger, pointed out that the shale revolution has been enabled by three major technology advances: horizontal drilling, multi-stage fracturing, and increasingly, petrophysics. As a result, the US domestic gas reserves are growing, and with its increased self-sufficiency, the US is facing a bright energy future. In contrast, Japan is facing a difficult situation. Not only does it lack energy resources, but also it has to deal with large electricity demand. Therefore, **Julia Nesheiwat**, Deputy Assistant Secretary from Bureau of Energy Resource, U.S. Department of State, emphasized that it is urgent to establish a closer US-Japan energy relationship, which will encourage gas trade, foster bilateral cooperation, and assist energy policymaking.

LNG (Liquefied Natural Gas) is a clear, colourless, non-toxic liquid that forms when natural gas is cooled to -162C. This shrinks the volume of the gas 600 times, making it easier to store and ship.

Hideto Nakahara, Senior Executive Vice President at Mitsubishi Corporation gave an overview of shale gas revolution and Japan-US relations in the context of Japanese energy security. After Japan's nuclear plants were shut down following the Great East Japan Earthquake disaster, Japan has dramatically increased its imports of LNG (liquefied natural gas), resulting in a large fiscal deficit. Importing shale



gas from the U.S. is expected to reduce Japan's fiscal deficits, as well as lowering the natural gas prices paid by Japan for LNG through a new pricing formula. The Obama administration's approval for U.S. LNG export projects represent an important facet of U.S.-Japan cooperation.

Nobuo Tanaka, Professor at the University of Tokyo, proposed that to solve the aforementioned issue, Japan needs to follow the European model. European countries have different energy patterns and mixed policies. For example, Poland uses coal; Sweden only relies on nuclear and hydro; and Germany has diverse energy resources and will phase out nuclear. Nevertheless, European gas pipelines, power grid connections, and Europe's expansion into Northern Africa, link these countries. Hence, it was suggested that Japan should learn from the European case and set up a strong strategic geopolitical framework such as one with Russia for regional energy security.

In addition, **Hirofumi Takinami**, member of the House of Councilors, National Diet of Japan, brought up the point that since the Tohoku earthquake, Japan faces three energy constraints: the earthquake's detrimental influence on the economy, the rise of dependency on fossil fuels, and the increase of CO₂ emissions. Nuclear power is an important base power source in terms of stable supply, cost reduction, and lack of global warming-contributing emissions. The Japanese government announced three basic guidelines for its nuclear energy policy: steadily promoting the nuclear fuel cycle; expanding the capacity of spent nuclear fuel storage; and finding places for the final disposal of high-level radioactive waste.

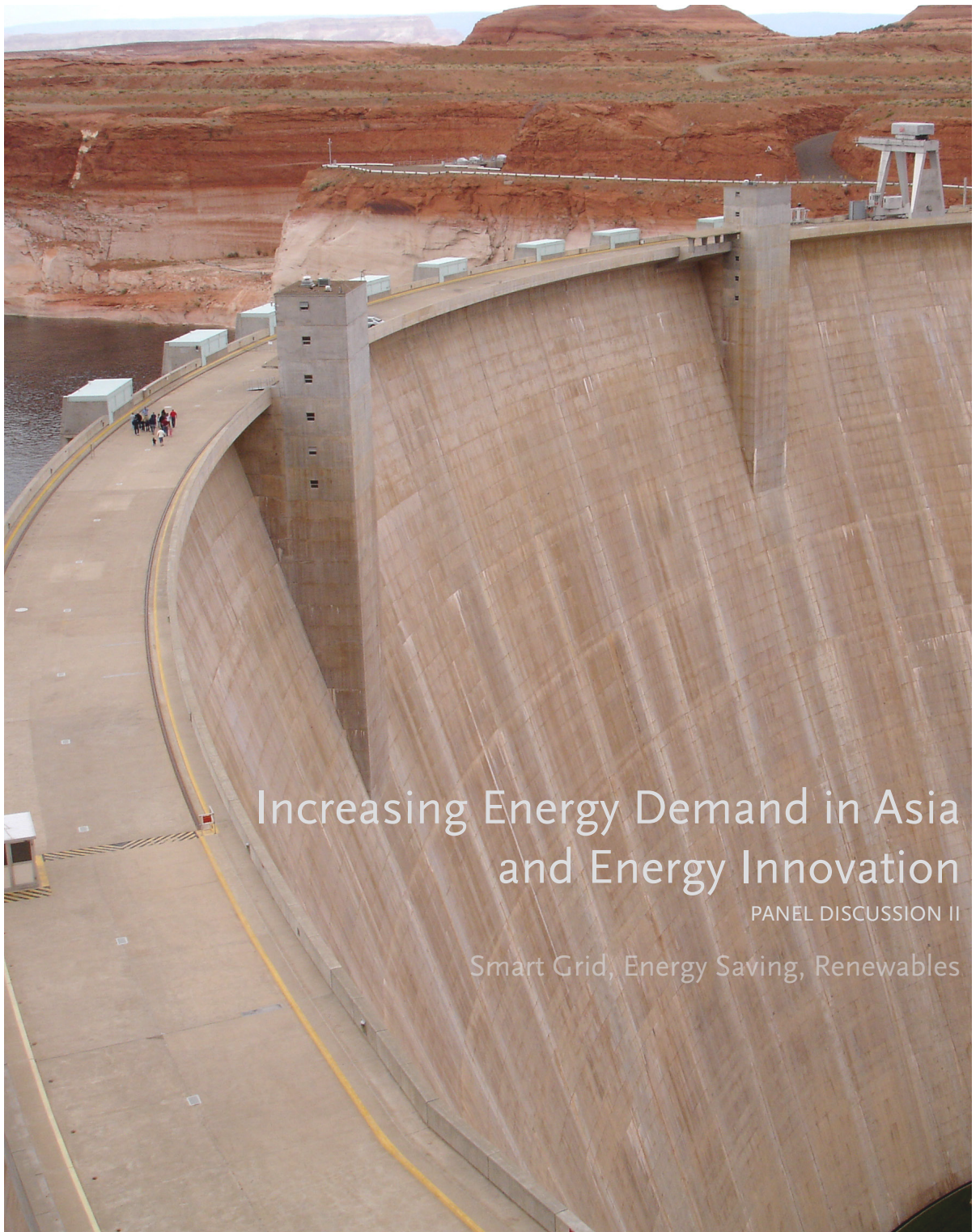
IFR (Integral Fast Reactor) is a reactor design concept developed at Argonne National Laboratory in the decade 1984 to 1994. IFR is a fast neutron reactor fueled by metal alloy and cooled by liquid sodium, which allows efficient and clean nuclear fuel cycle.

During the Q/A session, questions centered on the necessity of nuclear power and the process of green technology. One perspective was that the fourth generation reactor—the integral fast reactor (IFR)—will probably become a practical way

LWR (Light Water Reactor) is a thermal neutron reactor which uses light (or normal) water as both coolant and moderator to slow neutrons.

to advance nuclear energy. The IFR has features like an inexhaustible energy supply, inherent passive safety, long-term waste management solutions, proliferation-resistance, and economic fuel cycle closure. The IFR takes only 300 years to reduce high-level radioactivity, whereas the light water reactor (LWR), used by the Fukushima Daiichi nuclear power plant, requires 100,000 years. South Korea is eager to develop and deploy the IFR, but given the rising tensions on the Korean Peninsula due to escalating tensions with North Korea, the US may not approve the IFR. The speaker referred to a 2013 documentary movie, “Pandora’s Promises,” that shows with the help of new technology, nuclear power can be relatively safe and clean. Hence, some presenters expressed their hope that the US, Japan, and Korea would work together to create a more peaceful, safer, and less troublesome nuclear environment with IFR energy.





Increasing Energy Demand in Asia and Energy Innovation

PANEL DISCUSSION II

Smart Grid, Energy Saving, Renewables

Michael Armacost

Shorenstein Distinguished Fellow, Shorenstein APARC, Stanford University

Genevieve Shiroma

President of the Board of Directors, SMUD

Yukari Yamashita

Board Member, Institute of Energy Economics, Japan

Thomas Starrs

Vice President, SunPower

Koichiro Ito

Assistant Professor, Boston University School of Management

Japan has a very little energy security in the world because it supplies only 4% of its own energy as of 2010, the smallest percentage of self-supplied energy among G8 countries. Therefore, “Energy Security, Environment, Economic Efficiency, and Safety” (3E+S), as presented by **Yukari Yamashita**, board member of the Institute of Energy Economic, Japan, are the keys to the energy policy of Japan. After the earthquake of March 11, 2011, new challenges emerged, for example: how to avoid unexpected blackouts, how to meet a large-scale demand for stored reserves of electricity, and how to inform customers of how to respond to an emergency. Unfortunately, few solutions to these problems are available. According to the National Energy Committee of Japan, only four measures were proposed to guarantee power: using less nuclear, more renewable, and more thermal energy and conserving electricity. Since energy demand in Asia will continue to grow, the Japanese must secure an energy supply that will sustain daily life and provide energy at reasonable prices to industry.

California may be a paramount model from which Japan can learn. Although it is the largest state by population in the US, California’s per capita energy consumption ranks 48th out of 50 states in the country. Its low ranking is due in part to its mild climate and energy efficiency programs. **Genevieve Shiroma**, President of the Board of Directors, Sacramento Municipal Utility District (SMUD), spoke about SMUD, a not-for-profit, publicly owned utility (owned by customers). SMUD has implemented three major policies: climate change policy, energy efficiency policy,

and renewable energy policy. It has been aggressive in reducing greenhouse gas emissions, pursuing cost-effective energy efficiency measures, and accelerating the adoption of renewable energy. Furthermore, SMUD's Smart Grid Vision aims to create a platform to achieve higher renewables and better efficiencies while maintaining customer satisfaction and reliable power delivery.



Koichiro Ito, Assistant Professor at Boston University School of Management, pointed out another important but rather neglected aspect of electricity demand and conservation in Japan: timing. Several field experiments were conducted to examine potential economic policies with smart grid technologies. Electricity demand is very volatile in Japan and some US regions according to the time of the day. Peak-time usage is high, but since people pay a flat price, and they do not change their electricity usage according to demand peaks. From this research, findings are that, first, both price and non-pricing incentives can reduce peak-time consumption; second, the effect of “dynamic pricing” out-weighs non-price incentives because people do care about price.

Thomas Starrs, Vice President of SunPower, also discussed whether we should reduce the consumption of energy. We can participate in multiple energy saving activities, like car-pooling, using battery storage, and regulating trash categories.



the peak time is a current issue for the Japanese.

However, given the situation that global demand for energy is skyrocketing, it seems impossible for us to reduce total consumption dramatically. As a result, energy efficiency, that is, using less energy to provide the same amount, becomes more and more important. For instance, how to solve problems in

In addition, participants put great emphasis on how to build customer satisfaction. In the SMUD case, unions are strong enough that they usually take advantage of the utility network to negotiate their contracts. It conducted extensive pilots (over 8,000 customers) to understand how customers consume energy and respond to time of use and critical peak price rate structures. From the SMUD's perspective, communication is key along with the promise of providing efficient energy.



New Technologies after Fukushima

PANEL DISCUSSION III

Distributed Generation, Fuel Cells, Renewables connected to the Grid



Courtesy of mensatic at Morguefile

Masahiko Aoki

Freeman Spogli Institute Senior Fellow, Stanford University

Shigeru Muraki

Senior Executive Vice President, Tokyo Gas

K. R. Sridhar

Co-Founder/CEO, Bloom Energy

Kaichiro Nakano

Senior Manager, Smart Energy Business Planning Division, NEC

Yoriko Kishimoto

Mayor (former), City of Palo Alto

Gerald Hane

President/CEO, Battelle-Asia

Active efforts are now underway throughout the world to create a more innovative yet sustainable economy. **Yoriko Kishimoto**, former mayor of the City of Palo Alto, shared the results of the city of Palo Alto's work to "build a green economy through innovation" as a good example. It has achieved dramatic reductions in greenhouse gas emissions through city, community and business efforts. City operations emissions were reduced by 53% between 2005 and 2013 and the best estimates for community emissions are that they dropped by 32% between those years. Since Palo Alto owns and controls its own electricity supplies, it now has 100% carbon free electricity through renewable energy contracts (wind and landfill gas) and hydropower.



When it comes to Japan, **Shigeru Muraki**, Senior Executive Vice President of Tokyo Gas, proposed the “Smart Energy Network”. Smart Energy Network is an advanced distributed system that optimizes the use of heat and electricity generated by distributed energy systems such as CHP (Combined Heat and Power) and renewable energies through area-wide energy networks by using ICT (Information Communication Technologies). Therefore, it contributes to energy conservation, CO₂ reduction, and additional metrics such as BCP (Business and Living Continuity Plan) and peak-demand control. Furthermore, Smart Energy Network brings not only direct benefits related to energy cost saving, but also a variety of additional value to both residents and businesses. On one hand, it provides safer living conditions, an environmentally-friendly community, and increases residents’ awareness of sustainability issues. On the other hand, it ensures business continuity, a comfortable office environment, and increases real estate values for business. As a result, Smart Energy Network will play an important role for the 2020 Tokyo Olympics in terms of its contribution to BCP with energy independence, energy conservation and CO₂ reduction, demand-side management and power demand control, and cost reductions such as operational costs.

In addition, Bloom Energy CEO **K.R. Sridhar** talked about its fuel cell technology. Bloom’s Energy Server (Bloom Box) combines methane (natural gas) with oxygen to create an electrochemical reaction that generates electricity and emits carbon dioxide and water. It is a new class of distributed-power generator, producing clean, reliable, affordable electricity at the customer site. It also has three main features: low cost materials, high electrical efficiency, and fuel flexibility. With respect to distributed resilience, Bloom Box uses the natural gas grid, which has limited localized



failures in case a certain failure occurs. This is different from the electrical grid in that downstream and propagation failures are triggered by failure occurrence: for example, the fact that the Fukushima Daiichi Nuclear Power Plant relied on an electrical grid insured almost total grid failure instead of just localized failure.

Kaichiro Nakano, Senior Manager of Smart Energy Business Planning Division, NEC, focused on the energy storage system, which is based on battery integration technology. The system has two incentives for business activities: on the supply side, it is for load-leveling; on the demand side, it is for self-sufficiency and selling excess generated electricity. Hence, the system is operated for peak-shaving, time-shifting, as well as backups at offices and households. The NEC Group is focused on developing this system, and has implemented an “IT Fusion Demonstration Program” in the Northeastern part of Japan. The system is located in wide areas, and it covers remote controlling, energy consumption, and monitoring PC. Businesses such as grocery stores, restaurants and offices use this system in their day-to-day operations.

At the end of the panel, **Gerald Hane**, president and CEO of Battelle-Asia gave a presentation on energy storage, smart grid, solar power, and new fuels. He pointed out some potential areas for growth in Japan: wind power, deep water, algae, and fuel cells. Finally, he wrapped up his speech with ideas related to innovations in energy technology. For example, he insisted energy storage is key to enabling technology, with substantial potential for improvement in the control and distribution of energy, and finally, he predicted natural gas will play a larger role beyond power generation in such applications as fuel cells.

Reforming the Electricity Market

PANEL DISCUSSION IV



Takeo Hoshi

Director, Japan Program, Shorenstein APARC, Stanford University

Kazuhiko Ogimoto

Project Professor, Institute of Industrial Science, University of Tokyo

Takeo Kikkawa

Professor, Graduate School of Commerce and Management, Hitotsubashi University

Shmuel Oren

Professor, Department of Industrial Engineering and Operations Research, University of California, Berkeley

The future of nuclear energy in Japan is a politically contested issue. **Kazuhiko Ogimoto**, Project Professor in the Institute of Industrial Science, the University of Tokyo, noted that there are multiple scenarios of nuclear usage, ranging from immediate phase-out to longer-term phase out, and continuing at current potential capabilities. Long-term strategic planning is likely to be of crucial importance. To increase the use of variable renewable energy, such as wind and sun, the issues of variation in power output need to be considered. An important place to look is to increase the balancing capability to smooth the peak demand of electricity. The main challenge facing Japan now is how to move from an energy-dominated market to a flexibility-dominated markets. The critical question is whether the wholesale and retail markets can be designed to accommodate all the flexible technologies.

TEPCO is a Japanese electric utility servicing Kanto region of Japan. TEPCO stands for Tokyo Electric Power Company and is better know by the name Toden.

Takeo Kikkawa, Professor in the Graduate School of Commerce and Management, Hitotsubashi University, contended that in historical perspective, the Japanese power industry was almost always private management. Only for 12 years was the industry under state control. A key word for the industry was autonomous management of electric power companies, balancing private business characteristics

with public interest. In this context, reforming the market means several things: the need to address TEPCO's problem of being bureaucratic-heavy; governance needs to be based on competition; and the main road to competition may not simply be the entry of independent power providers and other new actors, but competition among electric power companies.

The issue of what to do with nuclear power plants looms large in any possible reform plan. Participants held a variety of views; for example, one perspective is that the nuclear power business should be separated (and nationalized) from private electric power utilities. In the discussion, the question was raised whether it should just be TEPCO, or others utilities as well selling off their nuclear power plants, such as Chubu, to increase competition. Lively debate ensued.

Another important point raised was that the dependence on nuclear power should be determined by subtraction—the dependent variable—rather than independent variables which could be the growth of renewables, deepening of energy saving, and other factors that could affect energy demand and supply.



A theme reiterated by numerous presenters and participants throughout the two days was the critical need for electricity transmission to be unbundled from energy generation. A very detailed overview of how the California markets operate was presented by **Shmuel Oren**, Professor at the Department of Industrial Engineering and Operations Research, University of California, Berkeley. Key challenges for increased reliance on renewable sources that are variable in their output (wind, solar) are the “ramping times” when demand for electricity increases sharply dur-

ing a typical day. Considerations of how structure an appropriate network to build the capacity to handle the ramping up challenge—without relying on gas power to ramp up, since that will undermine emissions and environmental benefits of renewables—leads to demand response solutions, in which demand can be shifted through various types of incentives, as well as making use of electricity loads that can be deferred easily, such as water heaters, refrigeration, agricultural pumping, electric vehicles, and other thermostatically controlled loads. Aggregator business models to bridge the gap between wholesale commodity markets and retail services are also needed as well.

In looking towards lessons for Japan, some of the discussion revolved around a variety of cases where electricity markets are unbundled. Some characterized parts of the US as the most advanced market, with Europe learning. Others point to notable advanced cases such as Denmark, which has a goal of being completely wind powered by 2050—but they enjoy the ability to utilize power lines to Norway to store energy in reservoirs at the same time that they deploy extensive demand response.



Reforming Electricity System in Japan -Lessons Learned from California

CLOSED DISCUSSION I

*What can we learn from the experience in California?
What mistakes Japan should avoid?*



Courtesy of mickepe at Morguefile

Hideichi Okada

Sasakawa Peace Fellow, Shorenstein APARC, Stanford University

Hiroshi Takahashi

Research Fellow, Economic Research Center, Fujitsu Research Institute

Frank Wolak

Professor, Department of Economics, Stanford University

In the 1990s, California attempted to restructure its electric utility industry. The state legislature unanimously passed a bill to open the industry to competition. As a result, consumers paid almost twice the rate they did before the deregulation, and they suffered rolling blackouts. What went wrong?

After the unprecedented earthquake occurring on March 11, 2011, Japan confronted a large-scale rolling blackout in Tokyo. The first presentation explained three causes of the blackout accident: heavy dependence on large-scale centralized generations, limited interregional power flow, and limited use of price mechanism. From this misfortune, Japan should draw a conclusion that it needs more distributed generations, a larger capacity of interregional grid, and a more competitive market. Consequently, the Japanese government is about to take three important steps to reform its electricity system: they will establish the Organization for Nationwide Coordination of Transmission Operators (by about 2015); they will fully liberalize the entry to electricity retail business (by about 2016); and they plan to



further secure neutrality of the power transmission/distribution sector and full liberalization of retail electricity rates (in about 2018-2020).

Next discussion was started by a presentation that laid out three major lessons



from California's experience for Japan. First, electricity retailers should purchase the vast majority of energy in fixed-price forward contracts. Without these contracts, a wholesale electricity supplier could take advantage of withholding output to raise prices. Therefore, in order to limit the suppliers' influence, customers had better plan ahead in the short-term. Second, effective market monitoring and strong regulatory oversight of market are

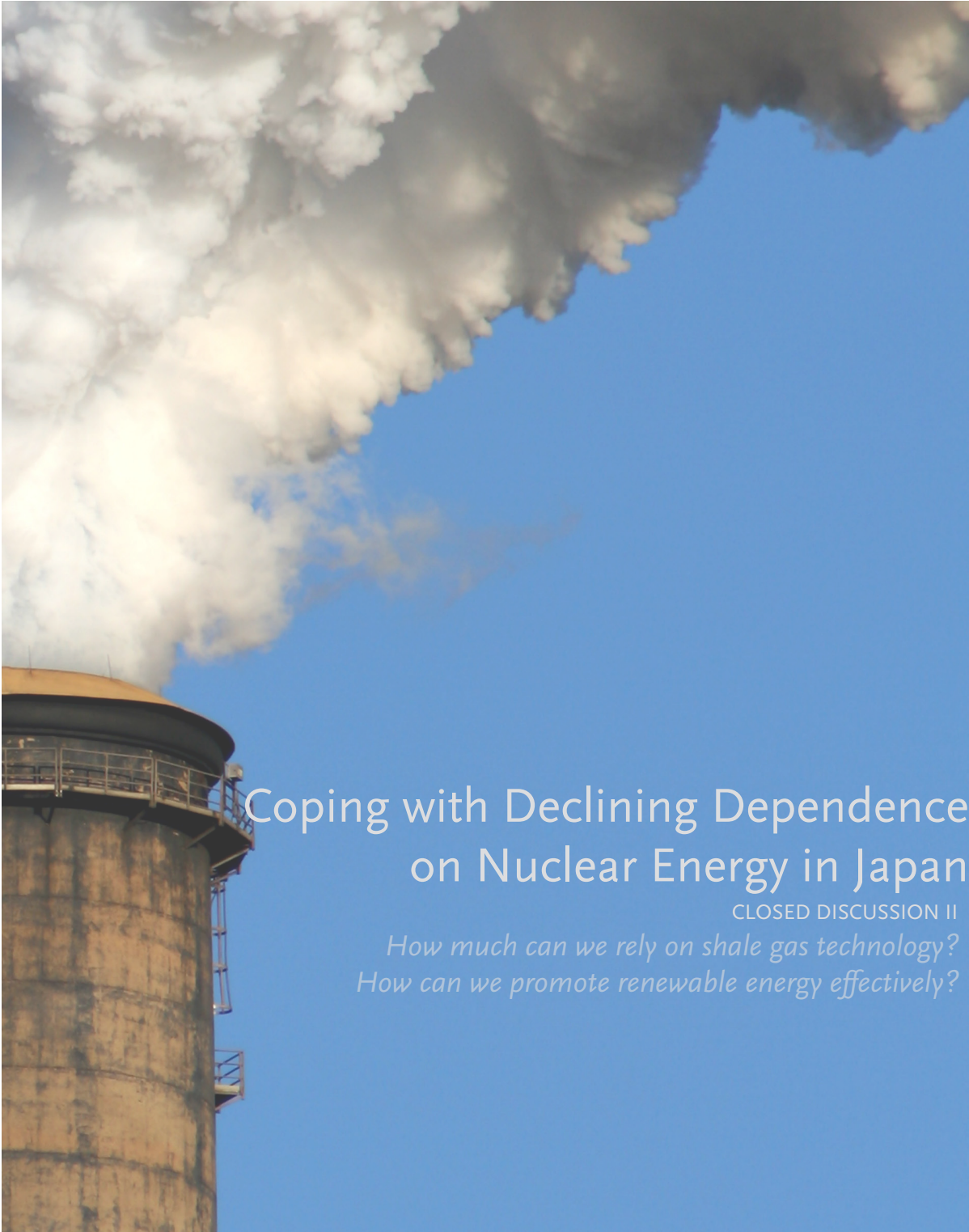
essential to the ultimate success of electric power market. Market monitoring process is the key to detecting and correcting market design flaws and protecting consumers from the exercise of significant unilateral market power. Third, regulators must make sure that retailers do not gamble with ratepayer's money and provide strong incentives for retailers to hedge short-term price risk.

Heated discussion on issues surrounding grid unbundling. California established the Independent System Operator (ISO) in 1998. The ISO runs the operating reserves market, operates the real-time energy market, and manages the transmission grid. However, most European countries try to avoid the ISO because they think separating the owner of the grid and the system operator is very risky. Japan is considering the Independent Transmission Operator (ITO), which is also adopted by France. The ITO owns the assets and belongs to a vertically integrated company, with special rules to guarantee its independence.



Questions were also raised on how to rebuild Tokyo Electric Power Company (TEPCO). Participants proposed some potential reforms such as the legal unbundling, the expansion of the electric power market, and enhancing the independence of the regulator. A strong set of conclusions was that since TEPCO is a half government-owned company, the regulator should become more neutral and use higher authority to promote competition.

From this session, a consensus was built around two principles. First, independent market monitoring is needed. This is not yet a part of Japan's current electricity system reform plan, which entails a plan to create an independent regulatory organization by 2015, but does not include specific details. Second, fixed price forward contracts are necessary to mitigate predatory supply withholding by suppliers that can lead to high prices for consumers.



Coping with Declining Dependence on Nuclear Energy in Japan

CLOSED DISCUSSION II

*How much can we rely on shale gas technology?
How can we promote renewable energy effectively?*

Kenji Kushida

Research Associate Fellow, Shorenstein APARC, Stanford University

Hajime Ito

Executive Vice President, Japan Petroleum Exploration (JAPEX)

Harry Rowen

Senior Fellow, Shorenstein APARC & Hoover Institution, Stanford University

After the Fukushima Daiichi nuclear disaster, nuclear energy in Japan has been a contentious issue. In the final discussion, some participants argued that, thanks to the shale revolution, LNG technology will become an ideal substitute for nuclear power. It is safe and clean, and will yield economic savings and environmental benefits. At the same time, other participants paid close attention to renewables, especially wind and solar power. Still others contended that, even though there were some negative attitudes toward nuclear energy, Japan could not abandon it because there is a huge demand for electricity. The Japanese government will cut down on nuclear power plants, but they will not eliminate all of them. Because the conference presented three different opinions, multiple strategies are available.



The majority of the participants emphasized the impact of the shale gas revolution on Japan. The dynamic change of global LNG flow makes it possible for Japan to import LNG and be a part of the new trend of E&P (Exploration & Production) Business. VLNG (Vladivostok LNG) and FELNG (Far East LNG) are two new projects Russia launched to meet the booming demand for LNG in the Pacific Basin. They also take advantage of the vigorous Japanese market for LNG. Most participants agreed that gas would be a new frontier in energy development, and that it would take a leading role.



Unlike Japan, the U.S. produces shale gas. Shale gas has four significant features: it exists in abundance, produces half of the CO₂ per unit of energy that coal does, costs little, and mitigates problems such as methane leaks or water contamination. The shale revolution has developed in the U.S. because, first, the energy industry is global, and the U.S. can distribute shale gas worldwide; and, second, the U.S. has an abundant reserve of shale gas, unlike other resources. Nevertheless, the most crucial cause is property rights. The U.S. is unique in private ownership of subsurface mineral rights. For example, the federal and the state have different gas ownerships. Therefore, private ownership allows the U.S. to avoid regulation, facilitate free exploration, and make the shale revolution thrive on.

In the discussion, several ideas were raised regarding energy renewables. The main challenge is storage. It is currently too costly to store up enough from variable

sources such as wind and solar, and the relationship between supply and demand is changeable. It is necessary to understand how much demand there will be and who will supply the proper match to customers. Inherent problems include the fact that hydro is largely developed, wind is intermittent, and the sun doesn't always shine.

Another big debate focused on whether Japan should continue running nuclear power plants. At the current stage, Japan is not able to shut down all the nuclear power plants since the LNG import will add a burden to its trade deficit. Moreover, on the demand response side, Japanese voters seem to choose to depend on nuclear power at least in the near future. The victory of Mr. Masuzoe, who supports the continued reliance on nuclear power, in the recent election for Tokyo Governor supports such an argument.



Participants For Closed Dialogue

ALPHABETICALLY ORDERED

Masahiko Aoki FSI Senior Fellow, Stanford University

Michael Armacost Shorenstein Distinguished Fellow, Shorenstein APARC, Stanford University

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Takeo Hoshi Director, Japan Program, Shorenstein APARC, Stanford University

Hajime Ito Executive Vice President, Japan Petroleum Exploration (JAPEX)

Koichiro Ito Assistant Professor, Boston University School of Management

Kazuho Kato Program Office, Sasakawa Peace Foundation

Takeo Kikkawa Professor, Graduate School of Commerce and Management, Hitotsubashi University

Yoriko Kishimoto Former Mayor, City of Palo Alto

Kenji Kushida Research Associate Fellow, Shorenstein APARC, Stanford University

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Hideto Nakahara Senior Executive Vice President, Mitsubishi Corporation

Kaichiro Nakano Senior Manager, Smart Energy Business Planning Division, NEC

Julia Nesheiwat Deputy Assistant Secretary, Bureau of Energy Resource, U.S. Department of State

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Hiroshi Takahashi Research Fellow, Economic Research Center, Fujitsu Research Institute

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Nobuo Tanaka Professor, The University of Tokyo, Former Executive Director, International Energy Agency

Ginger Vaughn TV Journalist, Reporter, CCTV America

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Yukari Yamashita Board Member, The Institute of Energy Economics, Japan

About the Participants

ALPHABETICALLY ORDERED



Masahiko Aoki is the Henri and Tomoye Takahashi Professor Emeritus of Japanese Studies in the Department of Economics, and a senior fellow of the Stanford Institute of Economic Policy Research and the Freeman Spogli Institute for International Studies at Stanford University. He is a theo-

retical and applied economist with a strong interest in institutional and comparative issues. His preferred field covers the theory of institutions, corporate architecture and governance, and the Japanese and Chinese economies.

Aoki was the president of the International Economic Association from 2008 to 2011, and is also a former president of the Japanese Economic Association. He is a fellow of the Econometric Society and the founding editor of the *Journal of Japanese and International Economies*. He was awarded the Japan Academy Prize (1990) and the sixth International Schumpeter Prize (1998). Between 2001 and 2004, Aoki served as the president and chief research officer of the Research Institute of Economy, Trade, and Industry in Japan.

Aoki graduated from the University of Tokyo with a BA and an MA in economics, and earned a PhD in economics from the University of Minnesota in 1967. He was formerly an assistant professor at Stanford University and Harvard University, and served as both an associate and full professor at the University of Kyoto before rejoining the Stanford faculty in 1984.



Michael Armacost is the Shorenstein Distinguished Fellow at the Walter H. Shorenstein Asia-Pacific Research Center. In the interval between 1995 and 2002, Armacost served as president of Washington, D.C.'s Brookings Institution, the nation's oldest think tank and a leader in

research on politics, government, international affairs, economics, and public policy. Previously, during his twenty-four year government career, Armacost served, among other positions, as undersecretary of state for political affairs and as ambassador to Japan and the Philippines.

Armacost began his career in academia, as a professor of government at Pomona College. In 1969, he was awarded a White House Fellowship, and was assigned to the Secretary and Deputy Secretary of State. Following a stint on the State Department's policy planning and coordination staff, he became a special assistant to the U.S. ambassador in Tokyo from 1972 to 74, his first foreign diplomatic post. Thereafter, he held senior Asian affairs and international security posts in the State Department, the Defense Department, and the National Security Council. From 1982 to 1984, he served as U.S. ambassador to the Philippines, and was a key force in helping the country undergo a nonviolent transition to democracy. In 1989, President George Bush tapped him to become ambassador to Japan, considered one of the most important and sensitive U.S. diplomatic posts abroad.

Armacost graduated from Carleton College and earned his master's and doctorate in public law and government from Columbia University.



Joao Felix is currently Director of External Communications, Schlumberger Limited.

Dr. Felix has over 20 years of experience in the Oil & Gas industry. Since joining Schlumberger in 1991, his experience encompasses Research & Engineering, Equipment Manufacturing, Oilfield Services

Field Operations, Sales, Marketing and Business Development, for which he has held various technical and managerial roles in North America, Latin America, Europe, and West Africa.

Educated in the United Kingdom, he holds a Ph.D. in Computational Fluid Mechanics from Imperial College of Science & Technology, University of London



Gerald J. Hane is the President and CEO of Battelle-Japan a joint venture of Battelle Memorial Institute, the world's largest independent, non-profit research organization, and the Mitsubishi Corporation. Battelle-Japan advances partnerships in technology commercialization, contract

research and laboratory management services in Japan and the Asia-Pacific. Prior to taking this position, Dr. Hane worked with venture companies, investors, the U.S. government and science and technology organizations in Asia regarding innovation-based business development and promotion. He current serves on the U.S.-Japan Innovation and Entrepreneurship Council.

Dr. Hane has also served as the Assistant Director for International Strategy and Affairs at the White House Office of Science and Technology Policy (OSTP), with a concurrent position with the National Security Council. Before entering OSTP, Dr. Hane was a Professional Staff Member of the Committee on Science, Space, and Technology of the U.S. House of Representatives.

Dr. Hane received his Ph.D. in Political Economy and Government from Harvard University where he examined the management of innovation and the role of collaborative research and development activities in Japan. He has B.S. and M.S. degrees in Mechanical Engineering from Stanford University.



Takeo Hoshi is the Henri and Tomoye Takahashi Senior Fellow at the Walter H. Shorenstein Asia-Pacific Research Center at Stanford University, and a professor of finance (by courtesy) at the Stanford Graduate School of Business. Before he joined Stanford University in 2012, he was Pacific

Economic Cooperation Professor in International Economic Relations at the Graduate School of International Relations and Pacific Studies (IR/PS) at the University of California, San Diego (UCSD), where he conducted research and taught on the Japanese economy for 24 years.

Hoshi also serves on the Board of Directors at Union BanCal Corporation. He is also a research associate at the National Bureau of Economic Research (NBER) and at the Tokyo Center for Economic Research (TCER). His main research interests include the study of the financial aspects of the Japanese economy, especially corporate finance, banking, and monetary policy.

Hoshi received his BA in social sciences from the University of Tokyo in 1983, and a PhD in economics from the Massachusetts Institute of Technology in 1988.



Hajime Ito is Executive Vice President for Americas & Russia Project Division, Japan Petroleum Exploration Co. (JAPEX). In the company, Ito plays the key role in various oil and gas projects, including British Columbia shale/LNG, Alberta oil sand, and Russian LNG (Sakhalin & Vladivostok).

Before joining JAPEX in 2010, he was President of JETRO New York Center from 2008 to 2010.

Between 2006 and 2008, Ito served as Deputy Director-General for Global Environmental Policy, the Japanese Ministry of Economy, Trade and Industry (METI). In addition, as METI official, he served a round of positions, including counselor for diet affairs, director at the Multi-Trade System Department of Trade Policy Bureau and counselor at the Cabinet Secretariat. From 1995 to 1998, he was counselor at the Embassy of Japan, Washington, DC.

Ito graduated from the Faculty of Law at University of Tokyo in 1980. He received his MBA in 1986 from Stanford Graduate School of Business.



Koichiro Ito is an Assistant Professor at Boston University School of Management and a Faculty Research Fellow of the National Bureau of Economic Research.

Before joining Boston University, Ito was a SIEPR Post-doctoral Fellow at Stanford Institute for Economic Policy Research. His research interests include environmental and energy economics, industrial organization, and public economics.

Ito received B.A. from Kyoto University in 2004, M.A. from University of British Columbia in 2005 and his Ph.D. from UC Berkeley in 2011.



Takeo Kikkawa is Professor at Hitotsubashi University, Graduate School of Commerce and Management and President at the Business History Society of Japan.

Between 1996 and 2007, Kikkawa served as Professor at University of Tokyo, Institute for Social Science. In addition, he served as Guest Professor at Yonsei University in South Korea from 1998 to 2004, and as Guest Professor at Berlin Free University in Germany from 1998 to 1999.

Kikkawa graduated from the Department of Economics, University of Tokyo in 1975, and received his M.A. in 1977, and his Ph.D. in 1996 from Graduate School of University of Tokyo on Economics.



Yoriko Kishimoto is a Former Mayor of Palo Alto. She began her career by organizing the Presidio Energy Workshop (“Japan-US Perspectives on a Sustainable Energy Future”) and writing *The Third Century: America’s Resurgence in the Asian Era*. Prior to joining the Midpeninsula Regional

Open Space District as a public Director, she was a member of the Palo Alto City Council for eight years where she promoted walkable communities, open government, high environmental standards and fiscal responsibility. She became Mayor in 2007 with a call to action to “build a green economy through innovation.” In addition to her work in the City of Palo Alto, Ms. Kishimoto also served on the boards of the Bay Area Air Quality Management District and the Valley Transportation Authority where she worked for sustainable energy through air quality standards and progressive transportation policies.

Kishimoto holds a B.A. in East Asian Studies from Wesleyan University and an MBA from Stanford University.



Kenji Kushida is the Takahashi Research Associate in Japanese Studies at the Walter H. Shorenstein Asia-Pacific Research Center. He holds a PhD in political science from the University of California, Berkeley, and was a graduate research associate at the Berkeley Roundtable on the In-

ternational Economy.

Kushida’s research interests are in the fields of comparative politics, political economy, and information technology. He focuses mainly on Japan with comparisons to Korea, China, and the United States. He has four streams of academic research and publication: institutional and governance structures of Japan’s Fukushima nuclear disaster; political economy issues surrounding information technology; political strategies of foreign multinational corporations in Japan; and Japan’s political economic transformation since the 1990s..

Kushida has an MA in East Asian studies and BAs in economics and East Asian studies, all from Stanford University.



Shigeru Muraki is Representative Director and Executive Vice President for Tokyo Gas Co., LTD, Japan's largest supplier on natural gas for residential and business.

In the company, Muraki plays the key role in distributed energy projects and cogeneration projects as Chief Executive of Energy Solution Division from 2007 to the present. He became Senior Executive Officer and Chief Executive of Technology Development Division in 2006, and Senior Executive Officer and Chief Executive of R&D Division in 2004, Executive Officer and General Manager of Gas Resources Department, Planning Division in 2002.

Muraki graduated from University of Tokyo, School of Engineering on Applied Chemistry in 1972.



Hideto Nakahara is a Member of the Board and Senior Executive Vice President of Mitsubishi Corporation, Japan's largest general trading company (sogo shosha) with over 200 bases of operations in approximately 90 countries around the world, including Japan.

Nakahara held several positions such as General Manager of Coal & Nuclear Fuel Department and General Manager of Ferrous Raw Materials Business Unit, both at the Tokyo Headquarters, and Managing Director of Mitsubishi Corporation (UK) PLC in London. Nakahara also served as Senior Vice President and Regional CEO for Europe in London, Senior Vice President and Chief Representative for China in Beijing, and Executive Vice President for Global Strategy & Regional Development.

Nakahara graduated Tohoku University with LL.B in 1973.



Kaichiro Nakano is a Senior Manager of Smart Energy Business Planning Division, NEC Corporation. He is now engaged in working a technology strategy for the NEC's energy storage and management systems based on technologies of Li-ion battery, system-managing software, network

technology and system integration.

Previously, Nakano has developed materials and cell-design for novel Li-ion battery at the corporate laboratory in NEC Corporation. He was awarded some prizes, for instance, the Chemical Society of Japan Award for Technical Development in 2008, and the Prizes for Science and Technology in the Development Category from The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, Japan in 2009.

Nakano received his B.A. and M. A. from Kobe University, and Ph. D. from Osaka University. He is a member of the society of polymer science, Japan



Julia Nesheiwat is currently the Deputy Assistant Secretary of State for Implementation in the Bureau of Energy Resources, where she has served since October 2011. Beginning in 2008-2011, Ms. Nesheiwat was the Senior Advisor and Chief of Staff to the Special Envoy for Eurasian Energy. Immediately

prior, she also served as the Energy Policy Advisor in the Department's Economic bureau, where she focused on energy security issues for Europe and Central Asia. In 2010 to 2011, including the period following the Fukushima nuclear disaster, Ms. Nesheiwat served as a Council on Foreign Relations (CFR) Fellow in Japan.

Earlier in her career, Ms. Nesheiwat was Chief of Staff for Policy and Planning at the Office of the Director of National Intelligence, where she worked on international energy security issues including nuclear power and non-proliferation issues. She has also served on the U.S. Presidential Commission on Intelligence Capabilities Regarding Weapons of Mass Destruction.

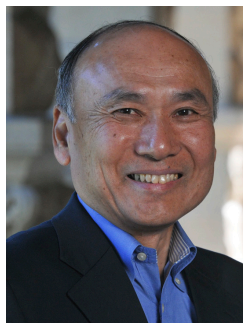
Ms. Nesheiwat received a B.A. from Stetson University, Deland, Florida; a Master of Arts degree from Georgetown University, Washington, D.C., and is currently a Ph.D. candidate in Mechanical Sciences and Engineering at Tokyo Institute of Technology, Tokyo, Japan.



Kazuhiko Ogimoto is Professor at the Institute of Industrial Science, the University of Tokyo. His major interests are Holistic Integration of Energy system, Energy system management, Long-range energy technology development strategy, Decentralized Energy management technology, and Plant maintenance and risk management.

Until 2007, Ogimoto worked at J-POWER (Electric Power Development Co.,Ltd.), Japan's largest wholesale power company, for power system planning and R&D on renewable energy and a HVDC converter, a hydrogen system, technology development strategy, operation and management of hydropower stations.

Ogimoto graduated from the University of Tokyo, Engineering School in 1979.



Hideichi Okada currently serves as Sasakawa Peace Fellow with the Japan Studies Program at Walter H. Shorenstein Asia-Pacific Research. He is Senior Adviser, NTT Data Institute of Management and Consulting.

Okada served as Vice Minister for International Affairs, Ministry of Economy, Trade and Industry (METI) from 2010 to 2012, where he promoted international trade and investment, and expanded industrial cooperation with various countries. He also served as Director General of Trade Policy Bureau (2008-2010) and Director General of Commerce and Information Policy Bureau of METI (2007-2008). He worked for Prime Minister Junichiro Koizumi as his executive assistant, where he dealt with policies on economy, industry, energy, science and technology, and environment, and with public relations (2001-2006). He was a professor at GRIPS (2006-2007) and a visiting scholar at Harvard Law School and IR/PS, University of California, San Diego in 2007.

Okada received LL.M. degree from Harvard Law School and graduated from the University of Tokyo with a LL.B.



Shmuel S. Oren is the Earl J. Isaac Chair Professor in the Science and Analysis of Decision Making in the Industrial Engineering and Operations Research department at the University of California, Berkeley. He is the Berkeley site director of PSERC – a multi-

university Power System Engineering Research Center sponsored by the National Science Foundation and industry members. He is also a member of the California ISO Market Surveillance Committee. His academic research focuses on planning and scheduling of power systems and on various aspects of electricity market design and regulation. He has been a consultant to various private and government organizations in the US and abroad including the Public Utility Commission of Texas (PUCT), the Energy Division of the California Public Utility Commission (CPUC), the Bonneville Power Authority and the California ISO.

He holds B.Sc. and M.Sc. degrees in Mechanical Engineering from the Technion in Israel and also M.S. and Ph.D. degrees in Engineering Economic Systems from Stanford University. He is a Fellow of the IEEE and of INFORMS.



Henry S. Rowen is a senior fellow at the Hoover Institution, a professor of public policy and management emeritus at Stanford University's Graduate School of Business, and a senior fellow emeritus of the Walter H. Shorenstein Asia-Pacific Research Center (Shorenstein APARC). Rowen is an

expert on international security, economic development, and high tech industries in the United States and Asia. His current research focuses on the rise of Asia in high technologies.

In 2004 and 2005, Rowen served on the Presidential Commission on the Intelligence of the United States Regarding Weapons of Mass Destruction. From 2001 to 2004, he served on the Secretary of Defense Policy Advisory Board. Rowen was assistant secretary of defense for international security affairs in the U.S. Department of Defense from 1989 to 1991. He was also chairman of the National Intelligence Council from 1981 to 1983. Rowen served as president of the RAND Corporation from 1967 to 1972, and was assistant director of the U.S. Bureau of the Budget from 1965 to 1966.

Rowen earned a bachelors degree in industrial management from the Massachusetts Institute of Technology in 1949 and a masters in economics from Oxford University in 1955



Gi-Wook Shin is the director of the Walter H. Shorenstein Asia-Pacific Research Center; the Tong Yang, Korea Foundation, and Korea Stanford Alumni Chair of Korean Studies; the founding director of the Korean Studies Program; a senior fellow of the Freeman Spogli Institute for Inter-

national Studies; and a professor of sociology, all at Stanford University.

As a historical-comparative and political sociologist, his research has concentrated on social movements, nationalism, development, and international relations. Shin is not only the recipient of numerous grants and fellowships, but also continues to actively raise funds for Korean/Asian studies at Stanford. He gives frequent lectures and seminars on topics ranging from Korean nationalism and politics to Korea's foreign relations and historical reconciliation in Northeast Asia.

Before coming to Stanford, Shin taught at the University of Iowa and the University of California, Los Angeles. After receiving his BA from Yonsei University in Korea, he was awarded his MA and PhD from the University of Washington.



Genevieve Shiroma was first elected to the SMUD Board of Directors in November 1998. She represents Ward 4, which includes Curtis Park, Land Park, Greenhaven, Pocket, Walnut Grove and part of Elk Grove. She served as President of the Board in 2002, 2006, and 2010.

Shiroma serves on the Agricultural Labor Relations Board, to which she was first appointed by the governor of California in May 1999. Prior to her appointment, she worked for the California Air Resources Board for more than 20 years. During this time she worked on air quality regulations and programs to identify toxic air contaminants and reduce air pollutants from power plants, consumer products, landfills, hazardous waste disposal, pesticide use, and other industrial sources. She last served as chief of the Air Quality Measures Branch.

Shiroma graduated from the University of California, Davis, with a bachelor's degree in material science and engineering.



KR Sridhar is the principal co-founder and CEO of Bloom Energy. Prior to founding Bloom Energy, Sridhar led a team developing technologies to sustain life on Mars for NASA. For his work, Fortune Magazine cited him as “one of the top five futurists that are inventing tomorrow today”.

Before this Sridhar was a professor of Aerospace and Mechanical Engineering as well as Director of the renowned Space Technologies Laboratory (STL) at the University of Arizona.

Sridhar has served on many technical committees, panels and boards. He has over fifty publications and is a sought-after speaker and advisor on energy and environmental issues.

Sridhar received his Bachelors Degree in Mechanical Engineering with Honors from the University of Madras, India, as well as his M.S. in Nuclear Engineering and Ph.D. in Mechanical Engineering from the University of Illinois, Urbana-Champaign.



Thomas Starrs serves as SunPower Corporation's vice president, market strategy and policy. Tom has been at SunPower since 2009. He has more than 20 years' experience in and around the solar power industry, including senior management positions with Iberdrola Renewables, PPM Energy, and Schott Solar. Starrs is widely recognized as a leading strategist on solar energy market assessment, business development and policy. He has served on the boards of the American Solar Energy Society, the California Foundation on the Economy and the Environment, the Center for Energy Efficiency and Renewable Technologies, the Solar Alliance, the Solar Electric Power Association, the Solar Energy Industries Association, and Vote Solar.

Tom holds a Ph.D. from the University of California, Berkeley's Energy and Resources Program, and a J.D. from the University of California Berkeley's School of Law.



Yuji Takagi is President of the Sasakawa Peace Foundation, which was established in 1986 as a private non-profit organization in Tokyo. He leads by conducting initiatives available only to private foundations in order to contribute to world peace through a promotion of international inter-

action, understanding and cooperation with a global society.

Takagi was senior research fellow at the Institute of Energy Economics, Japan, and vice president Middle East Research Center during 2008-2011. He specialized in world energy and environment issues, including world energy security, global environment analysis, U.S. energy policy and Middle East geopolitics, and the emerging Middle East economy, based on his extensive global experience derived from thirty-five years at Mitsui, fourteen years in the United States, and four years in the Middle East.

Yuji Takagi graduated from Hitotsubashi University with a bachelor's degree in business administration in 1973 and has completed the Program for Management Development at Harvard Business School in 1988.



Hiroshi Takahashi is the Research Fellow at the Fujitsu Research Institute. He specializes in energy policy with focus on market liberalization, grid unbundling, renewable energy and smart grid. He has actively participated in policy formation as Special Advisor to the Cabinet Office, as well

as a member of advisory panels of Agency of Natural Resources and Energy.

Takahashi served as a product planner at Sony Corporation, Deputy Director at IT Policy Office of Cabinet Secretariat and Assistant Professor at the University of Tokyo. He is the author of "Market Liberalization of Electric Utilities" published by Nihon Keizai Shinbun Shuppan-sha in 2011, and "The Politics of Technological Innovation" published by Keiso Shobo in 2009. He wrote many research papers on energy policy, bureaucracy and policy process for academic journals, major newspapers and commercial magazines.

Takahashi obtained doctoral degree from the University of Tokyo and master's degree from the Fletcher School of Law and Diplomacy, Tufts University.



Hirofumi Takinami is a member of the House of Councillors, National Diet of Japan, corresponding to a Senator in the U.S.. In this upper house, He has been engaging in energy policy of Japan as a member of the Committee on Economy and Industry as well as the Special Committee on Nuclear

Power Issues. Before starting his political career with the victory in his first run for an election last July, he was a Director, Ministry of Finance. During his about-20-years' service at the Ministry, he was once dispatched to this APARC (Asia-Pacific Research Center), Stanford University as a Visiting Fellow for 2009-11.

As a Japanese government official, he has served, among others, in policy coordination and management positions notably in the public finance area, including Public Relations Director, Director for Office of Planning and Personnel Management, Deputy Budget Examiner on social security expenditures at the Ministry of Finance; Deputy Cabinet Counselor in charge of coordinating domestic and economic policies at the Cabinet Secretariat.

Takinami graduated from the University of Tokyo in 1994, earning a Bachelor of Law. In his first dispatch to the United States by the Ministry of Finance, he received a Master of Public Policy (MPP) from the University of Chicago in 1998 with a major in finance and public finance.



Nobuo Tanaka is the Global Associate for Energy Security and Sustainability at the Institute of Energy Economics, Japan (IEEJ) since 2011. He is also Professor of the University of Tokyo, Graduate School of Public Policy.

Executive Director of the International Energy Agency (IEA) from 2007 to 2011, Tanaka oversaw a seminal period in the Agency's work and direction. Tanaka was responsible for pioneering the concept of 'comprehensive energy security' while also expanding the Agency's focus on climate change, renewable energy and the transition to a low-carbon energy economy. Notably, Tanaka also played a crucial and personal role in the strengthening of ties with major IEA non-Member energy players, including China, India, Russia, Brazil, Chile, Indonesia, Mexico and South Africa, and in IEA relations with business, including through the creation of the IEA Energy Business Council

Tanaka has a degree in Economics from the University of Tokyo and an MBA from Case Western Reserve University, Cleveland, Ohio.



Frank A. Wolak is a Professor in the Department of Economics at Stanford University. His fields of specialization are Industrial Organization and Econometric Theory. His recent work studies methods for introducing competition into infrastructure industries -- telecommunications, elec-

tricity, water delivery and postal delivery services -- and on assessing the impacts of these competition policies on consumer and producer welfare. He is the Chairman of the Market Surveillance Committee of the California Independent System Operator for electricity supply industry in California. He is a visiting scholar at University of California Energy Institute and a Research Associate of the National Bureau of Economic Research (NBER).

Professor Wolak received his Ph.D. and M.S. from Harvard University and his B.A. from Rice University.



Yukari Yamashita is Board Member and Director of the Energy Data and Modelling Center at The Institute of Energy Economics, Japan (IEEJ). She has been serving as a member of various government councils and committees in the fields of energy and science & technologies

Yamashita is responsible for quantitative analyses on energy policy issues. In the aftermath of the tsunami and nuclear incident, her team's analyses contributed greatly to the electricity saving campaign and to the national energy mix debate for Japan. In addition, she leads miscellaneous international and regional programs in the area of energy efficiency and conservation, energy modelling and demand analyses with IEA, IPEEC, APEC, ERIA, China, Saudi Arabia and Abu Dhabi.

Yamashita is a graduate of International Christian University (B.A.) and Master's Program in Business Administration & Public Policy at University of Tsukuba (M.A.). She studied at University of Sussex (U.K.) as an exchange student with government scholarship

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