Lessons from the U.S., Japan, and the Future of Renewable Energy Workshop

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On March 21, 2016, Sasakawa USA and the Daniel K. Inouye Asia-Pacific Center for Security Studies (DKI-APCSS) co-hosted a workshop on the future of renewable energy in the United States and Japan to examine the current status of and explore further opportunities for bilateral collaboration on clean energy. Held at DKI-APCSS in Honolulu, Hawaii, the invitation-only workshop brought together 23 experts representing both private and public stakeholders from Japan and the United States, along with 14 observers. The workshop kicked off with a brief examination of the current mix of U.S. and Japan energy production (Figure 1 – 4).

The goal of the workshop was to explore opportunities for bilateral cooperation in advancing the most promising renewable energy technologies. Toward that end, the program consisted of three panel discussions on renewable energy production, storage, and distribution. The workshop also included a keynote speech from the U.S. Pacific Command's director of resources and assessment on approaches to address energy security, resilience, and sustainability at military installations via deployment of micro grids powered by renewable energy. The workshop concluded with a seminar exercise in which the participants examined the day's discussion to determine challenges and opportunities for further collaboration as well as recommend a path forward. This report summarizes the workshop. Some of the most salient takeaways include:

- By setting ambitious goals (i.e., Hawaii's 2050 target of 100% of renewables meeting all its energy needs) policy makers can provide clear signals to investors, utilities, and manufacturers to spur them into action.
- There are many applications for energy storage beyond enabling intermittent renewables to provide stable supplies of energy. Japanese and U.S. policymakers need to consider reforming existing regulations to enable greater potential applications of energy storage across the power system from generation, transmission and distribution networks to end-users.
- The power system is transitioning from a system with clearly-defined boundaries between controllable generation and uncontrollable demand to a system with diffused boundaries thus

Figure 1: Japan active capacity at the end of 2015

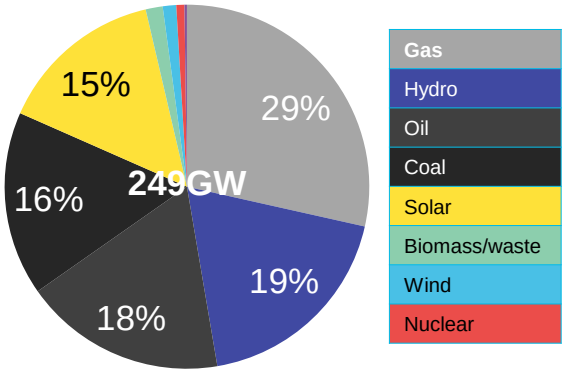


Figure 2: US active capacity at the end of 2015

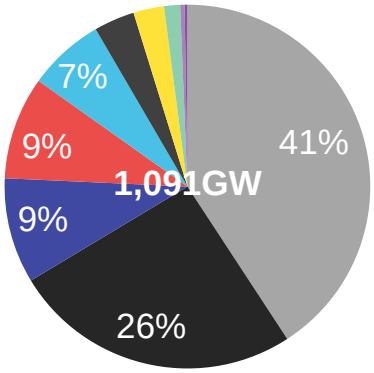


Figure 3: Japan generation mix for 2015

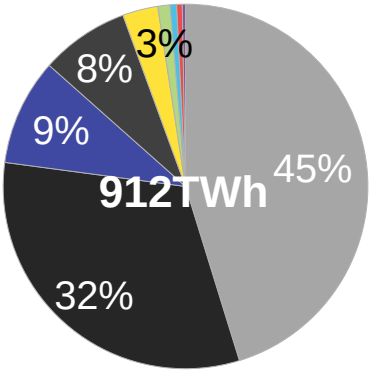
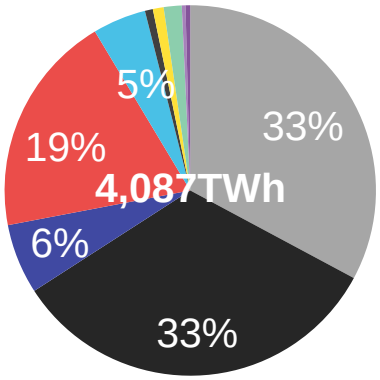


Figure 4: U.S. generation mix for 2015



Source: Bloomberg New Energy Finance

requiring new grid technologies and associated business models. This transition will entail an increased number of Internet-connected devices interacting with the grid, which will raise cyber security risks. There is an opportunity for Japan and US to jointly develop international standards to address such risks.

- Japan and the U.S. should also consider taking advantage of the fruits of their renewable energy partnership. One example would be to work together to deploy micro grids in developing countries.

INTRODUCTION

For over half a century, the partnership between U.S. and Japan has been a cornerstone of peace and economic development across the Asia-Pacific region and beyond. In 2009, President

Obama and then Prime Minister Hatoyama signed an agreement to formally expand the U.S.-Japan partnership to include cooperation on clean energy technologies to develop "solutions to the challenges of global energy security and climate change." Since then many joint initiatives have been launched, such as the "Hawaii-Okinawa Partnership on Clean and Efficient Energy Development and Deployment." Both countries have also enacted various domestic policies to support further development of renewables.

1. RENEWABLE ENERGY GENERATION TECHNOLOGIES

The first panel discussed policies adopted by U.S. and Japan to promote renewable energy generation and the impact of those policies. There was clear consensus that policy support mechanisms such as the feed-in tariff program in Japan, and the tax credit regime in the U.S. have had a positive impact on the deployment of renewable energy. However, these policies have not been without their flaws. In the case of Japanese feed-in tariffs, the initial rates were too generous for solar, while regulatory barriers such as a lengthy environmental impact assessment process for wind and geothermal hampered those sectors, thus leading to a market dominated by solar. In the case of the U.S., historically the uncertainty around the length of the tax credit program had caused boom-bust cycles, whereby developers would rush to complete projects before expiry of tax credits. Additionally, differing support schemes and regulations in each state had led to additional challenges for developers.

The panelists argued that while the unique advantages and disadvantages of particular regions (i.e., high wind speeds in Texas and low wind speeds in Japan) necessitate tailored local policies, there are many common features that transcend regional differences, which allow room for better policy coordination. The panelists recommended that policymakers foster an environment conducive to information sharing with the public, particularly in critical areas such as resource availability. In this regard, NREL's solar irradiation and wind speed map was cited as a good example to build on.

Going forward, the panelists concluded that for solar and wind specifically, policymakers should focus less on subsidies or other form of support since the economics of those technologies have already improved. Instead, policymakers should focus on removing regulatory barriers and level the playing field visa vie incumbent fossil fuelled power plants. For other renewable energy generation technologies, R&D support may still be needed. In the context of U.S.-Japan

collaboration, ocean thermal energy conversion (OTEC) was identified as a technology that could benefit from further support, including as part of existing Hawaii-Okinawa renewable energy collaboration.

A final recommendation for policy makers was to provide clear signals to investors, utilities, and manufacturers by setting ambitious goals. A good reference cited was Hawaii's 2050 target of 100% renewable energy production.

1. ELECTROCHEMICAL ENERGY STORAGE TECHNOLOGIES

The second panel focused on energy storage, specifically electrochemical forms of storage. Energy storage has garnered significant attention in recent years driven by both public policy (i.e., an energy storage mandate on California's utilities) and private action (i.e., Tesla's launch of its Powerwall). However, the panelists cautioned that, while increased attention to energy storage is welcome, stakeholders need to exercise care to ensure that the full benefits of energy storage are realized. While many current discussions are focused on using energy storage as a means to make intermittent renewables such as solar and wind more constant, solely focusing on storage in the context of renewables would mean other important applications of energy storage would be missed. Also, stakeholders, in particular policy makers, need to recognise that greater applications of renewable energy require various regulatory as well as technological approaches with storage.

Unlike typical equipment used in the power sector, modern energy storage systems can provide services useful for generation, transmission, and distribution as well as for consumers. However, in most jurisdictions, combining multiple applications can be challenging due to regulatory barriers. As regulators in some jurisdictions have moved to create more competition in the power sector by unbundling vertically-integrated utilities, they have created rules that restrict the types of assets that entities engaged in electricity generation, network operation, and electricity retail can own and operate. Such rules can challenge utilization of the multiple benefits of energy storage as the beneficiaries are differing entities. As such, new regulatory frameworks are needed. Initiatives by regulators in California, Hawaii, and New York are encouraging. It is also critical for policy makers to share their experiences, and over the long-term, work together to avoid the emergence of a patchwork of differing regulations that would hamper adoption.

On the question of technology, the panelists argued that though lithium-ion batteries are currently receiving the most attention, there are other alternative technologies such as flow batteries and power to gas – usage of water electrolysis to produce hydrogen – that are better suited for certain applications (i.e. ,long-duration energy storage). Additionally, the issue of safety needs further consideration as electrochemical energy storage devices contain varying degrees of highly flammable chemicals depending on their underlying storage technology. Going forward, the panelists expected significant improvements in the cost performance of energy storage technologies driven not only by advancements in the underlying hardware but also further developments in the software controlling energy storage systems.

In the context of the U.S.-Japan partnership, panelists recognised that each country has unique advantages that can complement one another. Japan has historically been strong in electrochemical energy storage cell technology dating back to commercialization of lithium-ion batteries in 1991, while U.S. players have driven development of storage integration technologies to serve power sector needs beyond those of consumer appliances. Going forward, both countries would benefit from collaboration on developments of electricity market regulatory regimes conducive to further use of energy storage as well as development of compatible safety standards.

2. NEXT GENERATION GRID TECHNOLOGIES

The traditional power system was built on the premise of a vast transmission and distribution network bringing electricity generated at distant power plants to consumers. The advent of distributed energy resources such as rooftop solar and home energy storage systems enable electricity generation closer to demand centers, giving rise to prosumers (i.e., customers who both consume electricity from the grid as well as produce their own electricity). In a traditional power system, grid operators exert precise control over the output of generators to ensure that supply matches demand. Adoption of intermittent renewable sources such as wind and solar is leading to loss of precise control over generation thus increasing the need for greater control over demand. The power system is transitioning from a system with clearly defined boundaries between controllable generation and uncontrollable demand to a system with diffused boundaries thus requiring new grid technologies and associated business models.

The panelists examined various examples across Japan and the U.S. to discern transferrable lessons of how to successfully implement this transition. Many technology examples were cited (i.e., self-balancing micro grids) that can be suitable both for island grids as well as those that can operate as part of larger regional grids. A common refrain was that technologies will be successful only if they are matched with the appropriate regulatory framework and business model. For example, the deployment of smart meters will not achieve control over demand if the retail tariff structure does not incentivize consumers to act on the information provided by a smart meter.

Beyond the need to carefully consider the need for new regulatory frameworks and business models, the panelists also raised the issue of security. While in a traditional power system, key infrastructure is primarily under the control of a closed network, there are now many internet connected devices that directly interact with the power infrastructure thus potentially exposing it to hackers. At the same time, the panelists recognised that further increases in distributed energy resources can increase the resiliency of a system. A modern power grid relying on thousands if not millions of smaller distributed energy resources is far less impacted when an individual generator encounters problems, compared to a traditional power network relying on fewer larger power plants, whereby an individual power plant failure could affect the whole grid. To better take advantage of increased resilience and minimize potential security risks, the panelists recommended enhanced cooperation between regulators, utilities and manufacturers towards development and deployment of security standards.

3. CONCLUSION

The workshop concluded with the panelists considering the lessons learned from U.S.-Japan cooperation on renewable energy thus far and recommend areas to prioritize in the future.

The panelists recognized demonstration projects (i.e., Okinawa-Hawaii) as the best examples of successful collaboration thus far. Many of the demonstration projects have benefitted from prior sister-city relationships and long-term cultural exchange. Beyond the joint demonstration projects, Japan’s renewable energy sector has benefited from investment by experienced U.S. renewable energy financiers since the country launched its feed-in tariff program in 2012.

Conversely Japanese manufacturers particularly auto OEMs, have benefitted from the U.S. market for commercializing new products (i.e., hybrid and fuel cell vehicles).

The biggest challenges thus far have stemmed from fundamental differences in regulatory frameworks and political incentives as well as vested interests. For example, in the U.S., energy policy is heavily influenced by state-level policies, whereas in Japan, energy policy is the sole domain of the central government. The existence of elected, state-level public utility commissions in the U.S., and the non-existence of equivalent bodies in Japan, means the framework for local stakeholder engagement is significantly different in each country. The procurement culture in each country is also different. While U.S. utilities have for years conducted competitive RFPs, Japanese utilities have only recently begun to move away from sole-sourced contracts. Despite these challenges, successes thus far have been encouraging, and more opportunities for collaboration exist. Going forward, the panelists recommended two new areas for potential collaboration:

1. Joint U.S.-Japan capacity building to support deployment of renewable energy in developing countries (i.e., deployment of micro grids in island nations).

2. Joint U.S.-Japan collaboration on development of cyber security standards for the power grid: The panelists recommended that Japan and the U.S. take the lead on development of international standards for cyber security for the power grid.