Japan: Smart Grid

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Summary
Japan aims to achieve a "Low Carbon Society" through increased use of renewable energy sources. The challenge of employing smart grid technologies in Japan lies in maintaining the current quality of electricity while introducing renewable energy sources. For example, when introducing a large amount of renewable energy to their existing grid networks for conventional power sources, Japanese power utilities will face problems such as backward flow and excessive electricity. Japan will look to employ smart grid technologies to address these issues.

As Japanese utility companies conduct all aspects of the power business themselves – everything from power generation, to transmission, to distribution, to bill collection – decision makers tend to view technological solutions for Japan's smart grid issues in a broad, comprehensive context rather than for their individual, incremental contributions.

Some Japanese utilities, trading firms, manufacturers and general contractors are also now considering the creation of a "Smart Community" infrastructure model, incorporating smart grid technologies, for export.

U.S. firms that offer control technologies or systems may have good prospects in the Japanese market, and possibly as part of consortia with Japanese companies in projects in other countries, as well.

Market Demand

In order to maintain stable electricity when a large amount of power from intermittent sources (most notably solar) are introduced into the grid system, Japanese utilities will need to develop the following technologies:

1. Balance control technology for electricity supply-and-demand, which carries out integrated control of all power stations and storage batteries;

2. System control technology, which activates components on the demand-side and regulates excessive electricity and control frequency, and limits voltage surges;

3. Third-party or consumer control systems for electric appliances and storage batteries.

However, the Government of Japan and industry experts estimate that it will take several years to develop such comprehensive technologies. As such, Japan's Ministry by Economy, Trade and Industry (METI) has set up The First Working Group of Next-Generation Transmission and Distribution System to discuss key issues and make recommendations on priorities. In May 2010 the First Working Group agreed that Japanese industry should tackle the issue of excessive electricity first.

For example, during holiday seasons such as New Years and traditional Buddhist holidays in August, many Japanese leave major metropolitan areas to visit family. Solar power generation in metropolitan areas during these holidays would produce supply far in excess of demand, creating the potential for a rise in frequency which could ultimately lead to power outages. Storing excess electricity in storage batteries is an attractive option. However, it is anticipated that it will take approximately 10 years to develop batteries with large enough capacity to handle the excess, and the costs are expected to be enormous. The First Working Group has agreed that the most practical technology to address this issue is to limit power output from solar panels by adding a calendar function. Another technology is to transmit wireless signals to solar panels to stop generating electricity. Technologies that can help improve these control functions are expected to be in high demand.

Market Data

In May 2010, METI simulated the costs of stabilizing the electric grid system to handle 28 million kilowatts of photovoltaic solar power expected to be introduced by 2020. The simulations were based on five scenarios, running from no limitations on output, to a full day limitation. Through the simulation METI estimates that Japan's power utilities will need to invest anywhere from $17.1 billion to $673 billion to enable systems to handle the 28 million kilowatts of solar power expected to be introduced into the current grid system by 2020. These estimates are a good representation of the dollar value of the size of the market in view of Japan's plans for smart grid.

Scenario	Distribution Grid ($Billion)	Storage Battery ($Billion)	Control System ($Billion)	Output Limitation (PCS) ($Billion)	Demand Creation ($Billion)	Water Pump-Up Loss ($Billion)	Thermal Power Adjustment ($Billion)	Total ($Billion)
① No Output Limitation (Storage Battery on grid side)	3.8	177.6	3.5	-	-	4.1	1.8	190.8
①' No Output Limitation (Storage Battery on demand side)	-	534.1～667.1	3.5	-	-	0.6	1.8	540～673
② Full Limitation on special days	3.8	32.9	3.5	0.2	-	0.9	1.8	43.1
③ Half Limitation on special days	3.8	88.9	3.5	0.2	-	2.2	1.8	100.4
④ Full Limitation on special days and off season days	3.8	6.5	3.5	0.2	-	0.2	1.8	16
⑤ Full Limitation on special days and off season days + Demand Creation	3.8	6.5	3.5	0.2	1.1	0.2	1.8	17.1

Best Prospects

In addition to the aforementioned solar output control technologies, U.S. firms that offer the following technologies may have good prospects in the Japanese market:

1. Storage batteries (large volume, long lifetime, low cost)
2. Technology to control solar panels in order to keep voltage in distribution lines constant
3. Technology and equipment to regulate and control voltage in distribution lines
4. Technology to keep frequency constant by controlling storage batteries and thermal power generation
5. Smart Meters

The integration of the above technologies essentially constitutes the Japanese version of smart grid.

With the introduction of a large volume of intermittent power sources over the next ten years, Japan's transmission and distribution (T&D) system will undergo significant change. Accordingly, Japanese power utilities will find it necessary to adopt comprehensive system technology, rather than incrementally adopt individual technologies. For U.S. firms that offer such integrated system technology, the potential export market will be huge, as shown in the previous section of this report.

Japan's smart grid plans also open up new business opportunities for Information and Communication Technology (ICT) firms to apply their technologies to the power industry.

In addition, some Japanese utilities, trading firms, manufacturers and general contractors are also now considering the creation of a "Smart Community" infrastructure model for export. Smart Community is an expanded version of smart grid incorporating smart grid technologies for electricity, water, and transportation. In February 2010 the New Energy and Industrial Technology Development Organization (NEDO), Japan's public management organization promoting research and development of energy and environmental technologies, set up "Japan Smart Community Alliance" (JSCA) in order to encourage the participation of Japanese companies in Smart Community projects. Some 352 companies and organizations have participated in JSCA so far. Such projects may provide opportunities for American firms to partner with Japanese firms.

Key Suppliers

The following Japanese suppliers have been leading suppliers of products and technologies to Japan's current electric power utilities for several years, and are now also active in the smart grid market:

- Mitsubishi Electric http://global.mitsubishielectric.com/
- Fuji Electric http://www.fujielectric.com/index.html
- Mitsubishi Heavy Industries http://www.mhi.co.jp/global/index.html
- Hitachi http://www.hitachi.com/
- Toshiba http://www.toshiba.co.jp/index.htm
- Meidensha http://www.meidensha.co.jp/epages/top/index.html

Prospective Buyers

There are two types of prospective buyers in Japan's smart grid market: electric power utilities themselves, and electric component manufacturers and trading firms that sell their products to the utilities.

There are ten regional retail power utilities in Japan: Hokkaido, Tohoku, Tokyo, Chubu, Hokuriku, Kansai, Shikoku, Kyushu, and Okinawa. These ten regional utilities sell approximately 99% of all electricity in Japan. In addition to these ten regional power utilities, there are also two wholesalers (J-Power and Japan Atomic Power), and thirty-seven independent power producers in Japan. These utilities conduct all aspects of the power business themselves – everything from power generation, to transmission, to distribution, to bill collection. As such, they are regarded as system integrators, and hence purchasers of smart grid technology.

There is no U.S. or other foreign direct investment in Japanese power utilities.

Manufacturers of products and technologies include, but are not limited to, Mitsubishi Electric, Fuji Electric, Mitsubishi Heavy Industries, Hitachi, Toshiba, and Meidensha. There are also a number of small or medium-sized trading firms with expertise in the electricity business and good contacts with the power utilities.

Market Entry

High-quality, highly-responsive product service and customer support throughout the sales cycle are crucially important in Japan. The Japanese utility market is no exception. Japanese utility companies are known to be quite conservative, and they tend to prefer dealing with a local agent when it comes down to actual business transactions. As such, once a U.S. firm's product finds acceptance with Japanese utilities, the firm will need to consider how best to provide ongoing service and support: through a representative, a local Japan office, or other arrangement.

Each year, Commercial Service Japan holds a matchmaking event between U.S. firms (and their representatives in Japan) and procurement managers of Japan's ten regional utilities and two wholesalers. U.S. firms interested in entering the Japanese utility market should consider participating in the event.

Market Issues & Obstacles

Japan is currently working to develop standards for smart grid, both within Japan and on the global stage. In January 2010, after consultation with Japanese industry, METI disclosed the "International Standardization Road Map on Smart Grid" in which it selected 26 technologies and systems as priorities for developing coherent standards and strategies among Japanese companies. Following this, in May 2010, NEDO and Japan Electronics and Information Technology Industries Association (JEITA) sent a delegation to the United States to discuss the issue of international smart grid trade collaboration with the National Institute of Standards and Technology (NIST) and the Association of Electrical and Medical Imaging Equipment Manufacturers (NEMA).

To date Japan has been cautious about developing its own smart grid standards and watchful of the development of standards in the United States and Europe. Government officials, and many in business, still remember how Japanese standards for cell phones did not become de facto international standards.

The Best Prospects section of this report noted potential opportunities for American firms to participate in Smart Community projects. That said, to date JSCA has included only Japanese firms. Should Smart Community projects develop under an "All Japan" model, they could serve as an obstacle for U.S. firms to partner with Japanese firms in other countries.

Trade Events

- 1st International Smart Grid Expo (March 2-4, 2011), Tokyo
  http://smartgridexpo.jp/en/

- Smart Grid Exhibition (June 15-17, 2011), Tokyo
  http://www.nikkan.co.jp/eve/smart/

Resources & Contacts

- Ministry of Economy, Trade and Industry
  http://www.meti.go.jp/english/index.html

- New Energy and Industrial Technology Development Organization (NEDO): http://www.nedo.go.jp/english/index.html

- Japan Electronics and Information Technology Industries Association (JEITA)
  http://www.jeita.or.jp/english/

- Japan Smart Community Alliance (JSCM)
  http://www.smart-japan.org/english/tabid/103/Default.aspx

- The Federation of Electric Power Companies of Japan (FEPC)
  http://www.fepc.or.jp/english/index.html

For More Information

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