JAPAN SEEKS TO BUILD ENERGY SECURITY AFTER THE QUAKE

The Fukushima disaster once again called into question Japan's energy security situation, with renewable energy becoming both a strategic opportunity and a practical challenge

Japan is the world's fifth largest energy consumer. But as an island nation located at the edge of maritime East Asia with few natural resources of its own, it is the most vulnerable of all OECD nations in terms of energy security. Its geographic isolation means prospects for importing electricity from neighboring countries are very poor, and as a result, Japan relies very heavily on imported energy resources to fuel its economy and society.

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Fortunately, until recently, the country was able to offset some of this external dependency as a result of its extensive network of nuclear reactors, which produced around a third of its power generation needs and placed it third in the world in nuclear energy production, behind the United States and France.

Then, disaster struck. In March 2011, a 9.0-magnitude earthquake struck the country, rendering significant energy-related infrastructure inoperable. Most notably, a 15-meter tsunami disabled the power supply and cooling of the country's three Fukushima Daiichi reactors, causing a nuclear accident.

The temblor and consequent tsunami took out 10.5 GW of nuclear power capacity and 12.4 GW of thermal power capacity. Shutdowns also affected nearly 1.5 million barrels per day (mmb/d) of refining capacity. Initially, 5.27 million households lost power.

The Fukushima disaster brought into sharp focus the potential risks of nuclear reactors in an earthquake-prone country, and the government moved quickly to take the rest of the country's plants offline. Nuclear power generation soon tumbled to less than 1 percent of Japan's energy mix, replaced by imports of oil, coal and gas, mainly through the geopolitically unstable Strait of Hormuz and Strait of Malacca, which exposed the country to potential supply disruptions, weakening its energy security situation. Fossil fuels accounted for almost the entirety of the country's energy supply, leading to rising electricity prices and a growing trade deficit.

"Japan can't escape from natural disasters but we did not expect that this kind of incident would have such an impact on a nuclear facility. We were confident that nuclear power was very safe. Nobody could have predicted such a devastating result," says Osamu Masuda, President of energy firm Astomos Energy.

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Following the election of Prime Minister Shinzo Abe in 2012, the new administration made clear that the post-disaster energy mix was untenable. It laid out a new vision for energy security in its Fourth Strategy Energy Plan in 2014, which aimed to reverse the nuclear shutdown and lay out an alternative energy strategy. The plan emphasized safety as a key component of nuclear restarts, handing over power to the newly-formed Nuclear Regulation Authority (NRA) to enforce stringent regulations and carry out extensive safety inspections before clearing reactors to re-open.

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"The Japanese energy structure needs nuclear and gas energy within its mix," says Michiaki Hirose, President of Tokyo Gas. "One of the 'arrows' of Prime Minister Shinzo Abe's Abenomics plan aims to conduct strategic structural reforms. In the energy sector we saw the full deregulation of the power retail sector last year, and this year the one for the gas sector will take place. I believe that such energy reform is giving us new possibility and opportunity for growth, hence we embrace it with great expectations."

Getting back to the status quo won't be easy. Naturally, there is some resistance to reopening reactors from a still-traumatized public. But if the country is to meet the commitments it made at the 15th Conference of the Parties (COP15) in 2009, where it pledged to reduce its greenhouse gas emissions by 25 percent from 1990 to 2020, swift action must be taken to clean up the fuels used in Japan's energy mix. The East Asian nation needs innovation to make up for the electrical capacity it lost when it switched off its nuclear power plants, and for that reason, as well as bringing some nuclear production back on line, the government is aiming for an increase in renewable energy sources.

To do this, it introduced a feed-in tariff system in 2012, to promote the introduction of renewable energy to fill the gaps. Generous incentives put in place by the government helped attract large investments quickly into Japan's range of renewable energy resources, including geothermal, hydropower, wind and solar energy as well as biomass. The feed-in tariff makes it mandatory for power companies to buy electricity generated by renewable sources at fixed prices set by the government, creating stable revenue for renewable power investors.

But for many in the industry, more still needs to be done for Japan to meet its objectives. The country's dense population and tricky, mountainous geography mean making land available for developing renewable energy projects is difficult, while the technical and regulatory structure of Japan's electricity system, divided as it is into regional monopolies, poses challenges to the integration of variable renewable energy.

"There is quite a strong view that, for the government to achieve the target of 22-24 percent of renewables within the energy mix, certainly solar will have to contribute more than 8 percent, probably in the range of 12 percent. That will not come through extended feed-in tariff schemes, but more via economically driven self-consumption models, that will be reinforced by policies like ZEH (zero-energy house) standards for example," says Atsuhiko Hirano, CEO of Solar Frontier. The world's largest provider of copper/indium/selenide (CIS) thin-film solar energy solutions, it has gradually begun selling a larger proportion of its solar panels into its domestic market as demand has increased.

Indeed, the growth in renewable energy sources could comfortably be described as "booming" in Japan. Recent data from the Ministry of Economy, Trade and Industry show the share of solar photovoltaics in electricity production at 4.3 percent in 2016, up from 2.7 percent in 2015. As a whole, renewable energy sources made up 14.2 percent of production last year, with more growth expected, as the planned liberalization of retail supply and legal unbundling of power generation, transmission and distribution comes into force by April 2020.

Through innovation and smart policymaking, Japan is now well on the way to restoring the energy security it lost after the quake. With the gradual emergence of a diverse, competitive, homegrown energy market, it is reversing its reliance on imported fuel and going green in the process, enabling it to meet its international commitments to climate change mitigation.

ADDING GAS TO THE MIX

Japan is diversifying its energy mix by increasing its levels of consumption of LNG and LPG

The Japanese capital of Tokyo is home to the world's largest LNG – natural gas super-cooled into liquid form at -260ºF – importing zone. Japan is the world's largest importer of LNG, swallowing up 35 percent of global demand every year. Today, imported LNG accounts for 44 percent of electricity generation after the Fukushima nuclear accident in 2011 meant nuclear reactors were taken offline, and most of it comes from Malaysia, Australia and the Gulf States. Thanks to the U.S. shale revolution, Japan has an unprecedented chance to diversify even further its source markets, and lower its energy costs at the same time.

For now, the country has agreements for at least 1.46 billion metric tons of supply up until 2040, according to *Bloomberg New Energy Finance* estimates. As global supply of LNG increases as a result of new U.S. supply, LNG buyers have gained bargaining power, and Japan is starting to take another look at its existing contracts to check whether the resale restrictions tied up in some of them contravene fair trade laws. Analysts predict that this could lead to the renegotiation – in Japan's favor – of more than $600 billion worth of agreements.

In order to maintain a healthy gas market at home, the government is also working on deregulating the sector. "Assuredly, [this] will open the gates to enter the gas industry to many other players and will increase competition," says Michiaki Hirose, President of Tokyo Gas, the country's largest gas utility and the first to bring LNG to the country in 1969. Since the 2011 earthquake, Japan's increased focus on alternatives to nuclear fuel have seen the company put in place a number of initiatives to enhance the LNG

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value chain, including expanding its source markets.

The country imported its first liquefied shale gas cargo from the United States earlier this year, with Japanese Prime Minister Shinzo Abe considering further increasing American energy imports, including LPG – liquefied petroleum gas, better known as propane.

"I see the LPG industry growing," says Osamu Masuda, President of Astomos Energy. Set up in 2006, the company operates 23 LPG shipping vessels, and has grown into one of the world's largest LPG traders and importers. "Historically, the main suppliers were Middle Eastern countries accounting for 90 percent of our supply. However, now the Japanese import volume ratio has changed and roughly 30 percent is coming from the U.S." Mr. Masuda adds that, in the wake of the shale gas revolution in the U.S., his company is now building new partnerships. "With the recent opening of the Panama channels our supply from the U.S. has new options. We have been able to diversify our sources and we are seeking new alternatives in Australia and Africa to reduce the geopolitical risk, giving us an alternative supply and increasing our bargaining power."

The plan for the country is not only to shore up its LNG supply, making sure it gets the best possible deal at the best possible cost, but also find new ways to capitalize on low LPG prices by increasing its share in the overall energy mix. And its private sector is hard at work making this happen.

Astomos sees enormous potential for growth in LPG, both at home in Japan and further afield. "[We are] planning to create new LPG demand in the shipping bunker sector. We think LPG has incredible potential as a shipping fuel because it will reduce sulfur emissions by 90 percent compared with heavy oil, and it requires less investment in creating tanks, barges and terminals," says Mr. Masuda, adding that while LPG is still somewhat of a niche market, it has the potential to become a major energy source. "Industrial use of LPG is very small in comparison to other alternatives," he points out, although he sees scope for power generation using LPG to gain market share in specific areas, for example on islands where building fuel tanks is not feasible.

Meanwhile, Japan Gas Energy is working on boosting energy security by replacing oil with LPG. "We are looking into creating higher demand for LPG especially in the industrial and commercial sectors," says Masatoshi Yoshida, the company's president and CEO. "The population has already started to look into new options and alternative sources of energy, hence, based on this movement we are aiming to educate and raise awareness about the benefits of LPG."