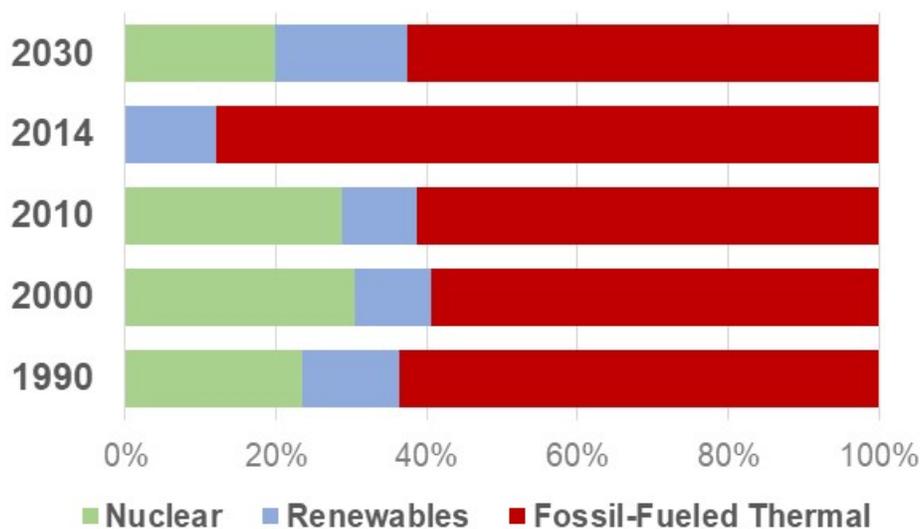


26 Feb 2019 (update) – NECG Commentary #26

Japan - Nuclear Power and Electricity Reform



Japan's Energy Mix

Japan has set a target for nuclear electricity production in 2030 of 20% or greater. At the same time, Japan is restructuring and reforming the electricity industry.

Reforming the electricity industry while maintaining a viable nuclear power industry during and after the nuclear power restart process is an important challenge for Japan.

Japan is restarting its nuclear power industry and has set a target for 2030 electricity production from nuclear power of 20-22%.

Japan began the process of restructuring and reforming the electricity industry in 1995, with reforms accelerated after the Great East Japan Earthquake and the Fukushima Daiichi accident in March 2011. Most Japanese electricity industry reforms were completed in 2016, when the retail market was liberalized. Wholesale electricity competition is increasing and final electricity industry reforms are to be completed in 2020.

Meeting nuclear electricity production targets in 2030 will require a nuclear power industry that can meet the challenges of the restart process while remaining financially viable. Doing this within the context of the electricity industry and market reforms will be an important challenge for Japan.

This Commentary looks at the situation with respect to nuclear power, the strategy for nuclear power in the future, and how the next phase of electricity industry reforms is likely to influence the Japanese nuclear power industry.

Nuclear power situation

[Updated 26 Feb 2019¹] At the beginning of 2011, Japan had 55 operating nuclear power units (including Monju FBR) with a capacity of 49,392 MWe, two nuclear power units under construction with a capacity of 2,756 MWe, one nuclear power unit with approval to start construction with a capacity of 1,385 MWe, and plans for another 12 nuclear power units with a total capacity of 15,375 MWe.

On 26 February 2019, Japan has 37 “operational” nuclear power units² with a total capacity of 37,635 MWe, comprised of:

- Nine nuclear power units actually in operation with a total capacity of 9,130 MWe;
- 16 “operational” but idle nuclear power units that have submitted restart applications with the Nuclear Regulatory Authority (NRA), of which six have received NRA approval for restart, but have not yet completed all other requirements for restart; and
- 12 “operational” but idle nuclear power units that have not yet filed restart applications with the NRA.

18 nuclear power units with total capacity of 11,757 MWe were permanently shut down after March 2011. More nuclear units may be vulnerable to permanent shutdown.

¹ JAIF capacity amounts used instead of IAEA PRIS RUP capacity; Genkai unit 2 status changed to permanent shut down; and errors corrected.

² Fukushima Daini units 1-4 are included, but it is likely that these units will be permanently shut down.

Japanese nuclear power units under construction and planned prior to March 2011 may no longer be viable; all have been deferred and some have been formally cancelled (e.g., Fukushima Daiichi units 7 and 8).

5th Strategic Energy Plan

The 5th Strategic Energy Plan, approved in July 2018, established a target for nuclear generation to provide 20-22% of the total electricity generation in Japan by 2030.

Assuming a typical capacity factor, this suggests that about 25,000 MWe of nuclear power capacity will be in operation by 2030. The 2030 nuclear generation share target:

- is a significant increase in nuclear electricity generation from today;
- will require about 16,000 MWe of operating nuclear generating capacity to be added to the nuclear units now generating electricity;
- will involve a combination of the restart of existing “operational” but idle units, life/license extensions, and the completion of new nuclear power units; and
- implies some “operational” but idle nuclear power units will be permanently shut down.

Meeting the 2030 nuclear generation share target will only be possible if the utility owners of nuclear power plants in Japan consider these nuclear power plants to be financially viable.

The challenge of obtaining permission to restart “operational” but idle units and of completing new nuclear units is significant. An additional challenge is to ensure that the Japanese nuclear power industry is financially viable as the electricity industry reforms are completed.

Electricity Industry Reform

The Japanese electricity reform process has multiple steps, with most of these steps already completed.

The Japanese retail electricity sector is mostly competitive, with only some small residential retail electricity customers remaining on regulated tariffs until 2020. Electricity retail providers are made up of new entrants and the retail segments of pre-reform electric utilities, some of which operate outside their historical rate areas.

Japanese electricity retailers buy most of their power from legacy electric utilities through bilateral power contracts that are monitored by the Electricity and Gas Market Surveillance Commission to ensure that there is fair competition. About 10% of power is obtained through trading in the Japan Electric Power Exchange (JPEX) spot market.

Before the electricity market reform, nuclear power plant costs were recovered in tariffs. Now, there is no guarantee that any electricity generator can recover costs in the bilateral or JPEX power markets.

My review of the most recent annual reports of Japanese electricity companies indicates that these companies are profitable on a company-wide basis. I was unable to find data on the profitability of nuclear power plants. Some Japanese electricity utilities have seen a decline in company-wide operating profits over the past few years.

Japanese electricity industry reforms are proceeding in a careful manner. This is different from some other electricity reform processes that involved large changes and sudden disruptions in the electricity industry.

Final electricity reforms in Japan are to be implemented by 2020 and will include a baseload market, legal unbundling, the end of all regulated retail tariffs, changes to the FIT approach for renewables, capacity markets, zero-carbon electricity markets, and, CfD contracts for nuclear power plants, and other items.

Baseload Market

In 2019, a Baseload Market is to be implemented. In this new market, utilities must bid power from baseload generators at the average cost of those generators less revenue from the capacity market. Japanese utilities have invested in nuclear power plants based on the expectation that they can improve their market competitiveness as a result of the low (i.e., zero) marginal cost of nuclear electricity. The new Baseload Market may negatively impact the overall profitability of nuclear power plants.

Legal unbundling

Legal unbundling appears to be focused on separating generation businesses from transmission and distribution utilities. This unbundling does not seem to require that generation companies are separate from electricity retailers or that generators cannot act as retailers. Generators will continue to be bundled with retailers, to act as retailers, and to provide power contracts to other retailers. This is far different from the strict legal unbundling in the US, where generation companies were separated from legacy electricity retailer affiliates. This legal unbundling may have little direct impact on nuclear power plants.

End of regulated retail tariffs

Most electricity customers are already in the competitive market. Regulated tariffs now remaining for some small residential retail customers are to stop in 2020. If the impact of ending regulated tariffs for these small residential customers is negative for customers, there is likely to be some sort of regulated last-resort tariff for small customers.

After the full liberalization of retail electricity market, new retail market suppliers entered the market by adopting a cream-skimming strategy. The profit margins of legacy electric utilities were reduced as their most profitable customers moved to new retail supply companies and the

legacy utilities were required to provide continued universal service (i.e., the remaining regulated tariffs for small residential customers) at low or negative margins. It is likely to be a positive step for nuclear utilities when the last remaining regulated residential tariffs are removed in 2020 and replaced with sales at competitive market prices.

After full liberalization of the retail electricity market, Japanese electric utilities are starting to consider how continued operation of nuclear power plants will impact their financial situation.

Changes to the FIT contracts

In Japan, Feed-In Tariff (FIT) contracts have resulted in a large increase in renewable generation. Lessons from the U.S., Germany, and other countries are reflected in the Japanese move to end FIT programs and to modify existing FIT contract prices. This will result in some dislocation in the renewable power project market, but should be effective in preventing a flood of renewable capacity additions in response to high FIT prices (i.e., out-of-market subsidies) as has been seen in other countries. The changes to the FIT regime are likely to be positive for nuclear power.

Capacity markets

The details of the planned capacity markets are not clear. The approach appears to involve a separate capacity market in each of the regions (i.e., regions are based on the rate areas of the nine legacy vertically-integrated General Electric Utilities plus Okinawa) that will ensure sufficient capacity is in place in each region to meet reliability targets and reserve margins.

If the capacity market has long-term commitments (i.e., contracts) and payments, this should help nuclear power plants earn additional long-term revenue that will ensure their financial viability.

Zero-carbon electricity markets

The details of the zero-carbon electricity market are also unclear. This might take the form of zero carbon electricity mandates for electricity retailers, who would then procure zero carbon electricity certificates or credits from generators, including renewables and nuclear power.

Depending on the approach to the zero-carbon electricity market, it could be an additional source of revenue for nuclear power plants.

CfD contracts for nuclear power plants

There have been general discussions of the potential for CfD contracts for nuclear power plants.

Strictly speaking, a contract for differences (CfD) is a financial hedge contract that is tightly linked to a wholesale market spot price. As the Japanese electricity reforms seem to be moving toward a bilateral contract / balancing market rather than a mandatory gross pool market, these power contracts may resemble conventional bilateral power contracts rather than financial hedge contracts.

These nuclear power contracts would need to have a counterparty (e.g., retail electricity providers and/or the grid company) and a means to recover the costs of the contracts. It will also be important that these nuclear power contracts do not interfere with the ability of the nuclear power plants to enter into other arrangements (e.g., other power contracts, zero-carbon credits, capacity markets, etc.).

Putting such nuclear power contracts in place to bolster nuclear power plant financial viability will help the nuclear power industry.

Other

JPEX implemented a voluntary bid-based wholesale electricity market in 2017. About 10% of all electricity is traded on the JPEX spot market. Changes to the Japanese electricity balancing market and other factors may lead to an increase in JPEX trading activity. However, the Japanese electricity reforms do not appear to include a transition to a mandatory pool market (e.g., like PJM and other U.S. electricity markets). Accordingly, Japan may not face the same issues seen in U.S. markets (i.e., spot prices that are sometimes negative, that are not sufficient to meet generator costs, and that not sufficient to provide incentives to build new generation) as a result of subsidized renewable generation.

Overall Assessment

Electricity reform in Japan has both favorable and unfavorable impacts on nuclear power.

METI is monitoring the overall impact on nuclear power profitability as electricity industry reforms move into the final stage. The Japanese electricity industry generally expects that METI will take action to help nuclear power remain financially viable (e.g., through nuclear CfD contracts) if electricity reforms present problems.

My assessment is that electricity reform in Japan should not prevent it from meeting its 2030 nuclear generation targets.

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