



Japan's uncertain energy future in the post-Fukushima era

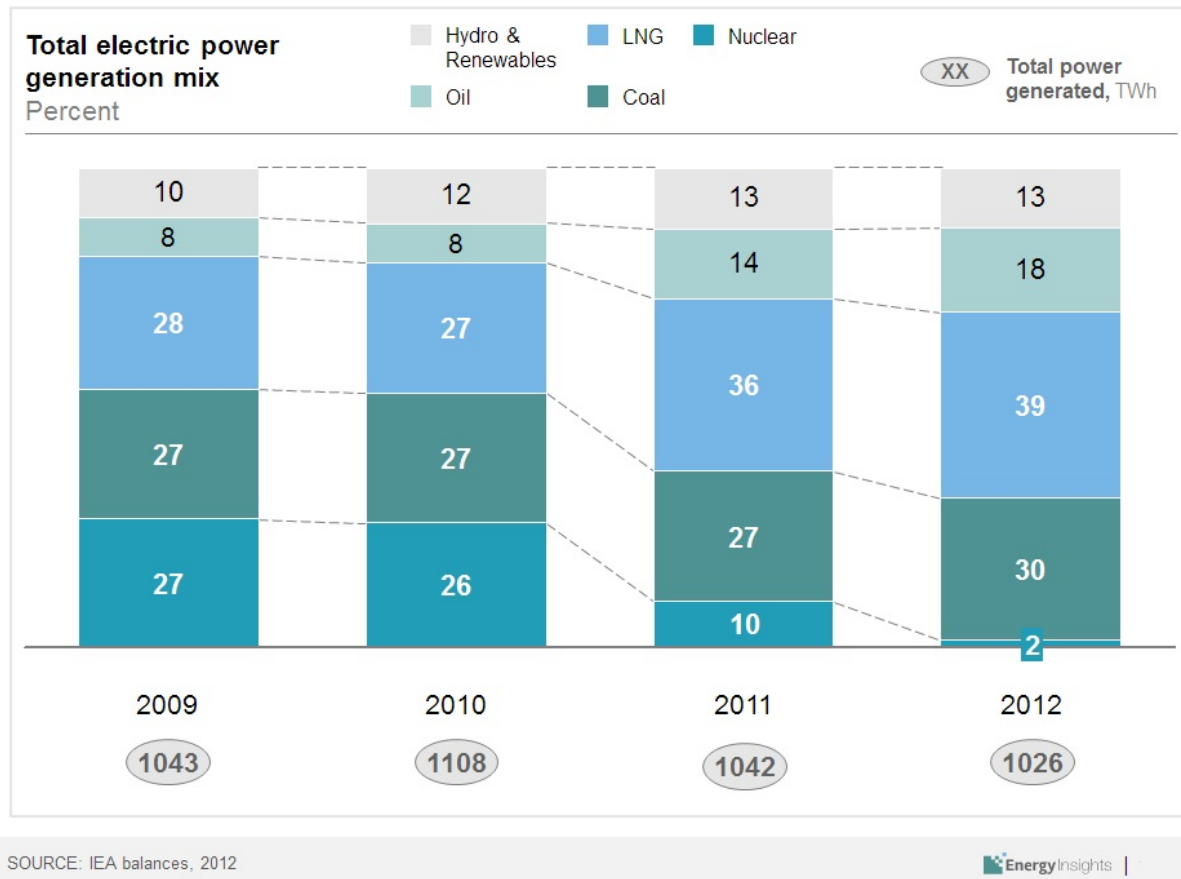
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BACKGROUND

Since the Fukushima incident in 2011 and the subsequent nuclear shutdowns, Japan has entered a period of energy uncertainty that is likely to extend until the next decade.

Figure 1. Total electricity generation mix, 2009-12; Source: IEA



There are three main issues shaping the outlook for power generation in Japan.

1. Fossil fuels – economics versus environment?

During the past three years, as it progressively shut down all nuclear power plants, Japan has relied on fossil fuels to meet its energy shortfall. The share of electricity generated from fossil fuels has increased from 63% to 87% between 2011 and 2013¹.

Increased coal, oil and gas imports have cost Japanese utilities an extra \$28 billion a year since 2011², putting Japan in a negative trade balance for the first time in decades. Household electricity prices have increased by more than 50% during the past two years from 10¢/KWh to 16¢/KWh.

Oil consumption in power plants witnessed a sharp increase from 2011 to 2014, but the high cost of importing oil and concerns about unclean fuel are likely to reverse this trend by 2020.

Coal and natural gas are the only viable options among fossil fuels for generating electricity.

While it is possible to produce electricity for an average \$80-85/MWh using coal, making it by far the cheaper of the two fuels, gas prices have dropped (\$12-13/mmbtu as of Q3 2014), making gas the second most competitive fuel costing an average \$100-105/MWh.

Coal is the cheapest option but it is unpopular among environmental lobbyists and projects that use coal have a long lead time. These factors make gas a favorable choice for capacity expansion. Japan's efforts to procure cheaper North American LNG in the coming years are expected to boost the build-up of combined cycle gas turbine (CCGT) plants^{7,8}.

This interplay of different factors makes the future split of generation between coal and gas a major uncertainty for Japan.

2. Nuclear restart – when and how much?

The new Abe government has abandoned the zero-nuclear goal of the previous government and pledged to restart nuclear reactors after adequate safety levels are established. However, negative public sentiment makes that a challenging task.

The first scheduled nuclear restart, at Sendai facility, which was scheduled for 2014, has been delayed until early 2015³ because of widespread protests.

There is also new research that suggests any restarted facilities might be unprepared to face high-intensity natural disasters⁴. This puts all the revised safety measures established by the Nuclear Regulation Authority under question and they may be subject to further scrutiny leading to delays and uncertainty.

3. The rise of renewables – a viable solution?

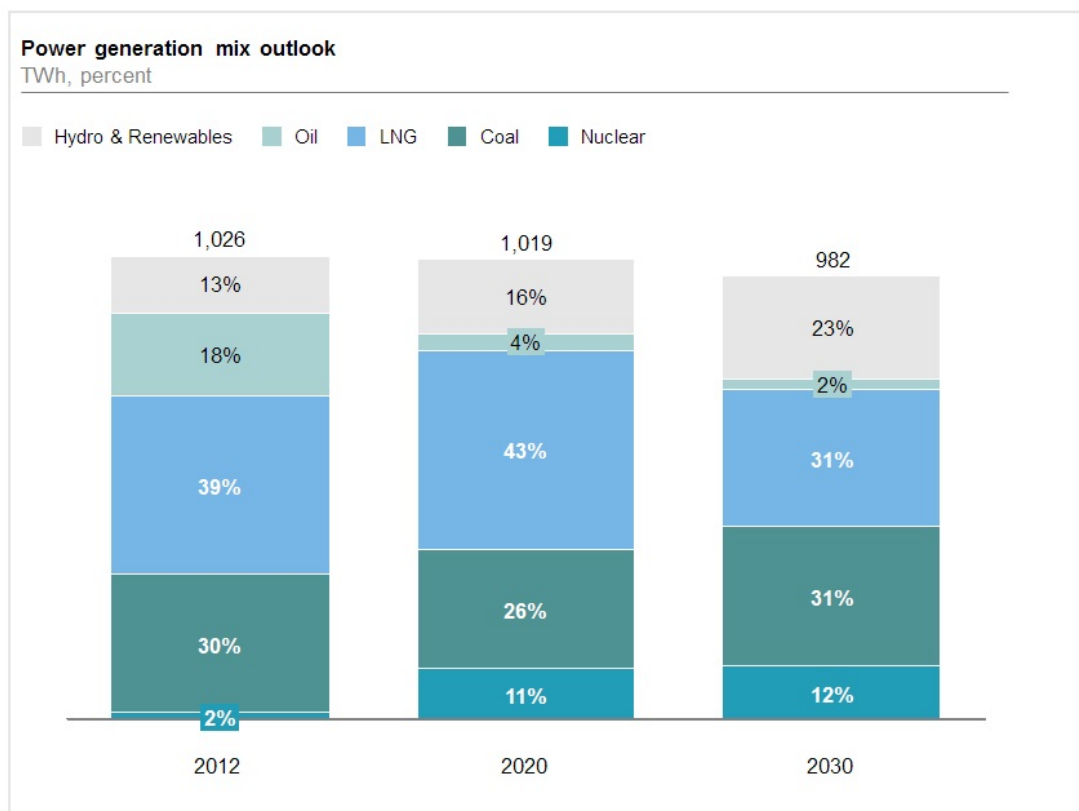
The nuclear shutdown has made Japan a solar power hotspot, with 7 gigawatts of solar installations during the 2012 financial year. Japan introduced one of the most generous feed-in tariff programs in the world in July 2012, offering 38¢/KWh to anyone supplying solar power to the grid. This has resulted in an increase of about 350% in solar installations in the past two years⁵.

The scheme has been a success, but state utilities are beginning to resist, saying the grid is not robust enough to handle renewable supply on a large scale and that renewables are not reliable enough to ensure uninterrupted power, which could lead to blackouts⁶.

A LIKELY ENERGY FUTURE FOR JAPAN

Taking into consideration these three uncertainties, we expect that in Japan by 2030, nuclear power would have regained about 35% of its pre-2011 capacity to account for about 12% of generation; coal and gas would together contribute about 62% of generation, and renewables would make up about 23%.

Figure 2. Base case outlook for Japan's power generation till 2030



SOURCE: EI Global Energy Perspective; Energy Insights, a McKinsey Solution

Energy Insights

Electricity demand in Japan is expected to decline by 0.1% per year until 2020 and by 0.4% from 2020 to 2030 because of the declining population and improvements in energy efficiency.

We predict 15 gigawatts of nuclear generating capacity to restart by 2020, representing a 15% share in total generation. Beyond 2020, the generation of electricity in nuclear facilities will remain flat as net operating capacity remains roughly unchanged.

We expect that, by 2030, renewable capacity from hydro, solar and wind sources will make up approximately 38% of total installed power capacity in Japan but represent only about 23% of generation, as they have lower availability compared with thermal generation plants.

We predict large capacity increases to take place in high-efficiency CCGT plants, which will total 68 gigawatts by 2030. Coal capacity is expected to decline by 2030 to 53 gigawatts

because of the planned retirement of 5 gigawatts and 8 gigawatts by 2020 and 2030 respectively.

To conclude, while fossil fuels step up and take up load till 2020, nuclear and renewables are likely to gain in significance by 2030, leading to a decline in fossil fuel usage, a much necessary step to maintain stable power prices. However, given the nature and enormity of uncertainties at hand, especially around nuclear restarts, it will be critical to closely follow the developments as dramatically different scenarios may emerge over time.