

## Japan Power Updates: Demand forecast for this summer, nuclear in the spotlight

July 2022

### 1. Introduction

Japan saw unseasonably high temperatures between late June and early July, which drove electricity demand up to 159 GW at the peak hours. The temperature rose to 35 degrees or higher on 9 consecutive days in Tokyo from 25 June to 3 July, the longest in record. A power shortage advisory was issued for the Tokyo area from 27 to 30 July as a reserve capacity margin for each of these days was expected to drop below 5% the day before. The heat has eased since then, but it is expected to come back to drive up power demand to peak in early August.

In this note, we update our power demand forecasts for this summer and demand-side policy measures to avoid supply crunch. We also analyze the implications of the results of the recent upper house election for nuclear power.

### 2. Higher power demand expected in August but below the level in late June

#### Higher temperature pushing up power demand

We reiterate our forecast in the May report that a higher power demand is expected this summer compared to the seasonal norm on the back of higher temperatures. Our updated weather forecast indicates that the temperature this summer will continue to be higher than the historical average with la Niña supporting warmth (Figure 1). Compared to last year, the temperature will be at the same level in July on average and will be 1 °C higher in August.

This translates into higher cooling demand for power in August while power demand sees a seasonal drop in mid-August for the Obon holiday (Figure 2). We forecast the power demand in July to be on par with last year averaging at 108GWh/h (80TWh) followed by an YoY 3% increase in August to 111GW/h

(83TWh). We expect the peak of power consumption (117-118GWh/h) in the first half of August given the temperature trend, but we do not foresee a surge to the level seen in late June to early July.

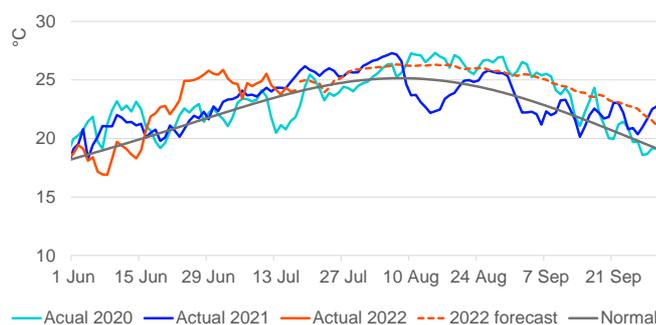


Figure 1: Temperature index, actual and forecasts. Note: The temperature index indicates the consumption-weighted average temperature at each observation point in Japan. The 2022 forecast is the combination of our monthly forecasts as of 17 July for July and August and our seasonal forecasts as of 1 July for September. Source: Refinitiv

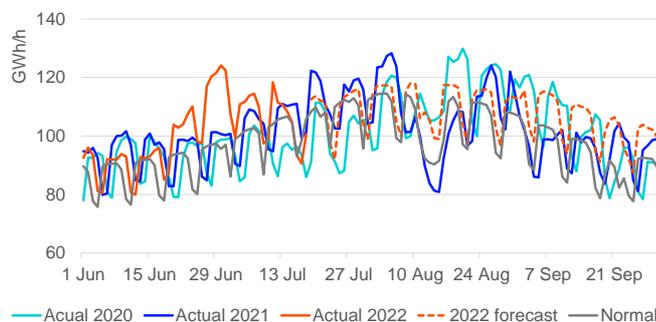


Figure 2: Power demand forecast, daily average. Note: The 2022 forecast is the combination of our monthly forecasts as of 17 July for July and August and our seasonal forecasts as of 1 July for September. Source: Refinitiv

### More thermal and nuclear capacity available

While demand will go up in August, supply shortage concerns will be mitigated from late June thanks to higher availability of power plants as planned. Since June power demand is usually not so high, many plants were offline for maintenance to prepare to serve the July/August peak. According to the METI, over 7 GW of thermal power capacity were planned to restart from inspection, repair work or long-term idling by mid-July.

The operational nuclear capacity is increasing, too, up to mid-August, which will particularly contribute to the western part of the country. Kyushu restarted Genkai 4 (1.18GW) on 13 July to reach full operation in early August. Kansai Electric restarted Ohi nuclear power plant unit 4 (1.18GW) on 17 July and will restart Takahama 3 (870MW) on 26 July, two months behind its initial schedule, and Mihama 3 (870MW) in August, two months ahead of schedule. In mid-August, the operational nuclear power capacity will peak at 7.9 GW from 8 reactors (Figure 3, Table 1, See section 5 for nuclear this winter and beyond).

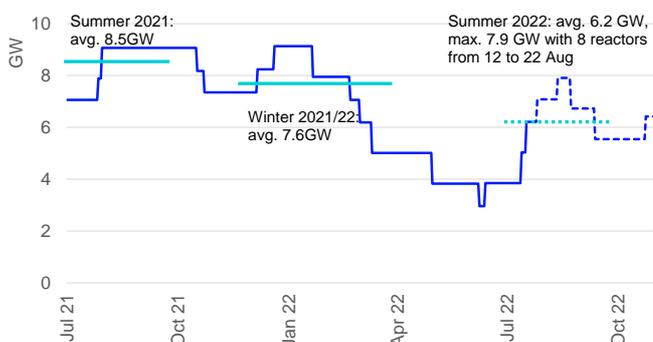


Figure 3: Nuclear power operational capacity, actual and plan. Note: Summer refers to the period from 1 July to 30 September, winter from 1 December to 31 March. Source: JEPX, Refinitiv

### Risks include unexpected outages of thermal power

While available power generation capacity increases, unexpected outages remain as a risk, especially in eastern Japan where thermal power accounts for a large share of the power mix with no nuclear in operation. The risk is real given that two-thirds of Japan's thermal fleet is older than 30 years and hence prone to outages in general. On 3 July, Tohoku Electric reduced operation of its 37-year-old Higashi Niigata gas-fired power plant (137MW) due to a fire. On 2 July, JERA was forced to stop operation of Chiba gas-fired power 3-2 (500 MW) for the same reason (although it is relatively new, commissioned in 2014). JERA and Tohoku's 39-year-old Nakoso coal-fired power plant unit 9 reduced operation due to technical troubles in the middle of the heat wave at the end of June. These problems could lead to prolonged outages which could collectively disrupt a secure power supply.

### Implications for the power price

We expect wholesale power prices to continue factoring in supply demand fundamentals by area including changes in the power mix. Prices can differ by area because of limited inter-

regional connection. Electricity spot prices at JEPX tend to be lower in the west and higher in the east (Figure 4). The day-ahead 24-hour average price among the three 50-Hz eastern areas (Hokkaido, Tohoku and Tokyo) is on average JPY6/kWh (\$44/MWh) higher than that of the six 60-Hz western areas in July to date. We see the difference partly attributable to the power mix difference with the west operating nuclear power in Kansai, Shikoku and Kyushu and a relatively high penetration of solar power in Kyushu, Shikoku and Chugoku on the one hand, and the east more reliant on thermal power on the other. The limited capacity of the frequency converters (2.1GW at present, to be expanded to 3GW in FY2027) between the 50-Hz Tokyo area, the country's consumption center and the 60-Hz Chubu means that Tokyo cannot fully benefit from supply from the west even when there is excess electricity.

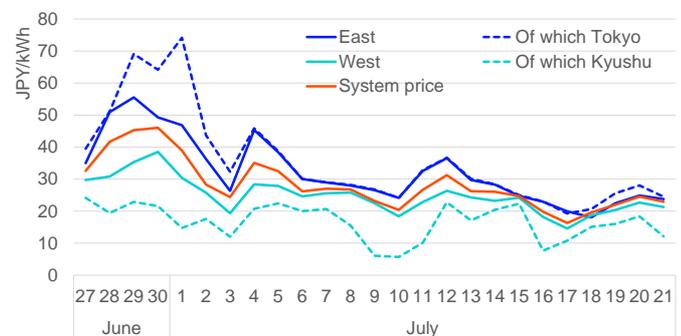


Figure 4: JEPX spot price by area, daily average. Source: JEPX

Reflecting the tight market balance, the Tokyo area in the east region particularly has seen a significant spike in prices. There are even cases where buyers appear to have offered too high bids. During the heatwave in the last week of June, a power shortage advisory was issued for the Tokyo area because the power capacity reserve margin was forecast to drop below 5% (but above 3%) the day before (in case the margin is forecast below 3%, a stricter alert will be issued). Tokyo saw the day-ahead power price at JEPX rise to record JPY200/kWh in some afternoon slots on 29 June, 30 June and 1 July, which coincides with the imbalance price ceiling that applies when the power market condition is tight with a reserve margin below 3%. It looks as if buyers (power retailers) rushed to offer high prices to secure electricity to avoid paying higher imbalance prices, but the actual reserve margin did not go below 3% in any trade interval and the actual imbalance price varied from JPY42/kWh to JPY128/kWh.

On the other hand, Kyushu enjoys a relatively lower level of power prices thanks to abundant solar power and operational nuclear. Electricity is being traded at the minimum price JPY0.01/kWh in multiple slots on sunny days and the upside to the price looks relatively limited even under cloudy conditions compared to other areas (for example, 4-6 July and 14-15 July in Figure 4). The second lowest price is usually observed in Shikoku which also has a high contribution of solar power and an operational nuclear reactor.

## 4. Demand side measures

### Government taking measures to reduce power demand and/or electricity bills

The government is taking various approaches to tackle the demand-side issues the country faces this summer and winter, namely, mitigating consumers' burden of raising power retail prices and controlling power demand to secure the power system stability. The measures vary from a power saving campaign and a new power shortage alert system which are on a voluntary basis by nature, to financial support for power retailers' demand response (DR) programs and funding for direct subsidies to consumers at municipality level.

### From voluntary effort to demand response

The government requested in early June for electricity saving in all areas for the summer months without numerical targets, while asking businesses to be prepared to reduce power consumption by around 10% in case of a very tight market situation. Moreover, the government introduced in May a stepped approach to notify power users of a possible power shortage. In addition to the power shortage warning for when a TSO foresees a reserve margin below 3% the day before (as was the case on 22 March), there now is an "advisory" to be issued when a reserve margin is expected at 3-5%. The shortage advisory was issued in the Tokyo area for 4 days in a row from 27 June to 30 June.

Secondly, financial support for demand response programs will be provided in the form of redeemable points equivalent of JPY2,000 to each household who participates in its retailer's power saving program. It is to supplement the ongoing DR programs initiated by major retailers. For example, TEPCO Energy Partner (the retail company of TEPCO group) and Kansai Electric implemented their demand response plans for household customers in July. When supply shortage is anticipated, customers will be asked to save electricity and offered points equivalent of JPY5/kWh. A similar financial incentive to promote DR more widely among commercial and industrial users (reportedly JPY200,000 for small and medium sized enterprises) as well as a further financial incentive for households in fall/winter are under consideration.

### No price cap subsidies in sight

In our view, it is unlikely the government will subsidize to cap retail power prices while some municipalities have moved to utilize a national budget to give subsidy directly to consumers to ease their burden of increasing electricity bills. This contrasts with the subsidy program introduced in January for oil products, in which oil refiners and wholesalers receive an amount (JPY37/liter at the time of writing) in excess of JPY168/liter in retail price for each liter of gasoline that they sell. The government has secured a budget of over JPY1trillion (\$7.2 billion) for the first half of this fiscal year (i.e. until the end of Sep 2022) but it is facing difficulties in finding the timing to phase out this subsidy as the crude oil price remains elevated. For

electricity, the government would rather provide financial incentive for demand reduction as described above.

### Effectiveness so far

The effectiveness of these demand side measures remains to be seen. The retailer-based program only started in July and is to be followed by the government's supplement JPY2,000 in August. Rolling out such a power saving program to new retailers and raising awareness of the program among consumers are key for success.

The newly created power shortage advisory does not appear to have effectively reduced demand, arguably because it was not considered as pressing as the power shortage "warning" as was the case on 22 March. The power shortage advisory was issued for 27-30 June in the Tokyo area when the reserve margin was expected to drop below 5 % the day before. The margin was forecasted to hit the lowest during 16:00-17:00 on each of these days at 3.2%-3.9%. Eventually, the advisory influenced supply more than demand to secure the stability of the power system (Figure 5). The OCCTO coordinated the supply increase that amounted to about 3GW each day by directing more power flow from other areas and allowing to extend the operational capacity of the interconnector with Tohoku as well as requesting power generators to produce electricity, in some cases above nameplate capacity.

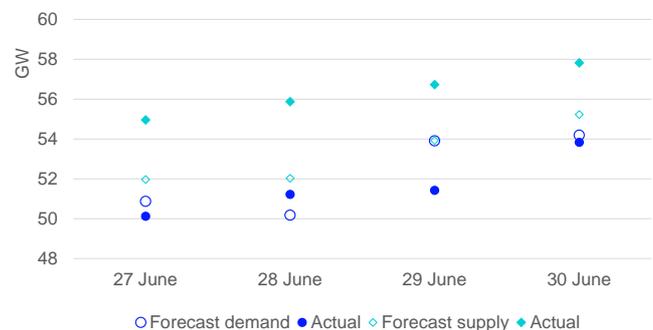


Figure 5: Power demand and supply in the Tokyo area at the expected time of the lowest reserve margin on 27-30 June 2022. Note: The forecast demand and supply are as of the night before each day. Source: TEPCO

## 5. Nuclear in the spotlight after the election

The ruling coalition's victory at the upper house elections on 10 July has implications for the electricity policy. Especially expectations for increased utilization of nuclear power are high. Since before the election, Prime Minister Fumio Kishida has said Japan must maximize the use of nuclear power plants as long as safety is secured on the back of the rising electricity price as fossil fuel prices increase, and emerging concerns of supply disruptions of Russian LNG. In our view, it is not clear how the government in practice could significantly change the baseline over the next 2-3 years, but it is possible that with voters' confidence in Kishida's Liberal Democratic Party, including its proactive stance on nuclear, a long-avoided debate

on newbuilds may finally begin in the context of the 2050 carbon neutrality goal.

### Up to 9 reactors in operation this winter

The Prime Minister on 14 July stated that he had asked the Minister of Economy, Trade and Industry to have up to 9 reactors in operation for this winter to account for about 10% of the country's power consumption volumes and to secure the capacity of additional 10 thermal power plants. Currently, it is anticipated that the reserve margins could be below 2% in all areas but Hokkaido and Okinawa in January. We see the PM's statement is in line with the utilities' plans but his indication could lead to adjustment of inspection schedules to stretch generation volume, or at least to ensure the current schedules will not be delayed.

The 9 reactors are among 10 reactors that have already restarted under the new safety rules after the accident at Fukushima in 2011. Based on the utilities' inspection schedules we estimate that there will be 9 reactors totalling 8.8GW in operational from late Jan to mid Feb 2023, and that the average operational capacity through the winter months (Dec-Mar) would be 7.9GW, up from an average of 6.2GW this summer (Jul-Sep) and 7.6GW last winter (Figures 6, Table 1).

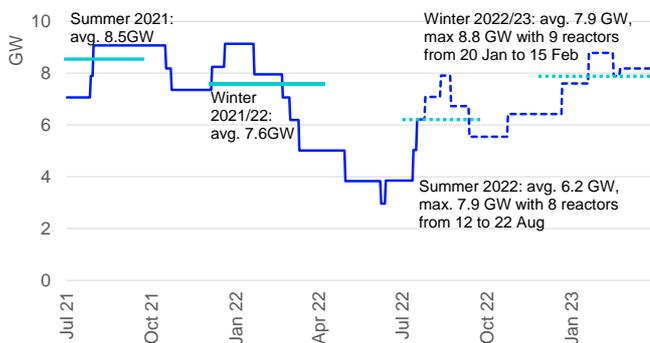


Figure 6: Nuclear power operational capacity, actual and plan up to 2022/23 winter. Note: Summer refers to the period from 1 July to 30 September, winter from 1 December to 31 March. Sources: JEPX, Refinitiv

### Beyond this winter

Beyond the already restarted reactors, what the government could do to accelerate the restart process seems limited in our view. There are 36 nuclear reactors installed in Japan (including 3 new reactors), of which 10 have restarted as mentioned in the previous section. Of the remaining 26, 7 have obtained approval for restart by the Nuclear Regulation Authority but have not restarted because they await the completion of required construction work to improve safety or the consent from local communities. We expect that the government could take a facilitative role or propose a solution to persuade host prefecture and municipality to give consent to restart, namely for Japan Atomic Power Company's Tokai Daini and TEPCO's Kashiwazaki Kariwa units 6 and 7 (Table 2).

On the other hand, we see it unlikely that the government will take effective measures to accelerate the NRA's process for the 10 reactors currently under review given that the Authority is an independent body. For the same reason, the NRA would unlikely agree to ease the five-year deadline for the installation of an anti-terrorism facility if the government requested, unless supply shortage becomes absolutely imminent. Without this deadline, Kansai's Takahama 1 and 2 which have obtained the NRA's approval and the local authority's consent could restart without waiting for the completion of such a facility until Q2/3 in 2023. Also, Kyushu's Genkai 4, the only restarted reactor that is not counted on for this winter, could operate for a longer period this summer and winter. The reactor is currently operational but will be offline for 5 months from 12 September, the day before the deadline, until late February next year.

### Time is ripe to consider new builds?

For a longer-term, the long-avoided discussion on new builds to replace older reactors may finally begin. This will be part of the country's green growth strategy for the 2050 carbon neutrality goal.

The METI is in the process of identifying issues in developing advanced reactor technologies in various phases, ranging from advanced light water reactors in the commercial phase to small module reactors in the demonstration phase and fast reactors and high temperature gas-cooled reactors in the development phase. Defining advanced reactor technologies as an important element for carbon neutrality and a better energy security, it looks to develop a roadmap for each technology as well as proposing frameworks to support financing of new builds or R&D, referring to cases in other countries such in the US, the UK and France. The government will likely attempt to push forward the discussion as much as it can while there is a relatively positive sentiment for nuclear for the first time since the 2011 accident and there is no national election to be held for three years unless the lower house is dissolved.

**Table 1: Planned availability of 10 restarted nuclear reactors**

Company	Reactor (location)	Capacity	Operation in summer 2022	Operation in winter 2022/23	Inspection schedule
Kansai Electric	Takahama (Fukui)	3 870 MW	Yes	Yes	To resume on 26 July 2022, no inspection until 12 July 2023
Kansai Electric	Takahama (Fukui)	4 870	No	Yes	Offline for inspection from 8 June to 23 Oct 2022
Kansai Electric	Ohi 3 (Fukui)	1,180	Yes	Yes	Offline for inspection from 23 Aug to 21 Dec 2022
Kansai Electric	Ohi 4 (Fukui)	1,180	Yes	Yes	Resumed on 17 Jul 2022, no inspection until 31 Aug 2023
Kansai Electric	Mihama (Fukui)	3 826	Yes	Yes	To resume on 12 August, no inspection until 2 Oct 2023
Kyushu Electric	Genkai (Saga)	3 1,180	No	Yes	Offline for inspection and installation of anti-terrorism facility from 21 Jan 2022 to 19 Jan 2023
Kyushu Electric	Genkai (Saga)	4 1,180	Yes	Partially*	Resumed on 13 Jul 2022, offline for inspection and installation of anti-terrorism facility from 12 Sep 2022 to 22 Feb 2023
Kyushu Electric	Sendai (Kagoshima)	1 890	Yes	Yes	Offline for inspection from 16 Feb to 22 Apr 2023
Kyushu Electric	Sendai (Kagoshima)	2 890	Yes	Yes	Resumed on 13 June 2022, no inspection until 13 May 2023
Shikoku Electric	Ikata 3 (Ehime)	890	Yes	Yes	Offline for inspection from 23 Feb to 17 May 2023

Note: Summer 2022 refers to the period from 1 July to 30 September and Winter 2022/23 the period from 1 December 2022 to 31 March 2023. \*Partially indicates that the reactor is operational for fewer than half of the period. Sources: JEPX, company websites

**Table 2: Japan's 26 un-restarted reactors by status**

Company	Reactor (location)	Capacity	Note
<b>Safety review passed + local consent obtained (4)</b>			
Tohoku Electric	Onagawa 2 (Miyagi)	830 MW	Additional safety measures to complete in FY2023, planned to restart in Feb 2024
Kansai Electric	Takahama 1,2 (Fukui)	830 each	Planned to restart in June/July 2023 after anti-terror measures complete
Chugoku Electric	Shimane 2 (Shimane)	820	Construction work for additional safety measures to complete within FY2022 (by Mar 2023)
<b>Safety review passed (3)</b>			
Tokyo Electric	Kashiwazaki Kariwa 6, 7 (Niigata)	1,360 each	Delay in local approval due to a series of scandals
Japan Atomic Power	Tokai Daini (Ibaraki)	1,100	Awaiting local communities' approval and construction work for anti-terrorism and other safety measures to complete in Sep 2024
<b>Under review (10)</b>			
Hokkaido Electric	Tomari 1,2,3 (Hokkaido)	580/580/910	
Tohoku Electric	Higashidori (Aomori)	1,100	
Hokuriku Electric	Shika 2 (Ishikawa)	1,210	

Japan Atomic Power	Tsuruga 2 (Fukui)	1,160	
Chubu Electric	Hamaoka 3,4 (Shizuoka)	1,100/1,140	
J Power	Ohma (Aomori)	1,380	New reactor, construction for safety measures under way
Chugoku Electric	Shimane 3 (Shimane)	1,370	New reactor, construction for safety measures under way
<b>Review request not submitted (9)</b>			
Tohoku Electric	Onagawa 3 (Miyagi)	830	
Tokyo Electric	Kashiwazaki Kariwa 1-5 (Niigata)	1,100 each	
Hokuriku Electric	Shika 1 (Ishikawa)	540	
Chubu Electric	Hamaoka 5(Shizuoka)	1,380	
Tokyo Electric	Higashidori (Aomori)	1,390	Under construction, construction suspended since 2011

Sources: Company disclosure, METI

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