Mizuho Economic Outlook & Analysis

November 30, 2022

Growing importance of stable energy supply

Policy support required for a stable procurement of fuels

< Summary >

◆ This winter, it is expected to be able to secure an electricity reserve margin of 3%, the minimum required level for a stable supply of electricity, even in eastern Japan, where the margin is expected to be smallest. However, combination of adverse conditions, such as extreme cold or fuel supply disruptions, could push Japan into power shortages.

◆ In eastern Japan, if the supply falls short (-2% to -4%) for five days, eight hours per day, total industrial production is estimated to decline by 1.6 to 5.1 trillion yen (0.3% to 1.0% of annual production).

◆ The procurement environment for fuels, particularly LNG, is expected to remain challenging. To ensure a stable fuel supply, it is essential for the government to support both short-term spot procurements and long-term supply contracts with gas-producing countries.

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1. Introduction – current status and importance of stable energy supply

For resource-poor Japan, stable energy supply has always been an important issue. The situation has been particularly severe recently as emerging countries' energy demands are surging and Russia's invasion of Ukraine threw fuel markets into chaos. Thus the environment surrounding the procurement of fuels, especially liquefied natural gas (LNG), become more difficult. From an energy supply infrastructure maintenance viewpoint, making decisions on facility investments becomes harder for utility companies amid electricity market liberalization and the growing social demand for decarbonization. According to the situation, the government involvement and support should be considered.

In the wake of the 2011 Great East Japan Earthquake, the restart of idled nuclear reactors has been slow to progress, making the country depend more on thermal power generation. Maintaining a sufficient electricity reserve has not been easy, and the situation is expected to remain unstable this winter, the government is encouraging the public to make energy conservation efforts. This report estimates the potential economic impact of a situation when energy supply is destabilized for some reasons and temporary electricity shortages occur. Regarding the economic effects of power shortages, Kitatsuji (2022) estimates that if the electricity supply for industries fell by 1%, domestic production decrease by 961.6 billion yen per year. The estimation in this report incorporates risks that might arise this winter, focusing on eastern Japan where the reserve margin is the lowest according to the electricity supply-demand forecast for fiscal 2022 winter (**Chart 1**). In making the estimation, such business attributes as industries' self-power generation ratios were not taken into account. For the purpose of estimating the overall impact of disruptions in the region's electricity supply-demand balance, including ripple effects, the effects on total industrial production were simply calculated by using input-output tables. Although the minimum required reserve margin for a stable supply of electricity, 3%, is expected to be secured, we assumed unexpected events affecting both supply and demand, based on the electricity supply-demand forecast for fiscal 2022 winter as of September 15, 2022.[1] Specifically, we considered a situation where electricity demand temporarily exceeds the anticipated level because of extreme winter cold[2] and a number of power plants suspend operations due to difficulties in procuring fuel. (Power plant operations could also stop for other reasons, such as failures caused by a natural disaster.) In our assumption, securing the reserve margin becomes difficult despite maximum energy-saving efforts, and the supply capacity temporarily falls to -4% (Case 1) and -2% (Case 2), with extreme cold

[1] The document, released from a review meeting on electric supply and demand, dated November 1, 2022, states the reserve margin in eastern Japan has improved to 4.1% after early recovery from problems at power plants, changes in the repair plan of electricity sources, and the soliciting of new electricity sources.

[2] According to the three-month weather forecast of the Meteorological Agency released on October 25, 2022, temperatures are expected to be around average or lower in the nation's eastern and western regions.

conditions continuing for five consecutive weekdays, and the electricity supply becoming tight during the peak demand periods from 8 to 12 a.m. and 4 to 8 p.m., for a total of 8 hours a day (**Chart 2**).

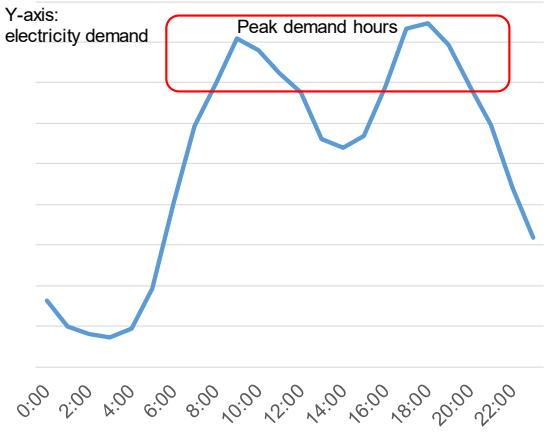
Chart 1: Estimated reserve margins for H1 demand this winter

(Sending end, 10,000kW)	Eastern Japan	Western Japan
Supply capacity	7,160	9,229
Maximum electricity demand	6,927	8,804
Reserve margin	233	425
Reserve margin (%)	3.4%	4.8%

(Sending end, 10,000kW)	Hokkaido area	Okinawa area
Supply capacity	585	158
Maximum electricity demand	542	119
Reserve margin	43	39
Reserve margin (%)	7.9%	32.8%

Note: H1 demand means the maximum electricity demand under severe weather conditions in the summer or winter (extreme heat or cold that occurs once in about ten years).
Source: Made by Mizuho Bank Industry Research Department based upon the 53rd Electricity and Gas Basic Policy Subcommittee.

Chart 2: Model case of winter electricity demand



Note: The model case was estimated based upon actual electricity demands in the service areas of Tohoku Electric Power and TEPCO in January 2022.
Source: Made by Mizuho Bank Industry Research Department.

2. Estimation of the impact of an electricity shortage using input-output tables

(1) Assumptions of the estimation

Based on the electricity supply-demand scenario described above, the economic impact was estimated assuming that the electricity supply falls short in the service areas of Tohoku Electric Power Company and Tokyo Electric Power Company (TEPCO) this winter and power supplies are partially cut.

First, two patterns were considered for Case 1 (-4% reserve margin) and Case 2 (-2% reserve margin), respectively; the first pattern lowers electricity demand to a necessary level through planned power outages (Pattern 1), and the second pattern curtails the power supply by suspending manufacturing plants' operations (Pattern 2). In Pattern 1, the supply is temporarily halted by planned outages in the target areas during the time when shortages occur (8 hours x 5 days). As a result, production outputs decline altogether. In Pattern 2, only the operations of manufacturing plants are suspended during tight supply hours, and the output must be reduced to a rate roughly five times that of the necessary electricity reduction (-20% output reduction rates for -4% electricity supply, -10% output reduction rates for -2% electricity supply). (This is because the manufacturing sector accounts for approximately 20% of the total electricity consumption.) **Chart 3** shows the rates of output

reduction by industry groups resulting from partial supply suspensions in individual cases and patterns.

Next, the industries' output reduction rates in individual cases and patterns were applied to the 2015 input-output tables of the prefectures covered by Tohoku Electric Power (Aomori, Iwate, Akita, Miyagi, Yamagata, Fukushima, Niigata) and TEPCO (Tokyo, Chiba, Saitama, Kanagawa, Ibaraki, Gunma, Tochigi, Yamanashi, Shizuoka[3]) to calculate the impact on production (with only primary ripple effects included).

(2) Summary and assessment of the estimation results

Chart 4 shows the calculation results of output reduction in values and rates (percentages to annual production values) in the assumed cases and patterns (with direct effects and primary ripple effects combined). Case 1, Pattern 2, is considered to have the greatest impact at -5.1 trillion yen (-1.0%), while the impact is thought to be minimum in Case 2, Pattern 1, at -1.6 trillion yen (-0.3%).

The Hokkaido Eastern Iburi Earthquake in September 2018 caused extensive power blackouts across Hokkaido that took two days to fully restore. To avoid such a worst-case scenario, electricity companies implement all possible measures to adjust supply and demand during an emergency, but if shortages occur despite maximum efforts, electricity supply must be partially suspended. Comparing the economic effects of Pattern 1 (planned outages) and Pattern 2 (suspension of manufacturing plants' operations), Pattern 2 is thought to have a greater impact on production, because the manufacturing industry has far-reaching ripple effects on overall production compared with the average of other industries. At a glance, the impact of planned power outages seems smaller. However, as the situation in the aftermath of the Great East Japan Earthquake, a loss of power for train systems, traffic lights, household lights, heating systems, and so on in power outages affects people's lives to a great extent. The lack of household heating in the depth of winter especially increases the risk to people's health. Therefore, it is practical to suspend factory operations even at the cost of the strong impact on manufacturing businesses. In Pattern 2 (suspension of plant operations), the output is estimated to drop by 5.1 trillion yen (-1.0%) in Case 1 (-4% electricity), and by 2.5 trillion yen (-0.5%) in Case 2 (-2% electricity).

Currently, the Japanese economy is recovering from the coronavirus pandemic. The government's nationwide travel promotion and the easing of border controls are expected to stimulate the consumption of services and boost inbound tourism. Meanwhile, the recent rise in infection cases is fueling concerns over a potential eighth coronavirus wave delaying

[3] One-third of Shizuoka was counted as part of TEPCO's service area, since the proportion of electricity supplied by TEPCO and Chubu Electric Power in the prefecture is approximately 1:2.

the country's economic recovery. The power shortage scenario in this report is merely a tail risk, but any such shortage would constitute a major factor hampering the Japanese economy's recovery this winter. The 1.0% output decline in Pattern 2, Case 1, is the percentage to annual production in the service areas of Tohoku Electric Power and TEPCO. On a quarterly basis, it will pushed down by -4% during January-March period. Since the combined production of the two power companies' service areas accounts for 49.1% of the country's overall production (based on 2015 producer prices), the national output is estimated to shrink by around 2.0% during January-March period. This highlights significant impact of temporary power supply suspensions on the economy. (This report used a simplified calculation method; in reality, the impact on manufacturing activities can be alleviated to some extent by such measures as demand response (DR[4]) and peak shifting.[5] The estimation should be understood as the maximum possible impact, although the damage of suspending electricity supplies on the economy and society would still be substantial.)

Chart 3: Estimated output decrease rates by industrial groups

	Case 1 (Electricity -4%)	Case 2 (Electricity -2%)
Pattern 1 (Planned outages)	All industries: -4%	All industries: -2%
Pattern 2 (Suspension of plant operations)	Electricity: -4% Manufacturing: -20% Others: 0%	Electricity: -2% Manufacturing: -10% Others: 0%

Source: Made by MHRT.

Chart 4: Economic impact of outages (Values and rates of output decreases)

	Case 1 (Electricity -4%)	Case 2 (Electricity -2%)
Pattern 1 (Planned outages)	-3.2 trillion yen (-0.6%)	-1.6 trillion yen (-0.3%)
Pattern 2 (Suspension of plant operations)	-5.1 trillion yen (-1.0%)	-2.5 trillion yen (-0.5%)

Note: The values are based on producer prices in 2015. The decrease rates are against the total annual production of the service areas of Tohoku Electric Power and TEPCO.
Source: Made by MHRT based upon prefectural input-output tables.

3. Short-term and medium to long-term policies vital for securing a stable energy supply

The assessment in the preceding section indicates that Japan would be severely affected even if the energy supply disruption is temporary. Policy actions are therefore crucial to prevent events that could disturb the supply-demand balance. In dealing with this problem, it is also important to adopt a two-way approach to control both supply and demand.

[4] A program to request energy customers who have a specific contract with a utility company to lower consumption during an electricity shortage or other emergency and provide payments in return.

[5] The process of charging storage batteries at night or other off-peak times and using the electricity during high-demand hours.

Recently, policy councils are heading in the direction of proposing concerted efforts to manage supply and demand as part of the government's short-term measures. In detail, on November 1, 2022, the government urged the public to make energy-saving efforts to reduce demand, after 7 years since 2015 and consider the development of incentive systems to promote energy conservation and the preparation of emergency response plans. On the supply side, measures under consideration include establishing a framework to share raw fuels across industries to stabilize fuels procurement, maximizing the use of existing electricity sources to secure supply capacities, and further soliciting of new electricity sources.

In securing a stable supply of fuels, particularly LNG, the situation is expected to remain challenging in the next fiscal year or beyond considering international situation. In November 2022, the International Energy Agency (IEA) released its "Never Too Early to Prepare for Next Winter: Europe's Gas Balance for 2023-2024" report that predicts Russia's restrictions on natural gas deliveries to Europe will continue into 2023 or further, while China's demand for LNG is likely to rebound, and signals the potential risks to the energy procurement environment both in supply and demand. To ensure a stable procurement of fuels under such circumstances, Japan needs to start improving and strengthening the systems to provide policy support for short-term spot procurements and medium- to long-term procurement. For short-term spot procurements, obtaining a buffer against sudden demand increases is important, but if risk events that cause sudden surges in demand do not occur, then the buffer becomes redundant and losses are incurred. Since it is difficult for private companies to continue buying buffer energy voluntarily, government needs to consider changing the current energy procurement structure for securing a stable energy supply (**Chart 5**). From a medium to longer perspective, long-term procurement contracts that Japan has secured so far will have significant meaning in severe procurement situations. However, with gas demand expected to decline amid the growing decarbonization trend, maintaining long-term procurement contracts will become increasingly difficult for private firms (Mizuho Bank Industry Research Department, 2022). To ensure a stable energy supply in the future, it is vital to consider policy support measures for managing those long-term risks difficult for private businesses to deal with.

Chart 5: Outline of the discussion points on LNG procurement

Procurement type	Issues	Discussion points
Short-term spot procurement	• From the perspective of the government, Japan needs to secure buffer energy to prepare for sudden increases in demand. • But it is difficult for private firms to continue making extra purchases voluntarily, since they might sustain losses if risk events do not occur and the buffer becomes redundant.	• Distribution of stable energy procurement cost among society
Long-term contract procurement	• With the decarbonization trend exacerbating the downward pressure on gas demand, it is difficult for private firms to maintain long-term procurement contracts on their own.	• Gap between the conditions sought by fuel suppliers and buyers in long-term contracts • Absence of parties that can take on long-term risks

Source: Made by Mizuho Bank Industry Research Department.

Reference

Refer to the original Japanese report by clicking the URL below for the reference material.
https://www.mizuho-rt.co.jp/publication/report/2022/pdf/insight-jp221130.pdf