

# Outlook and Issues Concerning Electric Power Business in 2022

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**Institute of Energy Economics, Japan**

Junichi Ogasawara  
Electric Power Group, Electric Power Industry & New  
and Renewable Energy Unit

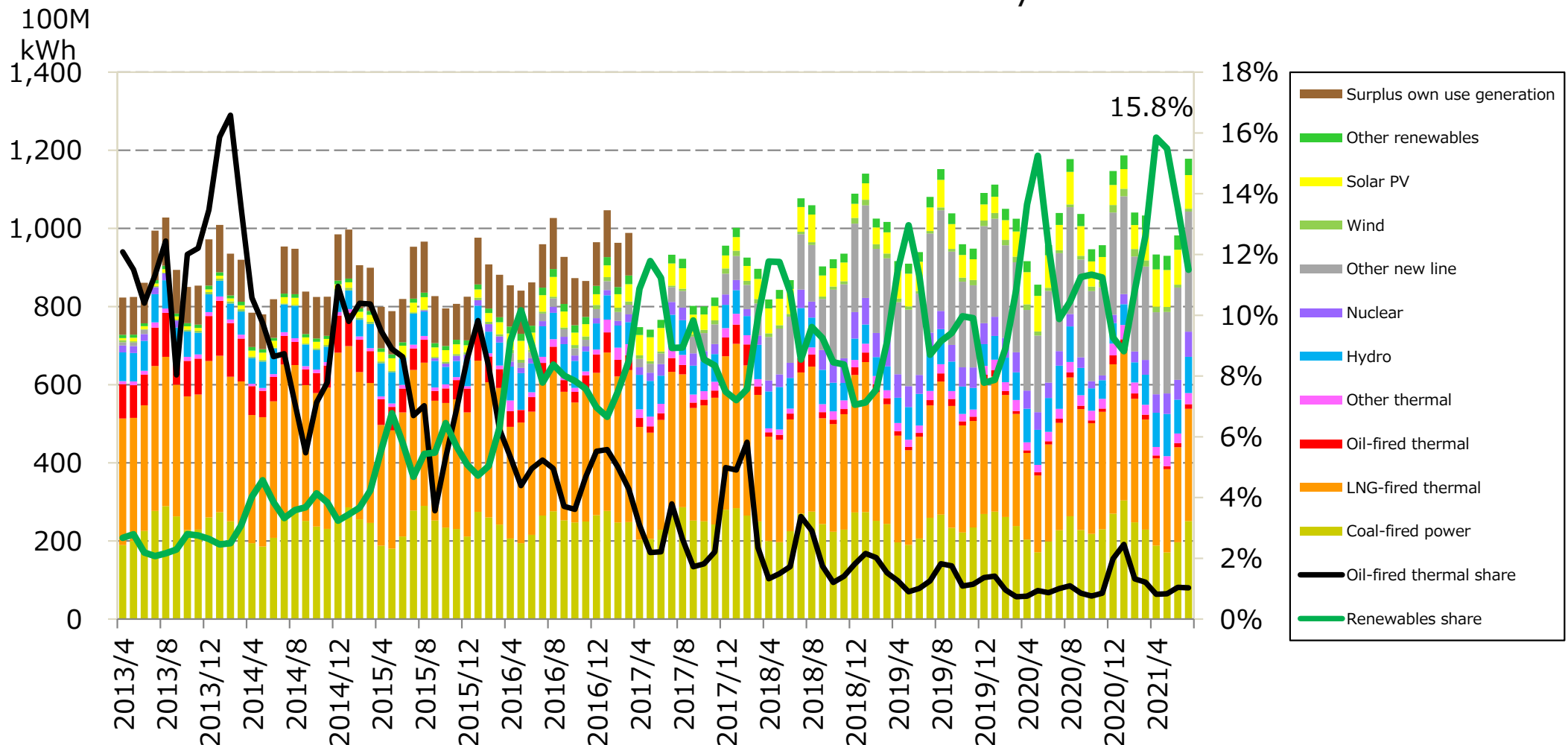
# Key Points of the Report

- ✓ Wholesale electricity spot prices are rising in many non-gas producing countries and regions that have chosen to privatize. These prices are also gradually increasing in Japan, although not to the extent of Europe, due to rising LNG import prices. This document examines conditions in Japan and presents an overview of conditions in several other countries.
- ✓ Capacity market mechanisms were reviewed based on the results of a capacity market auction last fiscal year. A review of non-fossil fuel value market mechanisms is also being done in response to increasing customer demand for renewable energy value. This document presents an overview of the impacts of these reviews.
- ✓ The following pages look at issues to be considered for FY 2022 based on the above developments.

# 1. State of electricity market competition in Japan

## (1) Historical power output by energy source

- While the fossil fuels share has risen since the Great East Japan Earthquake, the number of months below 10% has gradually increased since around 2015. The renewables share also went above 5% at around this time, and has trended around 10% since 2017. The renewables share hit 15.8% in May 2021.

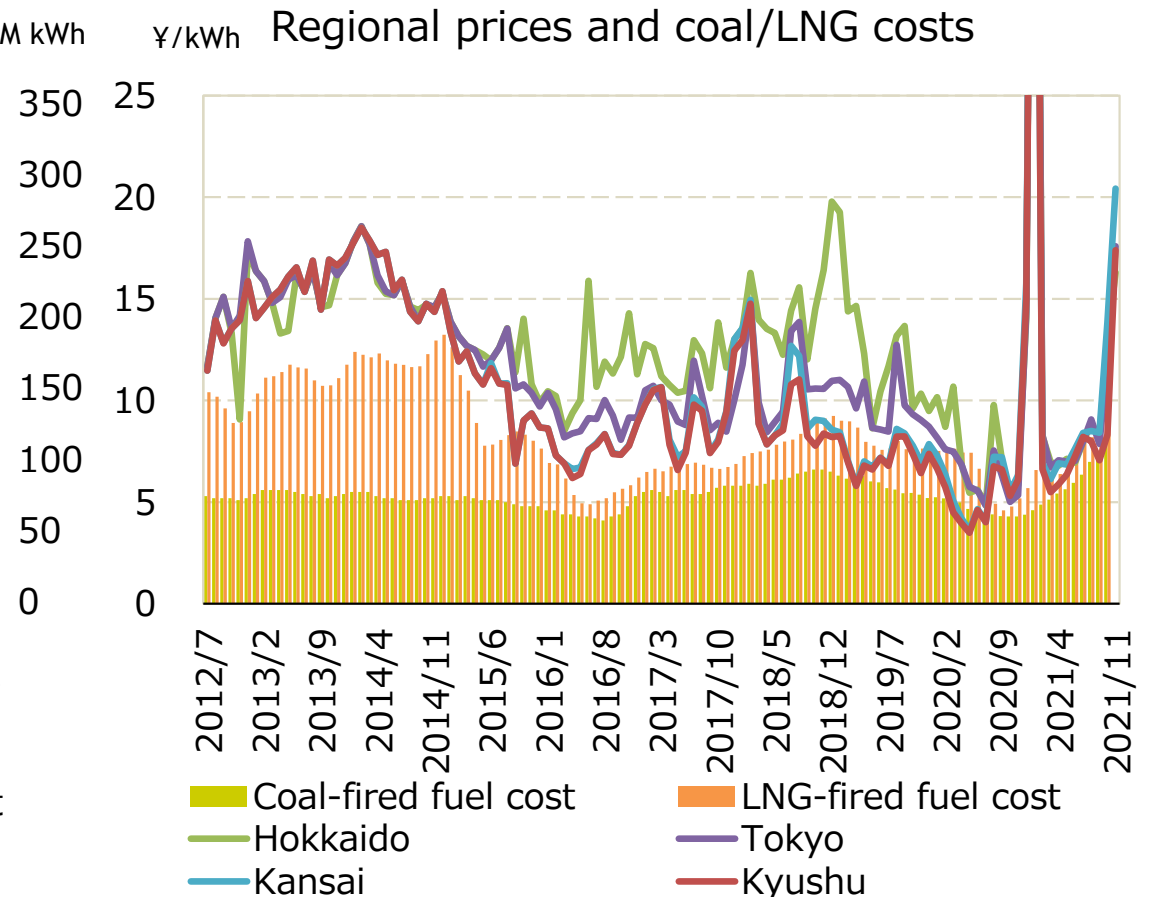
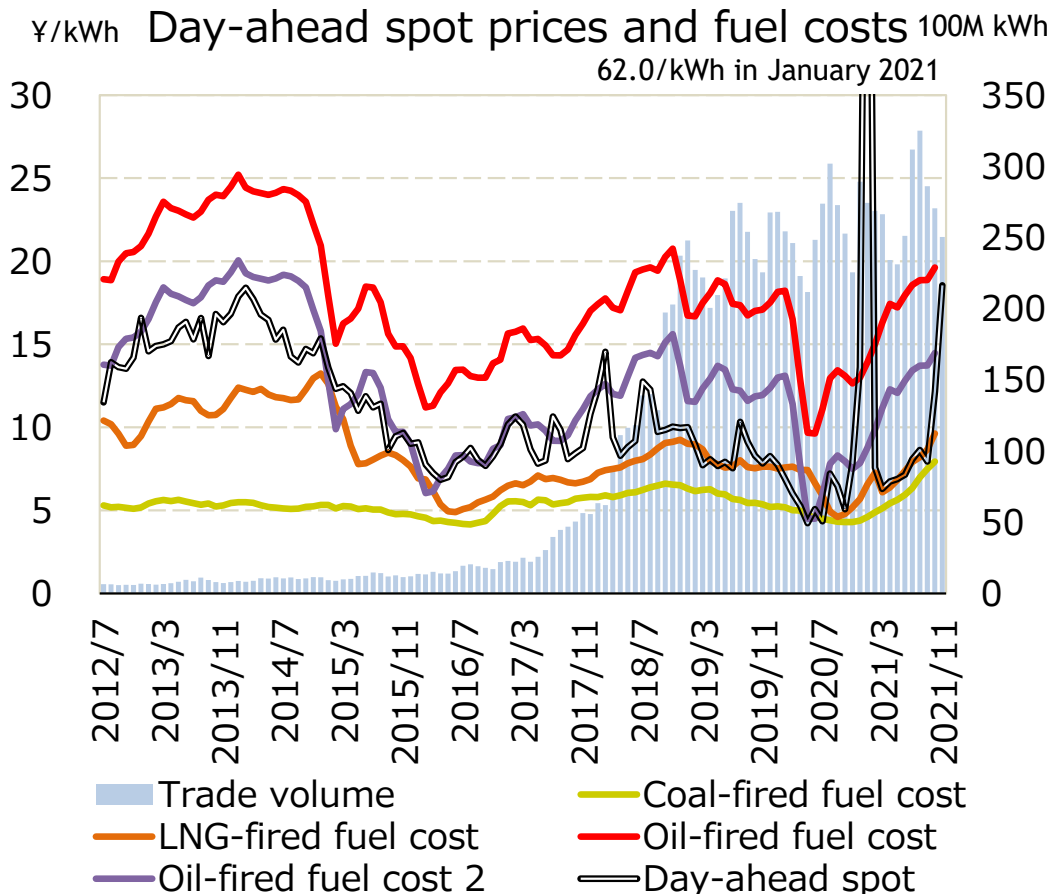


Note: Statistical data was changed beginning in April 2017.  
 Source: Prepared based on data from the "Survey of Electric Power Statistics,"  
 Agency of Natural Resources and Energy

# 1. State of electricity market competition in Japan

## (2) Day-ahead spot prices and fuel costs

- Day-ahead spot system prices moved largely in step with oil-fired thermal power fuel costs up until around February, 2017, but a decline in oil-fired thermal power fuel has seen them approach LNG-fired thermal power fuel costs ever since. Since around 2015, increasing East-West market fragmentation caused by the effects of rising renewable capacity has tended to see prices drop in western Japan.
- After FIT power regulation began in the Kyushu service area in October, 2018, spot prices have dropped to the point that they are now below LNG-fired thermal power fuel costs, especially in central and western Japan. While these prices have slowly moved upwards since September in anticipation of winter, this is seen as owing to rising LNG prices. The situation bears careful watch going forward.



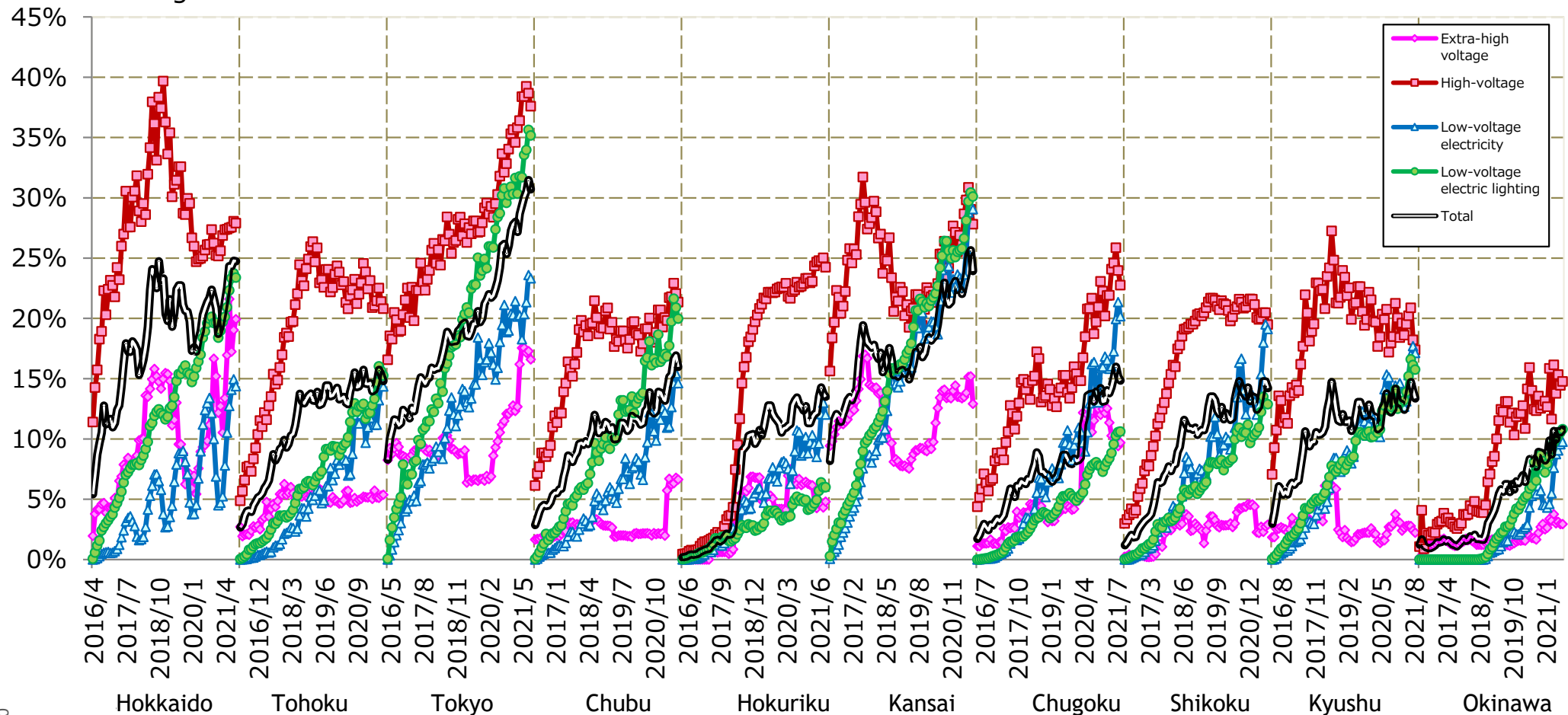
Note on cost calculations: Coal-fired thermal power = fuel costs (power generation efficiency 40%) + operation and maintenance costs ¥1.7/kWh; LNG-fired thermal power = fuel costs (power generation efficiency 50%) + operation and maintenance costs ¥0.6/kWh; Oil-fired thermal power = fuel costs (power generation efficiency 35%) + operation and maintenance costs ¥5.15/kWh (oil-fired thermal power fuel cost 2 is for fuel only)

Sources: Measurement Analysis Unit, Institute of Energy Economics, Japan (for fuel prices), Japan Electric Power Exchange (for spot prices)

# 1. State of electricity market competition in Japan

## (3) Retail competition (since April 2016)

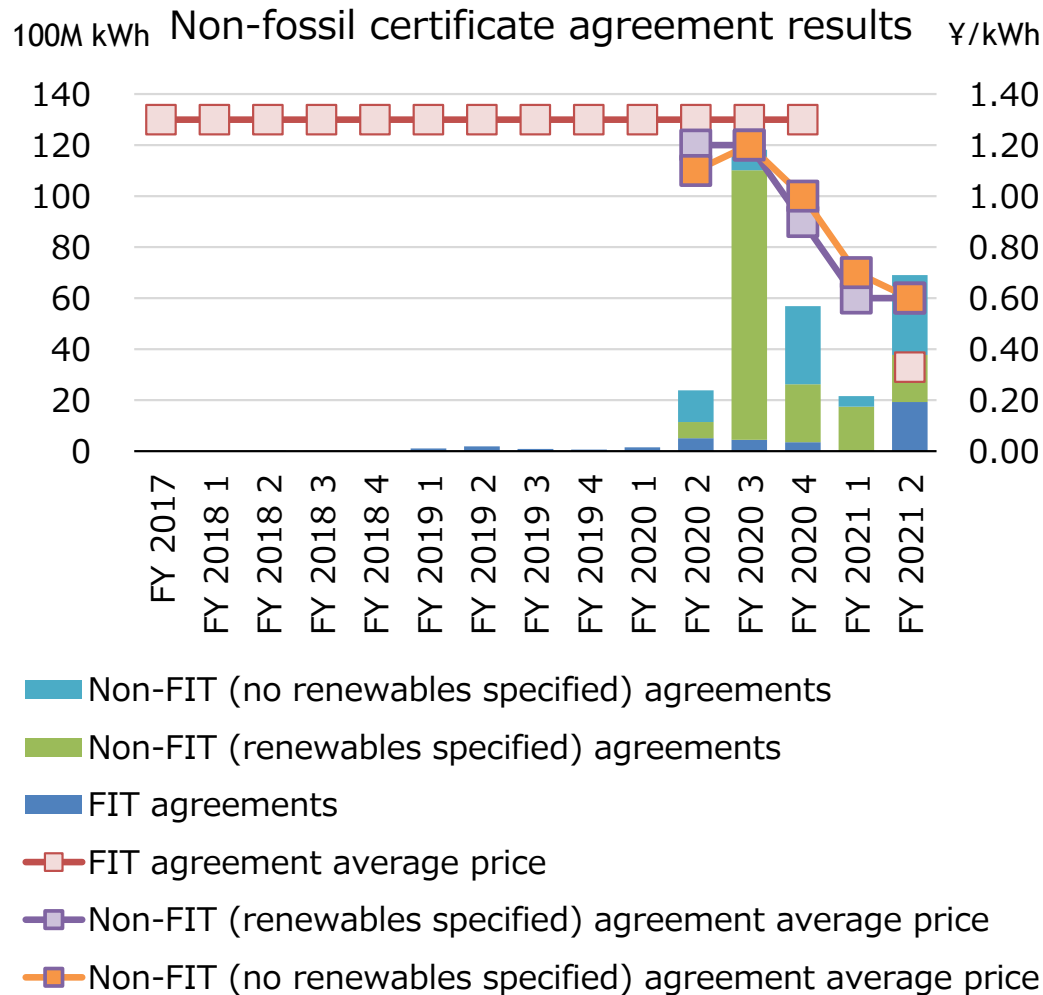
- The national average switching rate as of August 2021 was 22.6%. The switching rate remained high among high-voltage customers, and was high in Hokkaido, Tokyo, and Kansai. Low voltage switching rate was also high in Hokkaido, Tokyo, Chubu, and Kansai. Day-ahead spot prices in central and western Japan are becoming variable, and until capacity market trade begins, competition could intensify among PPS, which supply power they purchase on the spot market. On the other hand, if LNG prices continue to rise into winter, it will likely be difficult for PPS to operate with a reliance on the spot market, in which case fuel cost market conditions will require continued monitoring.



Source: Prepared based on data from "Electricity Trade Data Aggregation Results," Electricity and Gas Market Surveillance Commission

# 1. State of electricity market competition in Japan

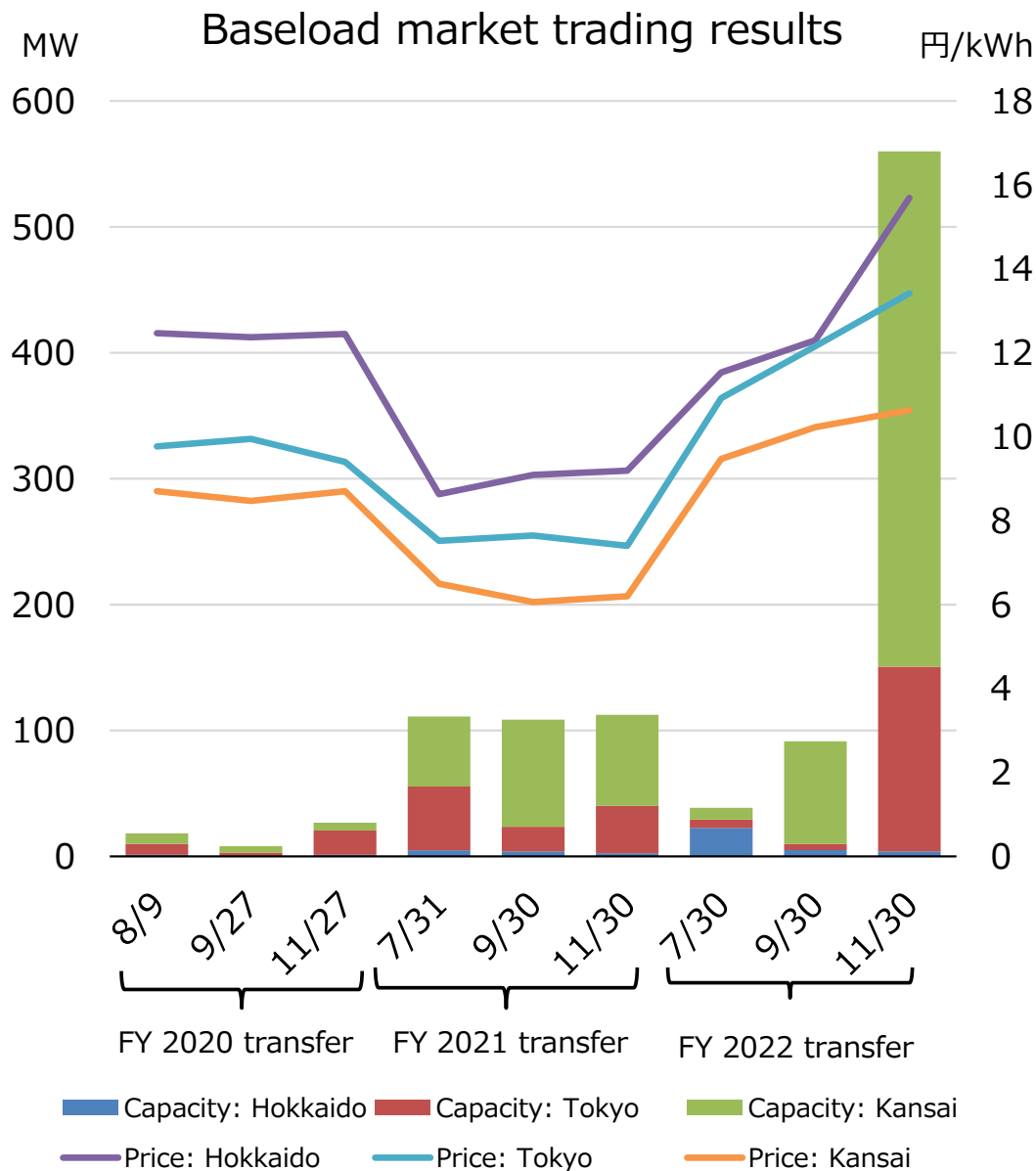
## (4) Non-fossil certificate trading



- While FIT non-fossil certificate trading volume grew at the 3rd auction of FY 2020, volume declined at the 4th auction of FY 2020 and first auction of FY 2021. Lower limits are being reconsidered for auction prices, as well, and are trending downward.
- Given customer interest in renewable value purchasing, the market for trading in non-fossil fuel value will be split into a market for renewable value trade (FIT non-fossil certificates) and market for meeting the obligations of the Act on Sophisticated Methods of Energy Supply Structures (non-FIT non-fossil certificates).
- As for FIT certificates, Japan will basically settle on ¥0.3–0.4/kWh in light of price levels for similar credit in other countries. It has been said that this will help mitigate the FIT surcharge burden when deploying the system, but it will not in fact help much at all.

# 1. State of electricity market competition in Japan

## (5) Baseload market trading



- In the baseload market, PPS can purchase, at an annual fixed price, electricity from baseload sources such as coal-fired power, large-scale hydropower, nuclear power, and geothermal power supplied by large power producers.
- Trading for FY 2021 increased significantly year on year. Trading was much higher for FY 2022 than for 2021, due to high trading volume at the 3rd auction.
- By region, Kansai (central/western Japan) had relatively higher trading volume due in part to comparatively lower prices.

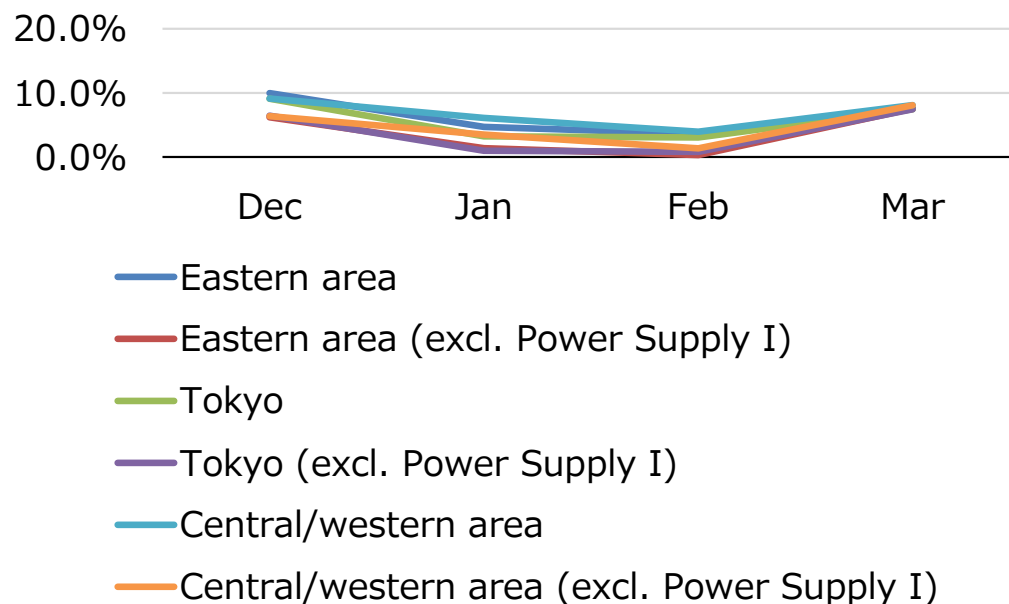
# 1. State of electricity market competition in Japan

## (6) Outlook for winter supply and demand in Japan

- Systemically, supply tends to get tight as coal-fired power is increasingly abandoned or suspended due to worsening profitability, the result of stagnant wholesale electricity prices and a declining coal-fired power availability factor that owe to increasing renewables generation. Regarding electricity supply and demand for this winter, while Japan has secured the 3% reserve margin needed at minimum for stable electricity supply in severe winters, supply could become tight if additional factors come into play. Reserve margin calculations factor in Power Supply I', which must be maintained in the event of a once-in-a-decade extreme weather event. If not factored in, the reserve margin is under 3% for all of Japan.
- For this winter, in light of last winter's electricity shortage, power producers are working to ensure a stable electricity supply by monitoring efforts by companies in the northeastern U.S. (e.g., ISO New England and PJM) to secure fuel. As such, continued efforts to encourage power saving will be needed.

A Tokyo area supply is expected to get tight for the winter of FY 2021, as well, if there is extreme weather

Electricity supply and demand outlook for winter FY 2020



Electricity supply outlook in the event of extreme weather for FY 2021 summer and winter

	Jul	Aug	Sep	Dec	Jan	Feb	Mar
Hokkaido	12.9%	18.9%	23.8%	14.1%	7.3%	10.4%	16.2%
Tohoku	8.4%	5.5%	7.8%	13.2%	5.1%	10.4%	16.2%
Tokyo	4.5%	5.5%	4.0%	9.6%	<b>2.1%</b>	<b>0.4%</b>	6.7%
Chubu	4.5%	5.5%	4.0%	9.6%	6.1%	3.2%	9.1%
Hokuriku	4.5%	5.5%	8.5%	9.6%	6.1%	5.9%	16.4%
Kansai	4.5%	5.5%	8.5%	9.6%	6.1%	5.9%	16.4%
Chugoku	4.5%	5.5%	8.5%	9.6%	6.1%	5.9%	16.4%
Shikoku	4.5%	5.5%	8.5%	9.6%	6.1%	5.9%	16.4%
Kyushu	4.5%	5.5%	19.7%	9.6%	6.1%	5.9%	16.4%
Okinawa	28.8%	29.2%	34.3%	30.7%	31.3%	51.2%	63.1%

Source: Prepared based on data from Organization for Cross-regional Coordination of Transmission Operators, Japan, "Electricity Supply and Demand Study Report," October 2020

Source: Organization for Cross-regional Coordination of Transmission Operators, Japan, "FY 2022 Supply and Demand Outlook, and Countermeasure Implementation Progress" 7



## 2. Situation in the U.S./Europe

### (1) Power crises around the world

Electric power crises occurred around the world in 2021. While much of these was the result of heat waves and cold waves, it is conceivable that a declining "energy reserve" needed to ensure a stable supply of electricity is also a factor.

Rising gas prices caused soaring wholesale power prices in Europe since September

Heat wave prompted calls for energy saving in Greece in August

Heat wave caused power outage in Turkey in August

Cold wave caused power crunch and rolling blackouts in China in January

Coal shortage caused power shortage in China in September

Cold wave caused power crunch in Japan in January

Falling imports in California from June to September prompted calls for energy saving

Hurricane Ida caused large-scale power outage in Louisiana in August

Cold wave caused large-scale rolling blackouts in Texas in February

Coal shortage caused power crisis in India in October

Gas supply decrease sharply drove up spot prices in Singapore in August

Drought-driven water shortage prompted calls for energy saving in Brazil in August

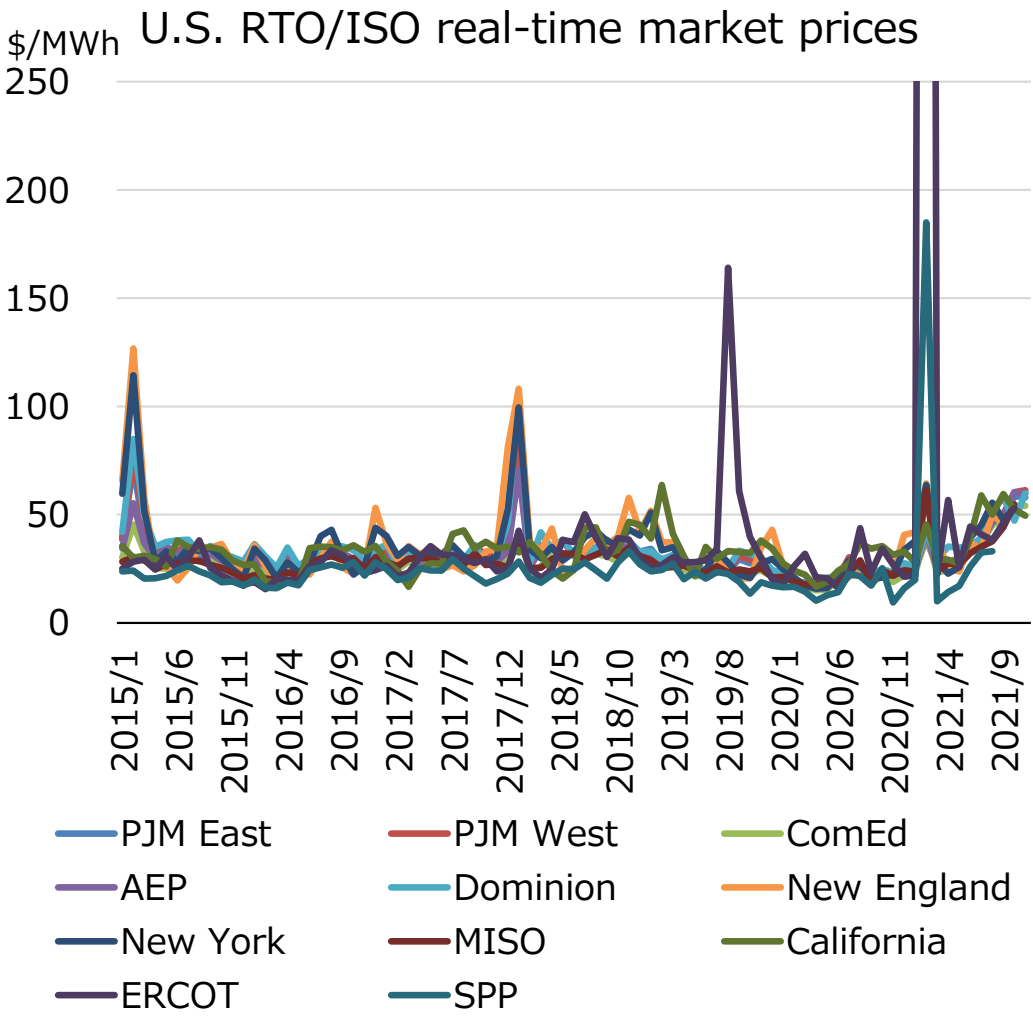
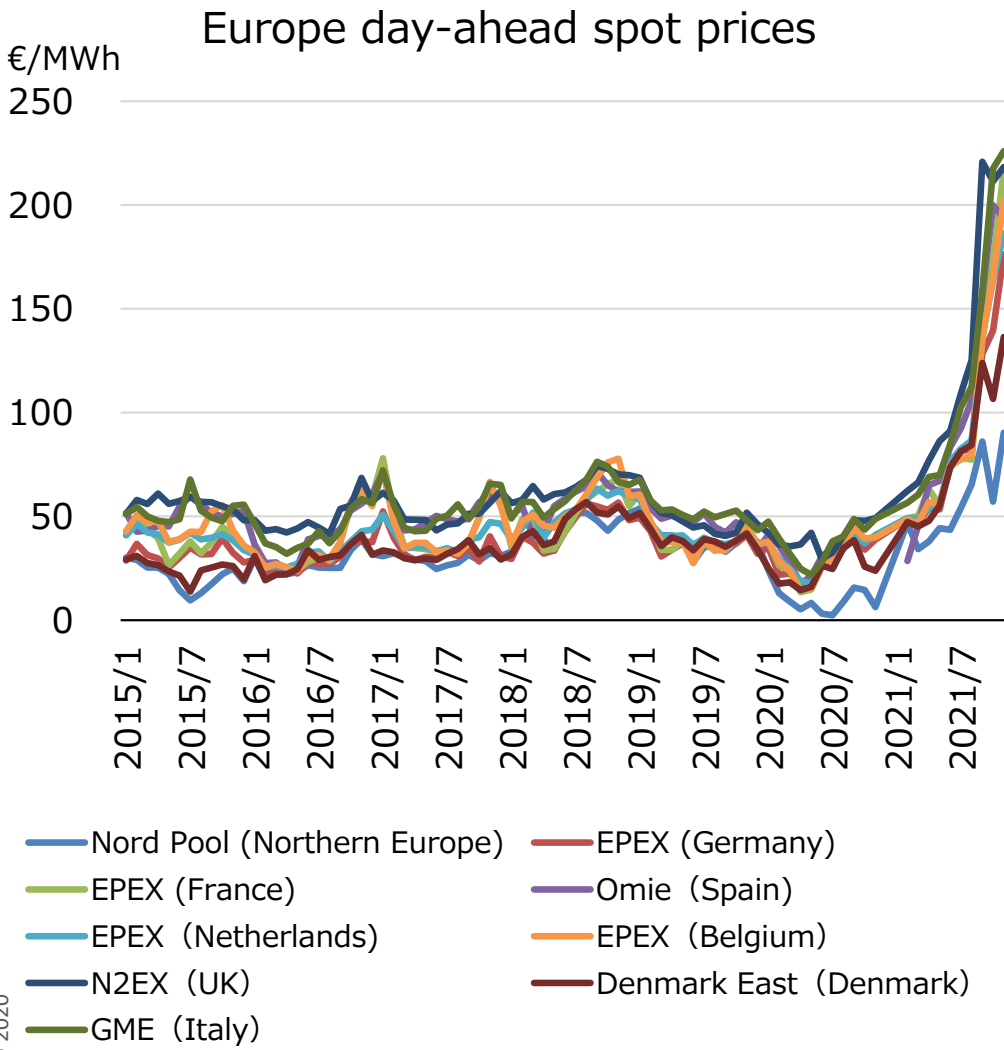
Cold wave caused rolling blackouts in New Zealand in August

Source: Prepared based on sources including Ministry of Economy, Trade and Industry, "Recent Trends Involving Fuel and Electricity," October 2021

# 2. Situation in the U.S. and Europe

## (2) Historical wholesale electricity market prices in the U.S. and Europe

- In Europe, wholesale electricity prices have risen in many countries on the back of rising natural gas prices. Monthly average prices have risen to unprecedented levels. The UK has seen a quick succession of retail suppliers abandoning the market. In the U.S., meanwhile, natural gas prices have risen to high levels but not to the extent in Europe.



Note: February 2021 ERCOT price: \$1,784.27/MWh

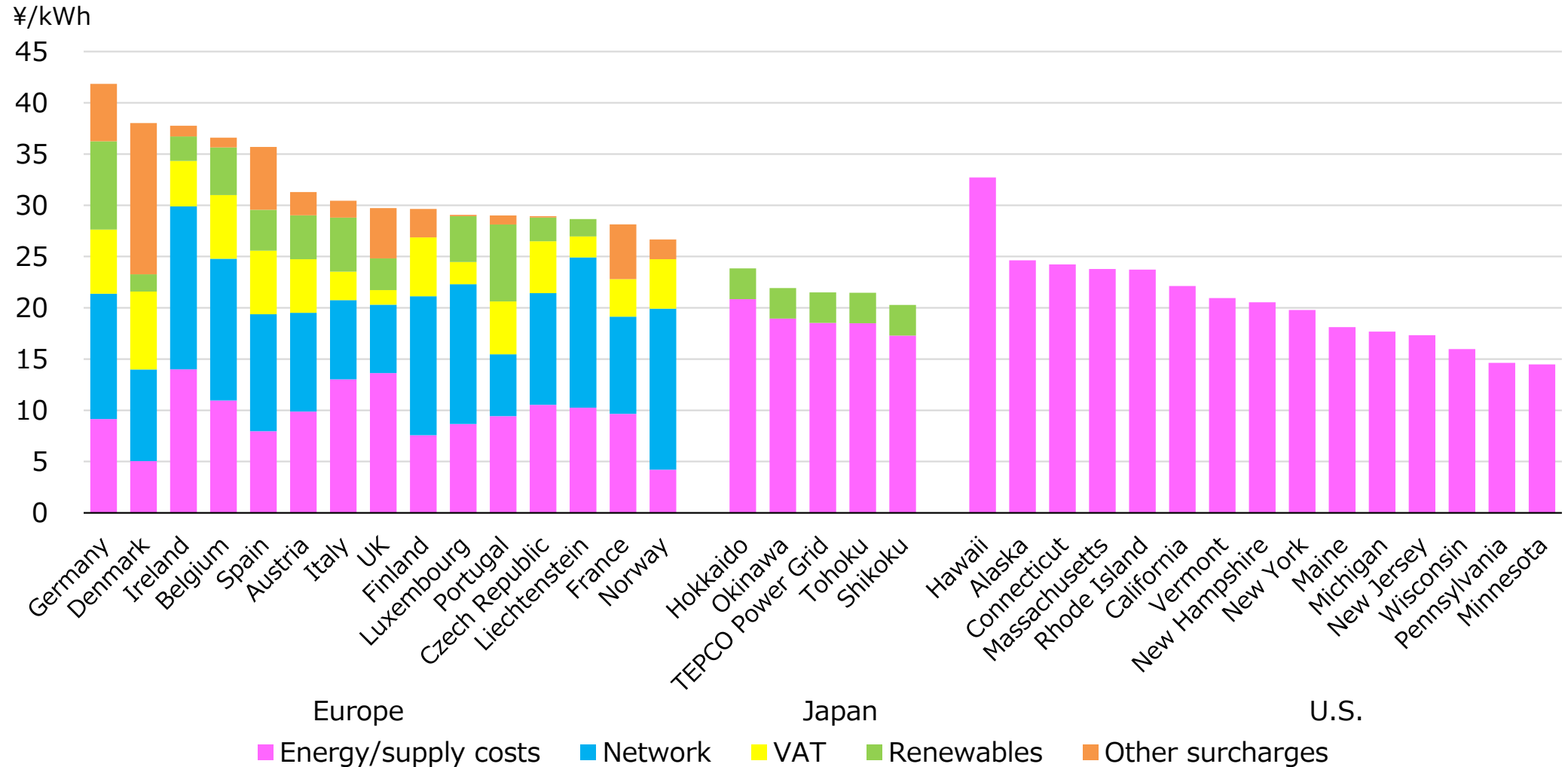
Source: Prepared based on data from exchange websites

Source: Prepared based on data from RTO and ISO websites

# 2. Situation in the U.S. and Europe

## (3) International comparison of electricity rates (2020)

- Rising surcharges and costs of transmission and distribution that owe to increasing renewable capacity deployment are making electricity rates go up in more countries. This is making solar PV self generation profitable for an increasing number of countries and regions. Some countries have begun to show the effects of rising spot prices on electricity rates, fueling concern about the impact on retail prices.

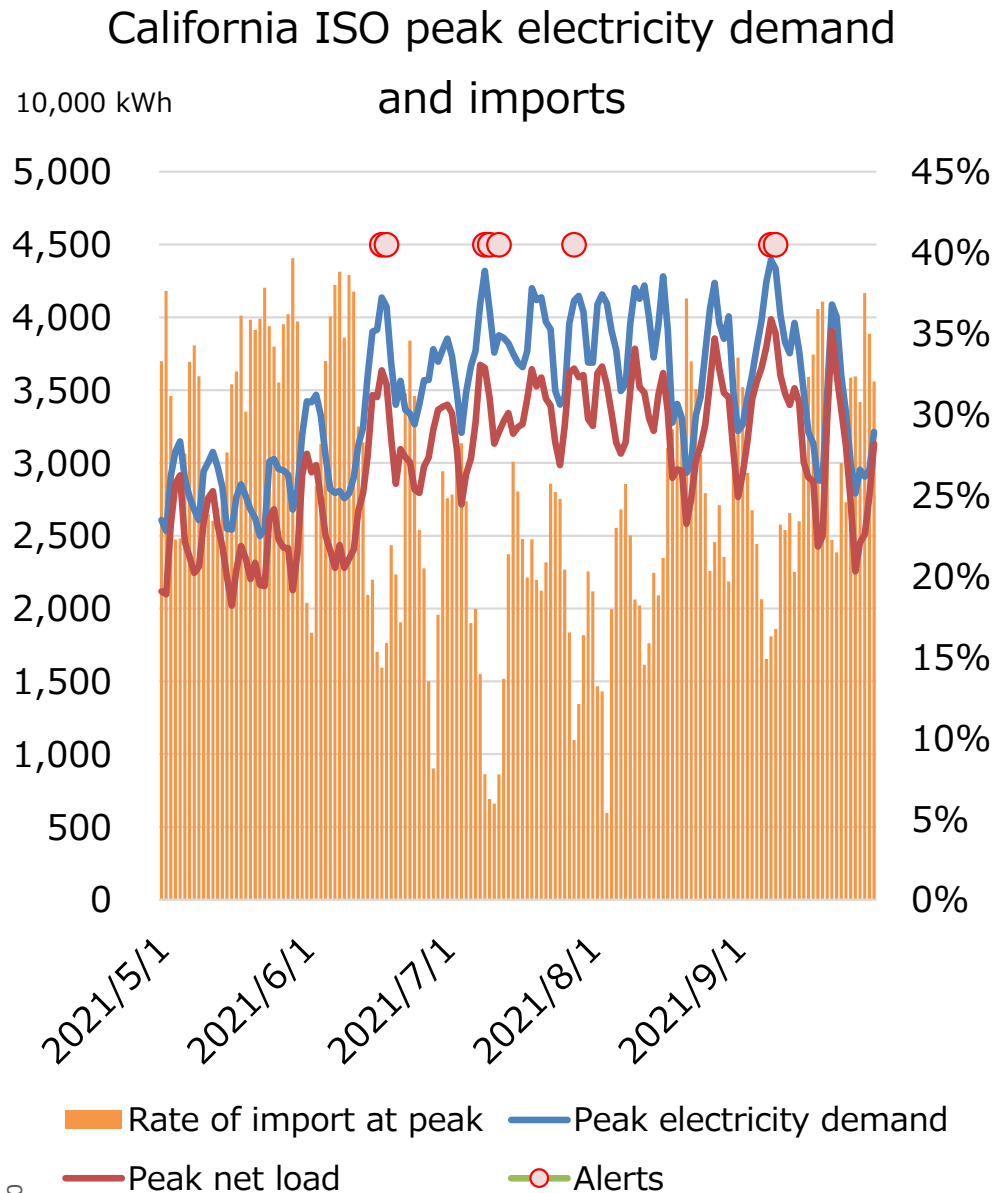


Note: Foreign Exchange cap rate Table was used for exchange rates. Average rates for 2020 were 1euro = 123.2yen, and 1USD = 107.9yen. UK rates are for 2019, Japan rates are for FY 2020

Source: Prepared based on data from Eurostat (customers using 1000–2,500 kWh annually) for Europe; the Electricity and Gas Market Surveillance Commission, "Electricity Trade Data Aggregation Results" (¥2.90/kWh for the average electric lighting unit cost and surcharge) for Japan; and EIA, "Electricity Annual" for the U.S.

# 2. Situation in the U.S. and Europe

## (4) Power crunch at the California ISO

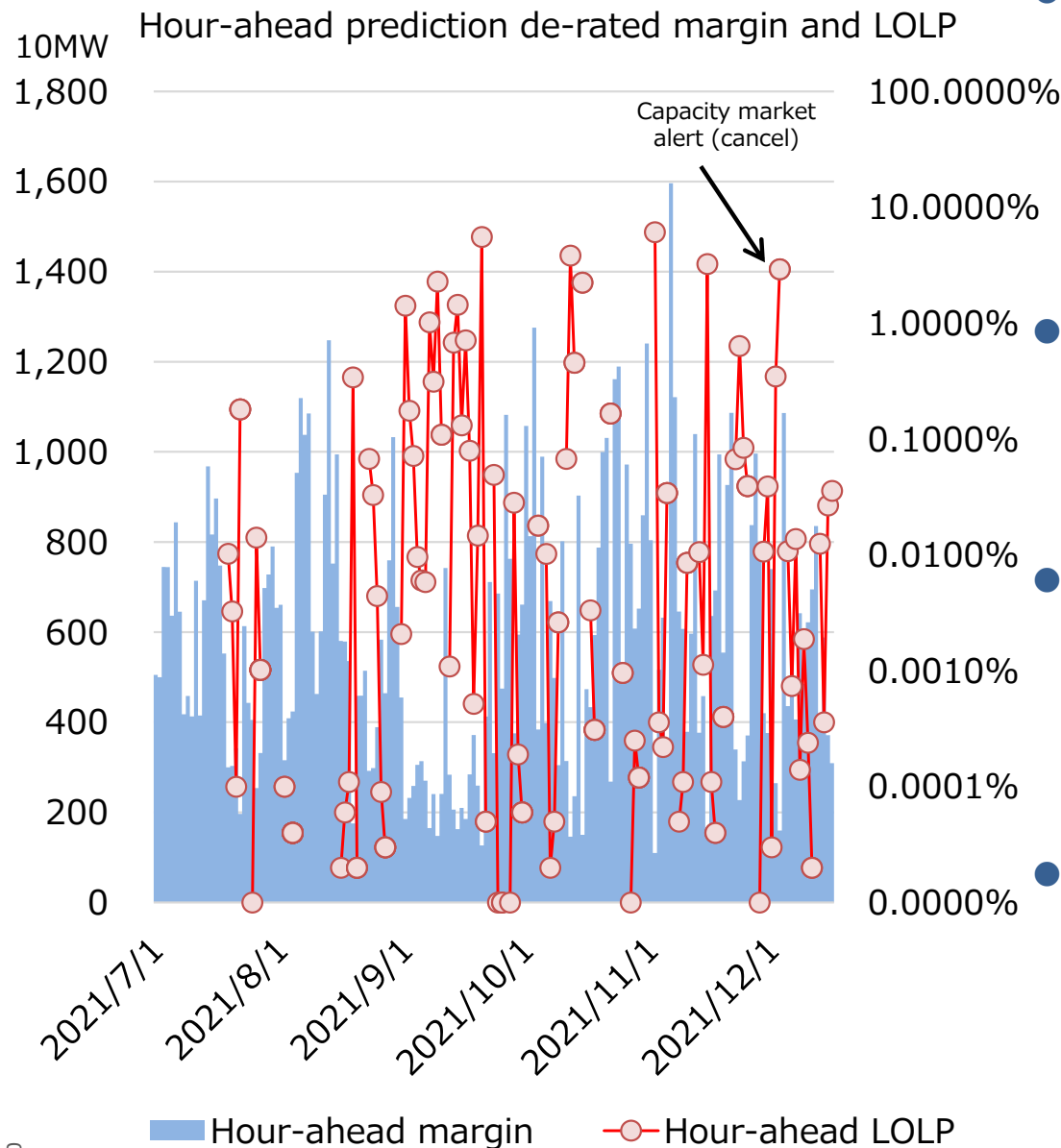


- Following a planned outage it conducted last summer in the face of a power crunch, the California ISO has so far asked residents to save energy eight times this summer because of another crunch. Residents were asked to save energy on the evenings of June 17 and 18; July 9, 10, 12, and 28; and September 8 and 9. These calls were prompted by a rise in demand resulting from a heat wave. The peak electricity demand this summer was 43.94 million kWh, which is on par with the 44.30 million kWh of the summer of 2019 and is less than the peak demand in the recent past (peak demand in the last 10 years was 50.12 million kWh in the summer of 2017).
- Electricity supply tightened the summer as demand increased throughout the Western U.S. Although the California ISO wanted to import more energy, it could not and was forced to issue a call for energy saving. Batteries installed on-site at the California ISO can supply around 1.5 million kW. In August, for example, the batteries supplied between 720,000 and 1.42 million kW daily. The batteries provide additional supply to satisfy demand during peak periods.
- The North American Electric Reliability Corporation sees power crunch risk in the event of a severe winter for ERCOT, MISO, and SPP in Texas, while California and ISO New England face the same risk due to natural gas shortages.

Source: Prepared based on California ISO, "Today's Outlook"

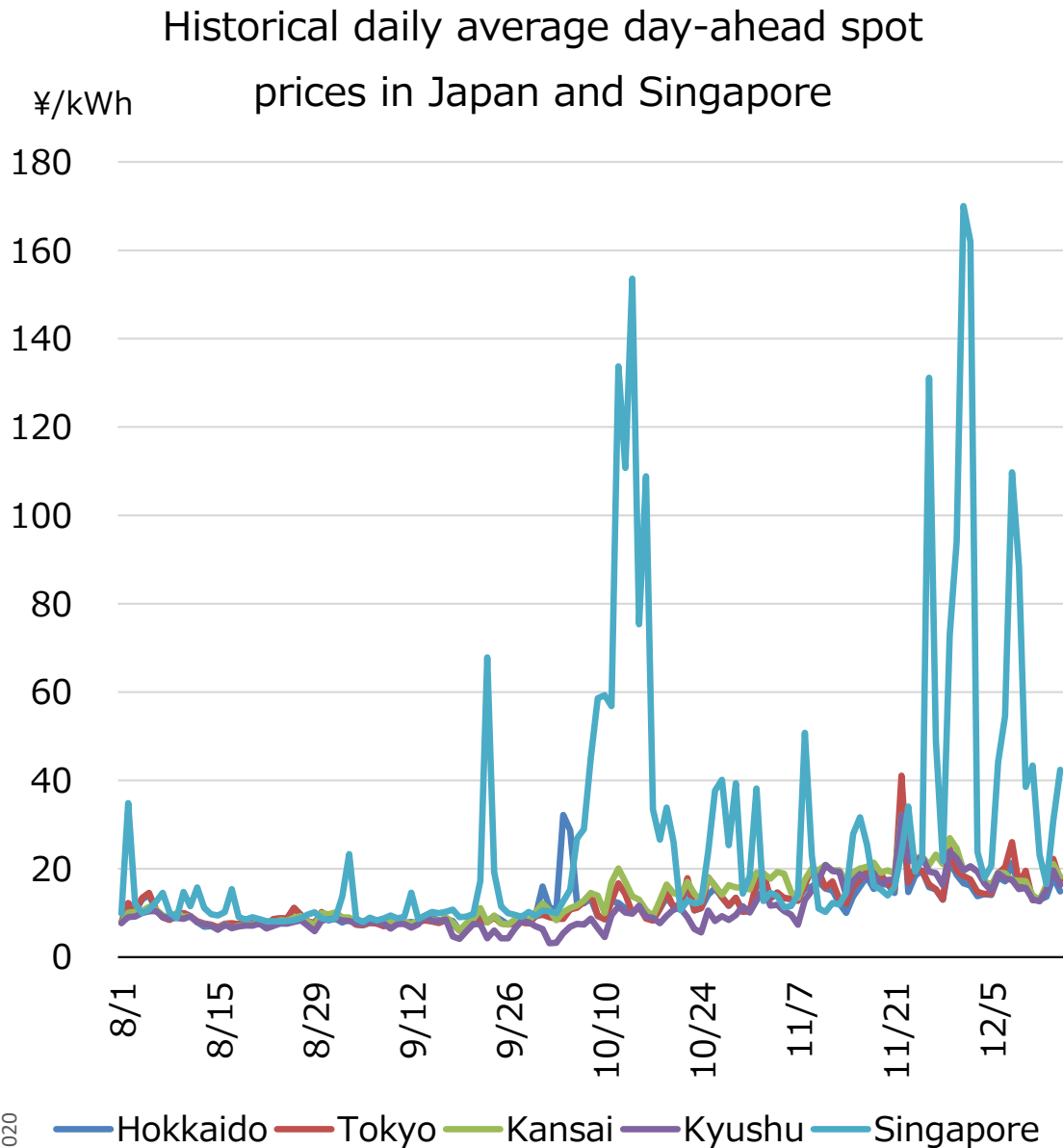
# 2. Situation in the U.S. and Europe

## (5) Declining supply capacity in the UK



- The supply capacity of the UK's power transmission grid has been falling since around July, and as of one hour ago, there has been a rise in the number of days with a positive LOLP. This owes in part to an increase in the number of low wind power generation days in September.
- However, supply capacity in the capacity market includes the supply capacity of the power distribution system, and there were no days where capacity market bid winners were required to contribute capacity.
- A tightening supply situation led to increased operation of coal-fired power plants. While 2020 saw 179 days with no coal-fired power generation, this had dropped to 83 days as of the end of November, 2021.
- Looking at Europe overall, traditional power generation is continuing its decline, with the possibility of supply tightening based on the weather. In France, a shutdown of nuclear power facilities due to the effects of COVID-19 could create a power crunch.

## 2. Situation in the U.S. and Europe [Reference] Historical spot prices in Japan and Singapore

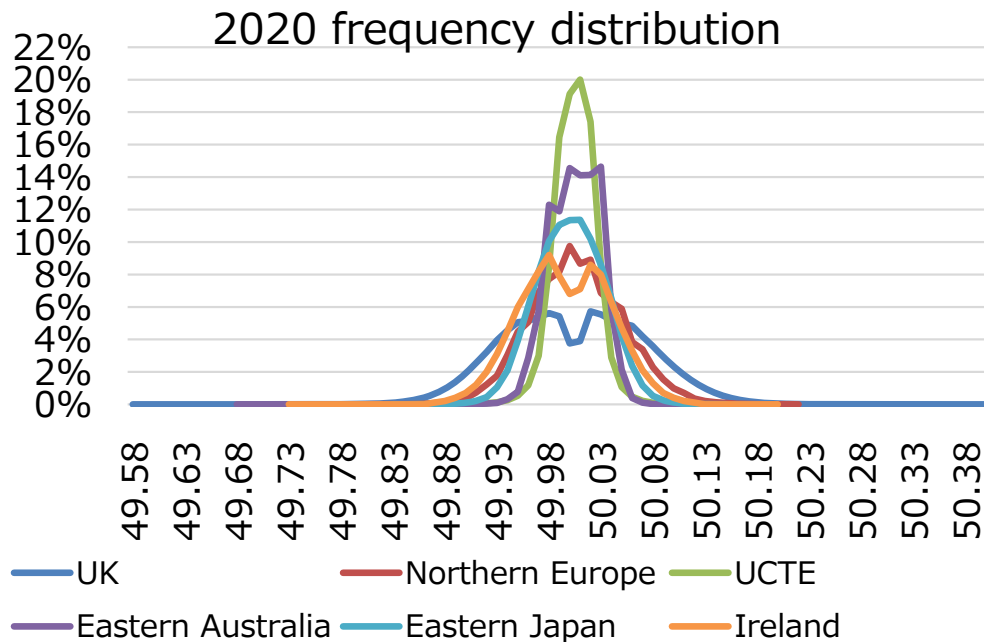


- Rising LNG prices around the world are also impacting Asia. Japan has also seen day-ahead spot prices trend slowly upward since October, while Singapore has recorded multiple days where the average daily price has exceeded ¥100/kWh. December 2 saw a peak price of ¥371.9 in Singapore. This situation has led to many retail suppliers pulling out of the market.
  - Singapore's the energy mix consists almost entirely of gas-fired power, and output from the country's superannuated gas-fired power plants decreased by 1 million kW in 2019 (about 7.8% of 2018's installed capacity). In the face of a tightening supply, it is considering importing power from other countries as it is unable to cover the fixed costs of constructing new gas-fired power plants.
  - Wholesale electricity market prices are also climbing in the Philippines on the back of rising LNG prices. The average daily price on October 20 was ¥31.2/kWh (Luzon) (peak price is ¥74.9/kWh).
- \* This points to the risk of an energy mix becoming heavily skewed.

# 2. Situation in the U.S. and Europe

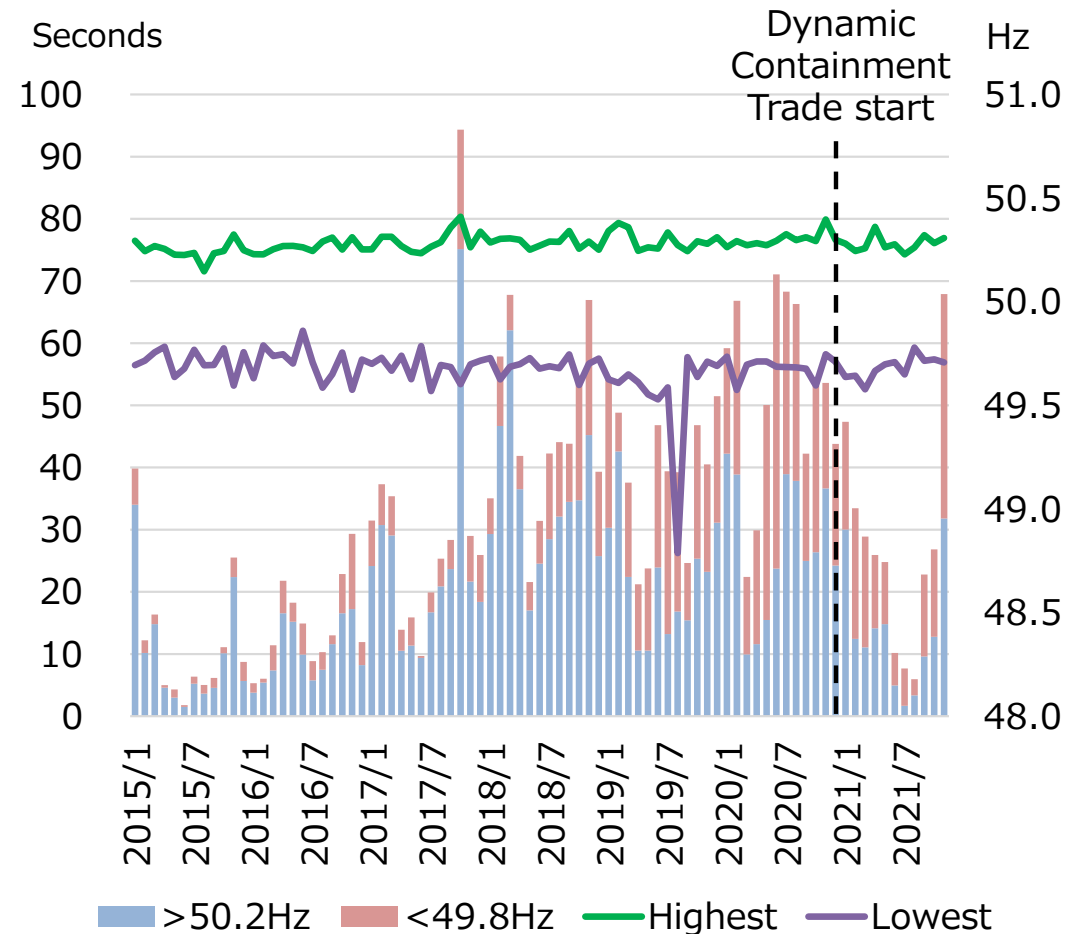
## (6) Inertial force decline and frequency stabilization

- In the UK, grid frequency started becoming unstable around 2019, with the region even experiencing a low-frequency demand disconnection in August 2019. Since the deployment of Dynamic Containment, a fast frequency response deployed in October 2020, the rate at which frequency fluctuations exceed  $50 \text{ Hz} \pm 0.2 \text{ Hz}$ , which is the control target, has fallen. National Grid ESO, a transmission grid operator, as plans to introduce more such products.
- \* Under Dynamic Containment, which commenced in October 2020, response will need to be within a second to the frequency deviation outside of the deadband. DC will be procured in 24-hour blocks at a day-ahead auction.



Notes: 1. Intervals for frequencies are 1 second for the UK, 3 minutes for North America, 10 seconds for UCTE, 4 seconds for Eastern Australia, 5 minutes for Eastern Japan, and 5 seconds for Ireland  
 2. Intervals are from January to March, 2021 for Eastern Australia and April to September, 2021 for Ireland

Sources: Prepared based on data from National Grid ESO, "Historic Frequency Data"; RTE, "Download data published by RTE"; Fingrid, "Frequency - real time data"; AEMO, "Weekly monitoring reports"; Organization for Cross-regional Coordination of Transmission Operators, Japan, "Grid Information Services"; and Eirgrid, "Smart Grid Dashboard"



Note: Frequencies are given as 1 second interval data  
 Source: Prepared based on National Grid ESO, "Historic Frequency Data"  
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### 3. Issues Concerning Electric Power Business in 2022

- Electricity spot prices continue to rise alongside gas prices in Europe as well as in Asia, where Singapore is seeing soaring spot prices. These situations exemplify the abnormal situations that exist in primarily energy-importing countries. Gas prices are also rising in Europe, albeit not to the extent of creating a power crunch. Governments could take preparatory steps against an electricity supply shortage, which is a quantitative risk. However, there is little room for governments to get involved in cases where fuel costs are rising without any such quantitative risk, so discussing approaches that governments could take seems a necessary move.
- In Japan, a Tokyo area supply is expected to get tight for the winter of FY 2022, if there is extreme weather. This trend could continue until capacity market trade begins in FY 2024. However, it will still be difficult to build new large-scale power systems even once capacity market trade begins. Thought should therefore be given to a framework for promoting investment aimed at according with decarbonization.
- Regarding the problem of declining inertial force owing to the increasing prevalence of asynchronous power generation systems, issues to be addressed could come to light by FY 2030. Japan will need to consider countermeasures while taking cues from approaches that other countries have used.