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Outlook and Issues Concerning the Electric Power Business in 2023

Securing stable supply and changing roles of operators

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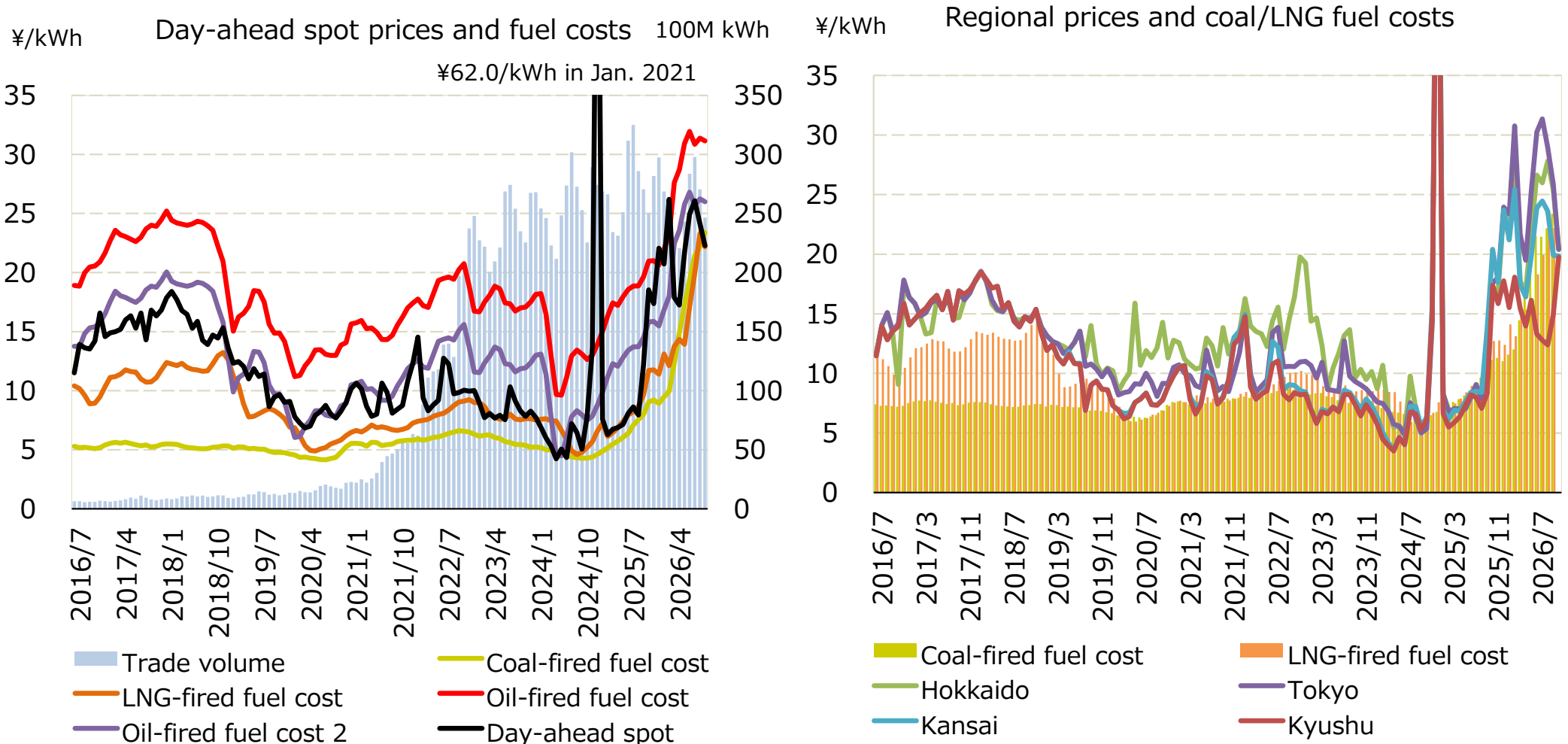
Key Points of the Report

- ✓ Day-ahead spot prices have been rising due to soaring fuel prices. In developed countries, including Japan, power crunches are becoming more likely to occur, and securing stable supplies has become an issue.
- ✓ Revising the wholesale electricity market and securing investment in power supply are under consideration. Signs of change are emerging in the roles of the various operators (power providers, electrical grid operators, and retail suppliers).
- ✓ Based on the above trends, this presentation will outline important issues to be considered in 2023.

1. Japan's Electricity Market

(1) Day-ahead spot prices and fuel prices

- Wholesale electricity spot prices have been rising since the fall of 2021 due to higher fuel prices. It is difficult to immediately reflect the increase of wholesale electricity procurement costs in electricity prices, and there have been a number of petitions to raise regulated rates amid the deteriorating profitability of the retail suppliers.



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. Japan's Electricity Market

(2) Winter Supply-Demand Projections for 2022

- The table below shows projections for electricity supply and demand for the winter of 2022 under extreme weather events. Additional public offering of supply capacity was conducted, procuring 779,000 kW in the Tohoku/Tokyo area and 1,856,000 kW in the 6 Central and Western areas, among others. As a result, the Tokyo area, which initially had a negative reserve margin, is now expected to secure the minimum 3% required for stable supply during extreme weather events.
- There remains a need to address the risk of supply capacity shortages due to a large-scale power supply dropout or an unexpected increase in demand. Support for electricity conservation is being promoted, including compensatory demand response service (DR) to be implemented under the auspices of the government. The effectiveness of this initiative bears watching.

During extreme weather events

		Hokkaido	Tohoku/Tokyo	6 Central and Western areas	Okinawa
Dec.	Reserve margin	14.4%	9.2%	7.4%	44.5%
	3% surplus	59	364	373	48
Jan.	Reserve margin	7.9%	4.1%	5.6%	33.1%
	3% surplus	27	78	229	36
Feb.	Reserve margin	8.1%	4.9%	6.5%	34.4%
	3% surplus	28	131	312	37
Mar.	Reserve margin	12.1%	11.5%	11.5%	56.6%
	3% surplus	46	499	648	59

Source: Organization for Cross-regional Coordination of Transmission Operators, Japan "Electricity Supply and Demand Verification Report," October 2022.

1. Japan's Electricity Market

(3) Supply and Demand Projections for 2023

- The table below shows the projection of electricity supply and demand during extreme weather events. At the time of the September 2022 calculation, the reserve margin in the Tokyo area was expected to be in the 3% range from July to September 2023 with extreme weather events. But that number returns to the 4% range in August and September 2023 due to a revised maintenance schedule and other factors. The July 2023 projection remains tight at 3.3% and will need to be monitored closely.

During extreme summer weather events

	July	August	September
Hokkaido	11.6%	8.6%	14.9%
Tohoku		8.3%	
Tokyo	3.3%	4.2%	4.4%
Chubu	4.3%	5.5%	
Hokuriku	14.6%	15.1%	17.4%
Kansai			
Chugoku		19.4%	
Shikoku			
Kyushu	15.1%		
Okinawa	23.3%	23.7%	27.6%

During extreme winter weather events

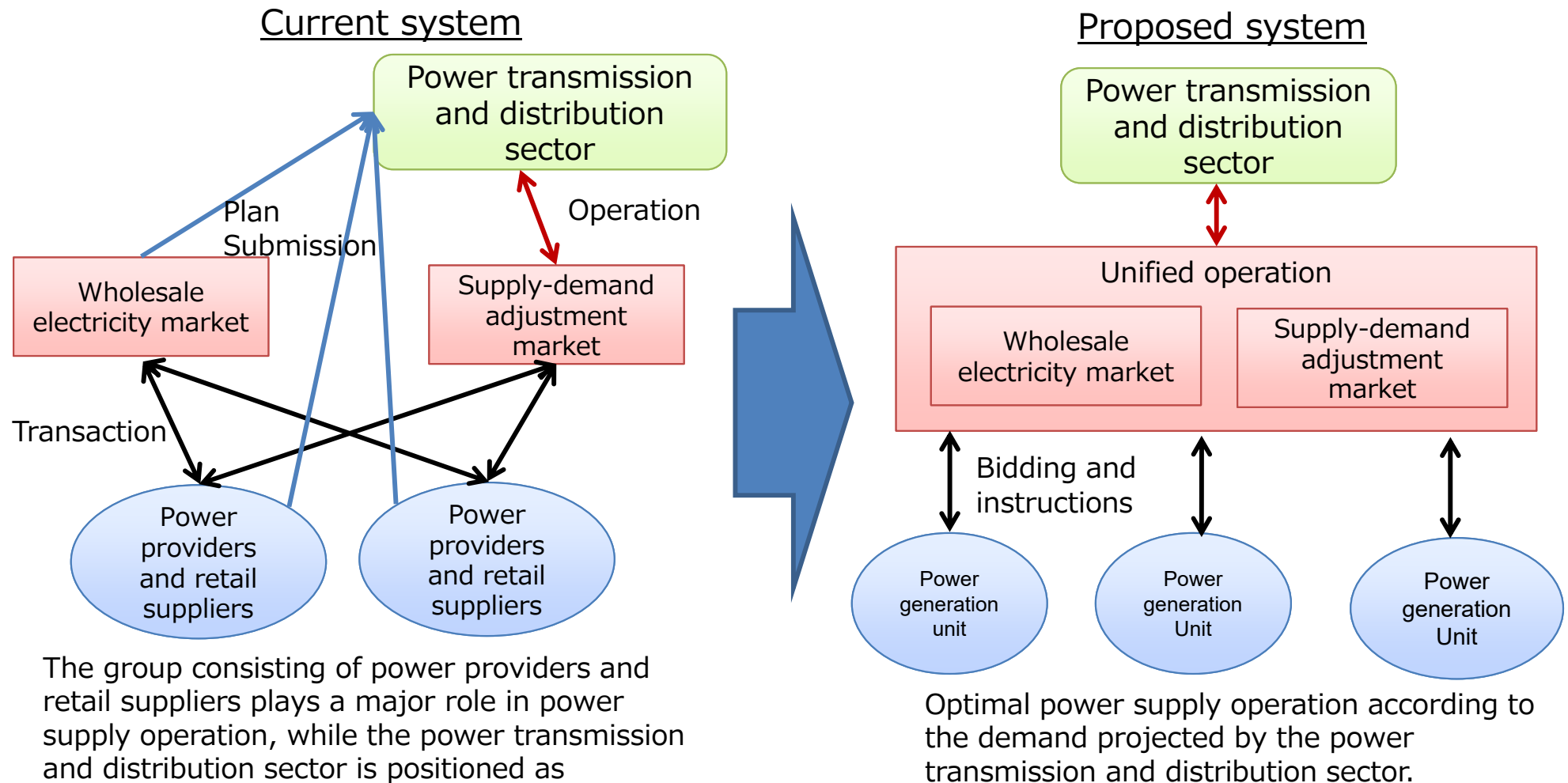
	December	January	February	March
Hokkaido	12.8%	6.8%	9.0%	13.8%
Tohoku	10.8%	6.0%	7.4%	
Tokyo		4.9%		10.6%
Chubu		7.0%		
Hokuriku				22.1%
Kansai	10.7%			
Chugoku		10.7%		
Shikoku	10.7%			
Kyushu		10.7%		
Okinawa	30.9%		32.6%	53.0%

Source: Organization for Cross-regional Coordination of Transmission Operators, Japan "Supply and Demand Projections for 2023 (proposal)," October 2022.

1. Japan's Electricity Market

(4) Revising the wholesale electricity market

- A revision of the operation methods of the wholesale electricity market and the supply-demand adjustment market is underway in conjunction with a review of the central load dispatch control system. The contents of this review are closer to “cost-based bidding,” which emphasizes the perspective of power supply activation and merit order for stable supply. It remains to be seen what systems will be adopted for the price formation method and congestion treatment method.

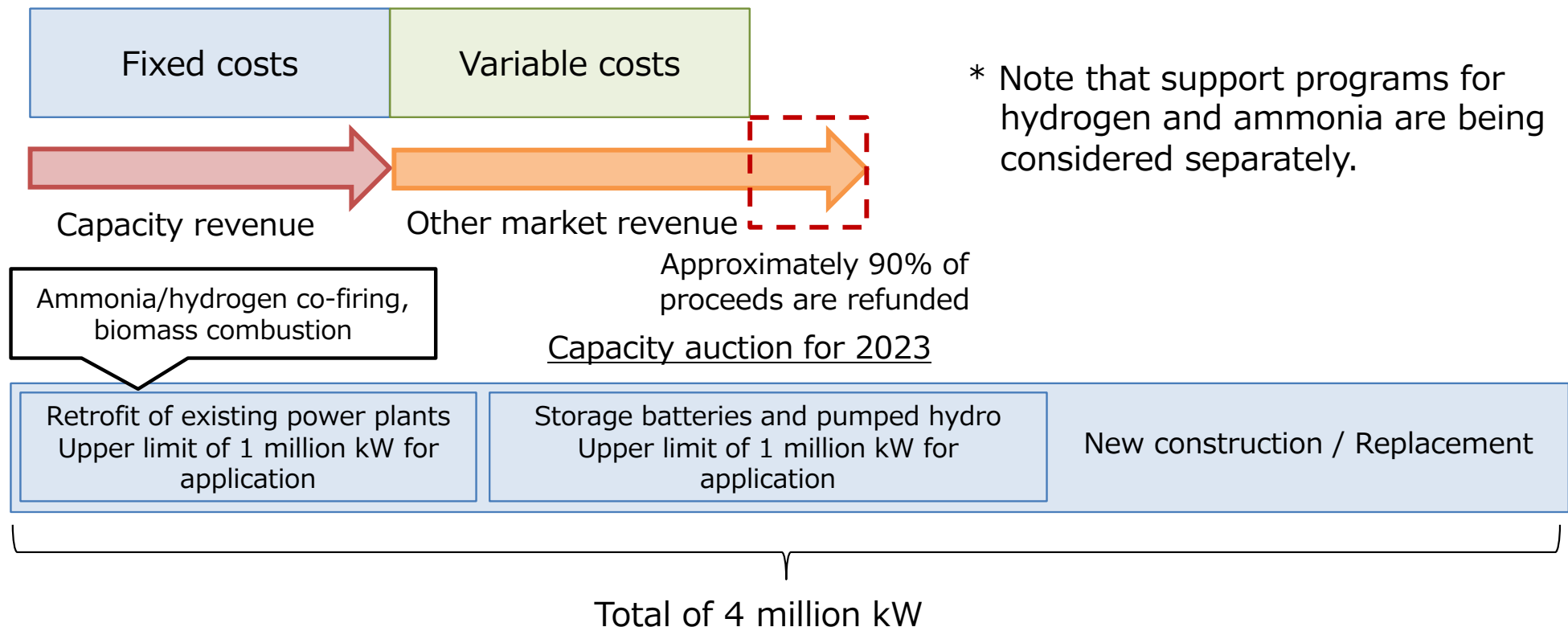


The group consisting of power providers and retail suppliers plays a major role in power supply operation, while the power transmission and distribution sector is positioned as complementary to adjusting power operations.

1. Japan's Electricity Market

(5) Long-Term Decarbonized Power Supply Auction

- The introduction of a long-term decarbonized power supply auction is being considered for 2023. Low-carbon power sources such as storage batteries, pumped hydro, and hydrogen/ammonia co-firing are eligible for this system, and LNG-fired power will be applicable only for the first three years after the introduction of the system. The bidding is based on fixed costs (construction costs, grid connection costs, disposal costs, operation and maintenance costs, and project compensation) and guarantees, in principle, that capacity revenues based on the bid prices will be earned for 20 years.
- Use of hydrogen/ammonia co-firing will undergo demonstrations in the near future. For now, bidding is expected to focus on LNG-fired power replacement and power storage batteries.



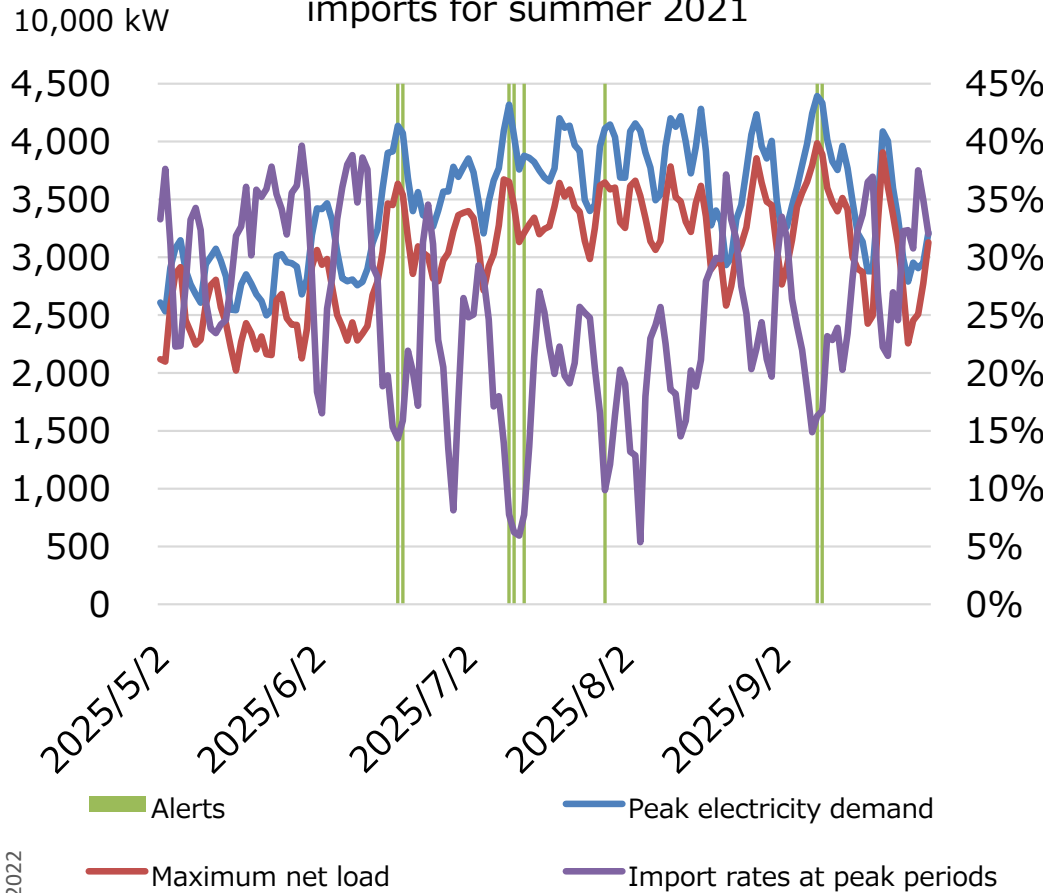
Source: Agency for Natural Resources and Energy, "Long-term Decarbonized Power Supply Auction," Working Group for Institution Review, November 30, 2022.

2. Conditions in Europe and the U.S.

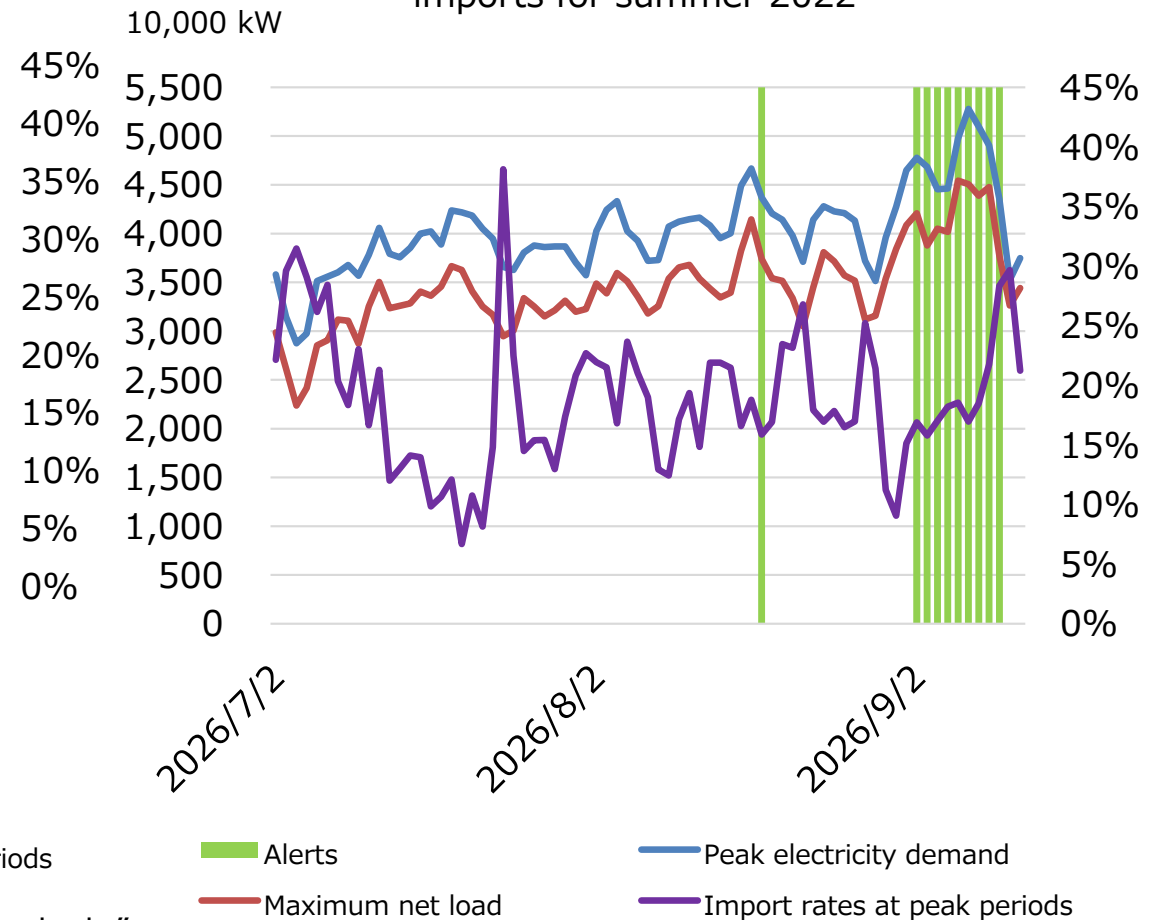
(1) The California ISO Power Crunches

- The California ISO implemented planned outages in the summer of 2020 due to power crunch and also issued alerts in the summers of 2021 and 2022 as a result of power crunches. In all cases, heatwaves occurred throughout the West, and the inability to increase imports of hydropower from outside the state led to a power crunch. On the other hand, gas-fired power plants are not allowed to be built due to global warming, and only renewable energy plants and storage batteries can be newly constructed. With 6.15 million kW of gas-fired and nuclear power generation scheduled to be phased out between 2023 and 2025, the effective use of storage batteries will be an issue for stable supply.

California ISO peak electricity demand and imports for summer 2021



California ISO peak electricity demand and imports for summer 2022

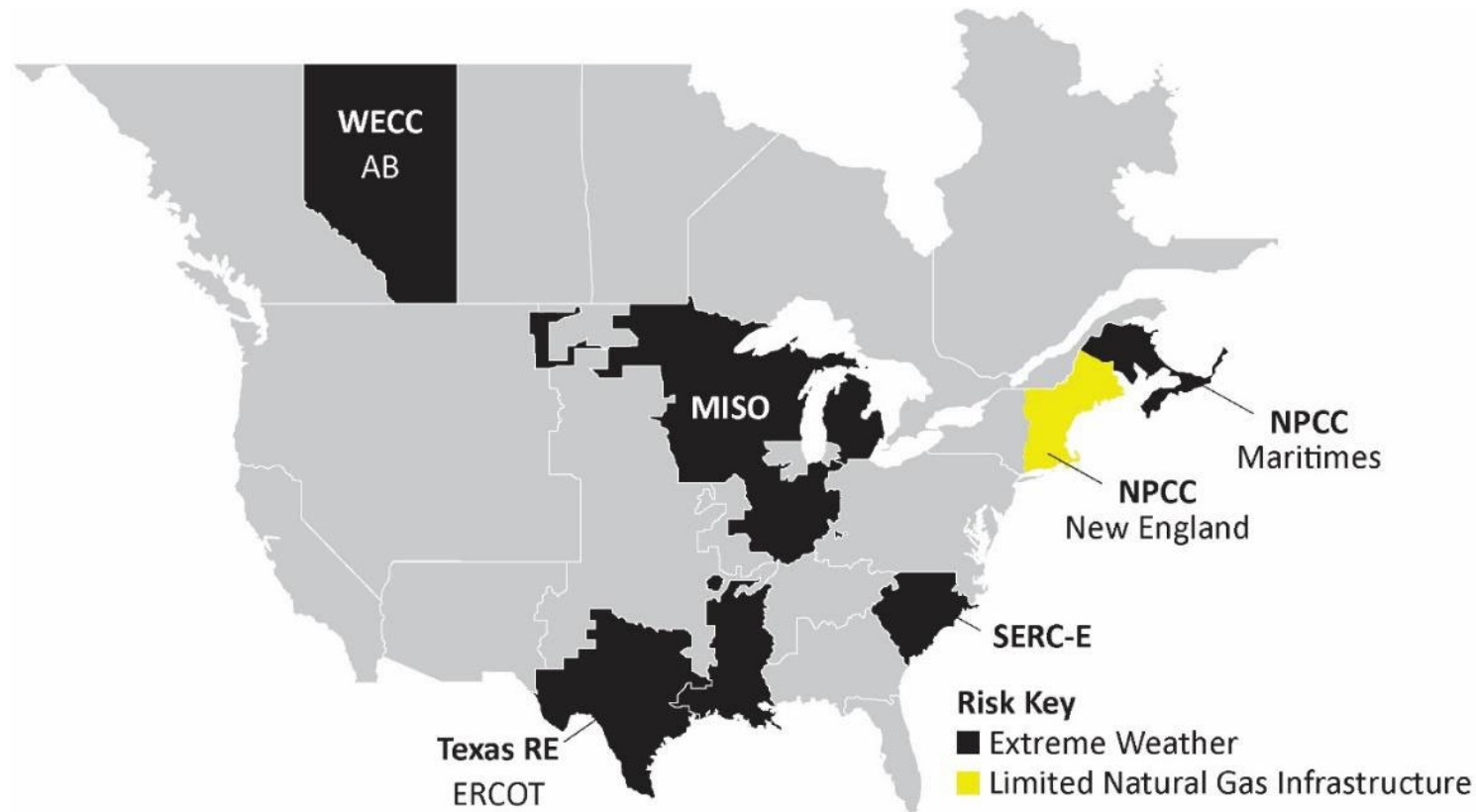


Source: Based on data from California ISO, "Today's Outlook."

2. Conditions in Europe and the U.S.

(2) U.S. Winter Reliability Assessment

- According to the winter reliability assessment by NERC, a U.S. reliability organization, there is a risk of power outages during severe winters in such places as ERCOT in Texas and ISO New England in the Northeast. In particular, cold weather measures are underway at ERCOT, but the U.S. Environmental Protection Agency's decision may affect the operation of coal-fired power plants (1,477,000 kW in total). ISO New England has a procurement risk because of its dependence on LNG imports when gas demand increases.

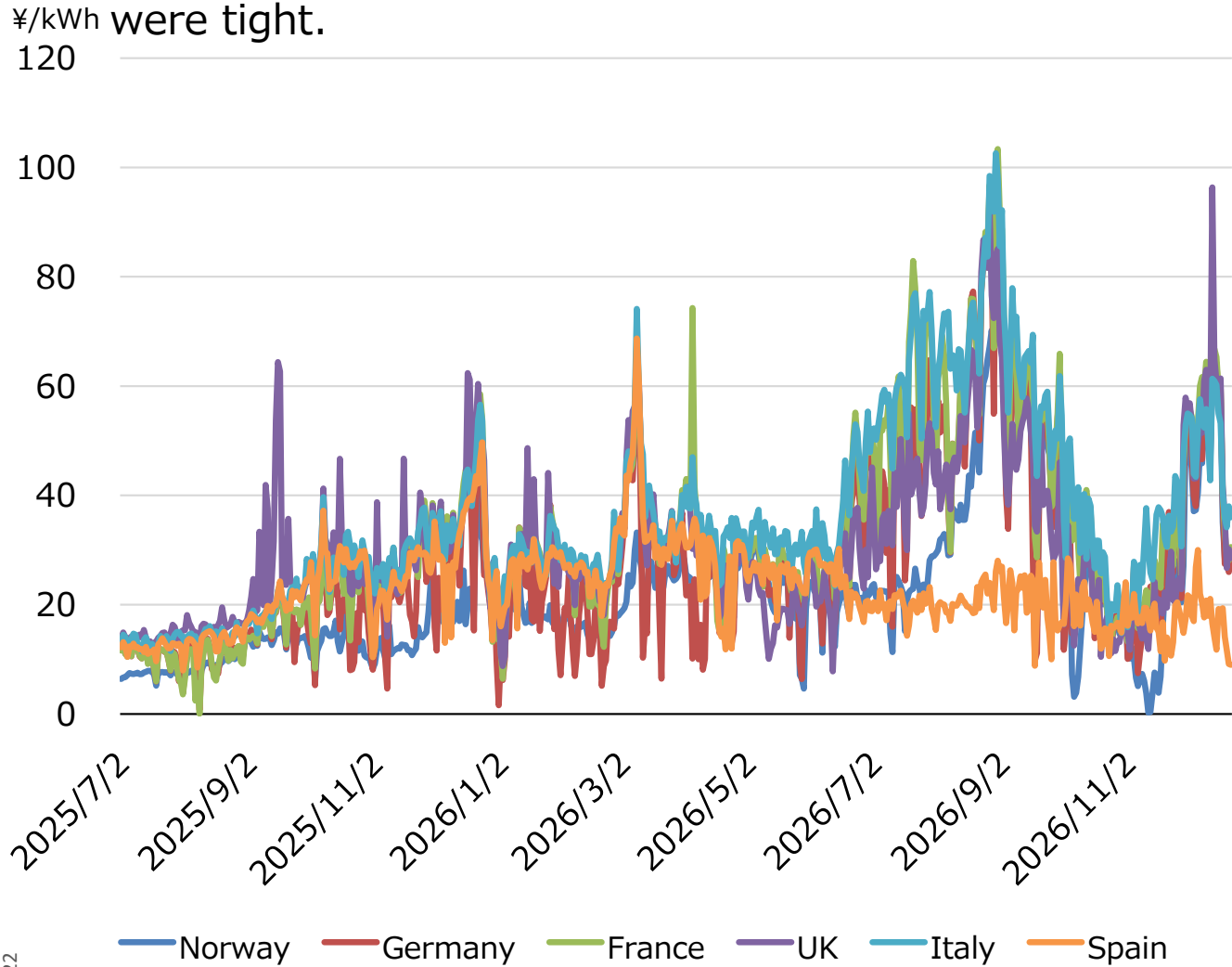


Source: NERC, "2022–2023 Winter Reliability Assessment," November 2022.

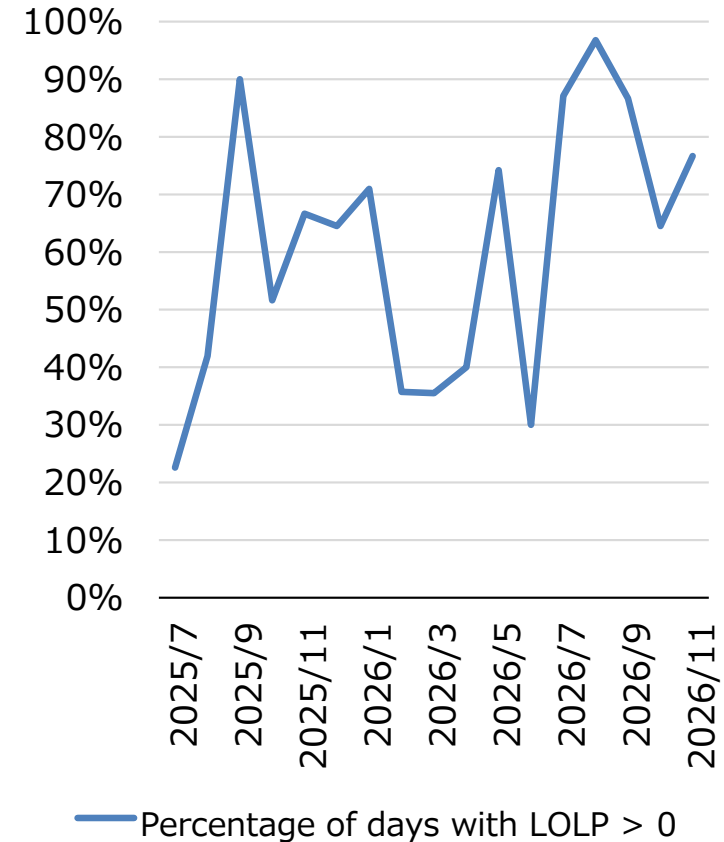
2. Conditions in Europe and the U.S.

(3) Soaring day-ahead spot prices in Europe

- In Europe, day-ahead spot prices have been rising due to the surge in natural gas prices. Prices soared especially high from late June to the end of August 2022. The percentage of days with a positive one-hour-ahead outage probability published in the UK was high in August and September 2022, indicating that supply and demand were tight.



Percentage of days with LOLP > 0 (UK)



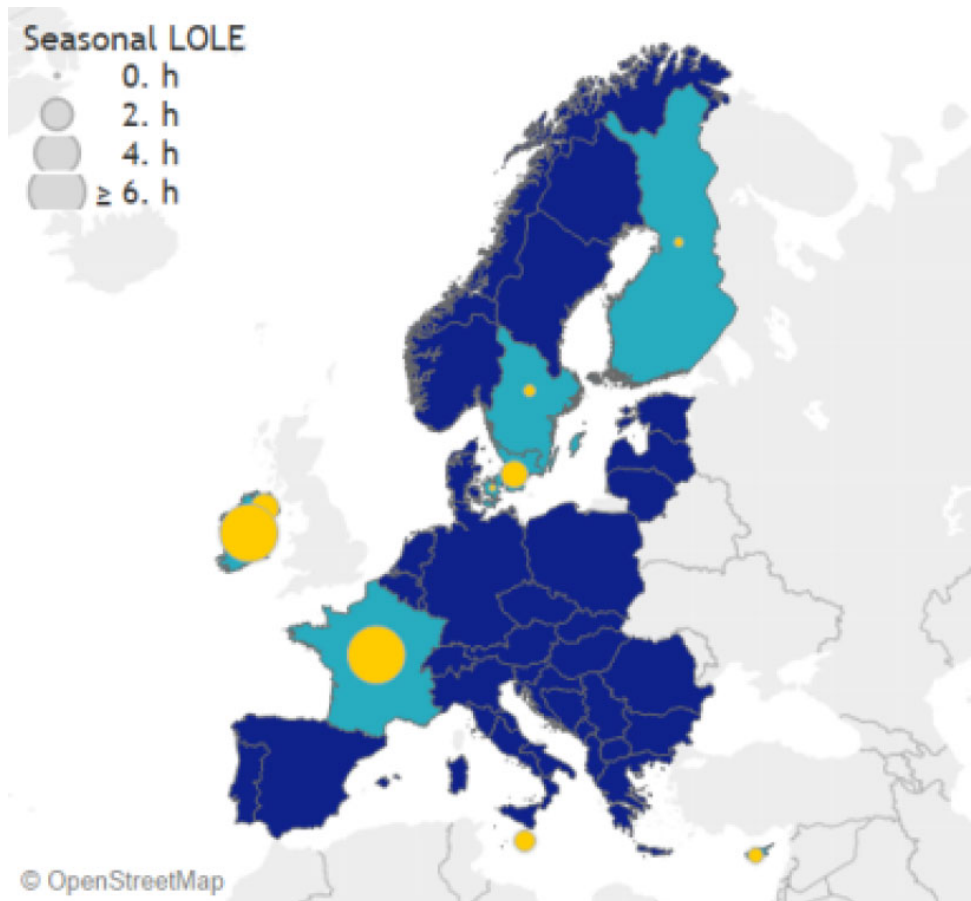
Source: Based on data from the Nord Pool, GME, and OMIE websites.

Source: Based on data from Elexon, "Loss of Load Probability (LoLP) and De-rated Margin."

2. Conditions in Europe and the U.S.

(4) Winter Supply and Demand Projections for 2022

Probability of outage under standard scenario



Source: ENTSO-E, "Winter Outlook 2022-2023, Summer 2022 Review," October 2022.

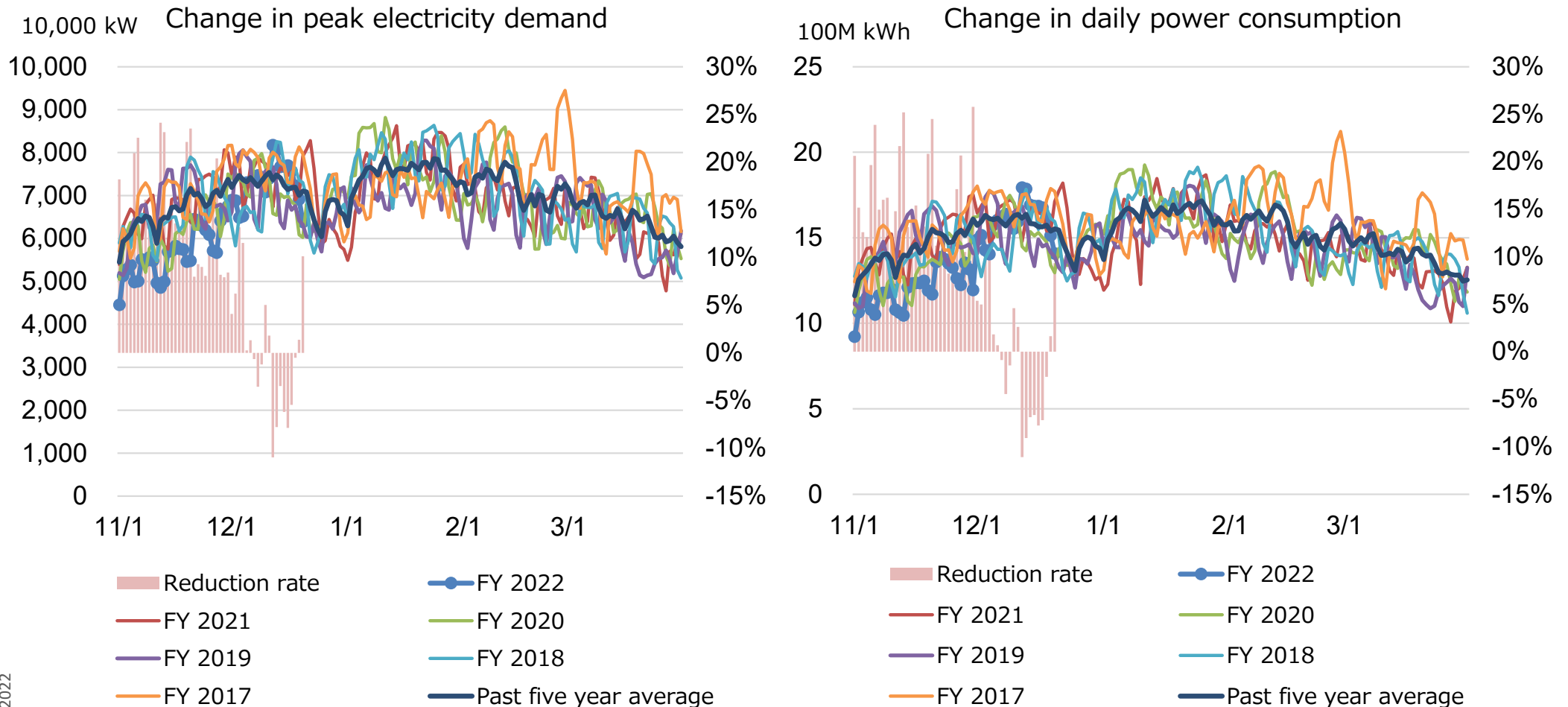
- The winter reliability assessment published by ENTSO-E on December 1, 2022, stated that there are risks of power crunches due to low nuclear availability in France and low wind output in Ireland.
- The risk of power crunch is believed to remain even with the implementation of the voluntary 10% reduction in overall electricity consumption and mandatory 5% reduction in peak demand, which have been set as measures to address high energy prices.
- In France, where the risk of power crunch is considered particularly high, they say that it can be addressed through operational measures but requires the cooperation of neighboring countries. Ireland is at risk if low wind power and import restrictions through interconnection lines occur at the same time.

2. Conditions in Europe and the U.S.

(5) Electricity Saving Situation in France

Under the EU's intervention regulations on high energy prices, electricity savings are to be calculated in relation to the previous five year average. France has generally achieved 10% to 20% savings in electricity consumption, but there are days when the weather turns cold, causing an increase in demand. Close monitoring is required to determine if power conservation can be continued in the future.

- In the UK, a new trial is underway in which households are paid £3/kWh save electricity during periods of power crunch. The effectiveness of various initiatives in different regions remains to be seen.



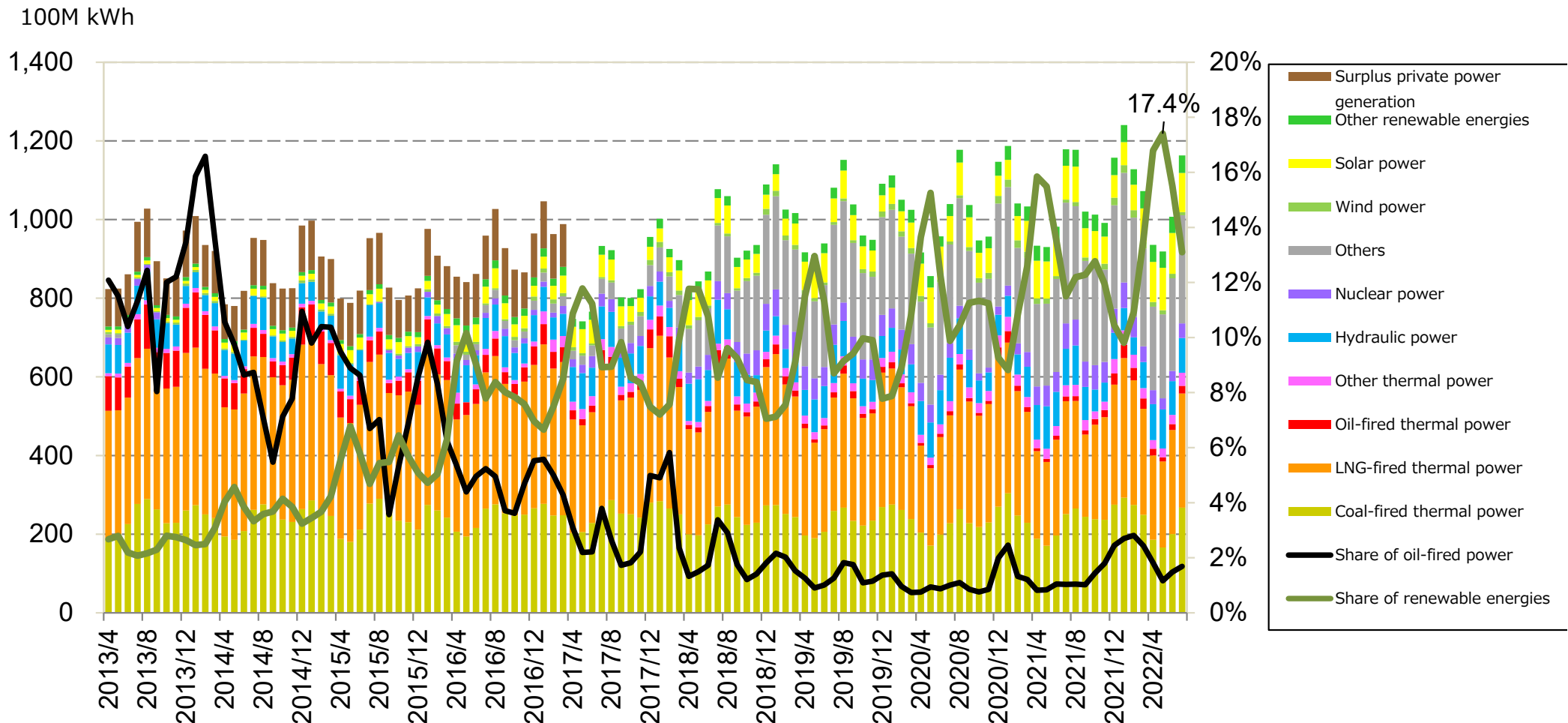
Source: Based on data from ENTSO-E, "Transparency Platform."

Issues Concerning the Electric Power Business in 2023

- The supply-demand balance is tightening in developed countries around the world, and securing fuel and ensuring supply capacity to replace thermal power generation has become an issue. In response to the immediate crisis, market intervention is increasing in Europe in the form of subsidies and taxation of windfall profits to deal with high energy prices.
- In Japan, a revision of the wholesale electricity market and a new framework for securing investment in power sources are also under consideration. It is expected that the role of transmission system operators will increase in supply-demand management and the degree of freedom for power providers and retail suppliers will be reduced. In addition, there are plans to introduce a new bidding system to ensure both low-carbonization and stable supply by guaranteeing a certain level of cost recovery with the aim of achieving a low-carbon supply capacity.
- The specific circumstances of the energy crisis and the corresponding accelerated low-carbon transition have produced these policies. It is time to consider the future of competition and market mechanisms in the electric power business.

【Reference 1】 Changes in Electricity Generation by Source

- Following the Great East Japan Earthquake, the share of oil-fired power generation rose. However, since around 2015, the number of months when its share was below 10% has gradually increased. At the same time, the share of renewable energy generation rose to exceed 5%, and it has been hovering around 10% since 2017. In May 2022, it reached 17.4%.

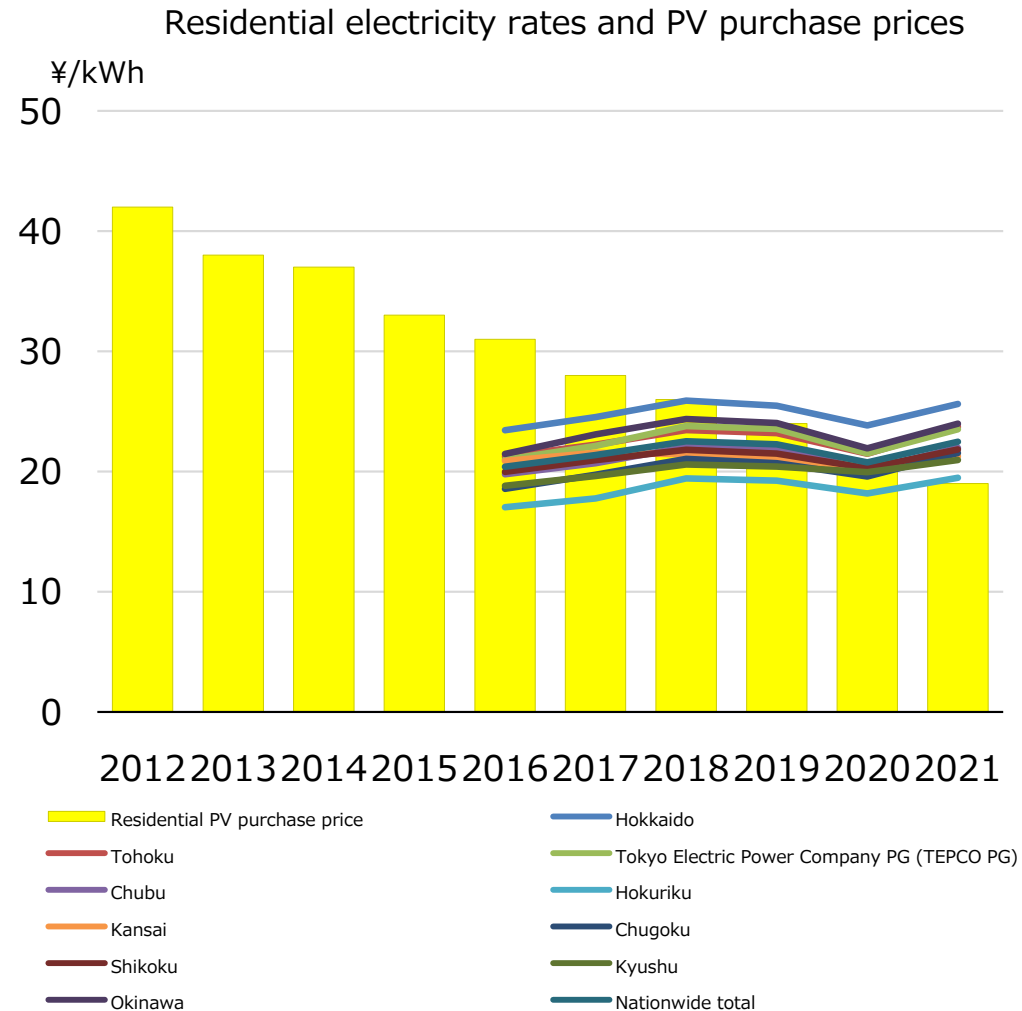
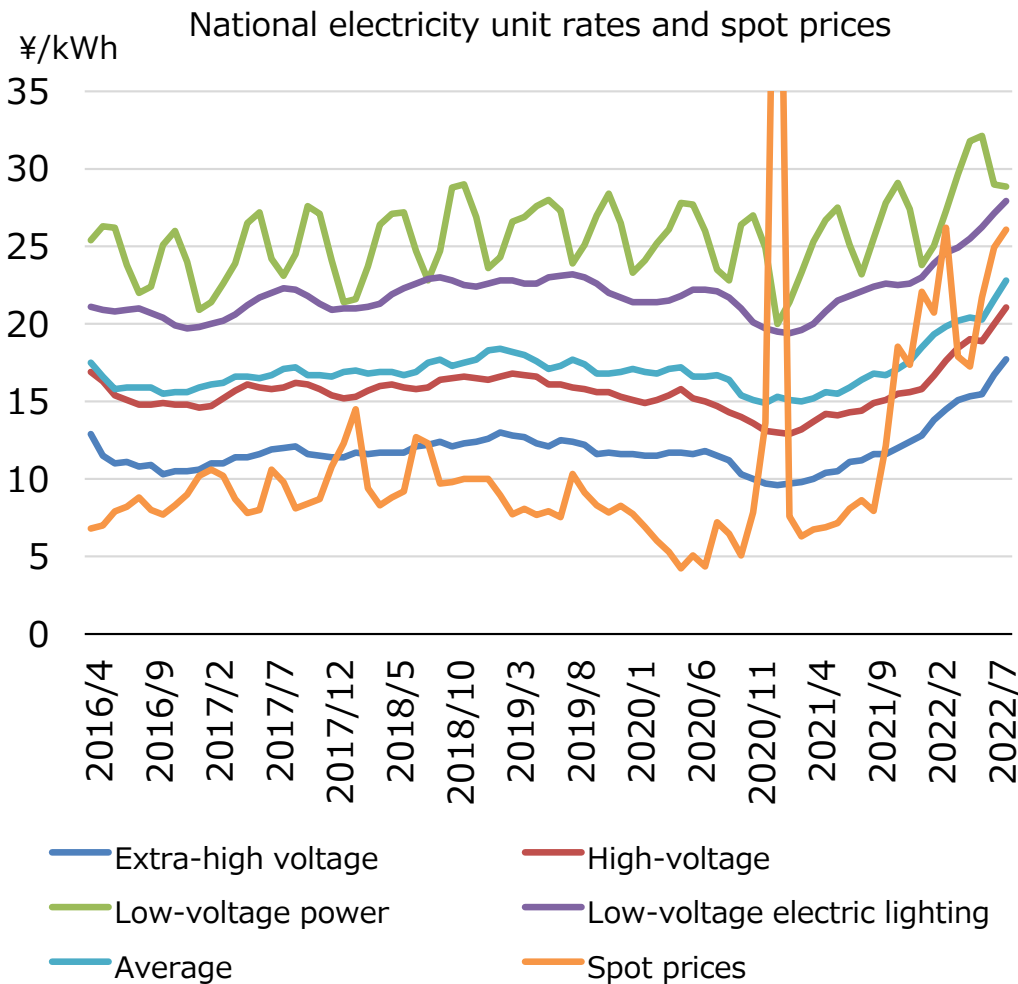


Note: Some statistical content has changed since April 2017.

Source: Based on data from Agency for Natural Resources and Energy, "Electric Power Survey Statistics."

【Reference 2】 Electricity rates, spot prices, and PV purchase unit prices

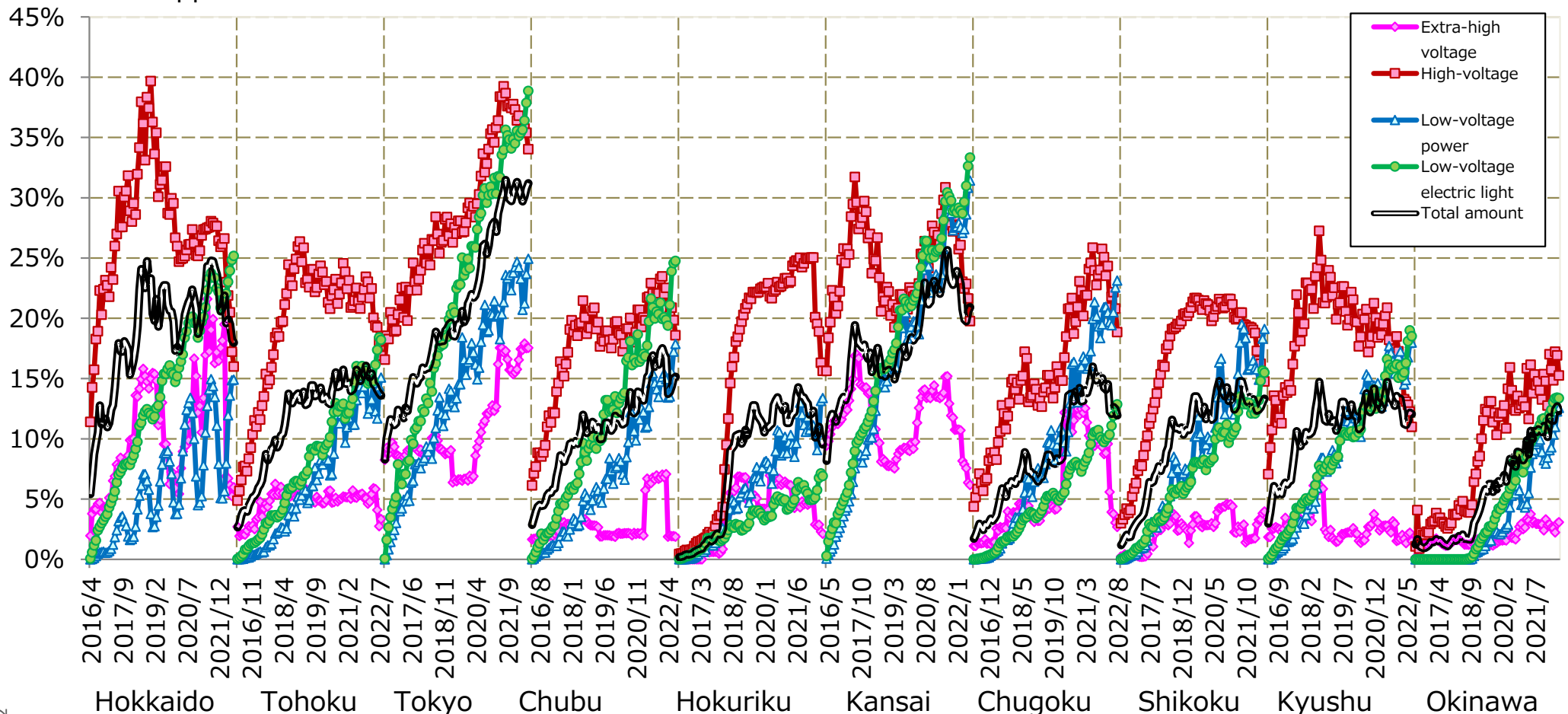
- Wholesale electricity spot prices have been soaring since the second half of 2021, leading to a situation of backwardation. Due to soaring fuel prices, the rates set by the fuel cost adjustment system have reached their ceiling, and some companies are considering petitioning for an increase in the regulated rate. In addition, residential electricity prices now exceed the PV purchase price. Nationwide, installing PV has resulted in lower electricity costs.



Source: Based on data from the Electricity and Gas Market Surveillance Commission, "Electricity Transaction Report Aggregate Results."

【Reference 3】 Retail Competition Situation (since April 2016)

- The national average withdrawal rate as of August 2022 was 20.5%. The withdrawal rate was large among high-voltage consumers but has been declining. On the other hand, the withdrawal rate for low-voltage consumers is on the rise. In Hokkaido, Tohoku, Tokyo, Chubu, Kansai, and Kyushu, the withdrawal rate for low-voltage customers was the highest by category of customer.
- However, the number of Power Producer and Supplier (PPS) that have opted to suspend or discontinue their business has been increasing due to soaring day-ahead spot prices. The question of how to properly regulate retail electric suppliers has become an issue.



Source: Based on data from Electricity and Gas Market Surveillance Commission, "Electricity Transaction Report Aggregate Results."