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Electric Utility Industry Outlook and Challenges for 2020

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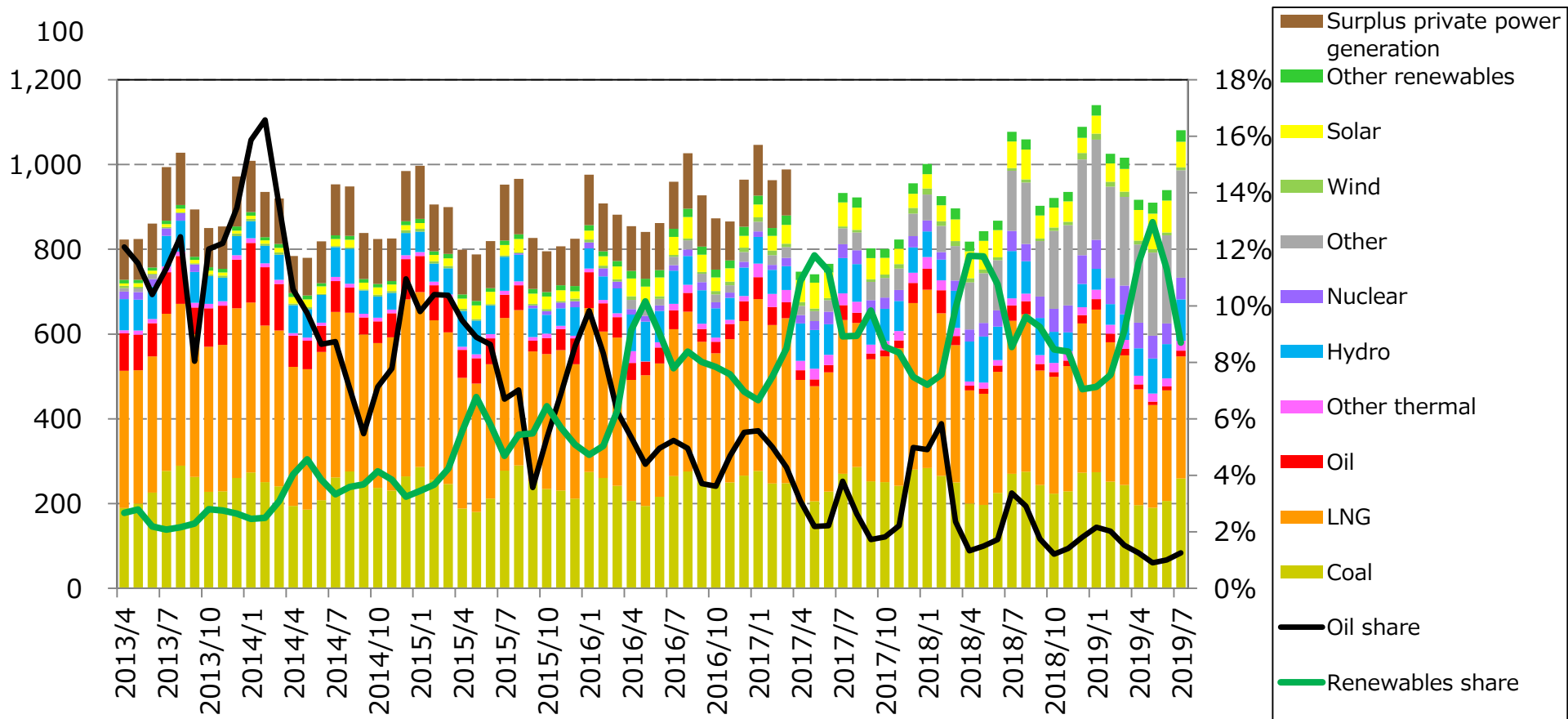
Points of the Report

- ✓ Day-ahead spot trading now accounts for 30% of total electricity sales. This means that day-ahead spot prices are having a major impact on the profitability of power-generating facilities and the competitiveness of electricity retailers. In-line with the reduction in share of oil-fired power generation, day-ahead spot prices shifted from being linked to fuel costs for oil-fired power to being linked to fuel costs for LNG-fired power generation. In mid-west Japan, there are periods when costs are growing close to those for coal-fired power, which is having an impact on maintaining **LNG-fired power facilities**. Gaps in fuel costs between LNG-fired and coal-fired power generation shrank. The change from coal-fired to LNG-fired for peak periods is affecting the profitability of pumped-storage power.
- ✓ Trading began for the baseload, indirect transmission rights, and non-fossil value certificate markets. Transaction volumes are still small, but there is concern that delays in recommencing nuclear power generation is reducing the merits of establishing new varieties of markets.
- ✓ In-line with increased competition in Japan, the US, and Europe, supply and demand balances are becoming tighter. Even in Japan, there have been more orders from the Organization for Cross-Regional Coordination of Transmission Operators to improve supply and demand balance. There has also been an increase in use of Power Source I, an extreme weather countermeasure. Even in the US and Europe, there has only been a slight increase in conventional capacity in response to the abolishment of fossil-fuel and nuclear power plants. An overlap between increased demand and a decrease in output from renewable energy is causing supply and demand to become tighter. Securing stable supply will require considering additional compensation and premium payment measures to ensure that existing facilities continue to operate.
- ✓ In fiscal 2020, the price levels for each new market indicated by the Policy Subcommittee for Acceleration of Electricity System Reform will be roughly in place, with revisions to business strategies by power companies to proceed.

1. Competition in the Japanese Electricity Market

(1) Trends in Power Generation by Source

- The proportion of oil-fired power generation increased after the Great East Japan earthquake in 2011. However, from around 2015 there has been a gradual increase in months where this has been less than 10% of the total, and where renewables have been more than 5%, trending at around 10% in 2017.



(Note) Statistics have changed since April 2017.

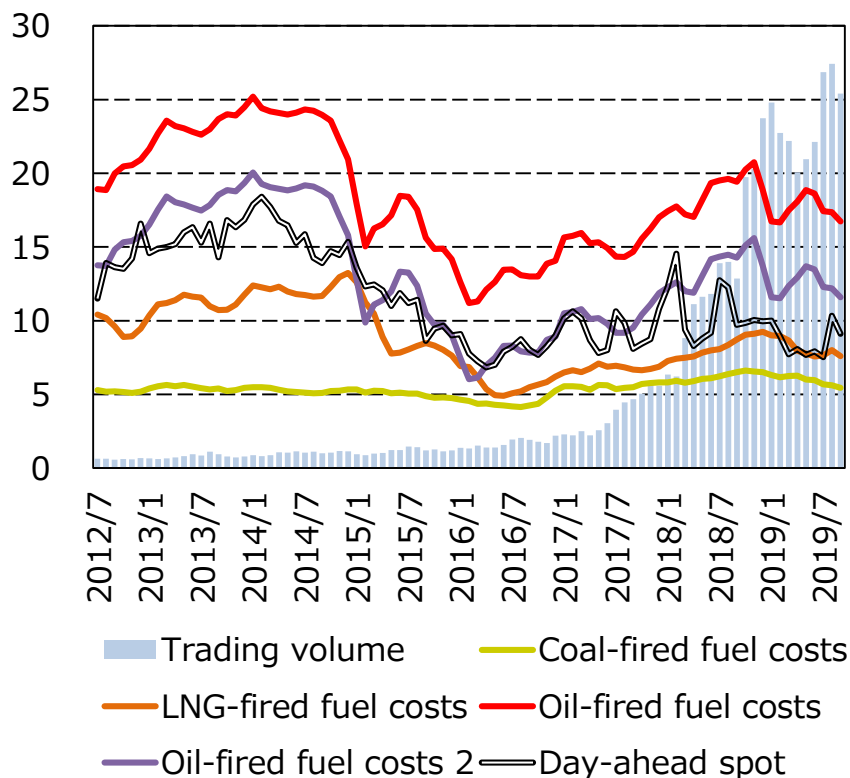
(Sources) Prepared from Agency for Natural Resources and Energy "Survey of Electric Power Statistics"

1. Competition in the Japanese Electricity Market

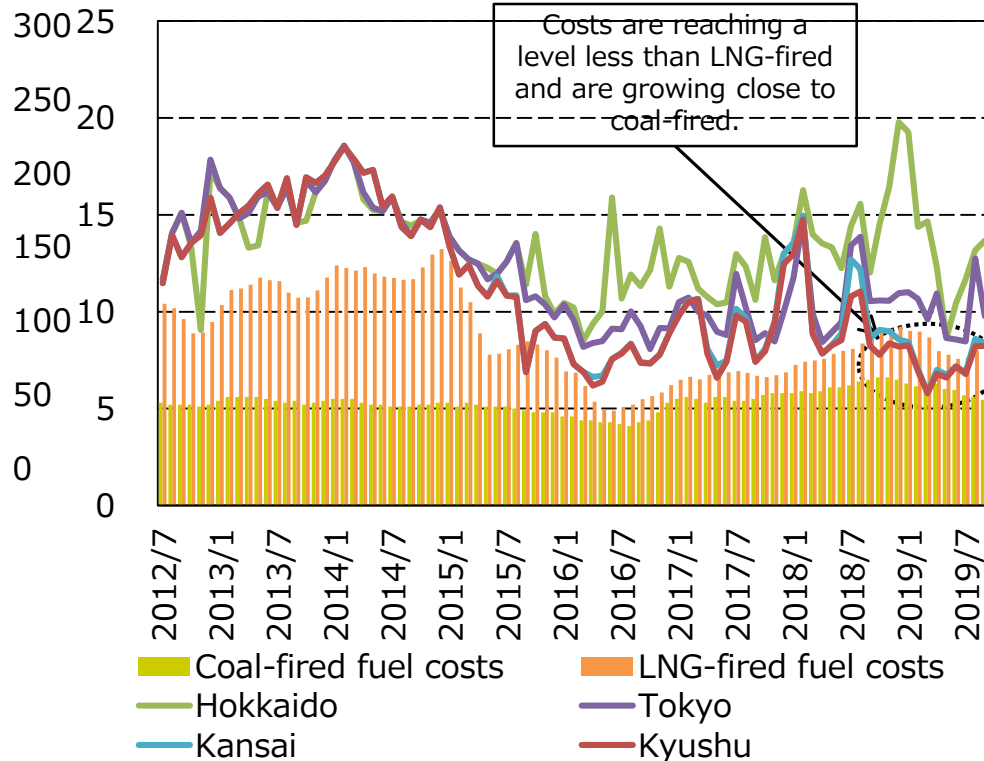
(2) Day-Ahead Spot Prices and Fuel Costs

- Until **around** February of 2017, day-ahead spot system prices were heavily linked to oil-fired fuel costs, but have now drawn closer to LNG-fired costs. Effects from an increase in renewable energy caused a further division in the west and east markets from around 2015. The west Japan market is trending towards cheaper costs.
- Between April and November 2019, day-ahead spot prices of <1 yen/kWh were at 1.2% in Kansai and 2.7% in Kyushu. However, the increase in renewable energy means that it is likely that this proportion will grow.

Yen/kWh Day-Ahead Spot Prices and Fuel Costs



Yen/kWh Regional Prices and LNG-Fired Fuel Costs



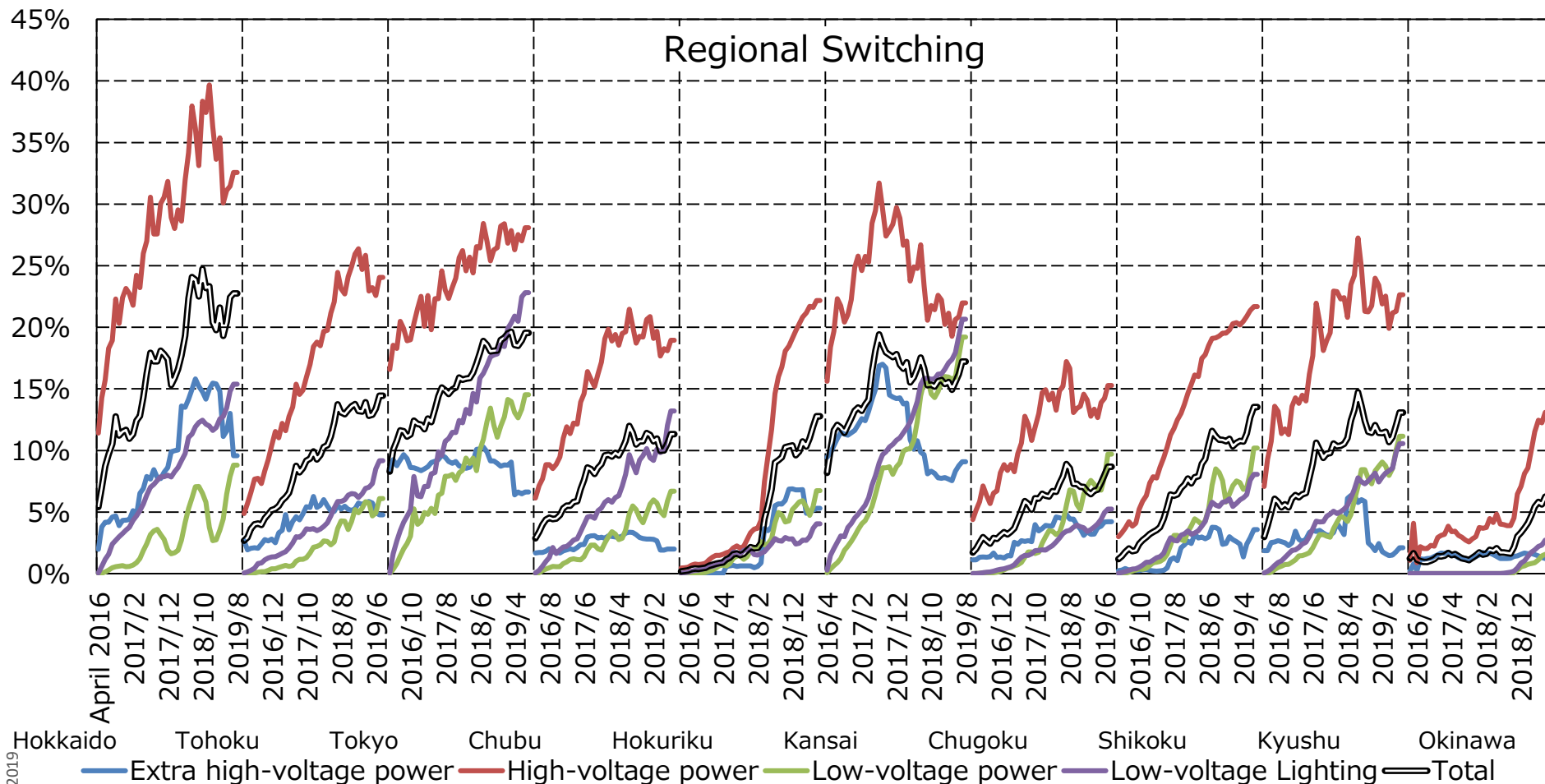
(Note) Fuel cost (power generation efficiency at 40%) + Operation/maintenance cost at JPY1.7/kWh for coal-fired power generation, Fuel cost (power generation efficiency at 50%) + Operation/maintenance cost at JPY0.6/kWh for LNG-fired power generation, Fuel cost (power generation efficiency at 35%) + Operation/maintenance cost at JPY5.15/kWh for oil-fired power generation. Fuel cost for oil power generation 2 covers fuel cost alone).

(Sources) Fuel prices have been computed by the IEEJ Energy Data and Modelling Center. Spot prices are from the Japan Electric Power Exchange.

1. Competition in the Japanese Electricity Market

(3) Competition Amongst Electricity Retailers

- As of August 2019, the nationwide average for switching from traditional electric utilities was 16.0%. This has continued to be high for users of high-voltage **power service**, with switching rates increasing in Hokkaido, Tokyo, and Kansai. In mid-west Japan, day-ahead spot prices are becoming a variable costs marketplace. Until delivery begins in the capacity market, there's a possibility that the competitiveness of new electric power, which performs supply procurement in the spot market, will increase.



(Source) Prepared from Electricity and Gas Market Surveillance Commission
"Electricity Trading Report Aggregation"

2. Situation in New Markets

(1) New Markets Where Trading Has Begun

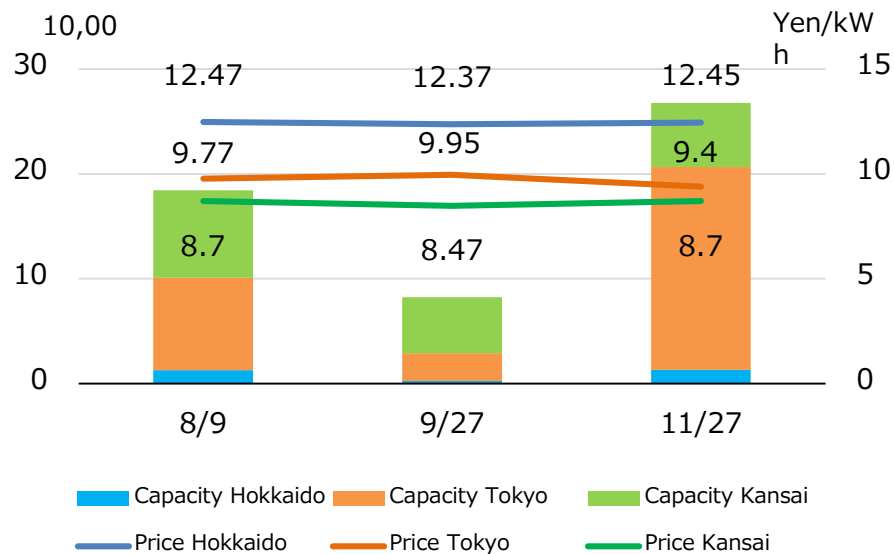
- Out of the new markets determined by the Policy Subcommittee for Acceleration of Electricity System Reform, trading has begun in the baseload, indirect transmission rights, and non-fossil value certificates markets. The wider-area supply-demand adjustment market will gradually begin performing wider-area procurement from 2021 . Bidding for the capacity market will starts in fiscal 2020, with delivery to begin in fiscal 2024.

	Overview
Baseload trading market	Baseload power generation capacity such as nuclear, coal and hydro are sold through forward auctions (will be annual trading for the immediate future). Sales will be performed by creating three regions: Hokkaido, East Japan, and West Japan. The first round of bids was held on August 9, 2019
Indirect transmission rights trading market	Rights/obligations for accepting or paying day-ahead spot price gaps in regions with interconnection lines. Being sold in one-week units within the empty capacity of these interconnection lines. Trading began in April 2019 for the first week of June.
Non-fossil value certificates trading market	A framework for producing value certificates from the environmental value of electricity produced through zero-carbon emission power-generating facilities. These are purchased by electricity retailers to help meet non-fossil power generation capacity targets. Trading for fiscal 2017 certificates began in May 2018. Sales of fiscal 2018 certificates was performed in four lots, with sales for fiscal 2019 certificates beginning in August 2019.

2. Situation in New Markets

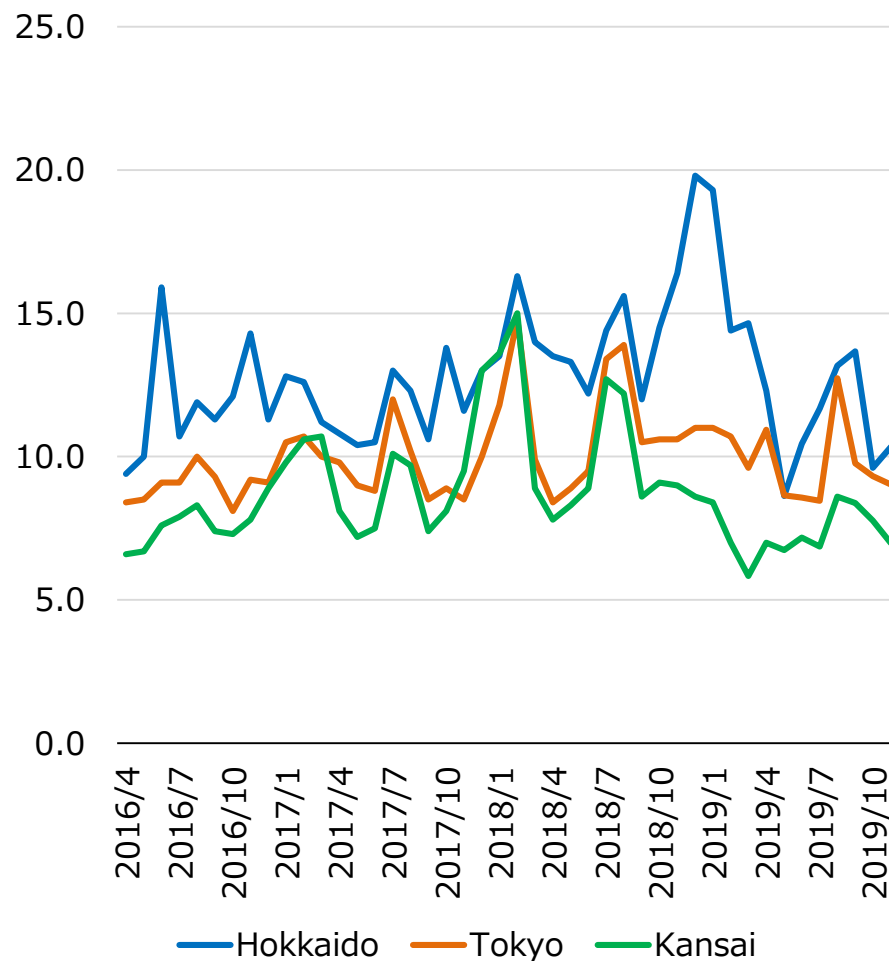
(2) Trading Results in the Baseload Market

- Delivery in fiscal 2020 was performed three times for the baseload market, with total trading volume stopping at just 534,000 kW. Since Kyushu Electric Power Co. implemented FIT power generation curtailment in the Autumn of 2018, there has been an anticipated fall in day-ahead spot prices centered around mid-west Japan, with a wait-and-see attitude leading to many new retailers passing the market over.
- Some have commented that there are few benefits compared to negotiation transactions with major electric power companies and constant backup contracts. However, baseload system has an advantage when fuel cost prices increase, which means it's likely that the system will not be easily revised.



(Source) Japan Electric Power Exchange

Yen/kW Day-Ahead Spot Monthly Average
Prices

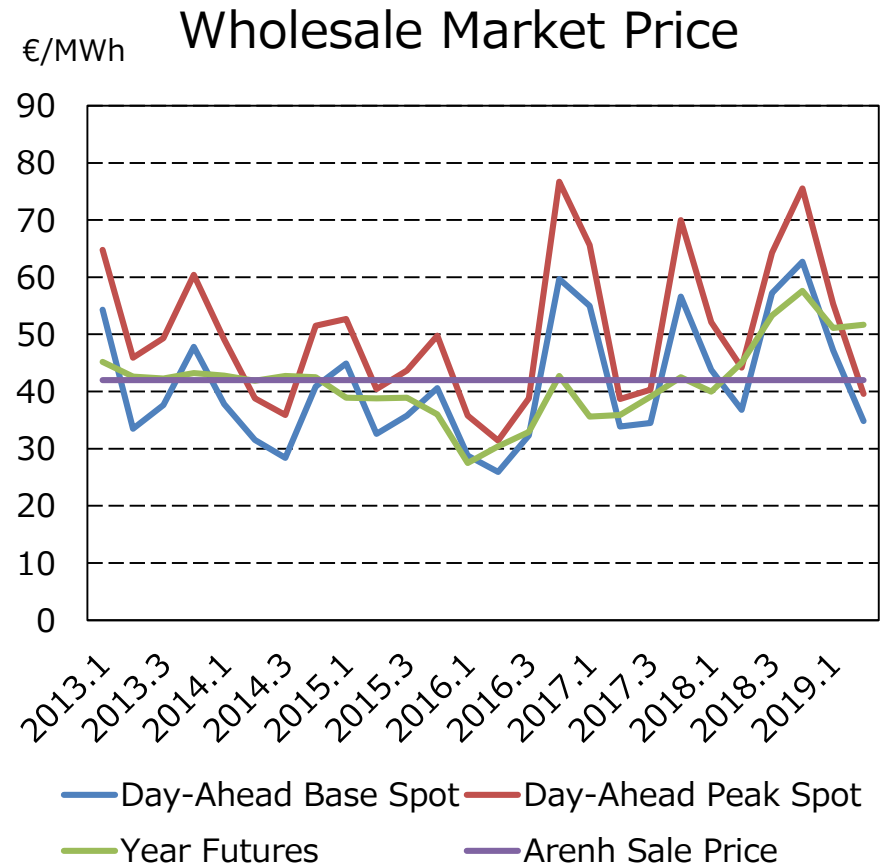
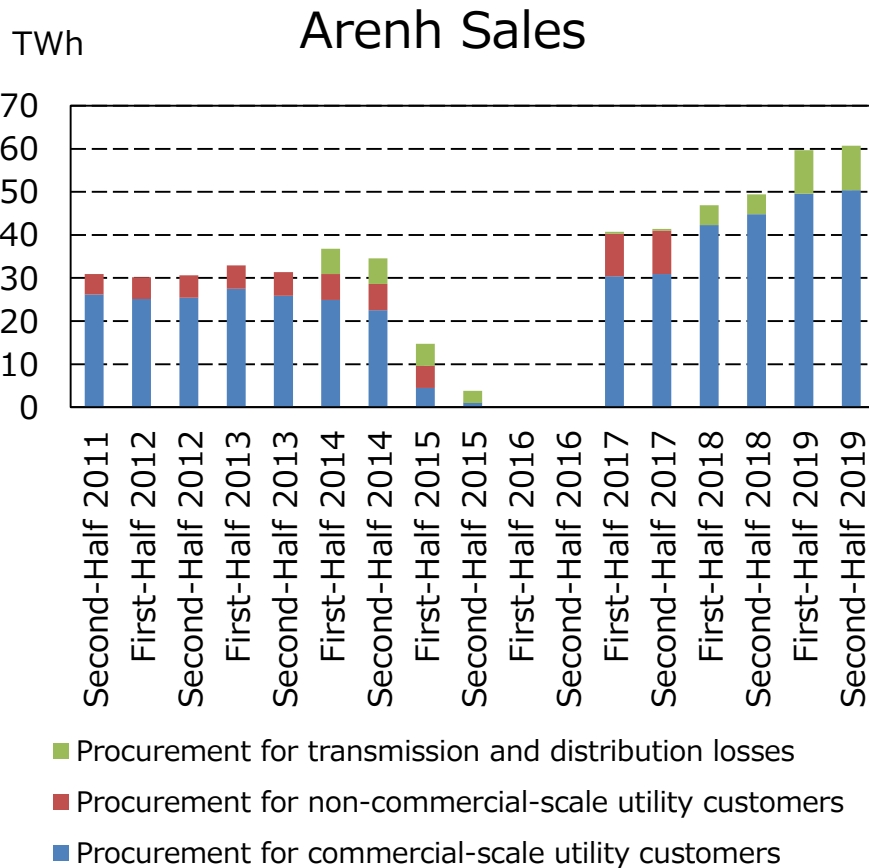


(Source) Japan Electric Power Exchange

2. Situation in New Markets

[Reference] The French Arenh System

- French regulations relating to the nuclear power access system caused a decrease in sales amounts due to slack wholesale power prices between 2015 and 2016. However, sales amounts have increased from 2017. It is believed that this has been caused by increased divisions with the German market leading to more constant spikes in wholesale prices.



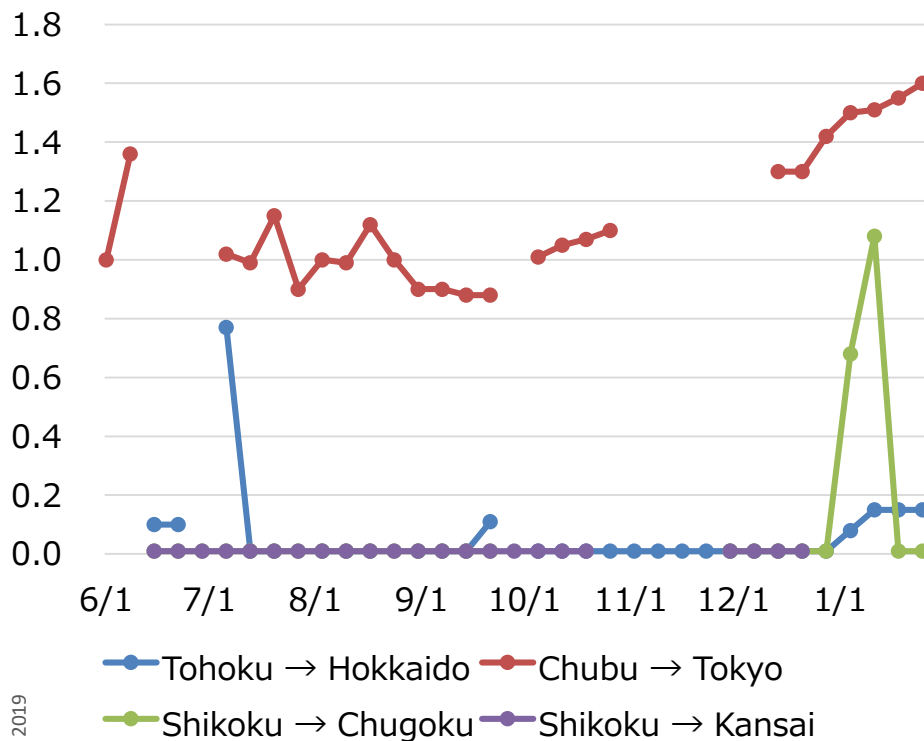
(Source): Produced from CRE's "Regulated access to historical nuclear electricity" and "Wholesale market observatories"

2. Situation in New Markets

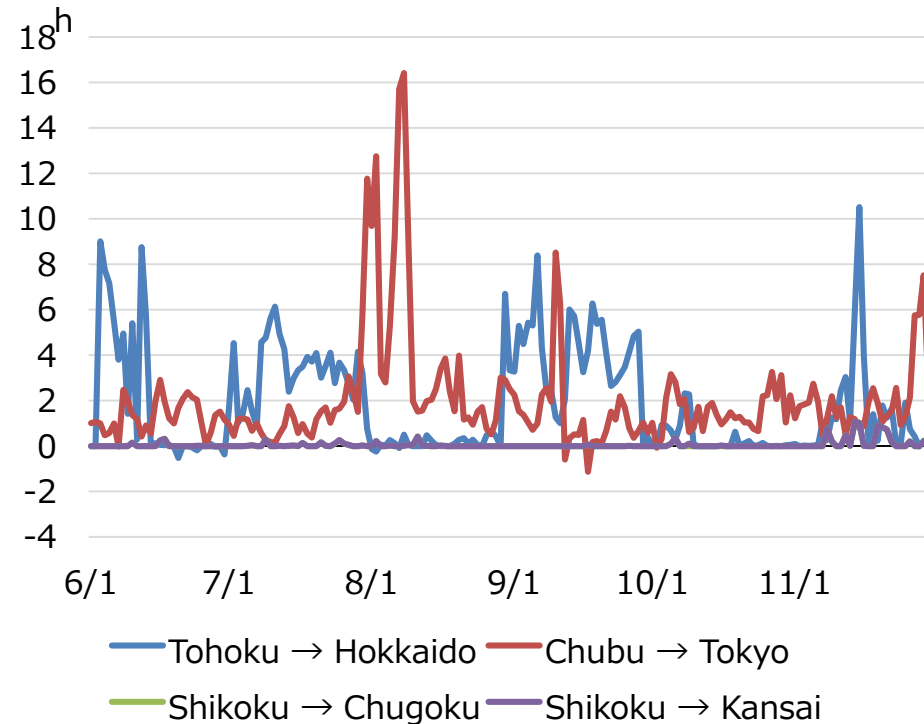
(3) Indirect Transmission Rights

- Indirect transmission rights trading for accepting or paying day-ahead spot price gaps between regions began from the week of June 1, 2019. Trading is performed in week-long units, in 24-hour sections. Five interconnection lines are being sold in six varieties (Tohoku → Hokkaido, Tokyo → Chubu, Chubu → Tokyo, Shikoku → Kansai, Shikoku → Chugoku, Kyushu → Chugoku). There was only one trade for Tokyo → Chubu and none for Kyushu → Shikoku, only the results for the other four varieties will be examined here.
- Varieties for which a price gap resulted between June and November included Tohoku → Hokkaido at 45.7%, and Chubu → Tokyo at 77.6%, showing an extremely high level of frequency and a big price gap. However, Shikoku → Chugoku and Shikoku → Kansai were both at 2.6%, revealing that there were only a few periods during which there was a gap, and a small price gap when there was. Tohoku → Hokkaido and Chubu → Tokyo probably helped to create profit for trading participants.

Yen/kW Indirect Transmission Rights Contract Prices



Yen/kW Day-Ahead Spot Price Gap

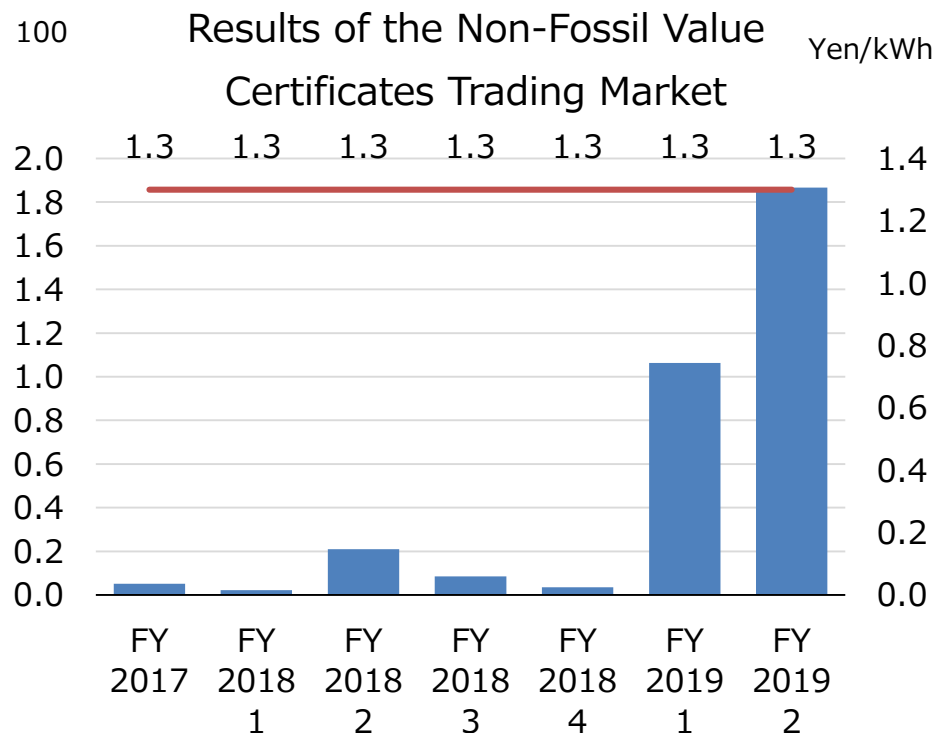


(Source) Japan Electric Power Exchange

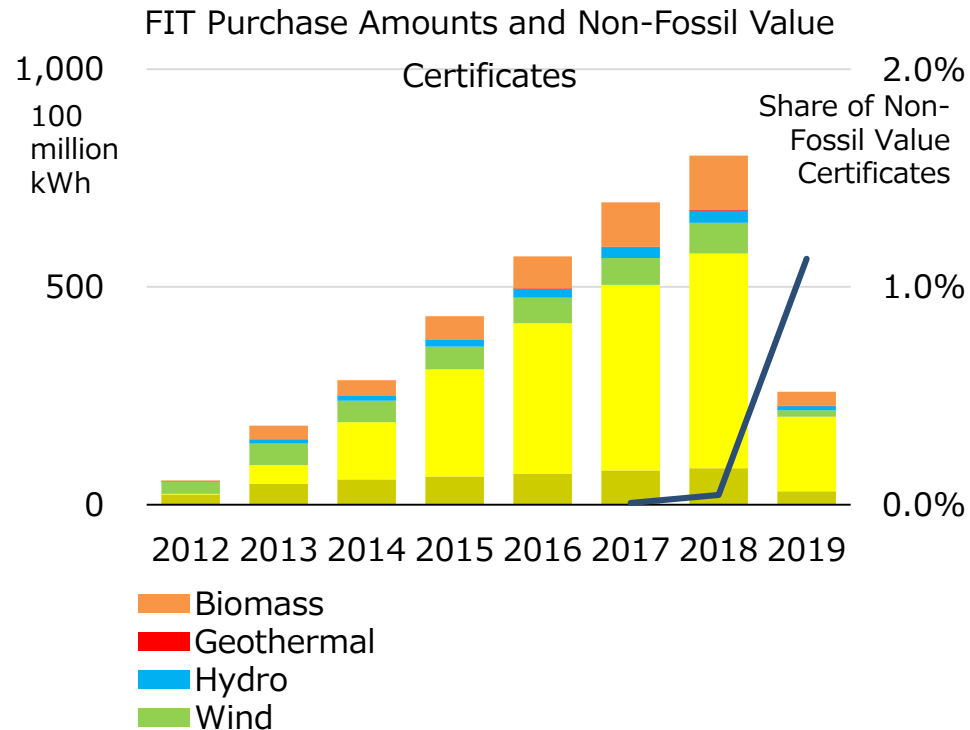
3. Situation in New Markets

(4) Trading of Non-Fossil Value Certificates

- Sales of non-fossil value certificates were performed for the fiscal 2017 portion, four times for fiscal 2018, and twice for fiscal 2019. The portion for fiscal 2017 was 5.16 million kWh, 35.32 million kWh for fiscal 2018, and 293.02 million kWh for fiscal 2019. This shows a sharp comparative increase for fiscal 2019 but is just 1% of FIT electricity purchasing amounts. Average trading prices were set at a lower limit of 1.30 yen/kWh.
- There were 57 companies which were required to report in fiscal 2018 under the Energy Supplier Enhancement Act (performed sales of 500 million kWh). However, there were only 18 companies that participated in trading of non-fossil value certificates (fourth session in fiscal 2018). It's believed this is due to the challenge of passing on costs to customers when electricity retailers purchase non-fossil value certificates. There is low awareness of non-fossil value certificates, and the actions required to reveal their benefits bring with them many issues.



■ Contract Amount — Contract Average Price
(Source) Japan Electric Power Exchange



(Note) Between April to June of Fiscal 2019

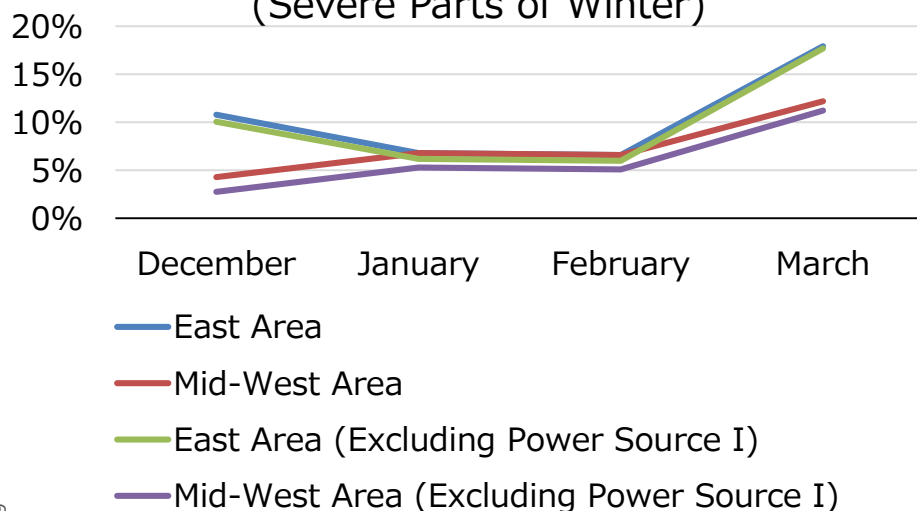
(Source) Prepared from Agency for Natural Resources and Energy "Website for Publicizing Information on Fixed Price Sales System"

3. Ensuring Capacity

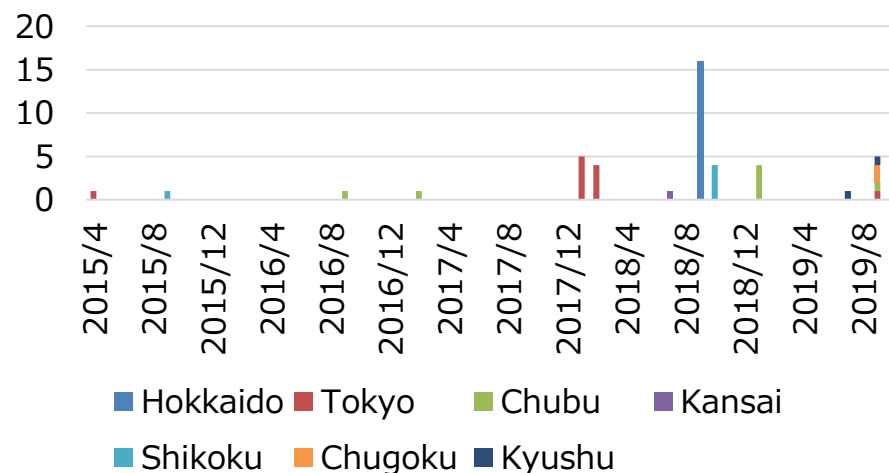
(1) Demand Forecasts for Japan's Winter Season

- 3% of the minimum required supply reserve margins have been ensured for the most severe parts of winter. However, any additional unforeseen factors may further tighten supply and demand balance. Calculations for supply reserve margins include Power Source I as preparation for once-a-decade severe weather. During the Summer of fiscal 2019, Power Source I was put into use once in Tokyo, Chubu, Kansai, and Kyushu respectively. This reveals that supply and demand balance is becoming even tighter. Conventional evaluation methods show that more than 8% of supply reserve margins have been ensured.
- Orders from the Organization for Cross-Regional Coordination of Transmission Operators to improve supply and demand balance reveal an increase in usage numbers from around the winter of 2017. This includes irregularities such as the aftermath of the Hokkaido earthquake in September 2018, but even excluding these, there has still been increased usage due to increased demand and for climate-based reasons. As on September 10, 2019, the reserve rate is expected to fall below 3% in multiple regions. In 2019 this was overcome by utilizing Power Source I and orders to improve supply and demand. There is not wide awareness of this situation, so revisions need to be made to how information is being shared.

Supply Reserve Margin Expectations
(Severe Parts of Winter)



Number of Orders to Improve Supply and Demand



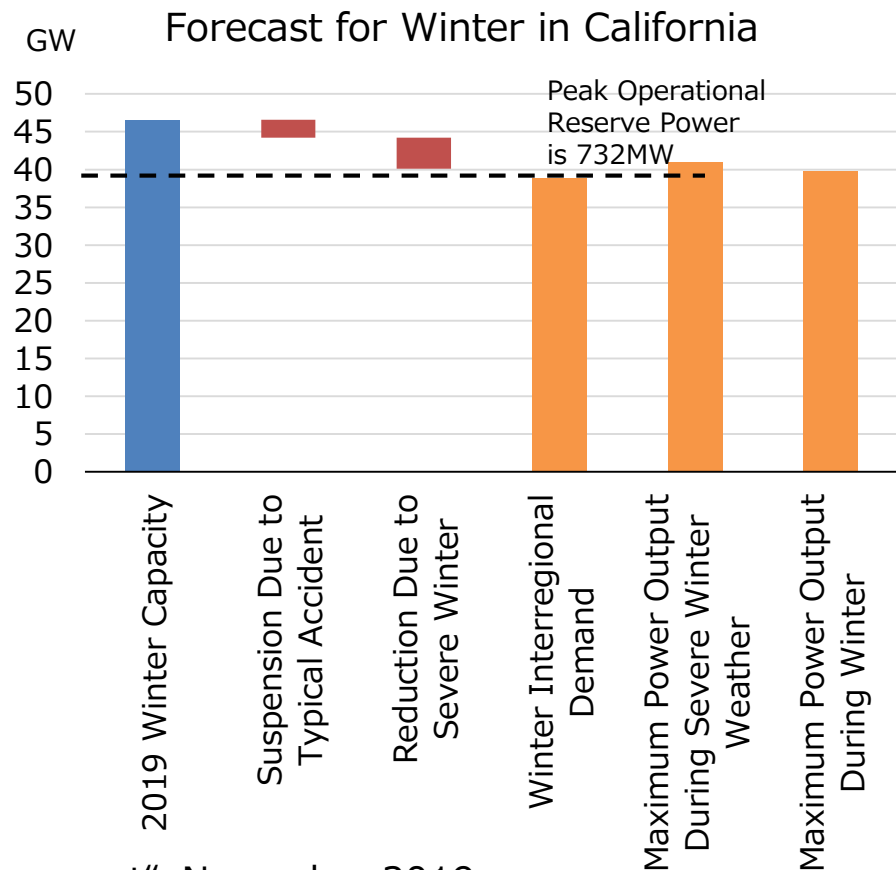
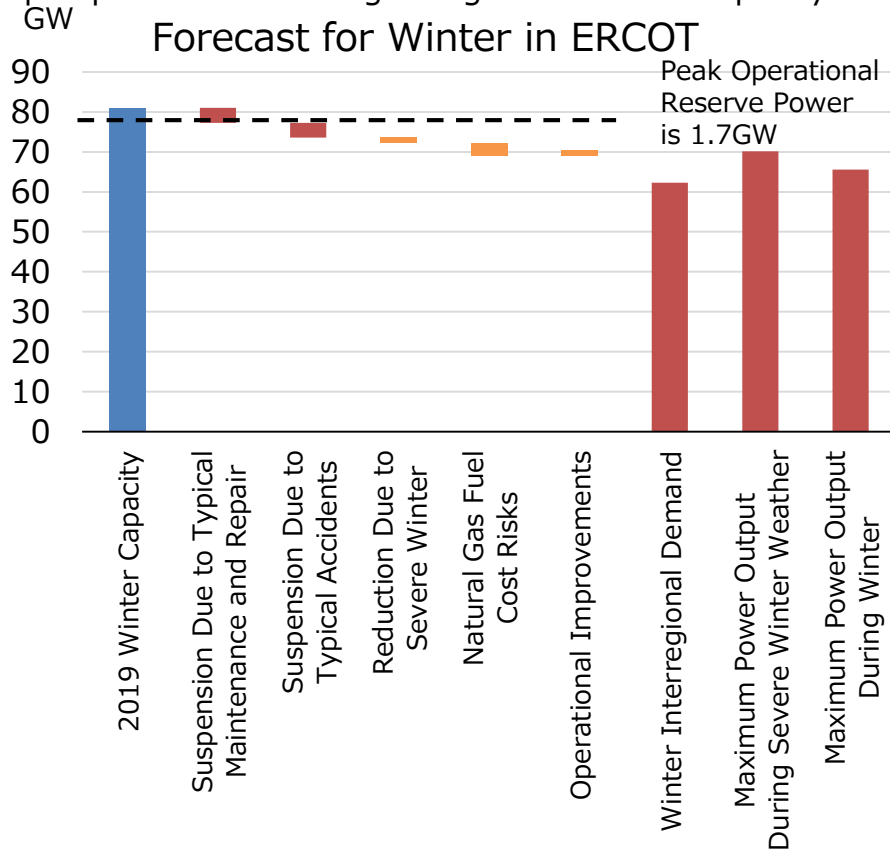
(Source) Prepared from Organization for Cross-Regional Coordination of Transmission Operators "Electrical Supply and Demand Verification Report" October 2019

(Source) Prepared from Organization for Cross-Regional Coordination of Transmission Operators "Responses to Times of Reduced Supply and Demand"

3. Ensuring Capacity

(2) US Winter Risk Scenario

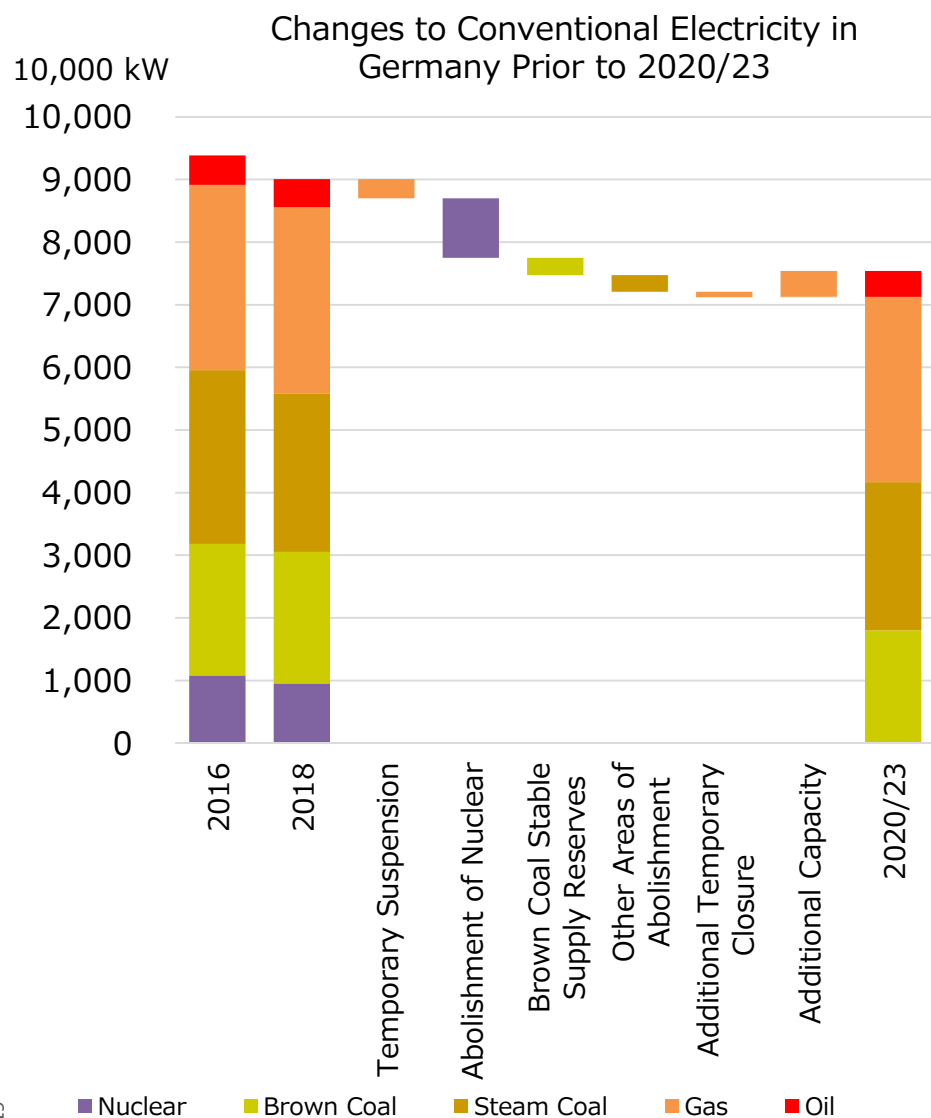
- In the US, severe winter weather is incorporated into short-term reliability evaluations. The Electric Reliability Council of Texas (ERCOT) found there was tightened supply and demand balance during the summer of 2019 and announced that the same could occur in the event of a severe winter. This can also be seen in California and MISO, etc. where severe winter weather could create similar risks.
- Between 2012 and 2017, 4.77 million kW of nuclear, 55.315 million kW of coal-fired, and 35.549 million kW of gas-fired power generation was abolished in the US. In Texas, 4.42 million kW of coal-fired power was abolished in 2018, but construction of new gas-fired facilities has not proceeded. An evaluation of the market is vital from the perspective of avoiding a large decrease in capacity in the short-term.



(Source) NERC, "2019–2020 Winter Reliability Assessment", November 2019

3. Ensuring Capacity

(3) Germany's Reduced Power-Generating Facilities and Demand Forecasts for Winter Season



- Germany is attempting a policy-based shift from both nuclear and coal-fired power. However, electrical capacity from sources other than renewables is not increasing. The RWE is predicting that the 93.88 million kW of capacity from conventional facilities in 2016 will be reduced to 75.4 million in 2020/23 (20% decrease).
- Germany's maximum power output in 2018 was 78.98 million kW. There is a high possibility that a reduction in electrical output from renewables could make Germany highly reliant on imports.
- On the other hand, the power crisis due to the nuclear power outage in Belgium in 2018 reveals that nearby countries have not yet managed to create new facilities to provide stable supplies. There is a high possibility that supply will not meet overall demand in Germany, France, Holland, and Belgium from 2020. ENTSO-E's winter forecasts also show that if France and Belgium had overlapping issues caused by severe winter weather and a reduction in renewable output, there could be power outages in January of 2020.

(Source) RWE, "Factbook 2018"

3. Ensuring Capacity

(4) Ensuring Stable Supplies

- Reductions in oil-fired power generation, the expansion of renewable energy, and a slump in gas prices in the United States have led to lower wholesale electricity prices in many developed nations. This has caused the profitability of conventional power generation facilities to deteriorate. Even in countries and regions that have created capacity markets, it is becoming difficult to create new conventional power-generating facilities.
- Storage batteries and demand response are expensive when compared to conventional facilities and their usage in the wholesale power market is limited. They are often used as ancillary services in overseas countries, and they still cannot provide sufficient supply capacity.
- For the time being, gas and pumped-storage are expected to play an important role as renewables expand. However, in the spot market, premiums are not provided for functions such as load followability and resilience, making it difficult to maintain equipment. Some sort of additional measures are required, such as providing premiums for capacity performance.

4. Electric Utility Industry Challenges for 2020

- 2020 was believed to be the end of the third phase of the power system reforms. However, the split-up of TEPCO in April 2016, alongside the approval of other companies at the general meeting of shareholders in 2019 means that the completion of third phase is planned to take effect in April 2020. Evaluations show that the various initiatives have led to appropriate measures being put in place. A future challenge will be maintaining efficiency as progress is made with internalizing processes.
- The new varieties of markets decided by the Policy Subcommittee for Acceleration of Electricity System Reform including the baseload, indirect transmission rights, and non-fossil value certificates markets have already begun trading. From fiscal 2020 delivery will commence in the baseload market and bidding will be performed in the capacity market. In terms of third-order adjustment capacity, three companies will commence broader operations and begin dealing in non-FIT non-fossil value certificates. There are also plans for interim goals to be created for electricity retailers based on the Energy Supplier Enhancement Act. Clarity surrounding price levels for the new framework will allow revisions to related companies' business strategies to proceed.
- At present, more than 8% of supply reserve margins for Summer 2020 have been ensured. However, on the whole, surplus capacity is decreasing and orders by the Organization for Cross-Regional Coordination of Transmission Operators to improve supply and demand are increasing in frequency. When trading prices in the capacity market become clear, it is likely that a verification will need to be performed of whether there is enough adjustment capability to ensure stable supplies.