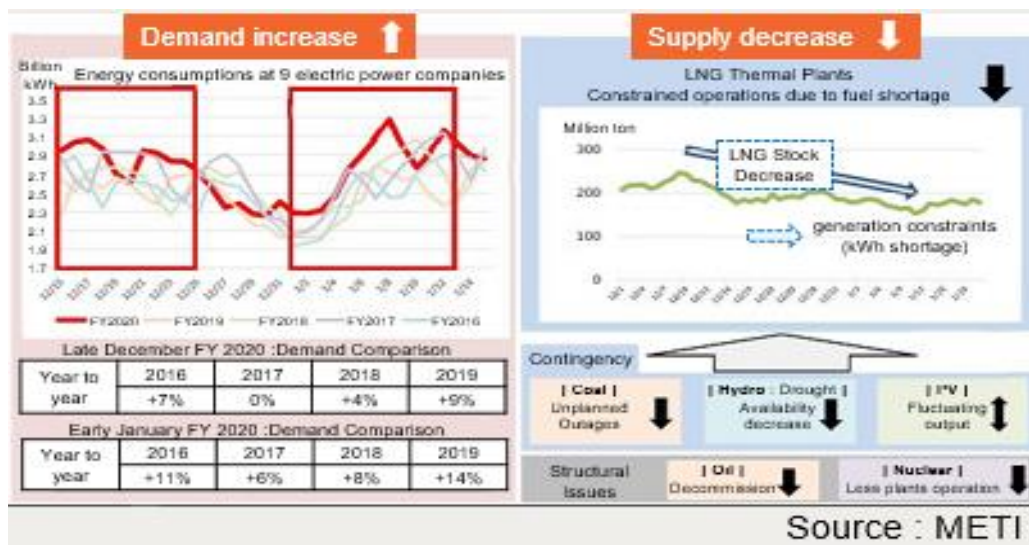


1. Dealing with severe demand-supply balance

In Japan, we operated severe demand-supply balance for about one month from late December in 2020 to mid-January in 2021. In the winter demand-supply balance outlook conducted in October, it was confirmed that we had enough reserve in severe weather conditions, and it was expected to be no shortage of kW. However, due to generator operating constraints caused by nationwide LNG fuel shortage, we experienced kWh shortage. The wholesale price soared to 251.0 yen/kWh at record-breaking level since the market opened in 2005, while the annual average price for FY2020 is 12.1 yen/kWh.



2. Factors of the price spikes

a. Demand increase due to lower temperature

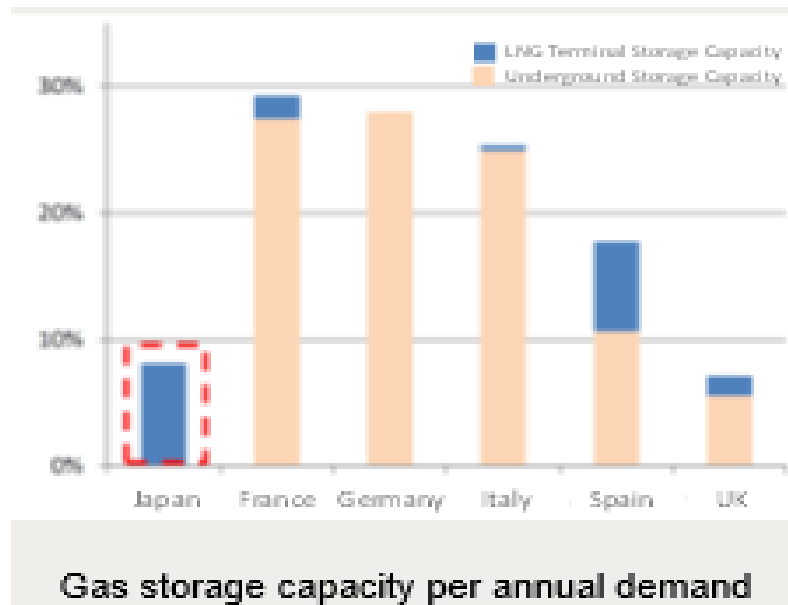
b. Constrained operations of LNG plants due to decreasing LNG stock

- Contingencies of facilities in LNG producing countries
- More consumption than our forecast
- Difficulties in immediate procurements for LNG
(Normal lead time is 1 - 1.5 month)

c. Supply decrease except for LNG plants

(ex. Coal-fired power plants outage)

- Japan is an island country and relies on gas import. Difficulty in immediately procuring fuel due to lead time for procurement which is about 1 to 1.5 months from arranging LNG suppliers to transportation.
- As for Gas storage, tank storage at LNG terminals is more common rather than pipeline networks or underground storage with large capacities which is mainly used in European countries.



3. Background for LNG stock decrease and managing shortage risks

- Due to renewable energy penetration, renewable generators are more competitive than thermal plants in the market. It's difficult to predict profitability to have a lot of LNG stock.
- Physical limitation: LNG is easy to evaporate, and excess inventory leads to financial loss, so generators procure the amount of LNG stock as their balancing group need.
- To manage kWh shortage risks, the government led TSOs offer additional kWh offer 5~6 weeks before summer and winter when demand-supply balance outlook predict severe supply-demand balance occur.



- The government let the TSOs jointly publicly offer additional kWh as a kind of social insurance against unforeseen risks. The government noted that the additional kWh offer was different from fuel procurement by each operator on its own initiative.

4. Additional kWh offer

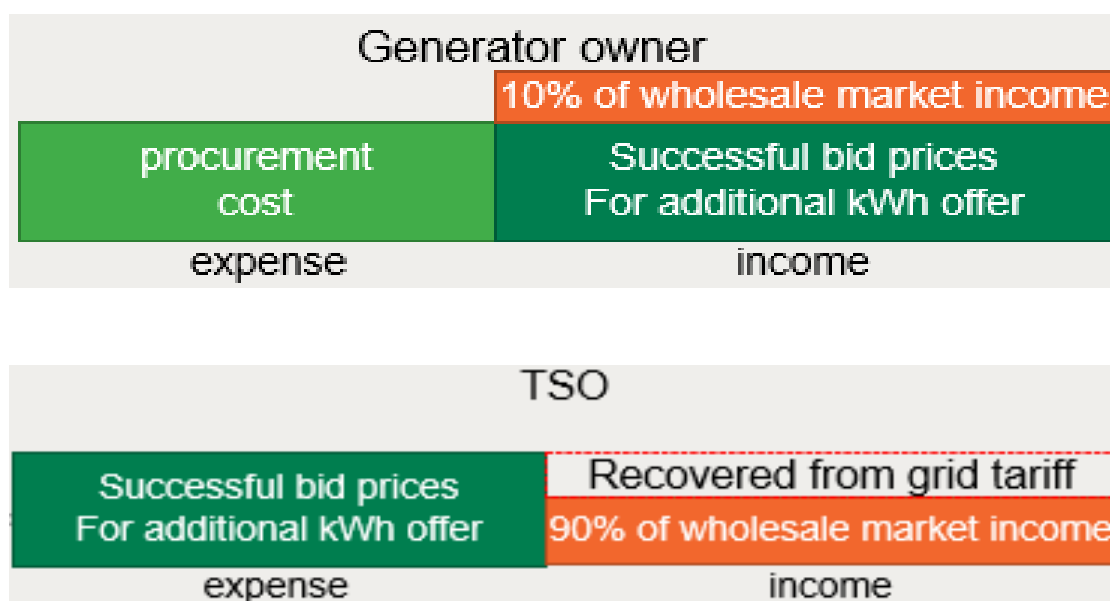
a. Concept for additional kWh offer

Basically generator owners are responsible for procuring their fuel. However, it is very difficult to predict the amount of usage and shortage for fuel because daily demand heavily depends on temperatures and weather. This is why generator owners are reluctant to procure additional fuel with an existing structure. In order to manage shortage risks for coming severe demand-supply balance days, TSOs needed to offer additional kWh with a new structure which promote generator owners to procure the additional fuel. Additional kWh offer held in FY 2021 winter and FY 2022 summer.

b. Mechanism for recovering cost from additional kWh offer

The procurement cost of generators owners is recovered from the income of the additional kWh offer, and generator owners also have profits equivalent to 10% of wholesale market

income. TSO's expense is mainly recovered from wholesale market income. When the income is smaller than expense, the remain is recovered from grid tariff.



5. Procurement volume & Offer results

The concept of the procurement volume is as follows;

- **2022 winter :** The volume is conservatively estimated from the viewpoint of minimizing social costs. During 2021 winter severe demand-supply balance days, 30 GWh was the most amount of interconnection between electric companies in a day. It is assumed that severe demand-supply balance days continue 10 days, then 300 GWh was offered. It is also equivalent to the amount which 1GW power plants operate for about 2 weeks.

- **2022 summer :** The risk of fuel procurement was higher than ever due to the Russian-Ukrainian crisis and international fuel prices stayed high, then 1,000 GWh which represented 2-3 times of 2022 winter volume was offered. It is equivalent to two LNG carriers (a standard LNG carrier is equivalent to about 500 GWh).

	Offering amount (GWh)	Bid amount (GWh)	Successful bid amount (GWh)	Successful tender amount (billion yen)	Average contract price(yen/kWh)
FY 2021 winter	300	496	419	15	35.88
FY 2022 summer	1,000	930	930	33	36.04