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In Japan, various methods are being considered to resolve system congestion caused by insufficient transmission capacity, including Non-firm connections and Methods of resupply. Under these circumstances, the potential exists to resolve system congestion by utilizing DER flexibility in some use cases.
Conventionally, when system congestion was forecasted on the bulk and local power system, the facility reinforcement was planned. Currently, solutions through Non-firm connections and Method of resupply are being considered, assuming output control on the generator side. On the other hand, DER flexibility could be utilized to avoid congestion under the local power system and the distribution system.
This contribution introduces the results of the cost benefit analysis for avoiding system congestion by utilizing local flexibility in two cases, as shown in Figure 1.

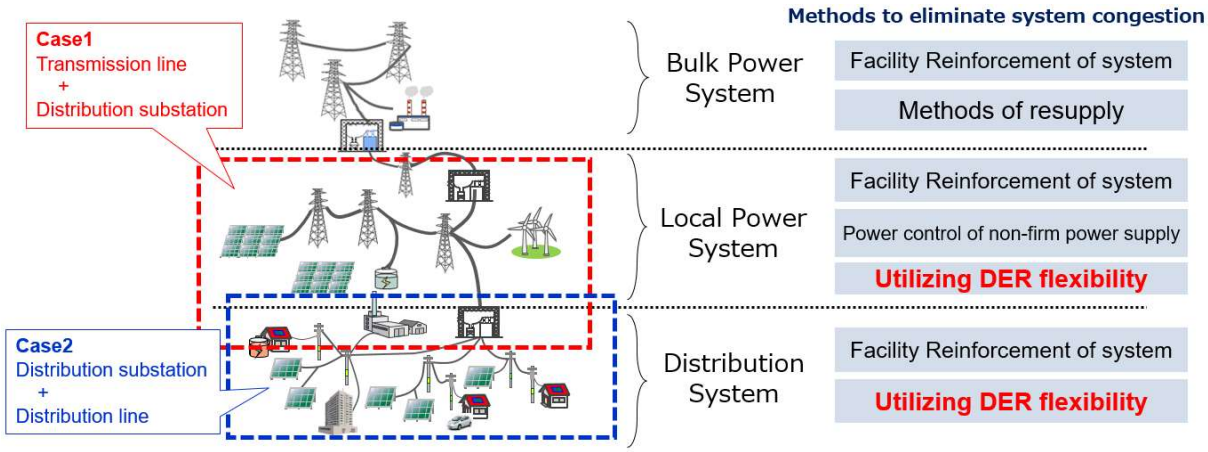

Fig.1 Image of utilizing local flexibility in Japan

Calculation conditions for the cost benefit analysis are as belows.

- The period of calculation is from 2028 to 2050.
- The amount of PV and EV installed in the 6th Energy Basic Plan* is applied.
- Calculate the cost benefit for each system facility when system congestion is avoided・・・(A)
- Estimate the number of facilities that may exceed capacity in Japan・・・(B)
- Estimate costs for utilizing local flexibility (e.g., platform construction costs, operating costs)・・・(C)

* The 6th Energy Basic Plan is the policy response for 2030 with the view toward carbon neutrality in 2050, which was established in Japan in 2021.
The data of (A), (B), and (C) were applied averages for Japanese TSO/DSO. The cost benefit was calculated by the formula, as shown in Figure 2.

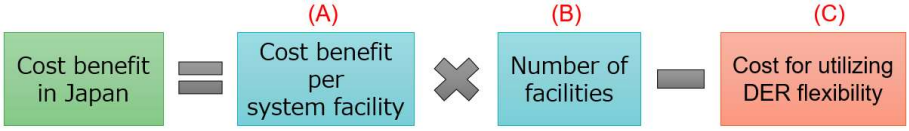

Fig.2 Calculation formula

The results of the calculations for each of Case 1 and Case 2 are shown in Figure 3. Blue bars indicate the cost benefit of the facility reinforcement. Orange bars indicate cost for utilizing DER flexibility. The difference between blue bars and orange bars is the cost benefit and is shown in the black line graph. In Case 1, the cost benefit became positve in 2049. On the other hand, in Case 2, the cost benefit was not positive even in 2050.

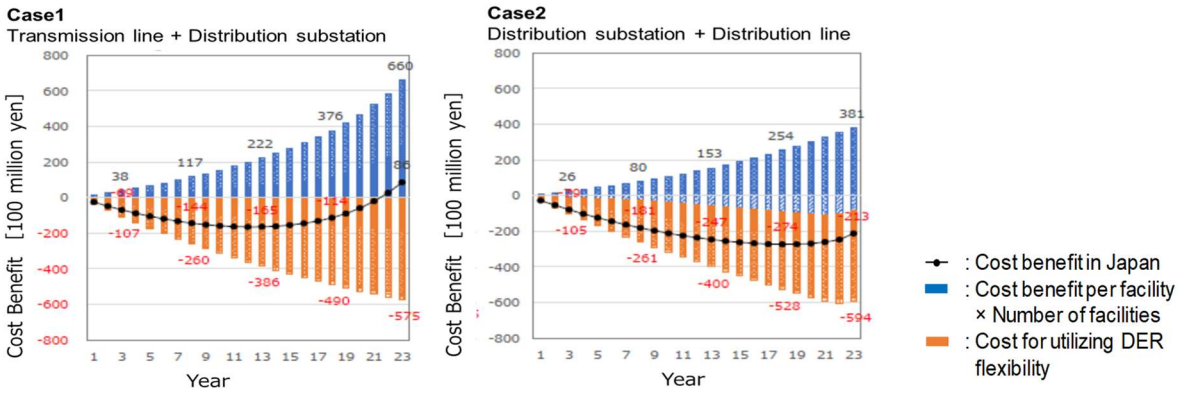

Fig.3 Results of cost benefit calculations

The cost benefit calculations showed the following three results.

- As for transmission lines or distribution substations, utilizing DER will not require additional costs but bring cost benefits by avoiding facility reinforcement.
- As for distribution facilities, utilizing DER requires more costs to install sensing equipment until 2050 than cost benefits by avoiding facility reinforcement.
- Utilizing DER requires the cost to build a platform for managing DER and replace TSO/DSO's existing system for monitoring and controlling DER.

These results show that higher voltage class facilities were found to be more cost effective in Japan. In the next term, we will consider under actual operation and verify by using actual facilities, focusing on higher voltage class facilities.