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QUESTION N° : 2-4

1. Introduction and background

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, as shown in Figure 1.

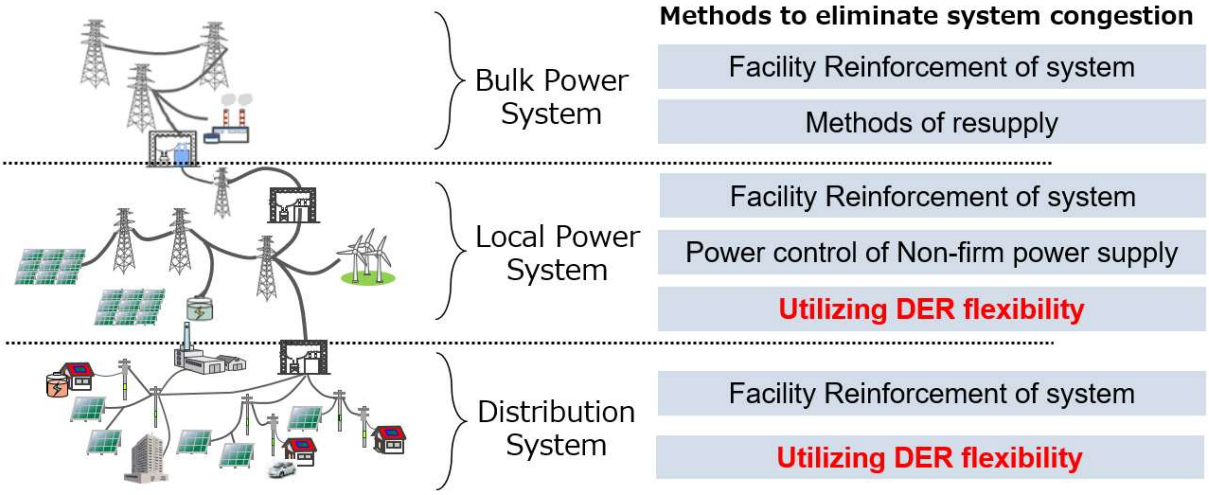

Fig.1 Image of the methods to resolve system congestion in Japan

2. Examples of DER utilization to avoid reinforcement of system facility

Increased PVs may cause reverse power flow and excess capacity of system facilities. Conventionally, the system congestion was avoided by the reinforcement of system facilities. In the future, by utilizing DER during congestion time periods, reverse power flow can be suppressed, reinforcement of system facility can be avoided or deferred, and reinforcement costs can be reduced.

Figure 2 shows an image of avoidance or postponement of reinforcement. The gray line shows the general load, and the yellow line shows the generated current from PV connected to the distribution system. The difference between these two lines shows the system power flow with blue line. The red line shows the capacity of the system facility, which means that the system power flow exceeds the capacity during the time around 12:00.

In the case of this scenario shown in the figure, it is conventionally necessary to reinforce the system facility, but by storing the PV generation current in storage batteries during the time when the capacity is exceeded, the reinforcement can be avoided or differed, and reinforcement cost can be reduced.

With the quantitative evaluation using the above model case, qualitative issues were revealed.

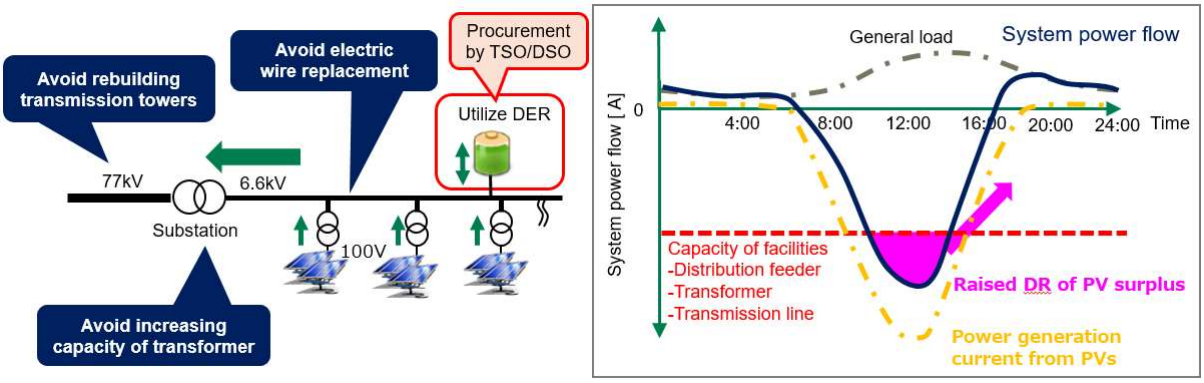

Fig.2 Image of avoidance or postponement of reinforcement

3. Issues to utilize DER flexibility

To utilize DER to avoid system congestion, solutions are being studied in each of the following fields in terms of technologies and rules, as shown in Figure 3.

The issue for local distribution systems is to keep the voltage within the operational range. There are upper and lower limits of voltage that must be kept in the distribution system, and voltage fluctuations must be monitored to ensure not to deviate from these limits before and after the DER utilization, and the fluctuation range before and after the DER utilization must be calculated. It is also necessary to consider the risk of occurrence of unresponsive DER resource due to a malfunction when a procurement command is issued to the DER resource, and to consider alternative measures in such a case.

To fulfill its role as aggregators, they need to grasp how much each DER generates or consumes. The issue for aggregators is the need to develop the technology to grasp it. It is also necessary to develop technology to allocate optimal output values to each resource when output commands are received from TSO/DSO. In addition, aggregators need to consider how to determine the procurement price offered to DER sellers.

As for platform operators, it is necessary to discuss which operator will be responsible for operating the platform in the future. In addition, platform operators need the method to determine the market price. For TSO/DSO, a lower cost will lead to lower procurement costs, while for aggregators, a higher cost will bring greater benefits to their entry into the market. Therefore, the method to determine the market price that can strike a balance between them needs to be considered in the future.

The issue for TSO/DSO is to improve the accuracy of estimating system congestion. Currently, system congestion is estimated based on the actual demand in the weekly past and the actual supply-demand balance over the past several years. However, to prevent the over-procurement or system congestion caused by under-procurement, it is necessary to develop technology to estimate with higher accuracy than the present method. In addition, it is needed for TSO/DSO to consider how to determine the procurement price offered by DER buyers.

This research will be continued to solve these issues.

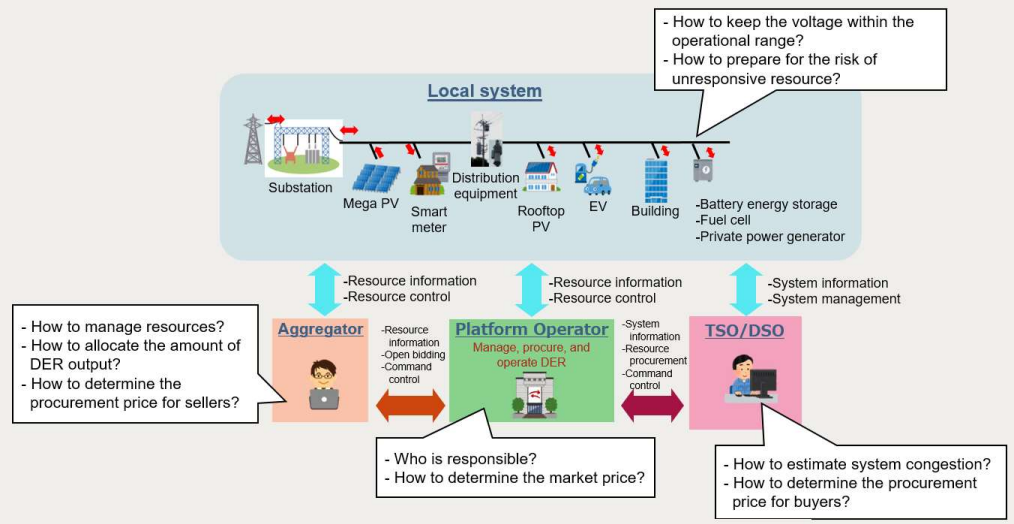

Fig.3 Issues to utilize DER flexibility in each field