Study Committee C4

Power System Technical Performance

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Countermeasures against voltage flicker by photovoltaic inverters with islanding detection function occurring in a wide area network

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1. Background

- In 2019, **voltage flicker (VF) occurred** in our area and affected distribution networks with many PVs during the TN switching period. There were **numerous complaints about light flickering** from customers.
- Measures (=**STATCOM installation** and **reducing the reactive power by IDF setting change**) have been considered. The pre-verification was conducted before implementing two measures. After implementation of the measures, **VF was sufficiently mitigated**.
- This paper presents the **pre-verification and measurement validation findings** based on numerical simulation and data analysis

2. Islanding detection function

- The islanding detection function (IDF) of PV inverters is divided into passive and **active methods**.
- Various active methods have been proposed, but the challenge was that the performance of **isolated operation detection deteriorates** due to the interference of each inverter.
- The **frequency feedback method with step reactive power injection** (FFB) has been proposed to address the problem [1] and has become the **standard for low-voltage inverters**.

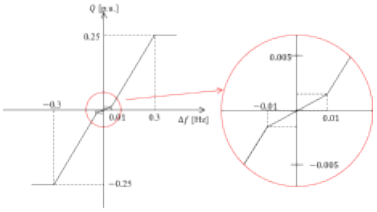

Fig.1. Output reactive power calculation unit

3. Voltage flicker (VF) in our area

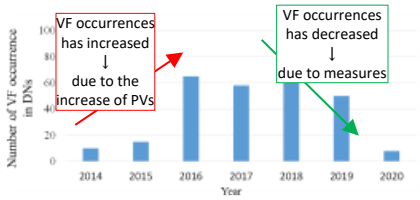

Fig. 2. Number of VF occurrences

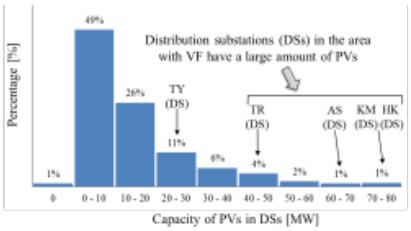

Fig.3. Distribution of PV capacity in DNs

4. Pre-verification for measures

○ Pre-verification of STATCOM installation

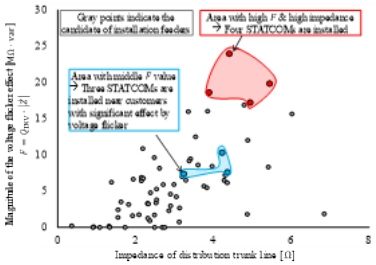

Fig.4. STATCOM installation feeder

○ Pre-verification of IDF setting changes

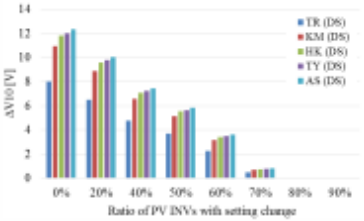

Fig.5. Simulation result: Required ratio of PV inverters with setting change

5. Evaluation of measures against VF

Fig.6. VF magnitude of two feeders with/without STATCOMs

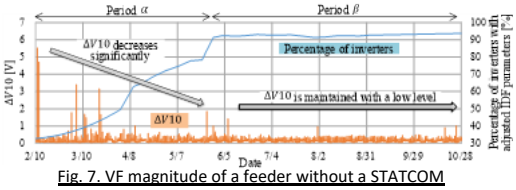

Fig. 7. VF magnitude of a feeder without a STATCOM

6. Conclusion

- The preferable STATCOM installation feeders were determined.
- The simulation results indicated that the required ratio of PV inverters for VF mitigation was more than 80%.
- The effectiveness of measures such as STATCOM installation and IDF setting changes were confirmed.