

Providing training opportunities for replicating psychological pressure on substation operators

1. Introduction

Training contents and opportunities were very limited for substation operators in Country P, because training was only conducted either during power outages for maintenance in the substation, or it was based only on textbooks. In addition, gathering substation operators at the training center for education was not efficient in consideration of travel time, consequently it was extremely infrequent. Hence, we provided substation operation training simulators, which can provide experiences of power system faults, to their training center and major substations. We also provided training scenarios which are similar to actual faults, in order to have experiences of actual events.

2. Substation operator training simulator

The substation training simulator of the training center consists of a trainer desk and two trainee desks. The training management screen, overall system diagram, and event screen are displayed on the trainer desk, and the single-line diagram and event screen of the substation are displayed on the trainee desks. A speaker for sounding an alarm and a telephone device for communicating with the control center and other substations are installed to simulate actual operations. The two trainee desks can be used for training operators at the same substation, joint training with adjacent substations, and joint training with IPPs and DSOs.

PC version simulators are provided at 20 major substations. The PC version simulators have the same training functions and training grid scenarios as the training center, and consist of one laptop PC and two external monitors. Total 10,000 substation operators will be trained on a daily basis, and substation operators can train independently.

The training simulator incorporates voltage power flow calculation, frequency calculation, fault calculation, and incident simulation functions. In the training scenario, the initial system status, the load pattern, settings of protection relays and faults / status change events can be registered in advance and training can be performed repeatedly. Maximum 200 training cases which consist of line-, transformer- and bus faults, and status change events can be registered. Realistic training scenarios will be created by simply choosing the fault points and conditions with a protection relay response function.



Figure-1 Substation operator training simulators

3. Practical training scenarios

A representative grid is modeled, and training scenarios which could occur on the grid, and their recommended recovery procedures, are provided. A training curriculum which covers all operators, such as rookies, mid-level and veteran, will be provided to increase training opportunities.

4. Conclusion

The simulator provides experiences of alarm sounds and major event messages during faults to substation operators, reduces concerns about misoperation during normal and recovery operations, and evaluates operations for rare incidents. Hence, the simulator can reduce psychological pressure. RES (Solar PV and Wind power) and HVDC (LCC and VSC) will be added to the simulator, so that it can provide realistic training for more complicated system operations in the future.