

Feasibility Evaluation of Building an HVLC Short Circuit Laboratory

(High Voltage Section : Jiang, Rong-Cheng 、 Wen, Jian-Shu)

I. Research Background

The capability to deal with high-voltage and large-capacity (HVLC) short circuit testing in Taiwan is insufficient. For a long time, domestic electric manufacturers need to send their products abroad for testing and spend millions of NT dollars to complete a type test. To cope with national energy policies and the amendment of the Electricity Act, Taiwan Power Research Institute (TPRI) launched a renewal and expansion plan regarding high-voltage test equipment.

This research aims to evaluate the feasibility of building a 36 kV 40 kA HVLC short circuit laboratory at one of the two candidate sites, the TPRI Shulin branch and the TPRI Shen 'ao branch. The main items of the said feasibility evaluation include: better location, transportation restrictions, environmental risks, operation patterns of TPRI's laboratories, power system impact analysis, etc.

Research results

II. Research Results

Regarding a better location, the research results show that the said world-class HVLC short circuit laboratories may be built either at the Shulin branch or the Shen 'ao branch. Regarding the preference of stakeholders, the investigation results showed that domestic electric equipment manufacturers preferred the Shulin branch.

As for the restrictions of transportation, we assumed that a short

circuit generator is the object to be tested.

To transport such heavy equipment (stator of the generator) to Shulin branch, the suggested path of this research is "Taipei Port Heavy Terminal → Tai 61 Expressway → Tai 15 Provincial Highway → Tai 4 Provincial Highway → Tai 110 County Road → Tai 114 County Road → the Shulin branch." The path to Shen 'ao Institute is suggested as "Keelung Port East Wharf → Tai 2 Provincial Highway → Shen 'ao branch." The distance from Tai 2 Provincial Highway to Shen 'ao Institute is about 9.2 km and has to pass through the urban area. Under the circumstances of many narrow roads and overhead lines, traffic control along the transportation path must be adopted.

In terms of the environmental risks, the probability of the occurrences of typhoons in the areas of Shulin and Shen 'ao branches are around 26.1% to 38.6, out of the amount of typhoons affecting Taiwan. However, there is no obvious risk of historical mountain slope disaster, earth-rock flow and flooding in the areas of Shulin Institute and Shen 'ao branches. In addition, the faults (geology) near the two areas belong to the second type of active faults, instead of the first type of active faults, so they are less affected by earthquake disasters. In addition, Shen 'ao Bay, which is adjacent to Shen 'ao branch, has tsunami flooding potential of up to one or three meters. Therefore, it is suggested

that the elevation of the base in Shen 'ao branch should be at least EL. + 8.0 meters to reduce the impact of the tsunami on the important equipment and buildings. To sum up, although the short-circuit laboratory is vulnerable to natural disasters, if the corresponding prevention and control measures can be taken, the influence may be minimized.

With regard to power system impact analysis , when using the power system as the power source of 36 kV 40 kA short circuit testing, the simulation results show that the bus voltage of substation near Shulin and Shen' ao branches is less than 0.9 p.u, which failsto meet Taipower's transmission sysetem planning criteria.

When using the short-circuit generator as the power source of short-circuit testing, the simulation results show that the power flow, short-circuit current, transient stability and voltage dip of the power lines near Shulin and Shen 'ao Institute all meet the relevant specifications of Taipower.

III. Conclusion

This research case is to extensively study feasibility of building a 36 kV 40 kA HVLC short circuit laboratory at one of the two candidate sitesr. The conclusion is that it is feasible to build an international-level high-voltage and large-capacity power short circuit laboratory" either at Shulin or atShen 'ao branches.