GROUP REF. : B4
COUNTRY : Japan
PREF. SUBJECT :PS1
REGISTRATION NUMBER : 6667
QUESTION N° : Q1.15

Adjustment of AC voltage at converter station during commissionig test

Introduction

- Commissioning test is the last opportunity to verify the design and specified system performance. Thefore adjustments of many parameters are performed not only sequential test.
- Since the DC system is verified by simulation when it is designed, adjustments during the commissioning test are ideally unnecessary. But we know from past experience that adjustments may be necessary due to differences between reality and simulation (including manufacturing tolerance).

- Hida-Shinano HVDC link is LCC-HVDC system that started commercial operation in March 2021. The converter in Hida-Shinano HVDC link is connected to the AC grid via 2 transformers (step-down transformer and converter transformer).

Experience

- We planned the adjustment of AC voltage using 2 types of taps on each transformer to adjust the margin angle during commissioning test at Hida converter station.
- The adjustment of the margin angle was planned and performed according to following steps.

Step1 : Parameter adjustment of converter controller with tap changer adjustment determined by prior simulation (this is not main topic of my contribution).

Step2 : If the result of Step 1 does not comply with the specification, we determine and implement a solution by considering merits and demerits of the following two methods.

Method 1 : This is a popular method by step down transformer with on load tap changer(OLTC). The secondary voltage of step down transformer (154kV bus voltage) can be changed by adjusting the target voltage of OLTC. For example, if 154 kV bus voltage is increased by OLTC, the capacitive reactive power from the AC filter and the inductive reactive power from the converter will both increase. As a result, it is possible to increase the margin angle while improving the power factor to select this method.

Method 2 : This is a method by converter transformer with no load tap changer (NLTC). The secondary voltage of converter transformer (AC 86kV) can be changed by adjusting the turn ratio with NLTC. For example, if the secondary voltage is increased by NVTC (i.e., the turn ratio is reduced), the capacitive reactive power from the AC filter will remain almost the same (or slightly down) and the inductive reactive power from the converter will increase.

Conclusion

- As a result of comparing the two methods, we selected the solution with OLTC (Method 1).
- This contribution is the adjustment of the commutation margin angle for LCC HVDC system at rated operation.
- Although this experience is for LCC HVDC system, the adjustment of AC bus voltage is also very important factor for VSC HVDC systems. I think our methods presented here are useful for VSC HVDC systems with similar configurations.