Tianguang HVDC Retrofit Project

Tianshengqiao-Guangzhou is the first HVDC project of SGC, put into service in Dec, 2000. It's applied SIMADYN D system provided by SIEMENS. The basic information is as below:

Type	Rated Power	Rated AC voltage	Rated DC voltage	Rated DC current	Transmission distance
bipole	1800MW	500kV	±500 kV	1800A	960km

After 9 years' operation, control and protection system is suffering more and more serious problem; boards become aging and have a high failure rate, worse, parts of them are already discontinued. Moreover, some control and protection strategy has defects.

There were 4 bipole block events from 2000 to 2005, 3 of them were caused by failure of control & protection system. Finally, in 2009 it's decided to retrofit.

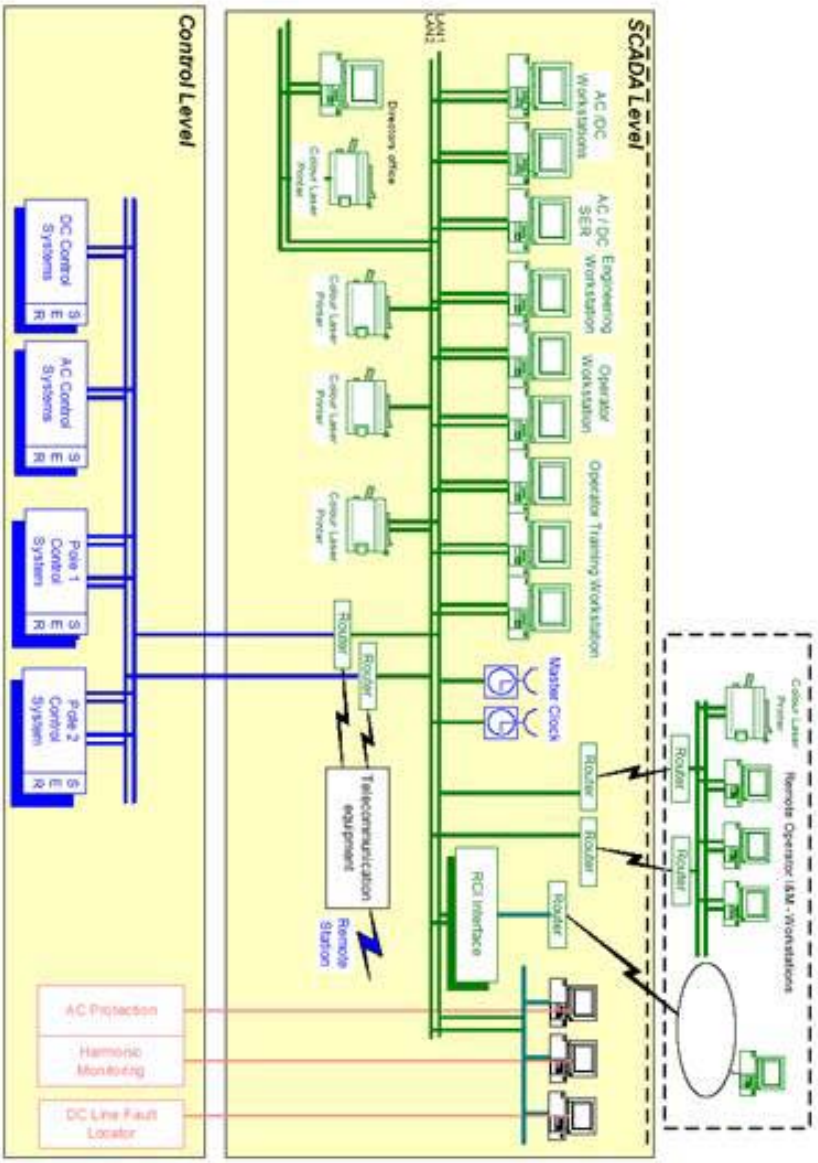

Fig 1. Former Overview

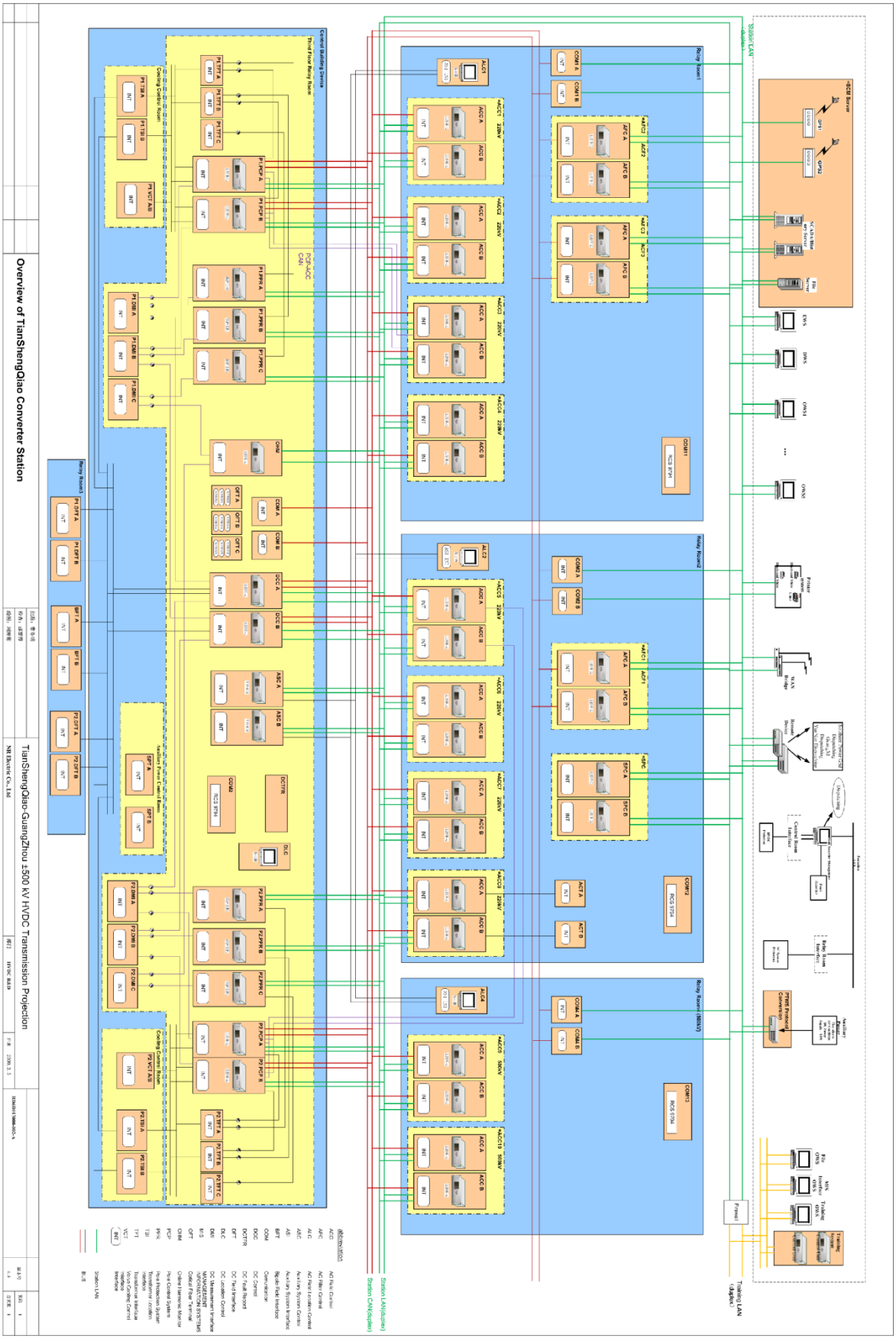

Fig 2 Overview of retrofit system

NR Electric is the contractor and the scope of supply is; HVDC control and protection system PCS-9550 which bases on NR's advanced UAPC platform, electronic CT&PT, AC yard protection devices. Base on its strong technical background and powerful production capacity, this project is finished in 16 months superiorly. The schedule is as below:

Award of contract	System design	Manufacturing	FAT	Delivery	Installation	Commissioning	Operation
2009.2	2009.5-2009.8	2009.5-2009.8	2009.9-2009.10	2009.11	2009.11 - 2009.12	2010.1-2010.4	2010.6

The new system is completely redundant configuration, including control devices, IO and power supply. Auto switch function makes seamless switchover.

New SCADA system integrates both DC and AC information, including protection devices. The whole system is compatible with IEC61850. Besides, compared to old system, it has no problem of compatibility and information storage.

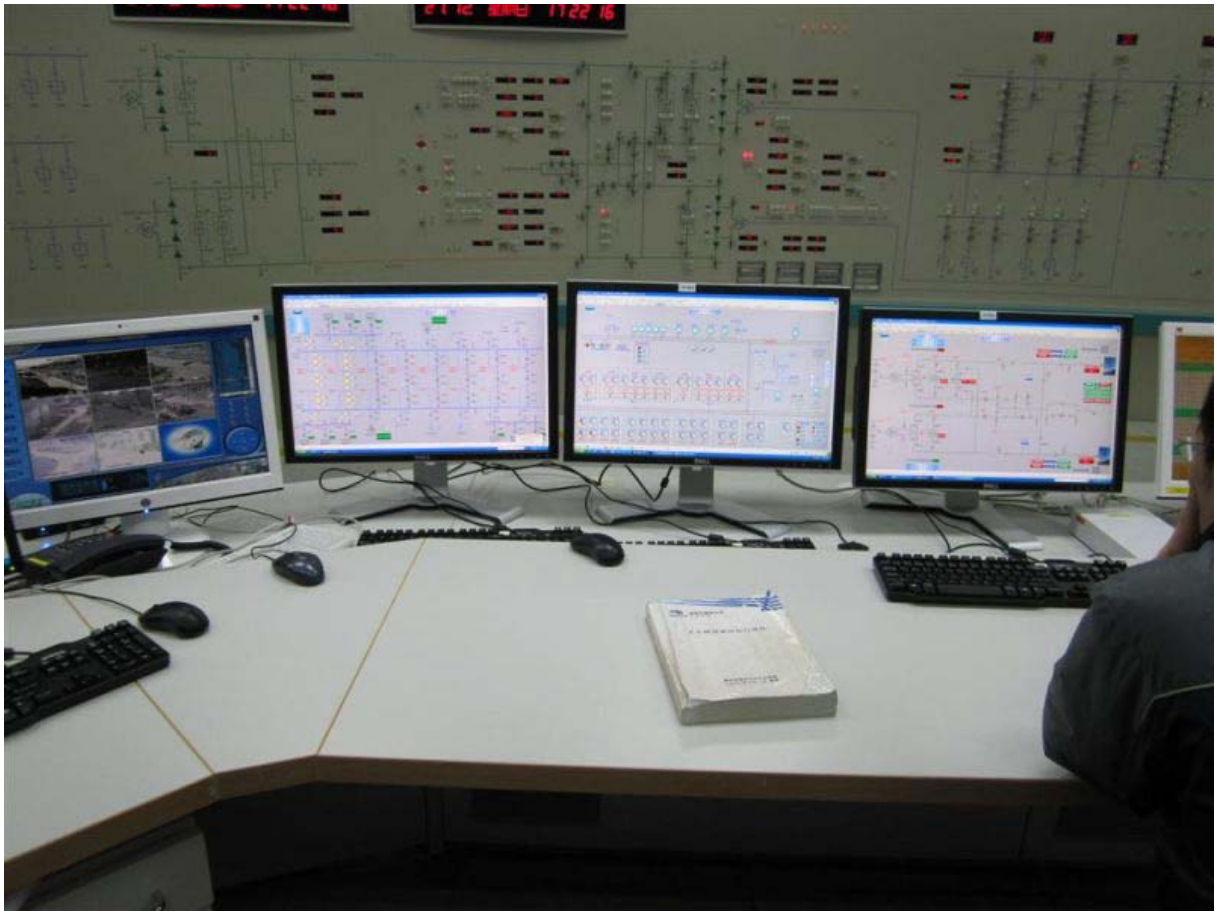

Fig 3 SCADA system

New electronic CTs and PTs resolve existing instability and measurement disturbance problem.

Fig 4 Electronic CT in DC field

Due to optimal heat elimination design and low radiation, temperature inside the cabinet is much lower than before.

Fig 4 Control and protection panels

Besides the replacement of hardware, a few control and protection strategy is also upgraded according to real situation, i.e. add online harmonic monitoring; protection for 2 poles are totally separate, prevent interrelationship; new protection philosophy for line under voltage protection, grounding electrode over current protection, etc and new restart logic when line fault happens.

After retrofit, Tianguang HVDC keeps good operating due to good performance of PCS-9550. This helps stable power supply to Guangzhuo load centre.

Below is the performance certification.

中国南方电网有限责任公司超高压输电公司

To Whom It May Concern

Subject: Satisfactory Performance of NR project

This is to certificate that Nanjing NR Electric Co., Ltd. (NR), with address at No.99 Shengtai Road, Jiangning, Nanjing, 211106, China successfully executed the upgrading project of C&P system of Tianshengqiao – Guangzhou ±500 kV HVDC transmission system.

兹证明南京南瑞继保电气有限公司(南瑞继保)，地址南京江宁胜太路 99 号，成功改造天广±500 kV 直流输电的保护控制系统。

We are very satisfied with their cooperative attitude, professional design, high quality products and project execution. The staffs from NR or its sub-contractors were well trained under the standard of OHSAS 18001 and safety rules of ours, and no hazards of personal or equipment occurred.

我们对南瑞继保的合作态度、专业设计，高质量产品以及项目执行非常满意。南瑞继保及其分包商的员工接受过 OHSAS 18001 标准及我们的安规的良好培训，没有发生过人身及设备的危险。

NR completed the project on time, because it has enough financial resources, experts, service engineers, manufacturing capability and good management system.

因为资金、人力以及生产能力充足，管理良好，南瑞继保按时完成了改造任务。

The PCS-9550 control and protection system provided by NR has successfully shouldered the test of reality operation, satisfyingly solved the problems of the old system. NR provides the first class techniques and service to assure reliable power transmission from Southwest to Guangzhou.

南瑞继保的 PCS-9550 保护控制系统成功地接受了实际运行的检验，令人满意地解决了老系统的问题。南瑞继保提供了一流的技术和服务，保障了从西南到广州可靠的输电。

贺智

China Southern Power Grid Co., Ltd.

中国南方电网有限责任公司超高压输电公司

2011 年 12 月 8 日

生产技术部

Besides reference above, NR also has successfully executed some other retrofit projects, the latest one is Philippines Ormoc-Naga HVDC transmission system which is monopole topology, 350kV DC voltage, 440MW capacity and 450km transmission lines. The system was in operation in 1998.The control and protection is MACH1 system provided by ABB.

The scope of supply includes, valve control unit, thyristor monitor, control of cooling system, electronic CT&PT, AC protection devices and HVDC control and protection system(PCS-9550). Besides, NR also finished system simulation, upgrading of control and protection strategy, FAT and site commissioning. The new system was in smooth operation since 7th Oct, 2014.