



The 350kV Ormoc-Naga HVDC transmission system is the only HVDC link in Philippines that has been put into commercial operation on August 6, 1998 with a transmission capability of 440 MW. The total length of transmission line is approximately 450km. Ormoc-Naga HVDC link takes an important role in supplying power to Luzon and whole Manila area.

Overview

The Ormoc-Naga HVDC system is situated in the eastern part of Central Philippines. The Ormoc Converter Station (OCS) in Leyte side normally acts as a rectifier and the Naga Converter Station (NCS) in Luzon side normally acts as an inverter. The two converter stations are connected via two (2) overhead DC lines and two (2) 21km long oil filled submarine cables. The overhead DC lines are 259 km long on Visayas side and 173 km long on Luzon side. In addition, Ormoc Converter Station is linked to Albuera Electrode Station via 23 km overhead electrode line, while Naga Converter Station is connected to Calabanga Electrode Station via 13 km overhead line.

LEYTE-LUZON HVDC SYSTEM



Figure 1. Map of Ormoc-Naga HVDC Link

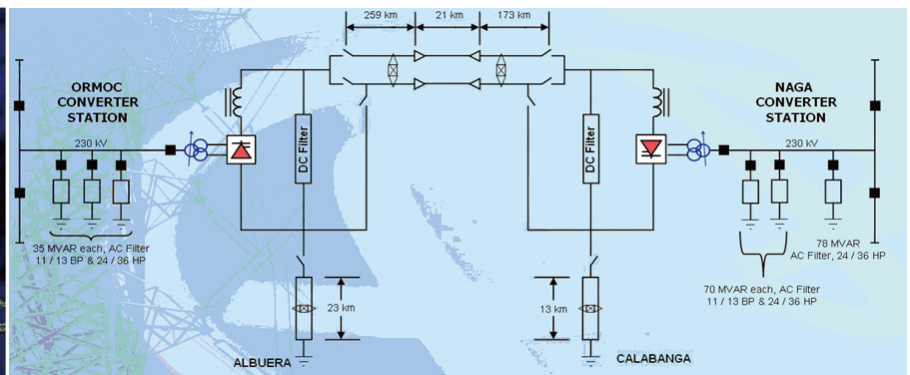


Figure 2. The control and protection is MACH1 system provided by ABB

The Ormoc-Naga HVDC power Transmission System is rated at 350kV DC, 1300A and 440 MW. It is configured as monopolar but the DC line is designed as bipolar. This gives flexibility to make four different line configurations depending on the condition of the lines and electrode stations, which are the Metallic Return, Line 1 to Ground, Line 2 to Ground and Line 1 & 2 to Ground.

The latter Line 1 & 2 to Ground is chosen as the normal or most preferred configuration as it has the lowest power losses. However, at present, Metallic Return line configuration is used due to the electrode problem in Calabanga.

Both Ormoc and Naga Converter Stations have identical configurations with converter transformers, thyristor valves, and smoothing reactors as shown below. But they differ in the AC filters. OCS has three identical 35Mvars BP and HP AC Filters while the NCS has two identical 70 Mvars BP and HP filters and one 78Mvars HP filter.

Existing Problem

After operation of 15 years, the hardware and software failure rate of control and protection system has a steep increase. The failure brought serious consequence, i.e. it caused forced outage 31 times in 2007, accounts for 86% of annual summation. In addition, a shortage of spares makes maintenance more and more difficult. So National Grid Corporation of The Philippines decided to retrofit the control and protection system.

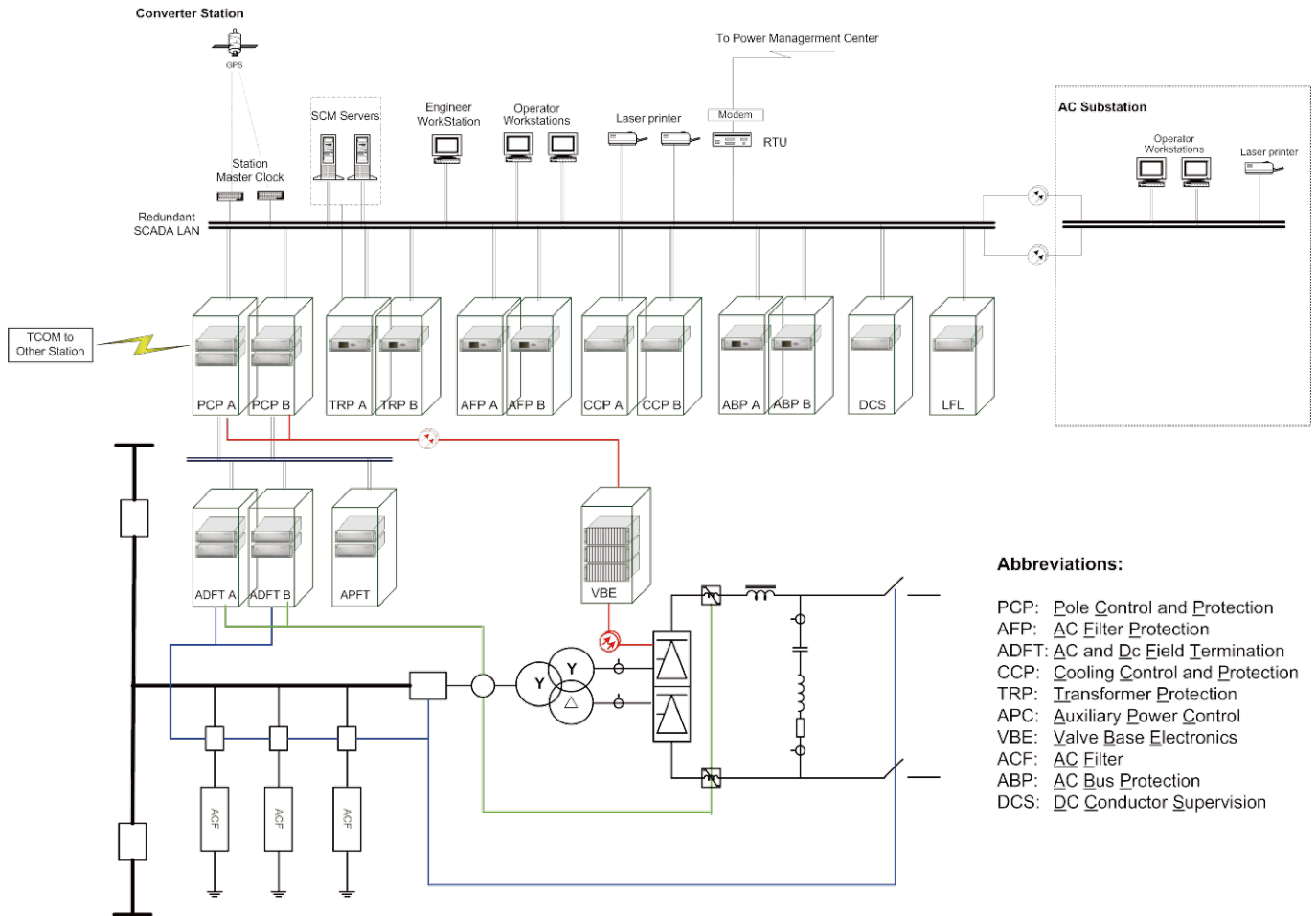


Figure 3. HVDC Control and Protection System Configuration



NR Solution

With strong technical background and vast experience on HVDC, NR Electric won this order to supply Valve Control Unit (VCU), thyristor monitor, cooling control system, DC measure system, UAPC platform based control and protection systems including AC protection devices and HVDC control and protection system PCS-9550 .

The retrofit system has 6 distinct advantages:

- Complete redundant design. In old system, I/O and bus are single configuration, and therefore the failure of I/O may cause forced outage.
- Optimized control strategy. Most control philosophies follow the existing one, only a few are modified according to actual conditions, i.e. emergency power control.
- Augment automatic power reversal function. In the old system, this reversal only can be operated manually.
- Optimized switching logic of the last AC filter
- Independent TFR panels are replaced by PCS-9550 with integrated TFR function.
- Update OWS.

Before shipment, NR has conducted 1176 RTDS tests to ensure the quality and performance of each single equipment and system. During site commissioning, NR professional engineering service team spent 17 days to complete 92 testing. Considering client's profits and local household electricity, NR engineers worked from day to night, finally shortened the power cut-off time into 3 days during key tests. Other system tests were all carried out at minimum load hour, sometimes even at midnight to minimize influence.

Customer Benefits

The upgraded HVDC system puts into operation on 7th Oct, 2014 and operates well since then. The new control and protection system brings advantages to the National Grid Corporation of the Philippines, such as,

- Life cycle extension of HVDC link
The upgrade of Ormoc-Naga HVDC link resolves critical problems such as high system failure rate and shortage of spares of control and protection system. The life cycle of HVDC link is extended.
- High availability
The availability of HVDC link is improved by preventing abnormal or fault situations that are caused by aged device.
- Easy operation and maintenance
NR's HVDC retrofit solution offers comprehensive functions including operation, monitoring and troubleshooting in SCADA system.
- Short interruption duration
NR's professional engineering service team successfully shortened the interruption duration by sufficient FAT and thorough site commissioning plan.

