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TECHNICAL AUDIT REPORT DOMAIL BANNU 220KV GRID STATION

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TECHNICAL AUDIT REPORT

DOMAIL BANNU

220KV GRID STATION

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Technical Audit of Domail Bannu 220kV Grid Station

Introduction:

This report covers the technical audit of Domail Bannu 220kV Grid Station (GS) located on D.I. Khan – Bannu road about 190 km from Peshawar, KPK. This GS was commissioned on July 18, 1999. It has a total of 480MVA transformation capacity and feeds major areas of southern KPK.

There are three (03) 160MVA-220/132kV autotransformers, two (02) 20/26MVA-132/11kV power transformers installed at this GS that are owned and maintained by NTDC. Two (02) 220kV and six (06) 132kV circuits link this station to others. The GS is connected to Daud khel 220kV GS through 220kV double circuit transmission line. Two (02) new 220kV circuits from ChashNUP are under construction, which need to be completed to achieve more stability of the system. For 220kV switchyard, one and half breaker scheme whereas for 132kV switchyard double bus single breaker scheme is used. Single line diagram is attached (Annex-A).

EPP audit team comprising transmission and protection experts visited this GS from November 9, 2014 to November 15, 2014. This report reflects their findings and prioritized fixes.

Findings:

Observations of technical experts are given below:

1. The loading condition of transformers is tabulated below:

Transformer No.	Rating			Max. Load Current Recorded (A)	Max. Percentage Loading of transformer (%)
	Voltage Ratio (kV/ kV/ kV)	Power (MVA)	HV/LV Current (A)		
T-1	220/132/11	160	420/700	640	91.42
T-2	220/132/11	160	420/700	640	91.42
T-5	220/132/11	160	420/700	560	80.00
T-3	132/11.5	26	113/1305	1300	99.61
T-4	132/11.5	26	113/1305	1300	99.61

From above, it is evident that two (02) 220/132kV and both 132/11kV transformers are loaded above the prescribed limits per NEPRA grid code clause OC 4.9.5 supported by IEC (International Electro-technical Commission), which allows up-to 80% loading of transformers. According to IEC standard 60354, continuous loading of transformer above 80% at ambient temperature equal to or above 40°C, prohibits the transformer's short time loading beyond its nameplate ratings. Exceeding this limit reduces the expected useful life of transformers in proportion to the amount and duration of overload.

2. Tap changer for transformer T-1 is operated locally in the switchyard.

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3. Oil seepage exists in the blue-phase LV bushing of autotransformer T-5 and in the top plate of power transformer T-4.
4. On LV side of 220/132kV transformer T-5, no dedicated CTs and PTs are installed for secure metering system (SMS).
5. The loading of 220kV Bannu - Daudkhel and 132kV Domail Bannu - Gurguri circuit is above the prescribed limits per NEPRA grid code i.e. 80%.
6. Two (02) 220kV circuit breakers are operated locally in the switchyard. Major maintenance of six (06) 220kV and eight (08) 132kV circuit breakers is pending due to unavailability of spare parts. Moreover, major maintenance of two (02) 220kV and four (04) 132kV circuit breakers will be due in near future. (For details see Annex-B)
7. Two (02) 132kV isolators are operated locally in the switchyard. Also, two (02) 132kV bus bar isolators have improper alignment. (For details see Annex-B)
8. The following tests are not being performed as required per SOPs for grid system operation and maintenance:
 - a. Purity and moisture content test of SF6 for circuit breakers.
 - b. Dissolved gas analysis and detailed oil testing of transformers.
 - c. Leakage current measurement (LCM) test of lightning arrestors.
 - d. Capacitance & dissipation factor (C&DF) test of current transformers (CTs), potential transformers (PTs) and capacitor voltage transformers (CVTs).All these tests are essential to ensure healthiness of the equipment.
9. The capacitor banks are not installed on 132/11kV transformers.
10. Tele-protection is out of circuit on both 220kV circuits. Also, direct transfer trip (DTT) facility is not available in 220kV system.
11. The following relays are either not installed or out of circuit on 220kV and 132kV circuits:
 - a. Tie line protection is not installed on both 220kV circuits.
 - b. Two (02) backup earth fault protection relays on 220kV circuits and six (06) on 132kV circuits are not installed.
 - c. Distance to fault locator (set-2) is not installed on both 220kV circuits.
 - d. Synchro check relays are blocked on both 220kV circuits.
 - e. Closing and alarm supply supervision relays are not installed on two (02) 220kV and six (06) 132kV circuits.

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12. Auto-reclosers are blocked on all 220kV and 132kV circuits.
13. HV connection, LV connection and rough balance differential relays are not installed on two (02) 220/132kV transformers (T-1 and T-2) to sectionalize the differential zones. Also, cross trip scheme is not installed on all 220/132kV transformers. (For details see Annex-B)
14. The following relays are not installed on 220/132kV and 132/11kV transformers:
- a. Two (02) overload (current based) protection
 - b. Two (02) neutral over current relay
 - c. Two (02) alarm/annunciation supply supervision
 - d. Two (02) closing supply supervision
15. The following equipment on 220/132kV and 132/11kV transformers are defective, blocked or not installed (for details see Annex-B & D):
- a. One (01) remote winding temperature indicator
 - b. Four (04) remote oil temperature indicators
 - c. Five (05) AVR relays are blocked
16. Sequential event recorders, fault recorders, power and voltage recorders are installed at the grid station but not in service since long due to lack of maintenance. This data helps engineers to check proper functioning of the protection system and identify components that failed to operate as required per scheme.
17. On two (02) 11kV feeders, USAID sponsored energy meters which are used for remote data transfer are not installed.
18. The SCADA system is installed but incomplete and not functional.
19. List of missing relays and other defective equipment is attached. (Annex-D)

Recommendations:

Transmission and Grid			
Sr. No.	Findings	Recommendations	Remarks
1	The loading of 220kV Bannu - Daudkhel and 132kV Domail Bannu - Gurguri circuit is above the prescribed limits per NEPRA grid code i.e. 80%.	Proper load flow studies need to be conducted. For 132kV circuit, NTDC needs to take up the matter with PESCO.	
2	Loading of transformers is above the prescribed limits per NEPRA grid code i.e. 80%.	At least one 220/132kV and one 132/11kV transformer needs to be augmented.	

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3	Delay in overhauling of fourteen (14) circuit breakers.	Six (06) 220kV and eight (08) 132kV circuit breakers need spare parts for major maintenance.	NTDC have trained staff and workshop facilities for overhauling and repair of C.Bs.
4	Absence of dedicated CTs and PTs for secure metering system (SMS) on autotransformer T-5.	Dedicated CTs and PTs needs to be installed for proper billing.	
5	Dissolved gas analysis and detailed oil testing of transformers, purity and moisture content test of SF6 for circuit breakers, leakage current measurement (LCM) test of lightning arrestors and C&DF test of CTs, PTs and CVTs are not being done.	All these tests should be carried out to ensure healthiness of the equipment.	
6	Absence of 11kV capacitor banks	Need to be installed with allied equipment.	
7	Local operation of two (02) 220kV circuit breaker	Remote operation needs to be made functional.	
8	Seepage in the LV B-phase bushing of T-5 and in the top plate of T-4 transformer.	Seepage needs to be attended properly.	
9	Local operation of tap changer for transformer T-1.	Remote operation of tap changer is an international standard. So remote operation needs to be made functional.	
10	Local operation of isolators and improper alignment.	Two (02) 132kV isolators are operated locally in the switchyard. Such switches should be made functional for remote operations. Also, improper alignment of two (02) 132kV bus bars isolators needs to be set right.	
Protection			
Sr. No.	Findings	Recommendations	Remarks
1	In-operative tele-protection on both 220kV circuits and direct transfer trip (DTT) of 220kV system.	System Protection and telecommunication departments of NTDC should look into it and make concerted efforts to enable carrier aided facility.	

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2	Tie line protection is not installed on both 220kV circuits	Needs to be installed.	
3	In-operative sequential event recorders, fault recorders, power and voltage recorders for 220kV system.	Need to be made operative for proper monitoring of the system.	
4	Absence of over load (current based) protection relays on 220/132kV transformers T-1 and T-2.	Thermal overload and overload (current based) protection has a vital role against sustained overloading. Hence recommended to be installed and configured precisely.	
5	Replacement of faulty, blocked and missing relays.	Needs replacement with latest version.	
6	Absence of HV connection, LV connection and rough balance differential relays on 220/132kV transformers T-1 and T-2.	Needs to be installed to sectionalize the differential zones.	
7	Absence of cross trip scheme on all 220/132kV transformers.	Recommended to be installed for protecting the system from total collapse due to overload.	
8	Blocked auto-reclosers on all 220kV and 132kV transmission lines.	This can significantly reduce the outage time, reduction in transmission line damage and thus provide higher service continuity.	

General			
Sr. No.	Findings	Recommendations	Remarks
1	Inoperative SCADA system.	SCADA system needs to be made functional.	

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