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TECHNICAL AUDIT REPORT

SAHOWALA (SIALKOT) 220KV GRID STATION

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SAHOWALA (SIALKOT) 220KV GRID STATION

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Introduction:

This report covers the technical audit of Sahowala (Sialkot) 220kV Grid Station (GS), located on Sialkot to Wazirabad road, about 122 km from Lahore, Punjab. This GS was commissioned on August 11, 1999. It has a total of 480MVA transformation capacity connected to the grid. It is the main source for feeding Sialkot and its surrounding areas where load demand is growing as a result of development of small industries.

There are three (03) 160MVA-220/132kV autotransformers, one (01) 20/26MVA-132/11kV and one (01) 10/13MVA-132/11kV power transformers installed at this GS that are owned and maintained by NTDC. Two (02) 220kV and ten (10) 132kV transmission circuits link this station to others. The main feeding sources for this GS are Kala Shah Kaku 220kV and Gakkhar 220kV GSs. A 132kV double circuit (D/C) transmission line has been constructed recently in order to connect Nandipur thermal power station (425MW) to the national grid at this station. 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 February 25, 2014 to March 6, 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 transformers (%)
	Voltage Ratio (kV/kV/kV)	Power (MVA)	HV/LV Current (A)		
T-1	220/132/11	160	420/700	630A	90.0
T-2	220/132/11	160	420/700	630A	90.0
T-3	220/132/11	160	420/700	610A	87.14
T-4	132/11.5	13	57/653	630A	96.47
T-5	132/11.5	26	114/1305	770	59.0

From above, it is clear that 220/132kV transformers are slightly loaded above the prescribed loading 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. A new Gujrat 220kV GS is under construction and will help share the load of this GS.

2) Tap changers of 132/11.5 kV transformers are operated locally in the switchyard on no load. Remote operation of tap changer is a safer practice and therefore should be implemented.

3) The existing sources i.e. Kala Shah Kaku and Gakkhar220kV single circuits are insufficient in case of an outage of any one of these sources.

4) Major maintenance of six (06) 220kV and twelve (12) 132kV circuit breakers (CBs) is pending due to unavailability of spare parts. Timely maintenance of circuit breakers is essential to ensure healthiness and reliable operation of the system. Moreover, major maintenance of two (02) 220kV and four (04) 132kV circuit breakers will be due in near future. (For details see Annex-B)

5) Five (05) 220kV and forty four (44) 132kV isolators are operated manually in the switchyard due to weak mechanical strength of porcelains and few improper alignments.

6) 132kV Sialkot-Sambrial, New-Sialkot, Ghuanki and Pasrur Road transmission lines are fully loaded. Also, during peak load season Gakkar-Sahuwala (Sialkot) 220kV circuit gets loaded above the prescribed limits per NEPRA grid code i.e. 80%.

7) The following tests are not being performed as required per SOPs for grid system operation and maintenance:

a. Leakage current measurement (LCM) test of lightning arresters
b. Capacitance & dissipation factor (C&DF) test of current transformers (CTs), potential transformers (PTs) and capacitor voltage transformers (CVTs)

It is necessary to conduct all tests timely to ensure healthiness of the equipment.

8) The 11kV capacitor banks are not installed on 132/11kV transformers.

9) Tie line/stub protection is not installed on both 220kV feeding circuits and tele-protection is also out of circuit. One (1) synchro check relay of 220kV Sialkot-Kala Shah Kaku circuit and two (02) synchro check relays of 220kV Sialkot-Gakkhar circuit are defective. Also, direct transfer trip (DTT) is out of circuit on 220kV system. Closing and alarm supply supervision relays are not installed on all 220kV and 132kV circuits except 132kV Sialkot-Gakkhar and Sialkot-Daska Industrial.

10) On all 220kV and 132kV transmission lines auto-reclosers are blocked.

11) On all 220/132kV transformers HV connection, LV connection and rough balance differential relays are not installed to sectionalize the differential zone. Also, cross trip scheme on 220/132kV transformers is not installed. (For details see Annex-D)

12) Thermal overload protection relays are not installed on all 220/132kV and 132/11kV transformers. Also, closing and alarm DC supply supervision relays are not installed on all transformers except autotransformer T-3. On both 132/11kV transformers, HV winding temperature protection (Electromechanical) is not installed. Four (04) remote winding temperature indicators are defective, five (05) remote oil temperature Indicators, five (05) kV meters, two (02) MW and two (02) MVAR meters are not installed on 132/11kV transformers. (For details see Annex-B and D)

13) AVR relays are not installed on all 220/132kV transformers whereas is out of circuit on 132/11kV transformers.

14) Sequential event recorder is not installed and fault/disturbance recorder with CPU and printer, voltage and power recorders are defective since long. Such data helps engineers to ensure proper functioning of the protection system and identifies the components which fail to operate as required per scheme.

15) List of other missing relays and defective equipment is attached in Annex-D.

Recommendations:

Transmission and Grid			
Sr. No.	**Finding**	**Recommendations**	**Remarks**
1	The 220kV Kala Shah Kaku and 220kV Gakkhar single circuits, which are the existing sources of this GS are insufficient in case of an outage on any one circuit	An additional feeding source is needed.	
2	Delay in overhauling of eighteen (18) circuit breakers due to unavailability of spare parts.	Six (06) 220kV and twelve (12) 132kV circuit breakers need spare parts for major maintenance. (for details see Annex-B)	NTDC have trained staff and workshop for overhauling and repair of CBs
3	Fully loaded four (04) 132 kV transmission circuits. Also, during peak load season Gakkar-Sahuwala (Sialkot) 220kV circuit gets loaded above 80%.	Proper load flow studies need to be conducted to analyse the system as construction of four new circuits is in progress and also a new Gujrat 220kV GS is under construction.	

4	Leakage current measurement (LCM) test of lightning arresters, C&DF test for all CTs and CVTs is due	All these tests should be carried out to ensure proper healthiness of equipment	
5	Requirement of spare parts for major maintenance of six (06) circuit breakers in future.	Spares for two (02) 220kV and four (04) 132kV circuit breakers are required for major maintenance in future.	
6	Fourty nine (49) isolators are operated manually in the switchyard.	Five (05) 220kV and forty four (44) 132kV isolators are operated manually due to weak mechanical strength of porcelains and improper alignment of few. Need to be replaced with appropriate ones.	

Protection			
Sr. No.	**Finding**	**Recommendations**	**Remarks**
1	Tele-protection (carrier aided) tripping facility is out of circuit on 220kV lines. Inoperative direct transfer trip (DTT) system.	"System Protection and Telecommunication departments of NTDC" should look into it and make concerted efforts to enable "Carrier aided facility" at either ends of the transmission lines in order to clear faults rapidly	
2	Sequential event recorder (SER) is not installed and fault/disturbance recorder with CPU and printer, voltage and power recorders are defective since long.	Need to be installed and made operative in the system so that data can be used to ensure proper working of system protection and to identify components which fail to operate.	
3	Absence of thermal overload protection relays on all 220/132kV and 132/11kV transformers. Absence of HV winding temperature protection relay (electro mechanical). Some remote temperature indicators are defective.	Thermal overload and HV winding temperature protection relays have a vital role against sustained overloading in transformers. Therefore are strongly recommended to be installed and configured precisely. The defective indicators need to be replaced or calibrated for proper monitoring of transformer temperatures.	

4	Absence of tie line protection on 220kV circuits	It is strongly recommended to install it.	
5	Absence of HV connection, LV connection and rough balance differential relays on all 220/132kV transformers.	Needs to be installed to sectionalize the differential zones.	
6	Three (03) defective synchro check relays	Recommended to be made operative for safe reclosing of the breakers.	
7	Replacement of faulty, blocked and missing relays.	Needs replacement with latest version. (for details see Annex-B)	
8	Auto reclosing is blocked on all 220kV and 132kV transmission lines.	"System Protection" and "System Operations" departments have to review the matter and take appropriate action for restoration of auto-reclosers. This can significantly reduce the outage time, reduction in transmission line damage and thus provide higher service continuity	
9	Absence of cross trip scheme on all 220/132kV transformers.	Recommended to be installed for protecting the system from total collapse due to overloading.	

General			
Sr. No.	**Finding**	**Recommendations**	**Remarks**
1	Thermovision survey of GS is not done	Thermovision survey needs to be carried out to avoid any major breakdowns	
2	Non-availability of testing equipment.	Universal testing sets need to be provided for appropriate testing of protection system.	

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