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## TECHNICAL AUDIT REPORT UNIVERSITY ISLAMABAD 220KV GRID STATION

January 2015

*This program is made possible by the support of the American people through the United States Agency for International Development (USAID)*

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## TECHNICAL AUDIT REPORT

# UNIVERSITY ISLAMABAD

# 220KV GRID STATION

Contract No: AID-EPP-I-00-03-00004

Order No: AID-391-TO-12-00002

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# Technical Audit of University Islamabad 220kV Grid Station

## Introduction:

This report covers the technical audit of University Islamabad 220kV Grid Station (GS) located in Bhara Kahu, Islamabad. The GS was commissioned on October 09, 2004 at 132kV level and later upgraded to 220kV voltage level on June 16, 2005. It has 500MVA transformation capacity connected to the grid, feeding Islamabad and its surrounding areas.

There are two (02) 250MVA-220/132kV autotransformers and two (02) 26MVA-132/11kV power transformers installed at this GS that are owned and maintained by NTDC. Two (02) 220kV and seven (07) 132kV circuits link this station to others. The GS is connected to Rawat 500kV GS through 220kV transmission circuits. It is a Gas Insulated Substation (GIS). For both 220kV and 132kV switchgear, double bus single breaker scheme is used. Single line diagram is attached (Annex-A).

EPP audit team comprising technical experts visited this GS from April 14, 2014 to April 25, 2014. This report reflects their findings and prioritized fixes.

## Findings:

Observations of technical experts are as below:

- 1) The loading condition of transformers are tabulated under:

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	250	656/1093	700	64.04
T-2	220/132/11	250	656/1093	625	57.18
T-4	132/11.5	26	114/1305	910	69.73
T-5	132/11.5	26	114/1305	1465	112.26

From above, only T-5 is overloaded 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 overloading beyond its nameplate ratings. Exceeding this limit, the expected useful life of a transformer is reduced in proportion to the amount and duration of overload. The GS feeds government institutions and civil population, therefore, uninterrupted power supply is very critical.

- 2) Presently, the GS is being fed radially from Rawat 500kV GS through a 220kV double circuit. In case of an outage, the supply to the GS will be interrupted. Therefore, an alternate source of supply is very essential for the GS as it is feeding very sensitive areas of Islamabad. A double circuit for In/Out arrangement from one of the 220kV double circuit

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ISPR-Mansehra line has to be made to serve as an alternate source of supply for this station, which needs to be expedited.

- 3) The following tests have not been performed as required per SOPs for grid system operation and maintenance:
  - a. Detailed oil testing and Dissolved Gas Analysis (DGA) test of oil of all transformers - In the absence of these tests, the quality of transformer oil cannot be ascertained in view of the contents of various undesired gases in the oil and other important parameters such as moisture content, flash point, kinematic viscosity, interfacial tension, acidity and tangent delta etc., resulting in breakdown of transformers

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

- 4) The SERGI fire protection system that was installed on the 160MVA 220/132kV transformers is lying abandoned after the augmentation of transformers. It cannot be integrated with the two (02) 250MVA 220/132kV transformers as there is no provision of SERGI protection. It may be shifted to any other station where needed.
- 5) Spares for 220kV and 132kV GIS are needed for internal inspection and major maintenance in future (For details see Annex-B).
- 6) Pole mounted 200kVA auxiliary transformer with bare live joints is lying on the ground and is prone to flashovers and other hazards.
- 7) Tele-protection (PLC aided) and direct transfer trip (DTT) is not available on 220kV transmission circuits. DTT is required for remote end tripping on "Breaker Failure Scheme" when there is no guarantee that relaying at remote line terminals will actuate quickly enough to minimize consequential damage.
- 8) Auto-reclosers on almost all 220kV and 132kV transmission lines are blocked. Auto-reclosers can significantly reduce the outage time, reduce transmission line damage and thus provide higher service continuity.
- 9) Cross trip protection facility is not available. Cross trip scheme is implemented in some sections of the system in order to avoid total or partial collapse.
- 10) The GS is missing some important relays such as: (For details see Annex-B and D).
  - a. Two (02) Tertiary earth fault relays on 220/132kV transformers
  - b. Two (02) Neutral over current relays on 220/132kV transformers
  - c. Two (02) Rough balance differential protection low impedance relays on transformers
  - d. Eighteen (18) back up earth fault relays on 132/11kV transformers

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- 11) The equipment for SCADA system is installed but has not been made functional.
- 12) Retaining wall is required at tower Nos. 63, 66, 79, 81, 82, 88, 95, 100, 110 and 123 of 220kV double circuit Rawat-University line for protection against flowing water. Tower No. 26 to 45 lie in Bahria Town where surroundings level has been raised above the chimney level and stagnant water causes erosion of stubs and tower members which need appropriate remedial measures. Tree topping from tower Nos. 130 to 164 is required to avoid breakdown of line which is not being allowed by Capital Development Authority (CDA).

### **Recommendations:**

<b>Transmission and Grid</b>			
<b>Sr. No.</b>	<b>Finding</b>	<b>Recommendations</b>	<b>Remarks</b>
1	The GS is being fed radially from Rawat 500kV GS through a 220kV double circuit. In case of an outage, the supply to the GS will be interrupted.	An alternate source of supply is very essential as it is feeding very sensitive areas of Islamabad. A double circuit for In/Out arrangement from one of the 220kV double circuit ISPR-Mansehra line has to be made, which needs to be expedited.	
2	Dissolved Gas Analysis (DGA) and detailed oil testing of all transformers are due	These tests need to be done on priority basis to ascertain the quality of oil and healthiness of transformer and its insulation.	
3	The 26MVA transformer T-5 is overloaded per NEPRA grid code.	Load balancing is required between T-4 and T-5. Efforts should be made to shift the 11kV distribution feeders to adjacent 132kV grid station transformers of Islamabad Electric Supply Company (IESCO) as per NEPRA grid code.	
4	Spares for 220kV and 132kV GIS are not available.	Major maintenance of 220kV and 132kV GIS will have to be carried out by the team of manufacturer/ supplier GIS experts in near future.	
5	Pole mounted 200kVA auxiliary transformer with bare live joints lies on the ground.	To be replaced with pad mounted transformer to avoid any mishap.	

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<b>Protection</b>			
Sr. No.	Finding	Recommendations	Remarks
1	Tele-protection (carrier aided) tripping facility is missing on all 220kV lines. Inoperative direct transfer trip (DTT) system.	"System Protection and Telecommunication departments of NTDC" should make concerted efforts to enable "Carrier aided facility" at either ends of the transmission lines in order to clear faults rapidly.	
2	Cross trip scheme is not available.	Recommended to be implemented for protecting the system from total collapse due to overloading. NTDC needs to look into the issue for system stability.	
3	Absence of Rough balance differential relays on 220/132kV transformers.	Needs to be installed to sectionalize the differential zones.	
4	The GS is missing some important relays: two (02) Tertiary earth fault relays on 220/132kV transformers, two (02) Neutral over current relays on 220/132kV transformers, eighteen (18) back up earth fault relays on 132/11kV transformers	All missing relays need to be installed. (For details see Annex-B and D)	
5	Auto reclosing is inactive for all 220kV and 132kV transmission lines.	"System Protection" and "System Operations" should review the matter and take appropriate action for the restoration of auto-reclosers. This can significantly reduce the outage time, reduction in transmission line damage and thus provide higher service continuity	

<b>General</b>			
Sr. No.	Finding	Recommendations	Remarks
1	In-operative SCADA system.	The installed equipment must be made functional.	

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2	Retaining wall is required at tower Nos. 63, 66, 79, 81, 82, 88, 95, 100, 110 and 123 of 220kV double circuit Rawat-University line for protection against flowing water. Tree topping from tower Nos. 130 to 164 is required to avoid breakdown of line, which is not being allowed by Capital Development Authority (CDA).	Appropriate action should be taken for the construction of required retaining walls to avoid breakdown of the towers and required tree cutting should be expedited for clearance of line.	
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