



FY 2014-15

Performance Evaluation Report



National Transmission & Despatch Company
(NTDC)



K-Electric Limited
(KEL)



National Electric Power Regulatory Authority

**Based on Reported Data
for**

FY 2014-15

With a comparison to

FY 2010-11

FY 2011-12

FY 2012-13

FY 2013-14

As per

**Performance Standards
Transmission Rules 2005**

Standards Department

Table of Contents

1	INTRODUCTION	1
1.1	REPORTING REQUIREMENT	1
1.1.1	Rule 9 of PSTR 2005	1
1.2	STANDARDS COMPLIANCE	1
1.2.1	Rule 6 of PSTR 2005	1
1.2.2	Rule 7 of PSTR 2005 - System Voltage	1
1.2.3	Rule 8 of PSTR 2005 - System Frequency	1
1.2.4	Rule 10 of PSTR 2005 - Reporting Guidelines	2
1.3	EVALUATION/ANALYSIS PARAMETERS	2
2	BRIEF ABOUT NTDC & K-ELECTRIC	3
2.1	NTDC	3
2.1.1	Licence	3
2.1.2	Transmission Network	3
2.2	K-ELECTRIC	4
2.2.1	Licence	4
2.2.2	Transmission Network	4
3	ANALYSIS OF ANNUAL PERFORMANCE REPORTS (APRs)	4
3.1	SYSTEM RELIABILITY	4
3.1.1	System Duration of Interruption	4
3.1.2	System Frequency of Interruption	5
3.2	SYSTEM SECURITY	6
3.3	QUALITY OF SUPPLY	7
3.3.1	System Voltage	8
	NTDC	8
	K-Electric	13
3.3.2	System Frequency	14
APPENDICES		16

Table of Figures

Figure 2.1: NTDC - Grid Stations Detail	3
Figure 3.1: System Duration of Interruption (Hrs/Point)	5
Figure 3.2: System Frequency of Interruption (Nos./Circuit)	6
Figure 3.3: Total ENS of the licensees	6
Figure 3.4: NTDC Regions ENS (GWh)	6
Figure 3.5: Region wise loss of supply incidents, 2014-15	7
Figure 3.6: Month wise loss of supply incidents	7
Figure 3.7: Number of voltage variations violating criteria - NTDC	8
Figure 3.8: Number of voltage variations beyond the limits - Islamabad Region	9
Figure 3.9: Number of voltage variations outside the limits - Lahore Region	11
Figure 3.10: Number of voltage variations outside the limits - Multan Region	12
Figure 3.11: Number of voltage variations outside the limits Hyderabad Region	13
Figure 3.12: K-Electric Number of voltage variations outside the limits	13
Figure 3.13: Highest frequency of the licensees	15
Figure 3.14: Lowest frequency of the licensees	15

Table of Tables

Table 1.1: Evaluation/Analysis Parameters	2
Table 3.1: Reliability Data - Duration of Interruption	4
Table 3.2: Reliability Data - Frequency of Interruption.....	5
Table 3.3: Reported ENS	6
Table 3.4: Loss of supply incidents, average ENS & duration per incident.....	7
Table 3.5: Number of voltage variations violating criteria, NTDC	8
Table 3.6: Number of voltage variations violating criteria, Islamabad Region	9
Table 3.7: Number of voltage variations violating criteria, Lahore Region	10
Table 3.8: Number of voltage variations violating criteria, Multan Region	11
Table 3.9: Number of voltage variations violating criteria, Hyderabad Region.....	12
Table 3.10: K-Electric Number of voltage variations outside the limits.....	13
Table 3.11: NTDC system frequency details	13
Table 3.12: NTDC system frequency, 2014-15.....	14
Table 3.13: NTDC system collapses and network splitting, 2014-15	14
Table 3.14: K-Electric system frequency, 2014-15	15

1 Introduction

This Performance Evaluation Report (PER) provides an overview of the performance of the Transmission Licensees i.e. National Transmission & Despatch Company (NTDC) and K-Electric (KE) as per National Electric Power Regulatory Authority (NEPRA) Performance Standards Transmission Rules (PSTR) 2005¹, based on their reported data for the FY 2014-15.

The performance statistics for the FY 2014-15 with a comparison for the last four financial years has been depicted in light of the PSTR 2005. The document, moreover, takes account of system reliability, security of supply and quality of supply of the transmission networks of the licensees during the reported period.

1.1 Reporting Requirement

1.1.1 Rule 9 of PSTR 2005

As per Rule 9 of PSTR 2005, the licensee² shall submit to the Authority every year, before the 31st of August of the succeeding year, an Annual Performance Report (APR). The APR shall contain all relevant information with respect to compliance with these rules during the year, including a statement of comparison with the compliance reporting achieved during the preceding year.

1.2 Standards Compliance

1.2.1 Rule 6 of PSTR 2005

As per Rule 6 of PSTR 2005, the quality of supply shall be measured with reference to system voltage and system frequency.

1.2.2 Rule 7 of PSTR 2005 - System Voltage

- 1) Under normal conditions the voltage variations of plus or minus $\pm 5\%$ of the nominal voltage for voltages of 132kV (where applicable) and above shall be permitted.
- 2) Under (N-1) contingency conditions voltage variations of plus or minus $\pm 10\%$ of the nominal voltage for voltages of the 132kV (where applicable) and above shall be permitted.
- 3) The criteria for reporting voltage variations outside the limits specified in sub-rules (2) and (3) only apply when the duration of variation exceeds a continuous period of thirty (30) minutes.

1.2.3 Rule 8 of PSTR 2005 - System Frequency

- 1) The frequency variations of plus or minus $\pm 1\%$ of the nominal frequency of 50 Hertz shall be permitted, i.e. frequency to remain within the frequency limits of 49.50 to 50.50 Hertz at all times.
- 2) The criteria for reporting frequency variations outside the limits specified in sub-rule (1) only apply when the duration of the variation exceeds a continuous period of five (5) minutes.

¹ In exercise of the powers conferred by section 46 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (XL of 1997), read with clause (c) of sub section (2) of section 7 and section 34 thereof, the National Electric Power Regulatory Authority, with the approval of Federal Government, has made the Performance Standards (Transmission) Rules (PSTR) notified vide S.R.O. 1138(I)/ 2005 dated 15th November, 2005.

² Transmission licensee.

1.2.4 Rule 10 of PSTR 2005 - Reporting Guidelines

All transmission licensees shall be required to report to the Authority the performance of their transmission system. The following guidance notes are provided to assist licensees on the presentation of system performance.

- a) System Reliability
 - i. System Duration of interruption
 - ii. System Frequency of Interruption
- b) Tie Line Reliability
- c) System Security (Energy Not Served)
- d) Quality of Supply
 - i. System Voltage
 - ii. System Frequency

1.3 Evaluation/Analysis Parameters

The data evaluation parameters as per PSTR 2005 are shown below in table 1.1.

Table 1.1: Evaluation/Analysis Parameters

System Description			Parameters
Reliability	Interruptions	Duration	• Total outages hours recorded at all interconnection points (excluding 132 kV line tripping); • Total number of interconnection points; • System duration of interruption.
		Frequency	• Total number of outages recorded at all 132 kV outgoing circuits (excluding 132 kV line tripping); • Total number of 132 kV circuits; • System frequency of interruption.
Security			• Total Energy Not Served (MWh/GWh); • Number of incidents, where there has been a loss of supply; • Avergae Energy Not Served per incident; • Average duration of incident.
Quality of Supply		Voltage	• List of transmission circuits violating the voltage criteria; • Total number of violations under normal conditions; • Total number of violations under N-1 conditions; • Highest/Lowest voltage recorded and time duration under normal conditions; • Highest/Lowest voltage recorded and time duration under N-1 conditions.
		Frequency	• Month wise Highest/Lowest frequency recorded; • Percentage variation of frequency; • %age of time (hours) of the year the frequency remained outside the limits; • Maximum continuous period of deviation.

2 Brief about NTDC & K-Electric

2.1 NTDC

National Transmission & Despatch Company (NTDC) Limited was incorporated on 6th November, 1998 and commenced commercial operation on 24th December, 1998. It was organized to take over all the properties, rights and assets obligations and liabilities of 220 KV and 500KV Grid Stations and Transmission Lines/Network owned by Pakistan Water and Power Development Authority (WAPDA).

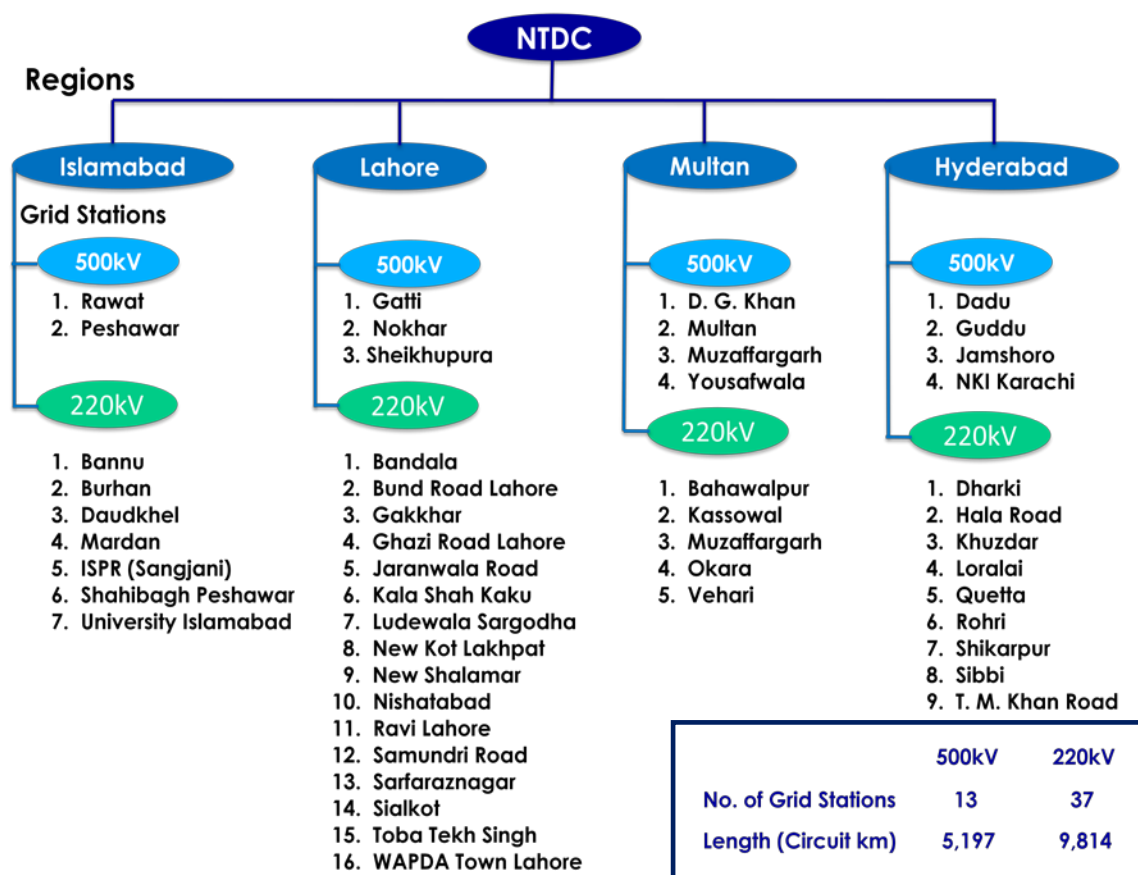
2.1.1 Licence

NTDC was granted Transmission Licence on 31st December 2002 by National Electric Power Regulatory Authority (NEPRA) to engage in the exclusive transmission business for a term of thirty (30) years, pursuant to Section 17 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

2.1.2 Transmission Network

As per reported data, NTDC has four regions³ and as of June, 2015, it operates & maintains thirteen (13) 500 kV and thirty seven (37) 220 kV Grid Stations, 5,197 km of 500 kV transmission line and 9,814 km of 220 kV transmission line in Pakistan. Figure 2.1 below, shows detail of its region wise 500 kV & 220 kV grid stations.

Figure 2.1: NTDC - Grid Stations Detail



³ NTDC Regions: - Islamabad, Lahore, Multan & Hyderabad.

2.2 K-Electric

K-Electric formerly known as Karachi Electric Supply Company was established on September 13, 1913 under the Indian Companies Act of 1882 as the Karachi Electric Supply Corporation (KESC). The entity was nationalized in 1952 and re-privatized on November 29, 2005. In September, 2008 it was renamed as Karachi Electric Supply Company (KESC). Recently it was rebranded as K-Electric.

2.2.1 Licence

K-Electric was granted transmission licence on 11th June 2010 by National Electric Power Regulatory Authority (NEPRA) to engage in the exclusive transmission business for a term of twenty (20) years, pursuant to section 17 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

2.2.2 Transmission Network

K-Electric's transmission system comprises a total of 1,249 km of 220 kV, 132 kV and 66 kV transmission lines with 64 grid stations, 14 Auto Transformers and 129 power transformers, as of June 2015. K-Electric grid is interconnected with the NTDC grid system through two double circuit 220 kV transmission lines.

3 Analysis of Annual Performance Reports (APRs)

The APRs submitted by NTDC & K-Electric have been evaluated in light of the PSTR 2005. The detail of which is as under;

3.1 System Reliability

The transmission licensees are required to provide reliability data as per requirement of the Rule 3 of the PSTR 2005. The indices thereof are as follows;

3.1.1 System Duration of Interruption

$$= \frac{\text{Sum of the total outage hours recorded at all the interconnection points (other than 132kV line trippings) in a period.}}{\text{Number of monitoring points (Interconnection Point).}}$$

Table 3.1: Reliability Data - Duration of Interruption

NTDC

Description		2010-11	2011-12	2012-13	2013-14	2014-15
Total outages hours recorded at all interconnection points (excluding 132 kV line tripping).	1	47.66	387.63	8.37	0	148
Total number of interconnection points	2	193	196	184	197	390
System duration of interruption (Hrs/Point*) (3 = 1/2)		0.25	1.98	0.05	0	0.38

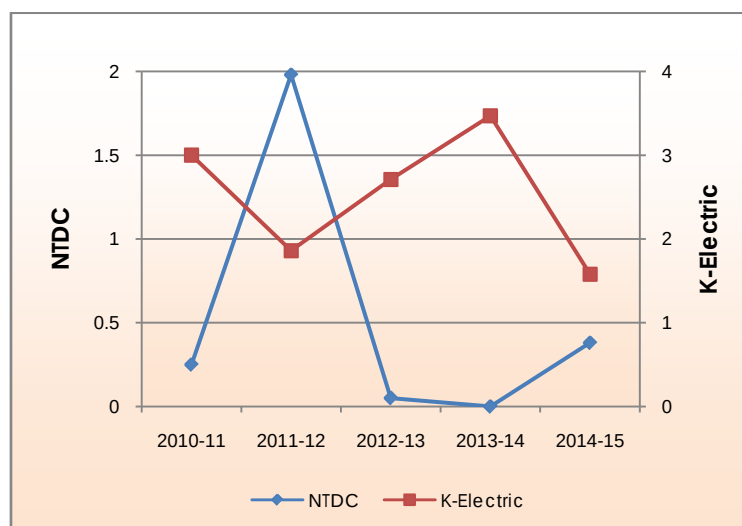
K-Electric

Total outages hours recorded at all interconnection points (excluding 132 kV line tripping).	1	21	13	19	24.31	11.06
Total number of interconnection points	2	7	7	7	7	7
System duration of interruption (Hrs/Point*) (3 = 1/2)		3	1.86	2.71	3.47	1.58

*Interconnection Point

Table 3.1 shows the system reliability data for the last five years of both the licensees. *The average duration of interruption per point during the reported period is 0.38 Hrs & 1.58 Hrs for NTDC and K-Electric respectively. Although K-Electric has shown an improvement as compared to the preceding year but it is noteworthy that in comparison to NTDC having much more larger network, K-Electric has greater duration of interruption per point. The table also shows a significant increase in the number of interconnection points for NTDC for the year 2014-15 i.e. 390 as compared to 197 for the year 2013-14. The performance indicator has been shown graphically in the following figure;*

Figure 3.1: System Duration of Interruption (Hrs/Point)



3.1.2 System Frequency of Interruption

$$= \frac{\text{Number of outages at all 132kV outgoing circuits (other than 132kV line trippings) in a period.}}{\text{Number of Circuits.}}$$

Table 3.2: Reliability Data - Frequency of Interruption

NTDC

Description	2010-11	2011-12	2012-13	2013-14	2014-15
Total number of outages recorded at all 132 kV outgoing circuits (excluding 132 kV line tripping). 1	5	17	3	0	116
Total number of 132 kV circuits 2	251	254	258	264	390
System frequency of interruption (Nos./Circuit) (3 = 1/2)	0.02	0.07	0.01	0	0.3

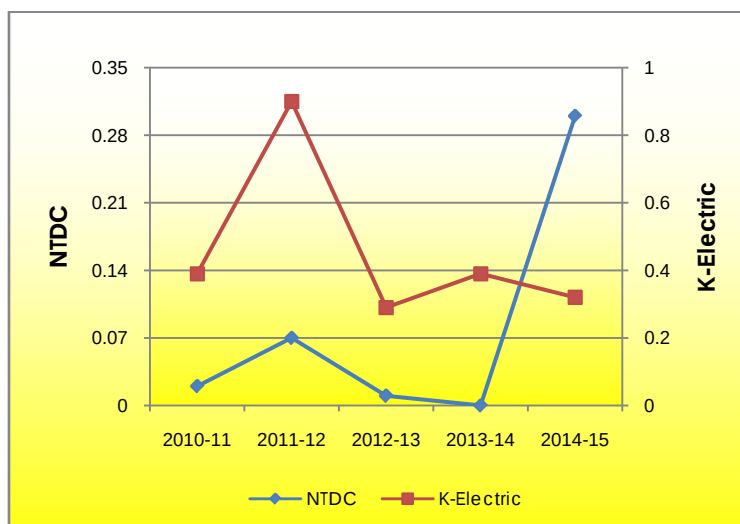
K-Electric

Total number of outages recorded at all 132 kV outgoing circuits (excluding 132 kV line tripping). 1	12	28	9	12	10
Total number of 132 kV circuits 2	31	31	31	31	31
System frequency of interruption (Nos./Circuit) (3 = 1/2)	0.39	0.90	0.29	0.39	0.32

The above table shows a comparable overview of NTDC & K-Electric in respect of the number of interruptions per circuit during the year 2014-15. *The average number of interruptions per circuit as reported by NTDC & K-Electric is 0.3 & 0.32 respectively. It also shows a large increase in total number of outages for NTDC in the year 2014-15 as compared*

to preceding years, which clearly indicates the lack of proper maintenance as per its SOPs for the transmission lines & grid stations. The following figure shows number of interruptions per circuit.

Figure 3.2: System Frequency of Interruption (Nos./Circuit)



3.2 System Security

For the purpose of system security measurements, the estimates of total energy not served (ENS) during the year as reported by the licensees have been analyzed.

The total ENS as reported by NTDC & K-Electric is 533 GWh & 5,459 MWh respectively. Based on the average power purchase price (PPP) of distribution companies (DISCOs) in their tariff determinations for the year 2014-15, the financial impact of 533 GWh ENS comes out to be approximately Rs. 5,330 million, which is 28.7% of the investment allowed by NEPRA to NTDC i.e. Rs. 18,600 million in its tariff determination for the year 2014-15. On the basis of average sale rate of K-Electric, the financial impact of 5,459 MWh comes out to be approximately Rs. 87 million. Reported ENS is given in table 3.3 and figure 3.3 shows the historical trend of ENS for both the licensees. The region wise break up for NTDC is shown in figure 3.4 below;

Table 3.3: Reported ENS

Licensee	2010-11	2011-12	2012-13	2013-14	2014-15
NTDC (GWh)	2	0.4	0.1	0	533
K-Electric (MWh)	1410	7393	7081	6765	5460

Figure 3.3: Total ENS of the licensees

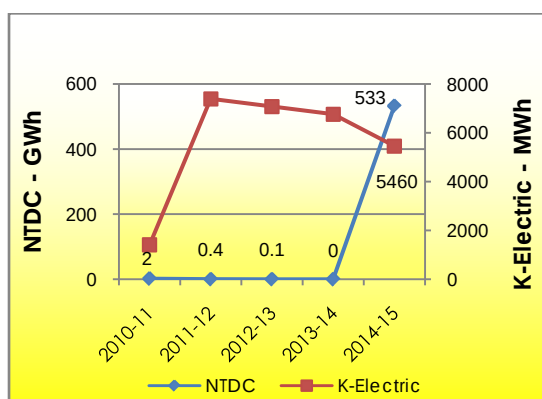
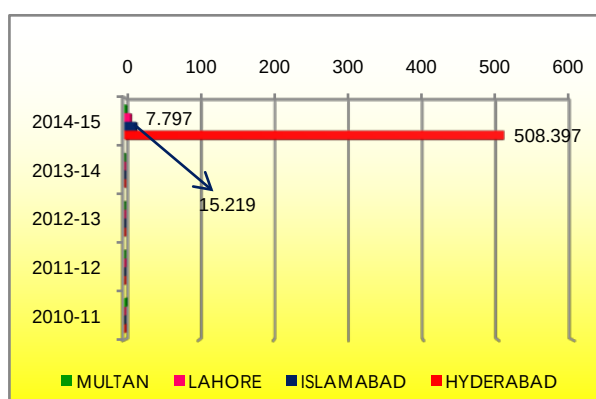


Figure 3.4: NTDC Regions ENS (GWh)



Number of incidents, where there has been a loss of supply, average ENS per incident and average duration per incident assessed is given below in table 3.3 for both the licensees.

Table 3.4: Loss of supply incidents, average ENS & duration per incident

Licensee	Loss of Supply Incidents (Nos.)	Average ENS per Incident (MWh)	Average Duration per Incident (Hrs)
NTDC	125	4264	1.2
K-Electric	10	545.9	1.1

The region wise and month wise breakup of loss of supply incidents has been shown for NTDC in the following figures;

Figure 3.5: Region wise loss of supply incidents, 2014-15

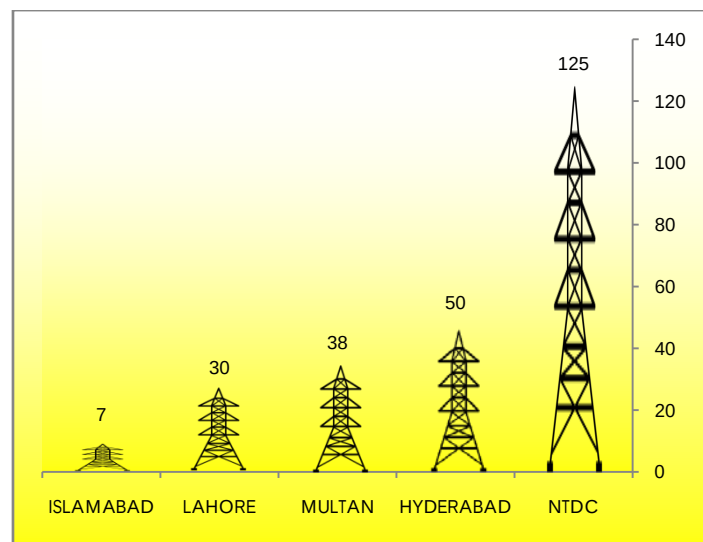
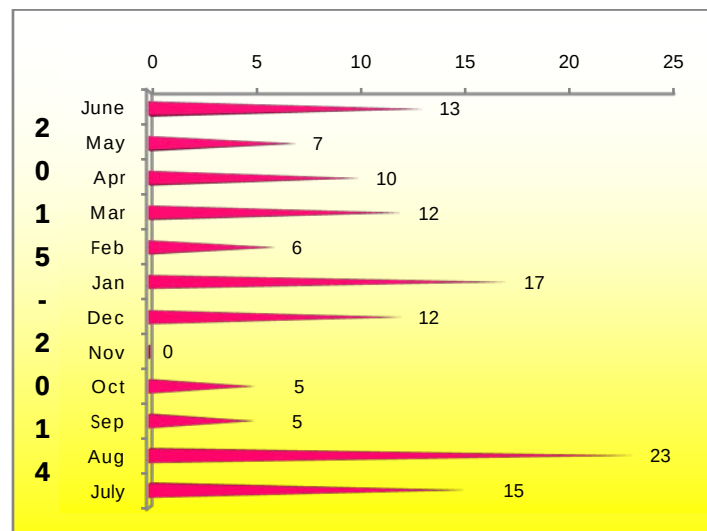


Figure 3.6: Month wise loss of supply incidents



3.3 Quality of Supply

As given in section 1.2.1 the quality of supply (QoS) is measured with reference to system voltage and system frequency. The analysis of QoS data as reported by the licensees is given hereunder;

3.3.1 System Voltage

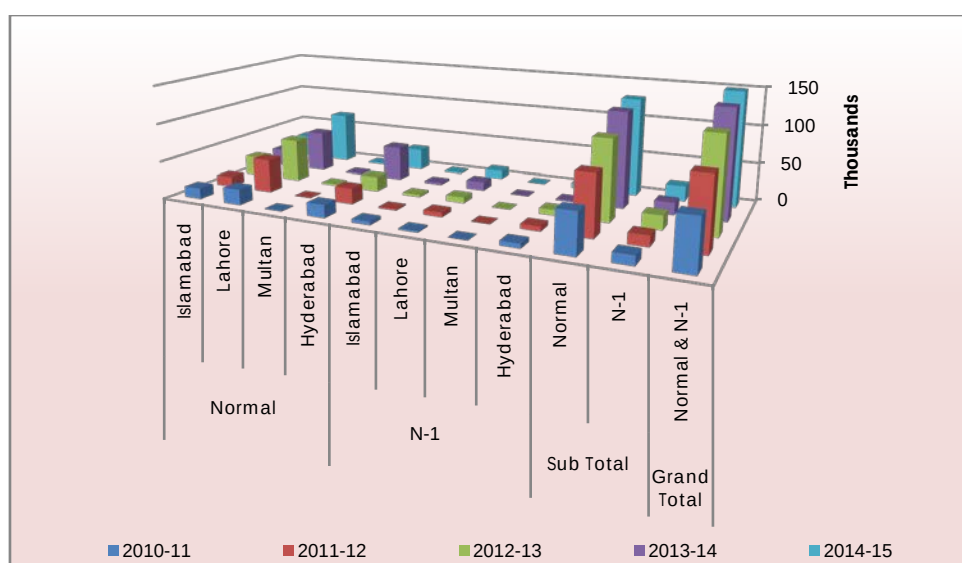
NTDC

The data as submitted by NTDC was analyzed and a total of 6.1% increase was observed in 'number of voltage variations violating criteria' in the year 2014-15 as compared to the year 2013-14 which indicates that NTDC has not carried out proper repair & maintenance activities during the reported period. NTDC was allowed Rs. 730 million under the head of repair & maintenance in its tariff determination for the year 2014-15. The following table and figure shows the historical overview of voltage variations in numbers.

Table 3.5: Number of voltage variations violating criteria⁴

Condition	Region	2010-11	2011-12	2012-13	2013-14	2014-15
Normal	Islamabad	14,081	13,413	26,142	22,717	30,165
	Lahore	20,570	44,172	56,937	54,262	68,552
	Multan	702	183	1,663	1,557	1,533
	Hyderabad	17,014	20,754	19,675	46,159	28,958
N-1	Islamabad	4,677	1,788	3,142	2,923	1,914
	Lahore	1,878	5,980	7,782	11,565	11,684
	Multan	-	-	-	12	-
	Hyderabad	5,770	6,241	7,499	1725	6,669
Sub Total	Normal	52,367	78,522	104,417	124,695	129,208
	N-1	12,325	14,009	18,423	16,225	20,267
Grand Total	Normal & N-1	64,692	92,531	122,840	140,920	149,475

Figure 3.7: Number of voltage variations violating criteria - NTDC



The region wise break up is shown in the following tables and figures.

⁴ Refer section 1.2.2

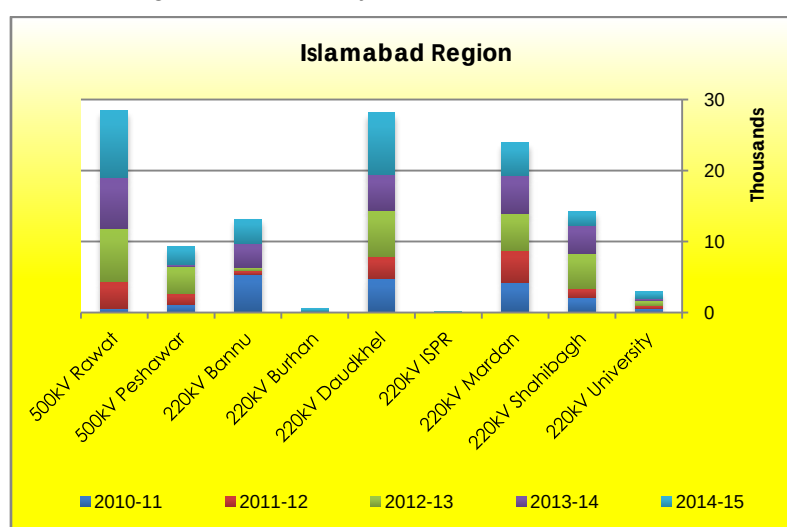
Table 3.6: Number of voltage variations violating criteria

Islamabad Region

Hints: The bold figures in red & green indicate the %age increase & decrease in number of variations w.r.t preceding years respectively.

S. No.	Grid Station	Number of Voltage Variations Violating Criteria					5 Years Average
		2010-11	2011-12	2012-13	2013-14	2014-15	
1	500 kV Rawat	611	3749 513	7473 99	7242 3	9376 30	5690
2	500 kV Peshawar	1108	1521 37	3808 150	335 91	2538 658	1862
3	220 kV Bannu	5388	473 91	502 6	3381 574	3413 1	2631
4	220 kV Burhan	76	8 89	30 275	73 143	422 478	122
5	220 kV Daudkhel	4725	3132 34	6582 110	4968 25	8714 75	5624
6	220 kV ISPR	27	77 185	13 83	19 46	9 53	29
7	220 kV Mardan	4189	4535 8	5244 16	5328 2	4653 13	4790
8	220 kV Shahibagh	2100	1288 39	4955 285	3930 21	1991 49	2853
9	220 kV University	534	418 22	677 62	364 46	963 165	591
Total		18758	15201 19	29284 93	25640 12	32079 25	2688

Figure 3.8: Number of voltage variations beyond the limits



The above table & figure shows the worst performance of 500 kV Rawat, 220 kV Daudkhel & 220 kV Mardan grid stations. Similarly, the variations for 220 kV Bannu and Shahibagh grid stations are also large in number. The detailed circuit wise analysis such as highest & lowest voltage recorded, time duration of variations, number of variations under normal and N-1 conditions for each grid station is given at appendix 1.

Table 3.7: Number of voltage variations violating criteria

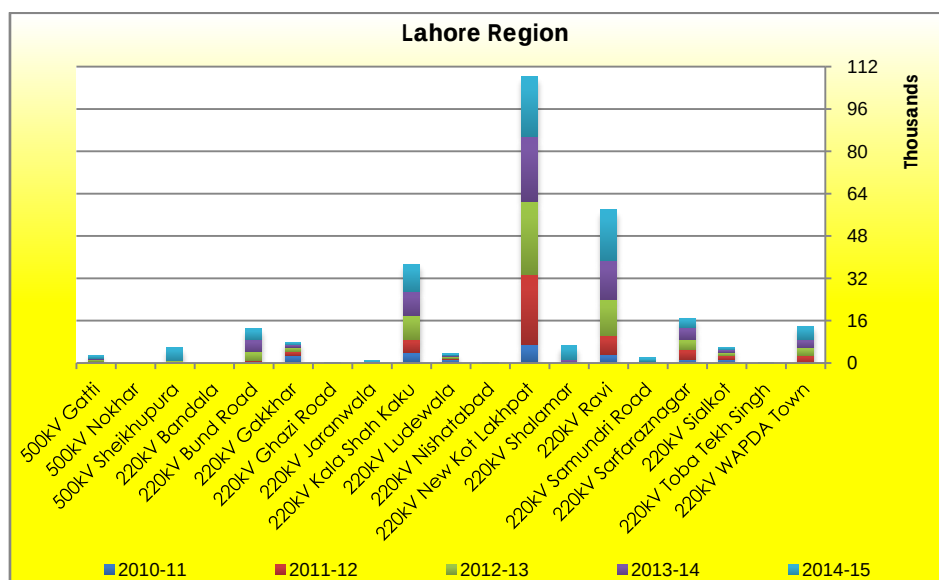
Lahore Region

Hints: The bold figures in red & green indicate the %age increase & decrease in number of variations w.r.t preceding years respectively.
†: Operational years average. NA: Not applicable.

S. No.	Grid Station	Number of Voltage Variations Violating Criteria						5 Years Average
		2010-11	2011-12	2012-13	2013-14	2014-15		
1	500 kV Gatti	294	416 41	789 90	335 58	1189 255		605
2	500 kV Nokhar	N o V i o l a t i o n						0
3	500 kV Sheikhpura	78	621 696	125 80	120 4	4837 3931		1156
4	220 kV Bandala	Commissioned/Energized on 26-06-2014					NA	NA
5	220 kV Bund Road	707	325 54	3278 907	4592 40	3844 16		2587
6	220 kV Gakkhar	2946	1445 51	1658 15	902 46	997 11		1590
7	220 kV Ghazi Road	Commissioned/Energized on 05-03-2014					61	61†
8	220 kV Jaranwala	70	19 73	222 1068	303 36	278 8		178
9	220 kV Kala Shah Kaku	3995	5014 26	8798 76	9120 4	10410 14		7467
10	220 kV Ludewala	1441	468 68	642 37	491 24	442 10		697
11	220 kV Nishatabad	148	- 100	- -	- -	20 -		34
12	220 kV New Kot Lakhpat	6937	26528 382	27430 3	24575 10	22707 8		21635
13	220 kV Shalamar	Commissioned/Energized on 05-03-2014			1321 -	5165 294		3243†
14	220 kV Ravi	3192	7070 122	13749 95	14693 7	19209 31		11583
15	220 kV Samundri Road	-	24 -	204 750	556 173	1160 109		389
16	220 kV Sarfaraznagar	1317	3752 185	3778 1	4572 21	3531 23		3390
17	220 kV Sialkot	1323	1533 16	1198 22	1031 14	982 5		1213
18	220 kV Toba Tekh Singh	Commissioned/Energized on 05-03-2014					241	241†
19	220 kV WAPDA Town	28-06-2011	2937 -	2848 3	3216 13	4976 55		3494†
Total		22448	50152 123	64719 29	65827 2	80236 22		3135

Table 3.7 shows that 220 kV New Kot Lakhpat, 220 kV Ravi, 220 kV Kala Shah Kaku, 220 kV WAPDA town, 220 kV Shalamar, 220 kV Sarfaraznagar & 220 kV Bund Road are the worst performing grid stations. It can also be noted that each year there is an increase in the number of variations which indicates poor performance of NTDC and it needs to be improved. Circuit wise detailed analysis for Lahore region is given at appendix 2. Figure 3.9 below shows graphically the number of variations;

Figure 3.9: Number of voltage variations outside the limits



The detail for Multan region is given below;

Table 3.8: Number of voltage variations violating criteria

Multan Region

Hints: The bold figures in red & green indicate the %age increase & decrease in number of variations w.r.t preceding years respectively.

†: Operational years average. NA: Not applicable

S. No.	Grid Station	Number of Voltage Variations Violating Criteria								5 Years Average	
		2010-11		2011-12		2012-13		2013-14			2014-15
1	500 kV D.G. Khan	Commissioned/Energized on 05-08-2014								14	14†
2	500 kV Multan	14	1	93	NIL	100	10	-	20	100	9
3	500 kV Muzaffargarh	N o V i o l a t i o n									0
4	500 kV Yousafwala	-	-	-	2	-	6	200	351	5750	72
5	220 kV Bahawalpur	31	135	336	15	89	421	2706	305	28	181
6	220 kV Kassowal	Commissioned/Energized on 15-07-2015									NA
7	220 kV Muzaffargarh	100	1	99	184	18300	-	100	4	-	58
8	220 kV Okara	Commissioned/Energized on 30-06-2014								75	75†
9	220 kV Vehari	557	46	92	1462	3078	1132	23	764	33	792
Total		702	183	74	1663	807	1569	6	1533	2	150

Table 3.7 above shows that as compared to other regions, Multan region has less number of variations and the grid stations are performing well. Please refer to appendix 3 for detailed circuit wise analysis of Multan region. Figure 3.9 below shows the variations graphically.

Figure 3.10: Number of voltage variations outside the limits

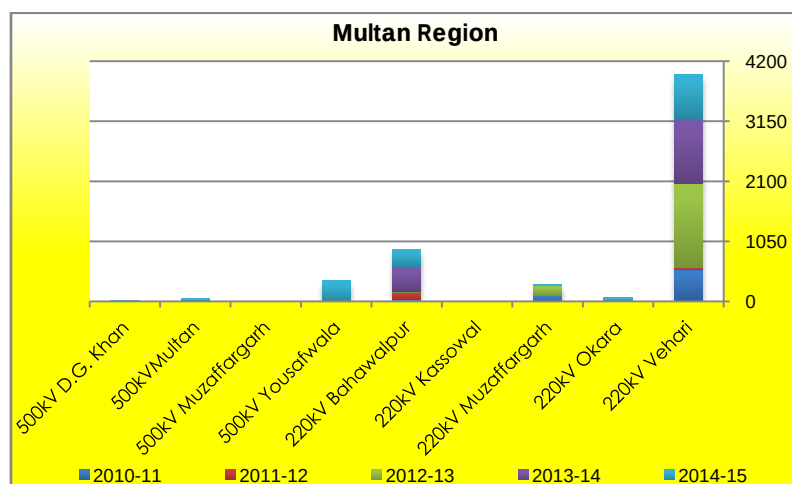


Table 3.9: Number of voltage variations violating criteria

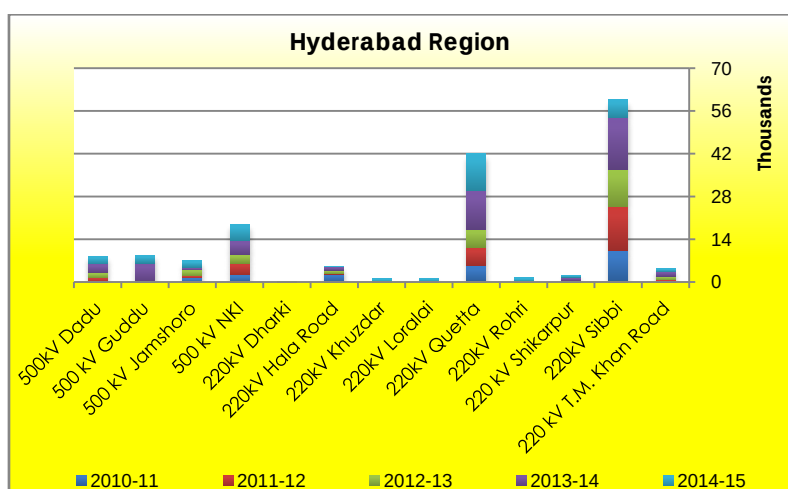
Hyderabad Region

Hints: The bold figures in red & green indicate the %age increase & decrease in number of variations w.r.t preceding years respectively.
†: Operational years average.

S. No.	Grid Station	Number of Voltage Variations Violating Criteria					5 Years Average
		2010-11	2011-12	2012-13	2013-14	2014-15	
1	500 kV Dadu	112	1315 1074	1651 26	2864 74	2525 36	1693
2	500 kV Guddu	N o V i o l a t i o n			6239 -	2538 59	4389†
3	500 kV Jamshoro	1375	673 51	1924 186	890 54	2112 137	1395
4	500 kV NKI Karachi	2337	3884 66	2738 30	4596 68	5389 17	3789
5	220 kV Dharki	50	11 78	21 91	- 100	- -	16
6	220 kV Hala Road	2624	206 92	1086 427	1086 0	162 85	1033
7	220 kV Khuzdar	Commissioned/Energized on 09-06-2014 & 24-08-2014					1140†
8	220 kV Loralai	Commissioned/Energized on 05-08-2014 & 29-08-2014					1322†
9	220 kV Quetta	5376	6032 12	5872 3	12636 115	12020 5	8387
10	220 kV Rohri	15	14 7	166 1086	90 46	1060 1078	269
11	220 kV Shikarpur	214	106 51	202 91	1108 449	572 48	440
12	220 kV Sibbi	10415	14302 37	12282 14	16841 37	5841 65	11936
13	220 kV T.M. Khan Road	266	452 70	1232 173	1534 25	946 38	886
Total		22784	26995 19	27174 1	47884 76	35627 26	4077

The table shows that 500 kV NKL Karachi, 220 kV Quetta and 220 kV Sibbi are the worst performing grid stations. Proper maintenance activities shall be carried out to minimize the voltage fluctuation level. The detailed circuit wise analysis for this region can be found at appendix 4. Figure 3.10 below shows the variations graphically.

Figure 3.11: Number of voltage variations outside the limits



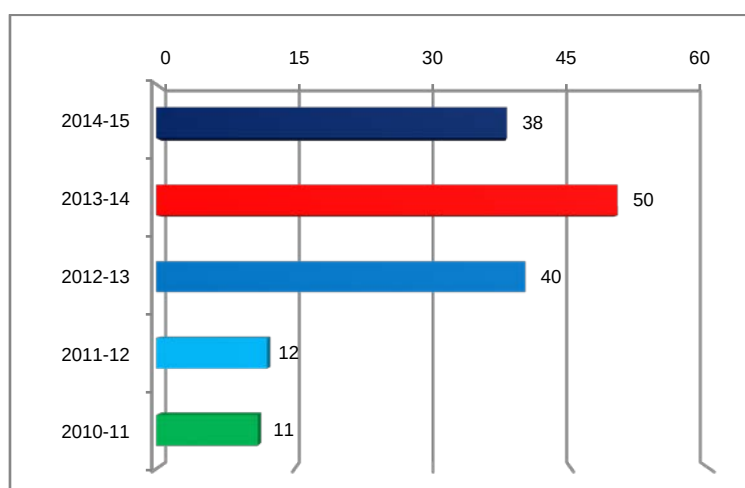
K-Electric

The system voltage data as submitted by K-Electric has also been evaluated and has revealed that the 'number of voltage variations violating criteria' has been reduced by 25% as compared to preceding year. Moreover, there is no any violation at 220 kV level under both normal and N-1 conditions. However, the duration of variation outside the limits has not been reported by K-Electric. The following table & figure shows the reported voltage variations data for K-Electric whereas, the circuit wise detail is given at appendix 5.

Table 3.10: K-Electric Number of voltage variations outside the limits

2010-11	2011-12	2012-13	2013-14	2014-15
11	12	40	50	38

Figure 3.12: K-Electric Number of voltage variations outside the limits



3.3.2 System Frequency

The data as submitted by both NTDC & K-Electric has been analyzed and it has been found that a total of 1264 times and 2.86% of the reported period the frequency remained outside the prescribed limits ⁵ as reported by NTDC. For detail refer the following tables.

Table 3.11: NTDC system frequency details

Number of times frequency remained outside the limits			Time duration the frequency remained outside the limits			Maximum continuous period of deviation	
year	average/month	average/day	days	hours	% of year	hours	minutes
1264	105	3.5	10.43	250.33	2.86	2.48	149

Month wise break up and other detail is given in table 3.12 below;

Table 3.12: NTDC system frequency, 2014-15

Month ¹	Number of days/hours for a month over a year ²		Frequency recorded (Hz) ³		Duration of variation ⁴		Variation (%) ^{5=(4÷2)×100}	Number of times frequency remained outside the limits ⁶
	Days	Hours	Highest	Lowest	Minutes	Hours		
July	31	744	50.71	48.74	1913	31.88	4.29	165
Aug	31	744	50.68	48.91	1692	28.2	3.79	142
Sep	30	720	50.55	48.93	1087	18.12	2.52	102
Oct	31	744	50.69	48.99	462	7.7	1.03	43
Nov	30	720	50.62	48.83	1185	19.75	2.75	98
Dec	31	744	58.63	45	2360	39.33	5.29	184
Jan	31	744	54.69	45	3791	63.18	8.49	303
Feb	28	672	49.49	49.06	234	3.9	0.58	20
Mar	31	744	50.65	49.11	840	14	1.88	72
Apr	30	720	50.66	49.02	1235	20.58	2.86	111
May	31	744	50.69	49.2	199	3.32	0.45	22
June	30	720	50.68	50.51	22	0.37	0.05	2
Year	365	8760	58.63	45	15020	250.33	2.86	1264

The reasons for the frequency fluctuations as reported by NTDC are short fall in generation, violation by DISCOs in load drawl, frequency control through operational margin/ and or emergency (forced) load shedding. System collapses and splitting of network have also been reported. The detail of which is given in table 3.13 below;

Table 3.13: NTDC system collapses and network splitting, 2014-15

S.No.	Date DD-MM-YYYY	Frequency Recorded (Hz)		Duration of variation		Remarks
		Highest	Lowest	Minutes	Hours	
1	12 - 12 - 2014	58.63	47.97	63	1.05	Partial system collapse
2	22 - 12 - 2014	49.47	49.24	24	0.4	Splitting of network
3	08 - 01 - 2015	51.62	45	101	1.68	Partial system collapse
4	08 - 01 - 2015	51.22	50.51	27	0.45	Partial system collapse
5	21 - 01 - 2015	49.49	49.11	37	0.62	Partial system collapse

⁵ Refer section 1.2.3

6	24 - 01 - 2015	54.69	46.26	149	2.48	Partial system collapse
7	25 - 01 - 2015	49.45	48.83	9	0.15	Partial system collapse
8	25 - 01 - 2015	54.02	46.76	13	0.22	Partial system collapse
9	25 - 01 - 2015	49.18	47.43	7	0.12	Partial system collapse
10	25 - 01 - 2015	49.27	45	21	0.35	Partial system collapse

From all above it can be said that NTDC has network constraints for evacuation of power i.e. the inconsistency of interconnection facility with the power generation schemes, its inability of load management and improper maintenance of equipments and grid stations. Measures/steps shall be taken by NTDC to avoid any undesirable impact on the system.

Neither the 'duration of variation' as required in form-5 of appendix-1 to PSTR 2005 nor the detail of 'number of times the frequency remained outside the limits' has been provided by K-Electric. Similarly other details as given in table 3.11 have not been reported by K-Electric. The reported data of K-Electric for the year 2014-15 is given below in table 3.14.

Table 3.14: K-Electric system frequency, 2014-15

Month	Frequency recorded (Hz)		Duration of variation		Variation w.r.t 50 Hz (%)	
	Highest	Lowest	Minutes	Hours	Highest	Lowest
July	50.58	48.97	N o t P r o v i d e d		1.16	2.06
Aug	50.64	49.1			1.28	1.80
Sep	50.51	49.13			1.02	1.74
Oct	50.53	49.18			1.06	1.64
Nov	50.55	48.94	P r o v i d e d		1.10	2.12
Dec	50.82	49.15			1.64	1.70
Jan	50.54	49.07			1.08	1.86
Feb	50.51	49.39			1.02	1.22
Mar	50.58	49.26			1.16	1.48
Apr	50.51	49.26			1.02	1.48
May	50.57	49.29			1.14	1.42
June	50.52	49.32			1.04	1.36

The figures below show NTDC & K-Electric month wise reported highest & lowest frequency for the year 2014-15. The dotted red line shows the prescribed limit as per PSTR 2005. For historical data as reported by NTDC & K-Electric see appendix 6.

Figure 3.13: Highest frequency of the licensees

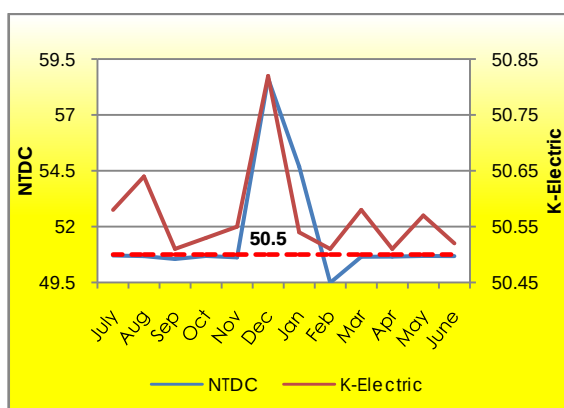
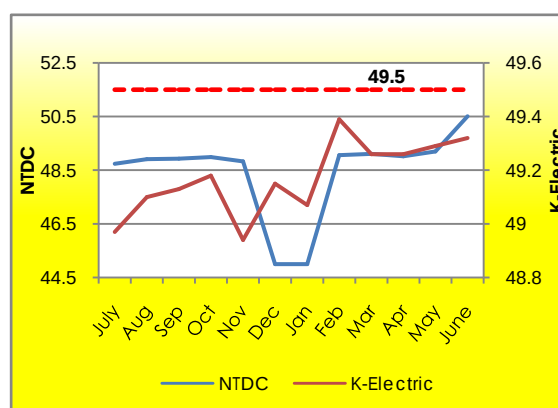


Figure 3.14: Lowest frequency of the licensees



Appendix 1

QoS data - detailed circuit wise analysis

NTDC Islamabad Region

1. 500 kV Rawat	1 of 9
2. 500 kV Peshawar	2 of 9
3. 220 kV Bannu	3 of 9
4. 220 kV Burhan	4 of 9
5. 220 kV Daudkhel.....	5 of 9
6. 220 kV ISPR (Sangjani).....	6 of 9
7. 220 kV Mardan	7 of 9
8. 220 kV Shahibagh	8 of 9
9. 220 kV University	9 of 9

NTDC Islamabad Region

1. 500kV Grid Station RAWAT

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Rawat - Barotha Ckt I & II	1	3	19	22	196	530	60	530	60	538	60	530	60	537	30	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	500 kV Rawat - Gakkhar Ckt I & II	1	3	19	22	196	530	60	530	60	538	60	530	60	537	30	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	500 kV Rawat - Tarbela	1	3	19	22	148	530	60	533	60	538	60	530	60	537	30	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Rawat - ISPR Ckt I & II	—	935	1850	1794	2211	—	—	239	60	241	120	240	60	241	120	—	—	—	—	—	—	—	—	—	—
N-1		—	—	4	—	—	—	—	—	—	245	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Rawat - Mangla Ckt I & II	608	935	1850	1794	2206	239	60	—	—	241	120	240	60	241	120	—	—	—	—	—	—	—	—	—	—
N-1		—	—	4	—	—	—	—	—	—	245	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Rawat - Bahria Town Ckt I & II	—	935	1850	1794	2211	—	—	—	—	—	—	240	60	241	120	—	—	—	—	—	—	—	—	—	—
N-1		—	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Rawat - University Ckt I & II	—	935	1850	1794	2208	—	—	—	—	241	120	240	60	241	120	—	—	—	—	—	—	—	—	—	—
N-1		—	—	4	—	—	—	—	—	—	245	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total No. of Variations - Normal	611	3749	7457	7242	9376
Total No. of Variations - N-1	—	—	16	—	—
Total of Normal & N-1	611	3749	7473	7242	9376

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	241	120	—	—
500kV	537	30	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—
500kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Islamabad Region

2. 500kV Grid Station SHEIKH MUHAMMADI PESHAWAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV	–	5	12	NP	–	–	–	–	531	60	NP				–	–	470	60	–	–	NP				
N-1	Tarbela - Peshawar	–	–	–		–	–	–	–	–	–					–	–	–	–	–	–					–
Normal	220 kV	352	607	1337	116	818	240	60	241	60	241	120	235	60	240	60	198	240	198	120	199	60	200	180	200	60
N-1	Barotha - Peshawar	104	10	27	5	95	–	–	–	–	246	60	–	–	–	–	178	60	180	120	174	60	190	60	180	60
Normal	220 kV	162	445	1271	89	711	238	60	240	60	241	120	238	60	241	60	198	60	198	60	199	60	200	60	–	–
N-1	Peshawar - Daudkhel Ckt I & II	197	12	30	6	2	–	–	–	–	246	60	–	–	243	60	176	60	180	120	172	60	190	120	195	60
Normal	220 kV	168	425	1106	114	817	237	180	239	60	241	60	235	60	240	60	198	120	198	120	200	60	200	60	200	60
N-1	Peshawar - Shahibagh	125	17	25	5	95	–	–	–	–	245	60	–	–	–	–	176	60	179	120	23	60	190	60	180	60

NP: Not Provided

Total No. of Variations - Normal	682	1,482	3,726	319	2,346
Total No. of Variations - N-1	426	39	82	16	192
Total of Normal & N-1	1,108	1,521	3,808	335	2,538

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	243	60	–	–
500kV	NP	NP	NP	NP

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	200	60	180	60
500kV	NP	NP	NP	NP

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Islamabad Region 3. 220kV Grid Station BANNU

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Daudkhel - Bannu Ckt I & II	3528	366	348	1743	2424	240	60	243	60	241	600	242	60	241	60	298	60	260	300	298	60	195	60	199	60
N-1		1860	107	154	1638	989	199	60	250	60	295	300	248	60	243	60	155	60	178	540	180	900	172	60	170	60

Total No. of Variations - Normal	3,528	366	348	1,743	2,424
Total No. of Variations - N-1	1,860	107	154	1,638	989
Total of Normal & N-1	5,388	473	502	3,381	3,413

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	241	60	243	60

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	199	60	170	60

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Islamabad Region

4. 220kV Grid Station BURHAN

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Burhan - ISPR Ckt I & II	38	4	30	38	211	—	—	—	—	240	60	236	60	237	60	202	180	203	60	204	60	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Burhan - Tarbela Ckt I & II	38	4	NP	35	211	—	—	—	—	NP		236	60	237	60	202	180	203	60	NP		—	—	—	—
N-1		—	—		—	—	—	—	—	—			—	—	—	—	—	—	—	—			—	—	—	—

NP : Not Provided

Total No. of Variations - Normal	76	8	30	73	422
Total No. of Variations - N-1	—	—	—	—	—
Total of Normal & N-1	76	8	30	73	422

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	237	60	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Islamabad Region

5. 220kV Grid Station DAUDKHEL

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Daudkhel - Peshawar Ckt I & II	1412	923	2176	1569	3445	244	60	242	60	240	60	241	60	242	60	198	120	198	120	202	60	200	120	198	60
N-1		323	121	92	87	59	248	60	243	60	244	60	246	60	248	60	171	60	175	60	—	—	184	60	186	60
Normal	220 kV Daudkhel - Chashma Ckt I & II	1097	898	1834	1569	1664	244	60	242	60	241	180	241	60	242	60	198	120	198	120	199	60	200	120	198	60
N-1		162	143	91	87	47	248	60	244	60	250	60	246	60	248	60	171	60	175	60	184	60	184	60	186	60
Normal	220 kV Daudkhel - Bannu Ckt I & II	1412	926	2294	1569	3440	248	60	242	60	241	180	241	60	237	60	198	120	198	120	199	60	200	120	198	60
N-1		319	121	95	87	59	246	60	244	60	250	60	246	60	248	60	171	60	175	60	184	60	184	60	186	60

Total No. of Variations - Normal	3,921	2,747	6,304	4,707	8,549
Total No. of Variations - N-1	804	385	278	261	165
Total of Normal & N-1	4,725	3,132	6,582	4,968	8,714

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	242	60	248	60

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	198	60	186	60

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Islamabad Region
6. 220kV Grid Station ISPR (SANGJANI)

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV ISPR - Mansehra Ckt I	—	—	2	1	3	—	—	—	—	233	120	232	120	232	120	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV ISPR - Burhan	8	—	1	1	2	—	—	—	—	231	60	232	60	232	150	202	420	—	—	205	120	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV ISPR - Tarbela	13	21	4	6	—	—	—	—	—	—	—	—	—	—	—	202	240	204	120	201	480	205	60	209	60
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV ISPR - Bahria Town	—	14	3	6	2	—	—	—	—	—	—	—	—	232	60	—	—	204	120	200	180	205	180	205	180
N-1		—	14	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	204	120	—	—	—	—	—	—
Normal	220 kV ISPR - Rawat	6	14	3	5	2	—	—	—	—	—	—	—	—	232	60	202	60	204	120	200	180	205	180	205	180
N-1		—	14	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	204	120	—	—	—	—	—	—

Total No. of Variations - Normal	27	49	13	19	9
Total No. of Variations - N-1	—	28	—	—	—
Total of Normal & N-1	27	77	13	19	9

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	232	150	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	205	180	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Islamabad Region

7. 220kV Grid Station MARDAN

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV	3451	3401	1925	1600	1356	—	—	290	60	—	—	—	—	—	—	192	60	188	120	199	240	200	540	199	120
N-1	Tarbela - Mardan Ckt I & II	738	1134	1267	176	139	—	—	—	—	—	—	—	—	—	—	182	60	170	60	170	120	182	60	180	240
Normal	220 kV	—	—	899	1600	1358	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	200	540	199	120
N-1	Mardan - Barotha Ckt I & II	—	—	128	176	137	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	182	60	180	240
Normal	220 kV	—	—	896	1600	1520	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	200	540	199	60
N-1	Mardan - Shahibagh Ckt I & II	—	—	129	176	143	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	182	60	181	60

Total No. of Variations - Normal	3,451	3,401	3,720	4,800	4,234
Total No. of Variations - N-1	738	1,134	1,524	528	419
Total of Normal & N-1	4,189	4,535	5,244	5,328	4,653

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	199	120	180	240

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%	10%	5%	10%
220kV	231	209	242	198

NTDC Islamabad Region
8. 220kV Grid Station NEW SHAHIBAGH PESHAWAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV	335	571	40	NP	241	60	242	60	241	180	NP				200	300	199	60	199	60	NP				
N-1	Shahibagh - Barotha	57	7	5		—	—	—	—	248	60					181	60	190	60	180	60					
Normal	220 kV	458	311	968	1331	NP	—	—	—	—	—	—	—	—	—	200	180	199	60	199	300	200	420	NP	NP	
N-1	Shahibagh - Peshawar Ckt I	396	44	341	130	NP	—	—	—	—	—	—	—	—	—	180	240	185	60	178	60	170	120	NP	NP	
Normal	220 kV	458	311	968	1331	1637	—	—	—	—	—	—	—	—	—	200	180	199	60	199	300	200	420	199	60	
N-1	Shahibagh - Peshawar Ckt II	396	44	341	130	52	—	—	—	—	—	—	—	—	—	180	240	185	60	178	60	170	120	181	60	
Normal	220 kV	NP		946	395	206	NP				—	—	238	240	—	—	NP				—	—	—	—	199	60
N-1	Shahibagh - Mardan Ckt I			200	109	96					—	—	—	—	—	—					—	175	60	180	60	
Normal	220 kV	NP		946	395	NP	NP				—	—	238	240	NP		NP				—	—	—	—	NP	
N-1	Shahibagh - Mardan Ckt II			200	109						—	—	—	—							—	—	175	60		

NP: Not Provided

Total No. of Variations - Normal	1,251	1,193	3,868	3,452	1,843
Total No. of Variations - N-1	849	95	1,087	478	148
Total of Normal & N-1	2,100	1,288	4,955	3,930	1,991

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	199	60	180	60

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Islamabad Region

9. 220kV Grid Station UNIVERSITY

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV University - Rawat Ckt I & II	534	418	676	362	962	240	60	240	60	241	60	240	60	241	60	—	—	—	—	—	—	232	120	—	—
N-1		—	—	1	2	1	—	—	—	—	245	60	242	60	243	60	—	—	—	—	—	—	—	—	—	—

Total No. of Variations - Normal	534	418	676	362	962
Total No. of Variations - N-1	—	—	1	2	1
Total of Normal & N-1	534	418	677	364	963

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	241	60	243	60

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

Appendix 2

QoS data - detailed circuit wise analysis

NTDC Lahore Region

1. 500 kV Gatti.....	1 of 19
2. 500 kV Nokhar.....	2 of 19
3. 500 kV Sheikhupura.....	3 of 19
4. 220 kV Bandala.....	4 of 19
5. 220 kV Bund Road.....	5 of 19
6. 220 kV Gakkhar.....	6 of 19
7. 220 kV Ghazi Road.....	7 of 19
8. 220 kV Jaranwala.....	8 of 19
9. 220 kV Kala Shah Kaku.....	9 of 19
10. 220 kV Ludewala.....	10 of 19
11. 220 kV Nishatabad.....	11 of 19
12. 220 kV New Kot Lakhat.....	12 of 19
13. 220 kV New Shalamar.....	13 of 19
14. 220 kV Ravi.....	14 of 19
15. 220 kV Samundri Road.....	15 of 19
16. 220 kV Sarfaraznagar.....	16 of 19
17. 220 kV Sialkot.....	17 of 19
18. 220 kV Toba Tek Singh.....	18 of 19
19. 220 kV WAPDA Town.....	19 of 19

NTDC Lahore Region

1. 500kV Grid Station GATTI FAISALABAD

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Gatti - Barotha Ckt I	–	–	3	NP		–	–	–	–	530	120	–	–	NP		–	–	–	–	–	–	–	–	NP	
N-1		–	–	–			–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–		
Normal	500 kV Gatti - Barotha Ckt II	2	1	12	4	2	530	90	530	90	535	60	530	90	528	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gatti - Muzaffargarh	180	286	169	140	358	540	300	542	120	540	120	535	90	545	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gatti - Rousch	30	22	83	17	137	540	90	540	60	540	120	538	60	540	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gatti - Multan	58	88	447	155	621	540	300	540	90	545	60	540	300	547	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gatti - Lahore	24	19	75	19	71	538	360	540	60	540	60	532	90	540	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

NP: Not Provided

Total No. of Variations - Normal	294	416	789	335	1,189
Total No. of Variations - N-1	–	–	–	–	–
Total of Normal & N-1	294	416	789	335	1,189

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
500kV	547	60	–	–

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
500kV	–	–	–	–

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Lahore Region

2. 500kV Grid Station NOKHAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Gakkhar - Rawat 1	No Violation					Within Limits										Within Limits									
N-1																										
Normal	500 kV Gakkhar - Rawat 2	No Violation					Within Limits										Within Limits									
N-1																										
Normal	500 kV Gakkhar - Lahore 1	No Violation					Within Limits										Within Limits									
N-1																										
Normal	500 kV Gakkhar - Lahore 2	No Violation					Within Limits										Within Limits									
N-1																										
Normal	220 kV Nokhar - Mangla	No Violation					Within Limits										Within Limits									
N-1																										
Normal	220 kV Nokhar - Gakkhar	No Violation					Within Limits										Within Limits									
N-1																										

Total No. of Variations - Normal	No violation
Total No. of Variations - N-1	
Total of Normal & N-1	

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	Within Limits			
500kV				

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	Within Limits			
500kV				

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Lahore Region 3. 500kV Grid Station SHEIKHUPURA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV	—	2	—	—	129	—	—	530	30	—	—	—	—	536	60	—	—	472	30	—	—	—	—	—	—
N-1	Sheikhupura - Yousafwala	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	500 kV	—	2	—	—	129	—	—	530	30	—	—	—	—	536	60	—	—	472	30	—	—	—	—	—	—
N-1	Sheikhupura - Gatti	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	500 kV	—	2	—	—	129	—	—	530	30	—	—	—	—	536	60	—	—	472	30	—	—	—	—	—	—
N-1	Sheikhupora - Nokhar Ckt I & II	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	220 kV	Commissioned /Energized on 28-06-2011	NP	25	23	887	Commissioned /Energized on 28-06-2011	NP		—	—	—	—	—	—	Commissioned /Energized on 28-06-2011	NP		198	120	200	90	198	30		
N-1	Sheikhupura - WTN			—	1	3				—	—	—	—	—	—				—	—	—	—	—	—	—	—
Normal	220 kV	26	205	25	23	887	237	1020	236	30	233	60	—	—	—	—	205	480	198	30	198	120	200	90	198	30
N-1	Sheikhupura - NKLP Ckt I & II	—	—	—	1	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	197	90	195	60	
Normal	220 kV	26	205	25	23	887	237	1020	236	30	233	60	—	—	—	—	205	480	198	30	198	120	200	90	198	30
N-1	Sheikhupura - Bund Road Ckt I, II, III & IV	—	—	—	1	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	197	90	195	60	
Normal	220 kV	26	205	25	23	887	237	1020	236	30	233	60	—	—	—	—	205	480	198	30	198	120	200	90	198	30
N-1	Sheikhupura - Ravi Ckt I & II	—	—	—	1	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	197	90	195	60	
Normal	220 kV	NP		25	23	887	NP				—	—	—	—	—	—	NP				198	120	200	90	198	30
N-1	Sheikhupura - ATLAS P/H			—	1	3					—	—	—	—	—	—					—	—	—	—	—	—

NP: Not Provided

WTN: WAPDA Town

NKLP: New Kot Lakhpat

P/H: Power House

Total No. of Variations - Normal	78	621	125	115	4,822
Total No. of Variations - N-1	—	—	—	5	15
Total of Normal & N-1	78	621	125	120	4,837

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—
500kV	536	60	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	198	30	195	60
500kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Lahore Region

4. 220kV Grid Station BANDALA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Bandala - KSK 1	Commissioned/Energized on 26-06-2014				NA	Commissioned/Energized on 26-06-2014								NA	NA	Commissioned/Energized on 26-06-2014								NA	NA
N-1						NA									NA	NA									NA	
Normal	220 kV Bandala - KSK 2	Commissioned/Energized on 26-06-2014				NA	Commissioned/Energized on 26-06-2014								NA	NA	Commissioned/Energized on 26-06-2014								NA	NA
N-1						NA									NA	NA									NA	
Normal	220 kV Bandala - Gatti 1	Commissioned/Energized on 26-06-2014				NA	Commissioned/Energized on 26-06-2014								NA	NA	Commissioned/Energized on 26-06-2014								NA	NA
N-1						NA									NA	NA									NA	
Normal	220 kV Bandala - Gatti 2	Commissioned/Energized on 26-06-2014				NA	Commissioned/Energized on 26-06-2014								NA	NA	Commissioned/Energized on 26-06-2014								NA	NA
N-1						NA									NA	NA									NA	

NA: Not Applicable

KSK: Kala Shah Kaku

Total No. of Variations - Normal	Commissioned/Energized on 26-06-2014	NA
Total No. of Variations - N-1		NA
Total of Normal & N-1		NA

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	NA	NA	NA	NA

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	NA	NA	NA	NA

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Lahore Region

5. 220kV Grid Station BUND ROAD LAHORE

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV	707	325	3228	4413	3844	242	90	234	30	–	–	–	–	–	–	203	60	196	60	196	60	195	150	182	30
N-1	Bus Bar No. 1 & 2	–	–	50	161	187	–	–	–	–	–	–	–	–	–	–	–	–	–	195	90	195	120	191	60	

Total No. of Variations - Normal	707	325	3,228	4,438	3,844
Total No. of Variations - N-1	–	–	50	154	187
Total of Normal & N-1	707	325	3,278	4,592	4,031

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	–	–	–	–

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	182	30	191	60

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Lahore Region

6. 220kV Grid Station GAKKHAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Gakkhar - Mangla Ckt I	649	357	393	148	183	—	—	—	—	—	—	—	—	—	190	60	198	180	199	60	204	280	198	60	
N-1		166	28	7	25	6	—	—	—	—	—	—	—	—	—	176	60	182	30	193	60	185	60	193	60	
Normal	220 kV Gakkhar - Mangla Ckt II	514	266	390	224	288	—	—	—	—	260	120	280	60	—	—	198	180	198	360	107	120	198	120	198	60
N-1		159	70	39	52	24	—	—	—	—	—	—	—	—	—	172	30	85	120	182	30	186	60	190	60	
Normal	220 kV Gakkhar - Mangla Ckt III	294	NP	NP	NP	NP	294	60	—	—	—	—	—	—	NP	NP	191	30	—	—	—	—	—	—	NP	NP
N-1		135	NP	NP	NP	NP	—	—	—	—	—	—	—	—	NP	NP	172	30	—	—	—	—	—	—	NP	NP
Normal	220 kV Gakkhar - Sialkot	628	358	390	148	182	—	—	—	—	—	—	—	—	—	198	120	191	60	199	60	198	60	193	60	
N-1		159	30	9	25	5	—	—	—	—	—	—	—	—	—	176	60	182	30	193	60	185	60	190	60	
Normal	220 kV Gakkhar - Nokhar	—	—	391	—	NP	—	—	—	—	—	—	—	—	NP	NP	—	—	—	—	107	120	—	—	NP	NP
N-1		—	—	39	—	NP	—	—	—	—	—	—	—	—	NP	NP	—	—	—	—	182	30	—	—	NP	NP
Normal	220 kV Old Gakkhar - New Gakkhar	218	266	NP	226	285	—	—	—	—	—	—	—	—	—	198	180	198	360	—	—	198	120	198	60	
N-1		24	70	NP	54	24	—	—	—	—	—	—	—	—	—	190	60	85	120	—	—	186	60	190	60	

NP: Not Provided

Total No. of Variations - Normal	2,303	1,247	1,564	746	938
Total No. of Variations - N-1	643	198	94	156	59
Total of Normal & N-1	2,946	1,445	1,658	902	997

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	193	60	190	60

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Lahore Region

7. 220kV Grid Station GHAZI ROAD LAHORE

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV	Commissioned/Energized on				61	Commissioned/Energized on								–	–	Commissioned/Energized on								202	30
N-1	KSK - Shalamar Via Ghazi	05-03-2014				–	05-03-2014								–	–	05-03-2014								–	–

Total No. of Variations - Normal	Commissioned/Energized on 05-03-2014	61
Total No. of Variations - N-1		–
Total of Normal & N-1		61

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	–	–	–	–

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	202	30	–	–

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Lahore Region

8. 220kV Grid Station JARANWALA ROAD FAISALABAD

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Jaranwala - Gatti Ckt I & II	70	19	222	303	278	235	90	236	45	240	40	237	60	238	34	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total No. of Variations - Normal	70	19	222	303	278
Total No. of Variations - N-1	—	—	—	—	—
Total of Normal & N-1	70	19	222	303	278

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	238	34	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Lahore Region

9. 220kV Grid Station KALA SHAH KAKU

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Kala Shah Kaku - Gatti Ckt I & II	836	678	2041	2040	NP	—	—	—	—	—	—	—	—	NP	NP	196	60	198	120	198	120	198	120	NP	NP
N-1		42	45	17	19	NP	—	—	—	—	—	—	—	—	NP	NP	193	120	188	60	194	60	194	60	NP	NP
Normal	220 kV Kala Shah Kaku - Mangla Ckt I, II & III	541	1195	1634	1632	1048	232	30	—	—	—	—	—	—	—	—	197	60	198	150	198	60	197	60	196	60
N-1		10	43	7	6	46	232	30	—	—	—	—	—	—	—	—	196	30	182	30	193	60	193	60	187	60
Normal	220 kV Kala Shah Kaku - Bund Road Ckt I & II	465	1336	1536	1535	1287	—	—	—	—	—	—	—	—	—	—	196	30	198	150	198	180	198	60	189	60
N-1		14	51	6	6	78	232	120	—	—	—	—	—	—	—	—	196	120	188	120	195	60	195	60	190	60
Normal	220 kV Kala Shah Kaku - Ravi Ckt I & II	1113	437	1809	1819	1752	—	—	—	—	—	—	—	—	—	—	198	150	198	120	198	180	198	420	195	60
N-1		154	23	116	117	288	—	—	—	—	—	—	—	—	—	—	190	90	182	30	188	60	190	240	188	60
Normal	220 kV Kala Shah Kaku - Sialkot	787	1140	1592	1830	1809	—	—	—	—	—	—	—	—	—	—	198	90	198	120	196	90	195	60	198	210
N-1		33	66	40	116	172	—	—	—	—	—	—	—	—	—	—	192	30	188	120	192	60	190	60	184	60
Normal	220 kV Kala Shah Kaku - Shalamar	Commissioned/Energized on 05-03-2014				1731	Commissioned/Energized on 05-03-2014								—	—	Commissioned/Energized on 05-03-2014								197	60
N-1						294									—	—									188	60
Normal	220 kV Kala Shah Kaku - Bandala Ckt I & II	Commissioned/Energized on 26-06-2014				1786	Commissioned/Energized on 26-06-2014								—	—	Commissioned/Energized on 26-06-2014								190	60
N-1						119									—	—									185	60

NP: Not Provided

NE: Not Existing

Total No. of Variations - Normal	3,742	4,786	8,612	8,856	9,413
Total No. of Variations - N-1	253	228	186	264	997
Total of Normal & N-1	3,995	5,014	8,798	9,120	10,410

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	189	60	184	60

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Lahore Region

10. 220kV Grid Station LUDEWALA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Gatti - Ludewala Ckt I & II	1214	414	639	435	351	234	30	233	90	242	210	244	60	239	90	190	60	198	90	150	150	208	60	208	150
N-1		227	54	3	4	—	—	—	—	—	248	90	—	—	—	—	175	30	186	60	190	60	—	—	—	—
Normal	220 kV Chashma - Ludewala Ckt I & II	—	—	—	52	91	—	—	—	—	—	—	237	150	238	120	—	—	—	—	—	—	202	60	199	60
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total No. of Variations - Normal	1,214	414	639	487	442
Total No. of Variations - N-1	227	54	3	4	—
Total of Normal & N-1	1441	468	642	491	442

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	239	90	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	199	60	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Lahore Region

11. 220kV Grid Station NISHATABAD FAISALABAD

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Nishatabad - Gatti Ckt I	37	—	—	—	5	235	120	—	—	—	—	—	—	234	90	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Nishatabad - Gatti Ckt II	37	—	—	—	5	235	120	—	—	—	—	—	—	234	90	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Nishatabad - Samundri Road Ckt I	37	—	—	—	5	235	120	—	—	—	—	—	—	234	90	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Nishatabad - Samundri Road Ckt II	37	—	—	—	5	235	120	—	—	—	—	—	—	234	90	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total No. of Variations - Normal	148	—	—	—	20
Total No. of Variations - N-1	—	—	—	—	—
Total of Normal & N-1	148	—	—	—	20

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	234	90	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Lahore Region
12. 220kV Grid Station NEW KOT LAKHPAT

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV NKLP - BDR - 1	2209	5297	5743	3424	3728	—	—	—	—	—	—	—	—	—	—	198	180	198	240	198	180	198	300	198	120
N-1		70	1741	1854	2422	2217	—	—	—	—	—	—	—	—	—	—	190	120	175	60	183	60	179	30	182	30
Normal	220 kV NKLP - BDR - 2	2209	5297	5743	3424	3728	—	—	—	—	—	—	—	—	—	—	198	180	198	240	198	180	198	300	198	120
N-1		70	1741	1854	2422	2217	—	—	—	—	—	—	—	—	—	—	190	120	175	60	183	60	179	30	182	30
Normal	220 kV NKLP - SKP Ckt I & II	999	2606	2484	3078	2652	—	—	—	—	234	30	240	30	235	30	195	30	198	90	198	60	198	120	198	120
N-1		50	60	164	341	222	240	60	—	—	—	—	—	—	—	—	190	30	185	60	188	30	185	30	190	60
Normal	220 kV NKLP - SNR Ckt I & II	1251	4660	4227	3690	3254	—	—	—	—	—	—	233	60	—	—	197	60	198	210	195	30	198	180	190	120
N-1		79	461	732	1046	759	233	60	—	—	—	—	—	—	—	—	191	60	180	60	185	60	183	60	187	30
Normal	220 kV NKLP - WTN	—	4338	3971	3671	3215	—	—	—	—	—	—	233	60	—	—	—	—	198	180	198	180	198	240	198	180
N-1		—	327	658	1057	715	—	—	—	—	—	—	—	—	—	—	—	—	181	60	184	60	181	30	186	30

SNR: Sarfaraznagar

YSW: Yousafwala

NKLP: New Kot Lakhpat

Total No. of Variations - Normal	6,668	22,198	22,168	17,287	16,577
Total No. of Variations - N-1	269	4,330	5,262	7,288	6,130
Total of Normal & N-1	6,937	26,528	27,430	24,575	22,707

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	235	30	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	190	120	182	30

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Lahore Region
13. 220kV Grid Station NEW SHALAMAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Shalamar - KSK	Commissioned/Energized on 05-03-2014				655	Commissioned/Energized on 05-03-2014						—	—	—	—	Commissioned/Energized on 05-03-2014						196	30	188	30
N-1						1							—	—	—	—							203	30	188	30
Normal	220 kV Shalamar - Ravi	Commissioned/Energized on 05-03-2014				664	Commissioned/Energized on 05-03-2014						—	—	—	—	Commissioned/Energized on 05-03-2014						196	30	194	90
N-1						1							—	—	—	—							203	30	188	30

Total No. of Variations - Normal	Commissioned/Energized on 05-03-2014	1,319	4,650
Total No. of Variations - N-1		2	515
Total of Normal & N-1		1,321	5,165

Voltage (kV)	Max Voltage Recorded 2014-15			
Time (Min)	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage (kV)	Min Voltage Recorded 2014-15			
Time (Min)	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	188	30	188	30

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Lahore Region

14. 220kV Grid Station RAVI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Ravi - Atlas	826	1889	2027	3140	3391	236	240	—	—	—	—	—	—	—	—	198	240	198	270	198	450	188	270	198	270
N-1		31	184	483	769	567	—	—	—	—	—	—	—	—	—	—	190	60	188	120	175	30	180	30	190	30
Normal	220 kV Ravi - KSK I	857	1229	3313	2553	3196	235	30	—	—	—	—	—	—	—	—	195	30	198	510	194	30	198	150	198	570
N-1		59	171	107	370	561	—	—	—	—	—	—	—	—	—	—	188	90	180	60	185	30	182	30	188	30
Normal	220 kV Ravi - KSK II	857	1927	3871	1673	3196	235	30	—	—	—	—	—	—	—	—	195	30	198	270	192	30	185	30	198	570
N-1		59	106	378	950	561	—	—	—	—	—	—	—	—	—	—	188	90	188	120	185	30	182	30	188	30
Normal	220 kV Ravi - SKP	477	1332	2930	3314	3120	236	240	—	—	—	—	—	—	—	—	198	300	198	270	198	270	198	270	198	450
N-1		26	232	640	775	534	—	—	—	—	—	—	—	—	—	—	190	60	182	60	182	30	188	30	188	30
Normal	220 kV Ravi - SMR	—	—	—	834	3262	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	198	270	198	390
N-1		—	—	—	315	821	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	188	30	185	30

KSK: Kala Shah Kaku

SKP: Sheikhpura

SMR: Shalamar

Total No. of Variations - Normal	3,017	6,377	12,141	11,514	16,165
Total No. of Variations - N-1	175	693	1,608	3,179	3,044
Total of Normal & N-1	3,192	7,070	13,749	14,693	19,209

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	198	570	185	30

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Lahore Region

15. 220kV Grid Station SAMUNDRI ROAD FAISALABAD

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Samundri Road - Multan Ckt I	—	5	51	139	289	—	—	—	—	240	60	236	390	240	90	—	—	196	30	202	150	200	90	—	—
N-1		—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	195	120	—	—	—	—	195	60
Normal	220 kV Samundri Road - Multan Ckt II	—	5	51	139	289	—	—	—	—	240	60	236	390	240	90	—	—	196	30	202	150	200	90	—	—
N-1		—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	195	120	—	—	—	—	195	60
Normal	220 kV Samundri Road - Nishatabad Ckt I	—	5	51	139	289	—	—	—	—	240	60	236	390	240	90	—	—	196	30	202	150	200	90	—	—
N-1		—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	195	120	—	—	—	—	195	60
Normal	220 kV Samundri Road - Nishatabad Ckt II	—	5	51	139	289	—	—	—	—	240	60	236	390	240	90	—	—	196	30	202	150	200	90	—	—
N-1		—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	195	120	—	—	—	—	195	60

Total No. of Variations - Normal	—	20	204	556	1156
Total No. of Variations - N-1	—	4	—	—	4
Total of Normal & N-1	—	24	204	556	1160

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	240	90	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	195	60

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Lahore Region
16. 220kV Grid Station SARFARAZNAGAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV SNR - YSW Ckt I	333	954	900	1081	672	—	—	—	—	—	—	—	—	—	—	196	60	198	300	198	840	198	660	190	240
N-1		—	34	63	68	33	—	—	—	—	—	—	—	—	—	—	—	—	190	120	190	120	185	30	190	240
Normal	220 kV SNR - YSW Ckt II	337	894	900	1081	672	—	—	—	—	—	—	—	—	—	—	198	180	198	300	198	840	198	660	190	240
N-1		1	30	63	68	33	—	—	—	—	—	—	—	—	—	—	196	60	190	120	190	120	185	30	190	240
Normal	220 kV SNR - NKLP Ckt I	307	868	862	1064	673	—	—	—	—	—	—	—	—	—	—	198	300	198	300	198	420	198	660	169	240
N-1		1	25	64	73	35	—	—	—	—	—	—	—	—	—	—	196	60	190	120	190	120	185	30	169	240
Normal	220 kV SNR - NKLP Ckt II	337	922	862	1064	673	—	—	—	—	—	—	—	—	—	—	194	120	198	300	198	420	198	660	169	240
N-1		1	25	64	73	35	—	—	—	—	—	—	—	—	—	—	190	30	190	120	190	120	185	30	169	240
Normal	220 kV SNR - Okara Ckt	Commissioned/Energized on 30-06-2014				672	Commissioned/Energized on 30-06-2014								250	30	Commissioned/Energized on 30-06-2014								195	240
N-1		Commissioned/Energized on 30-06-2014				33	Commissioned/Energized on 30-06-2014								—	—	Commissioned/Energized on 30-06-2014								190	120

SNR: Sarfaraznagar

YSW: Yousafwala

NKLP: New Kot Lakhpat

Total No. of Variations - Normal	1,314	3,638	3,524	4,290	3362
Total No. of Variations - N-1	3	114	254	282	169
Total of Normal & N-1	1,317	3752	3,778	4,572	3531

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	250	30	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	190	240	190	240

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Lahore Region

17. 220kV Grid Station SIALKOT

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Sialkot - Gakkhar	517	601	494	402	430	—	—	—	—	—	—	—	—	—	—	198	360	198	420	198	1700	198	180	190	360
N-1		171	184	104	113	76	—	—	—	—	—	—	—	—	—	—	160	120	170	60	175	60	180	120	180	120
Normal	220 kV Sialkot - KSK	498	597	478	403	401	—	—	—	—	—	—	—	—	—	—	198	420	195	420	198	180	198	300	190	360
N-1		137	151	122	113	75	—	—	—	—	—	—	—	—	—	—	120	60	175	60	175	60	180	120	180	120

KSK: Kala Shah Kaku

Total No. of Variations - Normal	1,015	1,198	972	805	831
Total No. of Variations - N-1	308	335	226	226	151
Total of Normal & N-1	1,323	1,533	1,198	1,031	982

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	190	360	180	120

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Lahore Region
18. 220kV Grid Station TOBA TEK SINGH

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Multan - T.T. Singh - Samundri Road Ckt I	Commissioned/Energized on 28-06-2015				240	Commissioned/Energized on 28-06-2015								240	660	Commissioned/Energized on 28-06-2015								-	-
N-1	T-OFF 220 kV G/S T.T.Singh	Commissioned/Energized on 28-06-2015				1	Commissioned/Energized on 28-06-2015								-	-	Commissioned/Energized on 28-06-2015								186	90

NE: Not Existing

T.T. Singh: Toba Tek Singh

Total No. of Variations - Normal	Commissioned/Energized on 28-06-2015	240
Total No. of Variations - N-1		1
Total of Normal & N-1		241

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	240	60	-	-

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	-	-	186	90

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Lahore Region

19. 220kV Grid Station WAPDA TOWN LAHORE

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV WTN - NKLP	Commissioned/ Energized on 28-06-2011	1575	1157	1610	2331	Commissioned/ Energized on 28-06-2011	—	—	—	—	—	—	—	—	Commissioned/ Energized on 28-06-2011	194	120	190	240	192	120	190	180		
N-1			14	14	—	288		—	—	—	—	—	—	—	—		—	196	30	194	60	—	—	187	60	
Normal	220 kV WTN - Sheikhpura	Commissioned/ Energized on 28-06-2011	1338	1592	1601	2233	Commissioned/ Energized on 28-06-2011	—	—	—	—	—	—	—	—	Commissioned/ Energized on 28-06-2011	198	90	197	60	190	120	197	90		
N-1			10	85	5	124		—	—	—	—	—	—	—	—		195	30	190	120	195	160	188	60		

WTN: WAPDA Town NKLP: New Kot Lakhpat

Total No. of Variations - Normal	Commissioned/ Energized on 28-06-2011	2,913	2,749	3,211	4,564
Total No. of Variations - N-1		24	99	5	412
Total of Normal & N-1		2,937	2,848	3,216	4,976

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	190	180	188	60

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

Appendix 3

QoS data - detailed circuit wise analysis

NTDC Multan Region

1. 500 kV D. G. Khan.....	1 of 9
2. 500 kV Multan	2 of 9
3. 500 kV Muzaffargarh.....	3 of 9
4. 500 kV Yousafwala	4 of 9
5. 220 kV Bahawalpur	5 of 9
6. 220 kV Kassowal	6 of 9
7. 220 kV Muzaffargarh.....	7 of 9
8. 220 kV Okara.....	8 of 9
9. 220 kV Vehari	9 of 9

NTDC Multan Region

1. 500kV Grid Station D.G. KHAN

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV	NIL				14	NIL								569	60	NIL								-	-
N-1	Multan - D.G. Khan - Guddu	NIL				-	NIL								-	-	NIL								-	-

Total No. of Variations - Normal	NIL	14
Total No. of Variations - N-1		-
Total of Normal & N-1		14

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	-	-	-	-
500kV	569	60	-	-

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	-	-	-	-
500kV	-	-	-	-

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Islamabad Region

2. 500kV Grid Station MULTAN

Multan Region
2 of 9

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV	NIL					NIL										NIL									
N-1	Multan - Guddu I																									
Normal	500 kV	NIL					NIL										NIL									
N-1	Multan - Guddu 747																									
Normal	500 kV	NIL					NIL										NIL									
N-1	Multan - Muzaffargarh																									
Normal	500 kV	NP	NIL				NP		NIL								NP		NIL							
N-1	Multan - Yousafwala																									
Normal	500 kV	NIL					NIL										NIL									
N-1	Multan - Gatti																									
Normal	500 kV	NIL					NIL										NIL									
N-1	Multan - Rousch																									
Normal	500 kV	NIL					NIL										NIL									
N-1	Multan - D.G. Khan - Guddu																									
Normal	220 kV	1	—	—	—	NIL	244	60	—	—	—	—	266	120	NIL		—	—	—	—	—	—	—	—	NIL	
N-1	Multan - Muzaffargarh 1	—	—	—	—		—	—	—	—	—	—	—	—	—			—	—	—	—	—	—	—		
Normal	220 kV	1	—	—	3	5	244	60	—	—	—	—	266	120	246	60	—	—	—	—	—	—	—	—	—	—
N-1	Multan - Muzaffargarh 2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	220 kV	1	—	—	2	1	244	60	—	—	—	—	250	60	244	240	—	—	—	—	—	—	—	—	—	—
N-1	Multan - Muzaffargarh 3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	220 kV	1	—	—	—	NIL	244	60	—	—	—	—	—	—	NIL		—	—	—	—	—	—	—	—	NIL	
N-1	Multan - Muzaffargarh 4	—	—	—	—		—	—	—	—	—	—	—	—	—			—	—	—	—	—	—	—		
Normal	220 kV	1	—	—	1	NIL	244	60	—	—	—	—	245	240	NIL		—	—	—	—	—	—	—	—	NIL	
N-1	Multan - Kapco 3	—	—	—	—		—	—	—	—	—	—	—	—	—			—	—	—	—	—	—	—		
Normal	220 kV	1	—	—	3	14	244	60	—	—	—	—	246	330	249	60	—	—	—	—	—	—	—	—	—	—
N-1	Multan - Kafco 4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	220 kV	2	—	—	1	NIL	244	60	—	—	—	—	246	180	NIL		—	—	—	—	—	—	—	—	NIL	
N-1	Multan - Kafco 5 & 6	—	—	—	—		—	—	—	—	—	—	—	—	—			—	—	—	—	—	—	—		
Normal	220 kV	2	—	—	—	NIL	244	60	—	—	—	—	—	—	NIL		—	—	—	—	—	—	—	—	NIL	
N-1	Multan - NGPS 1 & 2	—	—	—	—		—	—	—	—	—	—	—	—	—			—	—	—	—	—	—	—		
Normal	220 kV	2	—	—	—	NIL	244	60	—	—	—	—	—	—	NIL		—	—	—	—	—	—	—	—	NIL	
N-1	Multan - Vehari 1 & 2	—	—	—	—		—	—	—	—	—	—	—	—	—			—	—	—	—	—	—	—		
Normal	220 kV	2	—	—	—	NP	244	60	—	—	—	—	—	—	NP		—	—	—	—	—	—	—	—	NP	
N-1	Multan - Samundri Road	—	—	—	—		—	—	—	—	—	—	—	—	—			—	—	—	—	—	—	—		
Normal	220 kV	Commissioned/Energized on 28-06-2015				NIL	Commissioned/Energized on 28-06-2015								NIL		Commissioned/Energized on 28-06-2015								NIL	
N-1	Multan - T.T. Singh 1 & 2	Commissioned/Energized on 28-06-2015					Commissioned/Energized on 28-06-2015								NIL		Commissioned/Energized on 28-06-2015								NIL	

NP: Not Provided

Total No. of Variations - Normal	14	1	NIL	10	20
Total No. of Variations - N-1	—	—	—	—	—
Total of Normal & N-1	14	1	NIL	10	20

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	249	60	—	—
500kV	NIL	NIL	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	NIL	NIL	—	—
500kV	NIL	NIL	—	—



Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Multan Region

3. 500kV Grid Station MUZAFFARGARH

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV	NIL					NIL										NIL									
N-1	Muzaffargarh - Gatti																									
Normal	500 kV	NIL					NIL										NIL									
N-1	Muzaffargarh - Guddu																									
Normal	500 kV	NIL					NIL										NIL									
N-1	Muzaffargarh - Multan																									
Normal	220 kV	NIL					NIL										NIL									
N-1	500kV Grid Station TPS Phase-I - Muzaffargarh																									
Normal	220 kV	NIL					NIL										NIL									
N-1	500kV Grid Station TPS Phase-II - Muzaffargarh																									

TPS: Thermal Power Station

Total No. of Variations - Normal	NIL
Total No. of Variations - N-1	NIL
Total of Normal & N-1	NIL

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	NIL	NIL	NIL	NIL
500kV	NIL	NIL	NIL	NIL

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	NIL	NIL	NIL	NIL
500kV	NIL	NIL	NIL	NIL

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Multan Region 4. 500kV Grid Station YOUSAFWALA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV	–	–	1	–	33	–	–	–	–	–	–	–	–	538	120	–	–	–	–	465	60	–	–	–	–
N-1	Yousafwala - Lahore	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV	–	–	1	–	33	–	–	–	–	–	–	–	–	538	120	–	–	–	–	465	60	–	–	–	–
N-1	Yousafwala - Multan	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV	–	–	–	2	95	–	–	–	–	–	–	–	–	235	60	–	–	–	–	–	–	205	120	203	60
N-1	Yousafwala - SNR	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV	–	–	–	2	95	–	–	–	–	–	–	–	–	235	60	–	–	–	–	–	–	205	120	203	60
N-1	Yousafwala - Gatti	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV	–	–	–	2	95	–	–	–	–	–	–	–	–	235	60	–	–	–	–	–	–	205	120	203	60
N-1	Yousafwala - Vehari	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

SNR: Sarfaraznagar

Total No. of Variations - Normal	–	–	2	6	351
Total No. of Variations - N-1	–	–	–	–	–
Total of Normal & N-1	–	–	2	6	351

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	235	60	–	–
500kV	538	120	–	–

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	203	60	–	–
500kV	–	–	–	–

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Multan Region

5. 220kV Grid Station BAHAWALPUR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Bahawalpur - TPS Muzaffargarh	31	135	15	421	305	240	120	236	60	242	30	248	90	236	180	194	60	200	120	203	30	200	60	205	120
N-1	Ckt I & II	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TPS: Thermal Power Station

Total No. of Variations - Normal	31	135	15	421	305
Total No. of Variations - N-1	-	-	-	-	-
Total of Normal & N-1	31	135	15	421	305

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	236	180	-	-

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	205	120	-	-

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Multan Region

6. 220kV Grid Station KASSOWAL

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	Kassowal - Vehari 1	Commissioned/Energized on 15-07-2015				NIL	Commissioned/Energized on 15-07-2015								NIL		Commissioned/Energized on 15-07-2015								NIL	
N-1																										
Normal	Kassowal - Vehari 2	Commissioned/Energized on 15-07-2015				NIL	Commissioned/Energized on 15-07-2015								NIL		Commissioned/Energized on 15-07-2015								NIL	
N-1																										
Normal	Kassowal - Yousafwala 1	Commissioned/Energized on 15-07-2015				NIL	Commissioned/Energized on 15-07-2015								NIL		Commissioned/Energized on 15-07-2015								NIL	
N-1																										
Normal	Kassowal - Yousafwala 2	Commissioned/Energized on 15-07-2015				NIL	Commissioned/Energized on 15-07-2015								NIL		Commissioned/Energized on 15-07-2015								NIL	
N-1																										

Total No. of Variations - Normal	Commissioned/Energized on 15-07-2015	NIL
Total No. of Variations - N-1		NIL
Total of Normal & N-1		NIL

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	NIL	NIL	NIL	NIL

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	NIL	NIL	NIL	NIL

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Multan Region

7. 220kV Grid Station MUZAFFARGARH

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Muzaffargarh - Multan	50	1	92	—	4	—	—	232	60	239	90	—	—	236	90	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Muzaffargarh - TPS	50	—	92	—	NP	236	60	232	60	239	90	—	—	NP		—	—	—	—	—	—	—	—	NP	
N-1		—	—	—	—		—	—	—	—	—	—	—	—			—	—	—	—	—	—	—	—		

NP : Not Provided

TPS: Thermal Power Station

Total No. of Variations - Normal	100	1	184	—	4
Total No. of Variations - N-1	—	—	—	—	—
Total of Normal & N-1	100	1	184	—	4

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	236	90	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	5%		10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Multan Region

8. 220kV Grid Station OKARA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Okara - Sarfaraznagar	Commissioned/Energized on 30-06-2014				75	Commissioned/Energized on 30-06-2014								234	60	Commissioned/Energized on 30-06-2014								202	60
N-1						–									–	–									–	–
Normal	220 kV Okara - Yousafwala	Commissioned/Energized on 30-06-2014				–	Commissioned/Energized on 30-06-2014								–	–	Commissioned/Energized on 30-06-2014								–	–
N-1						–									–	–									–	–

Total No. of Variations - Normal	Commissioned/Energized on 30-06-2014	75
Total No. of Variations - N-1		–
Total of Normal & N-1		75

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	234	60	–	–

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	202	60	–	–

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Multan Region

9. 220kV Grid Station VEHARI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Vehari - Multan Ckt I & II	278	23	744	559	764	240	90	235	30	240	90	240	150	240	120	207	150	208	30	—	—	200	150	—	—
N-1		—	—	—	6	—	—	—	—	—	—	—	246	30	—	—	—	—	—	—	—	—	180	30	—	—
Normal	220 kV Vehari - Yousafwala Ckt I & II	279	23	718	561	NP	241	60	235	30	240	90	238	210	NP		207	150	208	30	—	—	200	150	NP	
N-1		—	—	—	6		—	—	—	—	—	—	246	30			—	—	—	—	—	—	180	30		

NP: Not Provided

Total No. of Variations - Normal	557	46	1,462	1,120	764
Total No. of Variations - N-1	—	—	—	12	—
Total of Normal & N-1	557	46	1,462	1,132	764

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	240	120	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198

Appendix 4

QoS data - detailed circuit wise analysis

NTDC Hyderabad Region

1. 500 kV Dadu.....	1 of 13
2. 500 kV Guddu	2 of 13
3. 500 kV Jamshoro	3 of 13
4. 220 kV NKI	4 of 13
5. 220 kV Dharki.....	5 of 13
6. 220 kV Hala Road.....	6 of 13
7. 220 kV Khuzdar	7 of 13
8. 220 kV Loralai	8 of 13
9. 220 kV Quetta Industrial-II	9 of 13
10. 220 kV Rohri	10 of 13
11. 220 kV Shikarpur.....	11 of 13
12. 220 kV Sibbi	12 of 13
13. 220 kV T. M Khan Road.....	13 of 13

NTDC Hyderabad Region

1. 500kV Grid Station DADU

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV	41	461	384	829	162	539	60	547	180	540	660	540	560	541	60	—	—	—	—	—	—	—	—	—	—
N-1	Dadu - Jamshoro I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	500 kV	57	759	1075	1510	565	540	60	545	120	545	60	544	120	542	300	—	—	—	—	—	—	—	—	—	—
N-1	Dadu - Jamshoro II	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	500 kV	9	84	177	472	149	535	60	540	120	540	300	540	120	542	120	—	—	—	—	—	—	—	—	—	—
N-1	Dadu - Guddu I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	500 kV	5	11	15	53	24	536	60	542	60	538	60	540	180	540	180	—	—	—	—	—	—	—	—	—	—
N-1	Dadu - Guddu II	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV	Commissioned/Energized on 24-08-2014				1484	Commissioned/Energized on 24-08-2014								246	120	Commissioned/Energized on 24-08-2014								—	—
N-1	Dadu - Khuzdar I					—									—	—									—	—
Normal	220 kV	Commissioned/Energized on 09-06-2014				141	Commissioned/Energized on 09-06-2014								242	240	Commissioned/Energized on 09-06-2014								—	—
N-1	Dadu - Khuzdar II					—									—	—									—	—

Total No. of Variations - Normal	112	1,315	1,651	2,864	2,525
Total No. of Variations - N-1	—	—	—	—	—
Total of Normal & N-1	112	1,315	1,651	2,864	2,525

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	240	540	246	120
500kV	542	300	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—
500kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Hyderabad Region

2. 500kV Grid Station GUDDU

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Guddu - Dadu I	—	—	NA	39	NA	—	—	—	—	NA	535	120	NA	—	—	—	—	NA	—	—	—	—	—	—	NA
N-1		—	—		—		—	—	—	—		—	—		—	—	—	—		—	—	—	—	—	—	
Normal	500 kV Guddu - Dadu II	—	—	NA	1545	1449	—	—	—	—	NA	540	60	540	180	—	—	—	—	NA	—	—	—	—	—	—
N-1		—	—		—	—	—	—	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—
Normal	500 kV Guddu - Multan (T-Off D.G.Khan)	—	—	NA	—	—	—	—	—	—	NA	—	—	—	—	—	—	—	—	NA	—	—	—	—	—	—
N-1		—	—		—	—	—	—	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—
Normal	500 kV Guddu - 747 MW CCPP Guddu	—	—	—	—	1089	—	—	—	—	—	—	—	540	120	—	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	500 kV Guddu - Muzaffargarh	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	500 kV Guddu - Multan Ckt I	—	—	—	1487	—	—	—	—	—	—	545	180	—	—	—	—	—	—	—	—	—	—	—	—	
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	500 kV Guddu - Multan Ckt II	—	—	—	1530	—	—	—	—	—	—	539	420	—	—	—	—	—	—	—	—	—	—	—	—	
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	500 kV Guddu - Multan Ckt III	—	—	—	1638	—	—	—	—	—	—	545	240	—	—	—	—	—	—	—	—	—	—	—	—	
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	220 kV Guddu - Sibbi (D/Ckt)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	220 kV Guddu - Uch (P/H)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Normal	220 kV Guddu - Shikarpur	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

NA: Not applicable.

Total No. of Variations - Normal	—	—	—	6,239	2,538
Total No. of Variations - N-1	—	—	—	—	—
Total of Normal & N-1	—	—	—	6,239	2,538

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—
500kV	540	180	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—
500kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Hyderabad Region 3. 500kV Grid Station JAMSHORO

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Jamshoro - Dadu I	75	16	47	17	188	540	360	535	60	538	180	544	60	542	60	—	—	—	—	245	60	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	500 kV Jamshoro - Dadu II	75	16	47	17	188	540	360	535	60	538	180	544	60	542	60	—	—	—	—	245	60	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	500 kV Jamshoro - NKI	134	62	55	17	177	538	60	538	120	538	180	544	60	542	60	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	500 kV Hub - Jamshoro (D/Ckt)	179	53	55	17	180	538	120	536	120	538	60	544	60	542	60	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Jamshoro - KDA33 - I	176	107	297	138	230	241	60	239	120	242	60	247	60	239	60	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Jamshoro - KDA33 - II	176	107	297	138	230	241	60	239	120	242	60	247	60	239	60	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Jamshoro - Hala Road I	113	66	277	136	229	239	120	239	180	240	120	247	60	239	60	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Jamshoro - Hala Road II	113	66	277	136	230	239	120	239	180	240	120	247	60	239	60	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Jamshoro - T.M. Khan - I	167	90	286	138	230	249	120	240	120	241	60	247	60	239	60	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV Jamshoro - T.M. Khan - II	167	90	286	136	230	249	120	240	120	241	60	247	60	239	60	—	—	—	—	—	—	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total No. of Variations - Normal	1,375	673	1,924	890	2,112
Total No. of Variations - N-1	—	—	—	—	—
Total of Normal & N-1	1,375	673	1,924	890	2,112

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	239	60	—	—
500kV	542	60	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—
500kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Hyderabad Region

4. 500kV Grid Station NKI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV NKI - Hub	64	53	200	201	175	531	60	531	60	542	30	539	30	537	30	—	—	468	30	472	30	—	—	463	30
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	500 kV NKI - Jamshoro	64	54	200	201	175	531	60	531	60	542	30	539	30	537	30	—	—	468	30	472	30	—	—	463	30
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV NKI - Baldia	1105	1854	1169	2097	2516	244	120	245	60	247	30	248	30	243	30	200	60	—	—	208	60	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV NKI - KDA33	1104	1923	1169	2097	2523	244	120	245	60	247	30	242	60	243	30	200	60	198	60	208	60	—	—	—	—
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total No. of Variations - Normal	2,337	3,884	2,738	4,596	5,389
Total No. of Variations - N-1	—	—	—	—	—
Total of Normal & N-1	2,337	3,884	2,738	4,596	5,389

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	243	30	—	—
500kV	537	30	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—
500kV	463	30	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Hyderabad Region

5. 220kV Grid Station DHARKI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Bus Bar	28	11	19	NA	NA	240	60	236	480	235	150	–	–	NA	–	–	208	120	207	30	–	–	NA	NA	
N-1		22	–	2			–	–	–	–	–	–	–	–		204	60	–	–	197	60	–	–			

Na: Not Applicable

Total No. of Variations - Normal	28	11	19	–	NA
Total No. of Variations - N-1	22	–	2	–	NA
Total of Normal & N-1	50	11	21	–	NA

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	NA	NA	NA	NA

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	NA	NA	NA	NA

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Hyderabad Region

6. 220kV Grid Station HALA ROAD

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV	1312	103	543	543	81	241	540	237	420	239	300	239	300	238	120	—	—	—	—	—	—	—	—	—	—
N-1	Hala Road - Jamshoro I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV	1312	103	543	543	81	241	540	237	420	239	300	239	300	238	120	—	—	—	—	—	—	—	—	—	—
N-1	Hala Road - Jamshoro II	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total No. of Variations - Normal	2,624	206	1,086	1,086	162
Total No. of Variations - N-1	—	—	—	—	—
Total of Normal & N-1	2,624	206	1,086	1,086	162

Voltage (kV)	Max Voltage Recorded 2014-15			
Time (Min)	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	238	120	—	—

Voltage (kV)	Min Voltage Recorded 2014-15			
Time (Min)	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Hyderabad Region

7. 220kV Grid Station KHUZDAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Dadu - Khuzdar I	Commisioined/Energized on 24-08-2014				567	Commisioined/Energized on 24-08-2014								240	540	Commisioined/Energized on 24-08-2014								185	120
N-1						3									—	—									194	60
Normal	220 kV Dadu - Khuzdar II	Commisioined/Energized on 09-06-2014				567	Commisioined/Energized on 09-06-2014								240	540	Commisioined/Energized on 09-06-2014								185	120
N-1						3									—	—									194	60

Total No. of Variations - Normal	Commisioined/Energized on 09-06-2014 & 24-08-2014	1134
Total No. of Variations - N-1		6
Total of Normal & N-1		1140

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	240	540	–	–

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	185	120	194	60

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Hyderabad Region

8. 220kV Grid Station LORALAI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV	Commisioined/Energized on				584	Commisioined/Energized on								242	600	Commisioined/Energized on								200	60
N-1	Loralai - D.G. Khan I	05-08-2014				77	05-08-2014								252	60	05-08-2014								-	-
Normal	220 kV	Commisioined/Energized on				584	Commisioined/Energized on								242	600	Commisioined/Energized on								200	60
N-1	Loralai - D.G. Khan II	29-08-2014				77	29-08-2014								252	60	29-08-2014								-	-

Total No. of Variations - Normal	Commisioined/Energized on 05-08-2014 & 29-08-2014	1168
Total No. of Variations - N-1		154
Total of Normal & N-1		1322

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	242	600	252	60

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	200	60	-	-

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Hyderabad Region

9. 220kV Grid Station QUETTA INDUSTRIAL-II

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Sibbi - Quetta Ckt I	477	522	641	6160	2865	—	—	—	—	—	—	—	—	240	120	188	60	199	120	199	120	170	60	199	180
N-1		2211	2494	2295	37	3145	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	174	60	170	120
Normal	220 kV Sibbi - Quetta Ckt II	477	522	641	6388	2865	—	—	—	—	—	—	—	—	240	120	170	300	155	60	180	60	170	60	199	180
N-1		2211	2494	2295	51	3145	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	174	60	170	120

Total No. of Variations - Normal	954	1,044	1,282	12,548	5,730
Total No. of Variations - N-1	4,422	4,988	4,590	88	6,290
Total of Normal & N-1	5,376	6,032	5,872	12,636	12,020

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	240	120	—	—

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	199	180	170	120

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Hyderabad Region

10. 220kV Grid Station ROHRI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Shikarpur - Rohri I	Commissioned/ Energized on 23-06-2012		NP	–	111	Commissioned/ Energized on 23-06-2012				240	30	239	30	242	60	Commissioned/ Energized on 23-06-2012				190	30	200	30	198	480
N-1				–	–	–					–	–	264	30	–	–			–	–	–	–	–	–	–	–
Normal	220 kV Shikarpur - Rohri II	Commissioned/Energized on 22-10-2014				111	Commissioned/Energized on 22-10-2014							–	–	Commissioned/Energized on 22-10-2014							198	480		
N-1						–									–								–			
Normal	220 kV Rohri - Engro I	12	13	166	83	419	240	180	239	30	240	30	239	30	242	60	203	60	200	30	190	30	200	30	–	–
N-1		3	1	–	7	–	245	60	245	60	–	–	264	30	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Rohri - Engro II	Commissioned/Energized on 30-08-2014				419	Commissioned/Energized on 30-08-2014							242	60	Commissioned/Energized on 30-08-2014							–	–		
N-1						–									–								–			

Total No. of Variations - Normal	12	13	166	83	1,060
Total No. of Variations - N-1	3	1	–	7	–
Total of Normal & N-1	15	14	166	90	1,060

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	242	60	–	–

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	198	480	–	–

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Hyderabad Region

11. 220kV Grid Station SHIKARPUR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Shikarpur - Guddu	83	35	87	276	182	240	660	–	–	–	–	–	–	–	–	200	480	200	240	200	1440	199	1440	199	720
N-1		24	18	14	1	4	–	–	–	–	–	–	–	–	–	–	180	240	180	180	180	1440	196	300	190	720
Normal	220 kV Shikarpur - Uch	83	35	87	276	167	240	660	–	–	–	–	–	–	–	–	200	480	200	240	200	1440	200	1440	200	780
N-1		24	18	14	1	1	–	–	–	–	–	–	–	–	–	–	180	240	180	180	180	1440	198	300	196	480
Normal	220 kV Shikarpur - Rohri I	–	–	–	276	111	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	200	1440	198	480
N-1		–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	198	300	–	–
Normal	220 kV Shikarpur - Rohri II	–	–	–	276	107	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	200	1440	198	480
N-1		–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	198	300	–	–

Total No. of Variations - Normal	166	70	174	1,104	567
Total No. of Variations - N-1	48	36	28	4	5
Total of Normal & N-1	214	106	202	1,108	572

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	–	–	–	–

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	198	480	190	720

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

NTDC Hyderabad Region

12. 220kV Grid Station SIBBI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Sibbi - Quetta Ckt I	1828	2742	1681	3754	851	240	240	–	–	240	120	–	–	240	60	192	60	200	180	199	60	199	90	180	60
N-1		255	299	558	426	–	245	60	–	–	–	–	–	–	–	–	170	60	180	60	130	30	180	30	–	–
Normal	220 kV Sibbi - Quetta Ckt II	1828	2742	1681	3754	781	240	240	–	–	240	120	–	–	–	–	192	60	200	180	199	60	199	90	180	60
N-1		255	299	558	426	1	245	60	–	–	–	–	–	–	–	–	170	60	180	60	130	30	180	30	195	60
Normal	220 kV Sibbi - Uch Ckt I	1828	2412	1483	2606	604	240	240	–	–	235	30	238	60	240	540	192	60	190	60	199	240	199	60	185	60
N-1		255	200	450	280	4	245	60	–	–	–	–	–	–	–	–	170	60	180	60	180	240	180	30	194	60
Normal	220 kV Sibbi - Uch Ckt II	1828	2412	1483	2606	722	240	240	–	–	235	30	238	60	240	540	192	60	190	60	199	240	199	60	185	120
N-1		255	200	450	280	4	245	60	–	–	–	–	–	–	–	–	170	60	180	60	180	240	180	30	194	60
Normal	220 kV Sibbi - Guddu DC Ckt	1828	2778	3075	2495	2669	240	240	–	–	241	210	240	30	240	30	192	60	20	30	199	270	192	90	195	60
N-1		255	218	863	214	205	245	60	–	–	–	–	–	–	–	–	170	60	180	60	180	120	180	60	180	30

Total No. of Variations - Normal	9,140	13,086	9,403	15,215	5,627
Total No. of Variations - N-1	1,275	1,216	2,879	1,626	214
Total of Normal & N-1	10,415	14,302	12,282	16,841	5,841

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	240	540	–	–

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	180	60	180	30

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules



NTDC Hyderabad Region
13. 220kV Grid Station T.M. KHAN ROAD

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV	133	226	616	767	473	240	180	242	60	240	540	241	60	242	60	—	—	—	—	—	—	—	—	—	—
N-1	T.M.Khan - Jamshoro I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal	220 kV	133	226	616	767	473	240	180	242	60	240	540	241	60	242	60	—	—	—	—	—	—	—	—	—	—
N-1	T.M.Khan - Jamshoro II	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total No. of Variations - Normal	266	452	1,232	1,534	946
Total No. of Variations - N-1	—	—	—	—	—
Total of Normal & N-1	266	452	1,232	1,534	946

Voltage (kV)	Max Voltage Recorded 2014-15			
Time (Min)	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	242	60	—	—

Voltage (kV)	Min Voltage Recorded 2014-15			
Time (Min)	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
220kV	—	—	—	—

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition		N-1 Condition	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

Appendix 5

QoS data - detailed circuit wise analysis

K-Electric

K-Electric System

Circuit Wise Number of Voltage Variations Violating Criteria

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV	-	-	-	-	Nil	-	-	-	-	-	-	-	-	Nil	-	-	-	-	-	-	-	-	-	Nil	
N-1	Baldia - Mauripur	1	-	-	-		-	-	-	-	-	-	-	-		207	-	-	-	-	-	-	-	-		-
Normal	132 kV	1	1	1	1	-	-	-	-	-	-	-	-	-	-	118	NP	122	NP	117	NP	116	NP	-	-	
N-1	Surjani - Maymar	1	-	-	1	-	-	-	-	-	-	-	-	-	111	-		-	-	-	114	-		-		
Normal	132 kV	1	1	1	1	-	-	-	-	-	-	-	-	-	-	122	NP	122	NP	117	NP	114	NP	-	-	
N-1	Surjani - Valika	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	118	112		-		-		
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1	SITE - SGT 1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	117	NP	-	-	-	-	-	-	-	-	
Normal	132 kV	1	-	-	-	-	-	-	-	-	-	-	-	-	-	122	NP	-	-	-	-	-	-	-	-	
N-1	SITE - SGT 2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	117		-	-	-	-	-	-	-	-	
Normal	132 kV	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	119	NP	119	NP	116	NP	115	NP	
N-1	KDA - Federal B	1	-	1	1	1	-	-	-	-	-	-	-	-	-	114	NP	-	-	118		113		114		
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1	Valika - N. Karachi	1	-	-	-	-	-	-	-	-	-	-	-	-	-	112	NP	-	-	-	-	-	-	-	-	
Normal	132 kV	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	119	NP	113	NP	-	-	
N-1	Gulshan - Civic	1	-	-	1	-	-	-	-	-	-	-	-	-	-	119	NP	-	-	-	-	113		-	-	
Normal	132 kV	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	119	NP	-	-	-	-	-	-	
N-1	West Wharf - Lyari	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	118	NP	116	NP	122	NP	112	NP	
N-1	Qayyumabad - K. East	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	114		116		
Normal	132 kV	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	120	NP	114	NP	114	NP	-	-	
N-1	Memon Goth - Malir	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	116		118		116		-	-	
Normal	132 kV	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	120	NP	114	NP	114	NP	-	-	
N-1	Malir - CAA	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	118		115		115		-	-	
Normal	132 kV	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	122	NP	116	NP	113	NP	-	-	
N-1	Gulshan - Hospital	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	118		-		113		-	-	
Normal	132 kV	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	123	NP	120	NP	118	NP	121	NP	
N-1	Gharo - RECP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	122	NP	118	NP	121	NP
N-1	BOC - Dhabeji	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

NP: Not Provided

K-Electric System

Circuit Wise Number of Voltage Variations Violating Criteria

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	132 kV	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	NP	118	NP	-	-
N-1	Dhabeji - Gharo	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	119	NP	-	-	-	-	-	-	-	
Normal	132 kV	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	119	NP	116	NP	115	NP
N-1	KDA - Memon Goth	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	114		
Normal	132 kV	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	113	NP	116	NP	115	NP
N-1	KDA - Johar	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118		113		114	
Normal	132 kV	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	113	NP	111	NP	-	-
N-1	Johar - Hospital	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116		111		-	-
Normal	132 kV	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116	NP	116	NP	115	NP
N-1	KDA - Gulshan	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118		113		114	
Normal	132 kV	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117	NP	116	NA	115	NP
N-1	KDA - Maymar	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118		113		114	
Normal	132 kV	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	119	NP	122	NA	-	-
N-1	Federal B - Valika	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		112		-	-
Normal	132 kV	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NP	114	NP	-	-
N-1	Haroonabad - Liaquatabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-		-	-
Normal	132 kV	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116	NP	111	NP	-	-
N-1	Valika - Nazimabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-		-	-
Normal	132 kV	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117	NP	113	NP	-	-
N-1	Gulshan - Jalil Road	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118		113		-	-
Normal	132 kV	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116	NP	113	NP	-	-
N-1	Gulshan - Azizabad	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117		113		-	-
Normal	132 kV	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116	NP	117	NP	112	NP
N-1	Mauripur - Haroonabad	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118		116		118	
Normal	132 kV	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116	NP	114	NP	-	-
N-1	Haroonabad - Nazimabad	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	114		-		-	-
Normal	132 kV	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118	NP	122	NP	115	NP
N-1	Korangi West - Defence	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-		-	
Normal	132 kV	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NP	121	NP	-	-
N-1	Pipri West - Port Qasim	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-		-	-

NP: Not Provided



K-Electric System

Circuit Wise Number of Voltage Variations Violating Criteria

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	132 kV	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	121	NP	-	-
N-1	Pipri West - KEPZ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	NP	-	-
N-1	KEPZ - Landhi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	122	NP	-	-
N-1	Gul Ahmed - Airport 1 & 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	NP	121	NP	-	-
N-1	KTPS - PRL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	114	NP	121	NP	-	-
N-1	K. East - K. South	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116	NP	-	-	-	-
N-1	Valika - North Nazimabad	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112	NP	-	-
Normal	132 kV	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	119	NP	-	-
N-1	Orangi - Valika	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	114	NP	115	NP	-	-
N-1	Liaquatabad - Azizabad	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116		117		-	-
Normal	132 kV	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	NP	-	-
N-1	Port Qasim - Landhi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	124	NP
N-1	Baldia - Orangi	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118	
Normal	132 kV	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	124	NP
N-1	Baldia - Valika	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	124	NP
N-1	Baldia - Hub	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118	
Normal	132 kV	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	124	NP
N-1	Baldia - SGT - SITE	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118	
Normal	132 kV	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	115	NP
N-1	K. West - Gizri - Baloch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	121	NP
N-1	Pipri - Korangi Town	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NP: Not Provided

K-Electric System

Circuit Wise Number of Voltage Variations Violating Criteria

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2010-11	2011-12	2012-13	2013-14	2014-15	2010-11		2011-12		2012-13		2013-14		2014-15		2010-11		2011-12		2012-13		2013-14		2014-15	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	132 kV	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	121	NP
N-1	Pipri - Landhi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	132 kV	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	112	NP
N-1	Qayyumabad - DHA 1	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	116	
Normal	132 kV	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	116	NP
N-1	Queen's Road - Clifton	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	116	
Normal	132 kV	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	116	NP
N-1	Queen's Road - Gizri	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	116	
Normal	132 kV	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	116	NP
N-1	Queen's Road - Elandar	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	116	
Normal	132 kV	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	116	NP
N-1	Queen's Road - Old	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	116	

NP: Not Provided

Total No. of Variations - Normal	8	9	27	32	22
Total No. of Variations - N-1	3	3	13	18	16
Total of Normal & N-1	11	12	40	50	38

Voltage (kV) Time (Min)	Max Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
132kV	–	–	–	–
220kV	–	–	–	–
500kV	NA	NA	NA	NA

Voltage (kV) Time (Min)	Min Voltage Recorded 2014-15			
	Normal		N-1	
Voltage Class	Voltage	Time	Voltage	Time
132kV	112	NP	116	NP
220kV	–	–	–	–
500kV	NA	NA	NA	NA

Voltage Class	Permissible Limits as per PSTR 2005			
	Normal Condition 5%		N-1 Condition 10%	
	Max (kV)	Min (kV)	Max (kV)	Min (kV)
132kV	138.6	125.4	145.2	118.8
220kV	231	209	242	198
500kV	525	475	550	450

PSTR: Performance Standards Transmission Rules

Appendix 6

System Frequency - Historical Data as Reported by the Licensees

- | | |
|---------------------|--------|
| 1. NTDC | A6 - 1 |
| 2. K-Electric | A6 - 2 |

Historical System Frequency Data as Reported by NTDC

Month	Highest System Frequency Recorded Violating the prescribed Upper Limit ¹ (Hz)				
	2010-11	2011-12	2012-13	2013-14	2014-15
July	50.54	50.56	50.48	50.2	50.71
Aug	50.53	50.48	50.52	50.31	50.68
Sep	50.56	50.44	50.56	50.22	50.55
Oct	50.43	50.44	50.45	50.35	50.69
Nov	50.44	50.56	50.4	50.3	50.62
Dec	50.39	50.48	50.4	50.28	58.63
Jan	50.4	50.44	50.21	50.7	54.69
Feb	50.4	50.36	50.1	50.63	49.49
Mar	50.48	50.48	50.34	50.63	50.65
Apr	50.44	50.4	50.3	50.68	50.66
May	50.5	50.44	50.26	50.6	50.69
June	50.48	50.48	50.23	50.57	50.68

Month	Lowest System Frequency Recorded Violating the prescribed Lower Limit ² (Hz)				
	2010-11	2011-12	2012-13	2013-14	2014-15
July	48.99	48.72	48.76	49.05	48.74
Aug	48.84	48.72	48.80	49.15	48.91
Sep	48.91	48.72	48.72	49.35	48.93
Oct	48.81	48.80	48.80	49.50	48.99
Nov	49.02	48.92	48.72	49.31	48.83
Dec	48.80	48.76	48.72	49.15	45
Jan	48.80	48.72	49.10	48.67	45
Feb	48.78	48.80	48.66	48.87	49.06
Mar	48.81	48.76	49.40	48.92	49.11
Apr	48.75	48.76	49.32	48.89	49.02
May	48.62	48.76	49.48	49.20	49.2
June	48.68	48.76	49.20	49.19	50.51

¹ Upper Limit: 50.50 Hz, Rule 8(1) of PSTR 2005

² Lower Limit: 49.50 Hz, Rule 8(1) of PSTR 2005

Historical System Frequency Data as Reported by K-Electric

Month	Highest System Frequency Recorded Violating the prescribed Upper Limit ³ (Hz)				
	2010-11	2011-12	2012-13	2013-14	2014-15
July	50.92	50.61	50.60	51.15	50.58
Aug	50.97	50.96	51.05	51.70	50.64
Sep	50.61	50.90	50.65	51.70	50.51
Oct	50.81	50.46	50.65	51.69	50.53
Nov	50.52	50.55	50.57	51.93	50.55
Dec	50.73	50.57	50.76	51.68	50.82
Jan	50.54	50.61	50.80	51.15	50.54
Feb	50.58	50.56	50.59	51.10	50.51
Mar	50.77	50.90	50.72	51.91	50.58
Apr	50.47	50.28	51.08	51.28	50.51
May	50.65	51.25	51.49	51.06	50.57
June	50.73	50.78	51.55	51.72	50.52

Month	Lowest System Frequency Recorded Violating the prescribed Lower Limit ⁴ (Hz)				
	2010-11	2011-12	2012-13	2013-14	2014-15
July	48.80	48.51	48.56	48.61	48.97
Aug	48.80	48.60	48.60	48.68	49.1
Sep	48.80	48.60	48.59	48.73	49.13
Oct	48.80	48.51	48.60	48.80	49.18
Nov	48.80	48.67	48.60	48.74	48.94
Dec	48.80	48.60	48.59	48.76	49.15
Jan	48.79	48.60	48.50	48.61	49.07
Feb	48.80	48.52	47.12	48.80	49.39
Mar	48.88	48.60	48.80	48.59	49.26
Apr	48.40	48.60	48.74	48.63	49.26
May	46.64	48.54	48.63	48.66	49.29
June	46.38	48.59	48.62	48.80	49.32

³ Upper Limit: 50.50 Hz, Rule 8(1) of PSTR 2005

⁴ Lower Limit: 49.50 Hz, Rule 8(1) of PSTR 2005