



NATIONAL
ELECTRIC POWER
REGULATORY
AUTHORITY

2019-20 Performance Evaluation Report

NTDC & K-Electric

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

National Electric Power Regulatory Authority (NEPRA) is the sole regulator of power sector in Pakistan. Provision of safe, reliable, efficient and affordable electric power to the electricity consumers is an integral part of NEPRA's regulatory regime.

In order to encourage safe, efficient and reliable transmission service, NEPRA has framed the Performance Standards (Transmission) Rules 2005 (PSTR)¹. Under PSTR, each transmission licensee is required to submit to NEPRA an Annual Performance Report (APR) in a manner as prescribed in PSTR. These performance reports are analyzed by NEPRA in light of the performance parameters such as System Duration of Interruption, System Frequency of Interruption, Energy Not Served (ENS), Loss of Supply Incidents and its financial impact, System Disturbances (if any), Voltage and Frequency Violation Limits prescribed under the PSTR, and Highest and Lowest Voltage Recorded at National Transmission & Despatch Company (NTDC) 500 kV and 220 kV grid stations under Normal system conditions.

The APRs for the year 2019-20, submitted by NTDC and K-Electric were reviewed on the basis of aforementioned parameters. Highlights of the analysis/findings are given below:-

PERFORMANCE OF NTDC

System Duration of Interruption: System duration of interruption is a reliability indicator that measures the average outage duration that an interconnection point observes in a year. The interruption was witnessed around 0.13 hours (8 minutes) on average that indicates a decrease of 59% as compared to preceding year's average of 0.32 hours (19 minutes).

System Frequency of Interruption: System frequency of interruption is a reliability parameter that measures the average number of outages per circuit in a year. During 2019-20 the average number of outages per circuit for NTDC turn out to be 0.12, showing a decrease of 8% over the previous year i.e. 0.13.

Energy Not Served (ENS): In order to gauge system security, the estimates of total ENS during the year as reported by the licensee has been analyzed. The total ENS as reported by NTDC in 2019-20 is **17.3 million kWh** that is 85% lower over the previous year i.e. 114 million kWh. Based on the average energy sale rate of DISCOs², the financial impact amounts to around **Rs. 88 million**.

Loss of Supply Incidents: NTDC reported 62 loss of supply incidents during the year 2019-20 which translates into total duration of 68.7 hours. The average ENS per incident along with duration and subsequent financial impact has been assessed in the following table.

¹ Under section 46 of the Regulation of Generation, Transmission and Distribution of Electric Power Act 1997 (XL of 1997), read with section 7 (2) (c) 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 Monthly adjustment in DISCOs approved tariff on account of variation in fuel charges 2019-20:- Average energy sale rate = Rs. 5.09/kWh

▼ Description / Unit / Year ►	Unit	2015-16	2016-17	2017-18	2018-19	2019-20
Loss of Supply Incidents	Nos.	87	165	142	66	62
Average ENS per Incident	Million kWh	1.644	0.454	3.3	1.7	0.3
Average Duration per Incident	Hrs : Min	02 : 24	03 : 07	02 : 06	02 : 24	01 : 06
Financial Impact per Incident	Rs. (Million)	8.322	2.5	17.5	9.7	1.4

System Collapses/Major Disturbances: - As reported by NTDC, these outages include 5 major disturbances in the year 2019-20. The details are summarized below: -

S. No.	Date	Loading at Interruption time	Duration of Interruption	Remarks
1	5-July-2019	100 MW	4 Hrs & 30 min	500 kV Circuits affected; Guddu – DG Khan, Guddu – Muzaffargarh – Guddu – Guddu 747, Rahim Yar Khan – Guddu 747 220 kV Circuits affected; Dadu-Khuzdar circuit # 1 & 2
2	29-July-2019	90 MW	2 Hrs & 12 min	500 kV Circuits affected; Moro – Engro Thar, Engro Thar – Jamshoro, Jamshoro – Dadu, Dadu – Port Qasim 220 kV Circuits affected; Jamshoro – Hala Road circuit # 1 & 2, Jhimpir – T.M Khan circuit # 1 & 2
3	21-Aug-2019	475 MW	2 Hrs & 44 min	220 kV circuits Kala Shah Kaku – Bund road circuit # 2, Ghakkar – Sahowala, Mangla – Gakkhar, Kala Shah Kaku – Sahowala, & Kala Shah Kaku – Ghazi affected.
4	20-May-2020	717 MW	16 min	500 kV circuits New Ghakkar – Neelum Jhelum, Rawat – Neelum Jhelum, New Ghakkar – New Lahore, and New Ghakkar – Lahore Sheikhupura affected.
5	30-June-2020	610 MW	4 Hrs & 2 min	Fire incident at 132 Jamshoro switchyard resulting in tripping of T1, T2 & T3 at Jamshoro, 220 kV G/S Jhimpir, T. M. Khan, Hala Road, and loss of generation of all wind power plants occurred.

Voltage Variations Violating Prescribed Limits: NEPRA has prescribed limits for voltage variations in the Rules. During year 2019-20, number of voltage violations for NTDC remained 149,130 that indicate 3% increase as compared to 144,782 violations in preceding year.

Highest and Lowest Voltage Recorded Under Normal System Condition: The highest voltage recorded due to voltage variations at 500 kV voltage class was 565 kV for time duration of 60 minutes, recorded at D. G. Khan. The voltage of 565 kV shows approximately 7.6% variation with respect to allowed limit ($\pm 5\% = 525/475$ kV). Detail is given in section 3.3.1 (figure 3.16).

Similarly, at 220 kV level, highest voltage was 250 kV recorded at Sibbi, Loralai and Dharki for time duration of 60 minutes and 120 minutes respectively. Voltage of 250 kV indicates approximately 8.2% variation with respect to allowed limit ($\pm 5\% = 231/209$ kV). Detail of highest voltage incidents is given in section 3.3.1 (figure 3.17). Some of the grid stations with highest voltage incidents are given below;

S. No.	Name of Grid Station	Highest Voltage Recorded (kV)	Duration of Variation (min)	Variation w.r.t Allowed Limit (%)
1	220 kV Sibbi	250	60	8.2%
2	220 kV Loralai	250	120	8.2%
3	220 kV Dharki	250	120	8.2%
4	220 kV Khuzdar	248	60	7.4%
5	220 kV Rohri	246	60	6.5%
6	220 kV University	246	240	6.5%
7	220 kV Jhimpir	245	120	6.1%
8	220 kV T. M. Khan Road	243	60	5.2%

On the lower side, the voltage remained as low as 171 kV that indicates 18.2% variation with respect to allowed limit ($\pm 5\% = 231/209$ kV) which may affect the consumer end voltages and consequently equipment damage. Some of the grid stations with lowest voltage incidents are given hereunder: -

S. No.	Name of Grid Station	Highest Voltage Recorded (kV)	Duration of Variation (min)	Variation w.r.t Allowed Limit (%)
1	220 kV Toba Tekh Singh	171	1410	18.2%
2	220 kV Quetta	176	60	15.8%
3	220 kV Sarfaraznagar	178	270	14.8%
4	220 kV Sialkot	180	150	13.9%
5	220 kV Khuzdar	180	60	13.9%
6	220 kV Mardan	181	60	13.4%
7	220 kV Shahibagh	182	60	12.9%
8	220 kV New Kot Lakhpat	185	90	11.5%
9	220 kV Chakdara	190	90	9.1%
10	220 kV ISPR Sangjani	190	60	9.1%
11	220 kV Mansehra	194	60	7.2%
12	220 kV Lal Sohanra	197	30	5.7%
13	220 kV Nowshera	199	30	4.8%

In order to diagnose the root cause of low voltage, monitoring activities are being initiated by NEPRA on periodic basis to avoid any undesirable condition on the system and ensure continuity and stability of supply to the electricity consumers of Pakistan.

Frequency Variations Violating Prescribed Limits: NEPRA has prescribed limits for frequency variations under the Rules. During the reported period, NTDC has violated the prescribed limits 9 times which shows improvement in comparison to the preceding year. Detail is given below: -

▼ Description / Unit / Year ►	Unit	2015-16	2016-17	2017-18	2018-19	2019-20
Number of times Frequency remained outside the Limits in a Year	In a year	248	35	25	25	9
	Average/month	21	2.9	2.1	2.1	0.8
	Average/day	0.7	0.096	0.068	0.068	0.024
Time duration the Frequency remained outside the Limits in a Year	Days	1.6	0.18	0.17	0.12	0.03
	Hours	37.9	4.2	4.1	2.98	0.8
	%age of year	0.43	0.048	0.047	0.034	0.009
Maximum continuous period of Deviation	Hours	1.5	0.25	0.18	-	-
	Minutes	89	15	11	-	-

Conclusion: Significant improvement has been shown by NTDC in reliability and security indicators during the year 2019-20 as compared to preceding year. However, voltage violations and low voltage profile is still a question mark and NTDC needs to improve its functions of planning, operation, protection, augmentation & expansions and rehabilitation to overcome these issues.

PERFORMANCE OF K-ELECTRIC

System Duration of Interruption: System duration of interruption was witnessed on average around 0.12 Hours (7 minutes) which shows a decrease of 80% as compared to preceding year's average of 0.61 Hours (37 minutes).

System Frequency of Interruption: Regarding system frequency of interruption it was observed that average number of outages per circuit for KE remained 0.09, showing a decrease of 77% over the previous year i.e. 0.39.

Energy Not Served (ENS): In order to gauge system security, the estimates of total ENS during the year as reported by the licensee has been analyzed. The total ENS as reported by KE is **0.701 million kWh** that is 74% lesser than the previous year i.e. 2.678 million kWh. Based on the average energy sale rate³ of KE, the financial impact amounts to around **Rs. 6.7 million**.

Loss of Supply Incidents: KE has reported 3 incidents of loss of supply during the year 2019-20 which translates into total duration of 0.95 hours. The average ENS per incident along with duration and subsequent financial impact has been assessed. The detail is given below:-

► Description / Unit / Year ►	Unit	2015-16	2016-17	2017-18	2018-19	2019-20
Loss of Supply Incidents	Nos.	10	10	8	13	3
Average ENS per Incident	Million kWh	0.481	0.285	0.323	0.206	0.234
Average Duration per Incident	Hrs : Min	01 : 24	00 : 43	00 : 25	00 : 20	00 : 19
Financial Impact per Incident	Rs. (Million)	6.24	3.65	4.1	2.6	2.2

Voltage Variations Violating Prescribed Limits: KE's voltage violations remained the same i.e. 9 in 2019-20 as compared to preceding year. Further, no violation has occurred at 220 kV level both under normal and N-1 conditions and at 132 kV level, limits were violated under normal condition.

Frequency Variations Violating Prescribed Limits: The data submitted by KE was analyzed and it was revealed that frequency remained within the prescribed limits.

Conclusion: KE's performance has been improved with respect to preceding year as the reliability and quality of supply indicators have shown considerable boost.

³ KE's Average energy sale rate = Rs. 9.55/kWh, subject to adjustment & indexation by NEPRA.

INTRODUCTION

1 Introduction

This Performance Evaluation Report (PER) provides information on 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) 2005⁴, based on their reported data for the year 2019-20.

The document, moreover, takes account of system reliability, security of supply and quality of supply of the transmission network of the licensees during the reported period. Comparison over the last five years has also been provided in this regard.

1.1 Reporting Requirement

Pursuant to Rule 9 of the PSTR, the licensee 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. The reporting guidelines are provided under Rule 10 of PSTR 2005.

1.2 Compliance

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

1.2.1 Rule 7 of PSTR 2005 (System Voltage)

- 1) *Under normal conditions the voltage variations of plus or minus ±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 ±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.*

1.2.2 Rule 8 of PSTR 2005 (System Frequency)

- 1) *The frequency variations of plus or minus ±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.*

⁴ Available at: [http://www.nepra.org.pk/Legislation/Rules/Performance%20Standards%20\(Transmission\)%20Rules%202005.pdf](http://www.nepra.org.pk/Legislation/Rules/Performance%20Standards%20(Transmission)%20Rules%202005.pdf)

NTDC

2 Brief about NTDC

National Transmission & Despatch Company (NTDC) Limited was incorporated under the Companies Ordinance 1984 on November 6, 1998 as a result of structural reforms introduced by the Government of Pakistan in the Power Sector. The principal business of NTDC is to own, operate and build infrastructure for transmission system of 500 kV and 220 kV transmission Lines and associated Sub-stations.

NTDC commenced its commercial operation on 1st of March 1999 and was organized to take over the properties, assets, rights, obligations and liabilities of transmission network all over Pakistan previously owned by Pakistan Water and Power Development Authority (WAPDA), except the area served by K-Electric.

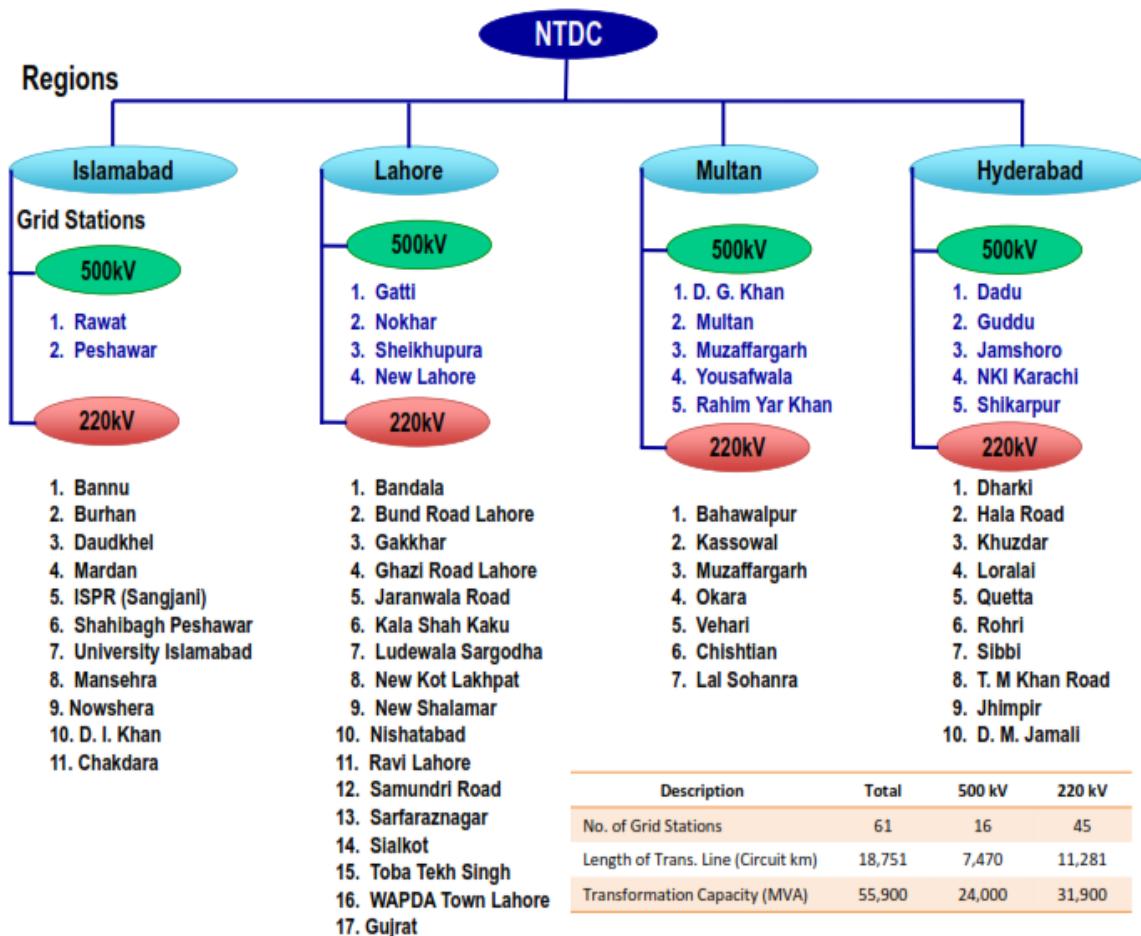
2.1 Licence

NTDC was granted Transmission Licence No. TL/01/2002 on 31st December 2002 by NEPRA to engage exclusively in the 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.

2.2 Transmission Network

NTDC operates & maintains sixteen (16) 500 kV and forty-five (45) 220 kV Grid Stations with 7,470 km of 500 kV and 11,281 km of 220 kV transmission lines as of June, 2020. Figure 2.1 shows detail of NTDC transmission system.

Figure 2.1: NTDC transmission system



2.3 Performance at a Glance

An overview of the performance of NTDC is given hereunder in light of the reported data;

System Reliability

Average Duration of Interruption

1. Total outages hours recorded at all interconnection points (excluding 132 kV line tripping) = **68.7 Hrs**
2. Total number of interconnection points = **512**
3. System duration of interruption = $68.7 \div 512 = 0.13 \text{ Hrs}/\text{point}$ i.e. **8 min.**

Indicates a 59% decrease over the previous year i.e. 0.32 Hrs/point (19 min)

Average Frequency of Interruption

1. Total number of outages recorded at all 132 kV outgoing circuits (excluding 132 kV line tripping) = **62**
2. Total number of 132 kV circuits = **512**
3. System frequency of interruption = $62 \div 512 = 0.12 \text{ Nos./circuit}$

Indicates a 8% decrease over the previous year i.e. 0.13 Nos./circuit

System Security

Energy Not Served (ENS)

1. Total ENS = **17.3 million kWh**
2. Number of incidents, where there has been a loss of supply = **62**
3. Average ENS per incident = **0.3 million kWh**
4. Average duration per incident = $68.7 \div 62 = 1.1 \text{ Hrs (1 Hr & 6 min)}$
5. Financial impact of ENS = **Rs. 88 Million**
6. Financial impact per incident = $88 \div 62 = \text{Rs. 1.4 Million.}$

Rs. 88 Million indicates 86% decrease than the previous year's impact of Rs. 638 Million.

Quality of Supply

Voltage

1. Total number of violations under normal conditions = **142,099**
2. Total number of violations under N-1 conditions = **7,031**
3. Total number of violations under Normal & N-1 conditions = **149,130.**
4. Highest voltage recorded under normal conditions; @500 kV level: **565 kV** for 60 min. at D.G Khan; @220kV level: **250 kV** for 60 min. at Sibbi & Loralai.
5. Lowest voltage recorded under normal conditions; @220kV level: **171 kV** for 1410 min. at T. T Singh.

Violations of 149,130, indicates 3% increase over the previous year's 144,782.

Frequency

1. Number of times frequency remained outside the limits in a year = **9**
2. Time duration the frequency remained outside the limits in a year = **48 min.**
3. %age time of the year the frequency remained outside the limits = **0.009% time of the year.**

4. Highest frequency recorded = **50.62 Hz**
5. No violation at lower end.

Allowable limits: 49.5 Hz – 50.5 Hz

3 Analysis of NTDC's Annual Performance Report (APR)

The Annual Performance Report submitted by NTDC has been evaluated in light of the PSTR 2005. The detail is given hereunder;

3.1 System Reliability

3.1.1 System Duration of Interruption

The total outages hours recorded at all interconnection points are 68.7 during the reported period, indicating a 57% decrease in comparison to the preceding year's 160 hours. Similarly, 12 number of interconnection points have been added to the system resulting into 512 in total. The same has been shown in figure 3.1.

The average duration of interruption per interconnection point during the reported period remained 0.13 hours (8 minutes). This indicates a 59% decrease over the previous year's 0.32 hours (19 minutes).

NTDC has shown improvement with respect to preceding year that has been shown in figure 3.2

Figure 3.1: Outages hours & No. of interconnection points

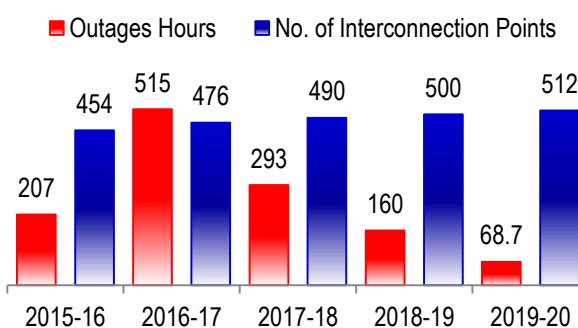
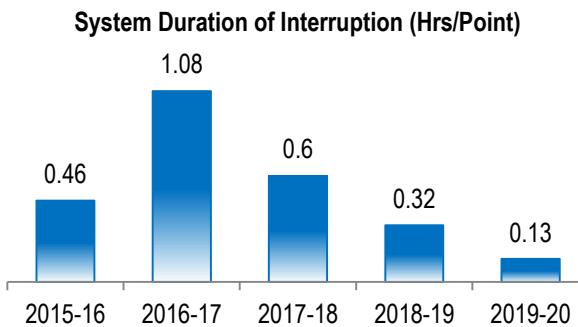


Figure 3.2: System duration of interruption (Hours/Point)



3.1.2 System Frequency of Interruption

A total of 62 number of outages have been recorded during the year 2019-20 that indicates 6% decrease over the previous year i.e. 66, as shown in figure 3.3.

The average number of interruptions per circuit during the reported period remained 0.12 indicating 8% improvement in comparison to the preceding year's 0.13 as shown in figure 3.4.

Figure 3.3: No. of outages & No. of 132kV outgoing circuits

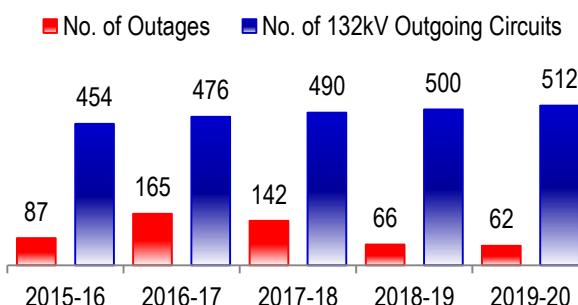
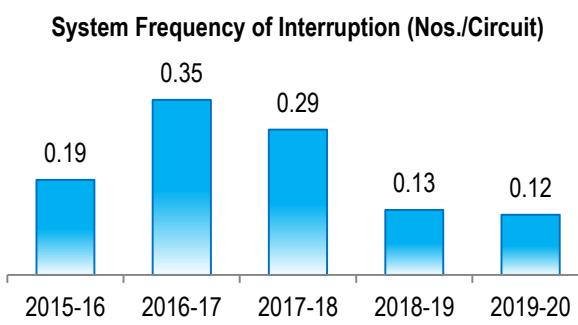


Figure 3.4: System frequency of interruption (Nos./Circuit)



3.2 System Security

In order to gauge system security, the estimates of total energy not served (ENS) during the reported period has been analyzed. The total ENS as reported by NTDC is 17.3 million kWh. Based on the average energy sale rate of DISCOs⁵, the financial impact of 17.3 million kWh, amounts to approximately Rs. 88 million. The detail is given hereunder;

Figure 3.5: Reported ENS

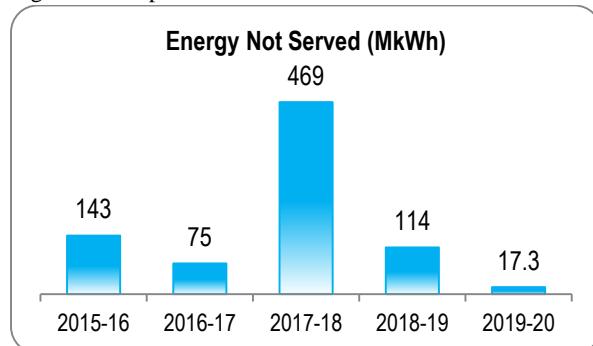


Figure 3.6: Loss of supply incidents & duration per incident

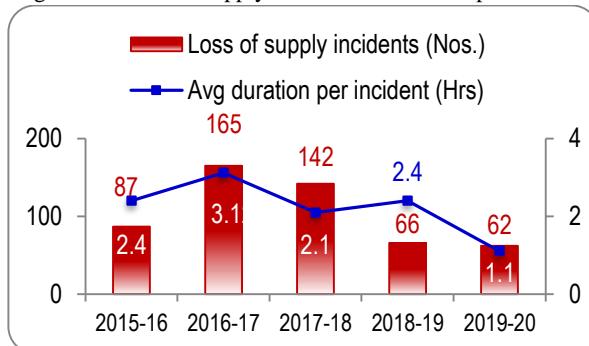


Table 3.1: Loss of supply incidents, average ENS, duration & financial impact per incident

▼ Description / Unit / Year ►	Unit	2015-16	2016-17	2017-18	2018-19	2019-20
Loss of Supply Incidents	Nos.	87	165	142	66	62
Average ENS per Incident	Million kWh	1.644	0.454	3.3	1.7	0.3
Average Duration per Incident	Hrs : Min	02 : 24	03 : 07	02 : 06	02 : 24	01 : 06
Financial Impact per Incident	Rs. (Million)	8.322	2.5	17.5	9.7	1.4

Figure 3.7: Total number of loss of supply incidents with average

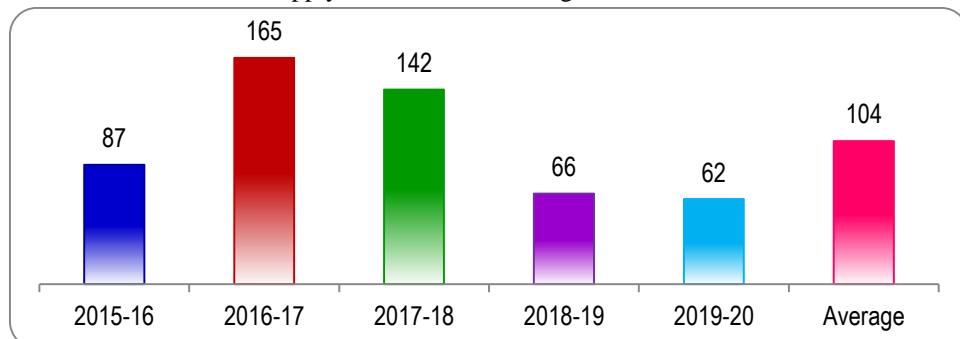
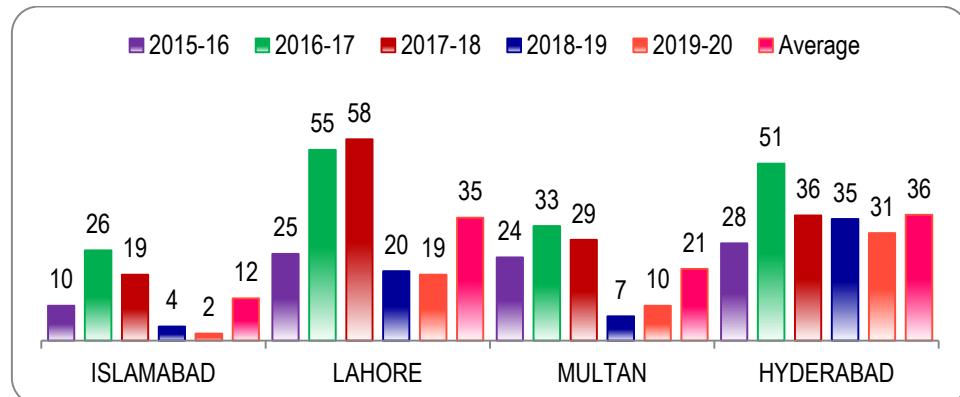
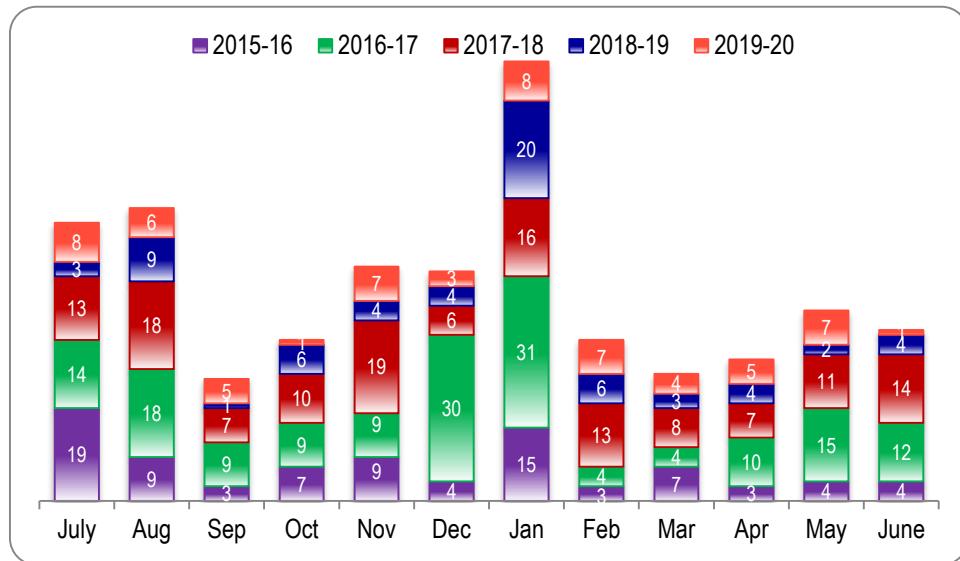


Figure 3.8: Region wise loss of supply incidents



⁵ Monthly adjustment in DISCOs approved tariff on account of variation in fuel charges 2019-20; Average energy sale rate = Rs. 5.09/kWh

Figure 3.9: Seasonal trend of loss of supply incidents



3.2.1 System Collapses/Major Disturbances

It has been observed that major system disturbances have occurred 5 times in the year 2019-20. The detail is summarized below: -

Table 3.2: System collapses/major disturbances

S. No.	Date	Loading at Interruption time	Duration of Interruption	Remarks
1	5-July-2019	100 MW	4 Hrs & 30 min	500 kV Circuits affected; Guddu – DG Khan, Guddu – Muzaffargarh – Guddu – Guddu 747, Rahim Yar Khan – Guddu 747 220 kV Circuits affected; Dadu – Khuzdar circuit # 1 & 2
2	29-July-2019	90 MW	2 Hrs & 12 min	500 kV Circuits affected; Moro – Engro Thar, Engro Thar – Jamshoro, Jamshoro – Dadu, Dadu – Port Qasim 220 kV Circuits affected; Jamshoro – Hala Road circuit # 1 & 2, Jhimpir – T.M Khan circuit # 1 & 2
3	21-Aug-2019	475 MW	2 Hrs & 44 min	220 kV circuits Kala Shah Kaku – Bund road circuit # 2, Ghakkar – Sahowala, Mangla – Gakkhar, Kala Shah Kaku – Sahowala, & Kala Shah Kaku – Ghazi affected.
4	20-May-2020	717 MW	16 min	500 kV circuits New Ghakkar – Neelum Jhelum, Rawat – Neelum Jhelum, New Ghakkar – New Lahore, and New Ghakkar – Lahore Sheikhupura affected.
5	30-June-2020	610 MW	4 Hrs & 2 min	Fire incident at 132 Jamshoro switchyard resulting in tripping of T1, T2 & T3 at Jamshoro, 220 kV G/S Jhimpir, T. M. Khan, Hala Road, and loss of generation of all wind power plants occurred.

3.3 Quality of Supply

Quality of supply (QoS) is measured with reference to system voltage and system frequency (see section 1.2.1). The analysis of QoS data as reported by the licensee is given hereunder:

3.3.1 System Voltage

The data pertaining to number of voltage violations as submitted by NTDC was analyzed and it was observed that NTDC's performance has declined by 3% in the year 2019-20 as compared to preceding year as shown in figure 3.10. Region wise detail of voltage violations is as under;

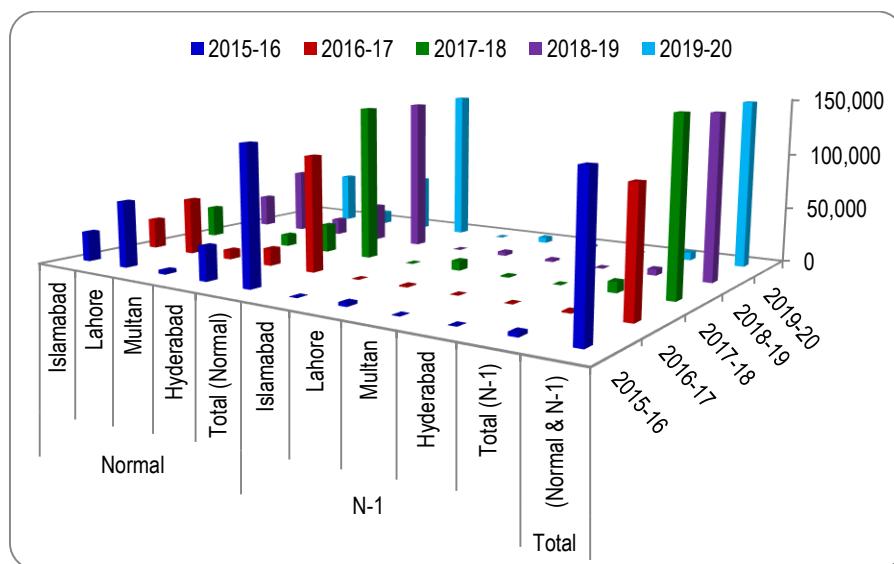
Figure 3.10: Number of voltage violations (NTDC)



Table 3.3: Number of voltage violations (NTDC Region wise)

System Condition	NTDC Region	2015-16	2016-17	2017-18	2018-19	2019-20
Normal	Islamabad	27,192	27,776	28,978	30,185	29,577
	Lahore	60,285	52,005	74,718	60,386	47,956
	Multan	3,453	8,455	10,800	14,921	11,868
	Hyderabad	31,072	15,582	25,826	33,850	52,698
Total (Normal)		122,002	103,818	140,322	139,342	142,099
N-1	Islamabad	277	—	—	—	—
	Lahore	2,951	1,029	8,506	3,355	5,009
	Multan	—	75	926	1,777	1,770
	Hyderabad	3	2	—	308	252
Total (N-1)		3,231	1,106	9,432	5,440	7,031
Total (Normal & N-1)		125,233	104,924	149,754	144,782	149,130

Figure 3.11: Number of voltage violations (NTDC Region wise)



The grid station wise breakup for each region is given hereunder:

Table 3.4: Number of voltage violations | NTDC Islamabad Region

S. No.	Grid Station	2015-16	2016-17	2017-18	2018-19	2019-20
1	500 kV Rawat	5,190	6,611	6,202	5,165	6,768
2	500 kV Peshawar	3,613	4,239	2,212	772	2,275
3	220 kV Bannu	2,733	3,394	1,256	1,195	716
4	220 kV Burhan	1,754	1,184	219	265	1,032
5	220 kV Daudkhel	9,456	5,631	1,421	906	684
6	220 kV ISPR	36	269	773	470	1,364
7	220 kV Mardan	2,220	4,008	11,359	13,513	5,460
8	220 kV Shahibagh	943	806	2,703	2,816	3,620
9	220 kV University	1,210	1,634	2,832	2,812	2,541
10	220 kV Mansehra	04-04-2018*		1	124	56
11	220 kV Nowshera	19-04-2019*		NA	1357	NA
12	220 kV Chakdara	16-09-2018*		317	578	317
13	220 kV D. I. Khan	18-02-2019*		1,830	3126	1,830
14	Total	27,155	27,776	28,978	30,185	29,577

* Date commissioned/energized

Figure 3.12: Number of voltage violations (NTDC Islamabad Region)

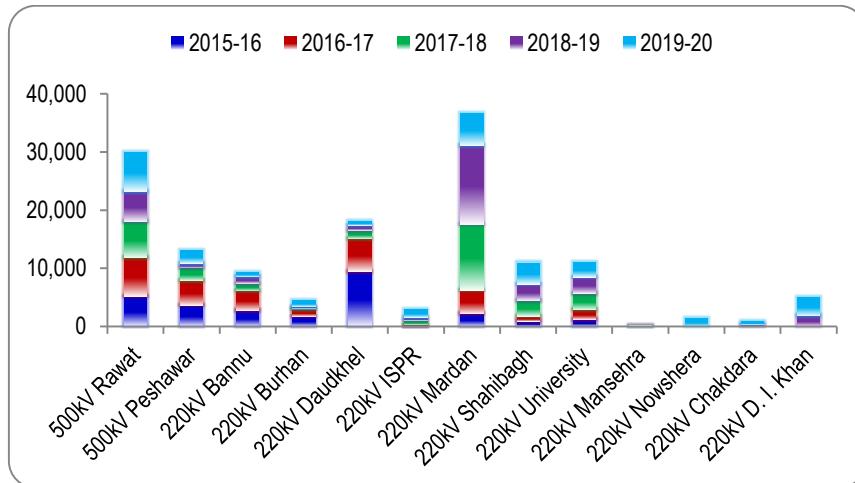


Table 3.5: Number of voltage violations

| NTDC Lahore Region

S. No.	Grid Station	2015-16	2016-17	2017-18	2018-19	2019-20
1	500 kV Gatti	1,285	3,223	3,155	796	1,026
2	500 kV Nokhar	—	318	710	738	3,012
3	500 kV Sheikhupura	4,137	15,365	33,604	8,706	693
4	500 kV New Lahore	01-11-2017		1,474	1,966	3,694
5	220 kV Bund Road	3,607	2,045	5,502	4,664	6,450
6	220 kV Gakkhar	1,582	6,569	6,544	10,357	661
7	220 kV Jaranwala	208	372	836	340	4,219
8	220 kV Kala Shah Kaku	20,704	4,690	4,629	4,754	411
9	220 kV Ludewala	303	486	590	376	3,822
10	220 kV New Kot Lakhpat	5,327	3,140	4,285	3,646	1,559

S. No.	Grid Station	2015-16	2016-17	2017-18	2018-19	2019-20
11	220 kV New Shalamar	6,309	1,236	1,777	1,522	268
12	220 kV Nishatabad	96	NA	128	48	4,746
13	220 kV Ravi	7,604	6,857	3,693	4,462	606
14	220 kV Samundri Road	2,536	324	156	52	3,266
15	220 kV Sarfaraznagar	5,898	3,548	2,968	2,546	2,420
16	220 kV Sialkot	1,363	2,252	2,352	2,425	960
17	220 kV WAPDA Town	1,381	1,267	2,039	1,392	8,932
18	220 kV Ghazi Road	—	—	2,578	6,940	1,800
19	220 kV Bandala	—	441	1,683	1,192	940
20	220 kV Toba Tekh Singh	896	850	910	1,418	2,632
21	220 kV Gujrat	Apr, 17*	51	3,611	5,401	1,026
22	Total	63,236	53,034	83,224	63,741	52,965

* Date commissioned/energized NA: Not applicable

Figure 3.13: Number of voltage violations (NTDC Lahore Region)

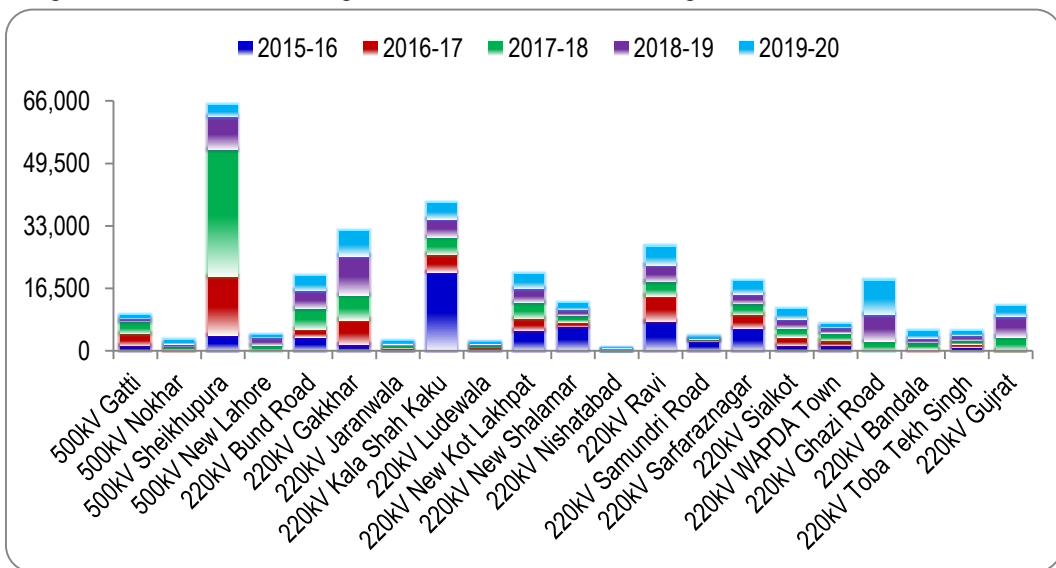


Table 3.6: Number of voltage violations

| NTDC Multan Region

S. No.	Grid Station	2015-16	2016-17	2017-18	2018-19	2019-20
1	500 kV Multan	8	3	-	20	28
2	500 kV Muzaffargarh	-	-	-	-	NIL
3	500 kV Yousafwala	-	126	543	1,601	1320
4	500 kV D.G. Khan	-	722	27	194	225
5	550 kV Rahim Yar Khan			Nil	6	NIL
6	220 kV Bahawalpur	506	20	21	836	1673
7	220 kV Muzaffargarh	-	-	650	463	416
8	220 kV Vehari	593	2,519	5,335	6,659	2870
9	220 kV Okara	338	526	365	884	408
10	220 kV Kassowal	2,008	3,822	998	1,274	1100
11	220 kV Chishtian	Oct, 16*	792	3,787	4,761	4867
12	220 kV Lal Sohanra		15-02-2018*			731
13	Total	3,453	8,530	11,726	16,698	13,638

* Date commissioned/energized

Figure 3.14: Number of voltage violations (NTDC Multan Region)

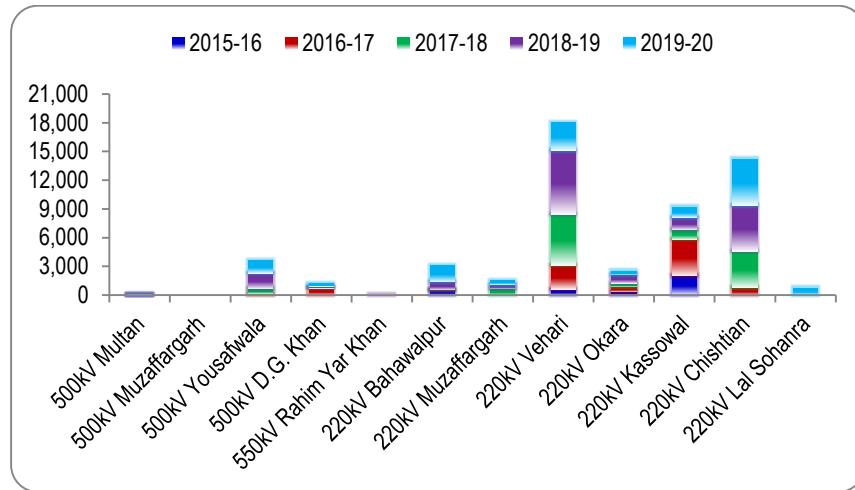


Table 3.7: Number of voltage violations

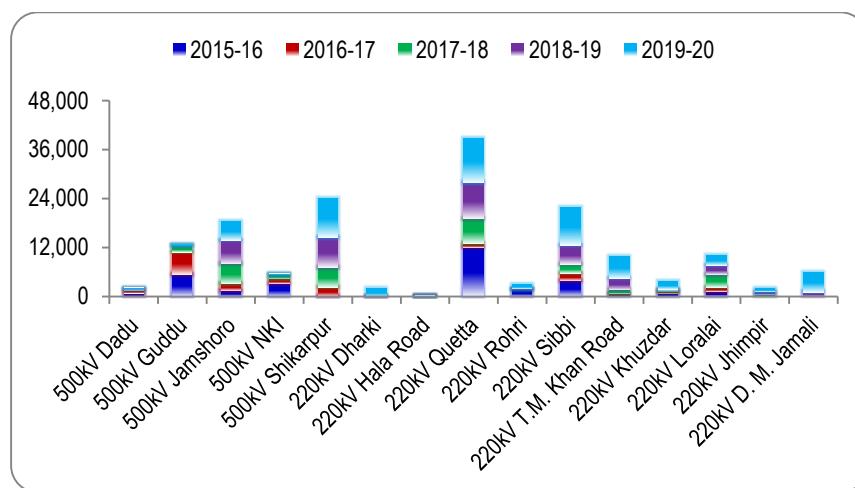
| NTDC Hyderabad Region

S. No.	Grid Station	2015-16	2016-17	2017-18	2018-19	2019-20
1	500kV Dadu	835	733	265	152	113
2	500 kV Guddu	5,433	5,433	1,494	46	260
3	500 kV Jamshoro	1,456	1,688	4,874	5,755	4,583
4	500 kV NKL	3,188	1,106	1,118	29	106
5	500 kV Shikarpur	45	2,242	4,842	7,258	9,602
6	220kV Dharki	24	2	NA	NA	1,912
7	220kV Hala Road	6	10	56	20	10
8	220kV Quetta	12,106	890	6,044	8,758	10,936
9	220kV Rohri	1,642	-	70	200	968
10	220kV Sibbi	3,924	1,768	2,239	4,579	9,186
11	220 kV T. M. Khan Road	374	244	1054	2818	5,208
12	220 kV Khuzdar	796	458	282	246	1,966
13	220 kV Loralai	1,246	1,010	3,140	2,290	2,440
14	220 kV Jhimpur		Aug, 2017*	348	888	830
15	220 kV D. M. Jamali			2018-19*	1,119	4,830
16	Total	31,075	15,584	25,826	34,158	52,950

* Date commissioned/energized

NA: Not applicable

Figure 3.15: Number of voltage violations (NTDC Hyderabad Region)



The detailed circuit wise analysis for each region is given at appendix 1 through appendix 4.

Figure 3.16: Highest voltage recorded at 500 kV grid stations under Normal condition

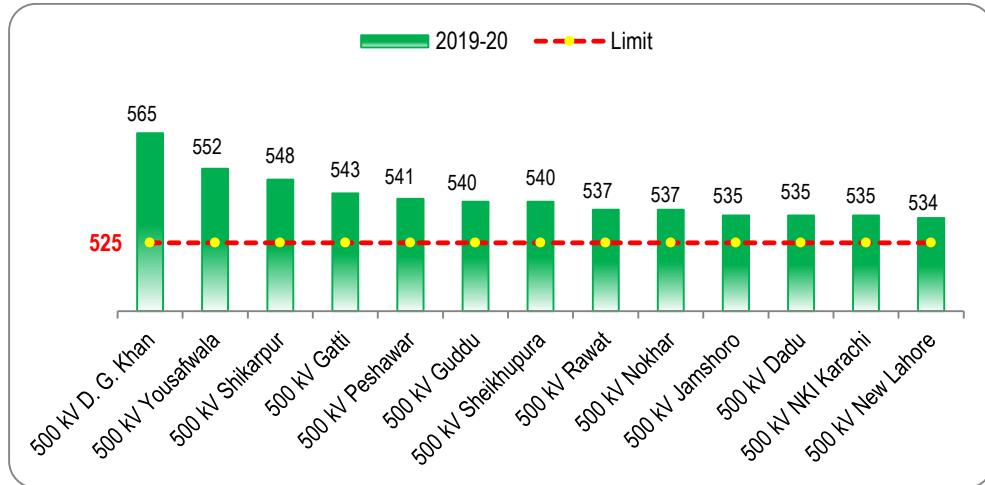


Figure 3.17: Highest voltage recorded at 220 kV grid stations under Normal condition

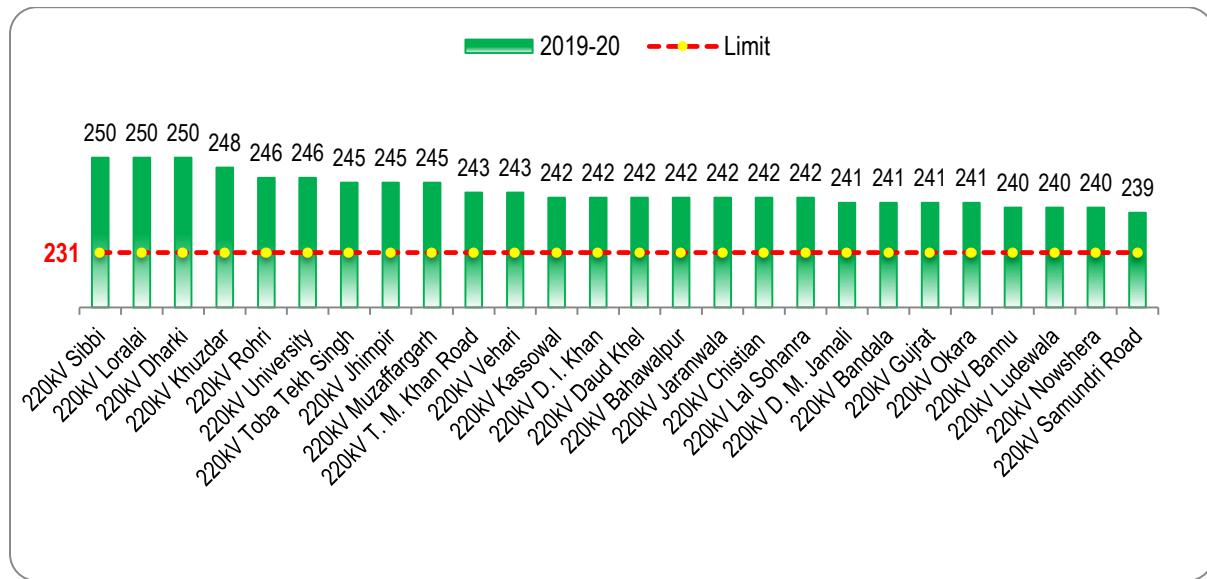
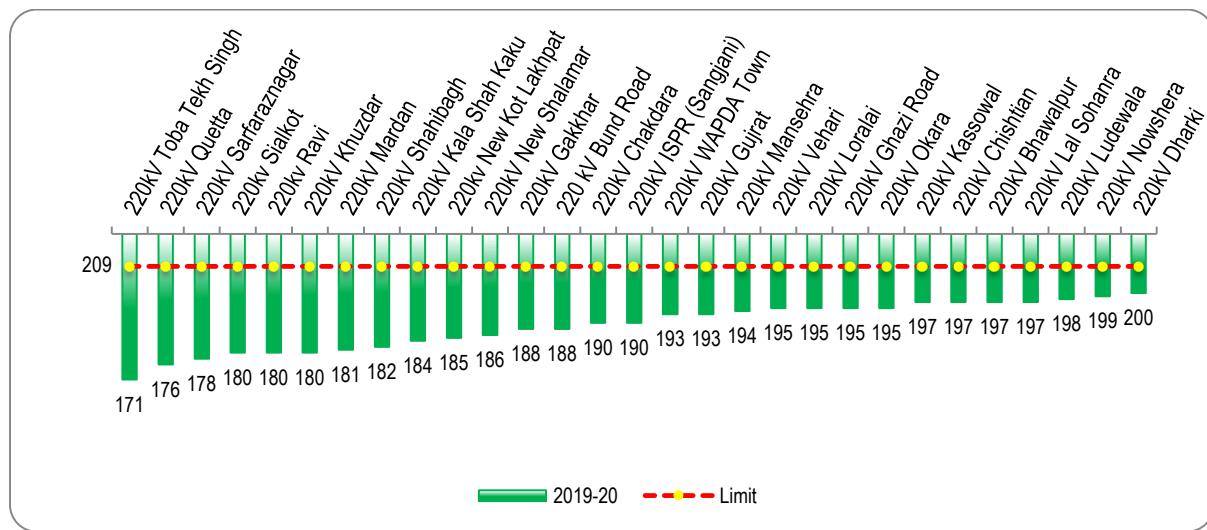


Figure 3.18: Lowest voltage recorded at 220 kV grid stations under Normal condition



3.3.2 System Frequency

The data submitted by NTDC was analyzed and it revealed that a total of 9 times frequency remained outside the prescribed limits and that comes out to be approximately 0.009% of the reported period. The following table shows statistics of system frequency over the reported period.

Table 3.8: System frequency stats (2019-20)

Month	Number of days/hours for a month over a year		Frequency violation recorded (Hz)		Duration of variation		Variation (%)			Number of times frequency remained outside the limits
	Days	Hours	Highest	Lowest	Minutes	Hours	Highest	Lowest	Period	
1	2	3	4	5	6	7	8=(4-50)/50*100	9=(5-50)/50*100	10=7/3*100	11
July	31	744	50.62	Nil	23	0.38	1.24	Nil	0.05	4
Aug	31	744	50.55	Nil	6	0.1	1.1	Nil	0.01	1
Sep	30	720	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Oct	31	744	50.59	Nil	7	0.12	1.18	Nil	0.02	1
Nov	30	720	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Dec	31	744	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Jan	31	744	50.58	Nil	6	0.1	1.16	Nil	0.01	1
Feb	28	672	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Mar	31	744	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Apr	30	720	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
May	31	744	50.6	Nil	6	0.1	1.2	Nil	0.01	1
June	30	720	50.54	Nil	6	0.1	1.08	Nil	0.01	1
Year	365	8760	50.62	Nil	54	0.9	1.24	Nil	0.01	9

Other details assessed pertaining to system frequency with a comparison to the preceding years is given in the following table;

Table 3.9: System frequency details with comparison

▼ Description / Unit / Year ►	Unit	2015-16	2016-17	2017-18	2018-19	2019-20
Number of times Frequency remained outside the Limits in a Year	In a year	248	35	25	25	9
	Average/month	21	2.9	2.1	2.1	0.8
	Average/day	0.7	0.096	0.068	0.068	0.024
Time duration the Frequency remained outside the Limits in a Year	Days	1.6	0.18	0.17	0.12	0.03
	Hours	37.9	4.2	4.1	2.98	0.8
	%age of year	0.43	0.048	0.047	0.034	0.009
Maximum Continuous period of Deviation	Hours	1.5	0.25	0.18	-	-
	Minutes	89	15	11	-	-

The following figures show the NTDC's month wise highest & lowest frequency for the year 2019-20. The dotted red line shows the prescribed limits (upper 50.5 Hz & lower 49.5 Hz) as per PSTR 2005. Historical data as reported by NTDC is given at appendix 6.

Figure 3.19: Highest frequency recorded (Hz)

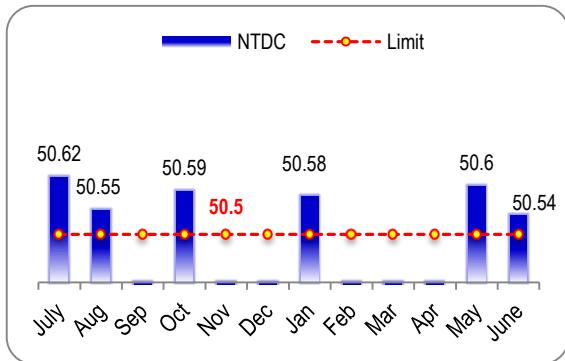
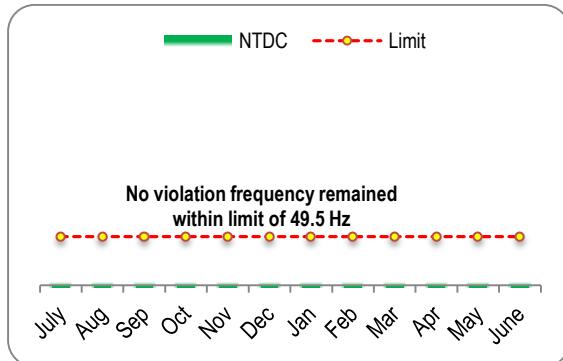
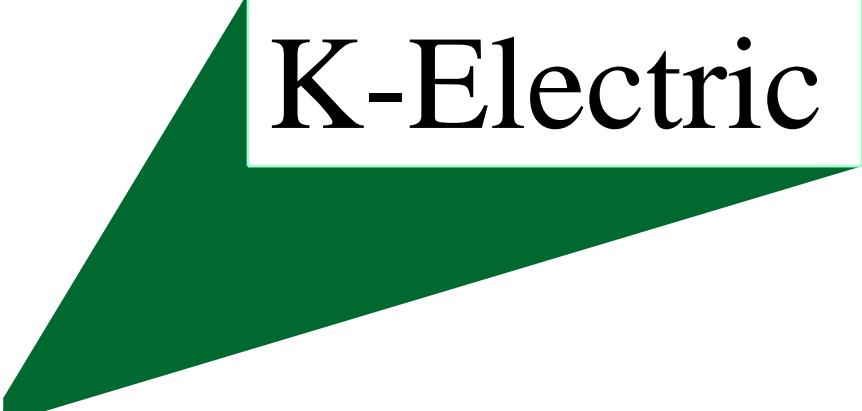


Figure 3.20: Lowest frequency recorded (Hz)





K-Electric

4 Brief about K-Electric

K-Electric (KE) 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). Thereafter, it was rebranded as K-Electric.

4.1 Licence

KE was granted Transmission Licence No. TL/01/2002 on 31st December 2002 by NEPRA to engage exclusively in the 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.

4.2 Transmission Network

KE's transmission system comprises a total of 1,318 km of 220 kV, 132 kV and 66 kV transmission lines, 70 grid stations, 20 Auto Transformers and 167 power transformers, as of June 2020. K-Electric grid is interconnected with the NTDC grid system through four (04) 220 kV transmission circuits, namely;

- i. KDA-NKI
- ii. Baldia-NKI
- iii. KDA-Jamshoro-1
- iv. KDA-Jamshoro-2

4.3 Performance at a Glance

An overview of the performance of KE is given hereunder in light of the reported data;

System Reliability

Average Duration of Interruption

1. Total outages hours recorded at all interconnection points (excluding 132 kV line tripping) = **0.95 Hrs**
2. Total number of interconnection points = 9
3. System duration of interruption = $0.95 \div 9 = 0.12 \text{ Hrs}/\text{point}$ i.e. **7 min.**

Indicates an 80% decrease over the previous year i.e. 0.61 Hrs/point

Average Frequency of Interruption

1. Total number of outages recorded at all 132 kV outgoing circuits (excluding 132 kV line tripping) = **3**
2. Total number of 132 kV circuits = **42**
3. System frequency of interruption = $3 \div 42 = 0.09 \text{ Nos./circuit}$.

Indicates a 77% decrease over the previous year i.e. 0.39 Nos./circuit

System Security

Energy Not Served (ENS)

1. Total ENS = **0.701 million kWh**
2. Number of incidents, where there has been a loss of supply = **3**
3. Average ENS per incident = **0.234 million kWh**
4. Average duration per incident = $0.95 \div 3 = 0.32 \text{ Hrs (19 min)}$
5. Financial impact of ENS = **Rs. 6.7 Million**
6. Financial impact per incident = $6.7 \div 3 = \text{Rs. 2.2 Million}$.

Rs. 9 Million indicates 80% decrease than the previous year's impact of Rs. 34.3 Million.

Quality of Supply

Voltage

1. Total number of violations under Normal conditions = **Nil**
2. Total number of violations under N-1 conditions = **9**
3. Total number of violations under Normal & N-1 conditions = **9**
4. Lowest voltage recorded under Normal conditions; @132kV level: 118.7 kV for 36 min. at Pipri West-Port Qasim.
5. As reported, no highest voltage violation recorded for 220kV & 132kV.

Frequency

As reported, the frequency remained within the limits.

5 Analysis of KE's Annual Performance Report (APR)

The Annual Performance Report submitted by KE has been evaluated in light of the PSTR 2005. The detail is given hereunder;

5.1 System Reliability

5.1.1 System Duration of Interruption

The total outages hours recorded at all interconnection points are 0.95 during the reported period, indicating a 78% decrease in comparison to the preceding year's 4.27 hours. Number of interconnection points raised to 8. The same has been shown in figure 5.1.

The average duration of interruption per interconnection point during the reported period remained 0.12 (7 minutes). This indicates a 27% increase over the previous year's 0.61 hours (37 minutes)

KE's performance has been improved with respect to preceding year that has been shown in figure 5.2

Figure 5.1: Outages hours & No. of interconnection points

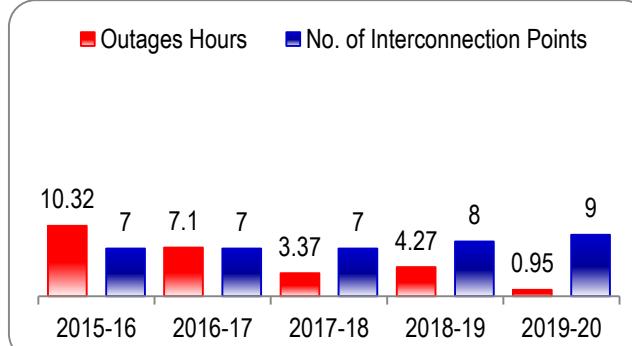
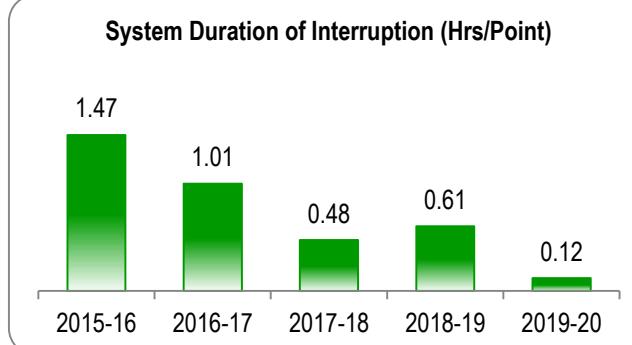


Figure 5.2: System duration of interruption (Hours/Point)



5.1.2 System Frequency of Interruption

A total of 3 number of outages have been recorded during the year 2019-20 that indicates 77% decrease over the previous year i.e. 13, as shown in figure 5.3.

Moreover, the number of 132 kV outgoing circuits have been increased as compared to preceding year.

The average number of interruptions per circuit during the reported period remained 0.09 indicating 77% decrease in comparison to the preceding year's 0.39 as shown in figure 5.4.

Figure 5.3: No. of outages & No. of 132kV outgoing circuits

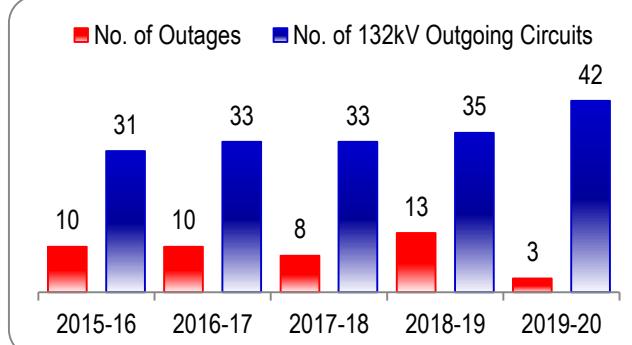
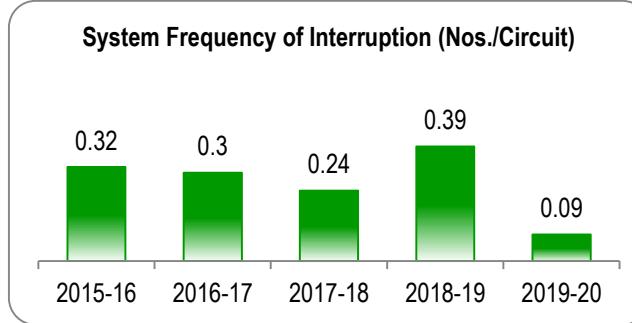


Figure 5.4: System frequency of interruption (Nos./Circuit)



5.2 System Security

In order to gauge system security, the estimates of total energy not served (ENS) during the reported period has been analyzed. The total ENS as reported by KE is 0.701 million kWh. Based on the average energy sale rate of KE⁶, the financial impact of 0.701 million kWh, amounts to approximately Rs. 6.7 million. The detail is given below;

Figure 5.5: Reported ENS

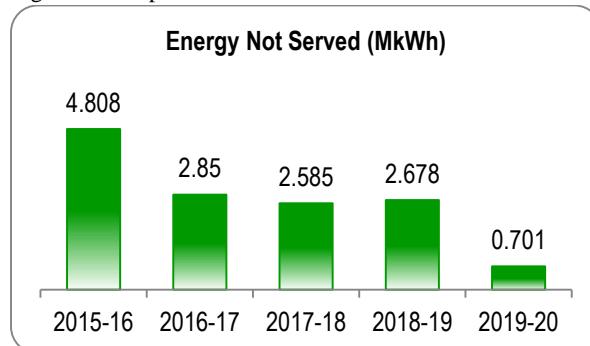


Figure 5.6: Loss of supply incidents & duration per incident

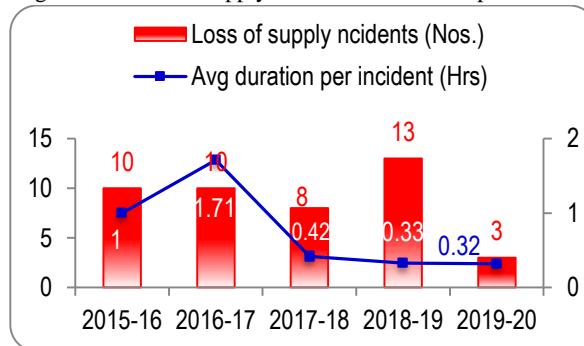
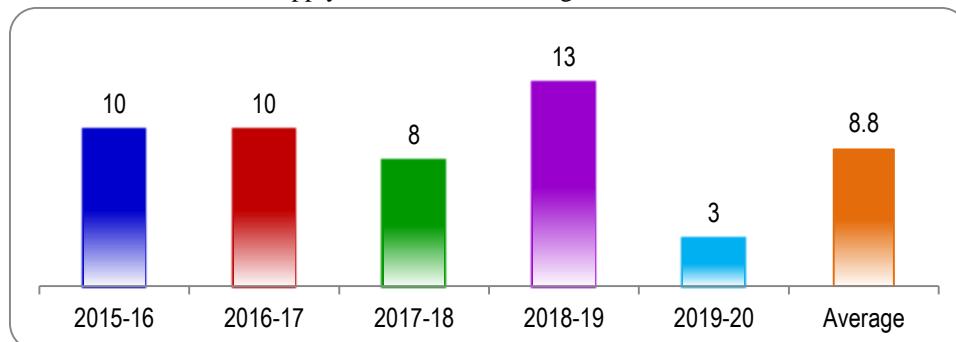


Table 5.1: Loss of supply incidents, average ENS, duration & financial impact per incident

▼ Description / Unit / Year ►	Unit	2015-16	2016-17	2017-18	2018-19	2019-20
Loss of Supply Incidents	Nos.	10	10	8	13	3
Average ENS per Incident	Million kWh	0.481	0.285	0.323	0.206	0.234
Average Duration per Incident	Hrs : Min	01 : 24	00 : 43	00 : 25	00 : 20	00 : 19
Financial Impact per Incident	Rs. (Million)	6.24	3.65	4.1	2.6	2.2

Figure 5.7: Total number of loss of supply incidents with average



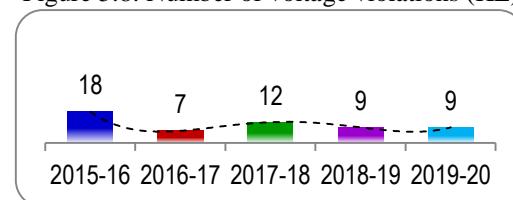
5.3 Quality of Supply

Quality of supply (QoS) is measured with reference to system voltage and system frequency (see section 1.2.1). The analysis of QoS data as reported by KE is given hereunder:

5.3.1 System Voltage

The voltage violations under normal condition at 132 kV level remained same in 2019-20 as compared to preceding year. Further, no violation has occurred at 220 kV level both under normal and N-1 conditions.

Figure 5.8: Number of voltage violations (KE)



⁶ KE's Average energy sale rate = Rs. 9.55/kWh, subject to adjustment & indexation by NEPRA.

Figure 5.8 shows historical trend over the five years' period. Detailed circuit wise analysis is given at appendix 5.

5.3.2 System Frequency

The data submitted by KE was analyzed and it was revealed that frequency remained within the prescribed limits.

APPENDIX 1

Voltage violations data - detailed circuit wise analysis

NTDC Islamabad Region

1.	500 kV Rawat	1 of 13
2.	500 kV Peshawar	2 of 13
3.	220 kV Bannu	3 of 13
4.	220 kV Burhan.....	4 of 13
5.	220 kV Daudkhel.....	5 of 13
6.	220 kV ISPR (Sangjani)	6 of 13
7.	220 kV Mardan.....	7 of 13
8.	220 kV Nowshera	8 of 13
9.	220 kV Shahibagh.....	9 of 13
10.	220 kV University.....	10 of 13
11.	220 kV Mansehra.....	11 of 13
12.	220 kV Chakdara	12 of 13
13.	220 kV D. I. Khan.....	13 of 13

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)								
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage
Normal	500 kV Rawat - Barotha Ckt I & II	83	494	552	482	223	533	60	540	120	541	60	553	60	537	150	-	-	-	-	-	-	-
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	500 kV Rawat - Gakkhar Ckt I & II	83	494	548	481	223	533	60	540	120	544	180	553	60	537	150	-	-	-	-	-	-	-
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	500 kV Rawat - Tarbela	83	494	276	481	223	533	60	540	120	541	60	553	60	537	150	-	-	-	-	-	-	-
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	500 kV Rawat - Neelum Jehlum	Energized in May 2018		53	479	223	Energized in May 2018			544	180	553	60	537	150	Energized in May 2018			-	-	-	-	-
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	220 kV Rawat - ISPR Ckt I & II	1245	1105	798	534	1469	240	60	241	90	241	60	246	60	245	180	-	-	-	-	-	-	-
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	220 kV Rawat - Mangla Ckt I & II	1198	1156	1604	1068	1469	240	60	241	90	243	90	246	60	245	180	-	-	-	-	-	-	-
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	220 kV Rawat - Bahria Town Ckt I & II	1249	1171	793	589	1469	240	60	241	90	241	90	246	60	245	180	-	-	-	-	-	-	-
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	220 kV Rawat - University Ckt I & II	1249	1697	1578	1051	1469	240	60	241	150	243	60	246	60	245	180	-	-	-	-	-	-	-
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total No. of Variations (Normal)		5,190	6,611	6,202	5,165	6,768	 Highest Voltage Under Normal Condition @500kV level																
Total No. of Variations (N-1)		-	-	-	-	-	 Highest Voltage Under Normal Condition @220kV level																
Total of Normal & N-1		5,190	6,611	6,202	5,165	6,768																	

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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	Time	2016-17	Voltage	Time	2017-18	Voltage	Time	2018-19	Voltage	Time	2019-20	Voltage	Time	2015-16	Voltage	Time	2016-17	Voltage	Time	2017-18	Voltage	Time	2018-19	Voltage	Time			
Normal	500 kV	1	17	58	19	432	526	60	531	60	527	60	538	60	541	60	-	-	473	60	-	-	-	-	-	-	468	60			
N-1	Tarbela - Peshawar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV	1211	1428	549	209	NP	239	60	242	60	236	60	238	60	NP		200	60	-	-	180	60	198	60	NP						
N-1	Barotha - Peshawar	-	-	-	-		-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV	1190	1415	1062	251	587	239	60	242	60	236	60	238	60	238	60	200	60	-	-	180	60	180	60	185	60					
N-1	Peshawar - Daudkhel Ckt I & II	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV	1211	1379	543	251	621	239	60	242	60	236	60	238	60	238	60	200	60	-	-	175	60	180	60	185	60					
N-1	Peshawar - Shahibagh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV	Added in 2018-19			42	635	Added in 2018-19					-	-	238	60	Added in 2018-19					180	60	186	60							
N-1	Peshawar - Nowshera				-	-						-	-	-	-																

NP: Not Provided

Total No. of Variations (Normal)	3,613	4,239	2,212	772	2,275
Total No. of Variations (N-1)	-	-	-	-	-
Total of Normal & N-1	3,613	4,239	2,212	772	2,275

█ Highest Voltage Under Normal Condition @500kV level

█ Lowest Voltage Under Normal Condition @500kV level

█ Highest Voltage Under Normal Condition @220kV level

█ Lowest Voltage Under Normal Condition @220kV level

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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	2016-17	Voltage	2017-18	Voltage	2018-19	Voltage	2019-20	Voltage	2015-16	Voltage	2016-17	Voltage	2017-18	Voltage	2018-19	Voltage	2019-20	2015-16	Voltage	2016-17	Voltage	2017-18	Voltage	2018-19	Voltage			
Normal	220 kV Daudkhel - Bannu Ckt I & II	2652	1859	651	586	358	241	60	256	60	241	60	241	60	240	60	240	60	198	60	178	120	174	60	198	60	200	60			
N-1		81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	60	-	-	-	-	-	-	-	-			
Normal	220 kV Chashma - Bannu Ckt I & II	Added in 2016-17	1535	605	609	358	Added in 2016-17	246	60	241	60	241	60	240	60	Added in 2016-17	202	60	180	60	196	60	200	60	202	60	180	60	196	60	
N-1			-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-			
Total No. of Variations (Normal)		2,652	3,394	1,256	1,195	716	Highest Voltage Under Normal Condition		Lowest Voltage Under Normal Condition																						
Total No. of Variations (N-1)		81	-	-	-	-																									
Total of Normal & N-1		2,733	3,394	1,256	1,195	716																									

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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	Time	2016-17	Voltage	Time	2017-18	Voltage	Time	2018-19	Voltage	Time	2019-20	Voltage	Time	2015-16	Voltage	Time	2016-17	Voltage	Time	2017-18	Voltage	Time	2018-19	Voltage	Time			
Normal	220 kV Burhan - ISPR Ckt I & II	877	590	51	130	516	238	60	241	240	-	-	241	60	235	120	-	-	203	60	200	120	-	-	194	60					
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Normal	220 kV Burhan - Tarbela Ckt I, II & III	877	594	168	135	516	238	60	241	240	232	60	241	60	235	120	-	-	203	60	200	120	206	60	194	60					
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Total No. of Variations (Normal)		1,754	1,184	219	265	1,032	 Highest Voltage Under Normal Condition								 Lowest Voltage Under Normal Condition																
Total No. of Variations (N-1)		-	-	-	-	-																									
Total of Normal & N-1		1,754	1,184	219	265	1,032																									

NTDC Islamabad Region

5. 220kV Grid Station DAUDKHEL

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)																					
							2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20													
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time														
Normal	220 kV ISPR - Burhan	13	8	25	43	259	232	300	232	120	-	-	235	120	232	30	-	-	205	60	200	60	204	60	190	60												
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
Normal	220 kV ISPR - Tarbela	5	169	139	54	322	-	-	236	180	-	-	240	60	238	90	204	120	199	60	195	60	204	60	195	60												
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
Normal	220 kV ISPR - Bahria Town	5	30	181	98	269	232	360	-	-	-	-	235	180	235	90	205	120	199	60	195	60	203	60	190	60												
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
Normal	220 kV ISPR - Rawat	5	30	192	101	268	232	360	-	-	-	-	235	180	235	90	205	120	199	60	198	60	200	60	190	60												
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
Normal	220 kV ISPR - Mansehra Ckt I	4	16	118	116	124	232	240	232	60	-	-	238	60	235	60	206	60	201	60	195	60	205	120	196	60												
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
Normal	220 kV ISPR - Mansehra Ckt II	4	16	118	58	122	232	240	232	60	-	-	238	60	235	60	206	60	201	60	195	60	205	120	196	60												
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
Total No. of Variations (Normal)		36	269	773	470	1,364	 Highest Voltage Under Normal Condition										 Lowest Voltage Under Normal Condition																					
Total No. of Variations (N-1)		-	-	-	-	-																																
Total of Normal & N-1		36	269	773	470	1,364																																

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)									
							2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time		
Normal	220 kV Tarbela - Mardan Ckt I & II	740	2004	5730	6875	1820	-	-	-	-	-	-	-	-	-	-	198	180	193	60	180	60	188	60	181	60
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	220 kV Mardan - Barotha Ckt I & II	740	1002	2845	3345		-	-	-	-	-	-	-	-	-	-	198	180	193	60	180	60	185	120		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	220 kV Mardan - Shahibagh Ckt I & II	740	1002	2784	747		-	-	-	-	-	-	-	-	-	-	198	180	193	60	180	60	185	150		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	220 kV Mardan - Nowshera Ckt I & II	-	-	-	-	1820	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	181	60
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	220 kV Mardan - Chakdara Ckt	Energized 16-Sep-2018			2546	1820	Energized 16-Sep-2018						-	-	-	-	Energized 16-Sep-2018						190	60	181	60
N-1					-	-							-	-	-	-							-	-	-	-
Total No. of Variations (Normal)		2,220	4,008	11,359	13,513	5,460																				
Total No. of Variations (N-1)		-	-	-	-	-																				
Total of Normal & N-1		2,220	4,008	11,359	13,513	5,460																				

 Lowest Voltage Under Normal Condition

NTDC Islamabad Region

8. 220kV Grid Station NOWSHERA

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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time		
Normal	220 kV Nowshera - Mardan	Energized on 19-Apr-2019			Nil	338	Energized on 19-Apr-2019						Nil	240	60	Energized on 19-Apr-2019						Nil	199	30	Nil						
N-1						-								-	-	-	-														
Normal	220 kV Nowshera - Shahibagh	Energized on 19-Apr-2019			Nil	-	Energized on 19-Apr-2019						Nil	-	-	Energized on 19-Apr-2019						Nil	-	-	Nil						
N-1						-								-	-	-	-														
Normal	220 kV Nowshera - Barotha 1 & 2	Energized on 19-Apr-2019			Nil	689	Energized on 19-Apr-2019						Nil	240	60	Energized on 19-Apr-2019						Nil	199	30	Nil						
N-1						-								-	-	-	-														
Normal	220 kV Nowshera - S. M Peshawar	Energized on 19-Apr-2019			Nil	330	Energized on 19-Apr-2019						Nil	240	60	Energized on 19-Apr-2019						Nil	199	30	Nil						
N-1						-								-	-	-	-														

NTDC Islamabad Region

9. 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)												
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time		
Normal	220 kV Shahibagh - Peshawar Ckt II	777	656	1612	1878	2103	-	-	-	-	-	-	-	-	-	-	198	60	171	120	190	180	190	120	182	60			
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV Shahibagh - Mardan Ckt I	166	150	1091	601	N.P	235	120	238	60	-	-	-	-	N.P	198	60	195	60	182	60	192	120	N.P					
N-1		-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-				
Normal	220 kV Shahibagh - Chakdara	Energized 16-Sep-2018		337	1517	Energized 16-Sep-2018					-	-	-	-	Energized 16-Sep-2018					170		60	182	60					
N-1				-	-						-	-	-	-	-	-	-	-	-	-	-	-	-	-					
Total No. of Variations (Normal)		943	806	2,703	2,816	3,620																							
Total No. of Variations (N-1)		-	-	-	-	-																							
Total of Normal & N-1		943	806	2,703	2,816	3,620																							

 Lowest Voltage Under Normal Condition

NTDC Islamabad Region

10. 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)																													
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20														
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	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	1210	1634	2832	2812	2541	241	60	241	60	242	60	250	60	246	240	-	-	-	-	-	-	202	60	202	120																		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																	
Total No. of Variations (Normal)		1,210	1,634	2,832	2,812	2,541	 Highest Voltage Under Normal Condition								 Lowest Voltage Under Normal Condition																													
Total No. of Variations (N-1)		-	-	-	-	-																																						
Total of Normal & N-1		1,210	1,634	2,832	2,812	2,541																																						

NTDC Islamabad Region

11. 220kV Grid Station MANSEHRA

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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time				
Normal	220 kV Mansehra - Allai Khwar 1	Energized Apr, 2018	1	31	14	Energized Apr, 2018	232	150	241	60	235	120	Energized Apr, 2018	-	-	-	-	-	-	194	60	Energized Apr, 2018	-	-	-	-	-				
N-1			-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-					
Normal	220 kV Mansehra - Allai Khwar 2	Energized Apr, 2018	1	31	14	Energized Apr, 2018	232	150	241	60	235	120	Energized Apr, 2018	-	-	-	-	-	-	194	60	Energized Apr, 2018	-	-	-	-	-				
N-1			-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-					
Normal	220 kV Mansehra - ISPR 1	Energized Nov, 2018	31	14	Energized Nov, 2018	241	60	235	120	Energized Nov, 2018	-	-	-	-	-	-	-	-	-	194	60	Energized Nov, 2018	-	-	-	-	-				
N-1			-	-		-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	220 kV Mansehra - ISPR 2	Energized Nov, 2018	31	14	Energized Nov, 2018	241	60	235	120	Energized Nov, 2018	-	-	-	-	-	-	-	-	-	194	60	Energized Nov, 2018	-	-	-	-	-				
N-1			-	-		-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Total No. of Variations (Normal)	Energized Nov, 2018	2	124	56	Highest Voltage Under Normal Condition								Lowest Voltage Under Normal Condition																		
Total No. of Variations (N-1)		-	-	-																											
Total of Normal & N-1		2	124	56																											

NTDC Islamabad Region

12. 220kV Grid Station CHAKDARA

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)																				
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20					
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time								
Normal	220 kV Chakdara - Shahibagh	Energized 16-Sep-2018	115	289	Energized 16-Sep-2018								-	-	-	-	Energized 16-Sep-2018								196	60	190	90							
N-1			-	-									-	-	-	-									-	-	-	-							
Normal	220 kV Chakdara - Mardan	Energized 16-Sep-2018	202	289	Energized 16-Sep-2018								-	-	-	-	Energized 16-Sep-2018								193	60	190	90							
N-1			-	-									-	-	-	-									-	-	-	-							
Total No. of Variations (Normal)	Energized 16-Sep-2018		317	578																					Lowest Voltage Under Normal Condition										
Total No. of Variations (N-1)			-	-																															
Total of Normal & N-1			317	578																															

NTDC Islamabad Region

13. 220kV Grid Station D. I. KHAN

APPENDIX 2

Voltage violations data - detailed circuit wise analysis

NTDC Lahore Region

1.	500 kV Gatti	1 of 21
2.	500 kV Nokhar	2 of 21
3.	500 kV Sheikhupura	3 of 21
4.	500 kV New Lahore.....	4 of 21
5.	220 kV Bandala	5 of 21
6.	220 kV Bund Road Lahore	6 of 21
7.	220 kV Gakkhar.....	7 of 21
8.	220 kV Ghazi Road	8 of 21
9.	220 kV Gujrat	9 of 21
10.	220 kV Jaranwala	10 of 21
11.	220 kV Kala Shah Kaku	11 of 21
12.	220 kV Ludewala.....	12 of 21
13.	220 kV Nishatabad	13 of 21
14.	220 kV New Kot Lakhpat.....	14 of 21
15.	220 kV New Shalamar.....	15 of 21
16.	220 kV Ravi.....	16 of 21
17.	220 kV Samundri Road	17 of 21
18.	220 kV Sarfaraznagar	18 of 21
19.	220 kV Sialkot	19 of 21
20.	220 kV Toba Tek Singh.....	20 of 21
21.	220 kV WAPDA Town	21 of 21

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)									
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20				
		Voltage	Time	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	NP		NA		NA		NP		NA		NA		NP		NA		NA						
Normal	500 kV Gatti - Barotha Ckt II	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA				
Normal	500 kV Gatti - Muzaffargarh	679	708	NP		542	90	540	150	NP		NA		NA		NP		NA		NA				
		-	-			-	-	-	-															
Normal	500 kV Gatti - Rousch	154	171	120	22	26	540	60	540	60	540	60	538	150	540	330	-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Normal	500 kV Gatti - H. B. Shah 1*	310	232	618	155	23	540	90	540	150	540	60	535	90	543	390	-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Normal	500 kV Gatti - H. B. Shah 2	Added in 2017-18		252	155	232	Added in 2017-18		540	90	545	30	540	690	Added in 2017-18		-		-		-			
				-	-	-			-	-	-	-	-	-										
Normal	500 kV Gatti - QATPL Bhikhi Ckt	**	208	340	8	1	**		540	120	540	90	530	180	533	100	**		540	60	-	-	-	-
		-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	500 kV Gatti - Lahore	142	NP		NP		538	60	NP		NP		-		-		NP		-		-			
		-					-	-																
Normal	220 kV Gatti - Nishatabad 1	NP	390	312	72	42	NP	240	90	240	150	243	90	234	120	NP		-	-	-	-	-	203	330
			-	-	-	-		-	-	-	-	-	-	-	-			-	-	-	-	-	-	
Normal	220 kV Gatti - Nishatabad 2	NP	384	313	72	42	NP	240	90	240	60	243	90	234	120	NP		-	-	-	-	-	203	330
			-	-	-	-		-	-	-	-	-	-	-	-			-	-	-	-	-	-	
Normal	220 kV Gatti - Jaranwala Road 1	NP	287	208	45	45	NP	240	60	242	90	242	90	232	120	NP		-	-	-	-	-	200	240
			-	-	-	-		-	-	-	-	-	-	-	-			-	-	-	-	-	-	
Normal	220 kV Gatti - Jaranwala Road 2	NP	7	208	45	45	NP	238	60	241	90	242	90	232	120	NP		-	-	-	-	-	200	240
			-	-	-	-		-	-	-	-	-	-	-	-			-	-	-	-	-	-	
Normal	220 kV Gatti - Yousafwala 1	NP	NA		67	NP	NA	NA	231	90	NP		NA		-		NA		-		-			
					-				-	-														
Normal	220 kV Gatti - Yousafwala 2	NP	NA		67	NP	NA	NA	231	90	NP		NA		-		NA		-		-			
					-				-	-														
Normal	220 kV Gatti - Ludewala 1	NP	NA		91	NP	NA	NA	-		NP		NA		-		NA		-		-			
					-																			
Normal	220 kV Gatti - Ludewala 2	NP	NA		91	NP	NA	NA	-		NP		NA		-		NA		-		-			
					-																			
Normal	220 kV Gatti - Bandala 1	NP	577	392	111	38	NP	244	150	242	90	245	90	236	240	NP		-	-	-	-	-	206	90
			-	-	-	-		-	-	-	-	-	-	-	-			-	-	-	-	-	-	
Normal	220 kV Gatti - Bandala 2	NP	467	392	111	38	NP	247	60	242	90	245	90	236	240	NP		-	-	-	-	-	206	90
			-	-	-	-		-	-	-	-	-	-	-	-			-	-	-	-	-	-	

NP: Not Provided

NA: Not Applicable

* Previously Gatti - Multan

** Added in 2017-18

■ Highest Voltage Under Normal Condition @500kV level

■ Lowest Voltage Under Normal Condition @220kV Level

■ Highest Voltage Under Normal Condition @220kV level

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)																		
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20			
		2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	Voltage	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20				
Normal	500 kV Gakkhar - Rawat 1	NA	77	117	77	32	NA	545	150	535	60	535	150	537	90	NA	453	60	450	90	465	90	472	180	NA	453	60	450	90	465	90	472	180
N-1			-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Normal	500 kV Gakkhar - Rawat 2	NA	77	117	77	32	NA	545	150	535	60	535	150	537	90	NA	453	60	450	90	465	90	472	180	NA	453	60	450	90	465	90	472	180
N-1			-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Normal	500 kV Gakkhar - Lahore 1	NA	77	117	77	32	NA	545	150	535	60	535	150	537	90	NA	453	60	450	90	465	90	472	180	NA	453	60	450	90	465	90	472	180
N-1			-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Normal	500 kV Gakkhar - Lahore 2	NA	77	117	77	32	NA	545	150	535	60	535	150	537	90	NA	453	60	450	90	465	90	472	180	NA	453	60	450	90	465	90	472	180
N-1			-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Normal	220 kV Nokhar - Mangla	NA	5	121	215	449	NA	232	120	232	360	236	90	241	150	NA	205	120	200	270	200	210	197	90	NA	205	120	200	270	200	210	197	90
N-1			-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Normal	220 kV Nokhar - Gakkhar	NA	5	121	215	449	NA	232	120	232	360	236	90	241	150	NA	205	120	200	270	200	210	197	90	NA	205	120	200	270	200	210	197	90
N-1			-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-

Total No. of Variations (Normal)

Total No. of Variations (N-1)

Total of Normal & N-1

NA | 318 710 738 1,026

NA | - - - -

NA | 318 710 738 1,026

█ Highest Voltage Under Normal Condition @500kV level

█ Highest Voltage Under Normal Condition @220kV level

█ Lowest Voltage Under Normal Condition @500kV level

█ Lowest Voltage Under Normal Condition @220kV level

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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time		
Normal	500 kV Sheikhupura - Yousafwala	24	NP	-	-	-	-	534	30	NP					NP					NP					NP						
N-1		-						-	-																						
Normal	500 kV Sheikhupura - Gatti	24	NP	-	-	-	-	534	30	NP					NP					NP					NP						
N-1		-						-	-																						
Normal	500 kV Sheikhupura - Nokhar Ckt I & II	24	900	476	30	8	534	30	547	30	539	30	532	90	528	90	-	-	462	60	-	-	-	-	-	-	-	-	-		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	500 kV Sheikhupura - CCP Sahiwal	* 900	NP	-	-	-	-	*	547	30	NP					NP					*					NP					
N-1		-						-	-																						
Normal	500 kV Sheikhupura - CCP Bhikhi	* 900	156	26	26	26	*	547	30	538	30	535	60	540	60	*					*					-					
N-1		-	-	-	-	-		-	-	-	-	-	-	-	-																
Normal	500 kV Sheikhupura - New Lahore	Energized November, 2017		476	52	5	Energized November, 2017					541	60	535	60	528	60	Energized November, 2017					-								
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-																
Normal	220 kV Sheikhupura - WTN	813	2833	3846	986	283	-	-	-	-	-	-	-	-	-	-	-	-	193	30	192	30	198	30	198	60	197	90			
N-1		-	60	392	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	190	30	189	30	192	60	
Normal	220 kV Sheikhupura - NKLP Ckt I & II	813	2833	2983	780	686	-	-	-	-	-	-	-	-	-	-	-	-	193	30	192	30	198	30	198	60	194	60			
N-1		-	60	1175	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	190	30	190	30	196	60	
Normal	220 kV Sheikhupura - Bund Road Ckt I, II, III & IV	813	2833	12587	4509	582	-	-	-	-	-	-	-	-	-	-	-	-	193	30	192	30	194	30	198	60	197	60			
N-1		-	60	4165	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	190	30	190	30	192	60	
Normal	220 kV Sheikhupura - Ravi Ckt I & II	813	2833	2845	472	436	-	-	-	-	-	-	-	-	-	-	-	-	193	30	192	30	198	30	198	60	197	60			
N-1		-	60	596	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	190	30	189	30	197	90	
Normal	220 kV Sheikhupura - ATLAS P/H	813	2833	3252	1662	986	-	-	-	-	-	-	-	-	-	-	-	-	192	30	198	30	198	60	184	60					
N-1		-	60	655	66	-	-	-	-	-	-	-	-	-	-	-	-	-	190	30	190	30	192	120							

NP: Not Provided

* Added in 2016-17

■ Highest Voltage Under Normal Condition @500kV level

■ Lowest Voltage Under Normal Condition @220kV level

Total No. of Variations (Normal)	4,137	15,065	26,621	8,517	3,012
Total No. of Variations (N-1)	-	300	6,983	189	-
Total of Normal & N-1	4,137	15,365	33,604	8,706	3,012

NTDC Lahore Region

4. 500kV Grid Station NEW LAHORE

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times					Highest Voltage Recorded (kV) / Time (Min)								Lowest Voltage Recorded (kV) / Time (Min)										
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	
Normal	500 kV New Lahore - Balloki	Energized 01-Nov-2017	674	214	110			542	60	542	60	534	60			Energized 01-Nov-2017		-	-	-	-	464	60		
N-1			-	-	-			-	-	-	-	-	-					-	-	-	-	-	-	-	
Normal	500 kV New Lahore - SKP	Energized 01-Nov-2017	667	291	111			544	120	542	60	534	60			Energized 01-Nov-2017		-	-	-	-	464	60		
N-1			-	-	-			-	-	-	-	-	-					-	-	-	-	-	-	-	
Normal	500 kV New Lahore - GAKKhar	Added in 2018-19	191	106				542	60	534	60					Added in 2018-19		-	-	464	60				
N-1			-	-				-	-	-	-							-	-	-	-	-	-	-	
Normal	500 kV New Lahore - CEPP Sahiwal	Added in 2019-20	111						534	60						Added in 2019-20		464	60						
N-1			-						-	-								-	-						
Normal	220 kV New Lahore - Ghazi Road	Added in 2019-20	11						234	150						Added in 2019-20		207	20						
N-1			-						-	-								-	-						
Normal	220 kV New Lahore - NKLP	Energized 01-Nov-2017	67	643	83			-	-	240	60	235	180			Energized 01-Nov-2017		203	60	198	60	203	60		
N-1			-	-	-			-	-	-	-	-	-					-	-	-	-	-	-	-	
Normal	220 kV New Lahore - SNR	Energized 01-Nov-2017	66	627	71			-	-	242	60	235	180			Energized 01-Nov-2017		203	60	198	60	203	60		
N-1			-	-	-			-	-	-	-	-	-					-	-	-	-	-	-	-	
Normal	220 kV New Lahore - Wapda Town	Added in 2019-20	90						235	180						Added in 2019-20		203	60						
N-1			-						-	-								-	-						
Total No. of Variations (Normal)		Energized 01-Nov-2017	1,474	1,966	693											Highest Voltage Under Normal Condition @ 500kV level		Lowest Voltage Under Normal Condition @ 500kV level							
Total No. of Variations (N-1)			-	-	-											Highest Voltage Under Normal Condition @ 220kV level		Lowest Voltage Under Normal Condition @ 220kV level							
Total of Normal & N-1			1,474	1,966	693																				

NTDC Lahore Region

5. 220kV Grid Station BANDALA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	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	NA	146	416	298	450	NA	240	60	240	60	—	—	241	90	NA	—	—	—	—	199	60	202	60	—	—	—	—			
N-1			—	—	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—			
Normal	220 kV Bandala - KSK 2	NA	146	416	298	450	NA	240	60	236	70	—	—	241	90	NA	—	—	—	—	199	60	202	60	—	—	—	—			
N-1			—	—	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—			
Normal	220 kV Bandala - Gatti 1	NA	149	432	298	450	NA	240	60	240	60	—	—	241	90	NA	—	—	—	—	199	60	202	60	—	—	—	—			
N-1			—	—	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—			
Normal	220 kV Bandala - Gatti 2	NA	—	419	298	450	NA	—	—	240	60	—	—	241	90	NA	—	—	—	—	199	60	202	60	—	—	—	—			
N-1			—	—	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—			

NA: Not Applicable

 Highest Voltage Under Normal Condition

 Lowest Voltage Under Normal Condition

Total No. of Variations (Normal)	NA	441	1,683	1,192	1,800
Total No. of Variations (N-1)		—	—	—	—
Total of Normal & N-1		441	1,683	1,192	1,800

NTDC Lahore Region

6. 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)																								
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20									
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	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 No. 1 & 2	3598	1916	*		-		-		-		-		-		-		190		60		186		120		*		-											
N-1		9	129	*		-		-		-		-		-		-		190		-		185		90		*		-											
Normal	220 kV Bund Road - NKLP I & II	Reported as Bus Bar No. 1 & 2		1202		1147		875		Reported as Bus Bar No. 1 & 2		-		-		-		-		-		-		-		182		90		184		90		188		90			
N-1		97		17		10																				Reported as Bus Bar No. 1 & 2		180		90		186		270		190		150	
Normal	220 kV Bund Road - KSK I & II	Reported as Bus Bar No. 1 & 2		1287		1196		1052		Reported as Bus Bar No. 1 & 2		-		-		-		-		-		Reported as Bus Bar No. 1 & 2		180		240		183		210		190		210					
N-1		135		29		9																					Reported as Bus Bar No. 1 & 2		180		90		187		90		190		210
Normal	220 kV Bund Road - SKP I & II	Reported as Bus Bar No. 1 & 2		1268		1119		852		Reported as Bus Bar No. 1 & 2		-		-		-		-		-		Reported as Bus Bar No. 1 & 2		182		90		183		90		188		90					
N-1		115		21		11																				Reported as Bus Bar No. 1 & 2		180		90		187		90		192		150	
Normal	220 kV Bund Road - SKP III & IV	Reported as Bus Bar No. 1 & 2		1270		1119		874		Reported as Bus Bar No. 1 & 2		-		-		-		-		Reported as Bus Bar No. 1 & 2		182		120		184		90		188		90							
N-1		128		16		11																			Reported as Bus Bar No. 1 & 2		184		90		188		90		192		150		

* Reported as separate circuits

Total No. of Variations (Normal)	3,598	1,916	5,027	4,581	3,653
Total No. of Variations (N-1)	9	129	475	83	41
Total of Normal & N-1	3,607	2,045	5,502	4,664	3,694

Lowest Voltage Under Normal Condition

Lowest Voltage Under N-1 Condition

NTDC Lahore Region

7. 220kV Grid Station GAKKHA

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)															
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		
		2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	Voltage	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20			
Normal	220 kV Gakkhar - Mangla Ckt I	791	2495	1335	1606	1133	-	-	-	-	-	187	60	188	60	189	60	188	60	189	60	-	-	-	-	-	-	-	-			
N-1		-	-	4	12	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	190	60	190	60	188	60	-	-			
Normal	220 kV Gakkhar - Mangla Ckt II	NP	1580	NP	1606	1133	NP		NP		-	-	-	-	NP		-	-	-	-	NP		185	60	NP		188	60	189	60		
N-1			-		12	19					-	-	-	-			-	-	-	-			-	-	NP		190	60	188	60		
Normal	220 kV Gakkhar - Mangla Ckt III	NP			1606	1133	NP		NP		-	-	-	-	NP		-	-	-	-	NP		NP		188	60	189	60				
N-1					12	19					-	-	-	-			190	60	188	60												
Normal	220 kV Gakkhar - Sialkot	791	914	1360	1626	1147	-	-	-	-	-	-	-	-	-	-	-	-	-	-	187	60	188	60	191	60	183	60	189	60		
N-1		-	-	11	19	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	190	60	186	60	186
Normal	220 kV Old Gakkhar - New Gakkhar (Nokhar)	NA	1580	1917	1898	895	NA		NA		-	-	-	-	-	-	-	-	-	-	NA		185	60	191	60	181	60	188	60		
N-1			-	-	31	19					-	-	-	-	-	-	-	-	-	-			-	-	190	60	184	60	184	60		
Normal	220 kV Gakkhar - Gujrat	Energized Apr, 2017		1917	1898	895	Energized Apr, 2017		Energized Apr, 2017		-	-	-	-	-	-	-	-	-	-	Energized Apr, 2017		191	60	181	60	188	60	190	60	184	60
N-1				-	31	19					-	-	-	-	-	-	-	-	-	-			190	60	184	60	184	60	190	60	184	60

NP: Not Provided

Total No. of Variations (Normal)	1,582	4,989	6,529	10,240	6,336
Total No. of Variations (N-1)	-	-	15	117	114
Total of Normal & N-1	1,582	6,569	6,544	10,357	6,450

 Lowest Voltage Under Normal Condition

 Lowest Voltage Under N-1 Condition

NTDC Lahore Region

8. 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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time		
Normal	220 kV KSK - Shalamar Via Ghazi	NA	2539	*		NA						*			NA							178	60	*							
N-1			39																				190	50							
Normal	220 kV Ghazi - Shalamar	NA	2539	2505	1745	NA						NA			NA							178	60	170	60	195	60				
N-1			39	672	1765																		190	50	174	60	168	60			
Normal	220 kV Ghazi - KSK	NA	2539	2229	1745	NA						NA			NA							178	60	170	60	195	180				
N-1			39	1484	1765																		190	50	173	60	168	60			
Normal	220 kV KSK - New Lahore	Added in 2019-20		771		Added in 2019-20					Added in 2019-20			Added in 2019-20							Added in 2019-20						198	180			
N-1				185																		Added in 2019-20						184	60		
Normal	220 kV Ghazi - Shalamar	Added in 2019-20		771		Added in 2019-20					Added in 2019-20			Added in 2019-20							Added in 2019-20						198	180			
N-1				185																		Added in 2019-20						184	60		

NA: Not Applicable

* Reported as separate circuits Ghazi - Shalamar & Ghazi - KSK

Total No. of Variations (Normal)	2,539	4,734	5,032
Total No. of Variations (N-1)	39	2,156	3,900
Total of Normal & N-1	2,578	6,940	8,932

NA	2,539	4,734	5,032
	39	2,156	3,900
	2,578	6,940	8,932

 Lowest Voltage Under Normal Condition

 Lowest Voltage Under N-1 Condition

NTDC Lahore Region

9. 220kV Grid Station GUJRAT

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)																															
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20																
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time																	
Normal	220 kV Gujarat - Old Gakkhar	Energized Apr, 2017	51	1211	2815	876	Energized Apr, 2017	—	—	234	60	238	60	241	60	Energized Apr, 2017	199	60	190	60	189	60	193	60	Energized Apr, 2017	—	—	—	—	—	—															
N-1			—	—	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—															
Normal	220 kV Gujarat - New Gakkhar	Energized Apr, 2017	—	1199	777	880	Energized Apr, 2017	—	—	234	60	238	120	241	60	Energized Apr, 2017	—	—	190	60	191	60	193	60	Energized Apr, 2017	—	—	—	—	—	—															
N-1			—	—	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—															
Normal	220 kV Gujarat - Mangla 1 & 2	Energized Apr, 2017	—	1201	1809	876	Energized Apr, 2017	—	—	234	60	238	60	241	60	Energized Apr, 2017	—	—	190	60	189	60	193	60	Energized Apr, 2017	—	—	—	—	—	—															
N-1			—	—	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—															
Total No. of Variations (Normal)		Energized Apr, 2017	51	3,611	5,401	2,632	 Highest Voltage Under Normal Condition								 Lowest Voltage Under Normal Condition																															
Total No. of Variations (N-1)			—	—	—	—																																								
Total of Normal & N-1			51	3,611	5,401	2,632																																								

NTDC Lahore Region

10. 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)																	
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	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	208	372	836	340	661	238	40	244	38	246	38	238	90	242	62	-	-	-	-	-	-	-	-	-	206	150					
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
Total No. of Variations (Normal)		208	372	836	340	661	 Highest Voltage Under Normal Condition												 Lowest Voltage Under Normal Condition													
Total No. of Variations (N-1)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Total of Normal & N-1		208	372	836	340	661																										

NTDC Lahore Region

11. 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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	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	NP					-	NP										-	-	NP											
N-1		-					-	-										-	-	-											
Normal	220 kV Kala Shah Kaku - Mangla Ckt I, II & III	2940	1016	702	680	639	-	-	-	-	-	-	-	-	-	-	-	-	-	-	184	60	182	60	185	90	180	120	-	-	
N-1		17	1	48	66	101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	188	90	185	60	180	90	180	60	-	-	
Normal	220 kV Kala Shah Kaku - Bund Road Ckt I & II	3425	486	777	768	560	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	60	190	90	185	90	184	90	-	-	
N-1		48	-	52	88	117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	188	90	-	-	180	60	187	90	180	90	
Normal	220 kV Kala Shah Kaku - Ravi Ckt I & II	3592	570	737	756	639	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	60	184	90	184	90	184	90	-	-	
N-1		53	15	56	86	115	-	-	-	-	-	-	-	-	-	-	-	-	-	-	187	90	180	120	185	90	180	90	181	90	
Normal	220 kV Kala Shah Kaku - Sialkot	3563	1038	710	735	596	-	-	-	-	-	-	-	-	-	-	-	-	-	-	182	60	189	90	184	90	183	60	187	90	
N-1		58	6	56	78	117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	189	60	191	90	185	60	181	90	180	90	
Normal	220 kV Kala Shah Kaku - Shalamar	3442	592	383	NP	-	-	-	-	-	-	-	-	NP		-	-	-	-	180	60	60	150	184	90	NP		-	-		
N-1		56	12	57		-	-	-	-	-	-	-	-			-	-	-	-	187	90	182	60	184	90			-	-		
Normal	220 kV Kala Shah Kaku - Bandala Ckt I & II	3456	950	592	566	457	-	-	-	-	-	-	-	-	-	-	-	-	-	-	183	60	183	60	184	60	187	120	189	120	
N-1		54	4	45	77	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	189	60	192	90	185	60	187	90	188	120	
Normal	220 kV Kala Shah Kaku - Ghazi Rd	Energized 18-Oct-2017				766	672	Energized 18-Oct-2017				-	-	-	-	-	-	-	-	Energized 18-Oct-2017				188	60	180	60	185	150		
N-1						88	133					-	-	-	-	-	-	-	-					-	190	90	180	90	181	90	

NP: Not Provided

Total No. of Variations - Normal	20,418	4,652	4,308	4,271	3,563
Total No. of Variations - N-1	286	38	321	483	656
Total of Normal & N-1	20,704	4,690	4,629	4,754	4,219

 Lowest Voltage Under Normal Condition

 Lowest Voltage Under N-1 Condition

NTDC Lahore Region

12. 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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	Voltage	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Voltage	2019-20	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Voltage	2019-20		
Normal	220 kV Gatti - Ludewala Ckt I & II	258	334	282	243	210	239	270	245	90	242	60	240	240	240	120	207	150	206	60	-	-	198	60	198	60					
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Normal	220 kV Chashma - Ludewala Ckt I & II	45	152	307	133	201	238	270	236	60	236	60	238	120	238	120	202	60	200	90	198	60	-	-	198	60					
N-1		-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	197	120	-	-	-	-				
Total No. of Variations (Normal)		303	486	589	376	411																									
Total No. of Variations (N-1)		-	-	1	-	-																									
Total of Normal & N-1		303	486	590	376	411																									

 Highest Voltage Under Normal Condition

 Lowest Voltage Under Normal Condition

NTDC Lahore Region

13. 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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	Voltage	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20		
Normal	220 kV Nishatabad - Gatti Ckt I	24	NA	22	12	67	235	60	NA	238	120	234	120	—	—	—	—	—	—	NA	—	—	—	—	—	—	203	60			
N-1		—		10	—	—	—	—		—	—	—	—	—	—	—	—	—	—		183	30	—	—	—	—	—	—			
Normal	220 kV Nishatabad - Gatti Ckt II	24	NA	22	12	67	235	60	NA	238	120	234	120	—	—	—	—	—	—	NA	—	—	—	—	—	—	203	60			
N-1		—		10	—	—	—	—		—	—	—	—	—	—	—	—	—	—		183	30	—	—	—	—	—	—			
Normal	220 kV Nishatabad - Samundri Road Ckt I	24	NA	22	12	67	235	60	NA	238	120	234	120	—	—	—	—	—	—	NA	—	—	—	—	—	—	203	60			
N-1		—		10	—	—	—	—		—	—	—	—	—	—	—	—	—	—		183	30	—	—	—	—	—	—			
Normal	220 kV Nishatabad - Samundri Road Ckt II	24	NA	22	12	67	235	60	NA	238	120	234	120	—	—	—	—	—	—	NA	—	—	—	—	—	—	203	60			
N-1		—		10	—	—	—	—		—	—	—	—	—	—	—	—	—	—		183	30	—	—	—	—	—	—			

NA: Not Applicable

Total No. of Variations (Normal)	96	NA	88	48	268
Total No. of Variations (N-1)	—	—	40	—	—
Total of Normal & N-1	96	NA	128	48	268

 Highest Voltage Under Normal Condition

 Lowest Voltage Under N-1 Condition

NTDC Lahore Region

14. 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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Year	Month	Year	Month	Year	Month	Year	Month	Year	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time			
Normal	220 kV NKLP - BDR - 1	1408	800	933	610	1042	233	30	-	-	-	-	-	-	-	-	-	-	-	150	90	177	90	180	150	185	150	185	90		
N-1		-	7	49	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	185	90	187	90	185	90	-	-	-	
Normal	220 kV NKLP - BDR - 2	1408	800	933	610	1042	233	30	-	-	-	-	-	-	-	-	-	-	-	150	90	177	90	180	150	185	150	185	90		
N-1		-	7	49	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	185	90	187	90	185	90	-	-	-	
Normal	220 kV NKLP - SKP Ckt I & II	593	407	563	442	479	-	-	-	-	-	-	-	-	236	190	235	90	160	330	182	60	184	150	191	90	190	90	190	90	
N-1		-	-	15	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	192	90	195	90	-	-	
Normal	220 kV NKLP - SNR Ckt I & II	942	539	731	539	474	-	-	236	90	-	-	-	-	-	-	-	-	-	160	210	182	90	184	90	187	90	195	150		
N-1		-	9	16	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	195	90	189	150	190	90	
Normal	220 kV NKLP - WTN	886	569	714	528	-	-	-	236	90	-	-	-	-	-	-	-	-	-	160	330	180	90	185	180	187	90	-	-		
N-1		-	2	33	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	195	90	187	90	191	150	
Normal	220 kV NKLP - New Lahore	Energized Apr, 2018		220	813	785	Energized Apr, 2018				-	-	-	-	-	-	-	-	Energized Apr, 2018				192	150	187	90	191	90			
N-1				29	12	-					-	-	-	-	-	-	-	-					190	90	191	90	-	-			
Total No. of Variations (Normal)		5,237	3,115	4,094	3,542	3,822					Highest Voltage Under Normal Condition												Lowest Voltage Under Normal Condition								
Total No. of Variations (N-1)		-	25	191	104	-																									
Total of Normal & N-1		5,327	3,140	4,285	3,646	3,822																									

NTDC Lahore Region

15. 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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	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	2120	386	193	NP	—	—	—	—	—	—	NP	—	—	NP	—	—	190	60	185	90	180	60	NP	—	—					
N-1		1036	—	4		—	—	—	—	—	—		—	—		—	—	178	60	—	—	180	150		—	—					
Normal	220 kV Shalamar - Ravi	2122	700	827	728	718	—	—	—	—	—	—	—	—	—	—	—	190	60	185	90	182	60	183	90	186	90				
N-1		1031	150	155	175	278	—	—	—	—	—	—	—	—	—	—	—	178	60	184	90	178	60	180	90	183	90				
Normal	220 kV Shalamar - Ghazi Rd	598		619	563					—	—	—	—	—	—	—	—					184	90	183	90	186	90				
N-1				—	—					—	—	—	—	—	—	—	—					—	—	—	—	—	—				

NP: Not Provided

Total No. of Variations (Normal)	4,242	1,086	1,618	1,347	1,281
Total No. of Variations (N-1)	2,067	150	159	175	278
Total of Normal & N-1	6,309	1,236	1,777	1,522	1,559

 Lowest Voltage Under Normal Condition

 Lowest Voltage Under N-1 Condition

NTDC Lahore Region

16. 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)											
							2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20			
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	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	1243	1310	426	587	558	-	-	-	-	232	90	-	-	-	-	180	90	180	150	191	90	188	90	188	90		
N-1		2	6	45	4	4	-	-	-	-	-	-	-	-	-	-	191	90	190	450	188	90	190	90	190	90		
Normal	220 kV Ravi - KSK I	1619	1367	856	1181	1258	-	-	-	-	-	-	-	-	-	-	180	270	180	570	190	270	190	90	180	90		
N-1		8	4	49	-	-	-	-	-	-	-	-	-	-	-	-	182	90	190	180	191	180	-	-	-	-		
Normal	220 kV Ravi - KSK II	1619	1367	856	1181	1258	-	-	-	-	-	-	-	-	-	-	180	270	180	570	190	270	190	90	180	90		
N-1		8	4	49	-	-	-	-	-	-	-	-	-	-	-	-	182	90	190	180	191	180	-	-	-	-		
Normal	220 kV Ravi - SKP	1298	1320	553	527	500	-	-	-	-	-	-	-	-	-	-	180	90	178	90	187	60	183	90	190	90		
N-1		7	3	25	4	-	-	-	-	-	-	-	-	-	-	-	190	150	191	150	190	90	192	90	-	-		
Normal	220 kV Ravi - SMR	1789	1467	800	974	1161	-	-	-	-	-	-	-	-	-	-	178	90	178	90	190	90	180	60	180	60		
N-1		11	9	54	4	7	-	-	-	-	-	-	-	-	-	-	180	120	188	90	190	60	190	60	190	60		
Total No. of Variations (Normal)		7,568	6,831	3,471	4,450	4,735																						
Total No. of Variations (N-1)		36	26	222	12	11																						
Total of Normal & N-1		7,604	6,857	3,693	4,462	4,746																						

Lowest Voltage Under Normal Condition

Lowest Voltage Under N-1 Condition

NTDC Lahore Region

17. 220kV Grid Station SAMUNDRI ROAD FAISALABAD

Condition	Name of Transmission Circuits violating the Voltage Criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)											
		2015-16		2016-17		2017-18	2018-19	2019-20	2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	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	633	48	36	7	-	240	150	236	60	241	150	241	150	-	-	-	-	200	330	200	330	-	-	-	-	-	-
N-1		1	33	3	6	-	-	-	-	-	-	-	-	-	-	-	190	150	180	150	190	120	180	90	-	-	-	
Normal	220 kV Samundri Road - Multan Ckt II	633	48	36	7	-	240	150	236	60	241	150	241	150	-	-	-	-	200	330	200	330	-	-	-	-	-	-
N-1		1	33	3	6	-	-	-	-	-	-	-	-	-	-	-	190	150	180	150	190	120	180	90	-	-	-	
Normal	220 kV Samundri Road - Nishatabad Ckt I	633	48	36	7	201	240	150	236	60	241	150	241	150	239	90	-	-	200	330	200	330	-	-	205	210	-	-
N-1		1	33	3	6	1	-	-	-	-	-	-	-	-	-	-	190	150	180	150	190	120	180	90	179	90	-	-
Normal	220 kV Samundri Road - Nishatabad Ckt II	633	48	36	7	201	240	150	236	60	241	150	241	150	239	90	-	-	200	330	200	330	-	-	205	210	-	-
N-1		1	33	3	6	1	-	-	-	-	-	-	-	-	-	-	190	150	180	150	190	120	180	90	179	90	-	-
Normal	220 kV Samundri Road - T.T Singh Ckt I&II	633	48	36	7	201	240	150	236	60	241	150	241	150	239	90	-	-	200	330	200	330	-	-	205	210	-	-
N-1		1	33	3	6	1	-	-	-	-	-	-	-	-	-	-	190	150	180	150	190	120	180	90	179	90	-	-
Total No. of Variations (Normal)		2532	192	144	28	603	Highest Voltage Under Normal Condition										Lowest Voltage Under Normal Condition											
Total No. of Variations (N-1)		4	132	12	24	3											Lowest Voltage Under N-1 Condition											
Total of Normal & N-1		2536	324	156	52	606																						

NTDC Lahore Region

18. 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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2018-19		2015-16		2016-17		2017-18		2018-19		2018-19	
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	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	1068	701	472	NP	—	—	—	—	—	—	NP	—	—	185	60	190	90	185	90	NP	—	—	NP	—	—					
N-1		110	48	2		—	—	—	—	—	—		—	—	180	30	184	90	195	150		—	—		—	—					
Normal	220 kV SNR - YSW Ckt II	1068	701	472	NP	—	—	—	—	—	—	NP	—	—	185	60	190	90	185	90	NP	—	—	NP	—	—					
N-1		110	48	2		—	—	—	—	—	—		—	—	180	30	184	90	195	150		—	—		—	—					
Normal	220 kV SNR - NKLP Ckt I	1073	694	667	630	814	—	—	—	—	—	NP	—	—	185	60	190	90	195	90	190	510	178	270	—	—					
N-1		109	46	6		—	—	—	—	—	—		—	—	185	150	180	60	185	90	—	—	—	—	—	—					
Normal	220 kV SNR - NKLP Ckt II	1073	694	667	630	814	—	—	—	—	—	NP	—	—	185	60	190	90	195	90	190	510	178	270	—	—					
N-1		109	46	6		—	—	—	—	—	—		—	—	185	150	180	60	185	90	—	—	—	—	—	—					
Normal	220 kV SNR - Okara Ckt	1068	531	670	643	818	—	—	—	—	—	NP	—	—	185	60	190	90	185	90	190	510	178	270	—	—					
N-1		110	39	4		—	—	—	—	—	—		—	—	180	30	180	60	190	510	—	—	—	—	—	—					
Normal	220 kV SNR - New Lahore	Added in 2018-19			643	475	Added in 2018-19						—	—	—	—	Added in 2018-19						190	510	195	570					
N-1					—	—							—	—	—	—							—	—	—	—					
Normal	220 kV SNR - Ghazi Road	Added in 2019-20			345	Added in 2019-20						Added in 2019-20						—	—	Added in 2019-20						178	270				
N-1					—							—	—	—	—																

NP: Not Provided

Total No. of Variations (Normal)	5,350	3,321	2,948	2,546	3,266
Total No. of Variations (N-1)	548	227	20	—	—
Total of Normal & N-1	5,898	3,548	2,968	2,546	3,266

 Lowest Voltage Under Normal Condition

NTDC Lahore Region

19. 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)															
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		
		Year	Month	Year	Month	Year	Month	Year	Month	Year	Month	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time			
Normal	220 kV Sialkot - Gakkhar	681	1123	1183	1219	1224	-	-	-	-	-	-	-	-	-	-	-	-	-	170	240	180	210	180	390	170	150	180	90			
N-1		1	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	195	60	195	90	188	90	-	-	-	-			
Normal	220 kV Sialkot - KSK	681	1127	1163	1200	1195	-	-	-	-	-	-	-	-	-	-	-	-	-	170	240	175	150	180	210	170	150	180	150			
N-1		-	-	2	6	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	90	160	90	190	90			
Total No. of Variations (Normal)		1,362	2,250	2,346	2,421	2,419																										
Total No. of Variations (N-1)		1	2	6	4	1																										
Total of Normal & N-1		1,363	2,252	2,352	2,425	2,420																										

Lowest Voltage Under Normal Condition

Lowest Voltage Under N-1 Condition

NTDC Lahore Region

20. 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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	Voltage	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20		
Normal	220 kV T.T. Singh - Multan Ckt I & II	448	425	455	707	468	238	600	244	390	243	450	248	570	245	660	193	60	189	150	180	870	170	480	171	1410					
N-1		-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	177	1290	172	1410				
Normal	220 kV T.T. Singh - Samundri Road Ckt I & II	448	425	455	707	468	238	600	244	390	243	450	248	570	245	660	193	60	189	150	180	870	170	480	171	1410					
N-1		-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	177	1290	172	1410				
Total No. of Variations (Normal)		896	850	910	1414	936	 Highest Voltage Under Normal Condition		 Lowest Voltage Under Normal Condition																						
Total No. of Variations (N-1)		-	-	-	4	4	 Lowest Voltage Under N-1 Condition																								
Total of Normal & N-1		896	850	910	1418	940																									

NTDC Lahore Region

21. 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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	Voltage	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20		
Normal	220 kV WTN - NKLP	690	710	1054	707	-	-	-	-	-	-	185	90	188	150	175	90	184	90	-	-	-	-	-	-	-	-	-			
N-1		-	-	13	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	175	90	196	90	-	-		
Normal	220 kV WTN - Sheikhupura	691	557	963	681	518	-	-	-	-	-	160	120	187	150	180	90	180	90	193	90	-	-	-	-	-	-	-	-		
N-1		-	-	9	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	191	150	194	150	-	-		
Normal	220 kV WTN - New Lahore	Added in 2019					441	Added in 2019										-	-	Added in 2019										193	90
N-1							1											207	90												
Total No. of Variations - Normal		1,381	1,267	2,017	1,388	959																									
Total No. of Variations - N-1		-	-	22	4	1																									
Total of Normal & N-1		1,381	1,267	2,039	1,392	960																									

 Lowest Voltage Under Normal Condition

 Lowest Voltage Under N-1 Condition

APPENDIX 3

Voltage violations data - detailed circuit wise analysis

NTDC Multan Region

1.	500 kV D. G. Khan	1 of 12
2.	500 kV Multan.....	2 of 12
3.	500 kV Muzaffargarh	3 of 12
4.	500 kV Yousafwala	4 of 12
5.	500 kV Rahim Yar Khan	5 of 12
6.	220 kV Bahawalpur	6 of 12
7.	220 kV Kassowal	7 of 12
8.	220 kV Muzaffargarh	8 of 12
9.	220 kV Okara.....	9 of 12
10.	220 kV Vehari	10 of 12
11.	220 kV Chishtian	11 of 12
12.	220 kV Lal Sohanra	1 2 of 12

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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time				
Normal	500 kV D.G. Khan - Guddu	NIL	15	26	20	39	NIL	564	60	575	60	561	60	565	60	NIL	—	—	—	—	—	—	—	—	—	494	60				
N-1			—	—	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—				
Normal	500 kV D.G. Khan - Multan	Provided as 500kV Multan-D.G. Khan-Guddu	1	20	38	Provided as 500kV Multan-D.G. Khan-Guddu	554	30	561	60	565	60	Provided as 500kV Multan-D.G. Khan-Guddu	—	—	—	—	—	—	—	—	—	—	—	—	494	60				
N-1			—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
Normal	220 kV D.G. Khan - Loralai I	NIL	150	NP	77	74	NIL	250	60	NP	251	60	252	60	NIL	—	—	NP	NP	NP	NP	NP	NP	NP	NP	NP					
N-1			—		—	—		—	—		—	—	—	—		—	—														
Normal	220 kV D.G. Khan - Loralai II	NIL	150	NP	77	74	NIL	250	60	NP	251	60	252	60	NIL	—	—	NP	NP	NP	NP	NP	NP	NP	NP						
N-1			—		—	—		—	—		—	—	—	—		—	—														

NP: Not Provided

Total No. of Variations (Normal)	NIL	315	27	194	225
Total No. of Variations (N-1)	NIL	—	—	—	—
Total of Normal & N-1	NIL	315	27	194	225

 Highest Voltage Under Normal Condition @500kV level

 Lowest Voltage Under Normal Condition @500kV level

 Highest Voltage Under Normal Condition @220kV level

NTDC Multan Region

2. 500kV Grid Station MULTAN

Multan Region
2 of 12

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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	Voltage	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Voltage	2019-20	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Voltage	2019-20		
Normal	500 kV Multan - Guddu I	NIL		NP		—						NIL		NP																	
N-1						—																									
Normal	500 kV Multan - Guddu 747	NIL		3	—							NIL		547	30	—	—														
N-1						—																									
Normal	500 kV Multan - Muzaffargarh	NIL		3	—	NP						NIL		560	30	—	—	NP											—	—	
N-1						—																									
Normal	500 kV Multan - Yousafwala	NIL		NP		—						NIL		NP																	
N-1						—																									
Normal	500 kV Multan - Gatti	NIL		NP		—						NIL		NP																	
N-1						—																									
Normal	500 kV Multan - Rousch	NIL	NP	3	—							NIL		NP	550	30	—	—									NP	—	—		
N-1						—																									
Normal	500 kV Multan - D.G. Khan - Guddu	NIL	NP	3	—	NP						NIL		NP	547	30	—	—	NP							NP	—	—			
N-1						—																								NP	
Normal	500 kV Multan - R Y Khan	Commissioned in Feb 2018		3	—	NP						Commissioned in Feb 2018		NIL	565	30	—	—	NIL							NIL	—	—			
N-1						—																								NIL	
Normal	500 kV Multan - Sahiwal	Add in 2018		2	—							Add in 2018			546	30	—	—	Add in 2018							NIL	—	—			
N-1						—																								—	
Normal	500 kV Multan - HBS	Add in 2018		3	—							Add in 2018			560	30	—	—	Add in 2018							NIL	—	—			
N-1						—																								—	
Normal	220 kV Multan - Muzaffargarh 1	NIL	NP	2	—							NIL		NP	—	—	—	—	NP							NP	207	570			
N-1						—																								—	
Normal	220 kV Multan - Muzaffargarh 2	7	2	NP	—							247	60	254	60	—	—	NP	—	—	—	—	—	—	NP	—	—				
N-1						—						—	—	—	—	—	—	—	—	—	—	—	—	—							
Normal	220 kV Multan - Muzaffargarh 3	NIL	1	NP	—							NIL	245	90	—	—	NP	—	—	—	—	—	—	NP	207	240					
N-1						—																								—	
Normal	220 kV Multan - Muzaffargarh 4	NP		2	—							NIL		NP	—	—	—	—	NP							NP	207	570			
N-1						—																								—	
Normal	220 kV Multan - New M-Garh	Added in 2019		6	—							Added in 2019			250	300	—	—	Added in 2019								—	—			
N-1						—																								—	
Normal	220 kV Multan - Kapco 3	NIL	—	NP	3	—						NIL	—	NP	251	90	—	—	NIL	—	—	—	—	—	NP	—	—				
N-1						—																								—	
Normal	220 kV Multan - Kapco 4	1	—	NP	3	—						246	120	—	—	NP	251	90	—	—	NP	—	—	—	—	—	NP	—	—		
N-1						—																								—	
Normal	220 kV Multan - Kapco 5 & 6	NP		NP	—	NIL						NIL		NP	—	—	—	—	NP							NP		NIL			
N-1						—																									
Normal	220 kV Multan - NGPS 1 & 2	NP		1	—							NIL		NP	—	—	—	—	NP							NP	208	120			
N-1						—																								—	
Normal	220 kV Multan - Vehari 1 & 2	NIL	—	NP	9	—						NIL	—	NP	250	210	—	—	NIL	—	—	—	—	—	NP	208	60				
N-1						—																								—	
Normal	220 kV Multan - Samundri Road	NIL	—	NP	—	NIL						NIL	—	NP	—	—	—	—	NP	—	—	—	—	—	NP	—	—				
N-1						—																								—	
Normal	220 kV Multan - T.T. Singh 1 & 2	NIL		NP	1	—						NIL		NP	—	—	—	—	NP						NP	208	60				
N-1						—																								—	

NP: Not Provided

Total No. of Variations (Normal)	8	3	NIL	20	28
Total No. of Variations (N-1)	—	—	—	—	—
Total of Normal & N-1	8	3	NIL	20	28

 Highest Voltage Under Normal Condition @220kV level

 Lowest Voltage Under Normal Condition @220kV level

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)																											
		2015-16	2016-17	2017-18	2018-19	2019-20	2015-16	Voltage	2016-17	Voltage	2017-18	Voltage	2018-19	Voltage	2019-20	2015-16	Voltage	2016-17	Voltage	2017-18	Voltage	2018-19	Voltage	2019-20	2015-16	Voltage	2016-17	Voltage	2017-18	Voltage	2018-19	Voltage	2019-20	2015-16	Voltage									
Normal	500 kV Muzaffargarh - Gatti	NIL	NP	-	-	-	NIL					NP	-	-	-	-	-	NIL					NP	-	-	-	-	-																
N-1							NIL						NIL					NIL																										
Normal	500 kV Muzaffargarh - Guddu	NIL					NIL										NIL										NIL																	
N-1		NIL					NIL										NIL										NIL																	
Normal	500 kV Muzaffargarh - Multan	NIL	NP	NIL	NIL					NP	NIL					NP	NIL					NP	NIL					NIL																
N-1					NIL						NP	-	-	-	-	-	NIL											NP	-	-	-	-	-											
Normal	220 kV 500kV Grid Station TPS Phase-I - Muzaffargarh	NIL	NP	-	-	-	NIL					NP	-	-	-	-	-	NIL					NP	-	-	-	-	-																
N-1							NIL					NP	-	-	-	-	-	NIL					NP	-	-	-	-	-																
Normal	220 kV 500kV Grid Station TPS Phase-II - Muzaffargarh	NIL	NP	-	-	-	NIL					NP	-	-	-	-	-	NIL					NP	-	-	-	-	-																
N-1							NIL					NP	NIL					NP	NIL					NP	NIL																			
Normal	500 kV Muzaffargarh - Guddu 747	NIL	NP	NIL	NIL					NP	NIL					NP	NIL					NP	NIL					NIL																
N-1					Added in 2019						NIL	Added in 2019					NIL	NIL					NIL	Added in 2019					NIL															

NP: Not Provided

Total No. of Variations (Normal)	NIL/NP	NIL
Total No. of Variations (N-1)		

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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time		
Normal	500 kV Yousafwala - Lahore	NA	NP	-	-	NA	NP	NP	-	-	-	NA	NP	-	-	-	-	-	-	NA	NP	-	-	-	-	-	-				
N-1																															
Normal	500 kV Yousafwala - Multan	NA	207	500	693	NA	544	120	541	180	552	120	NA	-	-	-	-	-	-	NA	-	-	-	-	-	-	-	-			
N-1			-	-	-			-	-	-	-																				
Normal	500 kV Yousafwala - CFPP	-	204	554	184	-	-	543	180	542	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
N-1			-	-	-			-	-	-	-																				
Normal	220 kV Yousafwala - SNR	NA	42	NP	-	NA	-	-	NP	-	-	NA	208	180	NP	-	-	-	-	-	-	-	-	-	-	-	-				
N-1			-																												
Normal	220 kV Yousafwala - Gatti	NA	42	49	156	167	NA	-	238	180	239	120	238	120	NA	208	180	-	-	-	-	-	-	-	-	-	-	200	120		
N-1			-	-	-	-				-	-	-	-	-																	
Normal	220 kV Yousafwala - Kassowal	NA	42	40	94	158	NA	-	236	180	237	120	236	120	NA	208	180	-	-	-	-	-	-	-	-	-	198	120	198	120	
N-1			-	-	-	-			-	-	-	-	-	-																	
Normal	220 kV Yousafwala - CFPP	NP	43	NP	-	NP	-	543	180	NP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
N-1			-																												
Normal	220 kV Yousafwala - Okara	-	297	118	-	-	-	-	236	180	237	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	120	199	120	
N-1			-	-					-	-	-	-																			

NP: Not Provided

NA: Not Applicable

 Highest Voltage Under Normal Condition @500kV level

 Lowest Voltage Under Normal Condition @220kV level

 Highest Voltage Under Normal Condition @220kV level

NTDC Multan Region

5. 500kV Grid Station RAHIM YAR 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)																			
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20				
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time					
Normal	500 kV Guddu 747 - RY Khan	Energized Feb, 2018	NIL	3	NIL	Energized Feb, 2018				565	30	NIL	Energized Feb, 2018				NIL	Energized Feb, 2018				NIL	NIL				NIL							
N-1				-						-	-												-											
Normal	500 kV Multan - RY Khan	Energized Feb, 2018	NIL	3	NIL	Energized Feb, 2018				565	30	NIL	Energized Feb, 2018				NIL	Energized Feb, 2018				NIL	-				NIL							
N-1				-						-	-												-											
Total No. of Variations (Normal)		Energized Feb, 2018	NIL	6	-	NIL																												
Total No. of Variations (N-1)																																		
Total of Normal & N-1							6																											

NTDC Multan Region

6. 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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	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 Ckt I & II	506	15	21	657	806	248	30	242	60	242	180	242	30	242	180	196	30	197	30	197	30	30	-	-	-	197	30			
N-1		-	5	-	179	226	-	-	246	30	-	-	251	60	252	90	-	-	194	30	-	-	-	-	-	-	190	30			
Normal	220 kV Bahawalpur - Lal Sohanra Ckt I & II	506	15	21	657	505	248	30	242	60	242	180	242	30	242	30	196	30	197	30	197	30	30	-	-	-	197	30			
N-1		-	5	-	179	136	-	-	246	30	-	-	251	60	250	90	-	-	194	30	-	-	-	-	-	-	190	30			
Total No. of Variations (Normal)		506	15	21	657	1311	Yellow Box: Highest Voltage Under Normal Condition								Blue Box: Lowest Voltage Under Normal Condition																
Total No. of Variations (N-1)		-	5	-	179	362	Green Box: Highest Voltage Under N-1 Condition								Green Box: Lowest Voltage Under N-1 Condition																
Total of Normal & N-1		506	20	21	836	1673																									

NTDC Multan Region

7. 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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time				
Normal	Kassowal - Vehari 1	502	980	248	318	273	241	30	245	30	243	120	250	60	242	60	200	60	198	60	197	60	-	-	197	60					
N-1		-	-	1	12	2	-	-	-	-	243	150	-	-	-	-	-	-	-	-	-	-	-	192	60	193	60				
Normal	Kassowal - Vehari 2	502	980	248	318	273	241	30	245	30	243	120	250	60	242	60	200	60	198	60	197	60	-	-	197	60					
N-1		-	-	1	12	2	-	-	-	-	243	150	-	-	-	-	-	-	-	-	-	-	-	192	60	193	60				
Normal	Kassowal - Yousafwala 1	502	931	248	299	273	241	30	245	30	243	150	250	60	242	60	200	60	198	60	197	60	197	60	197	60					
N-1		-	-	2	8	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	189	90	192	60	193	60		
Normal	Kassowal - Yousafwala 2	502	931	248	299	273	241	30	245	30	243	150	250	60	242	60	200	60	198	60	197	60	197	60	197	60					
N-1		-	-	2	8	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	189	90	192	60	193	60		

Total No. of Variations (Normal)	2,008	3,822	998	1,234	1,092
Total No. of Variations (N-1)	-	-	-	40	8
Total of Normal & N-1	2,008	3,822	998	1,274	1,100

■ Highest Voltage Under Normal Condition

■ Lowest Voltage Under Normal Condition

■ Lowest Voltage Under N-1 Condition

NTDC Multan Region

8. 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)								
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20			
		Voltage	Time	/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	NIL	276	207	179	NIL	244	120	244	60	242	210	NIL	—	—	—	—	—	—	—	—	—	
N-1			—	28	29		—	—	250	270	247	120		—	—	—	—	—	—	—	—	—	—
Normal	220 kV Muzaffargarh - TPS	NIL	374	199	179	NIL	245	180	244	60	245	60	NIL	—	—	—	—	—	—	—	—	—	—
N-1			—	29	29		—	—	250	270	247	120		—	—	—	—	—	—	—	—	—	—
Total No. of Variations (Normal)		NIL	650	406	358	Highest Voltage Under Normal Condition																	
Total No. of Variations (N-1)			—	57	58	Highest Voltage Under N-1 Condition																	
Total of Normal & N-1		NIL	650	463	416																		

NTDC Multan Region

9. 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)																															
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20																
		Voltage	Time	Voltage	Time	Voltage	Time	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	338	321	139	221	-	-	-	-	239	360	236	90	-	-	-	-	190	90	196	900	190	270	195	1380	-	-																			
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																			
Normal	220 kV Okara - Sarfaraznagar Ckt I & II	Proper in out energized on 19.12.2017		44	221	204	Proper in out energized on 19.12.2017				237	240	-	-	241	390	Proper in out energized on 19.12.2017				-	-	195	1380	195	1440																				
N-1				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																						
Normal	220 kV Okara - Yousafwala	338	205	137	221	-	-	-	-	239	360	236	90	-	-	-	-	190	90	196	900	199	1410	195	1380	-	-																			
N-1		-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	450	-	-	-	-																			
Normal	220 kV Okara - Yousafwala Ckt I & II	Proper in out energized on 19.12.2017		44	221	204	Proper in out energized on 19.12.2017				237	240	-	-	241	390	Proper in out energized on 19.12.2017				-	-	195	1380	195	1440																				
N-1				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																						
Total No. of Variations (Normal)		338	526	364	884	408	Highest Voltage Under Normal Condition												Lowest Voltage Under Normal Condition																											
Total No. of Variations (N-1)		-	-	1	-	-																																								
Total of Normal & N-1		338	526	365	884	408																																								

NTDC Multan Region

10. 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)									
							2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	2016-17	2017-18	2018-19	2019-20	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	297	837	1640	2074	900	240	90	242	270	242	270	-	-	243	210	205	30	204	30	196	30	135	90	195	60
N-1		-	2	140	228	99	-	-	243	90	248	150	-	-	245	270	-	-	-	-	190	30	191	30	190	90
Normal	220 kV Vehari - Yousafwala Ckt I & II	-	NP			NP	-	-	NP			-	-	NP		-	-	NP				NP				
N-1		-					-	-				-	-	-	-											
Normal	220 kV Vehari - Kassowal Ckt I & II	296	852	1638	2081	900	240	90	243	30	242	150	-	-	243	210	205	30	204	30	196	30	198	30	195	60
N-1		-	2	140	228	101	-	-	243	90	248	150	-	-	245	270	-	-	-	-	190	30	191	30	190	90
Normal	220 kV Vehari - Chishtian Ckt I & II		824	1637	1821	772			242	270	243	90	-	-	-	-			205	30	194	30	198	30	-	-
N-1									243	90	247	150	-	-	-	-			-	-	191	30	190	30	-	-

NP: Not Provided

Total No. of Variations - Normal	593	2,513	4,915	5,975	2,572
Total No. of Variations - N-1	-	6	420	684	298
Total of Normal & N-1	593	2,519	5,335	6,659	2,870

 Highest Voltage Under Normal Condition

 Lowest Voltage Under Normal Condition

 Highest Voltage Under N-1 Condition

 Lowest Voltage Under N-1 Condition

NTDC Multan Region

11. 220kV Grid Station CHISHTIAN

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)																	
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		
		2015-16	Voltage	2016-17	Voltage	2017-18	Voltage	2018-19	Voltage	2019-20	Voltage	2015-16	Voltage	2016-17	Voltage	2017-18	Voltage	2018-19	Voltage	2019-20	2015-16	Voltage	2016-17	Voltage	2017-18	Voltage	2018-19	Voltage				
Normal	220 kV Chishtian - Vehari Ckt I & II	Energized 24-Oct-2016	720	3282	3944	3923	Energized 24-Oct-2016	244	60	241	90	-	-	242	90	Energized 24-Oct-2016	-	-	199	120	198	60	197	30	-	-	173	30	189	30	190	60
N-1			70	505	817	944		247	60	249	30	-	-	250	30		-	-	199	120	198	60	197	30	-	-	173	30	189	30	190	60
Total No. of Variations (Normal)		Energized 24-Oct-2016	722	3,282	3,944	3,923		Highest Voltage Under Normal Condition			Lowest Voltage Under Normal Condition																					
Total No. of Variations (N-1)			70	505	817	944		Highest Voltage Under N-1 Condition			Lowest Voltage Under N-1 Condition																					
Total of Normal & N-1			792	3,787	4,761	4,867																										

NTDC Multan Region

12. 220kV Grid Station LAL SOHANRA

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)							
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	
Normal	220 kV Lal Sohanra - BWP Ckt I & II					631				242	90									197	30	
N-1		Added in 2019			100	Added in 2019						250	30	Added in 2019						190	60	
Total No. of Variations (Normal)					631							Highest Voltage Under Normal Condition								Lowest Voltage Under Normal Condition		
Total No. of Variations (N-1)					100															Lowest Voltage Under N-1 Condition		
Total of Normal & N-1					731							Highest Voltage Under N-1 Condition										

APPENDIX 4

Voltage violations data - detailed circuit wise analysis

NTDC Hyderabad Region

1.	500 kV Dadu.....	1 of 15
2.	500 kV Guddu	2 of 15
3.	500 kV Jamshoro	3 of 15
4.	220 kV NKI	4 of 15
5.	500 kV Shikarpur.....	5 of 15
6.	220 kV Dharki	6 of 15
7.	220 kV Hala Road	7 of 15
8.	220 kV Khuzdar.....	8 of 15
9.	220 kV Loralai.....	9 of 15
10.	220 kV Quetta Industrial-II.....	10 of 15
11.	220 kV Rohri	11 of 15
12.	220 kV Sibbi.....	12 of 15
13.	220 kV T. M. Khan Road	13 of 15
14.	220 kV Jhimpur	14 of 15
15.	220 kV Dera Murad. Jamali.....	15 of 15

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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	Time	2016-17	Voltage	Time	2017-18	Voltage	Time	2018-19	Voltage	Time	2019-20	Voltage	Time	2015-16	Voltage	Time	2016-17	Voltage	Time	2017-18	Voltage	Time	2018-19	Voltage	Time			
Normal	500 kV Dadu - Jamshoro I	9	1	15	7	6	539	1350	526	180	535	60	542	60	535	60	-	-	-	-	-	-	-	-	-	-	-	-	-		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Normal	500 kV Dadu - Jamshoro II	99	3	15	7	N.A.	540	180	530	240	535	60	542	60	N.A.	-	-	-	-	-	-	-	-	-	-	-	-	-	N.A.	-	
N-1		-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	500 kV Dadu - Guddu I	7	NP		-	535	420	NP						-	-	-	-	NP						NP				-	-		
N-1		-			-	-	-							-	-	-	-											-	-		
Normal	500 kV Dadu - Guddu II	NIL	2	5*	*	-	NIL		528	60	535	60	*		-	-	-	-	-	-	-	-	-	-	-	*	-	-	-		
N-1		-	-	-		-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	500 kV Dadu - Shikarpur I	Not existing	3	15	10	6	Not existing	530	60	535	120	542	60	535	60	Not existing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1		-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Normal	500 kV Dadu - Shikarpur II	Bifurcated from Dadu - Guddu II since March 2018	10	10	6	Bifurcated from Dadu - Guddu II since March 2018	535	120	542	60	535	60	Bifurcated from Dadu - Guddu II since March 2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
N-1		-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Normal	500 kV Dadu - Port Qasim	Energized in Apr, 2019			NA	6	Energized in Apr, 2019						NA		535	60	Energized in Apr, 2019						NA		-		-				
N-1						-									-	-									-		-				
Normal	500 kV Dadu - Moro	Energized in May, 2019			34	6	Energized in May, 2019						535		60	535	Energized in May, 2019						-		-		-				
N-1						-									-	-									-		-				
Normal	220 kV Dadu - Khuzdar I	531	344	106	42	50	240	360	240	120	238	360	240	240	240	60	-						-		-		-				
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						-		-		-				
Normal	220 kV Dadu - Khuzdar II	189	380	99	42	33	240	360	240	240	238	360	240	240	240	60	-						-		-		-				
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						-		-		-				

* 500 kV Dadu - Guddu II line bifurcated into Dadu - Shikarpur II & Guddu - Shikarpur II since March 2018 and does not exist anymore

Total No. of Variations (Normal)	835	733	265	152	113	 Highest Voltage Under Normal Condition @500kV level
Total No. of Variations (N-1)	-	-	-	-	-	 Highest Voltage Under N-1 Condition @220kV level
Total of Normal & N-1	835	733	265	152	113	 Highest Voltage Under N-1 Condition @220kV level

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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	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	NP				—	NA	NP				—	—	NA	NP				—	—	NA	NP				—	—			
N-1			—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
Normal	500 kV Guddu - Dadu II	1268	1183	521*	*	—	540	90	540	420	540	420	*	—	—	—	—	—	—	—	—	—	*	—	—	—	—	—			
N-1		—	—	—		—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—		—	—	—	—	—			
Normal	500 kV Guddu - D.G. Khan (Old Multan)	1382	NP	504	10	48	638	60	NP	540	300	535	300	538	420	—	—	NP	—	—	NP	—	—	NP	—	—	—	—	—		
N-1		—		—	—	—	—	—		—	—	—	—	—	—	—	—		—	—		—	—		—	—	—	—	—		
Normal	500 kV Guddu - 747 MW CCPG Guddu	1378	642	NA		20	541	90	541	90	NA				538	360	—	—	—	—	—	NA				—	—	—	—		
N-1		—	—	NA		—	—	—	—	—	NA				—	—	—	—	—	—	—	NA				—	—	—	—		
Normal	500 kV Guddu - Muzaffargarh	1405	NP	456	13	101	638	60	NP	540	300	535	120	540	240	—	—	NP	—	—	NP	—	—	NP	—	—	—	—	—		
N-1		—		—	—	—	—	—		—	—	—	—	—	—	—	—		—	—		—	—		—	—	—	—	—		
Normal	500 kV Guddu - Shikarpur I	does not exist	NA				29	does not exist	NA				539	60	does not exist	NA				does not exist	NA				—	—	—	—	—		
N-1			—	—	—	—	—		NA				—	—		NA					NA				—	—	—	—	—		
Normal	500 kV Guddu - Shikarpur II	Bifurcated from Dadu - Guddu II in March 2018			13	23	62	Bifurcated from Dadu - Guddu II in March 2018				536	120	535	120	538	420	Bifurcated from Dadu - Guddu II in March 2018				—	—	—	—	—	—	—	—		
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Normal	220 kV Guddu - Sibbi (D/Ckt)	—	NP	NP				—	—	—	NP				—	—	—	—	NP				—	—	—	—	—	—			
N-1		—		—	—	—	—	—	—	—	NP				—	—	—	—	NP				—	—	—	—	—	—			
Normal	220 kV Guddu - Uch (P/H)	—	NP	NP				—	—	—	NP				—	—	—	—	NP				—	—	—	—	—	—			
N-1		—		—	—	—	—	—	—	—	NP				—	—	—	—	NP				—	—	—	—	—	—			
Normal	220 kV Guddu - Shikarpur	—	does not exist anymore	does not exist anymore				—	—	—	does not exist anymore				—	—	—	—	does not exist anymore				—	—	—	—	—	—			
N-1		—		—	—	—	—	—	—	—	does not exist anymore				—	—	—	—	does not exist anymore				—	—	—	—	—	—			

NA: Not applicable.

NP: Not applicable * 500 kV Dadu - Guddu II line bifurcated into Dadu - Shikarpur II & Guddu - Shikarpur II in March 2018 and does not exist anymore

Total No. of Variations (Normal)	5,433	1,825	1,494	46	260
Total No. of Variations (N-1)	—	—	—	—	—
Total of Normal & N-1	5,433	1,825	1,494	46	260

 Highest Voltage Under Normal Condition @500kV level

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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	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	76	224	473	27	69	550	60	543	60	540	60	543	60	535	60	-	-	-	-	-	-	-	-	-	-	-	-	-		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	500 kV Jamshoro - Dadu II	76	228	473	27	69	550	60	543	60	540	60	543	60	535	60	-	-	-	-	-	-	-	-	-	-	-	-			
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	500 kV Jamshoro - NKI	77	218	231*	5	-	538	60	541	60	539	60	535	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	500 kV Jamshoro - Hub (D/Ckt)	70	235	473	**	69	536	120	543	60	540	60	543	60	535	60	-	-	-	-	-	-	-	-	-	-	-	-			
N-1		-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	500 kV Jamshoro - Port Qasim	Bifurcated from Jamshoro - NKI on 01-Nov-2017		242	26	69	Bifurcated from Jamshoro - NKI on 01-Nov-2017				540	60	543	60	535	60	Bifurcated from Jamshoro - NKI on 01-Nov-2017				-	-	-	-	-	-	-	-	-		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	500 kV Jamshoro - Thar Engro	Commissioned in Dec, 2018		6	1	Commissioned in Dec, 2018				535	60	528	30	Commissioned in Dec, 2018				Commissioned in Dec, 2018				-	-	-	-	-	-	-	-		
N-1				-	-					-	-	-	-	-	-	-	-					-	-	-	-	-	-	-	-		
Normal	220 kV Jamshoro - KDA33 - I	193	135	497	378	702	245	60	242	60	244	60	241	60	244	60	-	-	-	-	-	-	-	-	-	-	-	-	-		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV Jamshoro - KDA33 - II	192	134	497	378	702	241	60	-	-	244	60	241	60	244	60	-	-	-	-	-	-	-	-	-	-	-	-	-		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV Jamshoro - Hala Road I	193	135	497	409	747	245	60	242	60	244	60	241	60	244	60	-	-	-	-	-	-	-	-	-	-	-	-	-		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV Jamshoro - Hala Road II	193	130	497	409	747	245	60	242	60	244	60	241	60	244	60	-	-	-	-	-	-	-	-	-	-	-	-	-		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV Jamshoro - T.M. Khan - I	193	127	497	408	704	245	60	242	60	244	60	242	60	241	60	-	-	-	-	-	-	-	-	-	-	-	-	-		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV Jamshoro - T.M. Khan - II	193	122	497	408	704	245	60	242	60	244	60	242	60	241	60	-	-	-	-	-	-	-	-	-	-	-	-	-		
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			

* 500 kV Jamshoro - NKI line bifurcated into Jamshoro - Port Qasim & Port Qasim - NKI on 01-Nov-2017 on temporary basis

** Only comparison reported

Total No. of Variations (Normal)	2,112	1,688	4,874	5,755	4,583
Total No. of Variations (N-1)	-	-	-	-	-
Total of Normal & N-1	2,112	1,688	4,874	5,755	4,583

Highest Voltage Under Normal Condition @500kV level

Highest Voltage Under Normal Condition @220kV level

4. 500kV Grid Station NKI KARACHI

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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2017-18		2015-16		2016-17		2017-18		2018-19		2017-18	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	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	61	91	139	6	1	545	60	530	60	535	30	-	-	528	30	463	30	-	-	-	-	-	-	472	30	-	-			
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	500 kV NKI - Jamshoro	61	NP	3*	*	32	545	60	NP	NP	528	30	*	*	535	30	463	30	NP	NP	-	-	*	*	-	-					
N-1		-		-		-	-	-			-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-			
Normal	500 kV NKI - Port Qasim	Bifurcated from Jamshoro - NKI on 01-Nov-2017		138	6	-	Bifurcated from Jamshoro - NKI on 01-Nov-2017				535	30	-	-	-	-	Bifurcated from Jamshoro - NKI on 01-Nov-2017				-	-	472	30	-	-					
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV NKI - Baldia	1533	614	419	8	21	250	60	238	180	241	120	240	30	234	150	-	-	-	-	-	-	-	-	-	-	208	30			
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV NKI - KDA33	1533	401	419	9	21	250	60	239	120	241	120	240	30	234	150	-	-	-	-	-	-	-	-	-	-	208	30			
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	500 kV NKI - K2/K3	Added in 2019				31	Added in 2019						535	30	Added in 2019						-	-	-	-	-	-	-	-			
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			

* 500 kV NKI - Jamshoro line bifurcated into Jamshoro - Port Qasim & NKI - Port Qasim - NKI on 01-Nov-2017 and does not exist anymore

Total No. of Variations (Normal)	3,188	1,106	1,118	29	106
Total No. of Variations (N-1)	-	-	-	-	-
Total of Normal & N-1	3,188	1,106	1,118	29	106

█ Highest Voltage Under Normal Condition @500kV level

█ Lowest Voltage Under Normal Condition @220kV level

█ Highest Voltage Under Normal Condition @220kV level

NTDC Hyderabad Region

5. 500kV 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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20			
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time			
Normal	500 kV Shikarpur - Guddu Ckt I	does not exist	841	1176	1120	970	does not exist	540	1080	546	90	544	90	545	120	does not exist	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
N-1			—	544	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Normal	500 kV Shikarpur - Guddu Ckt II	Bifurcated from Dadu - Guddu II since March 2018	320	1177	973	Bifurcated from Dadu - Guddu II since March 2018	545	180	542	210	545	120	Bifurcated from Dadu - Guddu II since March 2018	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
N-1			—	—	—		—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
Normal	500 kV Shikarpur - Dadu Ckt I	does not exist	862	1193	82	965	does not exist	540	1080	546	90	540	450	548	120	does not exist	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
N-1			—	—	—	—		—	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
Normal	500 kV Shikarpur - Dadu Ckt II	Bifurcated from Dadu - Guddu II in March 2018	318	1133	905	Bifurcated from Dadu - Guddu II in March 2018	545	180	541	270	548	120	Bifurcated from Dadu - Guddu II in March 2018	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
N-1			—	—	—		—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
Normal	220 kV Shikarpur - Guddu Ckt I	18	258	482	548	869	235	180	240	180	240	180	240	150	242	120	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Normal	220 kV Shikarpur - Guddu Ckt II	Reported as Shikarpur - Guddu collectively	50	660	1031	Reported as Shikarpur - Guddu collectively	238	120	241	180	245	120	Reported as Shikarpur - Guddu collectively	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
N-1			—	—	—		—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
Normal	220 kV Shikarpur - Uch Ckt I	7	255	480	506	831	235	180	236	120	240	180	240	150	242	120	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Normal	220 kV Shikarpur - Uch Ckt II	Reported as Shikarpur - Uch collectively	48	657	1029	Reported as Shikarpur - Uch collectively	238	120	241	180	241	240	Reported as Shikarpur - Uch collectively	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
N-1			—	—	—		—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Normal	220 kV Shikarpur - Rohri I	19	13	37	687	1016	250	120	234	240	238	120	241	180	242	120	205	300	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Normal	220 kV Shikarpur - Rohri II	19	13	38	688	1013	250	120	234	240	238	120	241	180	242	330	205	300	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
N-1		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Total No. of Variations (Normal)		45	2,242	4,142	7,258	9,602	 Highest Voltage Under Normal Condition @500kV level																										
Total No. of Variations (N-1)		—	—	—	—	—	 Highest Voltage Under Normal Condition @220kV level																										
Total of Normal & N-1		45	2,242	4,142	7,258	9,602																											

NTDC Hyderabad Region

6. 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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	Voltage	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20		
Normal	220 kV Dharki - Engro	12	1	NA	948	240	120	235	180	NA	250	120	206	60	—	—	NA	200	120	NA	—	—	NA	—	—	NA	—	—			
N-1		—	—		—	—	—	—	—		—	—	—	—	—	—		—	—		—	—		—	—		—	—			
Normal	220 kV Ddharki - FPCDL	12	1	NA	964	240	120	235	180	NA	250	120	206	60	—	—	NA	200	120	NA	—	—	NA	—	—	NA	—	—			
N-1		—	—		—	—	—	—	—		—	—	—	—	—	—		—	—		—	—		—	—		—	—			

Na: Not Applicable

Total No. of Variations (Normal)	24	2
Total No. of Variations (N-1)	—	—
Total of Normal & N-1	24	2

NA	1912
—	1912

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Hyderabad Region

7. 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)												
							2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20				
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time			
Normal	220 kV Hala Road - Jamshoro I	3	5	28	10	5	232	90	235	180	240	60	240	30	238	270	-	-	-	-	-	-	-	-	-				
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
Normal	220 kV Hala Road - Jamshoro II	3	5	28	10	5	232	90	235	180	240	60	240	30	238	270	-	-	-	-	-	-	-	-	-				
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
Total No. of Variations (Normal)		6	10	56	20	10	Highest Voltage Under Normal Condition																						
Total No. of Variations (N-1)		-	-	-	-	-																							
Total of Normal & N-1		6	10	56	20	10																							

NTDC Hyderabad Region

8. 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)																				
							2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20												
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time													
Normal	220 kV Dadu - Khuzdar I	398	229	141	123	983	255	90	255	35	248	30	250	35	248	60	180	60	185	45	190	35	180	30	180	60											
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
Normal	220 kV Dadu - Khuzdar II	398	229	141	123	983	255	90	255	35	248	30	250	35	248	60	180	60	185	45	190	35	180	30	180	60											
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
Total No. of Variations (Normal)		796	458	282	246	1966	Highest Voltage Under Normal Condition										Lowest Voltage Under Normal Condition																				
Total No. of Variations (N-1)		-	-	-	-	-																															
Total of Normal & N-1		796	458	282	246	1966																															

NTDC Hyderabad Region

9. 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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	
Normal	220 kV Loralai - D.G. Khan I	623	505	1570	991	1094	250	60	248	600	254	300	242	240	250	120	-	-	-	-	-	180	180	143	180	195	60				
N-1		-	-	-	154	126	-	-	-	-	-	-	255	60	255	60	-	-	-	-	-	-	-	190	60	190	180				
Normal	220 kV Loralai - D.G. Khan II	623	505	1570	991	1094	250	60	248	600	254	300	242	240	250	120	-	-	-	-	-	180	180	143	180	195	60				
N-1		-	-	-	154	126	-	-	-	-	-	-	255	60	255	60	-	-	-	-	-	-	-	190	60	190	180				
Total No. of Variations (Normal)		1,246	1,010	3,140	1,982	2,188	 Highest Voltage Under Normal Condition										 Lowest Voltage Under Normal Condition														
Total No. of Variations (N-1)		-	-	-	308	252	 Highest Voltage Under N-1 Normal Condition										 Lowest Voltage Under N-1 Normal Condition														
Total of Normal & N-1		1,246	1,010	3,140	2,290	2,440																									

NTDC Hyderabad Region

10. 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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	Voltage	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20		
Normal	220 kV Sibbi - Quetta Ckt I	6053	444	3022	4379	5468	250	60	240	60	-	-	280	60	-	-	175	60	201	60	180	60	178	60	176	60	176	60			
N-1		-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	220 kV Sibbi - Quetta Ckt II	6053	444	3022	4379	5468	250	60	240	60	-	-	280	60	-	-	-	-	60	201	60	180	60	178	60	176	60	176	60		
N-1		-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Total No. of Variations (Normal)		12,106	888	6,044	8,758	10,936																									
Total No. of Variations (N-1)		-	2	-	-	-	-																								
Total of Normal & N-1		12,106	890	6,044	8,758	10,936																									

 Lowest Voltage Under Normal Condition

NTDC Hyderabad Region

11. 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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		2015-16	Voltage	2016-17	Time	2017-18	Voltage	2018-19	Time	2019-20	Voltage	2015-16	Voltage	2016-17	Voltage	2017-18	Voltage	2018-19	Voltage	2019-20	2015-16	Voltage	2016-17	Voltage	2017-18	Voltage	2018-19	Voltage			
Normal	220 kV Shikarpur - Rohri I	411	Nil	20	83	460	252	60	Nil	236	60	232	60	246	60	208	60	Nil	-	-	-	-	-	-	-	-	-				
N-1		-		-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-				
Normal	220 kV Shikarpur - Rohri II	411	Nil	20	83	460	252	60	Nil	236	60	232	60	246	60	208	60	Nil	-	-	-	-	-	-	-	-	-				
N-1		-		-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-				
Normal	220 kV Rohri - Engro I	410	Nil	15	17	24	252	60	Nil	238	180	232	60	244	60	208	60	Nil	-	-	-	-	-	-	-	-	-				
N-1		-		-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-				
Normal	220 kV Rohri - Engro II	410	Nil	15	17	24	252	60	Nil	238	180	232	60	244	60	208	60	Nil	-	-	-	-	-	-	-	-	-				
N-1		-		-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-				

Total No. of Variations (Normal)

Total No. of Variations (N-1)

Total of Normal & N-1

1,642 Nil 70 200 968

- - - -

1,642 Nil 70 200 968

Highest Voltage Under Normal Condition

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)														
							2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20						
		2015-16	2016-17	2017-18	2018-19	2019-20	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	1145	588	534	410	777	-	-	240	60	238	60	246	60	241	60	192	60	180	60	196	60	207	60	205	60					
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	220 kV Sibbi - Quetta Ckt II	1149	588	534	410	777	237	60	240	60	238	60	246	60	241	60	192	60	180	60	196	60	207	60	205	60					
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	220 kV Sibbi - Uch Ckt I	545	182	289	943	1554	253	60	240	60	240	60	246	60	250	60	192	60	200	60	200	120	-	-	207	60					
N-1		1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	196	60	-	-	-	-	-	-	-						
Normal	220 kV Sibbi - Uch Ckt II	543	182	289	943	1554	253	60	240	60	240	60	246	60	250	60	192	60	200	60	200	120	-	-	207	60					
N-1		2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	196	60	-	-	-	-	-	-	-						
Normal	220 kV Sibbi - Guddu DC Ckt	539	228	258	931	1514	253	60	240	60	240	60	246	60	250	60	192	60	200	60	200	60	-	-	207	60					
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
Normal	220 kV Sibbi - Uch DC Ckt	Energized on 05-05-2018	258	971	1505	Energized on 05-05-2018					240	60	246	60	250	60	Energized on 05-05-2018					200	120	-	-	206	60				
N-1			-	-	-						-	-	-	-	-	-						-	-	-	-	-					
N-1	220 kV Sibbi - D. M Jamali Ckt	Energized on 05-05-2018	77	902	1505	Energized on 05-05-2018					240	60	246	60	250	60	Energized on 05-05-2018					-	-	-	-	207	60				
			-	-	-						-	-	-	-	-	-						-	-	-	-	-					
Total No. of Variations (Normal)		3,921	1,768	2,239	4,579	9,186	 Highest Voltage Under Normal Condition												 Lowest Voltage Under Normal Condition												
Total No. of Variations (N-1)		3	-	-	-	-																									
		3,924	1,768	2,239	4,579	9,186																									

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)																
							2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20								
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time					
Normal	220 kV T.M.Khan - Jamshoro I	473	122	287	671	1284	242	60	244	60	242	60	247	60	243	60	-	-	-	-	-	-	-	-	-	-	-	-					
N-1	T.M.Khan - Jamshoro I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	220 kV T.M.Khan - Jamshoro II	473	122	287	671	1284	242	60	244	60	242	60	247	60	243	60	-	-	-	-	-	-	-	-	-	-	-						
N-1	T.M.Khan - Jamshoro II	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	220 kV T.M.Khan - Jhimpir I	Energized Aug 2017	240	738	1320	Energized Aug 2017					242	60	247	60	243	60	Energized Aug 2017				-	-	-	-	-	-	-	-					
N-1	T.M.Khan - Jhimpir I		-	-	-		-	-	-	-	-	-	-	-	-	-					-	-	-	-	-	-	-	-					
Normal	220 kV T.M.Khan - Jhimpir II	Energized Aug 2017	240	738	1320	Energized Aug 2017					242	60	247	60	243	60	Energized Aug 2017				-	-	-	-	-	-	-	-					
N-1	T.M.Khan - Jhimpir II		-	-	-		-	-	-	-	-	-	-	-	-	-					-	-	-	-	-	-	-	-					
Total No. of Variations (Normal)		374	244	1,054	2,818	5,208																											
Total No. of Variations (N-1)		-	-	-	-	-																											
Total of Normal & N-1		374	244	1,054	2,818	5,208																											

 Highest Voltage Under Normal Condition

NTDC Hyderabad Region

14. 220kV Grid Station JHIMPIR

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)														
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time		
Normal	220 kV Jhimpir - T.M.Khan I	Energized in Aug 2017	174	444	415	Energized in Aug 2017	245	60	247	60	245	120	Energized in Aug 2017	-	-	190	60	-	-	Energized in Aug 2017	-	-	190	60	-	-	Energized in Aug 2017	-	-		
N-1			-	-	-		-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-		-	-		
Normal	220 kV Jhimpir - T.M.Khan II	Energized in Aug 2017	174	444	415	Energized in Aug 2017	245	60	247	60	245	120	Energized in Aug 2017	-	-	190	60	-	-	Energized in Aug 2017	-	-	190	60	-	-	Energized in Aug 2017	-	-		
N-1			-	-	-		-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-		-	-		
Total No. of Variations (Normal)	Energized in Aug 2017	348	888	830	Highest Voltage Under Normal Condition																										
Total No. of Variations (N-1)		-	-	-																											
Total of Normal & N-1		348	888	830																											

NTDC Hyderabad Region

15. 220kV Grid Station Dera Murad Jamali

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)									
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20						
		Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time					
Normal	220 kV D. M. Jamali - Uch	1119	2205	Added in 2018-19		Added in 2018-19		241	60	241	120	Added in 2018-19		Added in 2018-19		Added in 2018-19		Added in 2018-19		-	-	-	-			
N-1		-	-					-	-	-	-									-	-	-	-			
Normal	220 kV D. M. Jamali - Sibbi	*	2625					241	60	241	120									-	-	-	-			
N-1			-	Added in 2018-19		Added in 2018-19		-	-	-	-									-	-	-	-			

* Only comparison reported

Total No. of Variations (Normal)	1,119	4,830	 Highest Voltage Under Normal Condition
Total No. of Variations (N-1)	-	-	
Total of Normal & N-1	1,119	4,830	

APPENDIX 5

Voltage violations data – KE's detailed circuit wise analysis

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)																
		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20			
		2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time			
Normal	220 kV Balidia - Mauripur	-	-	-	-	-	2015-16								2016-17								2017-18								
N-1							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Normal	132 kV Surjani - Maymar	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	123.8	31	
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV Surjani - Valika	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	123.8	31
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV SITE - SGT 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV SITE - SGT 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV KDA - Federal B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV Valika - N. Karachi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV Gulshan - Civic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV West Wharf - Lyari	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV Qayyumabad - K. East	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV Memon Goth - Malir	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV Malir - CAA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV Gulshan - Hospital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV Gharo - RECP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Normal	132 kV BOC - Dhabeji	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

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)																			
							2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20		2015-16		2016-17		2017-18		2018-19		2019-20	
				2015-16	2016-17	2017-18	2018-19	2019-20	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time						
Normal	132 kV Dhabeji - Gharo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	Dhabeji - Gharo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV KDA - Memon Goth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	KDA - Memon Goth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV KDA - Johar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	KDA - Johar	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117.4	147	-	-	118.6	33	118.6	33	-	-							
Normal	132 kV Johar - Hospital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	Johar - Hospital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV KDA - Gulshan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	KDA - Gulshan	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117.4	147	-	-	118.6	33	-	-	-	-							
Normal	132 kV KDA - Maymar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	KDA - Maymar	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117.4	147	-	-	118.6	33	-	-	-	-							
Normal	132 kV Federal B - Valika	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	Federal B - Valika	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV Haroonabad - Liaquatabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	Haroonabad - Liaquatabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV Valika - Nazimabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	Valika - Nazimabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV Gulshan - Jalil Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	Gulshan - Jalil Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV Gulshan - Azizabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	Gulshan - Azizabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV Mauripur - Haroonabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117.4	331	116.8	56	116.8	34	118.2	250	-							
N-1	Mauripur - Haroonabad	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117.4	331	116.8	56	116.8	34	118.2	250	-							
Normal	132 kV Haroonabad - Nazimabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1	Haroonabad - Nazimabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV Korangi West - Defence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117.1	280	114	48	117.3	47	118.2	250	-						
N-1	Korangi West - Defence	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117.1	280	114	48	117.3	47	118.2	250	-							
Normal	132 kV Pipri West - Port Qasim	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116.9	78	-	-	-	-	-	-	-							
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)																
		2015-16	2016-17	2017-18	2018-19	2019-20	2015-16	Voltage	Time	2016-17	Voltage	Time	2017-18	Voltage	Time	2018-19	Voltage	Time	2019-20	2015-16	Voltage	Time	2016-17	Voltage	Time	2017-18	Voltage	Time	2018-19	Voltage	Time
Normal	132 kV	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116.9	78	-	-	-	-	-	-	-	-	-	-
N-1	Pipri West - KEPZ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	KEPZ - Landhi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	Gul Ahmed - Airport 1 & 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	KTPS - PRL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	K. East - K. South	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	Valika - North Nazimabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	Orangi - Valika	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	Liaquatabad - Azizabad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	Port Qasim - Landhi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	Baldia - Orangi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	Baldia - Valika	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	Baldia - Hub	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1	Baldia - SGT - SITE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Normal	132 kV	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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)																
		2015-16	2016-17	2017-18	2018-19	2019-20	2015-16		2016-17		2017-18		2018-19		2018-19		2015-16		2016-17		2017-18		2018-19		2018-19								
Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time						
Normal	132 kV Pipri - Landhi	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116.9	78	-	-	-	-	-	-	-	-						
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV Qayyumabad - DHA 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV Queen's Road - Clifton	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118.68	36					
N-1		1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	117.1	280	114	48	117.3	47	118.3	54	-	-						
Normal	132 kV Queen's Road - Gizri	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118.68	36					
N-1		1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	117.1	280	114	48	117.3	47	118.3	54	-	-						
Normal	132 kV Queen's Road - Elander Road	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118.68	36					
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Normal	132 kV Queen's Road - Old Town	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118.68	36					
N-1		1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	117.1	280	114	48	117.3	47	118.3	54	-	-						
Normal	132 kV Pipri / RECP / Gharo	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116.9	78	-	-	-	-	-	-	-	-						
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
Normal	132 kV Pipri / BOC / Dhabeji	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116.9	78	-	-	-	-	-	-	-	-						
N-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
Normal	132 kV KDA / Memon Goth / Malir	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1		1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	117.4	280	-	-	118.6	33	-	-	-	-						
Normal	132 kV Korangi West / Baloch / Gizri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
N-1		1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	117.1	280	-	-	117.3	47	118.3	54	-	-						
Normal	132 kV Mauripur - Old Golimar	-			1		-						-						-						124.74		32						
N-1		1			1		-						-						-						118.2		250						
Normal	132 kV Mauripur - Lyari	-			1		-						-						-						124.74		32						
N-1		1			1		-						-						-						118.2		250						
Normal	132 kV Mauripur - Labour Square	-					1		-						-						-						1247.7		32				
N-1		-					1		-						-						-						-		-				

NP: Not Provided

Total No. of Variations (Normal)	6	Nil	Nil	Nil	9
Total No. of Variations (N-1)	12	7	12	9	Nil
Total of Normal & N-1	18	7	12	9	9

 Lowest Voltage Under Normal Condition

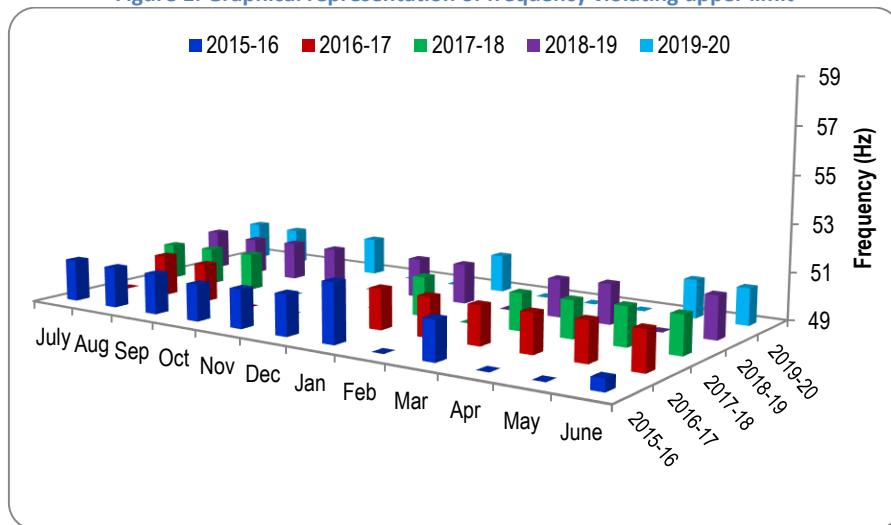
APPENDIX 6

System Frequency - Historical Data as Reported by the Licensees

- | | |
|--------------------|------|
| 1. NTDC | A6-1 |
| 2. K-Electric..... | A6-3 |

NTDC

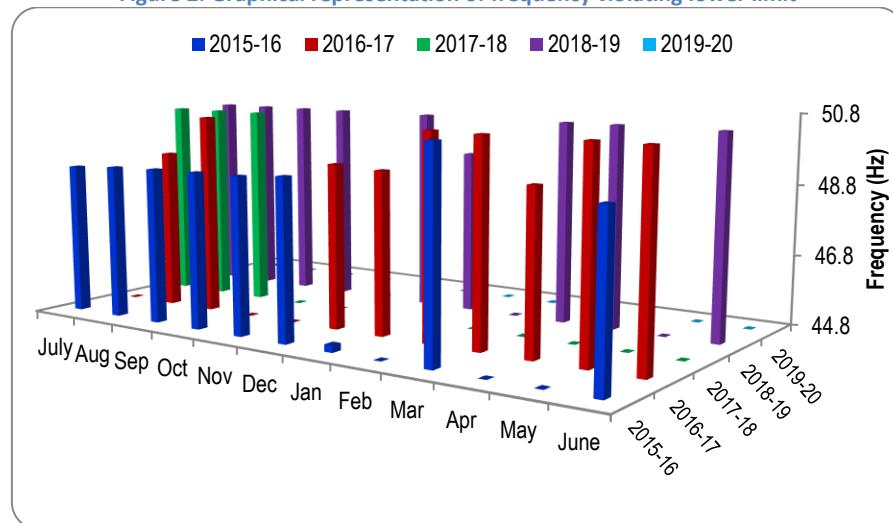
Month	Highest System Frequency Recorded Violating the Prescribed Upper Limit ¹ (Hz)				
	2015-16	2016-17	2017-18	2018-19	2019-20
July	50.75	NIL	50.5	50.66	50.62
Aug	50.69	50.72	50.56	50.54	50.55
Sep	50.69	50.6	50.56	50.6	NIL
Oct	50.53	NIL	NIL	50.58	50.59
Nov	50.62	NIL	NIL	NIL	NIL
Dec	50.71	50.63	NIL	50.64	NIL
Jan	51.47	50.68	50.64	50.67	50.58
Feb	NIL	50.65	NIL	NIL	NIL
Mar	50.64	50.61	50.54	50.59	NIL
Apr	NIL	50.63	50.56	50.68	NIL
May	NIL	50.65	50.62	NIL	50.6
June	49.49	50.64	50.6	50.79	50.54

Figure 1: Graphical representation of frequency violating upper limit
¹ Upper Limit: 50.50 Hz, Rule 8(1) of PSTR 2005

Month	Lowest System Frequency Recorded Violating the prescribed Lower Limit ² (Hz)				
	2015-16	2016-17	2017-18	2018-19	2019-20
July	49.07	NIL	50.51	50.51	NIL
Aug	49.15	49.36	50.51	50.51	NIL
Sep	49.19	50.51	50.51	50.51	NIL
Oct	49.21	NIL	NIL	50.51	NIL
Nov	49.22	NIL	NIL	NIL	NIL
Dec	49.32	49.44	NIL	50.51	NIL
Jan	45	49.37	NIL	49.44	NIL
Feb	NIL	50.53*	NIL	NIL	NIL
Mar	50.52	50.51*	NIL	50.51	NIL
Apr	NIL	49.32	NIL	50.52	NIL
May	NIL	50.52*	NIL	NIL	NIL
June	49.35	50.51*	NIL	50.51	NIL

* Cannot be validated

Figure 2: Graphical representation of frequency violating lower limit

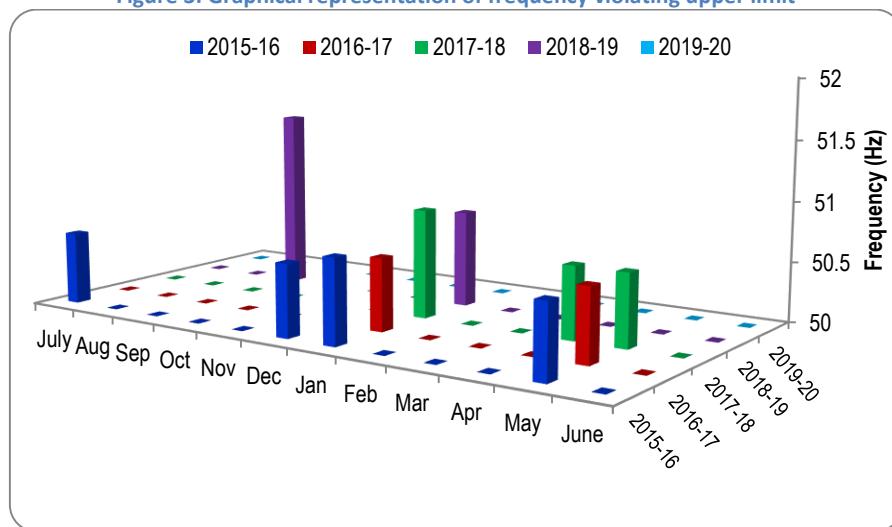


² Lower Limit: 49.50 Hz, Rule 8(1) of PSTR 2005

K-Electric

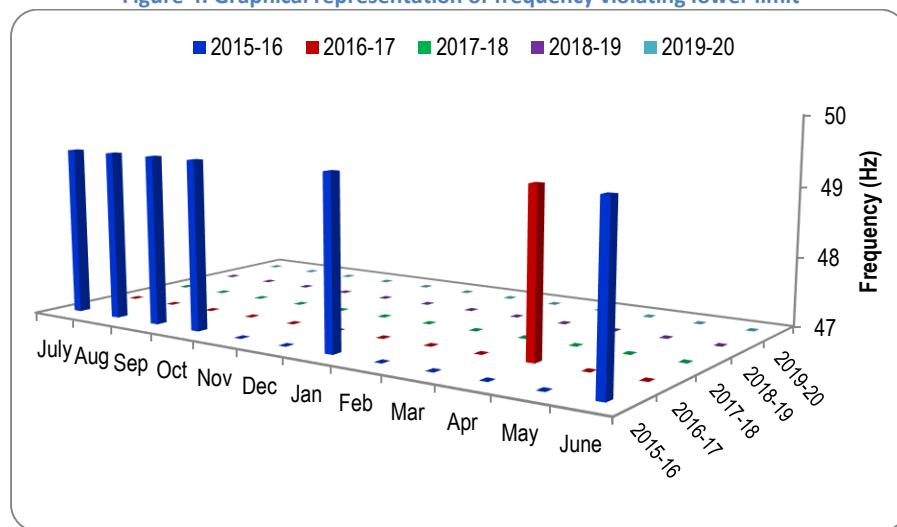
Month	Highest System Frequency Recorded Violating the Prescribed Upper Limit ³ (Hz)				
	2015-16	2016-17	2017-18	2018-19	2019-20
July	50.6	Nil	NA	–	Nil
Aug	Nil	Nil	NA	–	Nil
Sep	Nil	Nil	NA	51.5	Nil
Oct	Nil	Nil	NA	–	Nil
Nov	0	Nil	NA	–	Nil
Dec	50.6	Nil	NA	–	Nil
Jan	50.7	50.6	50.9	50.8	Nil
Feb	Nil	Nil	NA	–	Nil
Mar	Nil	Nil	NA	–	Nil
Apr	Nil	Nil	50.6	–	Nil
May	50.6	50.6	50.6	–	Nil
June	Nil	Nil	NA	–	Nil

Figure 3: Graphical representation of frequency violating upper limit



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

Month	Lowest System Frequency Recorded Violating the prescribed Lower Limit ⁴ (Hz)				
	2015-16	2016-17	2017-18	2018-19	2019-20
July	49.4	Nil	NA	–	–
Aug	49.4	Nil	NA	–	–
Sep	49.4	Nil	NA	–	–
Oct	49.4	Nil	NA	–	–
Nov	Nil	Nil	NA	–	–
Dec	Nil	Nil	NA	–	–
Jan	49.4	Nil	NA	–	–
Feb	Nil	Nil	NA	–	–
Mar	Nil	Nil	NA	–	–
Apr	Nil	49.3	NA	–	–
May	Nil	Nil	NA	–	–
June	49.4	Nil	NA	–	–

Figure 4: Graphical representation of frequency violating lower limit⁴ Lower Limit: 49.50 Hz, Rule 8(1) of PSTR 2005



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