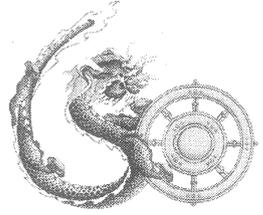




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Bhutan Power Corporation Limited
(Registered Office, Thimphu)
Bhutan Power System Operator
Thimphu : Bhutan



02/BPC/BPSO/PSOD/Vol-I/17/ 15

January 29, 2018

Chief Executive Officer,
Bhutan Electricity Authority,
Thimphu: Bhutan.

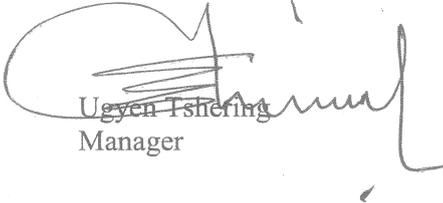
Sub: Submission of Transmission System Performance Annual Report for the year 2017.

Sir,

Kindly find enclosed with the transmission system performance annual report as per the Grid Code Regulation, 2008 Clause No: 6.14.1, for year 2017. Soft copy of the report is available in the <http://bpto.bpc.bt>.

Thanking you,

Yours faithfully,


Ugyen Tshering
Manager

Copy to:

1. Director, Operation & Maintenance Department, Druk Green Power Corporation, Thimphu
2. General Manager, TD/BPSO, BPC for kind information
3. General Manager, DCSD, BPC for kind information.

BHUTAN POWER CORPORATION LIMITED

BHUTAN POWER SYSTEM OPERATOR

THIMPHU: BHUTAN



ANNUAL TRANSMISSION SYSTEM PERFORMANCE REPORT FOR THE YEAR 2017

JANUARY-2018

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1.0 INTRODUCTION

In compliance to Grid Code Regulation 2008, Clause No. 6.14.2.1, this office prepared an annual report covering the performance of the Transmission System and details as required by the Ministry and the Authority annually for development of power system master plan and formulation of other policy decisions, thus this report contains the performance of Transmission System for the year 2017.

All the index and other calculations in this report have been executed based on the data received from substations and generating plants.

2.0 PERFORMANCE OF GENERATING STATIONS

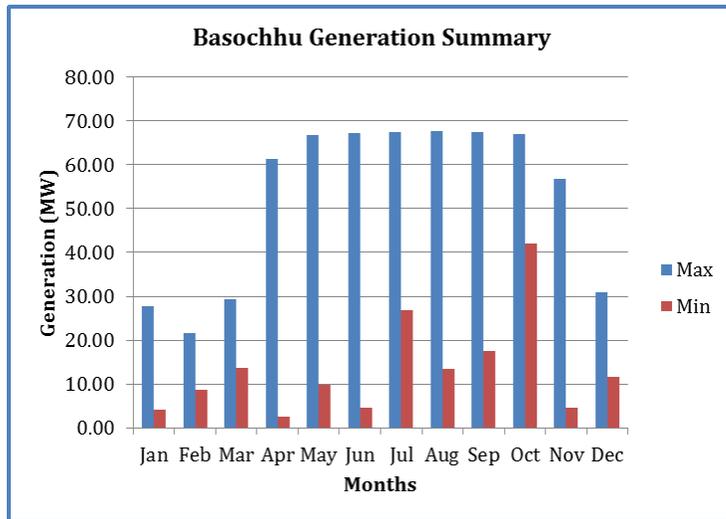
2.1 POWER GENERATION

The maximum individual plant generation was recorded as 1,134.00MW by the Tala Hydropower Plant, followed by 368.00MW by Chhukha Hydropower Plant.

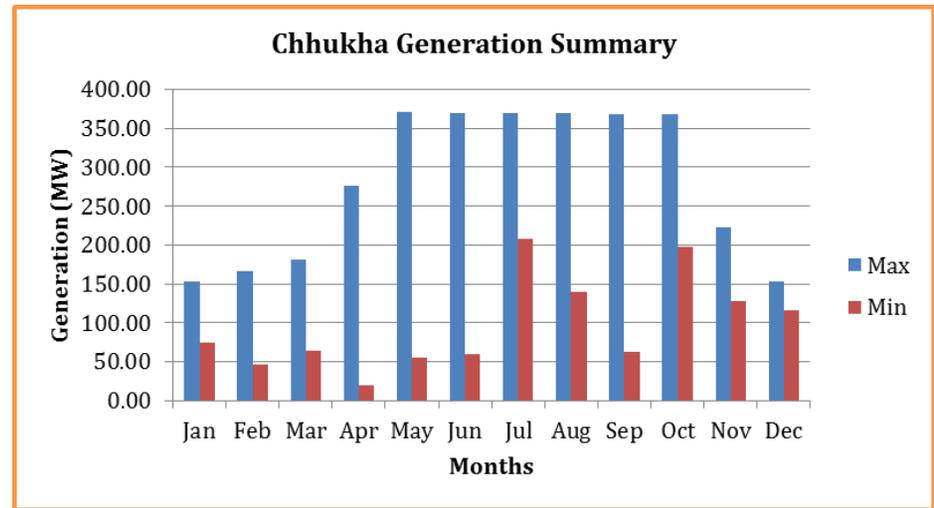
Table: 2.1.1 Monthly maximum and minimum generation summary

Sl. No	Hydropower Plant		Monthly Maximum and Minimum Generation (MW)												Max/Min of year (MW)	
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1	BHP	Max	27.80	21.63	29.30	61.30	66.76	67.25	67.39	67.59	67.54	67.02	56.69	30.94	67.59	
		Min	4.06	8.68	13.66	2.50	9.77	4.50	26.83	13.52	17.52	42.13	4.57	11.74	2.50	
2	CHP	Max	153.00	167.10	180.58	275.65	370.36	369.93	370.00	369.00	368.00	368.00	223.00	153.30	370.36	
		Min	74.94	47.00	63.36	19.00	55.00	59.10	208.00	140.17	63.00	197.00	128.50	115.56	19.00	
3	THP	Max	330.00	260.00	390.00	748.00	1,122.00	1,122.00	1,122.00	1,122.00	1,122.00	1,064.00	450.00	310.00	1,122.00	
		Min	100.00	140.00	130.00	140.00	230.00	250.00	910.00	935.00	697.00	420.00	260.00	130.00	100.00	
4	KHP	Max	32.65	32.42	63.01	66.27	66.10	66.00	66.00	66.00	66.00	66.00	65.55	34.17	66.27	
		Min	14.41	8.52	10.28	15.33	16.25	16.50	12.95	10.90	32.88	33.00	20.70	16.23	8.52	
5	DHP	Max	29.27	35.21	46.01	63.28	63.05	126.61	95.10	100.70	100.79	100.70	52.27	40.03	126.61	
		Min	10.22	7.20	14.21	10.02	10.22	15.26	5.50	1.13	40.30	48.74	31.31	23.06	1.13	

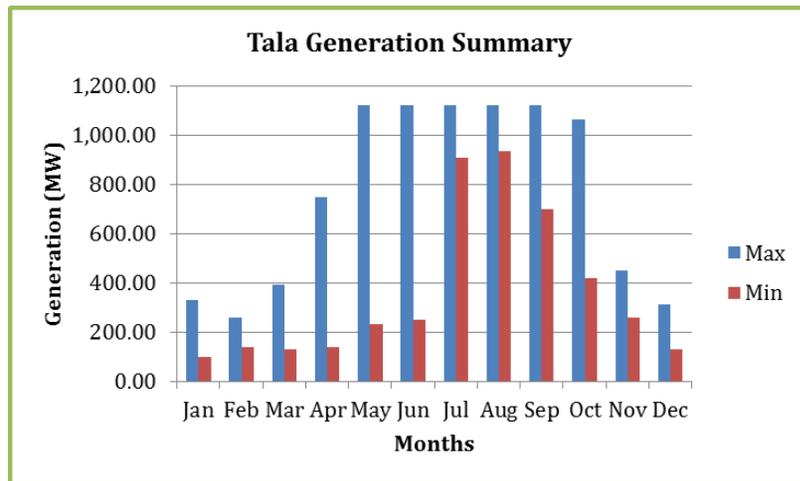
Graph: 2.1.1 Basochhu generation summary



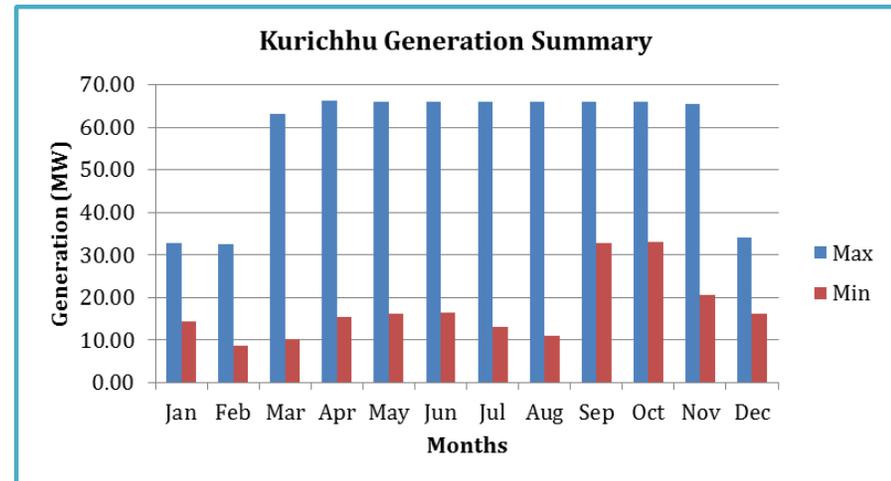
Graph: 2.1.2 Chhukha generation summary



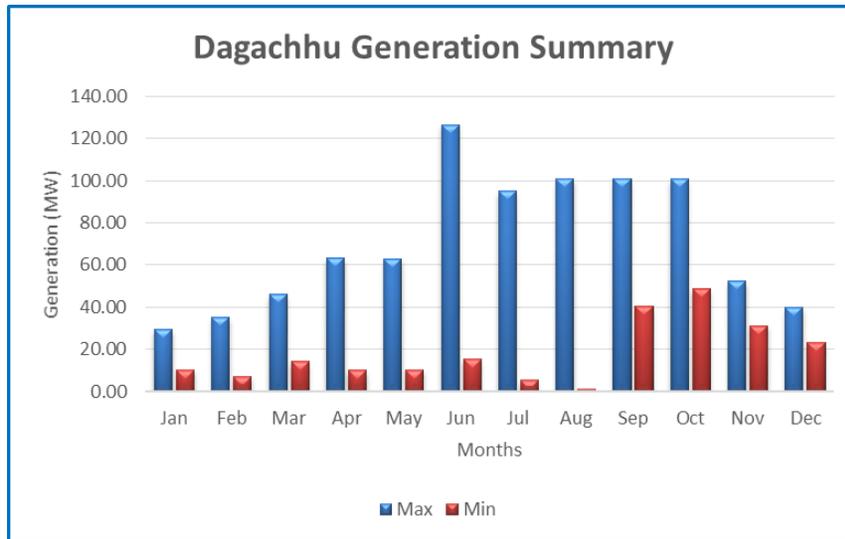
Graph: 2.1.3 Tala generation summary



Graph: 2.1.4 Kurichhu generation summary



Graph: 2.1.5 Dagachhu generation summary



2.2 PLANT FACTOR

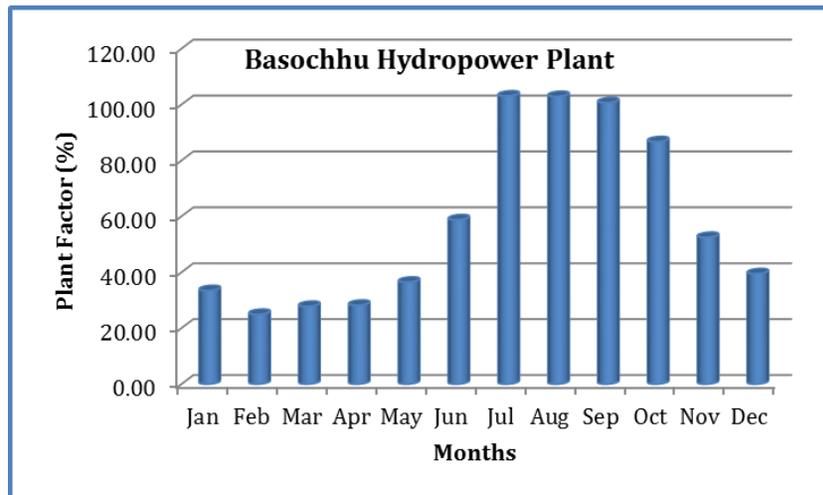
The plant factor of each generating plant was calculated as below:

$$\begin{aligned} \text{Plant factor} &= (\text{Actual output of a plant over a period of time}) / (\text{Output when operated at name plate rated capacity for entire time}) \\ &= (\text{Total energy plant has produced over a period}) / (\text{Total energy plant would produce when operated at full rated capacity}) \end{aligned}$$

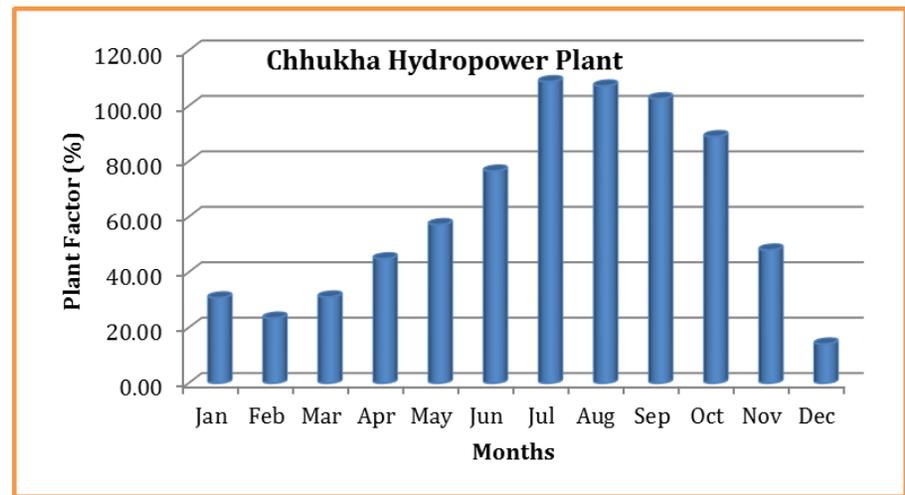
Table: 2.2.1 Monthly plant factor of the hydropower plants

Sl. No	Hydropower Plant	Monthly Plant Factor (%)												Max/Min of year (%)	
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min
1	BHP	33.44	24.94	27.81	28.22	36.47	58.79	103.09	102.91	100.67	86.72	52.50	39.49	103.09	24.94
2	CHP	30.76	23.45	31.06	44.86	57.18	76.53	108.77	107.20	102.63	88.94	48.02	14.12	108.77	14.12
3	THP	20.73	15.39	21.03	31.34	38.61	56.55	109.02	109.36	94.74	62.17	31.68	22.82	109.36	15.39
4	KHP	33.14	27.51	38.08	61.83	86.04	100.13	105.53	106.65	105.59	101.82	58.93	43.79	106.65	27.51
5	DHP				0.00	0.00	0.00	0.00	66.25	69.60	56.55	32.13	17.92	69.60	0.00

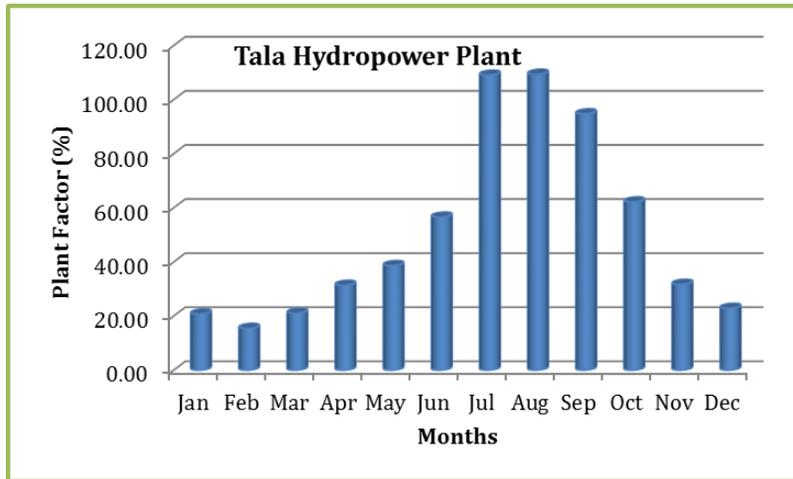
Graph: 2.2.1 Plant factor of Basochhu Hydropower Plant



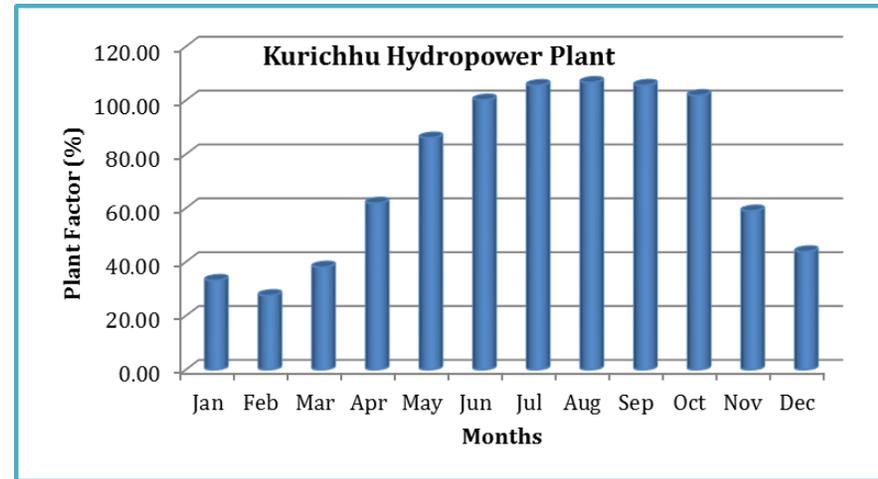
Graph: 2.2.2 Plant factor of Chhukha Hydropower Plant



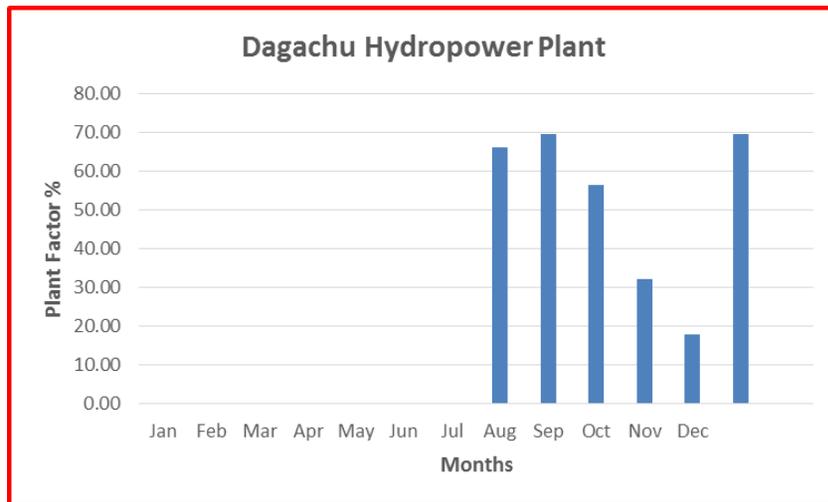
Graph: 2.2.3 Plant factor of Tala Hydropower Plant



Graph: 2.2.4 Plant factor of Kurichhu Hydropower Plant



Graph: 2.2.4 Plant factor of Dagachhu Hydropower Plant



3.0 PEAK DEMAND, ENERGY AVAILABILITY AND REQUIREMENT FOR THE COUNTRY

Calculation of coincidental peak load for the eastern grid, western grid and national load, we use the following methods:

1. *National Demand = (Sum of all total generation of each plant) – (Sum of all Export/Import)*
2. *National Demand = (Sum of all feeders loading at hydropower plant) – (Sum of all Export/Import)*
3. *National Demand = (Sum of all substation loading)*

The national load calculated using method-2 and method-3 are considered in the report.

3.1 NATIONAL LOAD

The national peak load for the year was 362.09MW occurred on 14th November, 2017 using method-2 (sum of all feeder loading at hydropower plant minus sum of export/import).

Table: 3.1.1 Monthly national peak load and corresponding generation using method- 2

Sl. No	Months	Date	Time	Total Grid (MW)		Western Grid (MW)		Eastern Grid (MW)	
				Load	Generation	Load	Generation	Load	Generation
1	Jan	22-Jan-17	18:00	337.63	363.05	278.45	342.65	59.19	20.40
2	Feb	25-Feb-17	20:00	336.33	287.94	287.64	266.99	48.69	20.95
3	Mar	18-Mar-17	19:00	344.02	336.63	276.73	316.07	67.29	20.56
4	Apr	12-Apr-17	20:00	341.95	388.38	281.75	359.72	60.20	28.66
5	May	3-May-17	19:00	342.97	450.38	275.24	419.48	67.73	30.90
6	Jun	27-Jun-17	22:00	342.94	1,408.93	287.41	1,344.55	55.53	64.38
7	Jul	12-Jul-17	16:00	343.86	1,682.30	306.31	1,618.84	37.55	63.46
8	Aug	16-Aug-17	7:00	343.97	1,749.38	289.93	1,683.71	54.04	65.67
9	Sep	19-Sep-17	11:00	343.98	1,483.87	300.82	1,417.87	43.16	66.00
10	Oct	4-Oct-17	19:00	343.99	1,418.71	295.50	1,352.71	48.49	66.00
11	Nov	14-Nov-17	19:00	362.09	588.68	309.37	543.15	52.72	45.53
12	Dec	1-Dec-17	19:00	361.79	474.16	309.46	443.64	52.33	30.52
National Peak Load of the year (MW)				362.09					

Graph: 3.1.1 Monthly national peak load and corresponding generation using method- 2

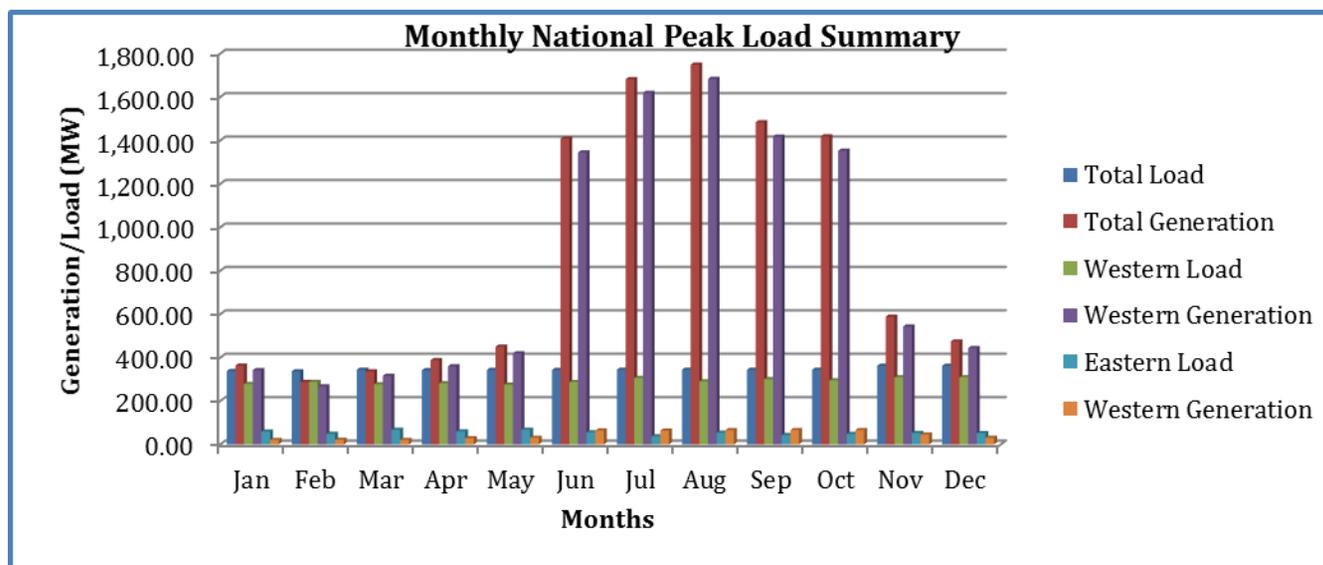
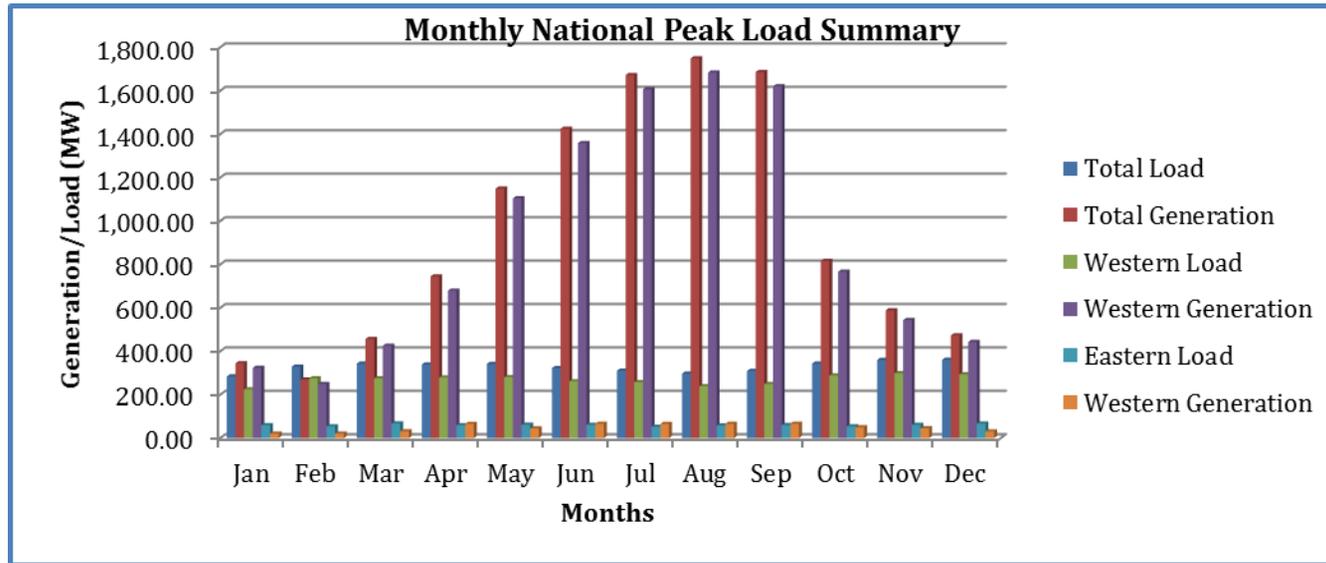


Table: 3.1.2 Monthly national peak load and corresponding generation using method- 3

Sl. No	Months	Date	Time	Total Grid (MW)		Western Grid (MW)		Eastern Grid (MW)	
				Load	Generation	Load	Generation	Load	Generation
1	Jan	20-Jan-17	20:00	283.96	344.25	224.85	323.64	59.10	20.61
2	Feb	24-Feb-17	19:00	329.26	269.49	275.21	248.76	54.05	20.73
3	Mar	27-Mar-17	19:00	342.69	456.29	275.21	425.24	67.48	31.05
4	Apr	24-Mar-17	19:00	338.53	744.67	279.08	679.15	59.45	65.52
5	May	16-May-17	20:00	341.67	1,149.02	280.41	1,104.46	61.26	44.56
6	Jun	20-Jun-17	20:00	322.46	1,425.00	261.53	1,359.00	60.94	66.00
7	Jul	9-Jul-17	21:00	310.31	1,671.78	258.12	1,606.84	52.19	64.94
8	Aug	16-Aug-17	7:00	296.71	1,749.38	238.43	1,683.71	58.28	65.67
9	Sep	21-Sep-17	19:00	309.03	1,686.12	248.97	1,620.12	60.06	66.00
10	Oct	30-Oct-17	18:00	342.93	816.15	288.44	766.65	54.49	49.50
11	Nov	14-Nov-17	18:00	359.87	588.67	298.86	543.58	61.01	45.09
12	Dec	1-Dec-17	18:00	360.49	473.11	293.92	442.66	66.57	30.45
National Peak Load of the year (MW)				360.49					

Graph: 3.1.2 Monthly national peak load and corresponding generation using method- 3



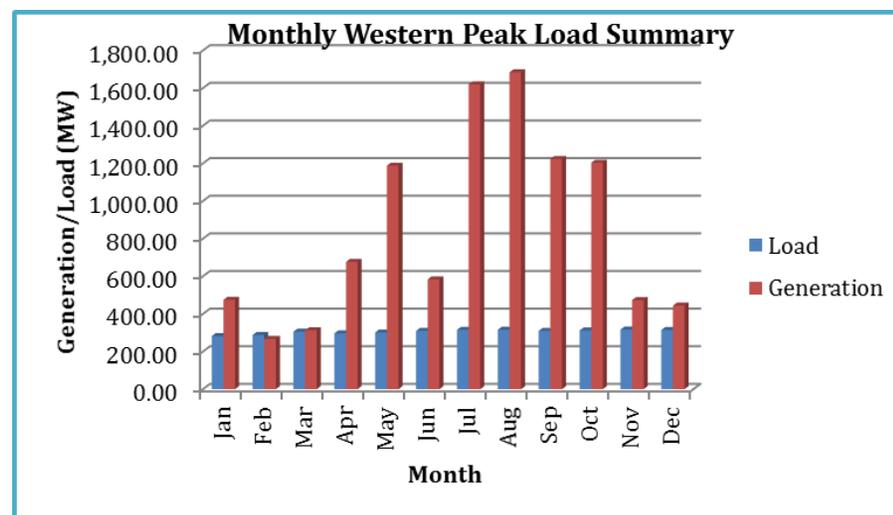
3.2 WESTERN GRID PEAK LOAD

Using method-2, the peak load for the western grid was 316.50MW which occurred on 29th November, 2017.

Table: 3.2.1 Monthly western peak load and corresponding generation

Sl. No	Months	Date	Time	Western Grid (MW)	
				Load	Generation
1	Jan	12-Jan-17	20:00	281.74	474.47
2	Feb	25-Feb-17	20:00	287.64	266.99
3	Mar	8-Mar-17	8:00	305.90	312.70
4	Apr	6-Apr-17	20:00	296.18	676.01
5	May	17-May-17	4:00	301.00	1,187.39
6	Jun	19-Jun-17	2:00	310.04	583.36
7	Jul	9-Jul-17	14:00	315.11	1,619.84
8	Aug	18-Aug-17	23:00	315.64	1,683.72
9	Sep	25-Sep-17	14:00	309.59	1,223.03
10	Oct	12-Oct-17	18:00	311.69	1,202.93
11	Nov	29-Nov-17	20:00	316.50	473.11
12	Dec	2-Dec-17	18:00	314.32	444.27
Western Peak Load of the year (MW)				316.50	

Graph: 3.2.1 Monthly western peak load and corresponding generation



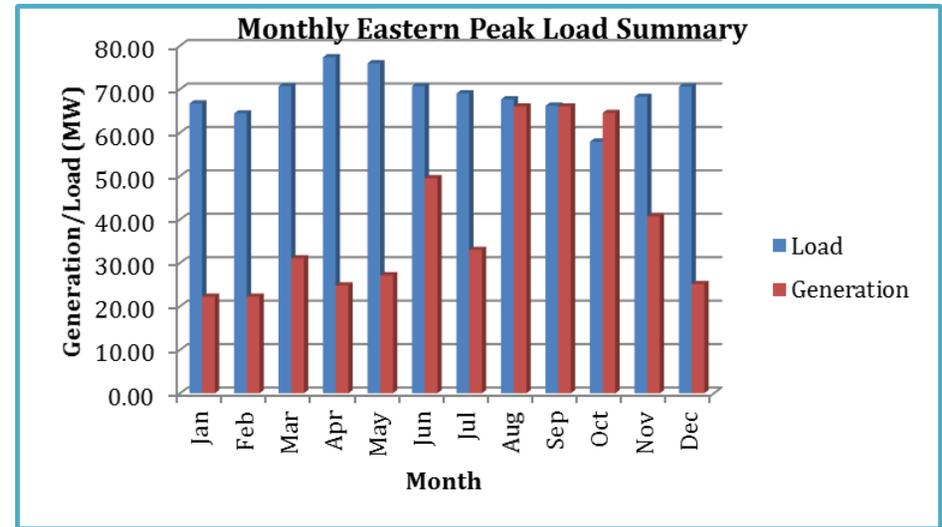
3.3 EASTERN GRID PEAK LOAD

Using method-2, the peak load for the eastern grid was 77.37MW which occurred on 13th April, 2017.

Table: 3.3.1 Monthly eastern peak load and corresponding generation

Sl. No	Months	Date	Time	Eastern Grid (MW)	
				Load	Generation
1	Jan	1-Jan-17	18:00	66.72	22.22
2	Feb	6-Feb-17	18:00	64.40	22.23
3	Mar	27-Mar-17	19:00	70.69	31.05
4	Apr	13-Apr-17	18:00	77.37	24.82
5	May	23-May-17	17:00	75.99	27.15
6	Jun	8-Jun-17	15:00	70.68	49.50
7	Jul	1-Jul-17	11:00	69.04	33.00
8	Aug	28-Aug-17	19:00	67.68	66.00
9	Sep	28-Sep-17	19:00	66.20	66.00
10	Oct	3-Oct-17	19:00	57.95	64.54
11	Nov	10-Nov-17	18:00	68.25	40.72
12	Dec	22-Dec-17	18:00	70.64	25.13
Eastern Peak Load of the year (MW)				77.37	

Graph: 3.3.1 Monthly eastern peak load and corresponding generation



4.0 EXPORT AND IMPORT OF ELECTRICITY TO/FROM NEIGHBORING COUNTRIES

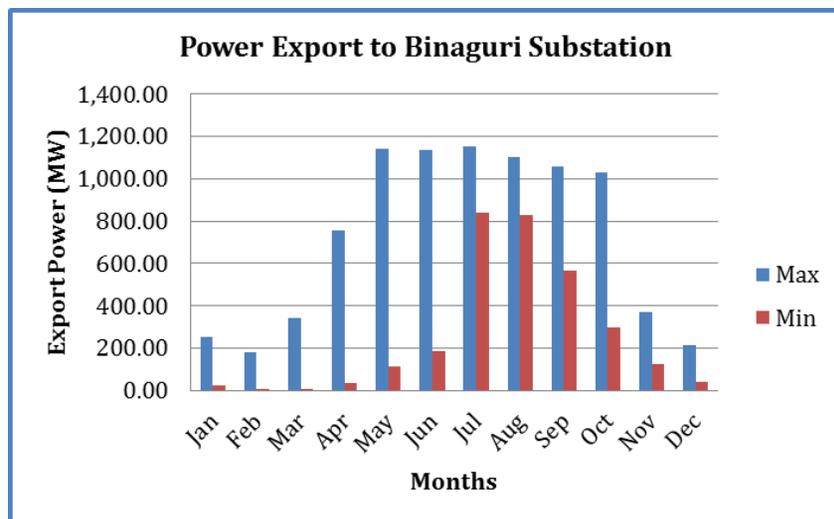
4.1 EXPORT OF ELECTRICITY TO NEIGHBORING COUNTRY

Maximum export of electricity for the year was 1,151.00MW to Binaguri substation in June, 2017, followed by 437.90MW to Birpara substation. The minimum export was 0.02MW to Birpara substation.

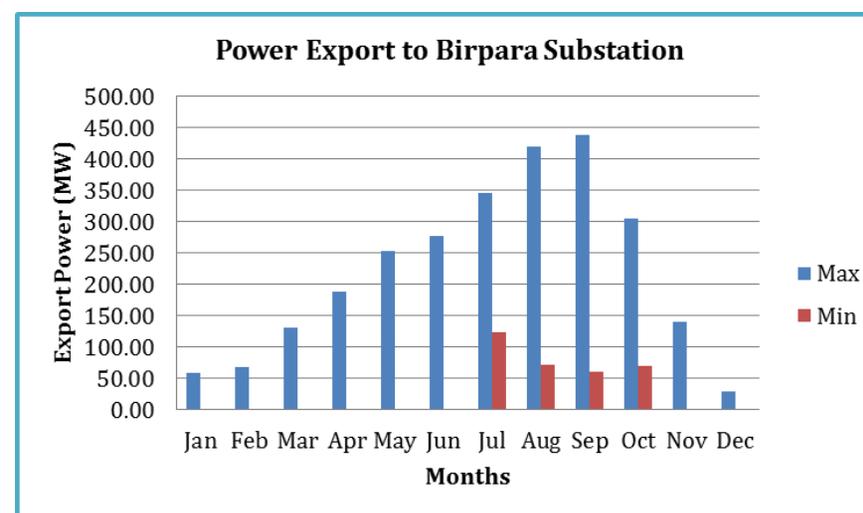
Table: 4.1.1 Monthly power export summary

Sl. No	Substation in India	Monthly Maximum and Minimum Export (MW)												Max/Min of year (MW)		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
1	Binaguri	Max	254.00	180.00	340.00	757.00	1,142.00	1,137.00	1,151.00	1,103.00	1,059.00	1,027.00	370.00	214.00	1,151.00	
		Min	24.00	1.00	1.00	37.00	115.00	187.00	839.00	826.00	565.00	297.00	123.00	42.00		1.00
2	Birpara	Max	59.00	66.93	131.30	187.40	252.90	276.30	345.00	420.50	437.90	305.90	140.90	29.60	437.90	
		Min	0.37	0.10	0.10	0.10	0.02	1.00	123.30	71.80	60.40	70.20	0.10	0.10		0.02
3	Salakoti & Rangia	Max	18.00	11.15	104.95	57.95	83.95	113.75	116.45	119.25	119.15	111.05	63.05	25.85	119.25	
		Min	0.05	0.05	0.05	0.15	0.25	2.40	26.05	14.95	19.95	34.55	7.05	0.05		0.05

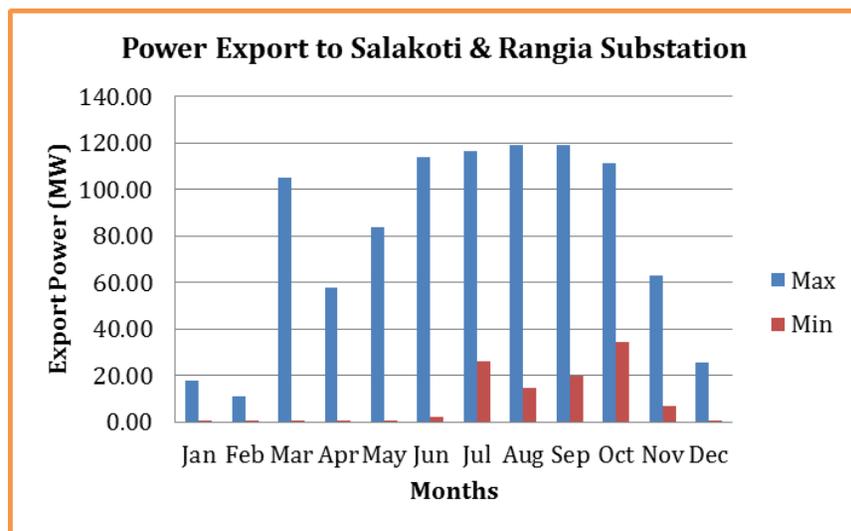
Graph: 4.1.1 Monthly power export to Binaguri substation



Graph: 4.1.2 Monthly power export to Birpara substation



Graph: 4.1.3 Monthly net power export to Salakoti and Rangia substation



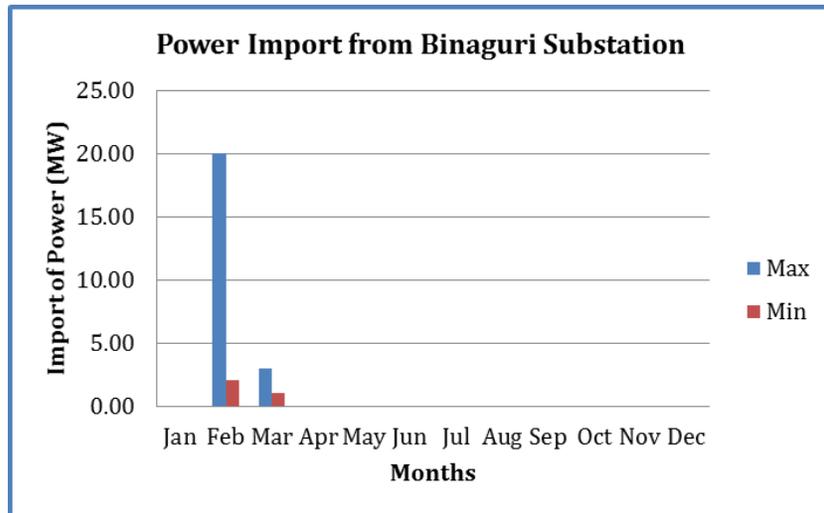
4.2 IMPORT OF ELECTRICITY FROM NEIGHBORING COUNTRY

Maximum import of power was 133.2MW from Birpara substation which occurred in April, 2017 followed by 56.00MW and 20MW from Salakoti and Rangia and Binaguri respectively.

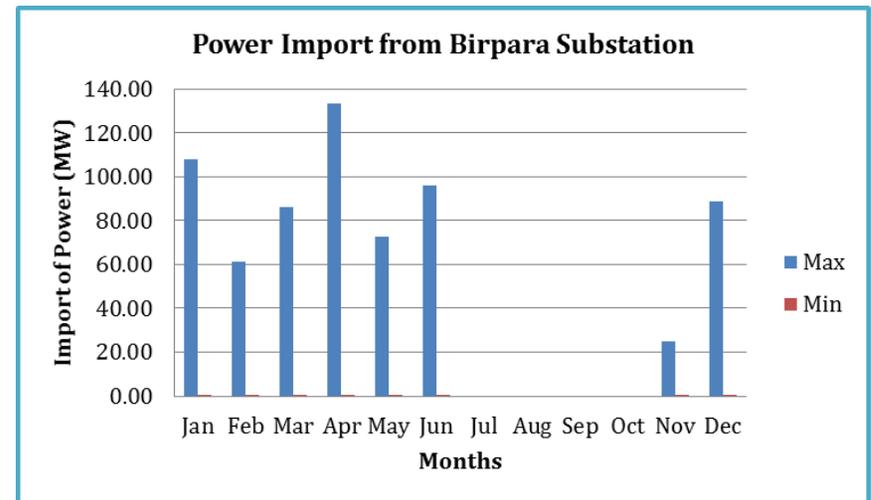
Table: 4.2.1 Monthly power import summary

Sl. No	Substation in India		Monthly Maximum and Minimum Import (MW)												Max/Min of year (MW)		
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
1	Binaguri	Max	0.00	20.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	0.00
		Min	0.00	2.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
2	Birpara	Max	108.00	61.10	86.00	133.20	72.50	96.00	0.00	0.00	0.00	0.00	24.80	89.00	133.20	0.00	
		Min	0.70	0.30	0.60	0.20	0.30	0.50	0.00	0.00	0.00	0.00	0.40	0.40			
3	Salakoti & Rangia	Max	23.00	56.00	23.40	35.15	31.55	10.85	0.00	18.80	0.00	0.00	5.40	39.80	56.00	0.00	
		Min	0.05	0.15	0.05	0.05	0.05	10.85	0.00	4.80	0.00	0.00	5.40	0.55			

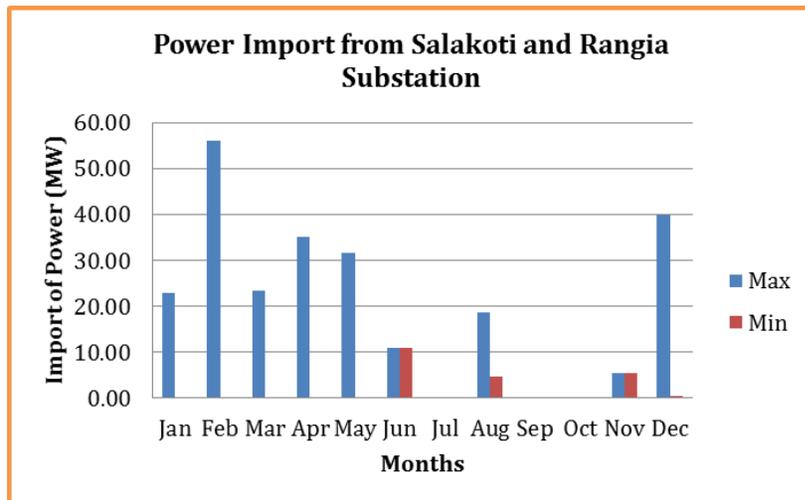
Graph: 4.2.1 Power import from Binaguri substation summary



Graph: 4.2.2 Power import from Birpara substation summary



Graph: 4.2.3 Power import from Salakoti and Rangia substation summary



5.0 FREQUENCY PROFILE: MAXIMUM AND MINIMUM FREQUENCY RECORDED AND THE FREQUENCY DURATION IN DIFFERENT FREQUENCY BANDS

As per the Grid Code Regulation 2008, Clause 6.4.1 the transmission system frequency was classified into three different bands as follows:

1. *Normal state*
The transmission system frequency is within the limit of 49.5Hz to 50.5Hz
2. *Alert state*
The transmission system frequency is beyond the normal operating limit but within 49.0Hz to 51.0Hz
3. *Emergency state*
There is generation deficiency and frequency is below 49.0Hz.

We base our frequency at 220kV Bus frequency at 220/66/11kV Semtokha substation in the western grid and 132kV Bus frequency at 60MW Kurichhu Hydropower Plant in the eastern grid.

Table: 5.0.1 Frequency profile at Semtokha substation
220/66/11kV Semtokha
Substation

Sl. No	Months	220kV Bus Frequency Operation State (%)			
		Normal	Alert	Emergency	Blackout/Other
1	Jan	100.00	0.00	0.00	0.00
2	Feb	100.00	0.00	0.00	0.00
3	Mar	100.00	0.00	0.00	0.00
4	Apr	96.51	0.13	0.00	3.36
5	May	100.00	0.00	0.00	0.00
6	Jun	100.00	0.00	0.00	0.00
7	Jul	100.00	0.00	0.00	0.00
8	Aug	77.28	0.00	0.00	22.72
9	Sep	99.73	0.27	0.00	0.00
10	Oct	100.00	0.00	0.00	0.00
11	Nov	100.00	0.00	0.00	0.00
12	Dec	100.00	0.00	0.00	0.00
Operation State for the year		97.79%	0.03%	0.00%	2.17%

Graph: 5.0.1 Frequency profile at Semtokha substation

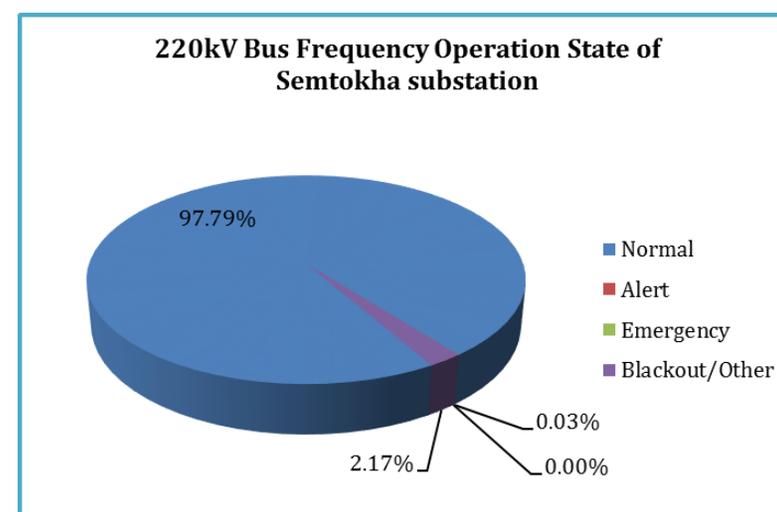
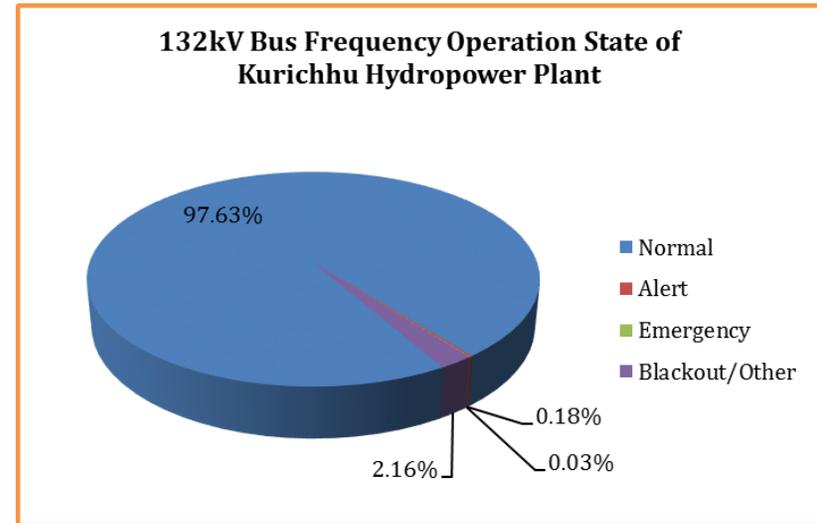


Table: 5.0.2 Frequency profile at Kurichhu Hydropower plant

Sl. No	Months	132kV Bus Frequency Operation State (%)			
		Normal	Alert	Emergency	Blackout/Other
1	Jan	99.73	0.27	0.00	0.00
2	Feb	89.92	0.40	0.00	9.68
3	Mar	95.43	0.00	0.00	4.57
4	Apr	96.37	0.00	0.00	3.63
5	May	100.00	0.00	0.00	0.00
6	Jun	96.37	0.27	0.00	3.36
7	Jul	99.46	0.54	0.00	0.00
8	Aug	98.92	0.27	0.13	0.67
9	Sep	99.06	0.00	0.27	0.67
10	Oct	99.73	0.13	0.00	0.13
11	Nov	96.64	0.13	0.00	3.23
12	Dec	99.87	0.13	0.00	0.00
Operation State for the year		97.63%	0.18%	0.03%	2.16%

Graph: 5.0.2 Frequency profile at Kurichhu Hydropower Plant



6.0 VOLTAGE PROFILE OF SELECTED SUBSTATIONS

As the Grid Code Regulation 2008, Clause 6.4.1, the voltage at all connection points was classified into three different bands as follows:

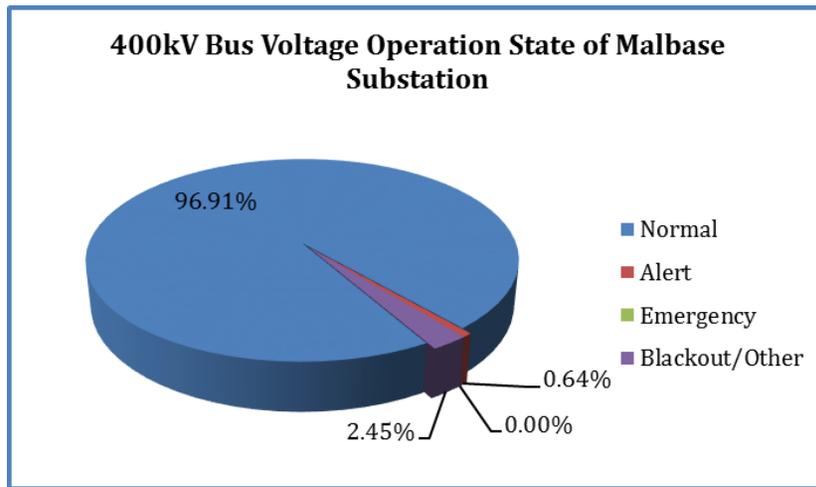
1. *Normal state*
The voltages at all connection point are within the limits of 0.95 times and 1.05 times of the normal values
2. *Alert state*
The voltage at all connection points are outside the normal limit but within the limits of 0.9 times and 1.1 times of the normal values
3. *Emergency state*
Transmission system voltages are outside the limits of 0.9 times and 1.1 times of nominal values.

The voltage profile of 400/220/66/11kV Malbase substation in western grid and 132/33/11kV Nangkhor substation in the eastern grid are considered in the report.

Table: 6.0.1 Voltage profile at Malbase substation

Sl. No	Months	400kV Bus Voltage Operation State (%)				220kV Bus Voltage Operation State (%)			
		Normal	Alert	Emergency	Blackout/Other	Normal	Alert	Emergency	Blackout/Other
1	Jan	100.00	0.00	0.00	0.00	89.38	10.62	0.00	0.00
2	Feb	99.55	0.45	0.00	0.00	76.34	23.66	0.00	0.00
3	Mar	97.98	2.02	0.00	0.00	83.74	15.59	0.27	0.40
4	Apr	96.10	0.27	0.00	3.63	92.07	4.44	0.00	3.49
5	May	100.00	0.00	0.00	0.00	99.87	0.13	0.00	0.00
6	Jun	96.77	0.00	0.00	3.23	96.77	0.00	0.00	3.23
7	Jul	100.00	0.00	0.00	0.00	99.87	0.13	0.00	0.00
8	Aug	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00
9	Sep	96.77	0.00	0.00	3.23	96.77	0.00	0.00	3.23
10	Oct	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00
11	Nov	95.30	1.48	0.00	3.23	92.61	4.17	0.00	3.23
12	Dec	94.76	5.24	0.00	0.00	87.50	12.50	0.00	0.00
Operation State for year		98.10%	0.79%	0.00%	1.11%	92.91%	5.94%	0.02%	1.13%

Graph: 6.0.1 Voltage profile at Malbase substation at 400kV bus



Graph: 6.0.2 Voltage profile at Malbase substation at 220kV bus

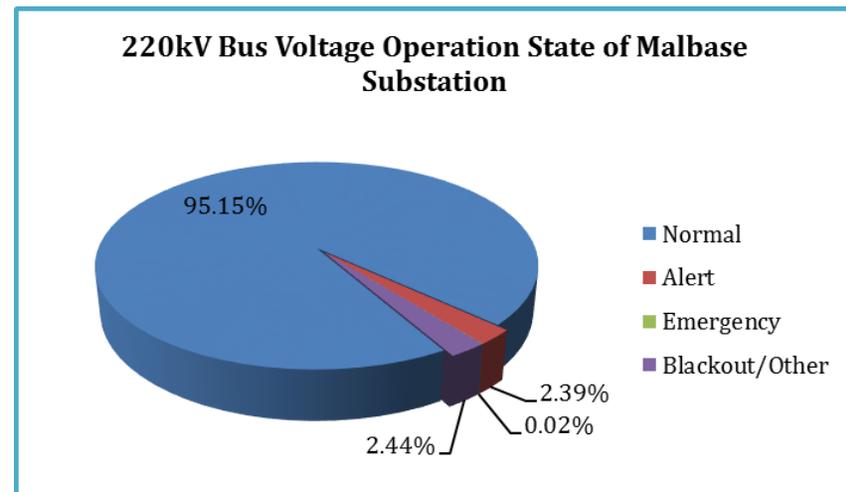
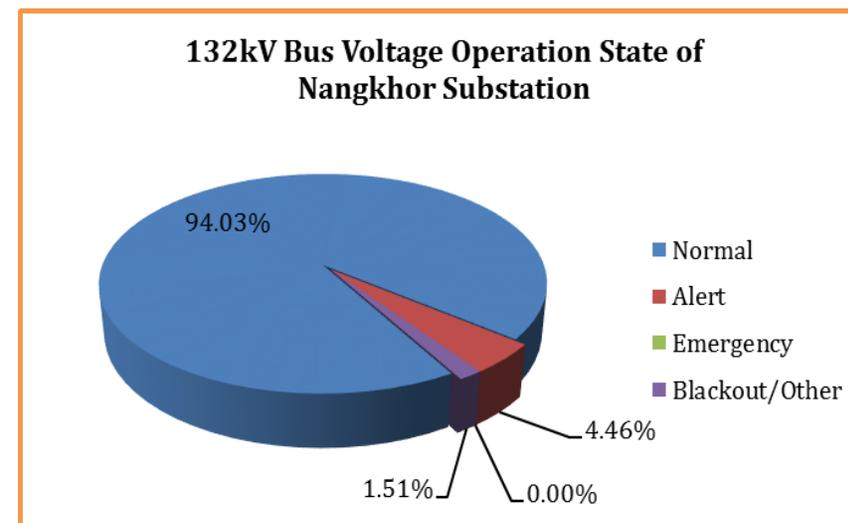


Table: 6.0.2 Voltage profile at Nangkhor substation

Sl. No	Months	132kV Bus Voltage Operation State (%)			
		Normal	Alert	Emergency	Blackout/Other
1	Jan	91.13	8.87	0.00	0.00
2	Feb	78.36	11.96	0.00	9.68
3	Mar	90.32	9.68	0.00	0.00
4	Apr	94.89	4.97	0.00	0.13
5	May	97.18	2.82	0.00	0.00
6	Jun	94.89	1.48	0.00	3.63
7	Jul	99.60	0.40	0.00	0.00
8	Aug	98.92	0.27	0.00	0.81
9	Sep	99.60	0.00	0.00	0.40
10	Oct	98.92	0.81	0.00	0.27
11	Nov	88.31	8.47	0.00	3.23
12	Dec	96.24	3.76	0.00	0.00
Operation State for year		94.03%	4.46%	0.00%	1.51%

Graph: 6.0.3 Voltage profile at Nangkhor substation



7.0 MAJOR GENERATING AND TRANSMISSION OUTAGE

The summary of the major generation and transmission outages for the eastern grid and western grid are attached as Annexure- I and Annexure- II respectively.

The outages of transmission line or transformer or any power system equipment below 66kV, tripping/outage of less than 30minutes and planned shutdown which do not cause supply interruption to the customers are not reflected.

8.0 TRANSMISSION CONSTRAINTS

There are no instant of transmission constraints due to the availability of alternate route of transmission line for the export of power.

9.0 INSTANCES OF PERSISTENT OR SIGNIFICANT NON-COMPLIANCE WITHIN THE GRID CODE REGULATION

The instance of non-compliance with the Grid Code Regulation 2008 for the year 2017 was recorded as nil.

Annexure- I

132/33/11kV, Nangkor substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	28-Jan-17	6:50	28-Jan-17	14:54	8:04	7.8	Nangkor-Nganglam	Nangkor-Nganglam line		Non directional E/F Relay-50N and tripping relay 86 operated.	Nangkor-Nganglam line	No supply was interrupted.
220/132/33/11kV, Jigmeling substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	28-Jan-17	5:17	28-Jan-17	6:00	0:43	-15.8	Tingtibi	Jigmeling Sustation & Tingtibi	86.1 & 86.2 trip. 21.1 prot. Trip. TBC SR A trip. Main 1 RYBtrip. GRP 1prot.trip. Main 1 zone 1 trip. PSB Optd. General Pick up	Z1, 16.06km	Over voltage	Supply fed from Tsirang
220/66kV, Tsirang substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	14-Feb-17	12:25	14-Feb-17	14:35	2:10	19.000	220kV Jigmeling-Tsirang Line	Tsirang Substation	Line tripped with 3phase fault R,Y,B alaram indicates on Distance Relay Main-I and Main-II operated at the Distance of 23km towards Jigmeling.	Distance Relay Main -I and Main -II Operated	Line Segment	
132/66/33/11kV, Gelephu substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	19-Apr-17	14:35	19-Apr-17	16:40	2:05	-12.40	132kv Gelephu-Salakati feeder		Taken emergency shutdown	Non		Emergency shutdown taken by Salakati substation to clear the bamboo.

132/66/33/11kV, Gelephu substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	9-May-17	10:56	9-May-17	11:40	0:44	-7.60	132kV Gelephu-Salakati	Gelephu	Heavy rainfall with thunder and lightening	67NX operated at Gelephu end & Relay operated at Salakati end Zone-III, Dist: 72.71km		At the same time 132kV Gelephu - Jigmeling tripped from Jigmeling end.
2	25-May-17	20:28	25-May-17	21:20	0:52	-10.00	132kV Gelephu-Salakati	Gelephu	Heavy rainfall with thunder and lightening			supply failed due to CB got opened at Salakati & jigmeling end.
132/33/11kV, Kilikhar substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
10	25-Jun-17	12:35	25-Jun-17	14:40	2:05	2.376	Kurichu I/C	All Feeder	Tripped	Null	KHP	Supply failed from Kurich (KHP) end
220/132/33/11kV, Jigmeling substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	18-Jun-17	11:07	18-Jun-17	11:40	0:33	1.70	220kV RT Line	220kV Rurrichhu Tsirang Line	Over Voltage	Both main -I and Main -II operated with GEN Tripped	Na	
132/33/11kV, Tintibi substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	8-Jun-17	8:50	8-Jun-17	10:00	1:10	-32.000	132 kV Tintibi-Jigmeling	132 kV Ting-Jigmeling feeder.	Taken shut down to rectify red hot spot on b phase jumpering wire terminal clam wave trap	86	132 kV Ting-Jigmeling line	
220/132/33/11kV, Jigmeling substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	20-Jul-17	14:05	20-Jul-17	15:22	0:45	32.66	Tsirang Feeder	Jigmeling & Tsirang	Over Voltage	R,Y,B phase Tripped. zone 1 tripped. 86.1 & 86.2 optd.		

132/66/33/11kV, Gelephu substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	4-Jul-17	12:35	4-Jul-17	13:20	0:45	43.8	132kV Gelephu-Salakati	non	heavy thunder & lightning	General trip, R,Y&B phase, Zone I,		
2	19-Jul-17	17:22	19-Jul-17	17:58	0:36	32.0	132kV Gelephu-Salakati	non	heavy thunder & lightning	General trip, R-phase, Zone I, dist 27.33km towards Salakati		
220/66kV, Tsirang substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	25-Aug-17	21:35	25-Aug-17	22:13	0:38	-65.6	220kV Tsirang-Jigmeling Line	Tsirang-Jigmeling Line	Earth fault at R and Y- Phase	Distance relay Main-I Operated with Earth fault at R, Bphase with R-1.94 and 2.04kA at the distance of 26.1km to wards Jigmeling (Z2)	Line segment	
132/66/33/11kV, Gelephu substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	1-Aug-17	18:58	2-Aug-17	19:20	24.38	42.0	132kV Gelephu-Salakati/Jigmeling	Gelephu substation	3 phase LA of 132kV Gelephu - salakati feeder blast and B-phase conductor snapped at tower location GT 08 due to heavy lightning & thundering.	General trip, R,Y&B phase, Zone 4, Fuse fail in REL670	Gelephu substation	

220/132/33/11kV, Jigmeling substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	8-Sep-17	1:13	8-Sep-17	1:58	0:45	64.8	Tsirang	Jigmeling	Earth fault at B-Phase	Main1-B phase tripped. Main2 B-phase tripped.	main 1&2 -7km	
2	9-Sep-17	3:58	9-Sep-17	4:37	0:39	-33.957	ICT-1 LV	Jigmeling	Alarm on SEF	LV SEF trip		
132/33/11kV, Nganglam substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	12/10/2017	17:47	12/10/2017	19:18	2:31	17.56	Nangkhor feeder	Eastern Grid	Grid failure	Nil	NA	
132kV, Motanga substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	1/11/2017	11:53	2/11/2017	2:26	2:33	43.6	Deothang Fdr.	Silicon area	General trip.	B-phase optd&SOFT optd	NA	Due to B phase PT blast at Silicon factory
2	1/11.2017	11:53	2/11/2017	6:14	6:21	27.7	Rangia fdr.	do	General trip.	B-phase optd&SOFT optd	NA	

Annexure- II

66/33/11kV Lobeysa substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	14-Feb-17	12:23	14-Feb-17	14:40	2:17		66kV Semtokha	Lobeysa ss	Generation fail	Null	Chhukha end	
2	14-Feb-17	12:23	14-Feb-17	15:05	2:42	4.88	66kV Basochhu	Lobeysa ss	Generation fail	Null	Chhukha end	
220/66/11kV Semtokha substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	12-Feb-17	14:51	12-Feb-17	16:30	1:39	-18.71	220kV Semtokha-		No interruption	time line got trip. Line	Main-1 & Main-2	Nizikha
2	14-Feb-17	12:22	14-Feb-17	15:08	2:46	-18.71	220kV Rurichu-Semtokha feeder	Semtokha, Dechencholing Olakha,Lobesa	Trip at Rurichu end.	No tripping at Semtokha substation	Rurichu power house	
66/33kV Olakha substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	12-Feb-17	14:51	12-Feb-17	16:41	1:50	0.3	66 kV Jemina Feeders	Olakha S/Station	Forest fire at Khasadrapchu area where the 220 kV line passes.		At Khasadrapchu Area near to 220kV Line	
400/220/66/11kV Malbase substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	4-Mar-17	15:59	4-Mar-17	16:25	0:26:00	-27	220kV Malbase-Bripara Feeder	220kV Malbase-Bripara Feeder	Main-I Trip	Main-I Trip, Distance Protection Main-I Trip, Fault location - 15.5km	Fault loop L1-L2=15.5km	
2	23-Mar-17	10:50	23-Mar-17	18:49	7:59	-65	220kV Malbase-Bripara Feeder	220kV Malbase-Bripara Feeder	Emergency Shutdon		Line	The conductor got snapped between the tower location No: HB 10-11 due to low clearance of the conductor (Y-Phase).

Chumdo Switching Station												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	11-Mar-17	11:06	11-Mar-17	11:17	0:11:00	1.46MW	66KV O/G Haa feeder trip	Haa s/s	due to heavy snow fall			
2	11-Mar-17	11:27	11-Mar-17	12:02	0:35:00	1.46MW		Haa s/s	due to heavy snow fall			
3	11-Mar-17	12:04	11-Mar-17	17:57	5:53:00	1.46MW		Haa s/s	due to heavy snow fall			
4	11-Mar-17	11:55	11-Mar-17	12:37	0:42:00	0.04MW	66KV O/G Paro feeder trip	Paro s/s	due to heavy snow fall			
5	11-Mar-17	13:13	11-Mar-17	17:35	4:22:00	0.04MW		Paro s/s	due to heavy snow fall			
6	11-Mar-17	11:55	11-Mar-17	12:32	0:37:00	0.3MW	66KV Jemina Fdr trip	Jemina s/s	due to heavy snow fall			
220/66/11kV Semtokha substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	11-Mar-17	9:32	12-Mar-17	8:46	22:14	0.190	66kV Lobesa feeder	Nil	Snow fall	Distance relay zone-1 operated	Transient fault	
66/33/11kV Jemina substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	11-Mar-17	11:52	11-Mar-17	12:49	0:57	0.72	Jemina-Chundu	Whole substation	Tripped due to heavy snow falls	Relay optd: 86 & 186	Jemina to Chundo line	Feeder tripped during the heavy snow falls
2	27-Mar-17	12:55	28-Mar-17	13:44	24:49:00	-6.24	Olakha to Jemina	Whole substation	Tripped on distance relay.	Relay optd: 86, 186 & Distance relay; H4,H7,H8,&H12.	AT Thimphu, IT park LA got puncture.	
66/33/11kV Lobeysa substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	11-Mar-17	8:44	12-Mar-17	8:50	24:06:00	0.57	66kV Semtokha feeder	Lobeysa ss	Line fault	Dist.Protection		

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400/220/66/11kV Malbase substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	3-Apr-17	9:27	3-Apr-17	10:14	0:47	46	66kV Pasakha Feeder-IV	66kV Pasakha Feeder-IV	Over Current	86 optd, General trip. Trip Value : I1=639.73A/2.39deg. I2=670.38A/-119.22deg. I3=645.06A/119.41deg.	Line	
2	5-Apr-17	14:08	5-Apr-17	14:59	0:51	47	66kV Pasakha Feeder-IV	66kV Pasakha Feeder-IV	Earth Fault	51 trip,86optd,General trip. Trip Values: I1=658.28A/0.0deg. I2=665.96A/-120.33deg. I3=664.02A/119.44deg.	Line	Tripped on Over current & Earth fault
3	5-Apr-17	14:08	5-Apr-17	14:58	0:50	41	66kV Pasakha Feeder-I	66kV Pasakha Feeder-I	Over Current	IEF 50N trip, 86 optd, General trip. Trip Values: I1=974.26A/-22.82deg. I2=379.86A/160.81deg. I3=4535.18A/16.05deg. IE=4979.15A/-168.44deg.	Line	
4	5-Apr-17	14:09	5-Apr-17	20:24	6:15	-	66kV Bus Coupler	66kV Bus Coupler	Over Current	51 trip,86optd,General trip. Trip Values: I1=1544.78A/0.0deg. I2=1544.61A/-120.40deg. I3=1546.29A/119.6deg.	Line	Delayed in charging since closing coil and TNC Switch were burnt and was charged after rectification and replacement. No supply was interrupted.
5	8-Apr-17	9:32	8-Apr-17	13:16	3:44		Malbase - Singhigoan	Malbase - Singhigoan	Shutdown	-	Line	There was flashing in 50MVA transformer panel at Singhigoan substation and the neutral cable of LV bushing of transformer was snapped at Singhigoan end. Cable jointing and testings was carried out.

6	8-Apr-17	13:50	8-Apr-17	17:40	3:50		66kV Pasakha Feeder-IV	66kV Pasakha Feeder-IV	Shutdown	-	Line	Emergency shutdown availed by TMD Phuentsholing for line patrolling of multi circuit tower to detect any line fault for frequent tripping of 66kV Feeders.
7	8-Apr-17	13:52	8-Apr-17	17:40	3:48		66kV Pasakha Feeder-I	66kV Pasakha Feeder-I	Shutdown	-	Line	
8	8-Apr-17	13:52	8-Apr-17	17:41	3:49		66kV Pasakha Feeder-II	66kV Pasakha Feeder-II	Shutdown	-	Line	
9		9:01	16.04.2017	19:26	10:25	42	66kV Pasakha Feeder-IV	66kV Pasakha Feeder-IV	-	51Trip,General Trip, 86 optd. Trip Value: I1=633.72A/0.00deg. I2=657.08A/-120.46deg. I3=646.59A/118.18deg.	Line	
10		9:10	16.04.2017	9:15	0:05	42	66kV Pasakha Feeder-II	66kV Pasakha Feeder-II	-	No Data being dispalyed	Line	
11	17.04.2017	7:43	17.04.2017	12:19	4:36	45	66kV Pasakha Feeder-IV	66kV Pasakha Feeder-IV	Over current	51Trip,General Trip, 86 optd. Trip Value: I1=617.05A/0.00deg. I2=662.24A/-120.56deg. I3=640.98A/116.44deg.		Tripped due to Overcurrent & Earth Fault
12	17.04.2017	7:43	17.04.2017	12:17	4:34	-	66kV Bus Coupler	66kV Bus Coupler	Over Current	51Trip,General Trip, 86 optd. Trip Values: I1=1451.48A/0deg. I2=1534.20A/-120.59deg. I3=1493.57A/116.28deg. IE=18.02A/7.69deg.		

66/33/11kV Phuentsholing substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	21-Apr-17	21:31	22-Apr-17	7:34	10:03	-6.49	66kV Chukha - Pling	Nil	Temporary	Dist pro. 86 & 186	Line	Heavy rainfall during the time of tripping.

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400/220/66/11kV Malbase substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	1-May-17	3:07	2-May-17	13:28	34:21:00	88	400kV Malbase-Siliguri Feeder III	400kV Malbase-Siliguri Feeder III	Over Current	General Trip, Tie CB open, Carrier Rev. MI, Zone- I Trip. Trip Value : I1=2815A/247.1deg. I2=176.6A/278.3deg. I3=2942A/68.42deg. I4= 75.37A/276.2deg.	Fault Loop= L3-L1, Distance-32km	After yard inspection, 400kV LA (R-Phase) was found damaged. Feeder was only brought back to service after the replacement of LA. Weather Condition: Heavy storm at the time of tripping.
2	5-May-17	17:29	7-May-17	12:12	42:43:00	-85	200kV Chhukha-Malbase feeder III	200kV Chhukha-Malbase feeder III	Earth Fault	Zone- I Trip, General Trip, Flt Loop- L2-N, Distance- 14.4km. Trip Value :I1=186.17A/175.5deg. I2=3853A/165.9deg. I3=234.9A/296.9deg. I4 = 3909A/168.8deg.	Line	At the time of inspection, the conductor(Y-phase) was found snapped at tower location No. 51.
3	5-May-17	17:29	5-May-17	18:52	1:23	-	220kV Bus Coupler	220kV Bus Coupler	-	No Data Displayed	-	The 220kV bus coupler was charged at 17:39hr. but it got tripped while charging the Chukha Malbase feeder at 18:46hr.
4	20-May-17	18:46	20-May-17	19:32	0:46	-78	220kV Chukha - Malbase Feeder III	220kV Chukha - Malbase Feeder III	Over Current & Earth Fault	Zone- I Trip, General Trip, Flt Loop- L2-L3, Distance- 3km Trip Values: I1=296A/137.2deg. I2=5695A/1719deg. I3=5122A/4197293.3 deg. I4- 5330A/108.1deg.	Line	Chukha unit I, III & IV got tripped along with the tripping of Chukha - Malbase Feeder III and the breaker at their end was hand tripped as it didn't get open at the time of tripping.
5	26-May-17	13:28	26-May-17	13:56	0:28	34	66kV Pasakha Feeder-IV	66kV Pasakha Feeder-IV	Over Current & Earth Fault	86 optd, General trip, IOC 50 trip, IEF 50N Trip. Trip Value: I1=71.87A/28.47deg. I2=427.71A/-179.35deg. I3=757.97A/124.73deg.	Line	

Chumdo Switching Station												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	4-May-17	14:02	4-May-17	14:40	0:38:00	(-)2.9MW	66KV jemina Fdr trip	Fed from chukha i/c	trip	Earth fault	transmission line	
2	6-May-17	16:07	6-May-17	16:41	0:34:00	(-)0.52MW		Paros/s, Haa s/s	Grid fail		Paro & Haa	
220/66/11kV Semtokha substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	1-May-17	3:03	1-May-17	4:09	1:06	14.530	220kV Semtokha-Chukha feeder		Busbar relay mal operated	Bus-bar zone-A operated	Busbar relay mal operated	
2	6-May-17	16:12	6-May-17	23:24	7:12	-39.690	220kV Semtokha-Chukha feeder	Semtokha	B-phase incommer CT blast	Main-I and II operated	Semtokha substation	
3	20-May-17	18:46	20-May-17	19:24	0:38	-23.420	220kV Semtokha-Chukha feeder		Buscoupler trip at Chukha end tripping feeder-IV.	Main-I and II Zone-3, operated	Chukha	
4	6-May-17	16:12	6-May-17	17:27	1:15	12.880	220kV Semtokha-Rurichu feeder	Semtokha	Trip along with 220kV Chukha incommer CT blast	Main-I perated	Semtokha substation	
5	1-May-17	3:30	1-May-17	4:11	0:41	0.000	220kV Buscoupler	No interruption	Busbar relay mal operated	Bus-bar zone-A operated	Busbar relay mal operated, Semtokha	
6	1-May-17	3:30	1-May-17	4:13	0:43	8.000	220/66kV, 50/63MVA-I	No interruption	Trip along with Busbar relay mal operated	Nil, busbar relay mal operated	Semtokha substation	
7	6-May-17	16:46	6-May-17	17:27	0:41	26.200	220/66kV, 50/63MVA-II	Semtokha	Hand trip due to 220kV Chukha incommer CT blast	No relay operation	Semtokha substation	
8	6-May-17	16:12	6-May-17	16:47	0:35	-0.620	66kV Lobesa-Semtokha feeder	Semtokha	Hand trip to charge from Basochu	No relay operation	Hand trip due to 220kV Chukha incommer CT blast, at semtokha	
66/33/11kV Paro substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	6-May-17	16:07	6-May-17	16:41	0:34	4.38	66kV Chumdo-Paro Line	Paro Substation and it's 33kV outgoing feeders	Tripped from Generation side	Tripped on fault	Chukha Power House	
66/11kV Haa substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	6-May-17	16:07	6-May-17	16:41	0:34	1.55	66kv I/Comer	Allfdrs	tripped			

220/66/11kV Singhigaon substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	30-Jun-17	11:40	30-Jun-17	12:53	1:13		66KV Bhutan Concast Frd(import)	66KV Bhutan Concast Frd(import)	trip	51B		Tripped on overcurrent. Weather Condition: Heavy rainfall
2	30-Jun-17	11:40	30-Jun-17	12:54	1:14		50MVA transformer(HV)	50MVA transformer(HV)	trip	51B		Tripped on overcurrent. Weather Condition: Heavy rainfall
220/66/11kV Singhigaon substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	8-Jul-17	23:20	8-Jul-17	23:54	0:34	25.9	66KV Bhutan Concast Frd(import)	66KV Bhutan Concast Frd(import)	Tripped	186,51N	Malbase S/s.	All 66KV from malbase got tripped at Malbase end.
2	8-Jul-17	23:23	8-Jul-17	0:20	0:57	32.4	66KV BFAL	66KV BFAL	Handtipped		Line	Hand tripped to avoid overloading on 50MVA as 66KV Bhutan concast got tripped.
3	8-Jul-17	23:26	8-Jul-17	0:23	0:57	10.8	66KV BSMPL	66KV BSMPL	Handtipped		Line	
5	13-Jul-17	11:47	13-Jul-17	13:53	2:06	32.5	66KV Bhutan Concast Frd(import)	66KV Bhutan Concast Frd(import)	Tripped	51,86	Malbase S/s.	
6	13-Jul-17	11:47	13-Jul-17	12:23	0:36	36.8	66KV BFAL	66KV BFAL	Handtipped		Line	Hand tripped to avoid overloading on 50MVA
7	13-Jul-17	11:47	13-Jul-17	12:26	0:39	12.8	66KV BSMPL	66KV BSMPL	Handtipped		Line	
8	13-Jul-17	11:47	13-Jul-17	12:27	0:40	16.8	66KV BSMPL	66KV BSMPL	Handtipped		Line	
66/33/11kV Phuentsholing substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	19-Jun-17	23:10	20-Jun-17	2:10	3:00	-12.11	66kV Chukha - Pling	Gedu	Temporary	Dist pro,86 & 186	Line	Feeder could not charged due to unbalance voltage.

400/220/66/11kV Malbase substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	13-Jul-17	11:46	13-Jul-17	13:42	1:56	39	66kV Pasakha Feeder - I	66kV Pasakha Feeder - I	Earthfault	86 optd, General trip, IEF50N Trip. Trip Values: I1=295.11A/21.67deg. I2=454.46A/-132.46deg. I3=2227.18A/71.44deg. IE=1998.78A/-109.61deg.	Line	
2	13.07.2017	11:46	13.07.2017	13:43	1:57	39	66kV Pasakha Feeder - II	66kV Pasakha Feeder - II	Earthfault	IEF 50N trip, 86 Opt & General trip. Trip Values: I1=415.57A/29.73deg. I2=404.29A/-135.23deg. I3=2227.16A/69.16deg.	Line	
3	13-Jul-17	11:46	13-Jul-17	13:44	1:58	44	66kV Pasakha Feeder - IV	66kV Pasakha Feeder - IV	&	IEF50N Trip, 86optd, General Trip, 51N - Trip, IOC - 50 - Trip. Trip Values: I1=612.37A/-40.02deg. I2=619.70A/-113.52deg. I3=2237.80A/71.56deg.	Line	
4	19-Jul-17	11:30	21-Jul-17	12:12	48.42	0	220kV Malbase - Birpara Feeder	220kV Malbase - Birpara Feeder	Earthfault	General trip, Trip Y - Phase, Zone - 1 Trip, Fatal loop Distance - 3.4KM. Trip Values: I1=369.5A/160.8deg. I2=5957A/169.3deg. I3=604.5/162.2deg. IE=6924A/168.1deg.	Line	220kV Malbase - Birpara conductor (Y - Phase) was found snapped at a distance of 3.4KM from Malbase Substation.

66/33/11kV Phuentsholing substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	5-Jul-17	18:05	6-Jul-17	11:16	17:11	17.09	66kV Malbase - Pling	Pling, Gedu & gomtu	O/C & E/F	50Y,50N, 186 & 86	Line	Feeder tripped due to conductor snap between loc. No. PS 001- PS 002. Heavy rainfall during the time of tripping.
2	8-Jul-17	23:25	9-Jul-17	14:36	15:11	17.55	66kV Malbase - Pling	Nil	E/F & O/C	51B,51N,86 &186	Substation	Feeder tripped as "Y" phase disc insulator from gantry punctured.
66/33/11kV Phuentsholing substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	31-Aug-17	1:10	31-Aug-17	2:03	0:53	5.61	66kV Pling - Gomtu	Nil	Temporary	186 & 86	Line	Tripped due to bad weather condition (Heavy rainfall, lightning and thundering)
220/66/11kV Semtokha substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	24-Sep-17	1:07	24-Sep-17	1:38	0:31	31.00	63.24	220kv Chukha - Semtokha	Chukha all the unit trip	Main 1/2 trip.Distance trip.	Chukha end	
220/66/11kV Singhigaon substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	12-Sep-17	0:00	15-Sep-17	19:01	67:01:00	35	50MVA transformer(HV and LV)	All 66KV and 11KV consumer	Tripped	50Y,51N and 86	Substation	Couldn't charged the transformer as there was problem on 87 T relay.
2	12-Sep-17	0:00	12-Sep-17	19:47	19:47	34.4	66KV Bhutan Concast Frd(import)	All 66KV and 11KV consumer	Tripped	50Y,51N and 86	Substation	66KV Bhutan concast frd got tripped from Malbase end. Weather:Raining, lightning and thundering

Watsa Substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	14/10/2017	12:35	14/10/2017	14:05	1:30	.534MW	66kV SF6 breaker	Fdr. I, II and station	Earthfault and Over current	Earth fault and Over Current relay operated	Station Feeder(500KVA transformer found defective)	
400/220/66/11kV Malbase substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	16/12/2017	5:31	16/12/2017	8:09	2:38	84	200MVA ICT	200MVA ICT	Tripped	86 B optd. Trip Values: HV, IL1 = 0.102A/44.31deg. IL2 =0.125A/-4.637deg. IL3 = 0.105A/175deg. LV, IL1 = 0.048A/81.18deg. IL2 =0.087A/-32.78deg. IL3 = 0.065A/-37.40deg.	Substation	All Domestic feeders were affected as 400kV Tala-Malbase Feeder & 220kV Chukha-Malbase Feeder was under shutdown. 220 kV Bripara Feeder got trip at their end.

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400/220/66/11kV Malbase substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	11-Sep-17	23:55	12-Sep-17	0:56	1:01	-	66kV Bus Coupler	66kV Bus Coupler	Overcurrent	51N Start, 51 Start. Trip Values: IL1 =467.92A, -1.61deg. IL2 = 3551.40A, -172.58 deg IL3 =673.78A,87.31deg. IL4 = 3024.87A,176.21deg.	Substation	Heavy Rainfall with lightning and thunder.
2	11-Sep-17	23:59	12-Sep-17	0:55	0:56	38	66kV Pasakha feeder - I	66kV Pasakha feeder - I	Overcurrent	51 Start, IEF 50N Trip Trip Values: IL1 =809.67A,2.45deg. IL2 =1510.51A, -162.58deg. IL3 =371.74A, 61.26deg. IL4 = 459.24A, 11.96 deg.	Line	
3	11-Sep-17	23:58	12-Sep-17	0:51	0:53	38	66kV Pasakha feeder - IV	66kV Pasakha feeder - IV	Overcurrent	51 Start, 86 Optd, IOC 50 Trip, IEF 50N Trip Trip Values: IL1 = 257.5, -27.610deg. IL2 =2408.10A, -164.85deg. IL3 =401.26A, 120.7deg. IL4 = 257.50A, -27.61deg. IL5 = 2408.1, -164.85deg. IL6 = 401.26, 120.7deg.	Line	
4	11-Sep-17	0:00	12-Sep-17	0:50	0:50	43	66kV Pasakha feeder - II	66kV Pasakha feeder - II	Overcurrent	51 Start, 86Optd.- Trip Values: IL1 =1241.56A,2.88deg. IL2 = 2614.11A, -135.84 deg. IL3 =2628.88A,99.34deg. IL4 = 1241.56A, 2.88deg.	Line	

5	12-Sep-17	1:05	12-Sep-17	10:30	9:25	-	66kV Bus Coupler	66kV Bus Coupler	Overcurrent	51 Start. General Trip Trip Values: IL1 =3418.55A, -134.70deg. IL2 = 201.42A, -174.60 deg. IL3 =1248.53A,68.28deg. IL4 = 2498.49A,-149.08deg.	Substation	The feeders were test charged after the first tripping at 0:50Hrs, but again got tripped.
6	12-Sep-17	1:07	12-Sep-17	10:35	9:28	43	66kV Pasakha feeder - IV	66kV Pasakha feeder - IV	Overcurrent	51 Start, 86 Optd. Trip Values: IL1 = 2171.31, -93.82deg. IL2 =215.94A, -131.82 deg. IL3 = 1472.79A,60.45 deg. IL4 = 2171.31A, -93.82deg.	Line	
7	12-Sep-17	1:09	12-Sep-17	10:36	9:27	38	66kV Pasakha feeder - II	66kV Pasakha feeder - II	Overcurrent	86 Optd, IEF 50N Trip Trip Values: IL1 = 2197.32A, -97.68deg. IL2 =129.92A,49.12 deg. IL3 = 1995.62A,57.03 deg. IL4 =2197.32A, -92.68deg.	Line	
8	24-Sep-17	1:07	24-Sep-17	4:56	3:49	-176	220kV Chhukha - Malbase Feeder.	220kV Chhukha - Malbase Feeder.	Tripped	86 A optd.,BBP optd. Trip Values: IL1 = 799.8A, 195.2deg. IL2 =2917A,- 123.52 deg. IL3 = 2154A,206.1 deg. IL4 = 32.03A, -152.6deg.	Line	

9	24-Sep-17	1:07	24-Sep-17	4:59	3:52	-	220kV Bus Coupler	220kV Bus Coupler	Tripped	No data displayed.	Substation	
10	24-Sep-17	1:07	24-Sep-17	4:58	3:51	55	220kV Malbase - Birpara Feeder.	220kV Malbase - Birpara Feeder.	Tripped	BB trip,86 optd. Trip Values: IL1=4316 A- 16.80 deg. IL2 = 3344 A --5.269 deg. IL3 = 3815 A--186.7 deg. IL4 = 49.08A - 207.4 deg.	Line	Tripped along with the tripping of 220kV Chhukha - Malbase Feeder. Heavy Rainfall with thunder and lightning at the time of tripping.
11	24-Sep-17	1:07	24-Sep-17	2:15	1:08	41	66kV Pasakha Feeder - I.	66kV Pasakha Feeder - I.	Tripped	86 optd., General trip, IOC-50-N trip. Trip Values: IL1=181.11 A-38.71 deg. IL2 = 170.7A -- 117.35 deg. IL3 = 129.40 A-- 141.97 deg.	Line	Tripped along with 220kV Chhukha - Malbase Feeder. The charging of these feeders were delayed due to heavy rainfall with lightning and thunder.
12	24-Sep-17	1:07	24-Sep-17	2:17	1:10	66kV Pasakha Feeder - II.	66kV Pasakha Feeder - II.	Tripped	86 optd., General trip, IOC-50-N trip. Trip Values: IL1=174.28 A-15.23 deg. IL2 = 159.99 A -- 128.23 deg. IL3 = 180.85 A-- 120.97 deg.	Line		
13	24-Sep-17	1:07	24-Sep-17	2:20	1:13	66kV Pasakha Feeder - IV.	66kV Pasakha Feeder - IV.	Tripped	86 optd., General trip, IOC-50-N trip. Trip Values: IL1=348.90 A-66.73 deg. IL2 = 438.37 A -- 113.42 deg. IL3 = 1368 A--84.59 deg.	Line		