Bhutan Power Corporation Limited

(An ISO 9001:2015, ISO 14001:2015 & OHSAS 18001:2007 Certified Company)

Registered Office, Thimphu

Bhutan Power System Operator

Thimphu: Bhutan

02/BPC/BPSO/PSOD/Vol-I/19/ 38

January 23, 2019

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

Sub: Submission of Transmission System Performance Annual Report for the year, 2018.

Sir,

Kindly find enclosed with the transmission system performance Annual Report as per the Grid Code Regulation, 2008 Clause No: 6.14.1, for the year 2018. Soft copy of the report is available in the BPSO website: http://bpso.bpc.bt.

Thanking you,

Yours faithfully,

(Sherub)
General 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.

Telephone: **+975-02-335631/337402/17129094/77764972**; Fax: **+975-02-335632**; Post Box: **580**;
Email: bhutansystemoperator@bpc.bt, bhutansystemoperator@gmail.com, Web: **bpso.bpc.bt**.

BHUTAN POWER CORPORATION LIMITED

BHUTAN POWER SYSTEM OPERATOR

THIMPHU: BHUTAN

ANNUAL TRANSMISSION SYSTEM PERFORMANCE REPORT FOR THE YEAR 2018

JANUARY-2019

Sl. No. **Table of Contents** **Page No.**

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 2018.

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

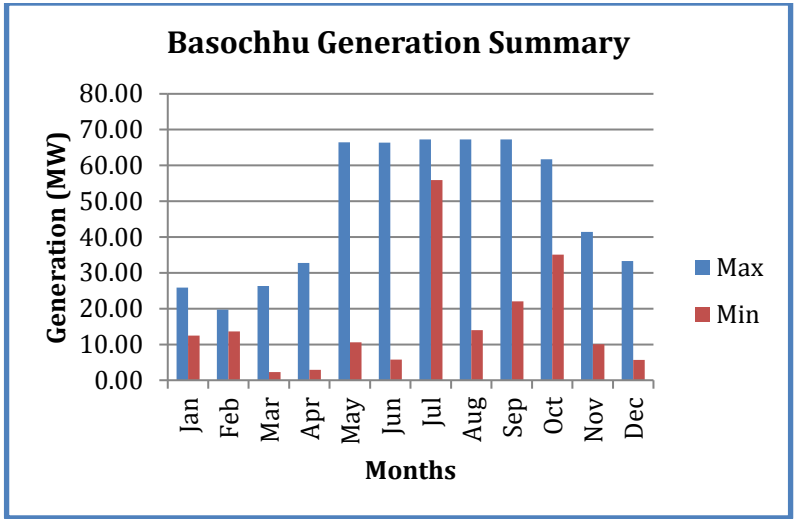
2.1 POWER GENERATION

The maximum individual plant generation was recorded as 1122.00 MW by the Tala Hydropower Plant, followed by 371.00 MW by Chhukha Hydropower Plant.

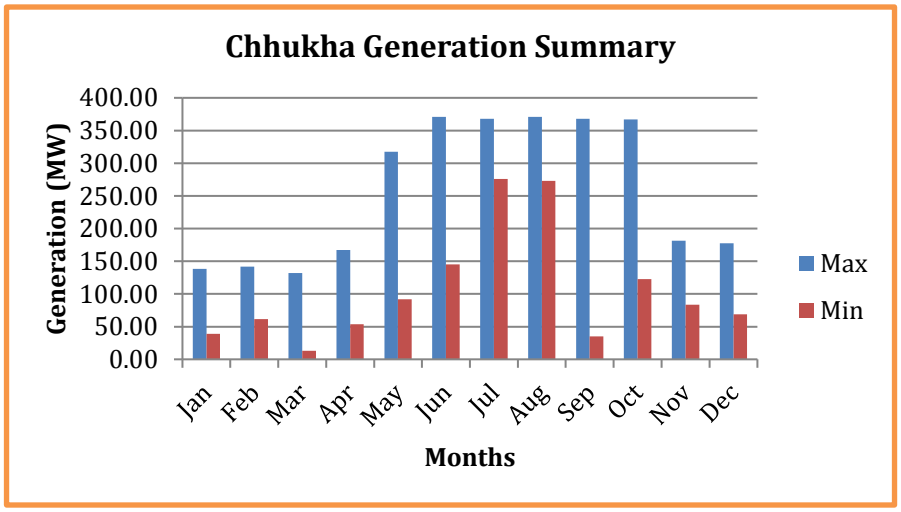
Table: 2.1.1 Monthly maximum and minimum generation summary

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	25.87	19.70	26.30	32.80	66.50	66.40	67.30	67.30	67.22	61.70	41.42	33.30	**67.30**	
		Min	12.48	13.62	2.30	2.90	10.60	5.80	55.90	14.00	22.00	35.12	10.03	5.72		**2.30**
2	CHP	Max	138.24	142.00	132.20	167.49	317.75	371.07	368.00	371.00	368.00	366.94	181.46	177.32	**371.07**	
		Min	38.83	61.40	13.00	53.91	92.00	145.00	276.00	273.00	35.00	122.77	83.46	68.95		**13.00**
3	THP	Max	270.00	270.00	300.00	350.00	736.00	1,122.00	1,122.00	1,122.00	1,122.00	731.00	390.00	360.00	**1,122.00**	
		Min	140.00	70.00	70.00	110.00	170.00	280.00	720.00	935.00	280.00	210.00	140.00	120.00		**70.00**
4	KHP	Max	31.90	32.95	49.50	64.18	66.00	66.00	66.09	66.00	66.00	66.00	49.50	32.36	**66.09**	
		Min	14.97	13.20	12.30	14.05	32.73	15.86	32.20	16.50	15.30	36.87	16.50	12.68		**12.30**
5	DHP	Max	32.06	22.70	26.23	35.04	42.06	126.50	95.10	100.70	100.79	100.70	52.27	40.03	**126.50**	
		Min	7.79	10.00	10.20	4.79	9.97	14.96	5.50	1.13	40.30	48.74	31.31	23.06		**1.13**

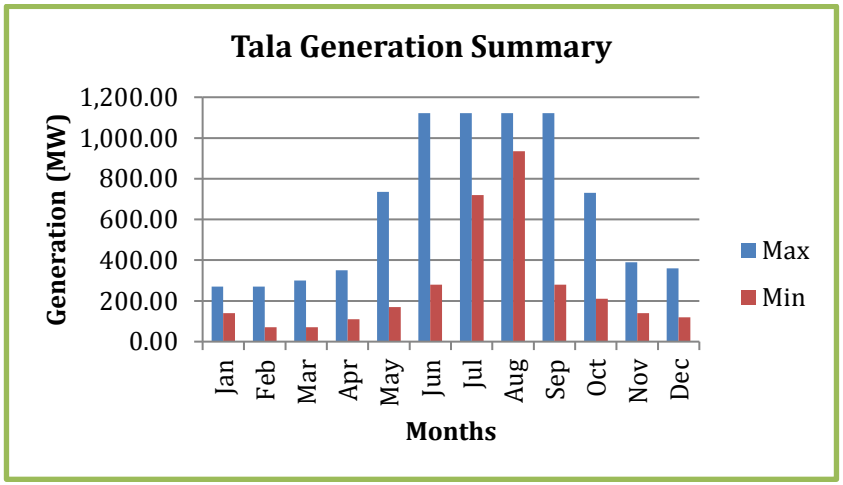
Graph: 2.1.1 Basochhu generation summary



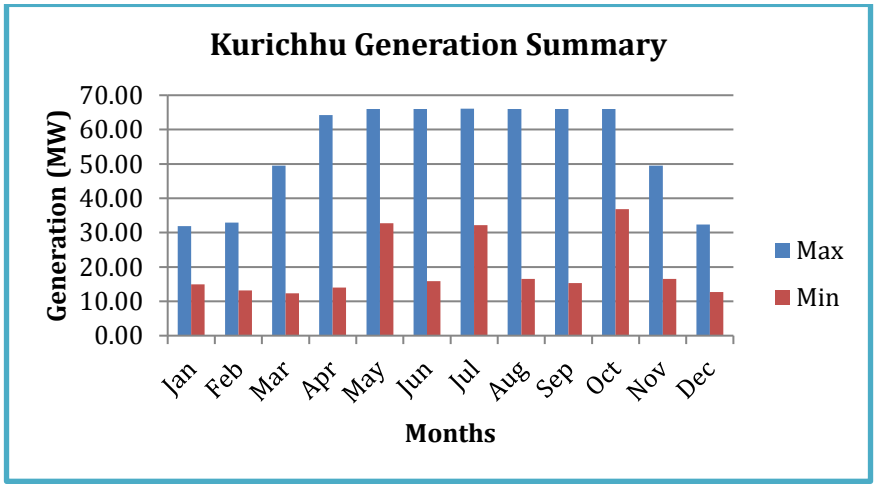
Graph: 2.1 Chhukha generation summary



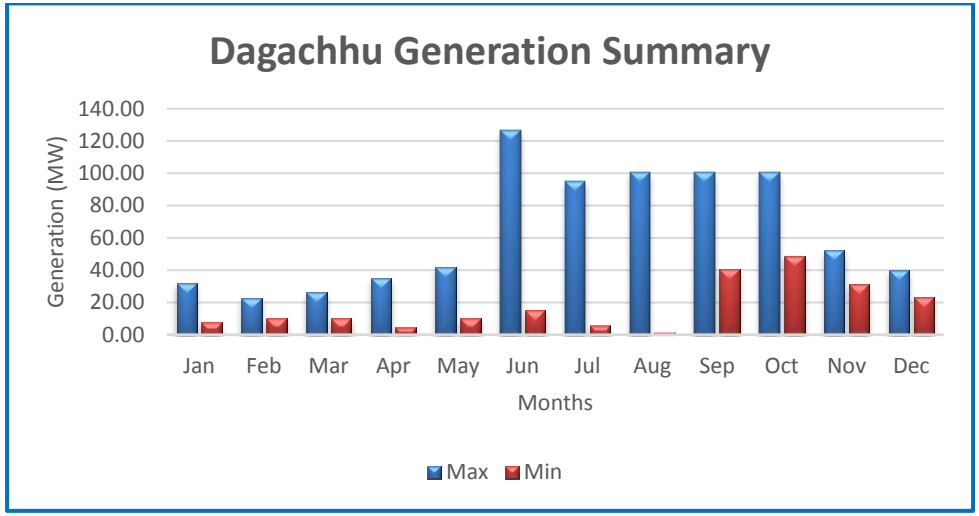
Graph: 2.1.3 Tala generation summary



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:

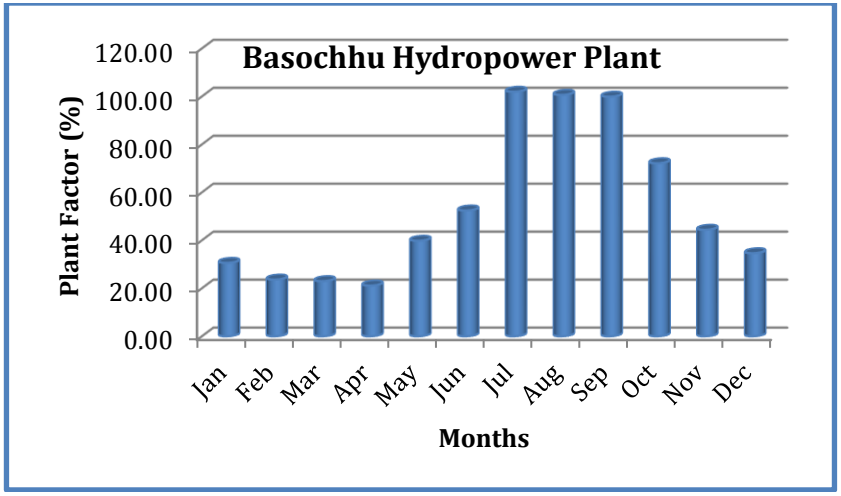
Plant factor = (Actual output of a plant over a period of time) / (Output when operated at name plate rated capacity for entire time)

= (Total energy plant has produced over a period) / (Total energy plant would produce when operated at full rated capacity)

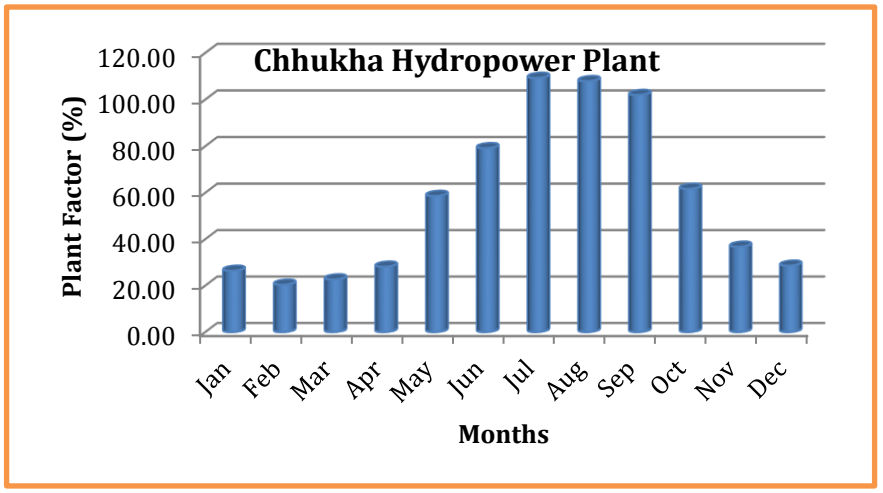
Table: 2.2.1 Monthly plant factor of the hydropower plants

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	30.59	23.61	22.97	21.10	39.80	52.42	101.93	100.62	99.88	72.13	44.38	34.61	**101.93**	**21.10**
2	CHP	26.39	20.38	22.65	28.14	58.63	79.11	109.28	107.87	101.95	61.69	36.75	28.58	**109.28**	**20.38**
3	THP	17.62	13.49	15.80	18.92	38.81	53.47	106.62	109.31	90.65	42.07	24.41	18.91	**109.31**	**13.49**
4	KHP	34.60	28.80	39.10	52.56	89.82	102.51	108.80	104.07	104.27	91.11	54.32	39.50	**108.80**	**28.80**
5	DHP	17.34	13.26	13.33	6.31	18.44	26.99	64.57	89.59	67.81	33.87	21.93	17.07	**89.59**	**6.31**

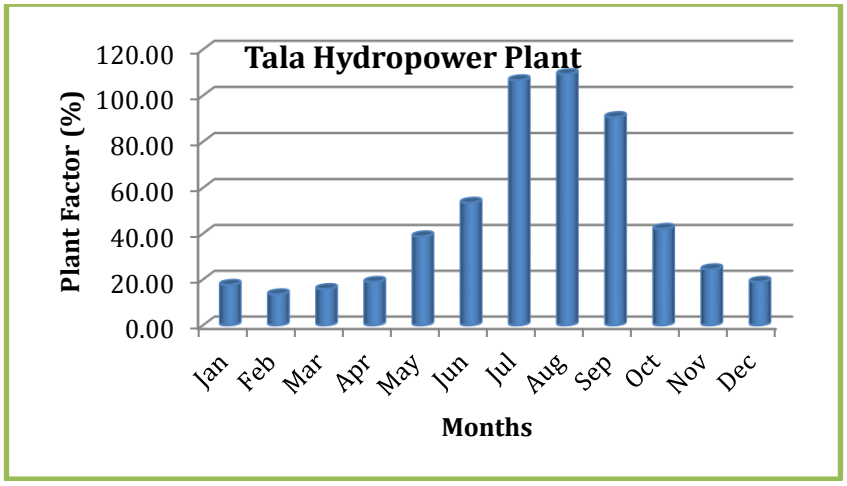
Graph: 2.2.1 Plant factor of Basochhu Hydropower Plant



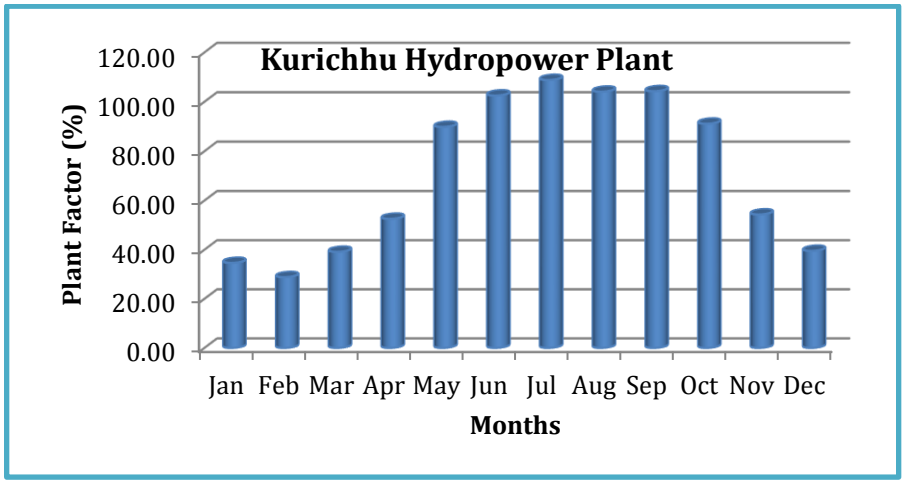
Graph: 2.2.2 Plant factor of Chhukha Hydropower Plant



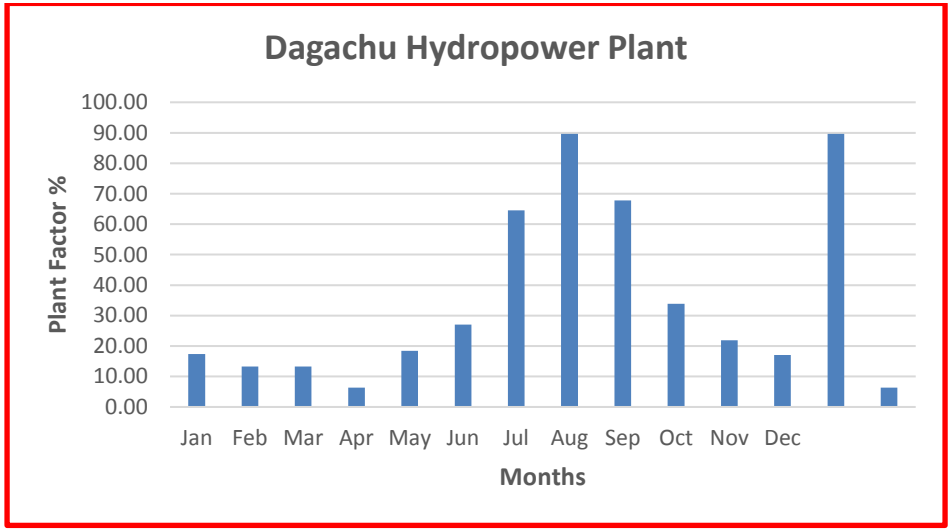
Graph: 2.2.3 Plant factor of Tala Hydropower Plant



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 coincidental peak load for the year was recorded 399.35 MW on November 27, 2018 at 18:18 Hrs. 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	8-Jan-18	19:00	357.33	337.89	321.43	306.93	35.90	30.96
2	Feb	24-Feb-18	19:00	373.15	257.80	305.58	231.36	67.57	26.44
3	Mar	12-Mar-18	19:00	369.88	323.90	318.76	297.57	51.12	26.33
4	Apr	8-Apr-18	20:00	371.01	365.88	313.95	332.88	57.06	33.00
5	May	25-May-18	19:00	372.46	931.31	315.01	865.31	57.45	66.00
6	Jun	19-Jun-18	19:00	372.72	1,060.30	311.74	994.30	60.99	66.00
7	Jul	11-Jul-18	20:00	336.80	1,685.86	274.26	1,619.96	62.54	65.90
8	Aug	14-Aug-18	18:00	340.03	1,680.28	290.14	1,620.18	49.89	60.10
9	Sep	15-Sep-18	18:00	330.66	1,615.42	281.38	1,615.42	49.28	0.00
10	Oct	18-Oct-18	18:00	372.91	772.37	303.81	729.81	69.10	42.56
11	Nov	16-Nov-18	18:00	373.94	492.70	305.34	459.70	68.60	33.00
12	Dec	27-Dec-18	18:18	399.35	374.63	329.04	348.01	70.32	26.62
National Peak Load of the year (MW)				399.35					

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

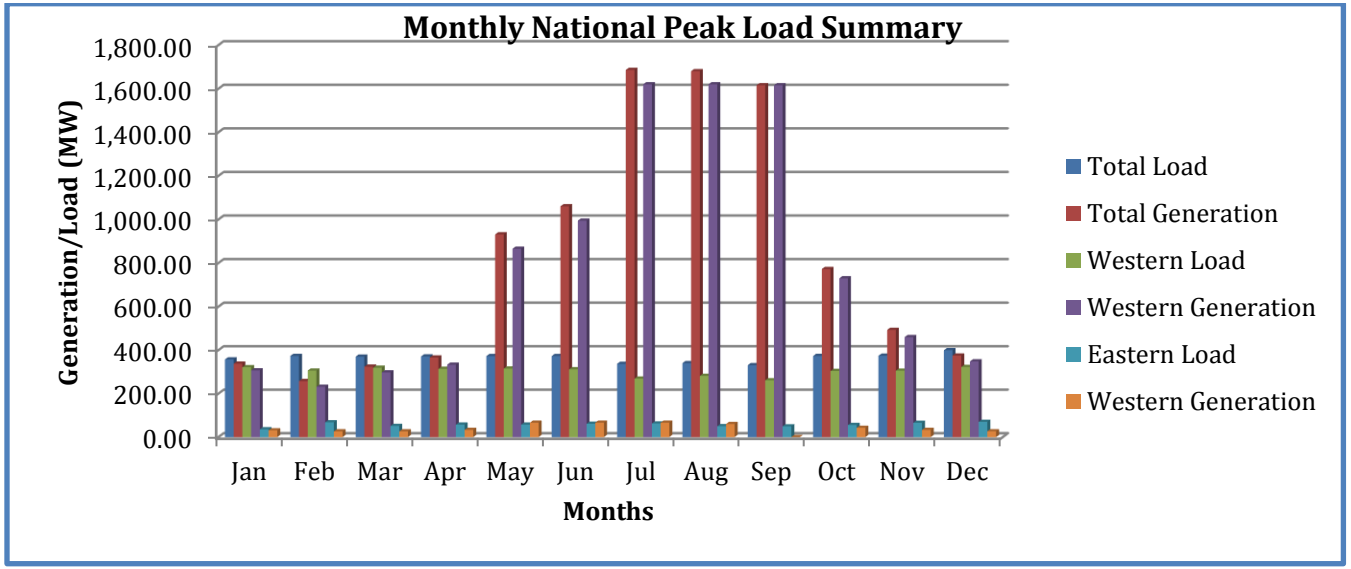
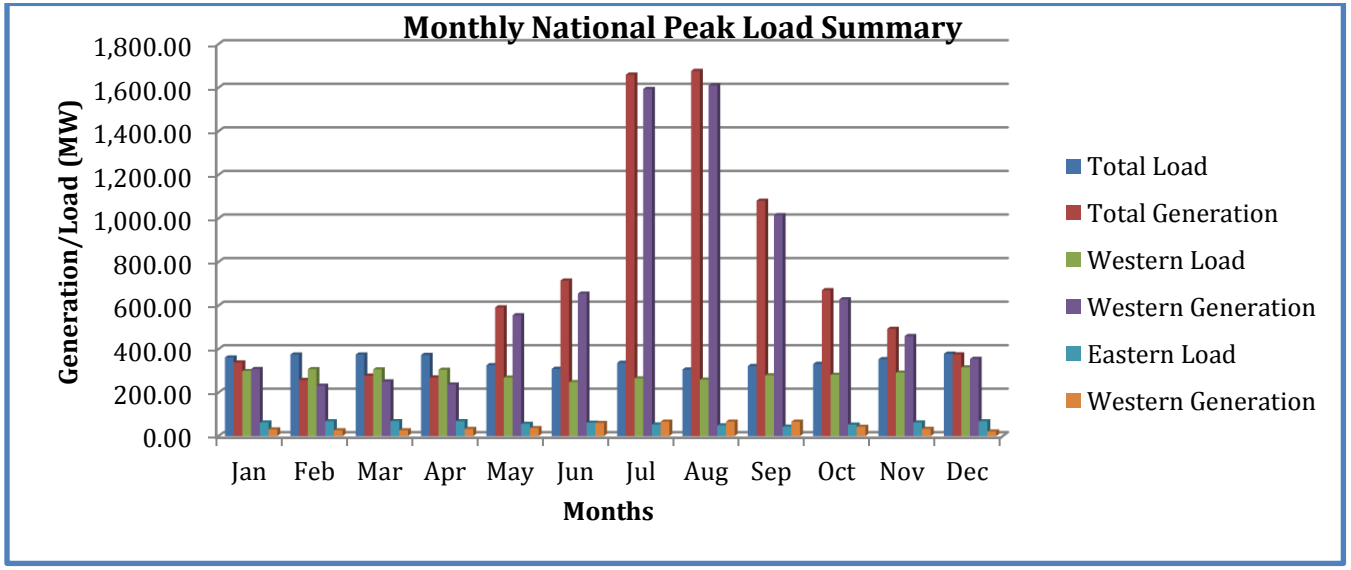


Table: 3.1.2 Monthly national peak load and corresponding generation using method- 3

Sl. No	Months	Date	Time	Total Grid (MW)		Western Grid (MW)		Eastern Grid (MW)	
				Load	Generation	Load	Generation	Load	Generation
1	Jan	16-Jan-18	19:00	361.19	338.29	298.75	307.99	62.43	30.30
2	Feb	24-Feb-18	19:00	374.91	257.80	307.34	231.36	67.56	26.44
3	Mar	21-Mar-18	19:00	374.72	277.48	306.49	250.97	68.23	26.51
4	Apr	1-Apr-18	19:00	372.88	269.19	304.53	236.89	68.35	32.30
5	May	5-May-18	20:00	325.53	591.90	268.75	555.40	55.95	36.50
6	Jun	8-Jun-18	20:00	308.92	714.75	247.93	654.67	60.98	60.08
7	Jul	29-Jun-18	19:00	336.38	1,659.65	265.10	1,593.65	52.88	66.00
8	Aug	16-Jun-18	20:00	305.70	1,676.66	259.44	1,610.66	48.74	66.00
9	Sep	29-Jun-18	8:00	321.81	1,080.90	279.13	1,014.90	42.68	66.00
10	Oct	26-Oct-18	19:00	331.45	670.61	281.60	628.36	52.43	42.25
11	Nov	15-Nov-18	18:00	353.36	492.70	291.20	459.70	62.16	33.00
12	Dec	27-Dec-18	19:00	387.03	375.52	319.28	354.72	67.75	20.80
National Peak Load of the year (MW)				387.03					

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



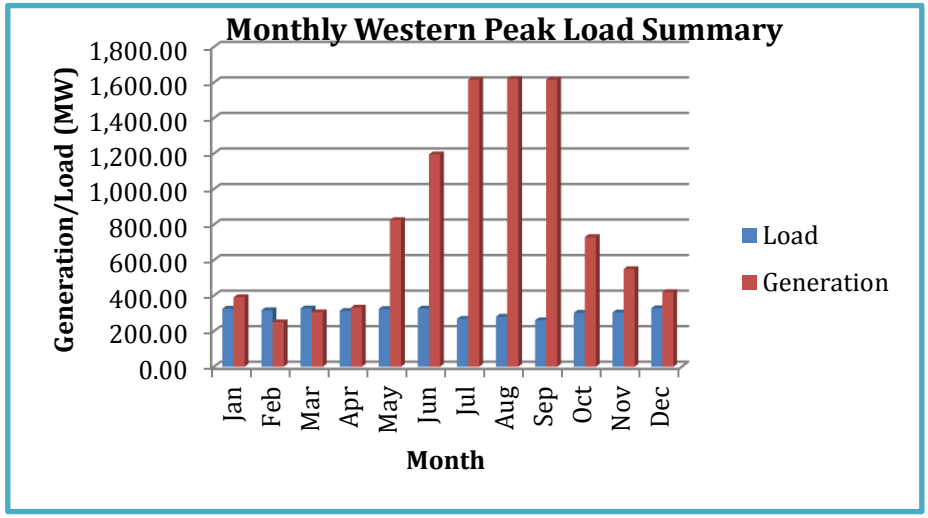
3.2 WESTERN GRID PEAK LOAD

Using method-2, the peak load for the western grid was 329.04 MW which occurred on December 27, 2018.

Table: 3.2.1 Monthly western peak load and corresponding generation

Sl. No	Months	Date	Time	Western Grid (MW)	
				Load	Generation
1	Jan	21-Jan-18	21:00	326.51	390.70
2	Feb	26-Feb-18	8:00	318.04	250.00
3	Mar	20-Mar-18	8:00	328.29	306.50
4	Apr	8-Apr-18	20:00	313.95	332.88
5	May	18-May-18	14:00	324.86	825.15
6	Jun	28-Jun-18	4:00	327.71	1,195.15
7	Jul	3-Jul-18	19:00	269.01	1,614.70
8	Aug	14-Aug-18	7:00	281.43	1,620.18
9	Sep	5-Sep-18	10:00	261.28	1,615.42
10	Oct	26-Oct-18	18:00	303.81	729.81
11	Nov	5-Nov-18	19:00	305.34	549.28
12	Dec	25-Dec-18	18:00	329.04	419.86
Western Peak Load of the year (MW)				329.04	

Graph: 3.2.1 Monthly western peak load and corresponding generation



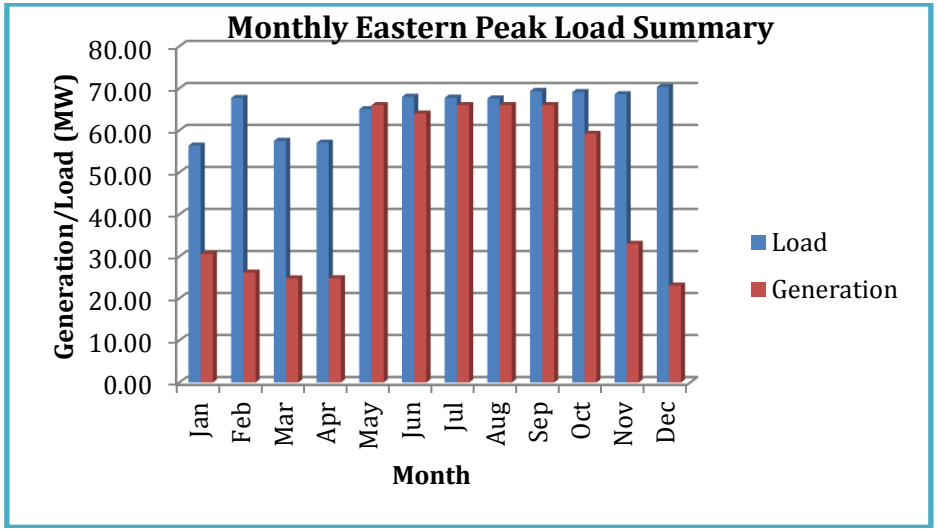
3.3 EASTERN GRID PEAK LOAD

Using method-2, the peak load for the eastern grid was 70.32 which occurred on December 27, 2018.

Table: 3.3.1 Monthly eastern peak load and corresponding generation

Sl. No	Months	Date	Time	Eastern Grid (MW)	
				Load	Generation
1	Jan	21-Jan-18	20:00	56.37	30.63
2	Feb	26-Feb-18	19:00	67.70	26.15
3	Mar	9-Mar-18	8:00	57.52	24.76
4	Apr	5-Apr-18	15:00	57.06	24.79
5	May	27-May-18	11:00	65.04	66.00
6	Jun	14-Jun-18	10:00	68.00	64.01
7	Jul	26-Jul-18	20:00	67.79	66.00
8	Aug	20-Aug-18	19:00	67.60	66.00
9	Sep	6-Sep-18	19:00	69.38	66.00
10	Oct	12-Oct-18	18:00	69.10	59.17
11	Nov	13-Nov-18	18:00	68.60	33.00
12	Dec	25-Dec-18	17:00	70.32	23.05
Eastern Peak Load of the year (MW)				70.32	

Graph: 3.3.1 Monthly eastern peak load and corresponding generation



4.0 EXPORT AND IMPORT OF ELECTRICITY TO/FROM NEIGHBORING COUNTRIES

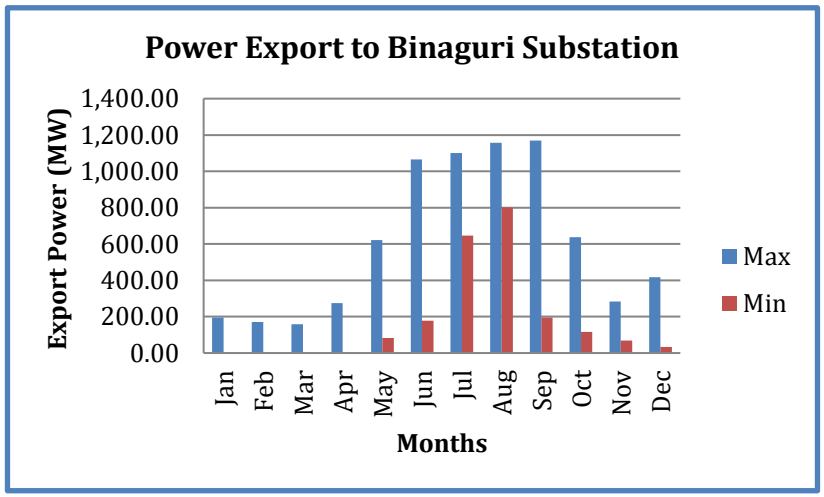
4.1 EXPORT OF ELECTRICITY TO NEIGHBORING COUNTRY

Maximum export of electricity for the year was 1,170.00MW to Binaguri substation in August, 2018, followed by 440.700MW to Birpara substation. The minimum export was 0.02 MW to Birpara substation.

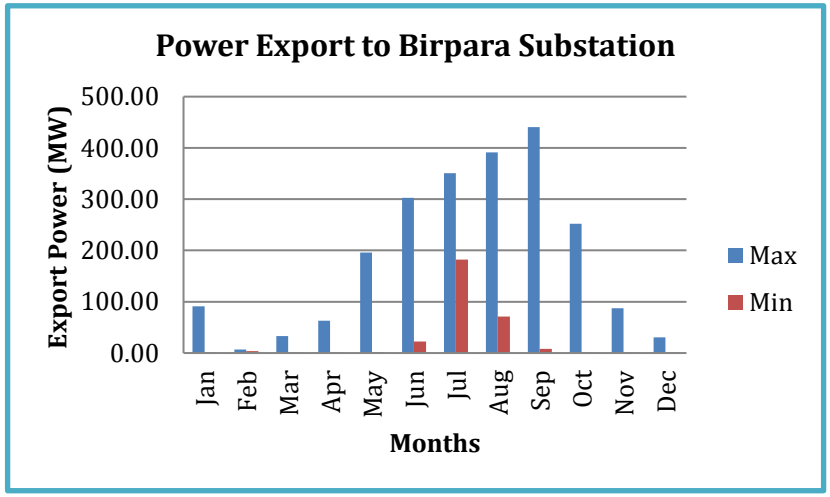
Table: 4.1.1 Monthly power export summary

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	195.00	171.00	159.00	274.00	622.00	1,065.00	1,100.00	1,157.00	1,170.00	637.00	283.00	417.00	**1,170.00**	
		Min	2.00	1.00	1.00	1.00	82.00	178.00	647.00	802.00	195.00	117.00	68.00	33.00		**1.00**
2	Birpara	Max	91.00	6.90	33.30	63.00	196.20	302.40	350.50	391.40	440.70	252.20	87.10	30.80	**440.70**	
		Min	1.34	3.60	1.30	0.40	2.00	22.40	182.30	71.00	8.00	0.20	0.30	1.20		**0.20**
3	Salakoti & Rangia	Max	26.40	37.00	46.40	39.50	73.80	155.00	127.10	136.60	129.80	92.80	43.30	15.30	**155.00**	
		Min	0.10	0.10	0.10	0.10	0.10	9.50	26.80	1.00	39.40	10.90	0.30	0.20		**0.10**

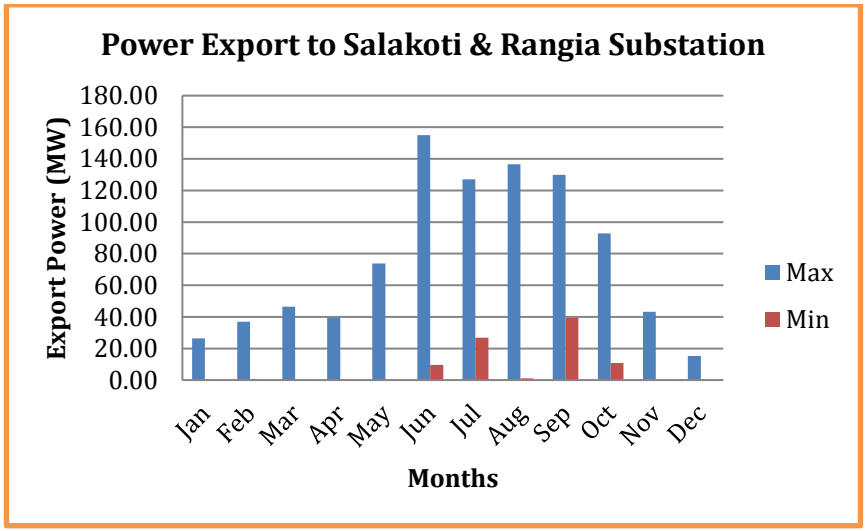
Graph: 4.1.1 Monthly power export to Binaguri substation



Graph: 4.1.2 Monthly power export to Birpara substation



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



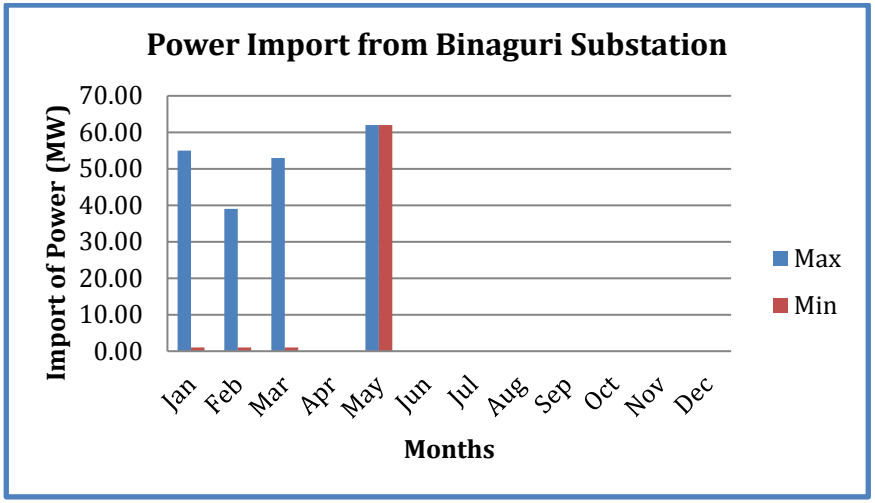
4.2 IMPORT OF ELECTRICITY FROM NEIGHBORING COUNTRY

Maximum import of power was 163 MW from Birpara substation which occurred in January, 2018 followed by 86.20 MW and 62.00 MW from Salakoti and Rangia and Binaguri respectively.

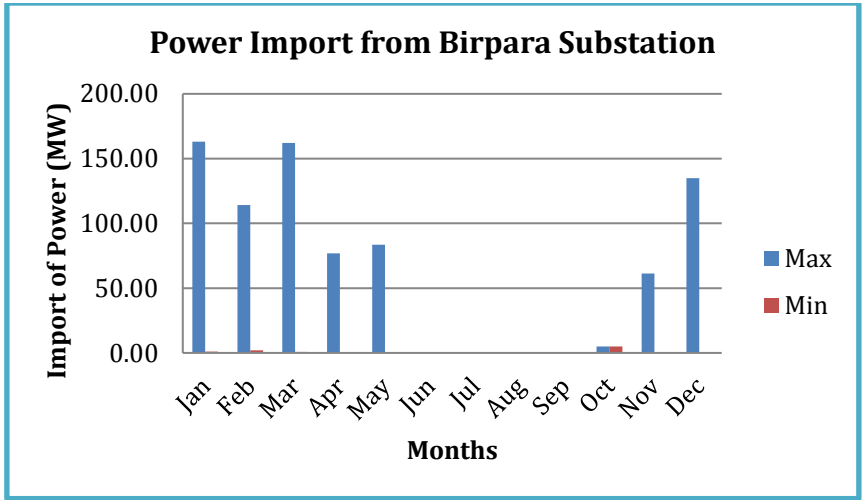
Table: 4.2.1 Monthly power import summary

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	55.00	39.00	53.00	0.00	62.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**62.00**	
		Min	1.00	1.00	1.00	0.00	62.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		**0.00**
2	Birpara	Max	163.00	114.20	162.00	76.90	83.60	0.00	0.00	0.00	0.00	5.00	61.20	135.00	**163.00**	
		Min	1.00	1.94	0.90	0.10	0.20	0.00	0.00	0.00	0.00	5.00	0.30	0.10		**0.00**
3	Salakoti & Rangia	Max	28.20	28.90	33.40	86.20	8.80	16.50	0.00	1.70	0.00	0.00	51.20	69.30	**86.20**	
		Min	0.10	0.10	0.10	0.10	0.70	16.50	0.00	1.10	0.00	0.00	0.20	0.10		**0.00**

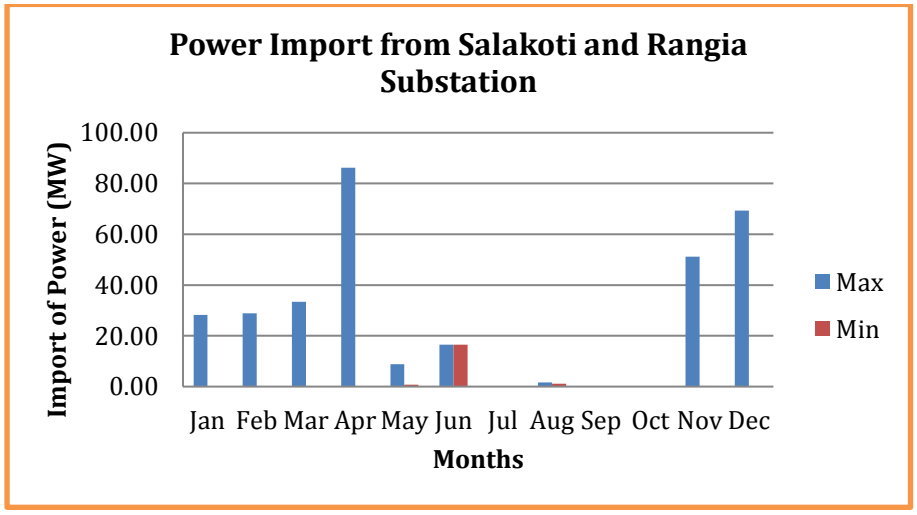
Graph: 4.2.1 Power import from Binaguri substation summary



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

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	99.19	0.13	0.00	0.67
4	Apr	96.51	0.13	0.00	3.36
5	May	100.00	0.00	0.00	0.00
6	Jun	99.19	0.13	0.00	0.67
7	Jul	99.33	0.00	0.00	0.67
8	Aug	99.23	0.00	0.00	0.67
9	Sep	99.33	0.00	0.00	0.67
10	Oct	99.33	0.00	0.00	0.67
11	Nov	99.33	0.00	0.00	0.67
12	Dec	0.00	0.00	0.00	0.67
Operation State for the year		90.95%	0.03%	0.00%	0.73%

Graph: 5.0.1 Frequency profile at Semtokha substation

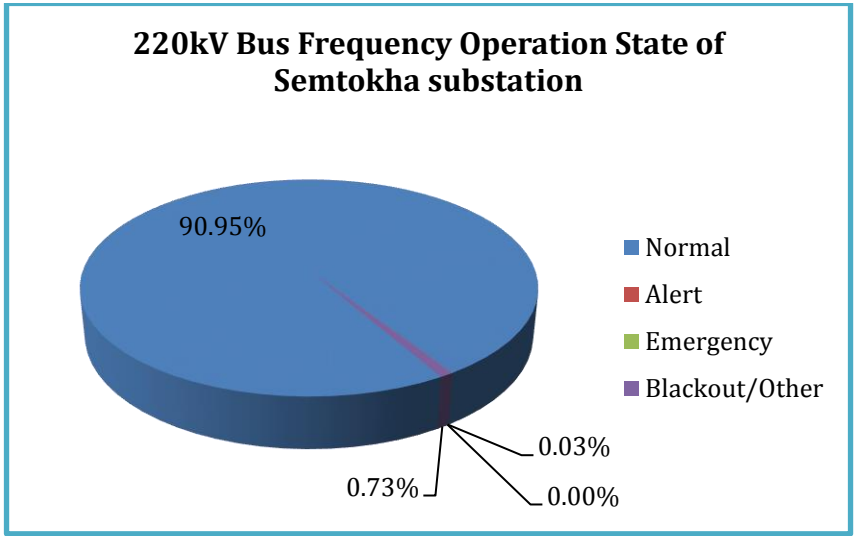
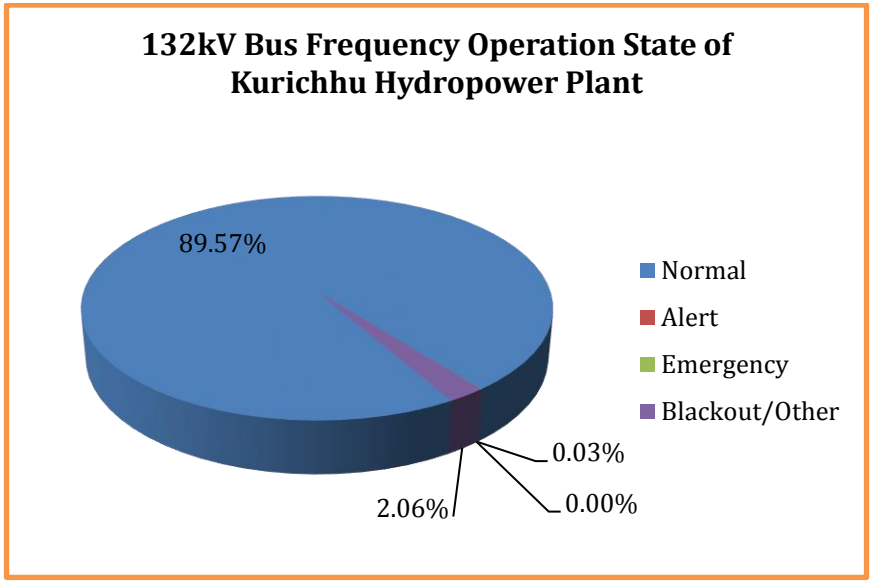


Table: 5.0.2 Frequency profile at Kurichhu Hydropower plant

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	90.19	0.00	0.00	9.81
3	Mar	98.52	0.13	0.00	1.34
4	Apr	96.37	0.00	0.00	3.63
5	May	100.00	0.00	0.00	0.00
6	Jun	96.77	0.00	0.00	3.23
7	Jul	100.00	0.00	0.00	0.00
8	Aug	100.00	0.00	0.00	0.00
9	Sep	96.77	0.00	0.00	3.23
10	Oct	99.87	0.00	0.00	0.13
11	Nov	96.64	0.00	0.00	3.36
12	Dec	0.00	0.00	0.00	0.00
Operation State for the year		89.57%	0.03%	0.00%	2.06%

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:

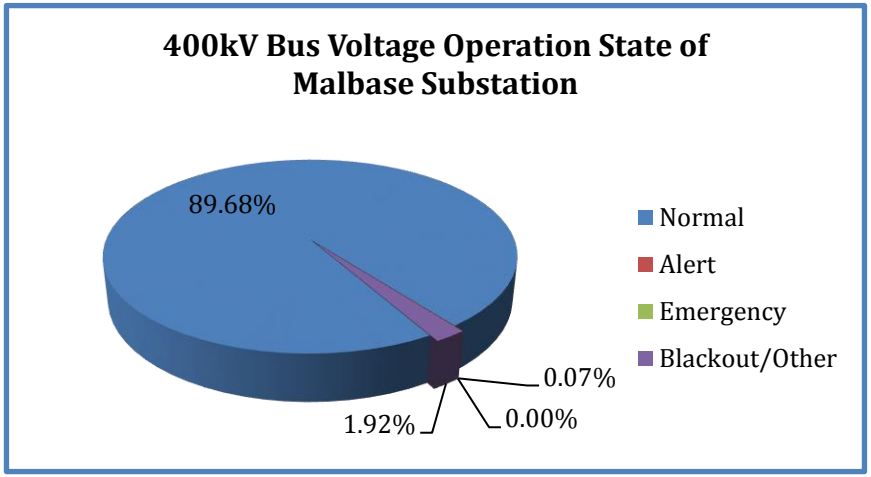
1. *Normal state*
   The voltages at all connection point are within the limits of 0.95 times and 1.05 times of the normal values
2. *Alert state*
   The voltage at all connection points are outside the normal limit but within the limits of 0.9 times and 1.1 times of the normal values
3. *Emergency state*
   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	99.73	0.27	0.00	0.00	100.00	0.00	0.00	0.00
2	Feb	90.32	0.00	0.00	9.68	90.32	0.00	0.00	9.68
3	Mar	99.73	0.27	0.00	0.00	99.87	0.13	0.00	0.00
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	100.00	0.00	0.00	0.00
8	Aug	0.00	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	96.77	0.00	0.00	3.23	96.77	0.00	0.00	3.23
12	Dec	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Operation State for year		**89.68%**	**0.07%**	**0.00%**	**1.92%**	**97.70%**	**0.39%**	**0.00%**	**1.90%**

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



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

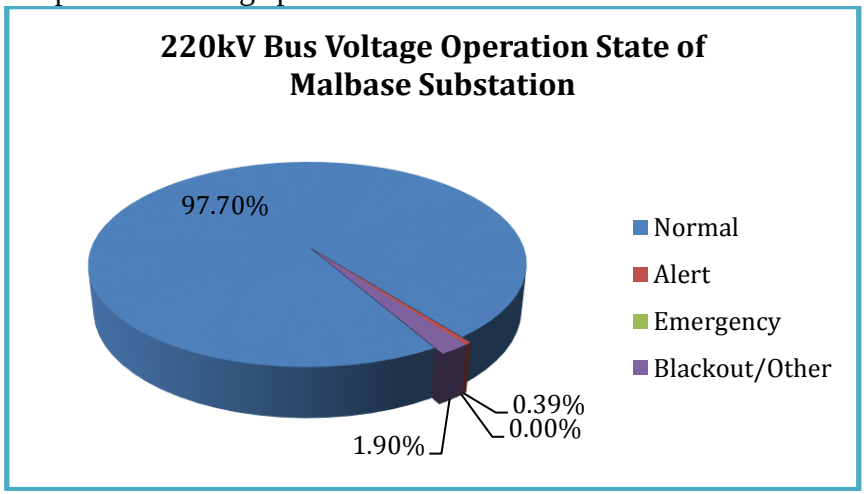
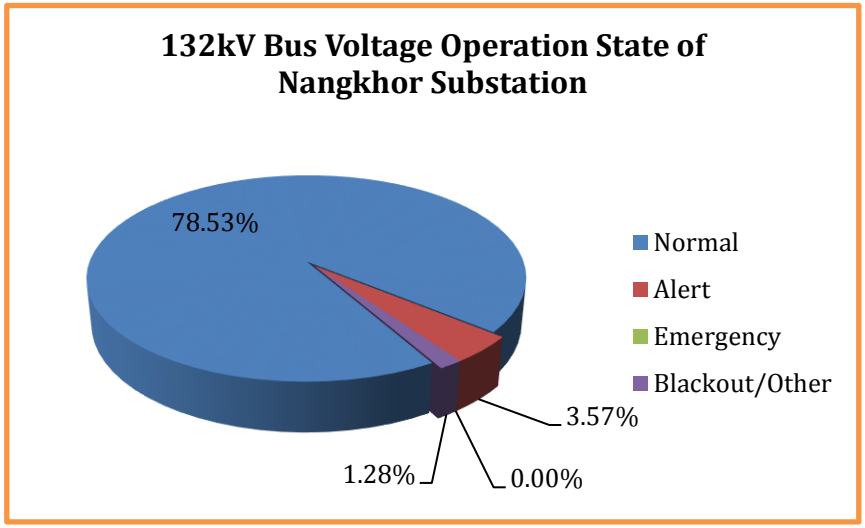


Table: 6.0.2 Voltage profile at Nangkhor substation

Sl. No	Months	132kV Bus Voltage Operation State (%)			
		Normal	Alert	Emergency	Blackout/Other
1	Jan	91.40	8.60	0.00	0.00
2	Feb	91.40	8.60	0.00	0.00
3	Mar	96.10	2.55	0.00	1.34
4	Apr	94.89	4.97	0.00	0.13
5	May	97.18	2.82	0.00	0.00
6	Jun	96.64	0.00	0.00	3.36
7	Jul	96.64	0.00	0.00	3.36
8	Aug	0.00	0.13	0.00	0.00
9	Sep	96.37	0.13	0.00	3.49
10	Oct	97.98	2.02	0.00	0.00
11	Nov	83.74	13.04	0.00	3.23
12	Dec	0.00	0.00	0.00	0.40
Operation State for year		**78.53%**	**3.57%**	**0.00%**	**1.28%**

Graph: 6.0.3 Voltage profile at Nangkhor substation



7.0 MAJOR GENERATING AND TRANSMISSION OUTAGE

The summary of the major 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 GIRD CODE REGULATION

The instance of non-compliance with the Grid Code Regulation 2008 for the year 2018 was not recorded.

Annexure- I

Eastern Grid Outages

132/33/11kV, Nangkhor 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	26-Jan-18	22:10	26-Jan-18	22.28	0:18	-1.69	Main Grid	All Feeders	-	Distance Relay operated showing at the distance of 16.6 km towards Nganglam, Z1, started phase B and N, Frequency 50.05Hz, IA-87.32A, IB-1.332kA, IC-55.0A, VAN-72.72kV, VBN-20.27kV, VCN-76.18kV, Fault resistance 4.261 ohms, E/F relay 50N & tripping relay 86 operated for Nganglam feeder at our end.	Rangia Substation	Nangkor-Deothang CB closed at 10:30 hrs, Kurichu-Nangkor CB closed at 10:33 hrs and Nangkor-Nganglam CB closed at 10:35 hrs
2	28-Jan-18	10:35	28-Jan-18	11:00	0:25	16.23	Nangkor-Deothang	Nangkor-Deothang Line	Due to low CB SF6 Gas on 'R' phase	Tripping relay 86 operated	Nangkor Substation	No supply was interrupted

132/33/11kV, Tingtibi 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
3	26-Jan-18	11:51	26-Jan-18	12:35	0:44	14.000	132kV Tingtibi-Jigmeling Feeder	Tingtibi substation	B phase suspension Insulator punctured for 132 kV transfer Bus.	50N,50C &Distance protection Relay:Fault Zone-None ,Start Phase-CN,System frequency:49.98HZ,Fault Duration:91.71 ms,Relay Trip time:0.00ms,IA:26.12 A,IB:170.8A,IC:1.374KA,VAN:83.38kV, VBN:85.53kV,VCN: 4.485kV.	Tingtibi-Jigmeling line	At same time Tingtibi-Nanglam Feeder Tripped
4	26-Jan-18	11:51	26-Jan-18	12:15	0:24	14.400	132kV Tingtibi-Nanglam Feeder	Tingtibi substation	B phase suspension Insulator punctured for 132 kV transfer Bus.	50N,50C &Distance protection Relay:Fault Zone-None ,Start Phase-CN,System frequency:49.98HZ,Fault Duration:406.9 ms,Relay Trip time:0.00ms,IA:106.2 A,IB:55.57A,IC:692.6A,VAN:83.61kV,VBN:85.32 kV,VCN:3906kV.	Tingtibi-Nanglam line	At same time Tingtibi-Jigmelin Feeder Tripped

132/33/11kV, Kanglung 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	6-Mar-18	15:03	6-Mar-18	15:12	0:09	2.02	132kV Incomer	all	Tripped on EF	50N	Kilikhar - Kanglung line	
2	23-Mar-18	0:47	23-Mar-18	1:02	0:15	1.32	132kV Incomer	all	Grid failed from Tingtibi due to heavy rainfall.	50N	Tingtibi	
3	23-Mar-18	19:26	23-Mar-18	19:28	0:02		132kV Incomer	all	Transient fault	86	Kilikhar - Kanglung line	The fault was transient due to bad weather.

132/33/11kV, Deothang 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	23-Mar-18	0:45	23-Mar-18	1:00	0:15	19.51	132kV Nangkor-Deothang	132kV N-D Line	Grid failed from Tingtibi end due to haevy rainfall.		Tingtibi	
2	23-Mar-18	0:45	23-Mar-18	1:05	0:20	17.86	132kV Motonga	Deothang SS	Grid failed from Tingtibi substation and at same time Motanga feeder got tripped at our end only.	Distance relay opt, zoneII and Zone III tripe, R,Y,B phase trip.	Fault Distance: 1Km, Fault Loop: L1-L3	Fault value: I1-1022.52A, 54.03deg, I2-260.53A,-74.21deg, I3-981.89A, -158.88, I4-330.98A,138.18deg.
3	23-Mar-18	18:41	23-Mar-18	18:45	0:04	1.66	5MVA TX.2	5MVA TX.2	Transient Fault	86 relay	Deothang	Due to the Bangtar feeder fault,Transformer II got tripped.
4	26-Mar-18	20:47	26-Mar-18	21:10	0:23	14.87	132kV Motonga	Nill	Line fault	Distance relay/Z5 trip and RYB phase trip	Unknown	Fdr tripped showing fault magnitude I1-135.74A/153.07deg,I2-1282.19A/164.09deg, I3-261.15A/146.18deg, I4-1669.71A/160.29deg.

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	01.04.2018	10:24	01.04.2018	10:40	0:16	0.5	132kV Nganglam	All	Tripped on fault	Distance Protection relay operated	Rangia Substation & Nganglam substation	132kV Nangkor-Deothang CB didn't opened at the instand of grid failure showing the fault at 37.36km towards Deothang, zone 3, start phase CN, fault resistance 1.928 ohms, IA-104.7A, IB-55.05A, IC-1.103kA, VAN-69.14kV, VBN-71.19kV, VCN-35.12kV. Distance relay operated at Nganglam showing the fault at a distance of 65.33km, zone 3
2	01.04.2018	10:37	01.04.2018	10:42	0:05	0.006	132/33kV Transformer-I	All 33kV & 11kV Feeders	Tripped on fault	Differential Protection Relay 87B & 87C and Tripping Relay 86 operated	Nangkor Substation	Load transferred to 132/33kV Transformer-II at 10:28 hrs
3	01.04.2018	18:26	01.04.2018	18:28	0:02	1.1	132/33kV Transformer-I	All 33kV & 11kV Feeders	Tripped on fault	Directional E/F- 67N and tripping relay 86 operated	Nangkor Substation	Load transferred to 132/33kV Transformer II and 132/33kV Transformer I kept under shutdown
4	05.04.2018	14:59	05.04.2018	15:21	0:22	-7.3	Main Grid	All feeders	Tripped on fault	-	Salakati substation	Main Grid failed from Salakati substation

132/33/11kV, Deothang 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	1.4.2018	10:23	1.4.2018	19:30	9:07	26.14	132 kV I/C Nangkor	Deothang S/S	Disc blast at s/s of I /C Nangkhor feeder.	NA	Deothang SS	Feeder got tripped due to disc blast of incomer Nangkhor feeder on B phase jumpering.
2	1.4.2018	10:23	1.4.2018	11:00	0:37	24.44	132kV Motonga	Deothang S/S	Disc blast at s/s of I /C Nangkhor.	Distance relay	Deothang SS	The feeder got tripped due to disc blast of incomer Nangkhor feeder on B phase jumpering. Fault value: I1=273.82A,22.54deg, I2=147.62A,7.77deg, I3=1212.75A,-155deg, I4=798.30A,-151.64deg.
3	4.4.2018	16:25	4.4.2018	16:27	0:02	1.74	132kV Transformer II	Deothang S/S	Tripped on fault	51A and 51C realy at LV side operated.	Deothang SS	Tripped due to transient fault.Charged and found ok.
4	5.04.2018	14:58	5.04.2018	15:20	0:22	20.92	132 kV Nangkhor Incomer	Deothang S/S	Tripped on fault	Nill	Salakati substation	Main Grid failed from Salakati substation
5	13.4.2018	22:31	13.4.2018	22:43	0:12	48.96	132 kV Nangkhor Incomer	132 kV Incomer Nangkhor	Tripped on fault	Nill	Nangkhor end	Grid fail from Nangkhor substation, at our end breaker satatus was normal, but at there end breaker was open
6	13.4.2018	22:31	13.4.2018	22:48	0:17	46.87	132kV Motonga	132kV Motonga	Tripped on fault	Distance relay	Motonga	Feeder got tripped due to Nangkhor feeder was tripped at there end. , Fault dist-13.273Km, Fault loop- L1-L2. Fault value I1=1365.66A,86.30deg, I2=1416.67A,-38.03deg, I3=1257.27A, -155.74deg, I4=61.73A, -26.57deg.
7	14.4.2018	18:44	14.4.2018	18:47	0:03	2.38	5 MVA Tr. II	All 33kV & 11kV outgoingss	Tree fall on line	O/C	Borbila, Nawkilo	Isolated the S/J fault feeder and charged the Transformer.
8	23.4.2018	9:15	23.4.2018	9:18	0:03	1.78	5MVA Tr.II	All 33KV & 11KV outgoings	Tripped on fault	NA	33kV S/J feeder	The 5MVA Transformer II was tripped due to 33kV S/Jonkhar feeder tripped on over current.
9	25.4.2018	16:03	25.4.2018	16:10	0:07	21.38	132 kV Nangkhor Incomer	All	Due to bad weather all feeders were affected.	NA	Motanga	Grid failed due to the Motanga-Rangia feeder was tripped on O/C and E/F.
10	25.4.2018	16:15	25.4.2018	16:18	0:03	21.38	132 kV Nangkhor Incomer	All	Tripped on fault	NA	Jigmeling and Tintibi substation	Grid failed due to the Jigmeling and Tingtibi substation was tripped, as inform by Nangkhor shift duty.(Transeint fault)

220/132/33kV, 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	10.04.2018	15:49	10.04.2018	18:33	2:44	35.58	220kV Tsirang	Jigmeling - Tsirang line	Overcurrent on R&B phases	Main1 main 2 optd. R & B phase trip. General relay trip. 86.1 &86.2 operated. Zone 1 trip.	Main1:14.7km	
2	25.04.2018	14:54	25.04.2018	15:10	0:16	-26.11	132kV Tingtibi	Jigmeling	Overcurrent on R&B phases	Main1 & main 2 optd. R & B phae trip.Zone 1 trip.	Main1: 19.5 km Main II: 18.7km	
3	25.04.2018	15:02	25.04.2018	15:21	0:19	11.21	220kV Tsirang	Jigmeling	Overcurrent on B phase	Main1 & main 2 optd. B phae trip. Zone 1 trip.	Main1: 15.7km Main2: 14.14km	
4	25.04.2018	15:27	25.04.2018	16:08	0:41	11.21	132Tingtibi	Jigmeling	Overcurrent on R&B phases	Main1 & main2 optd. R & B phase trip. Zone1 trip.	Main1: 18.1km Main2 : 18.9km	
5	25.04.2018	15:40	25.04.2018	15:45	0:05	4.1	132 kV Gelephu	Jigmeling	Overcurrent on all three phases	Main1 & main2 optd, R,Y and B phase trip. Zone 2 trip.	Main1: 13.55km main2: 21.5km	Grid available from Tintibi & Gelephu
6	25.04.2018	16:17	25.04.2018	16.23	0:06	-10.11	132kV Tingtibi	Jigmeling	Overcurrent on all three phases	Main1 & main 2 optd. R,Y and B phase trip.	Main1: 19.8km main2: 21.5km	Grid available from Tintibi & Gelephu
7	27.04.2018	8:50	27.04.2018	9:00	0:10	16.2	220kV Tsirang	Jigmeling	Overcurrent	Main2 optd. General relay trip.		
8	27.04.2018	13:07	27.04.2018	13:15	0:08	HV: ICT1 - 0.661, ICT2 - 0.838.	ICT 1 & 2, both HV	Jigmeling	Overcurrent and Earthfault	64/51 NS LV trip, LV SEF trip, main relay trip. 86.1 and 86.2 optd on both ICT 1 & 2 on HV.	Jigmeling substation	

220/66/33kV, Dhajay 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	10.04.2018	15:50hrs	10.04.2018	16:05hrs	0:15	-34.400	220kV Tsirang-Jigmeling Line	Tsirang - Jighmeling Line	The Line Tripped with OC at R& Bphase with the 1.87 & 2.00kA	Distance relay Main-I and Main-II Operated with OC atR& Bphase at the distance of 22.3km to wards Jigmeling (Z1/Z1B)	22.3km away from Dhajay substation	
2	25.04.2018	15:02hrs	25.04.2018	15:14hrs	0:12	-9.000	220kV Tsirang-Jigmeling Line	Tsirang - Jighmeling Line	The Line Tripped with OC at Bphase with the 1.51kA	Distance relay Main-I and Main-II Operated with OC at Bphase at the distance of 19.2km to wards Jigmeling (Z1/Z1B)	19.2km away from Dhajay substation	

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	05.04.2018	15.02hrs	05.04.2018	15.20hrs	0:18	-86.2	132 kv Gelephu-Salakati	Line segment	Overcurrent on R&Y phases	General trip,o/c on R & Y-Phase,zone I,Dist 41.16km towards Salakati end,dis protection,3-phase,REL 670.	41.16km away from Gelephu ss	
2	14.04.2018	04.40hrs.	14.04.2018	05.01hrs	0:21	-7.8	132kv Gelephu-Salakati	Line segment	Overcurrent on B&Y phases	General trip,o/c on Y&B Phases, Zone I, Dist: 34.18km towards Salakati end.	34.18km away from Gelephu ss	

132/33/11kV, Tingtibi 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	3/4/2018	13:12 Hrs	3/4/2018	13:30 Hrs	0:18	20.880	132kV Tingtibi-Nanglam feeder	Tingtibi Substation /132kV Tingtibi-Nanglam Line	Earth fault	86 &(distance relay data) : Start phase BNC,Fault duration:1.669ms,Fault zone :None, System Frequency :49.94HZ.	132kV Tingtibi-Nanglam feeder Line	
2	3/4/2018	13:12 Hrs	3/4/2018	13:37 Hrs	0:25	5.920	132kV Tingtibi-Yourmoo feeder	Tingtibi Substation &132kV Tingtibi-Yourmoo Line	Overcurrent on three phases	51N,50C &(Distance relay) :Active Group-1,Trip zone-1,Start phase:BC,Trip-ABC,System frequency:49.94HZ,Fault Duration:15.02ms,Relay trip time:80.1ms,Fault location:14.68KM,IA-25.95A,IB-26.16A,IC-129.27A,VAN-77.25V,VBN-76.85V,VCN-75.79V,Fault resistance XY:3.829 ohms.	132kV Tingtibi-Yourmoo feeder Line	
3	3/4/2018	13:12 Hrs	3/4/2018	13:42 Hrs	0:30	-27.640	132kV Tingtibi-Jigmeling feeder	Tingtibi Substation /132kV Tingtibi-Jigmeling Line	Earth fault	51N,50C ,86 & (Distance relay data) :Active Group-I,Start phase:BCN,Fault duration:1.669ms,Fault zone :None, System Frequency :49.94HZ	132kV Tingtibi-Jigmeling feeder Line	

220/132/33kV, 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	5/27/2018	4:14	5/27/2018	4.47	0:33	-23.1	Jig-Tsirang feeder	Jigmeling Substation	Line tripped on OC at 21.1 (R& B phases) and 21.2 (Y phase)	Main1(21.1) optd, R & B-phase trip. Main2 Y-phase trip.	Main1=18.1km Main2 =13.91km	

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	04.06.2018	14.05	04.06.2018	19.44	5:39	8.2	Salakati & Jigmeling	Gelephu substation	Overloading.	Non	Unkown	whole Grid fail at 14.05hrs but breaker did not triped at our end.
2	13.06.2018	21.55	13.06.2018	22.30	0:35	31.8	Salakati	non	Bad weather	General Trip,R-ph,Zone-1,dist:14.99km towards salakati.	salakati line	Thunder lightening & heavy rainfall.

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	16.09.2018	12:31	16.09.2018	12:35	0:04	17.42	132kV Tingtibi	Tingtibi	Tripped on fault	86 & 67N opted.	Unknown	transient fault.
2	18.09.2018	09:08	18.09.2018	09:12	0;04	0.71	132/33kV Tr.-I	All Feeders	Tripped on fault	86opted	DGCL feeder	The fault was in 33kV DGCL feeder(Earth Fault)
3	21.09.2018	3:06	21.09.2018	3:10	0:04	22.34	132kV Tingtibi	Tingtibi	Tripped on fault	67N & 86 optd.	Unknown	The feeder withstand during test charge.
4	23.09.2018	21:16	23.09.2018	21:33	0:17	32.50	132kV Tingtibi	Tingtibi	Due to Haevy lightening & Rainfall	Dist. Relay & 86 optd.	Unknown	Dist. Relay operated Zone-1, Dist-21.81km. IA=1.324kA, IB=1.429kA, IC=1.328kA. Must be due to lightening strike on transmission Line.
5	27.09.2018	1:26	27.09.2018	1:33	0:07	17.60	132kV Tingtibi	Tingtibi	Due to Haevy lightening & Rainfall	Dist. Relay & 86 optd.	Unknown	Dist. Relay operated Zone-1, Dist-2.439km. IA=1.608kA, IC=1.581kA, IC=1.516kA Fault resistance=646.3mohms.

132/33/11kV, Deothang 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	24.11.2018	14:57	24.11.2018	15:11	0:14	-36.47	132kV Nangkor Incomer	Deothang	Tripped on fault	Nill	Tingtibi end	Grid failed from Tingtibi
2	24.11.2018	14:57	24.11.2018	15:26	0:29	34.67	132kV Motonga fdr	Deothang	Tripped on fault	Distance Relay	Unknown	When grid fail from Tingtibi side, at same time Motanga feeder also got tripped,opt Zone I, II & III opt. Fault dist: 39.538km, Fault loop: L1-L2.with fault value: I1 969.96A,I2- 1124.57A ,I3-143.92A ,I4-2.25A.

Annexure- II

Western Grid Outages

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	9-Jan-18	15:10	9-Jan-18	15:57	0:47	6.76	66kV Chukha-Pling	Nil	Temporary	dist.prot, 86 & 186	Line	Test charged the feeder at 15:15hrs but didnot withstand as there was problem at Chukha end, isolate the line from Gedu Substation and test charged the feeder stood normal.
2	10-Jan-18	14:16	10-Jan-18	14:55	0:39	3.25	66kV Chuka -Pling	Nil	Temporary	dist.prot, 86 & 186	Line	Test charged the feeder at 14:20hrs but didnot withstand as there was problem at Chukha end, isolate the line from Gedu Substation and test charged the feeder stood normal.

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	3-Mar-18	9:55	3-Mar-18	10:50	0:55		220kV Semtokha-Chukha feeder	Semtokha, D/ling, Olakhaetc.	Trip at Chukha end	earth fault	Not yet confirm	
2	3-Mar-18	10:53	3-Mar-18	11:03	0:10		220kV Semtokha-Chukha feeder	Semtokha, D/ling, Olakhaetc.	While test charging 220kV Semtokha-Rurichu line from semtokha its got trip at Chukha end, not tripping at Semtokha end.	Nill	Not yet confirm	
3	3-Mar-18	14:41	3-Mar-18	14:45	0:04		220kV Semtokha-Chukha feeder	Semtokha, D/ling, Olakhaetc.	-do-	Nill	Not yet confirm	
4	9-Mar-18	7:18	9-Mar-18	8:13	0:55	-49.650	220kV Semtokha-Chukha feeder	Semtokha, D/ling, Olakhaetc.	Trip at Chukha end	earth fault	Not yet confirm	
5	9-Mar-18	12:38	9-Mar-18	12:58	0:20	-31.170	220kV Semtokha-Chukha feeder	Semtokha, D/ling, Olakha etc.	While test charging 220kV Semtokha-Rurichu line from semtokha its got trip at Chukha end, np tripping at Semtokha end.	Nill	Not yet confirm	

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	2-Mar-18	9:11	2-Mar-18	9:19	0:08	20	220 kV Malbase - Samtse Feeder	220 kV Malbase - Samtse Feeder	Trip	M-1trip,TripR,Y&B phase,zone1,2&3 Trip,Carrier fail Trip Values: IL1=5217A<289.5deg. IL2=5141A<159.4deg. IL3=153.7A<55.45deg. IL4=3796A<220deg.	Line	Fault loop = L1-L2 at a distance of 23.9 km. The feeder withstood while test charging. Heavy rainfall with thunder and lightning at th time of tripping.
2	3-Mar-18	2:34	3-Mar-18	2:56	0:22	-50	220kV Chukha - Malbase Feeder.	220kV Chukha - Malbase Feeder.	Trip	General trip, R,Y,B trip, zone I trip, 86A operated,F/L=L1-N Dist.= 7.0 KM Trip Values: L1=4970 A, 285.4 deg., L2=73.02 A, 36.81 deg. L3=163.7 A, 297.3 deg. L4=5109 A, 286.4 deg.	Line	Heavy Rainfall with thunder and lightning and restoring took time due to bad weather.
3	3-Mar-18	2:34	3-Mar-18	2:55	0:21	34	50/63MVA Transformer - I	50/63MVA Transformer - I	Trip	Diff. trip, 27 trip, 86A optd. Trip Values: L1=101.64 A, 109.63 deg., L2=83.53 A, -165.07 deg. L3=169.89 A, 118.92 deg. L4=297.49 A, 131.47deg.	Substation	
4	03.03.2018	2:34	03.03.2018	2:56	0:22	36	50/63MVA Transformer - III	50/63MVA Transformer - III	Trip	OLTC BUCH trip, Diff. trip, 27 trip, 86A optd. Trip Values: L1=124.77 A, 115.76 deg., L2=104.09 A, 173.46 deg. L3=196.96 A, 121.94 deg. L4=374.43 A, 134.37deg.	Substation	

220/66/33kV Dhamdum 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	05.04.2018	9:46	05.04.2018	9:51	0:05	10.1	50/63MVA transformer I&II	Dhamdhum substation	Transient fault	86A TRP RLY OPTD, 86B TRP RLY OPTD & SBEF(51NS) trip	Substation	At 9:46hrs both HV & LV of 50/63 MVA transformer got tripped.
2	17.04.2018	20:45	17.04.2018	21:44	0:59	9.97	50/63MVA transformer I&II	Dhamdhum substation		86A TRP RLY OPTD, 86B TRP RLY OPTD	Substation	The fault was at the sending end (malbase). 202Q52 was not opereated but both the 50/63 MVA transformer's breaker (HV &LV) got triped at our end
3	21.04.2018	19:24	21.04.2018	19:37	0:13	-20.83	220 kV Malbase	Dhamdum substation	Y & B phase fault	86A TRP RLY OPTD, 86B TRP RLY OPTD. GENERAL TRIP, Zone 1 Trip, Yphase fault, Bphase Fault, VT fuse fail	Substation	There was a fault between the Y phase and B phase. .

66/33/11kV Gomtu 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	07.05.2018	22:45	08.05.2018	20:12	21:27	4.57	66kV Gomtu-P/Ling		There was fire in 11 kV control room at Phuentsholing Substation	CB and Isolator opened for Phuentsholing Line.	P/Ling Substation	After the incident at Phuentsholing substation the CB and isolator for Phuentsholing line at our end was kept open.
2	02.05.2018	15:36	02.05.2018	15:47	0:11	11.52	66kV Incomer Dhamdum	Whole Gomtu	Tr. III & IV HV/LV side tripped at Malbase Substation.	B Phase Fault optd. at Gomtu Substation	Malbase Substation	Heavy rainfall at Malbase triping the Dhamdum line and simultaneously tripping Gomtu line. At 15:47 hrs Dhamdum line was charged to normal.

66/33/11kV Gedu 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	06.05.2018	11:36	06.05.2018	12:10	0:34	0.36	8MVA Transformer	33KV Gurung dara fdr I	The cause of tripping was due to flash over inside the 33kV Incomer I panel.	1. O/C relay R, Y& B phase). 2. Tripping relay 86	Substation	Opened 33kV Incomer I panel and found moisture formation on panel & CTs.
2	10.05.2018	16:25	10.05.2018	16:28	0:03	0.29	66/33/11kV, 5MVA transformer & 33kV Incomer II	33KV Gurung dara fdr II	Transformer got tripped due to fault on 33kV Gurungdara fdr II.	5MVA TR 1. REF relay. 2. Tripping relay 86 33kV INCOMER II 1. E/F relay (INST) 2. Tripping relay 86	Line	
3	10.05.2018	19:08	10.05.2018	19:10	0:02	0.22	66/33/11kV, 5MVA transformer & 33kV Incomer II	33KV Gurung dara fdr II	Transformer got tripped due to fault on 33kV Gurungdara fdr II.	5MVA TR 1. REF relay. 2. Tripping relay 86 33kV INCOMER II 1. E/F relay (INST) 2. Tripping relay 86	Line	
4	21.05.2018	5:52	21.05.2018	5:55	0:03	0.45	66/33/11kV, 5MVA transformer & 33kV Incomer II	33KV Gurung dara fdr II	Transformer got tripped due to fault on 33kV Gurungdara fdr II.	5MVA TR 1. REF relay. 2. Tripping relay 86 33kV INCOMER II 1. E/F relay (INST) 2. Tripping relay 86	Line	

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	10.06.2018	19:47	10.06.2018	20:13	0:26	4	Samtse-singhigaon Fdr(206 bay)		Trip	50/51 and 21	Line	samtse-singhigaon got trip on over current and distance protection(21)
2	10.06.2018	22:01	10.06.2018	23:17	0:16	3.5	Samtse-singhigaon Fdr(206 bay)		Trip	50/51 and 21	Line	samtse-singhigaon got trip on over current and distance protection(21)
3	18.06.2018	4:41	18.06.2018	4:53	0:11	36	66kV BFAL Frd		Trip	51		Trip on Over current.R Phase=0.38kA Y.Phase=0.44kA and B Phase=0.37.

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	03.06.2018	19:39	03.06.2018	19:48	0:09	3.4	66KV Chukha-Pling	Gedu	Temporary	86 & 186	Line	
2	04.06.2018	14:04	04.06.2018	14:37	0:33	7.25	66KV Chukha-Pling	Gedu	Temporary	Dist. Prot, 86 & 186	Line	
3	07.06.2018	14:59	07.06.2018	15:45	0:46	7.03	66KV Chukha-Pling	Nil	Temporary	Dist. Prot, 86 & 186	Line	Test charged the feeder at 15:11hrs but did not withstand
4	13.06.2018	19:44	13.06.2018	20:47	1:03	4.86	66KV Pling-Gomtu	Nil	Temporary	Dist. Prot, 86 & 186	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	03.06.2018	19:13	03.06.2018	19:24	0:11	114	200MVA ICT	200MVA ICT	Trip	400kV M CB open,400kV TI CB open Trip Values: HV L1=0.030A<-127.6deg, HV L2=0.073A<58.63deg, HV L3=0.075A<-66.53deg. LV L1=.038A<-122.7deg, LV L2=0.269A<deg, LV L3= .027<153.3deg.	Substation	For 50/63MVA Transformer I, the HV SIDE breaker was closed at 19:34 hrs but the LV side breaker could not hold while charging. So at 20:43 hrs the LV side breaker charged through emergency switch .i.e(PLUNGER) For 50/63MVA transformer II, the LV side breaker was still on when it's 86 relay got operated. At 20:40hrs opened the LV side breaker with emergency switch to charge its HV side breaker.At 21.07hrs HV breaker charged and 21.08hrs LV side breaker close through emergency switch. Heavy rainfall with thunder and lightning at the time of tripping.
2	03.06.2018	19:17	03.06.2018	19:32	0:15	10	220kV Malbase - Samtse Feeder.	220kV Malbase - Samtse Feeder.	Trip	M-1 TRIP,TRIP R PH,TRIP Y PH,TRIP B PH Trip Values: I1=84.05A<352.6deg, I2= 5353A<163.8deg, I3=33.39A<24.93deg, I4=5237A<163.6deg.	Line	
3	03.06.2018	19:11	03.06.2018	20:43	0:55	28	50/63MVA Transformer I	50/63MVA Transformer I	Trip	DIFF trip. Trip Values: I1=123.22A<-2.58deg, I2=68.72A<9.41deg, I3=73.14A<96.68deg, I4=184.77A<13.86deg.	Substation	
4	03.06.2018	19:39	03.06.2018	21:08	0:29	28	50/63MVA Transformer II	50/63MVA Transformer II	Trip	86A OPTD,GENERAL TRIP,BBP- OPTD, LBB TRIP Trip Values: I1=.11A<-61.85deg, I2=.04A<144.41deg, I3=.09A<-4.16deg.	Substation	
5	03.06.2018	19:12	03.06.2018	19:52	0:40	30	50/63MVA Transformer III	50/63MVA Transformer III	Trip	DIFF. TRIP,DIFF START, DIFF=HARM BLK,DIFF=WAVW BLK Trip Values: I1=154.49A<.37deg, I2=91.93A<-9.28deg, I3=84.61A<-84.77deg, I4=262.55A<15.56deg.	Substation	

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	20.07.2018	18:00	20.07.2018	18:06	0:06	321	400kV Tala - Malbase Feeder.	400kV Tala - Malbase Feeder.	Tripped	Zone 1 trip, Triped 3phase,Distance=9.381km Trip Values: IL1=3.835KA IL2=419.2A IL3=149.2A	Line	Stormy weather at the time of tripping and feeders took time to be restored due to bad weather.
2	20.07.2018	18:24	20.07.2018	19:30	0:06	232	400kV Malbase - Siliguri Feeder.	400kV Malbase - Siliguri Feeder.	Tripped	Zone 1 trip, fault loop=R-phase to neutrral ,Distance= 12.72km,carrier fail Trip Values: IL1=6.181KA, IL2=620A, IL3=242.6A, IL4=13.872kA	Line	
3	20.07.2018	18:11	20.07.2018	18:59	0:48	28	66kV Pasakha Feeder IV	66kV Pasakha Feeder IV	Tripped	IEF-50N-TRIP,86 OPT, General trip Trip Values: IL1=886.62A<125.75deg, IL2=993.72A<160.59deg, IL3=902.6A<-121.42deg	Line	
4	20.07.2018	18:12	20.07.2018	18:58	0:46	25	66kV Pasakha Feeder II	66kV Pasakha Feeder II	Tripped	IEF-50N-TRIP,86 OPT, General trip Trip Values: IL1=5704.17A<-55.38deg, IL2=1186.99A<-169.96deg, IL3=121.03A<-55.44deg	Line	
5	20.07.2018	18:13	20.07.2018	18:56	0:43	25	66kV Pasakha Feeder I	66kV Pasakha Feeder I	Tripped	IEF-50N-TRIP,IOC-50-TRIP ,86 OPT, General trip Trip Values: IL1=429.49A<148.78deg, IL2=2753.85A<-170.64deg, IL3=4645.92A<57.57deg	Line	
6	20.07.2018	18:09	20.07.2018	18:34	0:25	25	50/63 MVA Transformer I	50/63 MVA Transformer I	Tripped	Thol start, Diff. start L1,Diff start L2 Trip Values: IL1=745.3A<-52.32deg, IL2=747.48A<-172.2deg, IL3=710A<62.87deg IL4=70.93>-56.85deg	Substation	
7	20.07.2018	18:11	20.07.2018	18:36	0:25	27	50/63 MVA Transformer III	50/63 MVA Transformer III	Tripped	OLTC Buch trip, 021 Thol-start, 027 trip Trip Values: IL1=811.08A<-51.15deg, IL2=790.28A<-170.95deg, IL3=757.37A<64.31deg, IL4=92.18A<-52.4deg	Substation	

66/33/11kV Gomtu 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	05.07.2018	00:41	05.07.2018	07:57	6:16	5.44	66kV Gomtu-P/Ling	Nil	Over Current	O/C 51AX, 51BX & 51CX operated at Gomtu end.	Line segment	Test charged the line from P/ling Substation at 07:57 hours with charging code 409 from BPSO and supply stood normal.

220/66/33kV Dhamdum 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	10.09.2018	4:13	10.09.2018	4:17	0:04	-9.87	220kV Malbase feeder	Dhamdhum Subststion	Transient fault	86 operated, general trip, zone I trip & B ph fault	NA	The feeder was test charged against the charging code 644 given by BPSO and stood normal
2	16.09.2018	8:02	16.09.2018	8:51	0:49	-3.05	220kV Singyegaon feeder	No interruption	Transient fault	Gerenral trip & E/F	NA	Since the relay needs to be manually reset by Malbase shift personnel at Singyegaon. So it takes time to charge.
3	24.09.2018	2:45	24.09.2018	2:51	0:06	6.19	66 kv Gomtu feeder	Gomtu Subststion	Transient fault	86 operated, general trip,	NA	The feeder was test charged and stand normal.
4	25.09.2018	20:34	25.09.2018	20:46	0:12	7.07	50/63 MVA transformer I and II	Dhamdhum Subststion	Tripped due to Gomtu line fault	86 operated, general trip,	NA	
5	25.09.2018	22:05	25.09.2018	22:12	0:07	10	66 kv Gomtu feeder	Gomtu Subststion	Transient fault	86 operated, general trip,Y and B phase fault.	NA	The feeder was test charged against charging code 690 and stand normal.

66/33/11kV Gedu 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	26.09.2018	19:05	26.09.2018	19:21	0:16	2.71	66kV Chukha-Pling feeder	Gedu blackout			Substation	handtripped 5MVA trf II due to sparking on B phase isolator but still sparking was there, so we further informed Chukha and Pling substation to opened the CB from their end. Tighten the nuts and bolts. At 07:21 normalised the 66kV Chukha-Pling feeder.

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	11/18/2018	17:47	11/18/2018	18:06	0:19	-15.600		feed from 220kV Chukha feeder	Trasient fault	Distance protection operated 86relay operated.	unknown	

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	12/5/2018	10:49	12/5/2018	10:57	0:08	-39.530	220kV Semtokha-Rurichu feeder	Semtokha	Due to ICT trpied at Jemiling,Rurich CB got open in under frequency	Nil	Jemiling end	
2	12/25/2018	14:45	12/25/2018	16:31	0:46	-17.140	220kV Semtokha-Rurichu feeder	Semtokha	due to 220kv Chukha incomer B phase CT terminal came out	Nil	Semtokha upper switch yard	
3	12/18/2018	7:25	12/18/2018	7:30	0:05	-1.400	66kv Semtokhs Lobeysa	Nil, feed from Chukha	Due to snow fall	Fault loop: L1,L2 zone 1triped	Not known	
4	12/18/2018	8:50	12/18/2018	8:55	0:05	-2.430	66kv Semtokhs Lobeysa	Nil, feed from Chukha	Due to snow fall	Fault loop: L1,L2 zone 1triped	Not known	
5	12/18/2018	9:05	12/19/2018	17:44	20;39	-2.650	66kv Semtokhs Lobeysa	Nil, feed from Chukha	Due to snow fall	Fault loop: L1,L2 zone 1triped Dist:2.8km	Not known	

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	13.11.2018	18:57	13.11.2018	19:08	0:11	99	200MVA ICT	200MVA ICT	Tripped	86A OPTD Trip Values: HV L1=0.775A<165.1deg, HV L2=0.538A<41.24deg, HV L3=0.683A<-79.56deg, LV L1=0.215A<174.9deg, LV L2=0.263A<46.56deg, LV L3=0.059A<-97.21deg.	Substation	220 kV Bus Coupler tripped @ 19:06 with R/86 Optd & @ 220 kV Busbar Protection CT SUP C. ZONE and CT SUP ZONE-2 Optd.
2	13.11.2018	18:57	13.11.2018	19:15	0:18	38	50/63MVA Transforemr III	50/63MVA Transforemr III	Tripped	86 OPTD, BBP Optd. Trip Values: IL1=0.20A<-19.10deg, IL2=0.30A<13deg, IL3=0.33A<15.61deg.	Substation	
3	13.11.2018	18:57	13.11.2018	19:25	0:28	35	50/63MVA Transforemr I	50/63MVA Transforemr I	Tripped	86 OPTD,BBP Optd. Trip Values: IL1=101.37A<143.57deg, IL2=16.58A<13.91deg, IL3=9.60A<-43.35deg.	Substation	

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	t &	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 rainfal 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:Ranining,lighting 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.

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	The male and female contact of 220kV Bus-A isolator (Y-Phase), was burnt. The post insulator of isolator was also damaged. The feeder was fed through transfer isolator. Heavy Rainfall with thunder and lightning at the time of tripping.

9	24-Sep-17	1:07	24-Sep-17	4:59	3:52	-	220kV Bus Coupler	220kV Bus Coupler	Tripped	No data displayed.	Substation	Tripped along with the tripping of 220kV Chhukha - Malbase Feeder. Heavy Rainfall with thunder and lightning at the time of tripping.
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	
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	41	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	46	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	