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

02/BPC/BPSO/PSOD/Vol-I/15/ 21 January 25, 2017

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

Sub: Submission of Transmission System Performance Annual Report for the year 2016.

Sir,

Kindly find enclosed with the transmission system performance annual report as per the Grid Code Regulation, 2008 Clause No: 6.14.2.1, for the year 2016. Soft copy of the report is available in the http://bpso.bpc.bt.

Thanking you,

Yours faithfully,

Ujjwal Deep Dahal
General Manager

Copy to:

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

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BHUTAN POWER CORPORATION LIMITED

BHUTAN POWER SYSTEM OPERATOR

THIMPHU : BHUTAN

ANNUAL TRANSMISSION SYSTEM PERFORMANCE REPORT FOR THE YEAR 2016

25-JANUARY-2017

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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 2016.

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

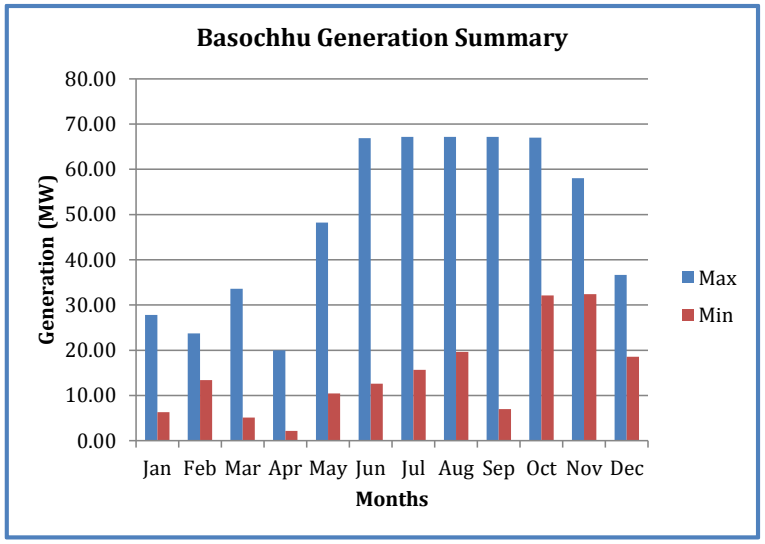
2.1 POWER GENERATION

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

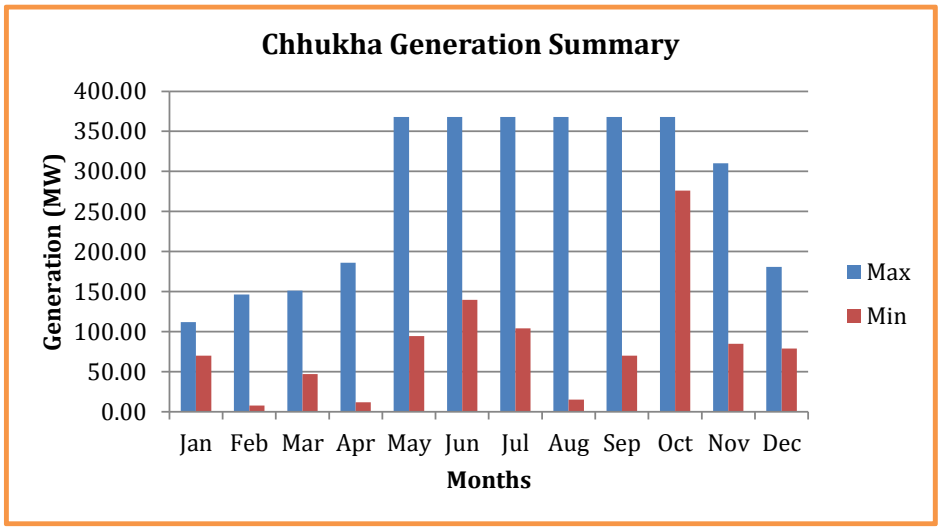
Table: 2.1.1 Monthly maximum and minimum generation summary

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	27.82	23.71	33.60	20.00	48.22	66.89	67.17	67.17	67.16	66.98	58.04	36.66	**67.17**	
		Min	6.32	13.39	5.14	2.17	10.46	12.58	15.64	19.63	7.00	32.13	32.40	18.58		**2.17**
2	CHP	Max	112.00	146.30	151.00	185.88	368.00	368.00	368.00	368.00	368.00	368.00	310.00	180.75	**368.00**	
		Min	70.00	7.80	47.00	12.00	94.30	139.74	104.00	15.00	70.00	276.00	85.00	79.00		**7.80**
3	THP	Max	230.00	300.00	340.00	561.00	748.00	1,126.00	1,134.00	1,122.00	1,122.00	1,122.00	680.00	507.00	**1,134.00**	
		Min	150.00	140.00	110.00	100.00	180.00	260.00	567.00	860.00	935.00	620.00	340.00	120.00		**100.00**
4	KHP	Max	28.37	44.60	49.06	65.88	66.00	66.00	66.00	66.00	66.00	66.76	53.03	40.85	**66.76**	
		Min	10.09	10.50	10.54	11.19	25.41	32.53	13.55	33.00	15.00	33.00	24.02	20.75		**10.09**
5	DHP	Max	0.00	0.00	32.12	38.19	50.10	113.45	95.10	100.70	100.79	100.70	52.27	40.03	**113.45**	
		Min	0.00	0.00	14.03	10.16	0.30	10.03	5.50	1.13	40.30	48.74	31.31	23.06		**0.00**

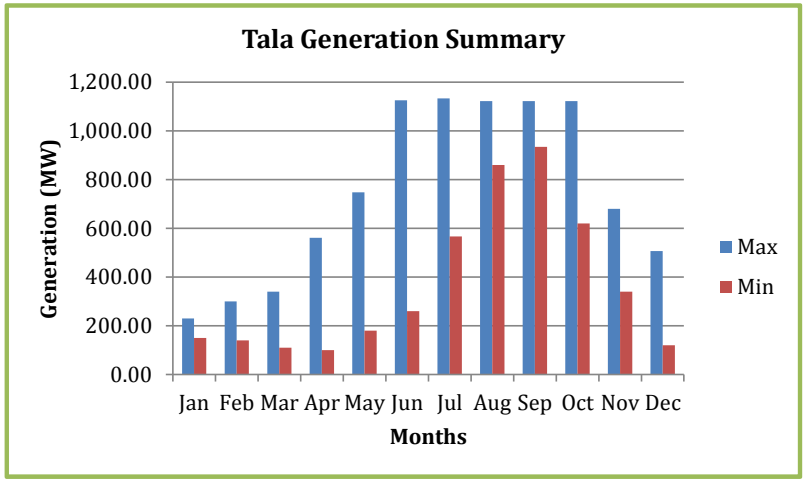
Graph: 2.1.1 Basochhu generation summary



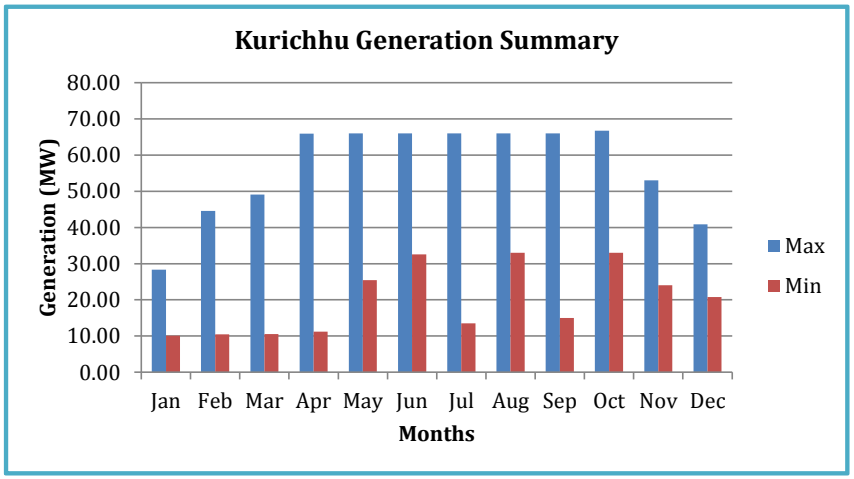
Graph: 2.1.2 Chhukha generation summary



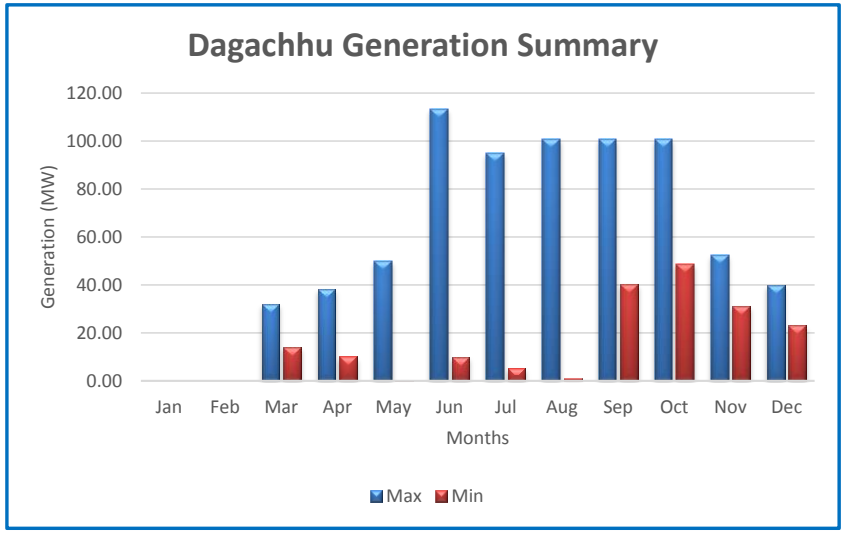
Graph: 2.1.3 Tala generation summary



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:

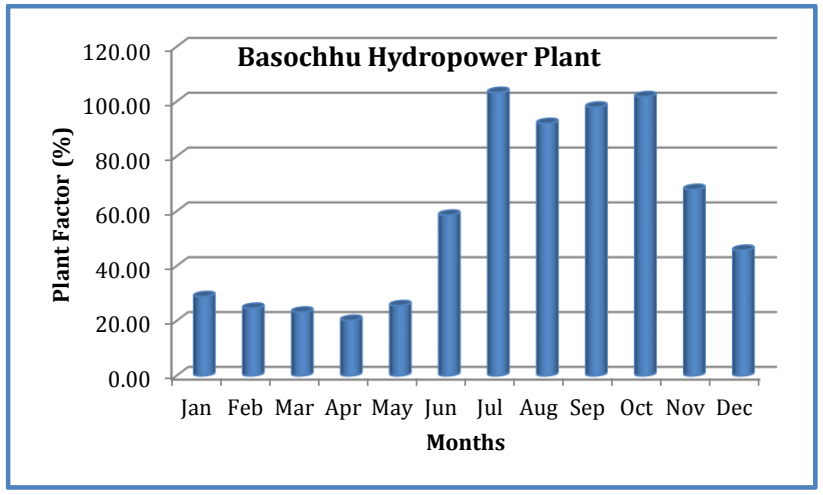
Plant factor = (Actual output of a plant over a period of time) / (Output when operated at name plate rated capacity for entire time)

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

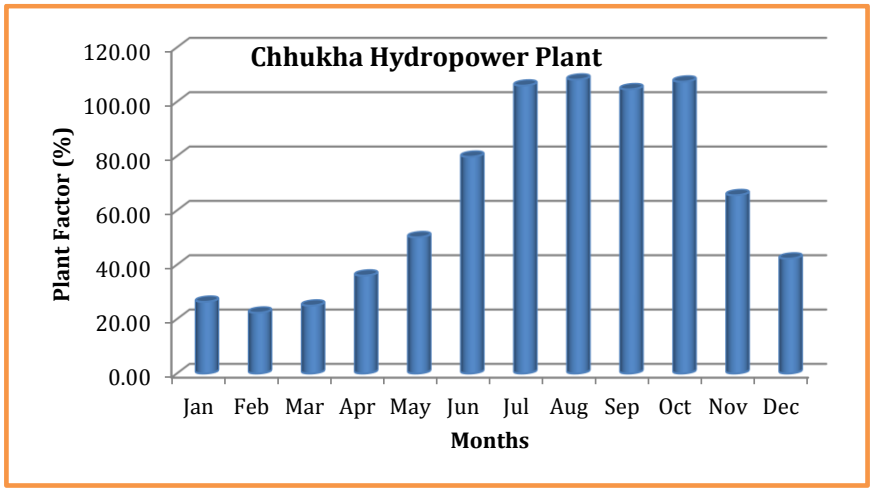
Table: 2.2.1 Monthly plant factor of the hydropower plants

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	28.83	24.57	23.18	20.16	25.53	58.53	103.29	91.98	97.95	101.75	67.92	45.72	**103.29**	**20.16**
2	CHP	26.35	22.35	24.95	36.00	50.12	79.74	105.93	108.13	104.56	107.39	65.59	42.26	**108.13**	**22.35**
3	THP	17.92	15.24	16.88	23.61	33.00	58.72	102.89	106.71	105.60	96.66	44.47	28.62	**106.71**	**15.24**
4	KHP	33.05	33.51	41.61	60.51	74.52	99.66	105.99	109.71	102.50	105.20	62.11	44.44	**109.71**	**33.05**
5	DHP				23.05	23.78	57.80	0.00	66.25	69.60	56.55	32.13	17.92	**69.60**	**0.00**

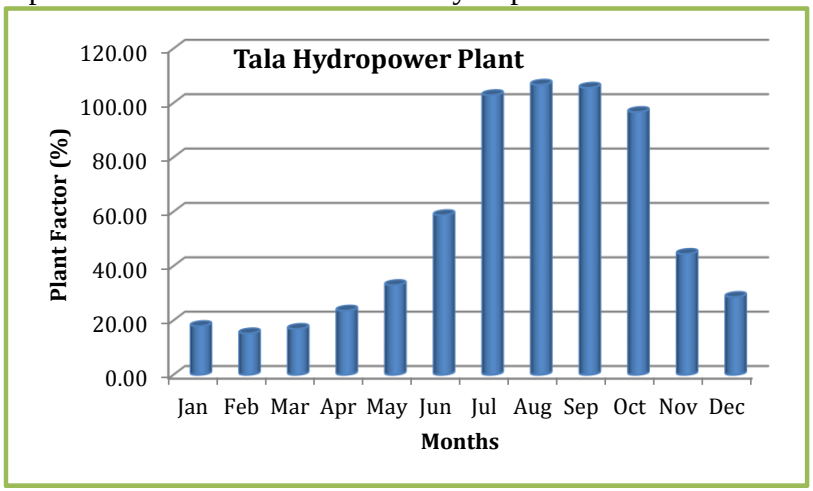
Graph: 2.2.1 Plant factor of Basochhu Hydropower Plant



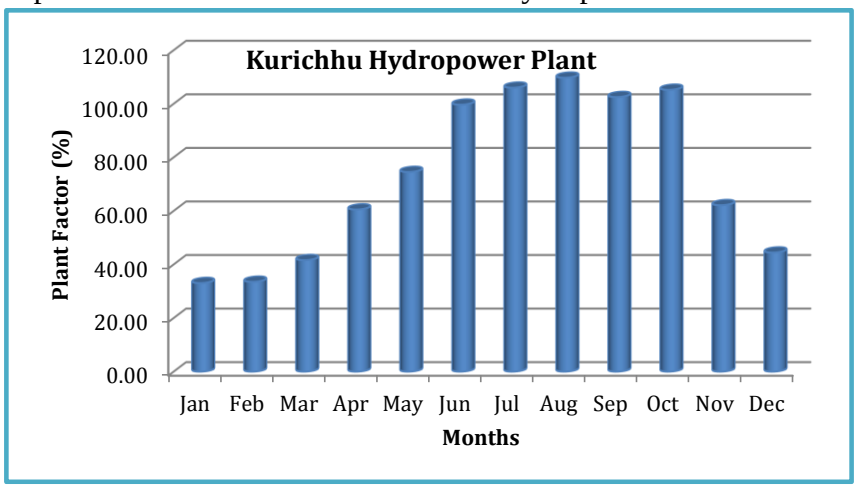
Graph: 2.2.2 Plant factor of Chhukha Hydropower Plant



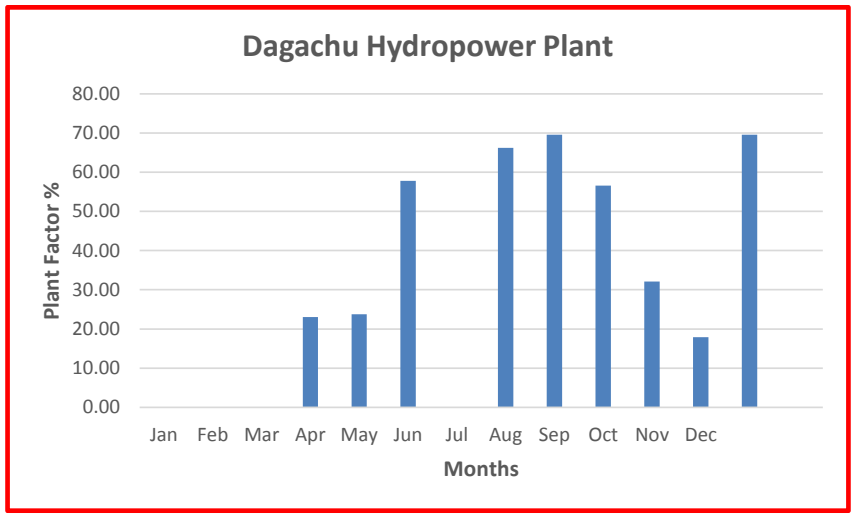
Graph: 2.2.3 Plant factor of Tala Hydropower Plant



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 335.87MW occurred on 4th September, 2016 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	3-Jan-16	18:00	322.18	369.84	271.05	348.29	51.13	21.55
2	Feb	28-Feb-16	10:00	329.84	240.58	308.82	218.84	21.02	21.74
3	Mar	19-Mar-16	19:00	321.35	283.48	258.19	258.89	63.16	24.59
4	Apr	8-Apr-16	19:00	326.55	445.77	274.04	407.07	52.51	38.70
5	May	19-May-16	19:00	333.47	627.46	267.49	580.52	65.98	46.94
6	Jun	12-Jun-16	12:00	335.65	1,030.12	290.46	964.12	45.19	66.00
7	Jul	30-Jul-16	8:00	334.89	1,495.98	294.36	1,432.13	40.53	63.85
8	Aug	4-Aug-16	5:00	334.98	1,682.30	279.01	1,616.30	55.97	66.00
9	Sep	4-Sep-16	0:00	335.87	1,678.34	288.77	1,612.34	47.10	66.00
10	Oct	15-Oct-16	20:00	335.40	1,622.52	287.62	1,556.52	47.78	66.00
11	Nov	4-Nov-16	8:00	334.87	965.64	293.08	920.45	41.79	45.19
12	Dec	17-Dec-16	19:00	331.89	491.03	271.98	462.45	59.91	28.58
National Peak Load of the year (MW)				335.87					

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

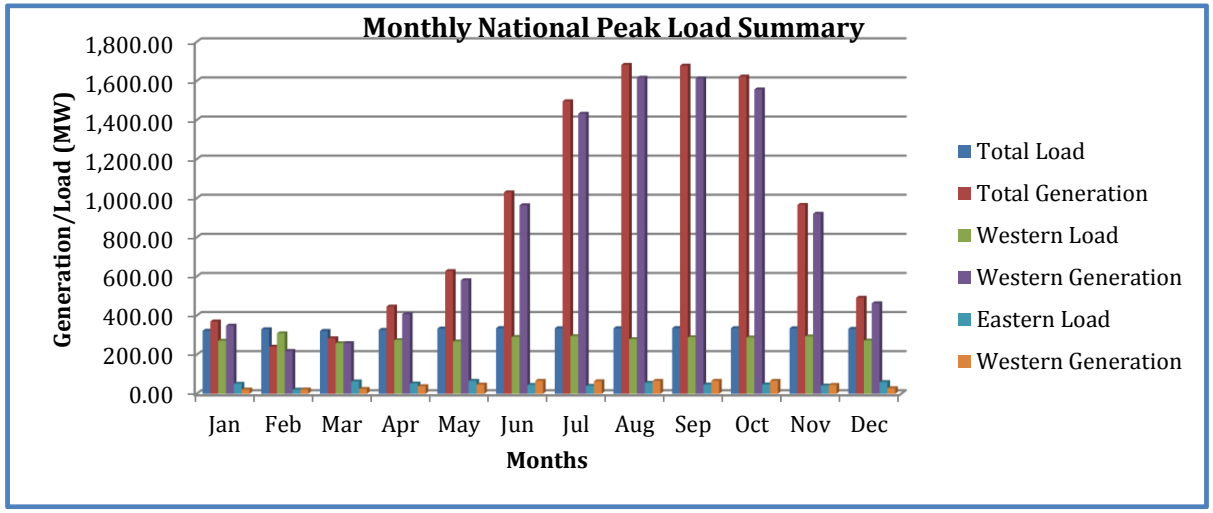
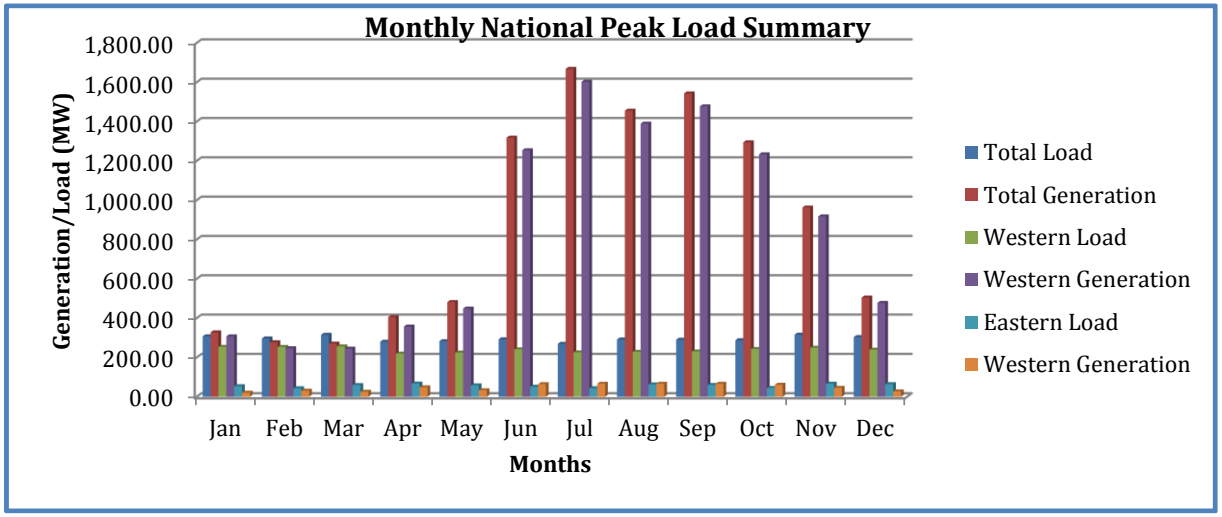


Table: 3.1.2 Monthly national peak load and corresponding generation using method- 3

Sl. No	Months	Date	Time	Total Grid (MW)		Western Grid (MW)		Eastern Grid (MW)	
				Load	Generation	Load	Generation	Load	Generation
1	Jan	8-Jan-16	19:00	307.10	327.41	253.50	306.98	53.60	20.43
2	Feb	14-Feb-16	19:00	296.30	277.22	253.17	246.61	43.13	30.61
3	Mar	20-Mar-16	19:00	314.98	269.98	255.80	244.73	59.17	25.25
4	Apr	13-Apr-16	19:00	279.62	404.80	219.48	356.85	66.81	47.95
5	May	12-May-16	20:00	282.42	481.42	224.51	448.42	57.91	33.00
6	Jun	12-Jun-16	20:00	291.88	1,317.82	240.97	1,253.92	50.91	63.90
7	Jul	13-Jul-16	20:00	269.02	1,667.87	225.59	1,601.87	43.42	66.00
8	Aug	30-Aug-16	19:00	291.12	1,455.21	228.46	1,389.21	62.66	66.00
9	Sep	1-Sep-16	19:00	289.99	1,543.03	230.26	1,477.03	59.72	66.00
10	Oct	26-Oct-16	18:00	287.38	1,294.26	242.89	1,233.29	44.49	60.97
11	Nov	5-Nov-16	18:00	315.44	962.38	249.05	917.25	66.39	45.13
12	Dec	13-Dec-16	19:00	303.27	504.46	239.41	477.21	63.86	27.25
National Peak Load of the year (MW)				315.44					

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



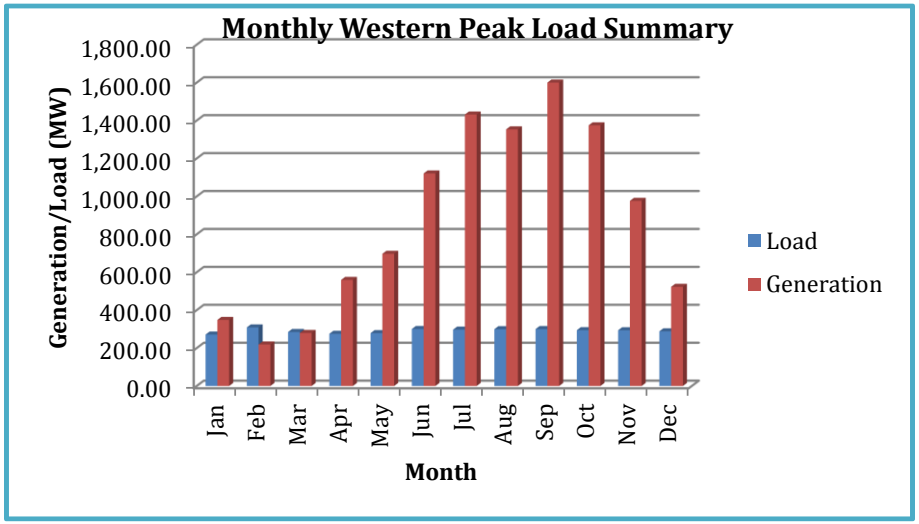
3.2 WESTERN GRID PEAK LOAD

Using method-2, the peak load for the western grid was 308.82MW which occurred on 28th February, 2016.

Table: 3.2.1 Monthly western peak load and corresponding generation

Sl. No	Months	Date	Time	Western Grid (MW)	
				Load	Generation
1	Jan	3-Jan-16	18:00	271.05	348.29
2	Feb	28-Feb-16	10:00	308.82	218.84
3	Mar	30-Mar-16	19:00	284.73	279.56
4	Apr	19-Apr-16	18:00	275.21	559.34
5	May	20-May-16	7:00	278.64	696.95
6	Jun	14-Jun-16	10:00	300.50	1,120.75
7	Jul	29-Jul-16	11:00	297.15	1,431.41
8	Aug	29-Aug-16	18:00	299.37	1,353.15
9	Sep	6-Sep-16	5:00	300.03	1,600.01
10	Oct	23-Oct-16	23:00	294.30	1,374.42
11	Nov	2-Nov-16	9:00	293.73	976.19
12	Dec	26-Dec-16	14:00	288.20	522.81
Western Peak Load of the year (MW)				308.82	

Graph: 3.2.1 Monthly western peak load and corresponding generation



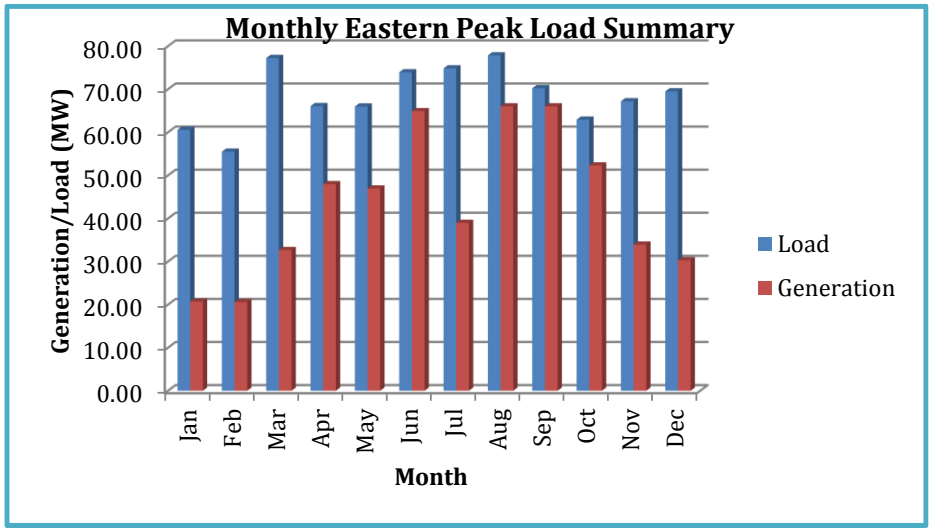
3.3 EASTERN GRID PEAK LOAD

Using method-2, the peak load for the eastern grid was 77.85MW which occurred on 19th August, 2016.

Table: 3.3.1 Monthly eastern peak load and corresponding generation

Sl. No	Months	Date	Time	Eastern Grid (MW)	
				Load	Generation
1	Jan	7-Jan-16	18:00	60.57	20.70
2	Feb	2-Feb-16	18:00	55.49	20.56
3	Mar	28-Mar-16	10:00	77.23	32.65
4	Apr	13-Apr-16	19:00	66.06	47.95
5	May	19-May-16	19:00	65.98	46.94
6	Jun	6-Jun-16	14:00	73.91	64.89
7	Jul	6-Jul-16	4:00	74.83	38.97
8	Aug	19-Aug-16	22:00	77.85	66.00
9	Sep	9-Sep-16	8:00	70.22	66.00
10	Oct	30-Oct-16	18:00	62.92	52.29
11	Nov	24-Nov-16	18:00	67.19	33.92
12	Dec	7-Dec-16	18:00	69.49	30.27
Eastern Peak Load of the year (MW)				77.85	

Graph: 3.3.1 Monthly eastern peak load and corresponding generation



4.0 EXPORT AND IMPORT OF ELECTRICITY TO/FROM NEIGHBORING COUNTRIES

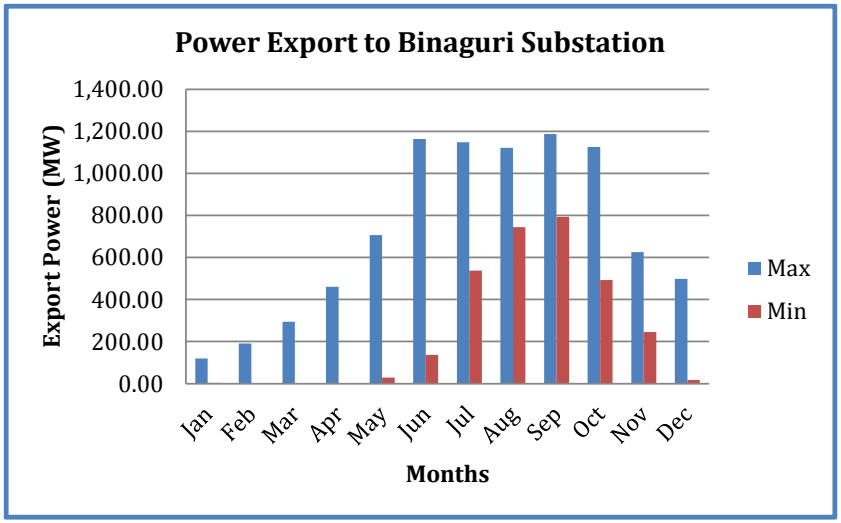
4.1 EXPORT OF ELECTRICITY TO NEIGHBORING COUNTRY

Maximum export of electricity for the year was 1,188.00MW to Binaguri substation in September, 2016, followed by 521.00MW to Birpara substation. The minimum export was 0.02MW to Salakoti and Rangia substation.

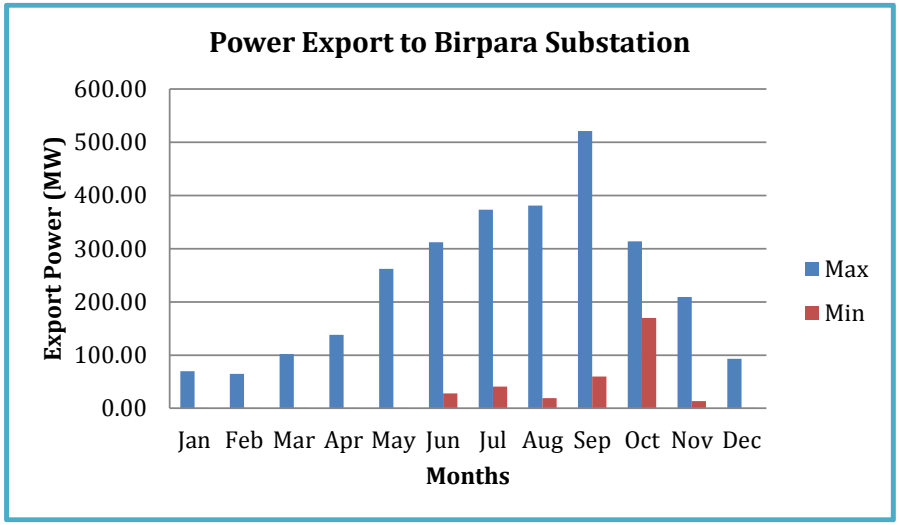
Table: 4.1.1 Monthly power export summary

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	119.00	191.00	295.00	461.00	707.00	1,164.00	1,149.00	1,122.00	1,188.00	1,126.00	625.00	498.00	**1,188.00**	
		Min	4.00	1.00	1.00	1.00	29.00	136.00	537.00	744.00	793.00	493.00	245.00	18.00		**1.00**
2	Birpara	Max	70.00	65.00	102.00	138.00	262.00	312.00	373.00	381.00	521.00	314.00	209.00	93.20	**521.00**	
		Min	1.00	1.00	1.00	1.00	1.00	28.00	41.00	19.00	60.00	170.00	13.50	0.20		**0.20**
3	Salakoti & Rangia	Max	9.75	16.52	29.45	47.05	77.45	89.95	113.95	134.15	136.45	130.55	78.65	45.65	**136.45**	
		Min	0.83	0.02	0.05	0.05	0.05	10.25	19.25	39.85	0.55	15.15	3.05	0.05		**0.02**

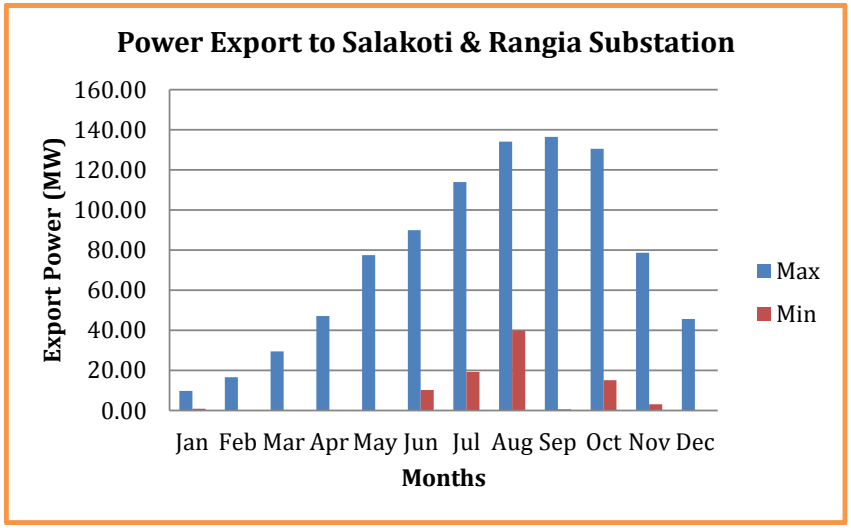
Graph: 4.1.1 Monthly power export to Binaguri substation



Graph: 4.1.2 Monthly power export to Birpara substation



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



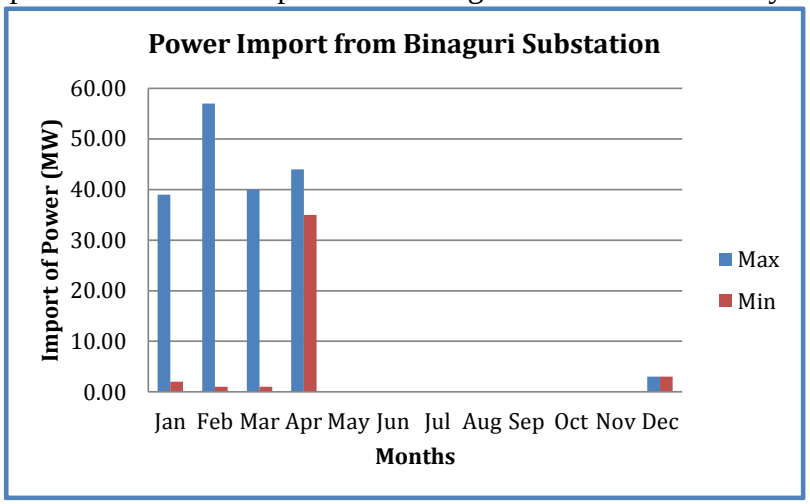
4.2 IMPORT OF ELECTRICITY FROM NEIGHBORING COUNTRY

Maximum import of power was 121.00MW from Birpara substation which occurred in March, 2016 followed by 57.00MW and 45.35 MW from Birpara and Salakoti and Rangia respectively.

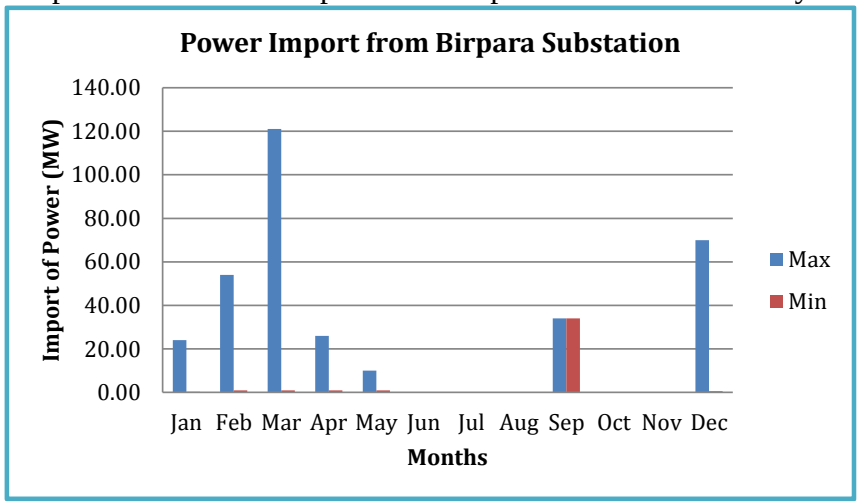
Table: 4.2.1 Monthly power import summary

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	39.00	57.00	40.00	44.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	**57.00**	
		Min	2.00	1.00	1.00	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00		**0.00**
2	Birpara	Max	24.00	54.00	121.00	26.00	10.00	0.00	0.00	0.00	34.00	0.00	0.00	70.00	**121.00**	
		Min	0.30	1.00	1.00	1.00	1.00	0.00	0.00	0.00	34.00	0.00	0.00	0.60		**0.00**
3	Salakoti & Rangia	Max	43.40	35.35	45.35	36.20	11.15	0.00	0.00	0.00	2.40	0.00	0.00	35.40	**45.35**	
		Min	0.40	0.05	0.20	0.20	0.05	0.00	0.00	0.00	2.40	0.00	0.00	0.20		**0.00**

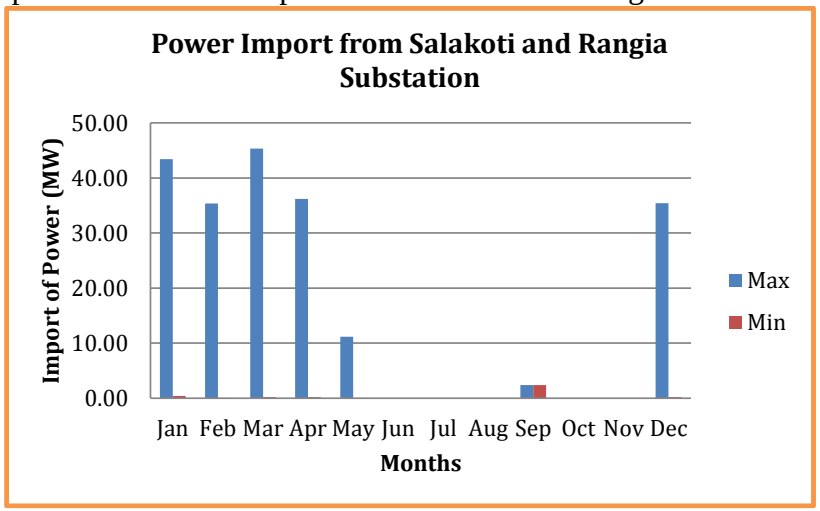
Graph: 4.2.1 Power import from Binaguri substation summary



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	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	100.00	0.00	0.00	0.00
9	Sep	96.64	0.13	0.00	3.23
10	Oct	100.00	0.00	0.00	0.00
11	Nov	96.77	0.00	0.00	3.23
12	Dec	100.00	0.00	0.00	0.00
Operation State for the year		99.16%	0.02%	0.00%	0.82%

Graph: 5.0.1 Frequency profile at Semtokha substation

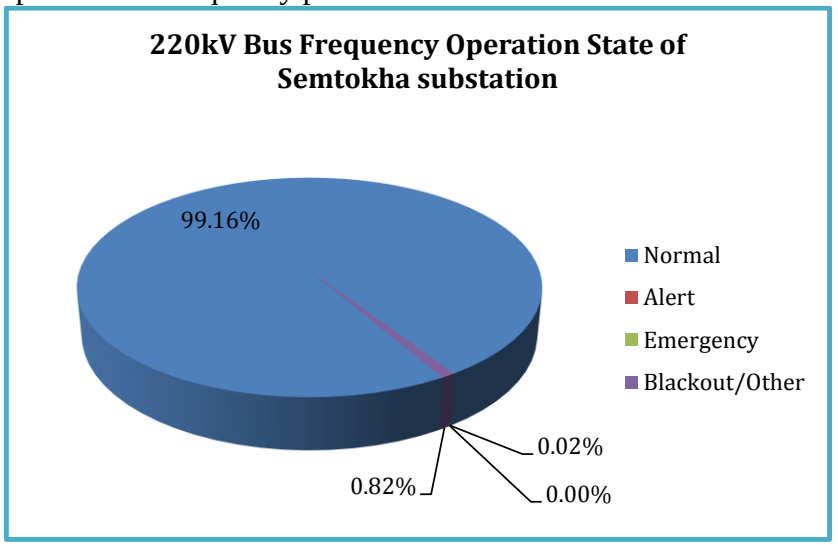
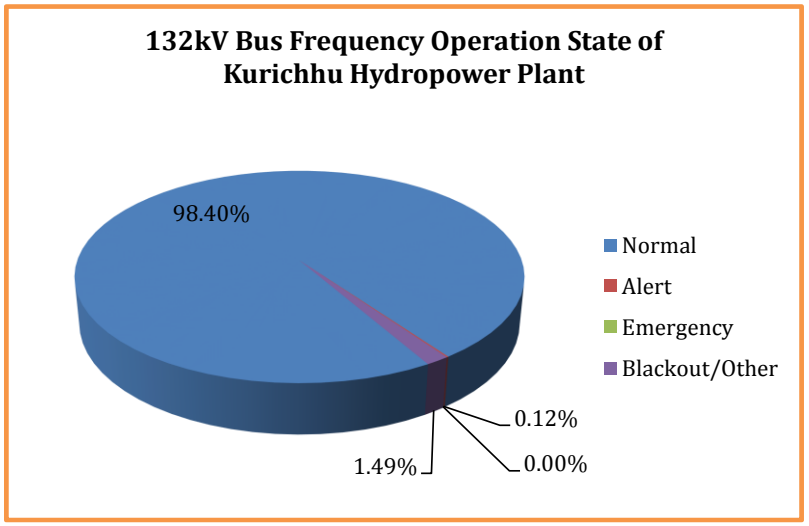


Table: 5.0.2 Frequency profile at Kurichhu Hydropower plant

Sl. No	Months	132kV Bus Frequency Operation State (%)			
		Normal	Alert	Emergency	Blackout/ Other
1	Jan	99.60	0.27	0.00	0.13
2	Feb	96.88	0.45	0.00	2.68
3	Mar	100.00	0.00	0.00	0.00
4	Apr	96.37	0.00	0.00	3.63
5	May	100.00	0.00	0.00	0.00
6	Jun	96.64	0.00	0.00	3.36
7	Jul	100.00	0.00	0.00	0.00
8	Aug	99.33	0.27	0.00	0.40
9	Sep	96.24	0.00	0.00	3.76
10	Oct	99.46	0.00	0.00	0.54
11	Nov	96.37	0.40	0.00	3.23
12	Dec	99.87	0.00	0.00	0.13
Operation State for the year		98.40%	0.12%	0.00%	1.49%

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:

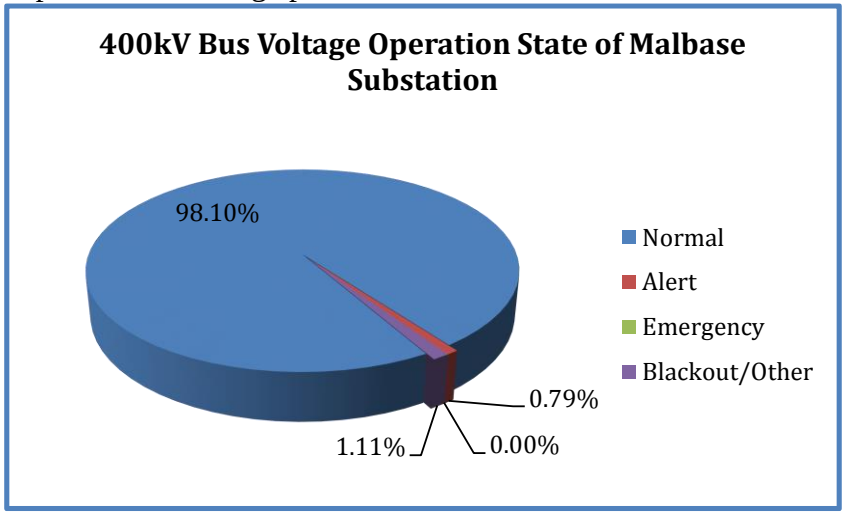
1. *Normal state*
   The voltages at all connection point are within the limits of 0.95 times and 1.05 times of the normal values
2. *Alert state*
   The voltage at all connection points are outside the normal limit but within the limits of 0.9 times and 1.1 times of the normal values
3. *Emergency state*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

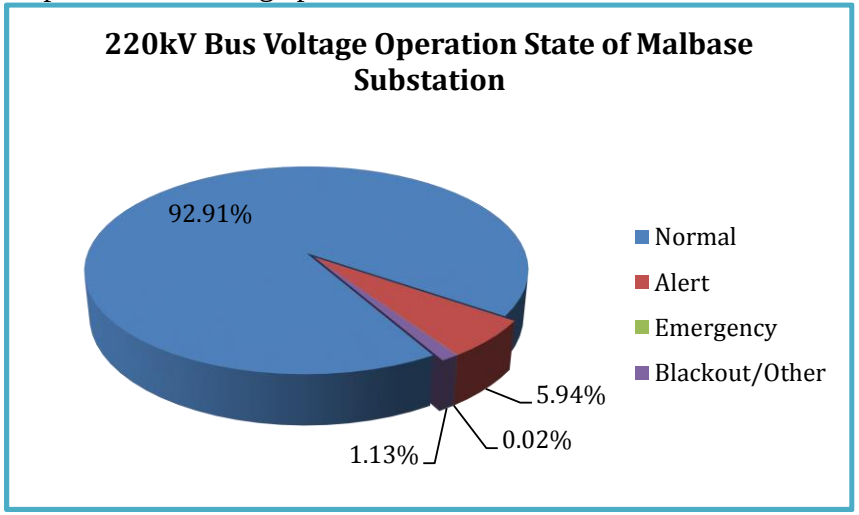
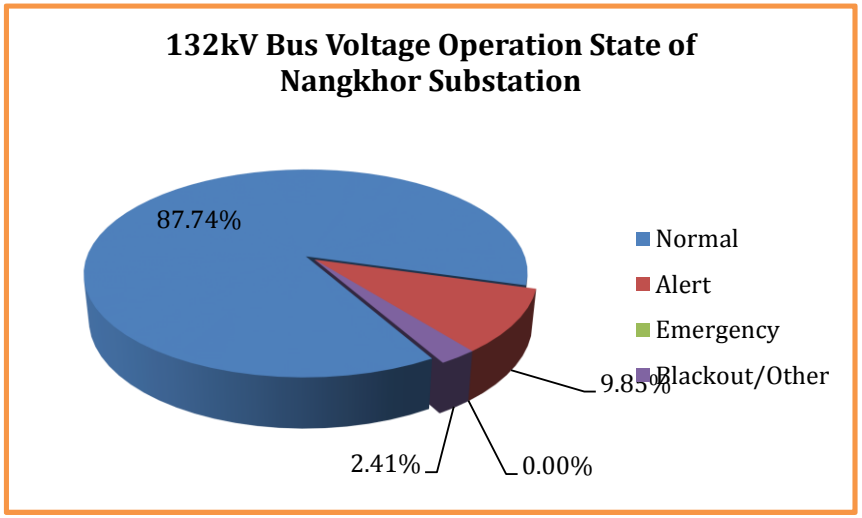


Table: 6.0.2 Voltage profile at Nangkhor substation

Sl. No	Months	132kV Bus Voltage Operation State (%)			
		Normal	Alert	Emergency	Blackout/ Other
1	Jan	77.28	22.72	0.00	0.00
2	Feb	70.24	29.76	0.00	0.00
3	Mar	81.05	18.82	0.00	0.13
4	Apr	94.89	4.97	0.00	0.13
5	May	97.18	2.82	0.00	0.00
6	Jun	96.51	0.27	0.00	3.23
7	Jul	99.60	0.13	0.00	0.27
8	Aug	99.87	0.00	0.00	0.13
9	Sep	95.97	0.13	0.00	3.90
10	Oct	99.60	0.13	0.00	0.27
11	Nov	69.22	10.08	0.00	20.70
12	Dec	71.51	28.36	0.00	0.13
Operation State for year		87.74%	9.85%	0.00%	2.41%

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 GIRD CODE REGULATION

The instance of non-compliance with the Grid Code Regulation 2008 for the year 2016 was recorded as nil.

Annexure- I

April, 2016

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	30-Apr-16	21:16	30-Apr-16	21:58	0:42	46.7	132kV Nangkor-Deothang feeder	all feeders	Lightning strike	O/C	Salakati (India)	
2	30-Apr-16	21:16	30-Apr-16	21:59	0:43	2.61	5MVA-Tr-II		Due to heavy lightning strike.	Over Current directional protn.tripped on 33kV side.	Deothang	5MVA tr- II energised after resuming the supply from Nangkhor and found normal.
3	30-Apr-16	21:16	30-Apr-16	22:05	0:49	44.3	Rangia Feeder			RYB,ZI,Z2,Z3 & CRS optd.	Rangia (India)	

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
1	2-Apr-16	14:14	2-Apr-16	16:36	2:22	2.91	Kurichu incommer	All Out Going feeders	shutdown	Nill	Kurichu	shutdown taken by kurichu (KHP) to change protection relay.
2	9-Apr-16	14:12	9-Apr-16	15:51	1:39	2.59	Kurichu incommer	All Out Going feeders	shutdown	Nill	Kurichu	shutdown taken by kurichu (KHP) for the replacement of new numerical relay.
3	13-Apr-16	23:15	14-Apr-16	1:46	2:31	2.16	Kurichu incommer	All Out Going feeders	Tripped	Nill	Kurichu	Tripped from kurichu (KHP) for unit testing.
4	17-Apr-16	12:05	17-Apr-16	13:39	1:34	2.96	Kurichu incommer	All Out Going feeders	shutdown	Nill	Kurichu	shutdown taken by kurichu (KHP) to change protection relay of Kurichu-Nongkhar feeder.
5	24-Apr-16	8:22	24-Apr-16	9:19	0:57	3.75	Kurichu incommer	All Out Going feeders	Tripped	Nill	Kurichu	supply faild from Kurichu end.
6	24-Apr-16	15:25	24-Apr-16	16:04	0:39	2.34	Kurichu incommer	All Out Going feeders	shutdown	Nill	Kurichu	shutdown taken by kurichu (KHP) for relay upgradation.

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	14-Apr-16	0:05	14-Apr-16	1:39	1:34	39.3	Nangkor-Deothang feeder	Nangkor-Deothang line	CB was opened from Nangkor our end for Unit test at KHP			Islanding mode testing of KHP unit
2	14-Apr-16	0:06	14-Apr-16	0:45	0:39	-8.5	Kurichu-Nangkor feeder	Kurichu-Nangkor line				
3	17-Apr-16	12:05	17-Apr-16	13:27	1:22	-31.8	Kurichu-Nangkor	Kurichu-Nangkor line	Replacement of protection relay at Kurichu end		Kurichu Power House	Approved shut down taken by KHP
4	24-Apr-16	15:31	24-Apr-16	16:20	0:49	-37	Kurichu-Nangkor	Kurichu-Nangkor line	CB was opened from nangkor end for relay up-gradation at KHP			CB was opened from nangkor end for relay up-gradation at KHP
5	24-Apr-16	16:25	24-Apr-16	16:55	0:30	-20	Nangkor-Nganglam	All Feeders	-	Non directional E/F Relay-50N & tripping relay 86 operated	Nangkor Substation	

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	14-Apr-16	0:05	14-Apr-16	1:43	1:38	0.43	Tintibi-Nanglam	Tintibi-Nanglam	KHPC Unit Test	Distance relay (21), Over Voltage, Trip relay(86)		During Islanding mode testing of KHPC Unit
2	14-Apr-16	0:05	14-Apr-16	1:45	1:40	0	Tintibi-Nanglam	Tintibi-Nanglam	KHPC Unit Test		Tintibi Substation	

132/66/11kV, 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	5-Apr-16	15:52	5-Apr-16	16:22	0:30	0.6	Gel-Salakati	Gelephu Substation	Bad weather condition	Distance relay (21)	Salakti line section	Zone-1, 19.76Km,

220/66kV, Tsirang substation

Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (Hrs)	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 (As reported)
1	18-Apr-16	9:00	18-Apr-16	14:27	5:27	13.2	220kv Rurichhu-Tsirang feeder	220 kV Ruri-Tsirang	Shutdown by SMD, Jigmeling	Na	Na	Extended Supply from Jigmeling

132/33kV, Yurmo substation

Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (Hrs)	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 (As reported)
1	11-Apr-16	16:10	11-Apr-16	18:20	2:10	6.5	132kV Tingtibi I/C	whole trongsa	CB Fault		Tigtibi Substation	Low air pressure in CB at Tintibi substation
2	13-Apr-16	11:29	14-Apr-16	1:43	2:14	5.3	132kV Tingtibi I/C	whole trongsa	Shutdown	Hand Tripped	Nill	Islanding mode testing of KHP Unit

May, 2015

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-May-16	9:20	24-May-16	9:50	0:30	1.66	5MVA tr-II	all out going fdrs.	Low air pressure	Low air pressure	Deothang	The transformer got tripped due to low air pressure. The feeder was normalised after building the pressure and found normal.

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	13-May-16	11:54	13-May-16	12:28	0:34	18	132kV Tintibi-Jigmeling	Tintibi-Jigmeling	Zone -1.Location :29.62 KM.	50A,50N,86&21	Tintibi Substation	Bad weather condition

132/66/11kV, 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	12-May-16	9:52	12-May-16	16:57	7:05	2.4	132kV Gel-Sal	Salakati	SD	Non	Salakati -Gelephu line	
2	31-May-16	1:59	31-May-16	2:33	0:34	17.4	132kV Gel-Sal	132kV Gelephu Substation	Ligntening surge	21 (Distance relay), Zone-1 at 39.81km		Simultaneous Trip on 132kV Gel-Jig.Heavy Ligntening & Thundering Supply fed from jigmeling

66/33kV, 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	11-May-16	12:47	11-May-16	14:47	2:00	Import from BHP= 21.3MW, Export to Jigmeling=34.1MW,Import from DHP=13.1MW	220KV Line	220kv Dhajay Substation	Failure of Grid	Non	Grid fail	

June, 2015

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
1	23-Jun-16	3:33	23-Jun-16	4:10	0:37	2.67	Kurichu Incomer	All feeders	Tripped	Nill	Nangkhor	supply failed from Kurichu end
2	24-Jun-16	2:34	24-Jun-16	2:54	0:20	2.35	Kurichu Incomer	All feeders	Tripped	Nill	Nangkhor	Supply failed from Nangkor due to breaker problem of kurichu feeder

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	23-Jun-16	3:35	23-Jun-16	4:05	0:30	-45.9	132kV Kurichu-Nangkor line	Kurichu-Nangkor line	-	No relay indication	Nangkor Substation	
2	24-Jun-16	2:30	24-Jun-16	2:55	0:25	-43.6	132kV Kurichu-Nangkor line	Kurichu-Nangkor line	-	No relay indication	Nangkor Substation	

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	15-Jun-16	15:50	15-Jun-16	15:58	0:08	18.48	132kV Nanglam-Tintibi Feeder	Eastern Grid	Tripped on O/current, E/fault.	O/current, E/fault, Dist. Relay Zone-1 operated.	NA	
2	16-Jun-16	17:14	16-Jun-16	17:27	0:13	24.4			Tripped on O/current.	O/current & 86 operated.		
3	22-Jun-16	5:24	22-Jun-16	5:38	0:14	7.59			Tripped on O/current, E/fault.	O/current, E/fault, Dist. Relay Zone-1 operated.		

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-Jun-16	5:50	28-Jun-16	6:10	0:20	-5.05	132kV Tintibi-Jigmeling	220/132kV Jigmeling substation.	Earth Fault & Over Current	Main 1. Z1 trip, R&Bph trip. Main2 Z1 trip, R&Bph trip. 86.1&86.2 operated	Main 1 =2.9km. Main 2 =2.4km towards Tintibi	supply from Gelephu and tsirang substation
2	28-Jun-16	5:50	28-Jun-16	6:10	0:20	25.7	ICT-I & ICT-II	220/132kV Jigmeling substation.	Earth Fault & Over Current	LV SEF optd 86.1& 86.2 optd	At ICT-I & ICT-II	supply from Gelephu substation

132/66/11kV, 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	16-Jun-16	9:06	16-Jun-16	18:05	8:59	18.6	132kv Gelephu -Salakati feeder.	Non	shutdown taken by Salakati substation to change insulator		Salakati substation	Gelephu substation was feeded from Jigmeling end.
2	28-Jun-16	5:54	28-Jun-16	6:13	0:19	-42	132kv Gelephu-Jigmeling feeder.	Gelephu Substation	Transient fault.	Relay Operations at Gelephu ends; main II,DIR earthfault 50N,67N 86 master relay tripped.	Jigmeling - Tintibi line section.	At the same time Salakati CB also tripped at their end. (weather condition: lightening & heavy Rainfall)
3	30-Jun-16	5:20	30-Jun-16	6:10	0:50	-34	132kv Gelephu -Salakati feeder.	Non	Transient fault.	only breaker at our end tripped without any relay indication.	Salakati line	Raining

132/33kV,Yurmo 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
2	16-Jun-16	17:15	16-Jun-16	17:27	0:12	5	132kV Tingtibi Incomer	132kV Yurmoo Substation	Bad weather condition	50C &86 operated	Location 40km from Nanglam Substation	No supply from Tingtibi Substation
3	22-Jun-16	5:25	22-Jun-16	5:45	0:20	4				DPR opt:Zone-1,O/C RYB,F/L:52.68 KM,Ia-1.19 kA Ib-1.30 kA Ic-1.210 kA.Van-27.28 kV Vbn-26.63 Vcn-26.38 kV & 50A ,50 C,50N.	Location 40km from Nanglam Substation	
4	28-Jun-16	5:50	28-Jun-16	6:10	0:20	4.8				DPR opt:Zone-1,fault location:2.9 Km	Zone 1 at distance of 2.9km from Jigmeling substation	

July, 2015

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 (Hrs)	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
4	19-Jul-16	21:04	19-Jul-16	22:04	1:00	6.84	Kurichu Incomer	All feeders	Tripped	Nill	Rongia	Supply failed from rongia end.

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 (Hrs)	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	17-Jul-16	15:26	17-Jul-16	19:34	4:08	-7.2	Nangkor-Nganglam	Nangkor-Nganglam line	Due to Over Loading			132kV Nangkor-Nganglam line kept opened due to over loading of 132kV Nangkor-Deothang feeder
2	19-Jul-16	21:40	19-Jul-16	22:04	0:24	56.5	Main Grid	All feeders			Rangia Substation	Supply failed from Rangia Substation.
3	27-Jul-16	19:39	27-Jul-16	21:05	1:26	54.1	132kV Nangkor-Deothang line	Nangkor-Nganglam line	To change 'R' phase jumper wire of Isolator		Deothang Substation	Emergency shut down taken by Deothang Substation.

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	7-Jul-16	1:13	8-Jul-16	10:04	8:51	16.05	132kV Nangkhor Feeder	Nganglam-Nangkor line		Nil	NA	
2	8-Jul-16	13:51	8-Jul-16	17:27	3:36	10.7	132kV Nangkhor Feeder	Nganglam-Nangkor line		Nil	NA	

August, 2015

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
1	8-Aug-16	21:04	8-Aug-16	21:46	0:42	6.3	Kurichu Incomer	All feeders	Tripped	Nill	Gelephu	supply failed from Gelephu end.
2	18-Aug-16	15:49	18-Aug-16	17:00	1:11	3.38	Kanglung	Only Kanglung	Tripped	Distance relay (21)	,Dist.5.770km	VAN:5.314kv,VBN:64.17kv &VCN:5.304kv,IA:1.258A,IB:62.61 & IC:1.284A &Fault restance:775.4mΩ

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	17-Aug-16	17:40	18-Aug-16	14:06	20:26	2.1	Nangkor-Nganglam	Nangkor-Nganglam line	-	-	Nangkor-Nganglam line	132kV Nangkor-Nganglam line kept opened to avoid over loading of 132kV Nangkor-Deothang line
2	18-Aug-16	15:08	18-Aug-16	16:05	0:57	25.4	Nangkor-Nganglam	Nangkor-Nganglam line	-	-	Nangkor-Nganglam line	132kV Nangkor-Nganglam line kept opened to avoid over loading of 132kV Nangkor-Deothang line
3	18-Aug-16	22:20	19-Aug-16	8:57	10:37	42.1	Nangkor-Nganglam	Nangkor-Nganglam line	-	-	Nangkor-Nganglam line	132kV Nangkor-Nganglam line kept opened to avoid over loading of 132kV Nangkor-Deothang 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	6-Aug-16	11:53	6-Aug-16	12:31	0:38	74.3	220kv Tsirang-Jigmeling Line	220kv Tsirang-Jigmeling Line	Earth fault on R- Phase	21 main I&2, 86	main 1 (9.6km) &main -2(7.69km)	
2	26-Aug-16	8:25	26-Aug-16	9:28	1:03	0.4	220kv Tsirang-Jigmeling Line	Tsirang- Jigmeling Line	Earth fault on R-ph	21 Main-1&2	Z1,24.8km in main-1	
3	26-Aug-16	8:25	26-Aug-16	9:30	1:05	-0.007	ICT 1, 220KkVside	Jigmeling S/S	Earth fault on R-ph	LV SEF trip,86.1/86.2 optd & relay gen trip	Jigmeling s/s	
4	26-Aug-16	8:25	26-Aug-16	9:33	1:08	0.058	ICT 2 132kV side	Jigmeling S/S	Earth fault R-Phase	OC/EF, 86	Jigmeling s/s	

132/66/11kV, 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	17-Aug-16	16:25	17-Aug-16	17:15	0:50	52.4	132kv Gel-Jig line & 132kv Gel-Salakoti line	Gelephu substation	Earth fault	21- R&Y Ph	Z1, 41.89km	Both 132kv Gel-Sal & 132kV Gel-Jig CB opened at same time
2	17-Aug-16	16:25	17-Aug-16	18:10	1:45	-54	132kv Gel-Jig line & 132kv Gel-Salakoti line	Gelephu substation	Earth fault	50N	132kv gel-jig	1. Both 132kv Gel-Sal & 132kV Gel-Jig CB opened at same time. 2 During tripping, trip coil on jigmeling fdr burnt and cause breaker problem.
3	17-Aug-16	17:15	17-Aug-16	18:27	1:12	52.4	132kv Gelephu -Salakati feeder.	132kv Gelephu -Salakati feeder.	Trip at salakati	not known	Salakati ss	
4	17-Aug-16	17:38	17-Aug-16	18:27	0:49	52.4	132kv Gelephu -Salakati feeder	Gelephu ss, Gelephu-Salakati line	not known	No C.B and relays has been operated.	Salakati end	Supply failed from Salakati end

September, 2015

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
1	16-Sep-16	21:45	16-Sep-16	22:24	0:39	5.24	Kurichu Incomer	All feeders	Tripped			

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	9-Sep-16	8:09	9-Sep-16	15:40	7:31	42.3	Nangkor-Deothang	Nangkor-Deothang line	Insulator De-caped		Nangkor-Deothang line at ND-57	Emergency shut down taken by TMD, Nangkor.
2	16-Sep-16	16:19	16-Sep-16	18:19	2:00	-12.7	Nangkor-Nganglam	Nangkor-Nganglam line			Nangkor-Nganglam line	Shut down taken for avoiding over loading of 132kV Nangkor-Deothang line. No supply interrupted
3	16-Sep-16	21:45	16-Sep-16	22:15	0:30	2.5	Main Grid	All feeders			Rangia Substation	Supply failed from Rangia
4	17-Sep-16	21:25	18-Sep-16	14:22	16:57	-11.2	Nangkor-Nganglam	Nangkor-Nganglam line			Nangkor-Nganglam line	Shut down taken for avoiding over loading of 132kV Nangkor-Deothang line. No supply interrupted
5	18-Sep-16	19:54	20-Sep-16	7:20	26:00.0	-13.6	Nangkor-Nganglam	Nangkor-Nganglam line			Nangkor-Nganglam line	Shut down taken for avoiding over loading of 132kV Nangkor-Deothang line. No supply interrupted
6	20-Sep-16	7:44	22-Sep-16	10:15	31:00.0		Nangkor-Nganglam	Nangkor-Nganglam line			Nangkor-Nganglam line	Shut down taken for avoiding over loading of 132kV Nangkor-Deothang line. No supply interrupted
7	23-Sep-16	15:30	27-Sep-16	9:45	90:15:00	-10.1	Nangkor-Nganglam	Nangkor-Nganglam line			Nangkor-Nganglam line	Shut down taken for avoiding over loading of 132kV Nangkor-Deothang line. No supply 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	15-Sep-16	23:15	16-Sep-16	0:35	1:20	-60.2	132kV Jig-Tin	Tintibi ss, Jigmeling ss	OC/EF	21(I&II)	Main-1:Z1, 5.7km > Main-2: Z1, 5.2km	

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	15-Sep-16	02:05	15-Sep-16	20:20	89:15:00	8.5	220kv Rurrichhu-Tsirang Line	220kv Rurrichhu-Tsirang Line	Tree fall down and damaged the conductor of Y &B Phase.	21 (I&2)	Z1, 10.2km	
2	16-Sep-16	18:40	16-Sep-16	19:35	00:55	121	220kv Tsi-Jig & Tsi-Dag	220kv Dhajay Substation	Indial grid fail	non of the relay operated at our end		
3	16-Sep-16	21:35	16-Sep-16	22:55	01:20	94	220kv Tsi-Jig & Tsi-Dag	220kv Dhajay Substation	Indial grid fail	non of the relay operated at our end		

December, 2016

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	4-Dec-16	02:09	4-Dec-16	06:57	4:48	-11.940	220kv Rurrichhu-Tsirang Line	220kv Dhajay Substation	Over Voltage of 237.35kv	Alarm on GEN TRIP.	NA	Restored the Line after having drop down the voltage level to 228kv.
2	26-Dec-16	04:43	26-Dec-16	05:16	00:33	-15.22	220kv Rurrichhu-Tsirang Line	220kv Dhajay Substation	Over Voltage of 233.6kV	Alarm on GEN TRIP.	NA	

Annexure- II

April, 2016

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	6-Apr-16	0:34	12-Apr-16	9:18	152:46:00	46	220kV Malbase-Singhigaon Feeder	220kV Malbase-Singhigaon Feeder		No data display on relay	Line	The weather was bad with heavy wind storm, thunder and lightening. The feeder could not be charged due to pole discrepancy of the breaker at Siinghigaon end.
2	6-Apr-16	12:07	6-Apr-16	17:40	5:33	3	220kV Malbase-Bripara Feeder	220kV Malbase-Bripara Feeder	Shutdown	-	Line	shutdown to stabilise the load as whole unit at Tala was under shutdown
3	7-Apr-16	9:49	7-Apr-16	19:10	9:21	33	400kV Malbase-Siliguri Feeder	400kV Malbase-Siliguri Feeder	Shutdown	-	Line	Shutdown availed by TMD, P/ling for replacement of flashover/broken insulators at tower no. TPS-086 & TPS-087
4	8-Apr-16	8:33	8-Apr-16	19:02	10:29	33	400kV Malbase-Siliguri Feeder	400kV Malbase-Siliguri Feeder		-		
5	9-Apr-16	9:23	9-Apr-16	16:08	6:45	11	400kV Malbase-Siliguri Feeder	400kV Malbase-Siliguri Feeder		-		
6	14-Apr-16	20:38	15-Apr-16	12:00	15:22	17	220kV Malbase-Bripara Feeder	220kV Malbase-Bripara Feeder	Over Current & Earth fault		Line	The breakers of the 400kV Tala-Malbase feeder, 220kV Chukha-Malbase feeder and 400kV Malbase-Siliguri feeder tripped. Supply was extended from the 400kV Malbase-Siliguri feeder at 22:23hrs.
7	14-Apr-16	20:38	15-Apr-16	8:28	11:50	-	220kV Bus Coupler	220kV Bus Coupler	-	o data display in the rela	Substation	
8	14-Apr-16	20:38	14-Apr-16	23:02	2:24	36	220/66kV, 50/63MVA Transformer-III	220/66kV, 50/63MVA Transformer-III	Over Current	R-Phase = 125.49A/-	Substation	
9	16-Apr-16	5:42	16-Apr-16	6:39	0:57	-7	220kV Malbase-Bripara Feeder	220kV Malbase-Bripara Feeder	Over Current & Earth fault	R = 546.8 A / 46.4 deg.	Line	Bad weather with heavy wind storm, thunder and lightening.
10	16-Apr-16	5:42	16-Apr-16	6:16	0:34	-	220kV Bus Coupler	220kV Bus Coupler	Over Current & Earth fault	17A, P	Substation	
11	24-Apr-16	8:34	25-Apr-16	16:44	8:10	67	220kV Chukha - Malbase Feeder- III.	220kV Chukha - Malbase Feeder- III.	Earth fault	R-Phase = 2717A/282.	Line	R-phase conductor snapped between tower no T8-T9.

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	5-Apr-16	13:21	5-Apr-16	14:35	1:14	51	220kV Malbase & 66kV Incomer [Bhutan Concast]	All 66kV & 11kV customers	O/C and Earth Fault	Ia.216 , Ib3600, Ic 162 and E/F 3595 , 51 and 51N	Line	Weather condition: Heavy Rain and Lightning
2	6-Apr-16	0:35	6-Apr-16	3:15	2:40	46	220kV Malbase Incomer	All 66kV & 11kV customers	O/C and Earth Fault	Ia.216, Ib2500, Ic 142 and E/F 1980	Substation	Breaker could not be closed due to pole descripancy on Yellow and Blue Phase. Weather condition: Heavy Rain and Lightning.
3	6-Apr-16	0:35	6-Apr-16	1:10	0:35	3.5	66kV Incomer [Bhutan Concast]	All 66kV & 11kV customers	O/C and Earth Fault	51 and 51N	Line	Weather conditions: Heavy Rain
4	14-Apr-16	20:38	14-Apr-16	23:38	3:00	36	220kV Samtse and 66kV [Bhutan Concast]	All 66kV & 11kV customers	Tripped from Malbase and GENCO	None		Weather condition: Heavy rain and lightning.

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	20-Apr-16	17:31	21-Apr-16	13:43	20:12	-5.45	66kV Chukha-Pling Incomer	Pling, Gedu & Gomtu	EarthFault	186 & 86	Line	Earthfault indication at a distance of 9.4kms from Chukha end.
2	20-Apr-16	17:31	20-Apr-16	18:20	0:49	0.58	66kV Gomtu-Pling	Pling, Gedu & Gomtu	Tripped from Dhamdum	None	Substation	Supply restored from Gomtu and extended til Gedu.
3	24-Apr-16	8:34	24-Apr-16	9:10	0:36	-5.73	66kV Chukha-Pling Incomer	Pling	Tripped from Chukha end	186 & 86	Line	Supply restored from Damdum substation and extended till Gedu.

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	6-Apr-16	12:36	6-Apr-16	13:10	0:34	8.2	220/66kV, 50/63MVA-I	No supply interruption	Bus-bar relay mal-operated	Bus-bar zone A operated		
2	6-Apr-16	12:36	6-Apr-16	13:12	0:36	8.2	220/66kV, 50/63MVA-II	No supply interruption	Bus-bar relay mal operation	Bus-bar zone A operated		
3	2-Apr-16	11:11	2-Apr-16	18:16	7:05	-24.44	Nil					Shutdown taken by DGPC, CHPC for relay testing at Chukha end.
4	1-Apr-16	10:30	1-Apr-16	18:26	7:56	13.l9	Nil					For attending air leakage from Y-pahse breaker operating mechanism
5	2-Apr-16	11:47	2-Apr-16	19:15	7:28	14	Nil					Air leakage from Y-pahse breaker operating mechanism. The damage internal part was repair and put back to service.

May, 2015

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
2	10-May-16	17:23	10-May-16	18:25	1:02	4	400kV Malbase-Siliguri Feeder III	400kV Malbase-Siliguri Feeder III	Over Current	86A optd.., Main1 tripped	Line	The weather condition during the time of tripping was heavy wind storm, thunder and lightening.

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	12-May-16	14:26	12-May-16	15:02	0:36	0.26	66kV Gomtu-Pling	Pling, Gedu & Gomtu	Temporary fault	186,86 & dist. Prot	Line	Charged the feeder after getting clerance from Gomtu

June, 2015

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-Jun-16	14:35	8-Jun-16	15:15	0:40	11.7	66KV Bhutan concast	Not effected	66KV Supply failed from Malbase end	Over current		66KV Supply failed from Malbase end

66/33/11kV Gedu 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-Jun-16	11:20	4-Jun-16	11:59	0:39	0.31	5MVA transformer III			Over current and 86 relay operated	Gedu 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	21-Jun-16	12:43	21-Jun-16	11:20	17:27	0.13	50/63 MVA Transformer II	50/63 MVA Transformer II at Dhamdum Substation	PRV operated	3. G	Water found inside PRD.	Transformer tripped by operating PRV relay due to water content inside the PDV device.

July, 2015

400/220/66/11kV Malbase substation

Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages (Hrs)	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-Jul-16	22:40	4-Jul-16	11:44	13:04	58	220kV Malbase-Bripara Feeder	220kV Malbase-Bripara Feeder	Tripped	-	Line	Feeder tripped at Birpara end due to R-Ph conductor snap at Tower No. 98 at a distance of 18 km from Bripara end, but the feeder did not trip at Malbase.
2	22-Jul-16	2:14	22-Jul-16	2:45	0:31	260	400kV Malbase-Siliguri Feeder III	400kV Malbase-Siliguri Feeder III	Earth fault	I2 = 546.4A /294.4	Line	Heavy rainfal during the time of the tripping. Tala Unit - 3 and Tala-Siliguri Feeder IV tripped at Tala end.
8	29-Jul-16	22:02	30-Jul-16	0:30	2:28	32	220/66 kV 50MVA Transformer -III	220/66 kV 50MVA Transformer -III	Over current	90.07A /170.01 deg,	Substation	
9	29-Jul-16	22:02	30-Jul-16	1:05	3:03	47	220kV Malbase-Singhigaon Feeder	220kV Malbase-Singhigaon Feeder	Over current	R = 2794A /275.6deg,	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	16-Jul-16	9:30	16-Jul-16	12:30	3:00	16.4 & 16.1	66 kV Bus	All transformers and 66 kV and 11KV Frds	Taken shutdown	Nil	Substation	Shutdown for replacement of strand cut conductor on 66 kV Bus and 66 kV BFAL Frds
3	28-Jul-16	10:30	28-Jul-16	12:30	2:00	32 & 23	50 MVA and 35MVA Transformer	All 66KV and 11KV Frds	Taken emergency shut down for maintenance on 66KV Bus isolator(BSMPL)			Shutdown for Maintenance work on 66KV Bus islator(BSMPL)
4	29-Jul-16	22:01	29-Jul-16	23:30	1:29	47 & 1.5	220KV Incomer Malbase and samtse,50MVA and 35MVA Transformer	66KV BCCl and BFAL	Overcurrent and Earthfault on 220KV Malbase Frd	51 and 51N	Substation	Tripped on Earth fault and Over current.

August, 2015

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	28-Aug-16	23:22	29-Aug-16	0:48	1:26	55	220kV Malbase-Singhigaon Feeder	220kV Malbase-Singhigaon Feeder	Over Current	86 optd.Tripping values: R = 59.3 A /284.1 deg. Y = 297.1 A /214.8deg. B = 1880 A /44.72deg. N = 1513 A /41.04deg.	Line	
2	28-Aug-16	23:22	29-Aug-16	0:45	1:23	-	220kV Bus Coupler	220kV Bus Coupler	-	No Data Display	Substation	
3	28-Aug-16	23:22	29-Aug-16	0:47	1:25	7	220kV Malbase-Samtse Feeder	220kV Malbase-Samtse Feeder	Over Current	87 optd., Main-I Trip, Trip R,Y,B Phase, Zone I Trip, Main-I Carrier Send. Tripping values: R = 69.80 A /230.4deg, Y = 114.3 A /223.5deg, B = 2230 A /42.84deg, N = 2051 A /42.08deg.	Line	
4	28-Aug-16	23:22	29-Aug-16	0:44	1:22	80	400/220 kV 200 MVA ICT	400/220 kV 200 MVA ICT	Earth Fault	86A optd., 400kV Main MCB Open, Tie CB Open	Substation	

September, 2015

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	12-Sep-16	12:50	12-Sep-16	15:33	2:43	-176	400kV Tala-Malbase feeder III	400kV Tala-Malbase feeder III	Emergency Shutdown	-	Feeder	Taken Emergency Shutdown rectification & replacement of strain cut conductor of R-phase near line isolator
2	16-Sep-16	12:12	16-Sep-16	13:05	0:53	28	66kV Pasakha Feeder-I	66kV Pasakha Feeder-I	Over current & Earth fault	,86 Optd, General trip,IE	Line	Tripped due to bad weather condition. Heavy rainfall with thundering & lightning.
3	16-Sep-16	12:12	16-Sep-16	13:03	0:51	28	66kV Pasakha Feeder-II	66kV Pasakha Feeder-II	-	No Data Display	Line	Tripped due to bad weather condition. Heavy rainfall with thundering & lightning.
4	16.09.2016	12:12	16.09.2016	13:01	0:49	31	66kV Pasakha Feeder-IV	66kV Pasakha Feeder-IV	Over current & Earth fault	C-50 trip,IEF50 trip,86 Op	Line	Tripped due to bad weather condition. Heavy rainfall with thundering & lightning.
5	20-Sep-16	22:17	20-Sep-16	22:50	0:33	48	220kV Malbase-Singhigaon Feeder	22kV Malbase-Singhigaon Feeder	Overcurrent	86 Optd.	Line	
6	25.09.2016	3:09	25.09.2016	13:34	10:25	-1	220kV Chukha-Malbase feeder III	220kV Chukha-Malbase feeder III	Emergency Shutdown		Line	Emergency Shutdown for replacement of snapped conductor on R-phase of wavetrap
7	25-Sep-16	9:03	25-Sep-16	9:58	0:55	76	220kV Malbase-Bripara Feeder	220kV Malbase-Bripara Feeder	Tripped	86 Optd.	Line	Tripped due to all Unit tripped at 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	14-Sep-16	18:40	14-Sep-16	21:45	3:05	30.6	66KV BFAL Frd	66KV BFAL Frd	Emergency Shutdown	Nil	Substation	Taken Emergency Shutdown by maintenance team for replacement of snapped conductor on R-phase.
2	15-Sep-16	13:19	15-Sep-16	14:00	0:41		220KV Damdum	220KV Damdum	Tripped			
3	20-Sep-16	22:17	20-Sep-16	22:52	0:35	48	220KV Malbase Incomer	All 66KV and 11KV Frds	tripped at both end	186A and 186B		Supply failed from Dhamdum end. Weather Condition: Heavy rain fall with thunder and lightning.
4	25-Sep-16	10:18	25-Sep-16	10:50	0:32	13.6	66KV BSMPL	66KV BSMPL	Tripped	51R,51Y and 51B		Tripped on overcurrent on the three phase as there was problem on customer side.
5	29-Sep-16	15:34	29-Sep-16	16:35	1:01	18	66KV Bhutan concast	Bhutan concast Frd	Tripped			Tripped due to overload. The 220 kV Malbase Incomer tripped due to bad weather condition.

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	17-Sep-16	16:39	17-Sep-16	17:32	0:53	3.57	66kV Pling- Gomtu Feeder	Gomtu	Temporary	86 & 186	Line	
2	18-Sep-16	0:40	18-Sep-16	12:45	12:05	2.37	66kV Pling- Gomtu Feeder	Nil	Handtripped	Nil	Gomtu SS	There was red hot spot on Y phase of wavetrap.

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	25-Sep-16	01:30	25-Sep-16	02:41	1:11	-9.460	220kv Chukha-Semtokha	Semtokha substation	All unit fail at Chukha	Hand trip to restore supply from Rurichu	Chukha end	
2	25-Sep-16	00:50	25-Sep-16	01:40	0:50	-45.740	220kv Rurichu-Semtokha	Semtokha substation	All unit fail at Rurichu end	No tripping at Semtokha end	Rurichu end	
3	25-Sep-16	01:30	25-Sep-16	02:12	0:42	3.920	66kV Semtokha - Olakha feeder	Semtokha substation	Bothe Chukha & Rurichu units fail	Hand trip at Semtokha end to restore Rurichu supply	Bothe Chukha & Rurichu units fail	
4	25-Sep-16	00:50	25-Sep-16	03:01	2:11	-3.660	66kV Semtokha - Lobesa feeder	Semtokha substation	Trip along with Rurichu units	Directional O/C	Bothe Chukha & Rurichu units fail	